CENTRO UNIVERSITÁRIO SENAI CIMATEC

PROGRAMA DE POS-GRADUAÇÃO STRICTO SENSU

GESTÃO E TECNOLOGIA INDUSTRIAL

Alex Santos Príncipe

Dinâmica da gestão em saúde em contextos complexos: um framework adaptativo para decisão em emergências de saúde pública

Salvador

2024

ALEX SANTOS PRÍNCIPE

Dinâmica da Gestão em Saúde em Contextos Complexos: Um Framework Adaptativo para Decisão em Emergências de Saúde Pública.

Tese apresentada ao Programa de Pós-Graduação Stricto Sensu do Centro Universitário SENAI CIMATEC como requisito para a obtenção do título de Doutor em Gestão e Tecnologia Industrial.

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Salvador

2024

Ficha catalográfica elaborada pela Biblioteca do Centro Universitário SENAI CIMATEC

P954d Principe, Alex Santos

Dinâmica da gestão em saúde em contextos complexos: um Framework adaptativo para decisão em emergências de saúde pública / Alex Santos Principe. – Salvador, 2024.

283 f. : il. color.

Orientadores: Prof. Dr. Cristiano Vasconcellos Ferreira.
Profa. Dra. Ingrid Winkler.

Tese (Doutorado em Gestão e Tecnologia Industrial) – Programa de Pós-Graduação, Centro Universitário SENAI CIMATEC, Salvador, 2024.
Inclui referências.

1. Contextos complexos- mapeamento. 2. Dinâmica de sistemas. 3. Emergência de saúde pública. 4. Framework Cynefin. 5. Framework em ESP. 6. Gestão estratégica em saúde I. Centro Universitário SENAI CIMATEC. II. Ferreira Vasconcellos, Cristiano. III. Winkler, Ingrid. IV. Título.

CDD 658.8

NDI - 02

CENTRO UNIVERSITÁRIO SENAI CIMATEC

Doutorado em Gestão e Tecnologia Industrial

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Dedico este trabalho a minha esposa, Erika Reçone Borges Príncipe

e filha, Laura Reçone Borges Príncipe.

Agradecimentos

Origem, trajetória e decisão marcam escolhas nessa jornada. É momento de agradecer e muitas dimensões, contextos e sentimentos me alimentam nesse momento. A memória mais recente nos conforta na lembrança de alguns nomes presentes nos últimos quatro anos, mas preciso ir além, e recordar a minha infância. Eu queria mesmo ser administrador, e descobri quando perguntei a um vizinho qual era o seu trabalho, quando me relatou algo desse universo.

Eu nem sabia que aquilo era o início da minha jornada. Quando chegávamos à casa de vovó, mãe de mamãe, na favela da Rocinha, Rio de Janeiro, eu e meu irmão tínhamos tampas de embalagens plásticas que ela separava para a gente brincar, combinar e usar a criatividade. Meu avô, nordestino, marceneiro e carpinteiro, fazia suas próprias ferramentas, aquilo que na mão do artesão superava a complexidade da intervenção necessária, de forma personalizada. É, estava tudo ali, e os ensinamentos despretensiosos me impregnavam a alma.

A disciplina de meu avô português, pai de papai, me trouxe a sabedoria nas escolhas da vida, e ternura e refinamento eram de minha avó e madrinha, que já depois dos 90 anos me acompanhou na trajetória de formação acadêmica. Ela estava lá e estará sempre comigo.

Sem roteiro, mas atento às variáveis de uma vida, meu pai me alertava sobre causas e efeitos da vida na comunidade onde cresci, aquele Vidigal onde ganhei e perdi amigos, alguns pelas consequências da sorte adversa.

Mas eu precisava enxergar mais do que a história e a genética me traziam, quando minha esposa Erika (1988) me proporcionou as inflexões mais importantes de uma vida, fortaleceu minhas capacidades e acolheu minhas fraquezas, fez superar barreiras, e despertou conhecimento e espiritualidade que me transformam. E nossa filha Laura, hoje, participa dessa jornada e faz as suas descobertas. Erika e Laura são a razão de tudo. Meu amor eterno e incondicional por vocês. Muito obrigado!

Agradeço a minha Zinha, mãe Amara, querida de tantas superações e afeto para chegar até aqui, sua inteligência é parte de mim. Aos meus irmãos e eternos amigos de fé, Rodney, Rodrigo e Grécia, por toda nossa história.

Agradeço à Fundação Oswaldo Cruz e em nome de Maicon e Emília aos colegas da vida institucional que marcaram esse momento. Agradeço ao Senai Cimatec pela minha formação, em especial aos meus orientadores Dr. Cristiano Vasconcellos Ferreira e Dra. Ingrid Winkler pela efetividade dos meus resultados, e aos mestres dessa trajetória pelo conhecimento compartilhado.

Ao meu pai, Amadeu, eu peço a benção. Pai, onde estiver, você está dentro de mim. Agradeço a você por mais uma etapa alcançada, com a certeza dos seus ensinamentos em meu coração, obrigado por tudo. Alex.

Resumo

A emergência de saúde pública (ESP) é um evento gerador de incerteza que desafia a tomada de decisão dos governantes, com inflexão de políticas e estratégias que condicionam a área de gestão nos macroprocessos de preparação, prevenção, resposta e recuperação (PPRR). Os estudos sobre decisão em ESP se intensificaram nos últimos anos, com a emergência de Zika (2014), de febre-amarela silvestre (2017) e a pandemia da COVID-19 (2020), com implicações ao desenvolvimento de estruturas analíticas para interpretar o contexto e sua determinação para a saúde, e produzir cenários a partir do comportamento de uma emergência e os limites do sistema de saúde. A decisão segue uma abordagem não linear, condicionada pelo planejamento do processo saúde–enfermidade-atenção, cuja complexidade lida com a dinâmica de variáveis e interação de atores na análise de um problema. O objetivo deste trabalho foi desenvolver um framework para apoiar a tomada de decisão do gestor público de nível estratégico da saúde em ESP, com produção de cenários para intervenções adaptadas ao nível de complexidade dos sistemas de saúde. Para o desenvolvimento do trabalho, foi realizada uma pesquisa de método misto, com grupo focal confirmatório e exploratório de especialistas e gestores de saúde. Uma revisão sistemática da literatura avaliou modelos existentes. A descrição de variáveis de complexidade seguiu o mapeamento de condicionalidades, a partir das diretrizes da Organização Mundial da Saúde (OMS) e estratégias de cooperação dos seus Estados-membros no enfrentamento da ESP. Na estrutura do framework foram integradas a Dinâmica de Sistemas e o Framework Cynefin, conceitos de abordagem dinâmica e sistemas complexos no apoio à decisão. Os resultados mostram que o desenvolvimento e aplicação do framework em ESP tem efetividade se apresenta estrutura capaz de incorporar o modelo de governança do país, as hesitações dos decisores, os aspectos éticos e as evidências no planejamento dos macroprocessos PPRR, como um ciclo permanente e escalável na relação do agravo com o sistema de saúde, em projeções adaptadas ao contexto. Foram analisadas 631 condicionalidades a partir de diretrizes da OMS e estratégias de 112 países no enfrentamento das ESP, como a atenção às características populacionais, à Saúde Única, ao Regulamento Sanitário Internacional, e aos recursos humanos e a informação como eixos estruturantes. O estudo reforçou a importância do planejamento no ciclo de preparação da ESP, conforme as vulnerabilidades e capacidades do contexto, para um acesso equitativo a contramedidas e a bens e serviços de saúde. O modelo desenvolvido foi aplicado ao caso da cidade de Manaus, Amazonas, Brasil, na pandemia da COVID-19, e avaliado por especialistas. Os resultados demostraram que o desenvolvimento da estrutura analítica, denominado Framework de Apoio à Decisão em Emergência de Saúde (FADES), permitiu integrar a modelagem da complexidade da gestão na ESP, conforme variáveis de interesse e a interpretação de estruturas e comportamentos do evento sanitário, numa abordagem sistêmica e adaptativa que amplia a capacidade de compreensão e de decisão do gestor da saúde.

Palavras-chave: Emergência de saúde pública; tomada de decisão; condicionalidades da gestão em saúde; contextos complexos; dinâmica de sistemas; Framework Cynefin.

Title and Abstract

DYNAMICS OF HEALTH MANAGEMENT IN COMPLEX CONTEXTS: AN ADAPTIVE FRAMEWORK FOR DECISION-MAKING IN PUBLIC HEALTH EMERGENCIES.

A public health emergency (PHE) is an event that generates uncertainty and challenges government decision making, with a shift in policies and strategies that condition the management area in the macro-processes of preparedness, prevention, response and recovery (PPRR). Studies on decision-making in PHE have intensified in recent years, with the emergence of Zika (2014), wild yellow fever (2017) and the COVID-19 pandemic (2020), with implications for the development of analytical frameworks to interpret the context and its determination for health, and to produce scenarios based on the behaviour of an emergency and the limits of the health system. The decision follows a non-linear approach, conditioned by the planning of the health-nursing-care process, whose complexity deals with the dynamics of variables and the interaction of actors in the analysis of a problem. The objective of this study was to develop a framework to support decision-making by public managers at the strategic level of health in PHE, producing scenarios for interventions adapted to the level of complexity of health systems. A mixed-methods study was carried out, with confirmatory and exploratory focus groups of experts and health managers. A systematic literature review evaluated existing models. The description of complexity variables followed the mapping of conditionalities, based on the guidelines of the World Health Organization (WHO) and the cooperation strategies of its member-states in tackling PHE. The structure of the framework integrated System Dynamics and the Cynefin Framework, concepts of dynamic approach and complex systems in decision support. The results show that the development and application of the PHE framework is effective if it presents a structure capable of incorporating the country's governance model, the hesitations of decision-makers, ethical aspects and evidence in the planning of PPRR macro-processes, as a permanent and scalable cycle in the relationship between the disease and the health system, in projections adapted to the context. 631 conditionalities were analysed based on WHO guidelines and the strategies of 112 countries in tackling PHE, such as attention to population characteristics, the One Health approach, the International Health Regulations, and human resources and information as structuring axes. The study reinforced the importance of planning in the PHE preparedness cycle, according to the vulnerabilities and capacities of the context, for equitable access to countermeasures and health goods and services. The model developed was applied to the case of the city of Manaus, Amazonas, Brazil, during the COVID-19 pandemic, and evaluated by experts. The results showed that the development of the analytical structure, called the Framework for Decision Support in Health Emergencies (FADES), made it possible to integrate the modelling of the complexity of management in PHE, according to the variables of interest and the interpretation of structures and behaviours of the health event, in a systemic and adaptive approach that expands the understanding and decision-making capacity of health managers.

Keywords: Public Health Emergency; decision making; health management conditionalities; complex contexts; system dynamics; Cynefin Framework.

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Lista de Siglas e Abreviaturas

CEIS - Complexo Econômico-Industrial da Saúde

ESPII – Emergência de Saúde Pública de Interesse Internacional

ESPIN - Emergência de Saúde Pública de Interesse Nacional

FADES - Framework de apoio à decisão em Emergência de Saúde

H-EDRM - Health Emergency and Disaster Risk Management Framework

OMS - Organização Mundial da Saúde

OPAS - Organização Pan-Americana da Saúde

PPGGETEC - Pós-graduação em Gestão e Tecnologia Industrial

RSI - Regulamento Sanitário Internacional

PPRR - Preparação, Prevenção, Resposta e Recuperação

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1 CAPÍTULO 1: INTRODUÇÃO

1.1 Introdução

A população mundial tem passado por desafios à saúde nas últimas décadas, que se renovam e comprometem a capacidade de resposta dos governos pela ocorrência de eventos como epidemias e pandemias, desastres ambientais, mudanças climáticas e perigos causados pelo homem (Goode *et al.*, 2021). São riscos à saúde pública que, em abrangência internacional, caracterizam as emergências de saúde pública (ESP) ou emergências sanitárias (WHO, 2016a), a exemplo da pandemia da COVID-19 declarada pela Organização Mundial da Saúde (OMS), em 2020.

A OMS, organismo que orienta os esforços para fortalecimento da saúde global, registra mais de 4500 sinais de riscos à saúde por ano e demarca como desafio, em todos os níveis dos sistemas nacionais, prover mais "inteligência" para prontidão dos Estados, nas ações de preparação, prevenção, resposta e recuperação dos sistemas de saúde, com base em melhores dados, para melhores análises e melhores decisões. A "inteligência" é alcançada na compreensão da dinâmica existente entre o comportamento da doença ou risco à saúde e os limites do contexto, com a compreensão de um risco que é global, mas promove impactos locais diferenciados, requerendo tomada de decisão e estabelecimento de políticas adequadas ao enfrentamento da crise (WHO, 2021a).

São contextos complexos de impactos econômicos, sociais, políticos e ambientais que comprometem as agendas de desenvolvimento e colocam os sistemas de saúde no limite de suas capacidades, diante da evolução de um objeto "doença" entendido como multifacetado, simultaneamente uma patologia, risco e dano que exige abordagem interdisciplinar (Almeida Filho; Barreto, 2024; WHO, 2019). Nesse sentido, gestores de empresas, instituições públicas e privadas, de países desenvolvidos ou em desenvolvimento, enfrentam dificuldades de tomada de decisão pelas incertezas do contexto. São decisões sobre problemas não estruturados, aqueles de processos lógicos não definidos e critérios de difícil compreensão (Gomes; Gomes, 2019).

A resposta de um país às ESP depende de colaboração multidisciplinar, ação multissetorial, adoção de novas arquiteturas globais de compartilhamento de dados e ampliação da capacidade de análise dos contextos, desafios que orientam as arquiteturas de frameworks numa perspectiva de mais "inteligência" para apoiar a tomada de decisão dos dirigentes em todos os níveis da saúde. O Estado no enfrentamento da ESP estabelece estratégias de planejamento, monitoramento e coordenação das ações, capacitação de pessoal, alocação de recursos, infraestrutura e logística, gestão da informação e gerenciamento de risco, áreas de objetos para o desenvolvimento de frameworks, métodos e modelos de análise de intervenções nos contextos, como o Health Emergency and Disaster Risk Management Framework - H-EDRM da OMS (Freitas, 2023; WHO, 2019, 2021a), cujas categorias orientam a trajetória desse trabalho.

As diretrizes da OMS para estruturação das capacidades dos países no enfrentamento das ESP integram múltiplas dimensões de gestão (WHO, 2019), embora estudos apresentem frameworks de abordagem limitada sobre a dinâmica das variáveis e a interação dos atores (Angeli; Montefusco, 2020; Keim, 2018; Khan *et al.*, 2018), bem como baixo poder de reaplicação para diferentes contextos e circunstâncias, e uma abordagem que não prioriza a iteração (Warsame; Blanchet; Checchi, 2020), caracterizando um desafio sistêmico dos problemas de gestão pública em contextos complexos de saúde (Eppel, 2017; Homer; Hirsch, 2006). O desenvolvimento de frameworks requer processos reprodutíveis, capazes de incorporar na análise os dados históricos ou lidar com a ausência de dados, para projeções de cenários em eventos novos ou extremamente raros geradores de incertezas (Keim, 2018).

Um estudo qualitativo com profissionais de saúde do Canadá identificou que o desenvolvimento de frameworks precisa estar alinhado com as diretrizes globais nas respostas às ESP, e que a importação de modelos de frameworks entre países deve ser cuidadosa pelas diferentes circunstâncias, em especial, ao pretender um modelo mais adaptativo de resposta às singularidades do contexto (Khan *et al.*, 2018). A interação de campos e atores deve ser preconizada na interconectividade das medidas adotadas, tendo um framework de apoio à decisão o papel de interface entre um problema de saúde e as heurísticas e vieses do decisor, que direcionam escolhas e comportamentos (Kayman; Logar, 2016).

A tomada de decisão numa ESP exige um cálculo o mais próximo possível da realidade, considerando as informações disponíveis no intervalo de tempo da decisão, sejam elas científicas, tecnológicas, políticas ou de gestão, e suas interdisciplinaridades. O uso de frameworks pode atenuar a racionalidade limitada do decisor diante de decisões complexas, quando restrições cognitivas e de informação do decisor, em contexto de incertezas, podem gerar modelos simplificados da realidade (Spiegel; Caulliraux, 2013).

Nesse contexto, este trabalho apresenta o desenvolvimento de um framework para apoiar a tomada de decisão do gestor público de nível estratégico da saúde em ESP, com produção de cenários para intervenções adaptadas ao nível de complexidade dos sistemas de saúde. O estudo assumiu que o contexto de uma emergência é marcado por incertezas que comprometem a decisão, por interdependência e interações complexas (Habegger, 2010), sendo os instrumentos de análise desafiados pela dinâmica dos sistemas envolvidos. Para a estruturação do Framework de Apoio à Decisão em Emergência de Saúde (FADES), desenvolvido por este trabalho, duas metodologias foram integradas: a Dinâmica de Sistemas (Meadows, 2008; Sterman, 2000), pela necessidade de modelagem de estruturas e comportamentos dos sistemas; e o Framework Cynefin (Snowden; Boone, 2007), com interpretação e posicionamento do gestor para a decisão, conforme os domínios de complexidade de um contexto.

1.2 Objetivos

1.2.1 Objetivo Geral

O objetivo geral deste trabalho foi desenvolver um framework para apoiar a tomada de decisão do gestor público de nível estratégico da saúde em emergências de saúde pública, com produção de cenários para intervenções adaptadas ao nível de complexidade dos sistemas de saúde.

1.2.2 Objetivos Específicos

- Elaborar diretrizes para o desenvolvimento de frameworks de apoio à decisão ao gestor público de nível estratégico da saúde, em contextos complexos de emergências de saúde pública;
- mapear condicionalidades de gestão em emergências de saúde pública;
- desenvolver um framework de produção de cenários para intervenções adaptadas ao nível de complexidade dos sistemas de saúde, pelo uso da Dinâmica de Sistemas e da estrutura Cynefin;
- avaliar a aplicação do framework desenvolvido.

1.3 Organização do Documento

Esta tese está organizada no formato multipaper, estruturada em 8 capítulos, com a produção científica apresentada no formato de artigos que se relacionam, visando alcançar o objetivo geral definido, como segue.

No Capítulo 1 é apresentada a introdução do trabalho com informações gerais sobre a contextualização de uma ESP e sua complexidade, a apresentação de lacunas que motivam o estudo e os desafios de frameworks que apoiam a decisão do gestor público de nível estratégico da saúde pública, concluindo com a declaração do objetivo geral e objetivos específicos.

O Capítulo 2 registra a Revisão de Literatura, onde estão abordados os temas que compõem os objetos de análise deste trabalho, iniciando com a tomada de decisão e a complexidade em contexto não-linear de ESP, e o framework de decisão como estrutura para lidar com incertezas, considerando a racionalidade limitada do decisor em ambiente de decisão de múltiplas variáveis.

O Capítulo 3 apresenta o primeiro artigo publicado durante o desenvolvimento desta tese, relacionado ao objetivo específico 2, intitulado *Decision Support Frameworks in Public Health Emergencies: A Systematic Review of Dynamic Models in Complex Contexts.* O artigo apresenta lacunas e diretrizes para o desenvolvimento de frameworks de apoio à decisão em ESP, com base nos componentes de gestão do H-EDRM, respondendo a três questões: Q1: como as estruturas de apoio à decisão gerencial são caracterizadas em contextos de emergência; Q2: para que tipo de intervenção os frameworks estão orientados; e Q3: quais

são os desafios e lacunas a serem superados por frameworks de apoio à tomada de decisão em contextos de ESP.

No Capítulo 4, o segundo artigo é apresentado, intitulado *Prospective Strategies to Enhance Resilience for Public Emergencies Preparedness: A Human Resources Management Perspective*, desenvolvido com alunos do PPGGTEC, que explora condicionalidades do componente Recursos Humanos do H-EDRM, relacionado ao objetivo específico 2, considerando o nível organizacional, o nível estratégico de alinhamento interministerial para respostas à crise sanitária, e a dimensão dos trabalhadores, numa interseção de resiliência psicológica do colaborador e cultura organizacional. No contexto da emergência, o estudo amplia o olhar sobre uma perspectiva de fatores políticos, sociais, econômicos, tecnológicos e ambientais que impactam as organizações e os recursos humanos em contexto de emergência de saúde púbica.

No Capítulo 5, o terceiro artigo é apresentado, intitulado *Guidelines for implementation of a public health emergency observatory*, desenvolvido em parceria com o programa de Bacharel em Ciência e Tecnologia da Universidade Federal de Santa Catarina. O artigo apresenta diretrizes para a formulação de observatórios nas ESP, como contribuição ao processo de promover a transparência das informações de saúde, colaborar na prevenção de surtos e epidemias, e integrar tecnologias para melhorar a coleta, análise e disseminação de dados de saúde, permitindo uma resposta mais eficaz e baseada em evidências. O título está associado ao componente Gestão da Informação e do Conhecimento do H-EDRM, relacionado ao objetivo específico 2.

No Capítulo 6, no quarto artigo, apresenta-se um mapeamento das condicionalidades de gestão segundo as diretrizes da OMS e as estratégias de cooperação dos Estados-Membros para enfrentamento das ESP, relacionado ao objetivo específico 2. O título do artigo é *Strategic Decisions in Public Health Emergencies: Management Conditionality based on WHO Guidelines, e foi desenvolvido como* uma revisão integrativa.

O Capítulo 7 apresenta, no quinto artigo, o modelo intitulado Framework de Apoio à decisão em Emergência de Saúde (FADES), e está relacionado aos objetivos específicos 3 e 4, de desenvolvimento e avaliação da aplicação. O artigo integra a Dinâmica de Sistemas com o Framework Cynefin, com estrutura de geração de sentido para o decisor e seu posicionamento na emergência, conforme o contexto. O caso dos hospitais da cidade de Manaus, Amazonas, Brasil, na pandemia da COVID-19, foi abordado como exemplo de modelagem na aplicação do FADES.

No Capítulo 8 encontram-se as conclusões do presente trabalho, com temas propostos para pesquisas futuras, com base nas lacunas abordadas e oportunidades de fortalecimento da gestão no ciclo de preparação, prevenção, resposta e recuperação dos sistemas de saúde, no âmbito das ESP. A Figura 1 apresenta o fluxograma da estratégia metodológica utilizada neste estudo, justificando a apresentação no formato de capítulos inter-relacionados.

Figura 1. Fluxograma da estratégia metodológica utilizada nesse estudo.



Fonte: elaborado pelo autor (2024).

2 CAPÍTULO 2: REVISÃO DE LITERATURA

2.1 Tomada de Decisão, Frameworks e Nível Estratégico em Emergências de Saúde Pública

Em contexto de complexidade, o processo de decisão é uma escolha diante de um problema ou oportunidade de mudança, com alternativas fruto do confronto de múltiplas variáveis e critérios, a fim de produzir um resultado possível. O centro decisor lida com objetivos conflitantes que distanciam a solução ótima, marcada pelo cálculo de ganhos e perdas dos agentes para alcançar uma nova realidade. As decisões requerem uma abordagem quantitativa e qualitativa, podendo ocorrer subjetividade e incerteza, dificultando a verificação dos impactos da decisão (Gomes; Gomes, 2019).

Centro decisor, no âmbito das ESP, constitui salas de situação, centros de operações e gabinetes de crise, o lugar da decisão. Cuba define a sala como uma unidade de inteligência epidemiológica de visão integral e intersetorial, que considera informações técnico-científicas no apoio à decisão. O Peru caracteriza a sala como um espaço de processo institucional da decisão, como parte do papel de governo numa coordenação que integra nível central e regional (OPAS, 2010).

No Brasil, a definição de sala destaca a integração de dados de saúde de um espaço geográfico num período, com dimensões sociais, econômicas e demográficas para uma visão global sobre o contexto, estrutura essencial para o processo de gestão (OPAS, 2010). No país, conforme os princípios de organização do Sistema Único de Saúde nas esferas federal, estadual e municipal, decisões são tomadas pelo Ministério da Saúde, secretarias estaduais, municipais e órgãos equivalentes, os quais são os lugares de decisão do gestor público de nível estratégico da saúde (Machado; Lima, 2012).

A Fundação Oswaldo Cruz, Instituição Estratégica de Estado para a Saúde, um órgão do Ministério da Saúde do Brasil, estabeleceu salas de situação para emergências nos últimos anos, em situações de desafios para a saúde púbica do país: a Epidemia de Febre Amarela Rural em 2017 (OPAS, [*s. d.*]; WHO, 2018); o caso do rompimento da barragem de Brumadinho, Minas Gerais, em 2019 (Vinicius; Lemos, 2020); o evento de contaminação do petróleo no litoral brasileiro, em 2019; (Pena *et al.*, 2020; Silva *et al.*, 2021); a pandemia da COVID-19 em 2020 (Portela; Reis; Lima, 2022; Sachs *et al.*, 2022); e a desassistência ao povo indígena Yanomami em 2023 (Brasil, 2023). São eventos que integram múltiplas variáveis de uma situação-problema de saúde pública, a articulação de atores e processos de decisão em contexto de incertezas.

Nesse sentido, a OMS amplia a visão sobre os mecanismos de preparação, prevenção, resposta e recuperação para as ESP, ao nível de um hub de inteligência, com incentivo a novas arquiteturas globais de compartilhamento de dados e fortalecimento das análises (WHO, 2021a), com base numa abordagem que relacione vulnerabilidades e capacidades como condicionalidades de um contexto nas respostas às emergências, observando fatores

demográficos, ambientais, sociais e econômicos, e gerando uma inteligência colaborativa no processo de decisão (WHO, 2022, 2023d).

Uma condicionalidade, no âmbito da economia, é definida como a prática de fornecer assistência financeira subordinada à implementação de políticas específicas, entendida como um dispositivo de compromisso para lidar com problemas de inconsistência temporal, ou seja, a tendência dos agentes econômicos de mudar suas preferências ao longo do tempo (Dreher, 2009). Para a área de saúde, conforme o Guia de Acompanhamento de Condicionalidades do Programa Bolsa Família do governo brasileiro, que visa a transferência de renda para famílias em situação de pobreza e extrema pobreza, uma condicionalidade estabelece um compromisso entre famílias e poder público para garantir acesso a direitos sociais como vacinação, acompanhamento nutricional de crianças e pré-natal para gestantes (Brasil, 2020).

A condicionalidade em gestão na saúde é um compromisso dos governos dos países com a sociedade, sobre capacidades, vulnerabilidades e níveis de exposição de uma população ao risco, que impactam no enfrentamento de ESP (Brasil, 2020). São vulnerabilidades como processos sociais, políticos, econômicos, biológicos e ambientais que influenciam as condições de vida e contribuem para o aumento de riscos nas ESP; e níveis de exposição da população aos perigos ou ameaças, conforme o perfil populacional; e capacidades instaladas do setor saúde para um evento sanitário (Freitas, 2023).

A decisão sobre condicionalidades na crise sanitária integra organizações, políticas públicas e sociedade, em um contexto que requer atenção às plataformas de colaboração multidisciplinar e multissetorial, à relação entre conhecimento gerado e ação, e à superação da fragmentação de dados entre os decisores em escala global. Assim, a complexidade da decisão implica adotar métodos e ferramentas de análise, articular especialistas, acessar o conhecimento coletivo e incorporar fatores cognitivos do decisor e seu ambiente para uma abordagem contextualizada (WHO, 2021a).

A tomada de decisão desafia os modelos de frameworks pela racionalidade limitada do decisor e suas heurísticas e vieses em ambientes de múltiplas variáveis de incerteza (Kayman; Logar, 2016), implicando ao modelo capturar informações linguísticas complexas e compreender hesitações dos decisores (Shi *et al.*, 2022). O decisor lida com evidências de baixa ou média certeza, que impactam as decisões iniciais no enfrentamento das emergências (Groot *et al.*, 2021; Miglietta *et al.*, 2021; Schünemann *et al.*, 2020).

Nesse sentido, o processo de decisão tem o desafio de aproximar heurísticas e vieses do decisor e o ambiente, promovendo subsídios que considerem o maior número de variáveis sobre a realidade, onde a informação cumpre papel estruturante no processo decisório. O termo heurísticas-cognitivas foi usado pela primeira vez por Albert Einstein para designar uma ideia que ele considerava incompleta, mas útil, por conta dos limites do nosso conhecimento, um tipo de raciocínio não entendido como final, mas provisional e plausível para resolver um problema. Na abordagem das heurísticas e vieses, percebe-se um grau de incerteza no raciocínio probabilístico humano, quando reduções ou simplificações da realidade diante de

problemas complexos são as primeiras reações do decisor, segundo sua cognição. Vieses são usados para descrever desvios de uma norma, mas podem indicar uma tendência sobre possibilidades (Spiegel; Caulliraux, 2013).

O framework para tomada de decisão na emergência é desenvolvido no campo de sistemas adaptativos complexos, que são dependentes de uma realidade de partida e da evolução das interações dos atores em situações de incerteza. Essa dinâmica torna desafiantes as reações sistêmicas a partir das medidas adotadas pelos governos dos países, que guardam características próprias de seus contextos (Angeli; Montefusco, 2020). É uma abordagem da dinâmica das estruturas e comportamentos com efeitos de feedback, que geram informações para uma abordagem flexível e adaptada a um ambiente em constante estado de mudança (Sterman, 2000).

2.2 A complexidade da decisão nas emergências de saúde pública

Os problemas em contexto complexo, como as ESP, são condicionados por múltiplas variáveis e critérios adotados pelos decisores, conforme suas expectativas e circunstâncias (Gomes; Gomes, 2019). As decisões são interdependentes e geram efeitos sistêmicos nas emergências: uma medida de isolamento social pode inibir a circulação do vírus, mas paralisar a economia e comprometer o sustento de famílias; a indicação de afastamento social nem sempre é possível na situação de populações em situação de vulnerabilidade social, como favelas e populações indígenas que vivem em agregamento familiar de maior densidade; o trabalho e o estudo remoto resolvem parcialmente a situação em contexto de crise, mas podem gerar ansiedade e complicações de saúde mental. São contramedidas adotadas que comprometem a ordem social, cujas ações no tempo devem alinhar socialmente mecanismos e contextos, e seguir uma tomada de decisão adaptativa para a produção de sentido e aprendizagem coletiva (Angeli; Montefusco, 2020).

A complexidade da decisão de nível estratégico na ESP reside na interdependência de fatores políticos, sociais, econômicos e sanitários, e relaciona aspectos locais, regionais e globais, cuja capacidade de resposta requer abordagem direcionada ao contexto da crise (Khan *et al.*, 2018), pois integra comportamentos de indivíduos e organizações, conectividades, dependências e a dinâmica de sistemas (Project Management Institute, 2014). As decisões convencionais de um estado de normalidade se mostram insuficientes para controlar uma crise de dimensão pandêmica. O evento pandêmico requer estratégias de governança, a capacidade de um ou mais tomadores de decisão realizar uma agenda, função ou valor público em face do desafio, por meio de adaptação e redirecionamento de soluções de governança (Ansell; Sørensen; Torfing, 2021).

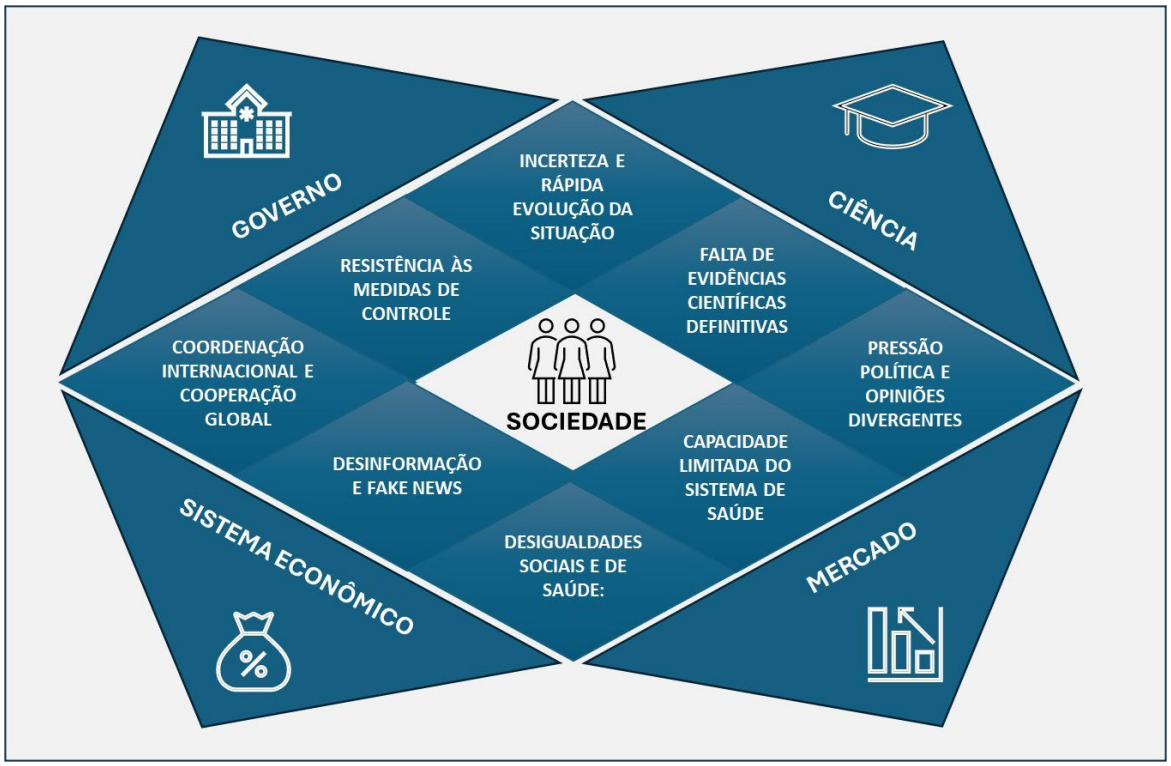
Em outra análise, a complexidade do contexto acata a possibilidade de decisão por improviso, que é adaptativa e responsiva, acontece fora do planejamento formal e tem forte peso da dimensão cognitiva do decisor, com ação por intuição e capacidade de julgamento para a locação de recursos estratégicos. Para isso, a improvisação deve se basear nas capacidades de fluidez de recursos, na liderança estratégica e no nível de resiliência

organizacional, aspectos que indicam um estado de prontidão das organizações para a improvisação em contextos complexos (Hughes *et al.*, 2020).

Notadamente, os governos agem conforme os níveis de centralização do modelo de decisão. A descentralização favorece os níveis de adaptação, mas a centralização alinha a coordenação das iniciativas pelo nível central de governo. Nesse sentido, a burocracia tem papel estruturante nas decisões, pois subsidia a implantação e o cumprimento de políticas e preserva as instituições, as quais são objeto de avaliação nos pós-crise, portanto, uma burocracia com estrutura preparada para o contexto de emergência sanitária, favorável ao processo de decisão na busca por adaptabilidade e estabilidade das respostas para a sociedade (Janssen; van der Voort, 2020).

A Figura 2 representa a complexidade das decisões na pandemia da COVID-19, que significou um desafio para os governos nos níveis de interlocução global, observando aspectos sistêmicos que integram governantes em todos os níveis, sistema econômico, mercado e a ciência que representa o conhecimento e a voz de especialistas.

Figura 2. Complexidade da decisão na pandemia da COVID-19.



Fonte: elaborado pelo autor (2024).

A natureza dinâmica da pandemia e a evolução rápida da situação epidemiológica dificultaram a previsão de cenários futuros e a tomada de decisão, pelas incertezas e rápida evolução da crise sanitária, que confrontava a capacidade dos sistemas de saúde e de todos os setores da sociedade num desafio de escala global, de coordenação internacional para implementação de contramedidas (Sachs *et al.*, 2022), num contexto de múltiplas variáveis e

que exigia uma abordagem adaptativa e iterativa dos processos de decisão (Warsame; Blanchet; Checchi, 2020).

No início da pandemia da COVID-19 havia uma escassez de evidências científicas definitivas sobre o vírus, sua transmissão e tratamento, o que tornou desafiador tomar decisões embasadas em dados concretos (Sachs *et al.*, 2022). As evidências são estruturantes para as decisões num contexto pandêmico (Miglietta *et al.*, 2021), mesmo que não sejam conclusivas e estejam em etapa de pesquisa na perspectiva de redução de danos, um desafio de como o dirigente lida com evidências de baixa ou média certeza no início da crise sanitária (Schünemann *et al.*, 2020). A proteção da sociedade com base em evidência associa dimensão científica, ética e gestão, fatores sociais, infraestrutura e logística para intervenções assertivas, geração de conhecimento e aprendizagem do decisor (Groot *et al.*, 2021; McDonald *et al.*, 2020).

A pressão política, opiniões divergentes de especialistas e a polarização da sociedade em relação às contramedidas de saúde pública complicaram o processo de tomada de decisão e a implementação de políticas eficazes. A capacidade limitada dos sistemas de saúde para lidar com inúmeros casos de COVID-19 na velocidade em que a doença avançava sobrecarregou os recursos disponíveis, o que influenciou as decisões sobre alocação de recursos e priorização de atendimentos (Sachs *et al.*, 2022), com ausência de equidade nas estratégias para garantir um acesso digno a saúde com base em evidência diante das desigualdades, como defende o Tratado Pandêmico da OMS que está em desenvolvimento a partir da experiência da COVID-19 (WHO, 2023b).

A sociedade vivia o limite das estruturas e da capacidade de resiliência que atingia o sistema econômico e os mercados, diante de uma fadiga pandêmica e resistência da população às medidas de controle, como lockdowns e distanciamento social, o que representou desafios adicionais para as decisões estratégicas e a manutenção do apoio público às ações de prevenção. O contexto estava marcado pela desinformação e disseminação de fake news, comprometendo a comunicação eficaz de medidas de saúde pública, levando a decisões equivocadas por parte da população e autoridades, exigindo colaboração e estratégias baseadas em evidência, sensíveis às necessidades da população para enfrentar esses obstáculos (Sachs *et al.*, 2022). O conceito de resiliência precisou ir além de restaurar o equilíbrio anterior de uma situação, na perspectiva de reconstruir melhor as estruturas para uma nova realidade (Ansell; Sørensen; Torfing, 2021).

A complexidade do planejamento como objeto de interface do comportamento de sistemas, indivíduos e grupos em contexto de saúde lida com não-linearidades, que é cíclica e iterativa no efeito sistêmico, potencializada por estímulos débeis e associada a eventos que não cabem numa abordagem cartesiana, que fraciona o objeto para entendê-lo numa visão reducionista do mundo, não integrativa de disciplinas e de desafios que acometem a sociedade. O processo saúde-doença-cuidado é transdisciplinar e provoca as políticas públicas sobre unidade e diversidade, processos históricos e fragilidades da sociedade, em especial ao lidar com uma emergência de saúde que agrega uma nova realidade, diferente de outras

formas de determinação do risco e que desafia estruturas existentes, quando lidar com essa complexidade exige ir além do reposicionamento de um elemento ou variável, da mudança de forma ou mesmo da composição de elementos que formam um novo objeto-doença (Almeida Filho, 2006).

O desafio se localiza na dinâmica dos sistemas da sociedade, pela sensibilidade ao movimento das estruturas e atores a partir das interações e transformações dos elementos de análise, que guardam a necessidade de superação de uma "borrosidade" ou efeito de pouca nitidez sobre as fronteiras dos sistemas, exigindo interpretação e adaptação. Nesse contexto, ALMEIDA FILHO (2000) chama a atenção para o conceito de "Integrais de saúde-enfermidade-atenção", definido como:

> objetos complexos, metáforas de representação social de enfermidades em forma de trama de pontos sensíveis ou estruturas epidemiológicas, redes de causalidade ou relações de produção de risco. Predomina em tais objetos uma lógica múltipla e plural que não se pode expressar de uma maneira codificada, mas que somente se pode reconhecer por seus efeitos (Almeida Filho, 2000, 2006).

Para a gestão, os integrais promovem uma abordagem interdisciplinar da saúde como bem-estar físico, mental e social; da doença como expressão da vida em contextos desfavoráveis; e do cuidado à saúde que recupera a capacidade do indivíduo em todas as suas formas. Essa trama favorece a investigação de problemas de saúde integrando os determinantes de saúde, o risco e a mobilização de produtos e serviços, nas ações intersetoriais, conforme o contexto e características populacionais (Almeida Filho, 2000; Almeida Filho; Barreto, 2024).

Nesse sentido, por um olhar interdisciplinar a partir dos integrais saúde-enfermidade-atenção, a Dinâmica de Sistemas (Sterman, 2000) possibilita avançar na capacidade explicativa de tratar a gestão dos problemas de saúde sem ter o conhecimento completo, mas por simulação e inferência na exploração do processo de entendimento-conhecimento-planejamento-ação-avaliação do processo de decisão (Almeida Filho; Barreto, 2024).

2.3 Dinâmica de Sistemas e Estrutura Cynefin

A área de gestão, em abordagem sistêmica, encontra no campo da Dinâmica de Sistemas uma perspectiva não linear para compreender as sociedades, suas estruturas e comportamentos (Sterman, 2000). A gestão pública como um processo que demanda dinâmica de produção de bens e serviços, susceptível às variáveis exógenas e ao contexto social, encontra no âmbito das emergências a instabilidade política e o gerenciamento de diferentes agravos ao mesmo tempo (WHO, 2021b), o que pode caracterizar uma sindemia pela coexistência de danos (Horton, 2020).

Nesse sentido, a metodologia de Dinâmica de Sistemas considera um movimento de constantes mudanças no contexto, permite incorporar experiências anteriores e o comportamento das estruturas na análise dos sistemas. Na perspectiva sistêmica, tudo está conectado e as decisões promovem impactos umas nas outras e nelas mesmas. O conceito

permite uma abordagem contraintuitiva sobre um problema, pois os pontos de alavancagem em sistemas complexos não são óbvios, sendo necessário ir além das causas próximas aos eventos que pretende explicar (Sterman, 2006), que nas ESP desafiam as estratégias de previsão, proteção e resiliência dos sistemas de saúde (Ansell; Sørensen; Torfing, 2021).

A Dinâmica de Sistemas contribui para superar a disparidade entre a capacidade da mente humana e a complexidade do mundo, face a não-linearidade diante da racionalidade limitada introduzida por Herbert Simon, que se refere à ideia de que os tomadores de decisão têm limitações no processamento de informações e na tomada de decisão devido a restrições cognitivas e limitações de tempo, o que é um desafio nas emergências, com implicações na compreensão sobre a percepção de risco a partir de estratégias excessivamente conservadoras ou otimistas (Yearworth, 2020).

Nessa abordagem, ao citar sistemas, entendem-se subsistemas de um único sistema, pois prevalece a observação do mundo como um continuum, sendo a análise circunscrita por uma questão focal sobre um ponto de discussão específico que se planeja conhecer o comportamento, mas sempre com fronteiras permeáveis para o grande sistema (Meadows, 2008). Busca-se, assim, amparo na evolução da Teoria Geral de Sistemas, que descreve sobre a interação de múltiplas variáveis, os fluxos e forças de organização da dinâmica das sociedades (Bertalanfy, 1975).

A Dinâmica de Sistemas tem como fundador Jay Forrester, um engenheiro de sistemas estadunidense e professor do MIT Sloan School of Management, que em seu livro "Industrial Dynamics" (1961), definiu a metodologia como uma forma de estudar o comportamento dos sistemas industriais pela interrelação de estruturas, políticas e decisões que influenciam o crescimento e a estabilidade organizacional. Ele traduzia o desafio da gestão como o gerenciamento de múltiplos fatores e suas conexões, as relações não-lineares e o curso dos eventos, sendo necessário simular a implantação de políticas e fluxos informacionais – o chamado Laboratório de Gestão (Forrester, 1961).

A ideia era reforçar o pensamento sistêmico com conceitos de loops de feedback e relações causais, números e computação digital para modelar e analisar sistemas complexos de forma dinâmica, visando compreender a interconexão e interdependência dos elementos que compõem as estruturas organizacionais numa perspectiva de longo prazo, um trabalho que alcançou as áreas de gestão de negócios, dinâmica urbana, sustentabilidade ambiental, saúde e economia nos estudos que o procederam (Forrester, 2007; Sterman, 2018).

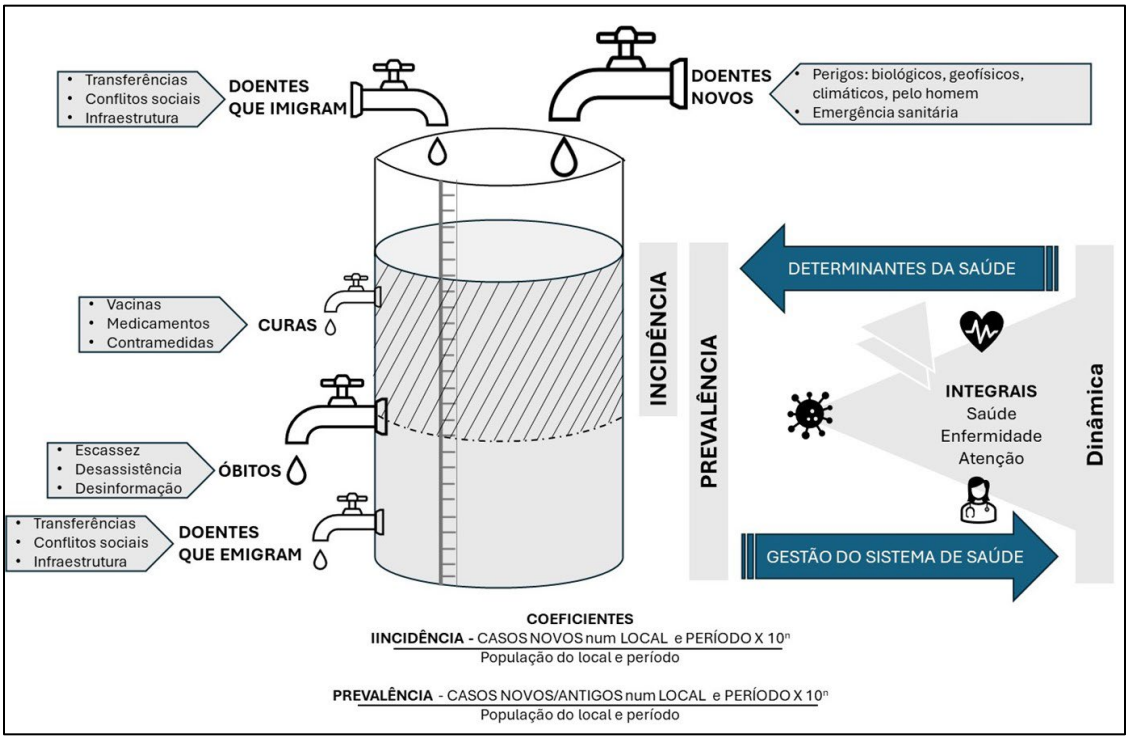
A modelagem de sistemas envolve a criação de modelos computacionais das estruturas de um sistema, por meio de representações gráficas das relações de causa e efeito entre as variáveis, para visualizar como as mudanças podem influenciar o sistema (Barnabè; Davidsen, 2020). Sua estrutura de análise tem como elementos: (a) o estoque que concentra a memória da história dos fluxos de mudança dentro do sistema, e que atua como amortecedor de choque; (b) os fluxos de entrada e saída dos estoques num período de tempo; (c) e ciclos de feedback, quando uma alteração no estoque altera o fluxo de entrada ou de

saída do mesmo estoque (Meadows, 2008). Sua aplicação adota equações que representam a simulação de processos, estruturas e comportamentos de um problema da vida real (Martín García, 2024).

A Dinâmica de Sistemas apoia o decisor na visualização e compreensão das interações dinâmicas entre diferentes variáveis e componentes de um sistema, antecipa possíveis consequências das decisões antes de implementá-las, identifica pontos de alavancagem, e permite testar hipóteses e gerar aprendizado no curso das decisões (Sterman, 2001). Qualitativamente incorpora diagrama causal para representar as relações de causa e efeito (Barnabè; Davidsen, 2020), e numa abordagem quantitativa, utiliza parâmetros e equações matemáticas que representam as relações entre variáveis, as acumulações e os atrasos que afetam a dinâmica do sistema (Naugle; Langarudi; Clancy, 2024).

Na saúde, conforme descrito na Figura 3, a dinâmica da variação do número de casos de uma doença ou agravo que incide sobre uma população considera um estoque resultante da quantidade de casos novos e existentes, e todos os fluxos de entrada e saída desse estoque. Esses compõem a Taxa de Prevalência, na relação entre o número de casos conhecidos (novos e antigos) e a população de origem dos casos, em um lugar referido, e num período de tempo (dia, mês, ano); e a Taxa de Incidência, que traduz a intensidade com que uma doença acontece na população, medindo a ocorrência de casos novos (Almeida Filho; Barreto, 2024).

Figura 3 - Prevalência e Incidência da doença e a dinâmica das variáveis na Gestão das ESP.



Fonte: Adaptado de (Almeida Filho; Barreto, 2024; Funasa, 2001).

O estoque como um acúmulo da memória dos fluxos de entrada e saída, a partir de variáveis que representam a doença e seus impactos, pelos coeficientes de incidência e de

prevalência, possibilita ao gestor observar comportamentos e estruturas relacionados às condicionalidades da gestão no enfrentamento da ESP (Príncipe; Winkler; Ferreira, 2024b).

Na Figura 3, o exemplo apresenta fluxo de entrada representado por doentes novos, a partir de perigos biológicos, climáticos, geofísicos ou aqueles causados pelo homem com potencial de gerar uma emergência de saúde (WHO, 2019). Em outro fluxo, existe a possibilidade de doentes imigrarem para um sistema de saúde, por transferência, deficiência de infraestrutura de saúde ou conflitos sociais e guerras, em ocorrências de saúde pública que não respeitam fronteiras e impactam um núcleo receptor, o que pode resultar em superlotação de estruturas e aumento do risco de transmissão de doenças (Gully, 2020)

Nos fluxos de saída são observados os pacientes curados, por acesso a medicamentos, vacinas e serviços, conforme as características do sistema produtivo de saúde do país, que no Brasil segue o conceito do Complexo Econômico-Industrial da Saúde – CEIS, uma visão sistêmica e interdependente da produção de recursos para a saúde, que fortalece o desenvolvimento econômico e social (Gadelha, 2021). O exemplo ainda registra como fluxo de saída, os óbitos resultantes da doença, para aqueles que não resistiram por falta de acesso, escassez de recursos, desistência ou desinformação que inibe a aceitação de tratamento adequado, a partir de retóricas anticiência. Doentes emigram por transferência para outras regiões, conforme as limitações do contexto, como aconteceu na pandemia da COVID-19 (Sachs *et al.*, 2022).

O tamanho da torneira significa a intensidade do fluxo e pontos de alavancagem para intervir num sistema, por exemplo, a adequação de um estoque pelo ajuste quantitativo e temporal de um parâmetro (taxas, índices, indicadores), o tamanho do estoque em relação aos seus fluxos (tempo de internação hospitalar), o sistema físico e os nós de interseção (insumo do complexo produtivo), o equilíbrio dos ciclos de feedback em relação aos impactos que pretende alcançar (limite seguro do sistema de saúde com o avanço da doença), e a mudança de paradigma que estrutura o sistema (estratégias, políticas que regulam o sistema) (Meadows, 2008)

A efetividade de uma ESP, no âmbito da gestão, considera na análise as taxas de incidência e de permanência, mas igualmente as variáveis que condicionam a situação de partida do contexto (Angeli; Montefusco, 2020). São os determinantes da saúde como resultante de processos políticos e sociais (Almeida Filho; Barreto, 2024), numa dinâmica que articula os integrais de saúde-enfermidade-atenção (Almeida Filho, 2000, 2006) na gestão do sistema de saúde, e que precisa ser monitorada, conforme a complexidade da emergência.

Nesse sentido, a Dinâmica de Sistemas pode ser usada para modelar doenças e riscos à saúde pública ao considerar as complexas interações e retroalimentações entre fatores, possibilitando avaliar a capacidade dos sistemas de saúde, o impacto de intervenções na saúde da população, e uma abordagem baseada em evidências para a formulação de políticas de saúde (Homer; Hirsch, 2006). A modelagem da complexidade em gestão integra variáveis a partir de condicionalidades de um contexto, como descrito em PRÍNCIPE; WINKLER;

FERREIRA (2024a), que mapeou pontos de atenção à luz de diretrizes da OMS, como o Regulamento Sanitário Internacional (WHO, 2016b) e as Estratégias de Cooperação dos Estados-membros (WHO, 2020b) no enfrentamento das emergências.

A Dinâmica de Sistemas é reconhecida por sua ênfase na compreensão dos processos causais subjacentes aos comportamentos observados nos sistemas, no entanto, alguns desafios são identificados para sua consolidação, relacionados à incompreensão de sua estrutura, ou ao seu alcance como método misto (qualitativo, quantitativo) para analisar contextos complexos (Kunc; Morecroft; Brailsford, 2018). Todavia, há críticas em relação à forma como a dinâmica de sistemas utiliza e interpreta os dados históricos na construção de modelos, por uma abordagem que tende a simplificar a complexidade dos sistemas e pode não capturar a diversidade das relações hierárquicas, ou a construção de modelos muito grandes e de difícil compreensão e comunicação de resultados, e em outra análise, alcançar a dimensão do comportamento do indivíduo em detrimento dos modelos de dados agregados (Featherston; Doolan, 2012).

Nesse sentido, a análise de variáveis produzida pela Dinâmica de Sistemas precisa ser interpretada e ganhar um caráter de urgência e hierarquia, o que na composição do modelo desenvolvido (FADES), se completa com os domínios do Framework Cynefin, uma estrutura que classifica os problemas em domínios de complexidade com abordagens e estratégias específicas, analisando a relação entre causa e efeito (Snowden; Boone, 2007).

A estrutura foi desenvolvida por Dave John Snowden em 2000, consultor e pesquisador no campo da gestão do conhecimento e da aplicação da ciência da complexidade. Cynefin (*kuh-nev-in*) é uma palavra galesa que relaciona horizontes de conhecimento e a compreensão das relações da sociedade em fluxo contínuo, que se transforma a partir do passado, com fatores interligados e experiências que influenciam pensamento, interpretação e ação (European Commission, 2021).

Em situações de crise auxilia o decisor na abordagem de estratégias específicas, como adaptar a resposta segundo as características de um problema e agir para restaurar a ordem. As orientações acontecem a partir da interação de fatores, incentivando a inovação a partir de um estado de crise e gerando aprendizagem na busca por decisões eficazes (Pinto; Davis; Turner, 2024).

Os domínios de complexidade são organizados em quadrantes do mais ordenado com causa e efeito previsíveis, denominados Simples e Complicado; passando por uma trajetória que requer experimentação e adaptação de estratégias, apresentada no domínio Complexo; até aquele que pode alcançar um estado de caos em ambiente instável e imprevisível, o domínio Caótico (Turner; Snowden; Thurlow, 2022), como detalhado em outro estudo do grupo que apresenta do FADES, em sua abordagem conceitual e estrutura analítica que associa Dinâmica de Sistemas e Estrutura Cynefin (Príncipe; Winkler; Ferreira, 2024a)

A Dinâmica de Sistemas precisa fortalecer o reconhecimento de uma hierarquia de decisões e aprimorar a comunicação das análises para a sociedade, a partir dos modelos

gerados (Featherston; Doolan, 2012), o que pode ser interpretado nos domínios de complexidade do Framework Cynefin, uma estrutura de naturalização do conceito de sensemaking em decisões complexas (Turner *et al.*, 2023). Por sua vez, o Framework Cynefin não indica como identificar as características de um contexto para localizar a rota de transição adequada (simples, complicado, complexo e caótico), o que pode ser alcançado pelo mapa sistêmico produzido pela modelagem da Dinâmica de Sistemas (Meadows, 2008; Sterman, 2000), portanto, um beneficiamento que segue a tendência de integração de diferentes metodologias para problemas de decisões complexas, numa compreensão qualitativa de questões que auxilia a estruturação de um modelo quantitativo, com a possibilidade de produção de cenários e experimentação de incertezas e preferências dos decisores (French, 2023).

Existem efeitos de transição entre os domínios do Framework Cynefin, o observável pela integração com a Dinâmica de Sistemas. São metodologias que se beneficiam de uma abordagem mais adaptativa de um contexto de saúde, numa combinação que entendemos ser capaz de ampliar a visão do gestor sobre as complexidades da gestão nas ESP.

2.4 Emergências de Saúde Pública

A OMS, agência especializada das Nações Unidas fundada em 1948, orienta os esforços das nações para alcançar uma cobertura universal de saúde, numa percepção de saúde além da ausência de doença que valoriza os direitos fundamentais de todo ser humano, fruto da cooperação dos países (WHO, 2020a). A OMS atua em cooperação com Estados-membros organizados nas regiões de África, Américas, Mediterrâneo Oriental, Europa, Sudeste Asiático e Pacífico Ocidental, e com a sociedade civil, organizações internacionais, fundações, pesquisadores e profissionais de saúde, que se articulam por uma agenda de saúde e desenvolvimento. Sua governança acontece por uma Assembleia Mundial da Saúde e um Conselho Executivo que cuidam do processo decisório e da execução de políticas. O financiamento acontece com a participação dos Estados-membros, com base numa percentagem do produto interno bruto e outras doações individuais do público e parceiros empresariais (WHO, [*s. d.*]).

A direcionalidade da OMS com os Estados-membros adota documentos de referência, diretrizes e pareceres de especialistas, os quais são constantemente atualizados, sendo o Regulamento Sanitário Internacional (RSI) a principal referência. Criado em 2005 e em aplicação a partir de 2007, o RSI é o instrumento que orienta os países em respostas contra a propagação internacional de doenças, visando o fortalecimento de capacidades mínimas (WHO, 2024b), incluindo legislação, política e financiamento nacionais, coordenação e comunicação de pontos focais, vigilância, orientações para os pontos de entrada numa região, comunicação de riscos e preparação de recursos humanos e de serviços laboratoriais. A revisão mais recente do RSI reforça equidade, solidariedade, cooperação internacional, transparência e soberania como pontos fundamentais para as medidas de enfrentamento das emergências (ANVISA, 2009; WHO, 2016a, 2023c).

A motivação inicial do RSI data de 1969, com a criação de regulamentos específicos para determinadas doenças, tendo evoluído para uma visão mais abrangente sobre risco à saúde pública (Gostin; Katz, 2016). O RSI define Emergência de Saúde Pública de Importância Internacional (ESPII) como a constituição de um risco que afeta os Estados devido à propagação internacional de uma doença e exige resposta internacional coordenada. Risco para saúde pública é "a probabilidade de um evento afetar adversamente a saúde das populações humanas, com ênfase naquele que pode se espalhar internacionalmente ou representar um perigo sério e direto" (WHO, 2016a). Como desafio amplo para a saúde global, as ESP ressaltam a importância de uma ação integrada e interdisciplinar sobre risco, considerando o conceito de Saúde Única (*One Health*), o qual relaciona a saúde humana, animal e dos ecossistemas (Winck *et al.*, 2022).

Nesse sentido, a OMS declara a meta dos três bilhões para valorização dos Objetivos de Desenvolvimento Sustentável até 2030, que estabelece: "um bilhão de pessoas melhor protegidas de emergências de saúde; um bilhão de pessoas desfrutando de melhor saúde e bem-estar; e um bilhão de pessoas beneficiadas por sistemas de saúde mais fortes e resilientes", o que tem impacto direto na capacidade de gestão dos Estados-membros e dos processos de decisão para fortalecer a resiliência da sociedade e a saúde global (WHO, 2021b).

Em dimensões e caracterização, a emergência pode ser um surto que ocorre com o aumento repentino na incidência de uma doença numa região; uma endemia, com presença constante de uma doença ou agente infeccioso em uma área geográfica, ou grupo populacional. Como epidemia, registra surtos repentinos de uma doença em um país que não eram reconhecidos naquela região, ou quando ocorre um aumento rápido do número de novos casos de uma doença endêmica previamente existente. Quando uma epidemia de doença infecciosa se dissemina para vários países, com presença em mais de um continente e afeta um número grande de pessoas, caracteriza uma pandemia (BIREME, 2023), uma Emergência de Saúde Pública de Importância Internacional (ESPII) decretada pela OMS (WHO, 2016b), ou Emergência de Saúde Pública de Importância Nacional (ESPIN), estabelecida pelos governos dos Estados, como no Brasil, descrita em portaria do Ministério da Saúde do Brasil (Brasil; Ministério da Saúde, 2011).

A declaração de uma ESPII pela OMS considera o impacto do evento na saúde pública, seu aparecimento inesperado, a possibilidade de propagação internacional e o risco para viagens e o comércio em geral, afetando a cadeia de logística, tendo os países o dever de notificar as autoridades. Nesse contexto, a estratégia de governo adota mecanismos extraordinários de mobilização de recursos, coordenação internacional e desenvolvimento acelerado de soluções de saúde, como medicamento, vacina e kit diagnóstico. A definição de uma ESP ou crise sanitária tem o desafio de ser uma decisão não binária, com uma abordagem graduada de risco mediante a complexidade do contexto. Entretanto, o atraso na resposta pode causar complicação na adoção de medidas urgentes, por outro lado, sua declaração pode significar um desafio econômico e social, tornando complexo o processo de instalação e convívio com a emergência. Um enfoque por tipo e intensidade de risco, sempre que possível,

pode incentivar medidas mais precoces para a preparação dos países (Wilder-Smith; Osman, 2020).

A tipificação e a características das emergências condicionam os níveis de decisão em gestão em diferentes abrangências, como apresentado no Quadro 1.

Quadro 1 - Emergências de saúde pública - complexidades.

ANO	EVENTO	ABRANGÊNCIA	FONTE
Vírus Respiratório			
1918	Pandemia H1N1 (Gripe Espanhola)	EUA -Mundo	(Barbosa, 2020; BIREME, 2023)
1957	Pandemia H2N2 (Gripe aviária)	China-Mundo	(Crowe, 2008)
1968	Pandemia H3N2 (Gripe Hong Kong)	China-Mundo	(Crowe, 2008)
2002	Epidemia de SARS	China-26 países	(BIREME, 2023; Crowe, 2008)
2009	Pandemia H1N1	México-Mundo	(Carmo, 2020; Rosella *et al.*, 2013)
2020	Pandemia COVID-19	China-Mundo	(Sachs *et al.*, 2022)
2024	Circulação Vírus H5N1 (Gripe aviária)	Mundo. 28 casos	(WHO, 2024a)
Outras Emergências			
1980	Epidemia HIV (atual)	Mundo	(UNAIDS, 2023)
2013	Epidemia Ebola	África-Mundo	(BIREME, 2023; Carmo, 2020)
2018	Epidemia Ebola	África-Mundo	(BIREME, 2023; Carmo, 2020)
2014	Epidemia Zika – Emergência Internacional	2020 - 89 países com casos	(BIREME, 2023; Valle; Pimenta; Aguiar, 2016; Wilder-Smith *et al.*, 2017)
2016	Surto de Febre Amarela	Angola, Congo	(OPAS, [*s. d.*]; WHO, 2018).
2022	Epidemia Sarampo	37 países	(WHO, 2023a)
2022	Surto de varíola dos macacos (países)	Mundo. 3413 casos	(BIREME, 2023)
Eventos climáticos extremos e desassistência às populações			
2010	Terremoto Haiti	Haiti	(ONU, 2011)
2015	Desastre ambiental em Brumadinho–MG	Brasil	(Vinicius; Lemos, 2020)
2023	Emergência Nacional Yanomami	Brasil. Desassistência.	(Brasil, 2023)
2024	Enchentes Rio Grande do Sul (RS)	Brasil	(Fiocruz - ENSP, 2024)
Guerras, violências e conflitos sociais			
2022	Oriente Médio e África Subsaariana (atual) Vietnam (1661-1971)	114 milhões de refugiados.	(Buss; Freire; Alcázar, 2022)
2022	Guerra Rússia-Ucrânia	Ucrânia	(ONU, 2024)
2024	Guerra Israel-Palestina	Palestina	(WHO, 2023e)

Fonte: elaborado pelo autor (2024).

Para os vírus respiratórios, os desafios de gestão estão relacionados à percepção ampliada do conceito de saúde única, que relaciona variáveis a partir da interação homem-

animal-ecossistema (Winck *et al.*, 2022). Como apresentado no Quadro 1, registros de emergências por síndromes respiratórias remontam ao início do Século XX, tendo como marco a pandemia H1N1 ou Gripe Espanhola, em 1918 (Barbosa, 2020; BIREME, 2023), com 40 milhões de mortes, a Gripe Aviária em 1957 (Crowe, 2008), Gripe de Hong Kong em 1968 (Crowe, 2008), a Epidemia de SARS em 2002 (BIREME, 2023; Crowe, 2008), a pandemia H1N1 em 2009 (Carmo, 2020; Rosella *et al.*, 2013), chegando à pandemia da COVID-19 em 2020 (Sachs *et al.*, 2022), com a morte de mais de 7 milhões de pessoas.

A pandemia da COVID-19 decretada em 2020 teve como ponto crítico a prontidão da OMS em alertar sobre a transmissibilidade humana da doença e declarar uma ESP de Interesse Internacional, com impacto no posicionamento dos países para responder à crise de forma adequada, sobre protocolos de viagem, estratégias de testagem, medidas de saúde pública e cadeias de abastecimento, notadamente pela ausência de evidências para formulação de políticas e tomada de decisão no início da crise. Esse contexto, considerando a oposição pública às possíveis medidas de saúde, alimentada por desinformação e falta de confiança, prejudicou o controle da epidemia, que afetou de forma desproporcional trabalhadores e comunidades em situação de vulnerabilidade social, pessoas com condições crônicas e grupos especiais como povos indígenas e refugiados sem acesso a cuidados de saúde. A economia registrou recessões, perdas de empregos e desaceleração no crescimento, sendo a vacinação em massa a chave para superar a pandemia e as consequências econômicas, mas essa estratégia encontrou desafios de acesso equitativo e limites dos centros de produção (Sachs *et al.*, 2022). Como exemplo, em 2024, foi registrada a circulação de vírus de influenza aviária altamente patogênica (H5N1) em aves migratórias, que alcança diferentes regiões do mundo e registra detecções em animais domésticos e em gado leiteiro, como nos Estados Unidos (WHO, 2024a).

Essa natureza de emergência pode caracterizar um contexto de elevado número de mortes pela rápida dissipação e mutação do vírus e a inexistência de imunidade de uma população para um novo patógeno, exigindo plataformas tecnológicas para rápido desenvolvimento de produtos e serviços, parceria público-privada e colaboração científica transnacional, como aconteceu com as vacinas desenvolvidas para a COVID-19 (Sachs *et al.*, 2022). As pandemias causadas por vírus respiratórios atingem as populações de forma diferenciada, quando a avaliação do perigo implica conhecer informações epidemiológicas e clínicas, e a susceptibilidade de exposição dos diferentes grupos populacionais, considerando período de incubação e potencial de transmissão. As diretrizes orientam sobre a identificação do vírus por especialistas, quando são observadas variáveis de risco como a gravidade da doença, a imunidade da população, as infecções em animais, a suscetibilidade ao tratamento antiviral e as características genômicas. Assim, uma avaliação de contexto por fatores sociais, científicos, econômicos, éticos e políticos, integra a análise da complexidade em saúde (WHO, 2020c).

Outras ESP registraram complexidades que deixam lições para o fortalecimento da gestão em futuros eventos. A epidemia de HIV (1980 - década), doença causada pela infecção

do vírus da Imunodeficiência Humana que ataca o sistema imunológico (Brasil; Ministério da Saúde, [*s. d.*]), ainda impacta os sistemas de saúde, com registros de mais de 39 milhões de pessoas vivendo com HIV no mundo em 2023, com uso de medicamentos e serviços que reduziram em 69% as mortes relacionadas, depois de um pico em 2004. Os desafios são de proteção dos direitos humanos, prevenção e acesso aos produtos e serviços, fruto de inovação e garantia de equidade, engajamento da comunidade, produção de dados confiáveis para decisões, e compromisso político com financiamento de sistemas públicos (UNAIDS, 2023).

A epidemia de Ebola (2013 e 2018), febre hemorrágica aguda altamente fatal causada por ebolavirus (BIREME, 2023), com registros iniciais na República de Guiné e Serra Leoa em 2013, e República Democrática do Congo em 2018 (Carmo, 2020), é um desafio para as autoridades. A OMS tem papel importante sobre o nível de governança, prontidão e resposta para essa emergência (Mackey, 2016), bem como de fortalecer a capacidade de diagnóstico, a comunicação de risco e o estabelecimento de sistemas de alerta precoce (Vong *et al.*, 2016).

O Zika vírus, um arbovírus com origem na Floresta de Zika em Uganda, foi introduzido na Ásia e nas Américas, ocasionando a epidemia de Zika no Brasil (2014) (BIREME, 2023). Pesquisas registram alterações congênitas associadas ao vírus, o que levou a OMS a decretar uma ESP de Interesse Internacional, pela ocorrência em 87 países até 2019 (Carmo, 2020). Tendo como mesmo vetor de transmissão o *Aedes aegypti*, o desafio no Brasil foi intensificado pela Chikungunya, doença que causa febre aguda semelhante à dengue, também transmitida por este vetor, o que implica em estratégias de diagnóstico, manejo e tratamento dessas doenças na gestão dos sistemas de saúde (BIREME, 2023; Valle; Pimenta; Aguiar, 2016; Wilder-Smith *et al.*, 2017)

A Febre Amarela, com registros recentes de surtos e epidemia em 2016, é uma doença causada por um arbovírus e transmitida por mosquitos *Haemagogus, Sabethes* e Aedes, conforme sua forma silvestre ou rural. A doença registra 30 mil mortes por ano, presente em 47 países. Com países endêmicos em África e nas Américas Central e do Sul, em áreas propensas a Zika e dengue, foi reafirmado o seu potencial e a necessidade de estabelecer a estratégia global de "Eliminação da Epidemia de Febre Amarela", para acesso à vacina, tecnologias e práticas de manejo da doença. Com impactos na vida das sociedades desde o início do século, em 2016 foram registrados casos exportados para China, e o risco de gerar uma emergência de interesse internacional não pode ser descartado (OPAS, [*s. d.*]; WHO, 2018).

Desafios mais recentes ou atualizados remontam a 2022 com a epidemia de sarampo, doença infecciosa altamente contagiosa e comum entre crianças que atingiu 37 países, com maiores incidências em Angola, Brasil, República Democrática do Congo, Etiópia, Índia, Indonésia, Madagascar, Nigéria, Paquistão e Filipinas, e registrou mais de 136 mil mortes e 9 milhões de casos, com agravamento pelo declínio das taxas de vacinação (WHO, 2023a). No mesmo ano foram notificados surtos de varíola dos macacos (Monkeypox - 2022) transmitida aos humanos por mordidas ou contato com sangue do animal (BIREME, 2023).

Os eventos climáticos extremos, outro importante fator de saúde global, representam importante impacto nos sistemas de saúde nos últimos anos. O terremoto no Haiti (2010) de magnitude 7,3 na escala Richter gerou 220 mil mortes, dezenas de milhares de feridos e mais de 1,5 milhão de desabrigados, com registro de 4.000 amputações, deslocamentos da população em larga escala e violência urbana, sendo vital um esforço de ajuda humanitária na região (ONU, 2011). O Rompimento da barragem da mineradora Vale S.A no município de Brumadinho, Minas Gerais, Brasil (2015) provocou mais de 300 mortes, com intoxicação por metais pesados, comprometimento da saúde mental dos moradores e perdas econômicas que geram insegurança sobre o futuro da região (Vinicius; Lemos, 2020).

No Brasil, as enchentes no Rio Grande do Sul (2024), ocasionadas por chuvas intensas, registram impactos sem precedentes na história do estado. A situação atingiu mais de 2 milhões de pessoas em 449 municípios e 538 mil desalojados, condicionando novos princípios de reconstrução de futuro (Fiocruz - ENSP, 2024). Nesse contexto, os desafios para a saúde são concentrados primeiramente no resgate de pessoas e animais e na possibilidade de doenças a partir do escoamento do volume de água em todo o estado, tais como diarreia, leptospirose, hepatite e dengue, além de doenças respiratórias, considerando as baixas temperaturas na região (Estado Rio Grande do Sul, 2024).

Em outra análise, as violências são causas importantes de emergências de saúde, que encontram nas guerras e conflitos sociais seu pior cenário, pois são situações deliberadamente provocadas que afetam os sistemas de saúde, sejam em regiões mais desenvolvidas ou de maior vulnerabilidade social. A violência coletiva pode gerar emergências complexas, quando ocorre

> “uma crise humanitária em um país, região ou sociedade onde haja ruptura total ou considerável de autoridade, resultante de conflito interno ou externo, que necessite de uma resposta internacional que ultrapasse o mandato ou a capacidade de qualquer organismo específico e/ou o programa em andamento das Nações Unidas para o país" (Krug; World Health Organization., 2002).

As guerras e conflitos no Oriente Médio e África subsaariana (e.g. Burkina Faso, Mali e Nigéria) afetam a vida de mulheres, crianças e idosos, e alcança uma complexidade maior em contexto de pandemia, como a COVID-19. A gestão dos serviços essenciais de saúde é comprometida pelas demandas de guerra nas regiões de conflito, pois as infraestruturas de saúde não são respeitadas. O fluxo de refugiados e deslocados pressiona os sistemas de países vizinhos, com possibilidade de transmissão de doenças. A ação de guerra impacta negativamente o meio ambiente, como no Vietnam (1661-1971) com despejo de herbicidas tóxicos na região que causaram mortes e comprometem futuras gerações com deficiências neurológicas (Buss; Freire; Alcázar, 2022). A guerra Rússia-Ucrânia (2022) registra mais de 600 mortes e 1,3 milhão de crianças feridas, além dos números de civis adultos e militares (ONU, 2024). O conflito Israel-Palestina (2024) registra comprometimento de serviços de saúde com hospitais em funcionamento precário e destruição da infraestrutura geral da região (WHO, 2023e)

O conhecimento é gerado no contexto das emergências de saúde de qualquer natureza, cuja complexidade ocorre por excesso de informação e ausência de evidências produzidas e acionáveis conforme o contexto, estabelecendo lacunas entre posicionamentos científicos e decisões políticas de governo, como contramedidas de quarentena, fechamento do comércio e restrições de viagens (El-Jardali *et al.*, 2020). São lacunas que se relacionam com a produção de sentido da sociedade (Angeli; Montefusco, 2020) na evolução da crise sanitária e relacionam variáveis para um cálculo de decisão pelos governantes e sociedade.

São tipos de emergências que representam riscos à população e impactos na gestão dos sistemas de saúde, o que está relacionado ao acesso a produtos e serviços, capacidade de diagnóstico e manejo da doença, estratégias de informação e comunicação, governança e coordenação dos esforços pelos governos e organismos de referência, com participação da comunidade nas estratégias de enfrentamento de uma enfermidade, como descrito no Health Emergency and Disaster Risk Management Framework da OMS (WHO, 2019)

2.5 Estrutura de Gestão de Riscos de Emergências e Desastres em Saúde

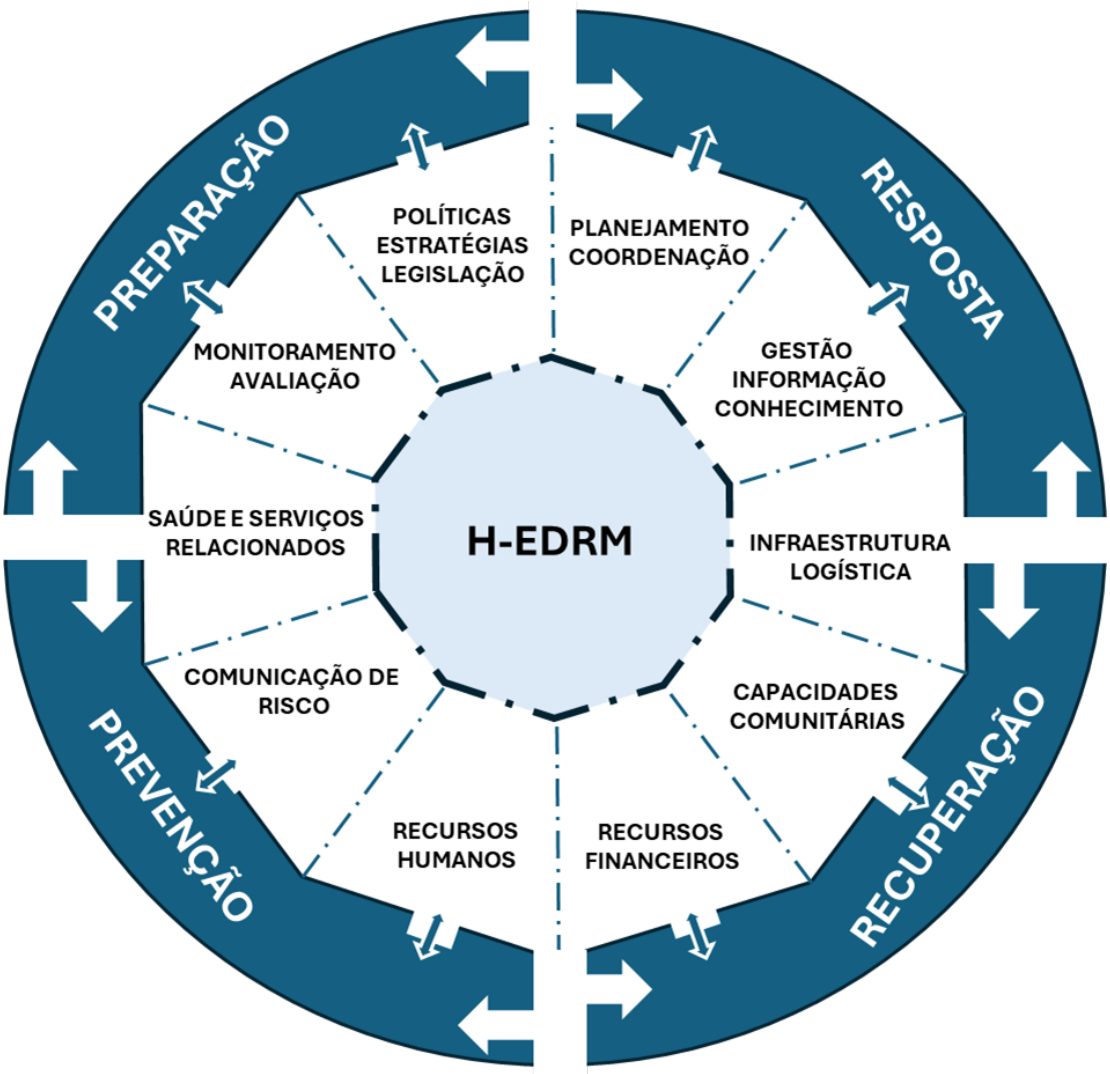
Diante de diferentes tipos de complexidade, a gestão de uma ESP demanda um esforço coordenado integrando disciplinas, níveis de governo e a sociedade em geral. A comunicação clara e eficaz, a capacitação contínua de pessoal, o engajamento comunitário, um sistema de logística eficiente e a vigilância em saúde, são pilares para mitigar os impactos das crises e proteger a saúde pública de forma abrangente e integrada. No contexto das emergências, os desafios da gestão vão além das tarefas rotineiras e exigem uma abordagem multifacetada, envolvendo atividades interdisciplinares, múltiplas variáveis e uma vasta gama de informações que auxiliam na tomada de decisões dos gestores. Essa complexidade se acentua para os dirigentes públicos, os quais são os responsáveis pela condução de crises sanitárias em todos os níveis de organização do Estado (Rose *et al.*, 2017).

Nesse sentido, a OMS estabeleceu em 2019 o *Health Emergency and Disaster Risk Management Framework* (H-EDRM), estrutura de gestão elaborada por especialistas para fortalecer uma abordagem integrada no enfrentamento de emergências de saúde e riscos de desastres, que combina esforço e recurso relacionados à saúde, com visão abrangente das medidas de Preparação, Prevenção, Resposta e Recuperação (PPRR) do sistema de saúde, um ciclo para planejar a crise de forma não exclusivamente sequencial.

A Preparação é a etapa de estruturação do ciclo PPRR, que fortalece a prontidão do sistema de saúde diante da emergência ao orientar a capacidade dos governos, das instituições e da sociedade por meio de legislação adequada, planejamento de recursos e empoderamento da comunidade. Na etapa de Resposta à crise sanitária, todo esforço é direcionado para salvar vidas, principalmente nos componentes da força de trabalho, infraestrutura e serviço, logística e sistema de comunicação. A Prevenção reduz o impacto de um evento de risco à saúde, sobretudo para a população em situação de vulnerabilidade socioeconômica. Recuperação é o momento pós-emergência que envolve investimento de recursos e planejamento de novas estruturas (Freitas; Silva; Alpino, 2021; WHO, 2002).

No H-EDRM, o ciclo PPRR reúne dimensões que se sobrepõem num ciclo planejamento-ação de uma emergência de saúde, com base em 10 componentes de gestão: políticas, estratégias e legislação; planejamento e coordenação; comunicação de risco; gestão da informação e do conhecimento; monitoramento e avaliação; infraestrutura e logística; saúde e serviços relacionados; capacidades comunitárias; recursos humanos; e recursos financeiros (WHO, 2019), conforme descrito na Figura 4.

Figura 4 - Estrutura de Gestão de Riscos de Emergências e Desastres em Saúde (H-EDRM).



Fonte: elaborado pelo autor (2024).

O H-EDRM, em sua abrangência, é objeto para o desenvolvimento de frameworks de apoio à decisão em ESP, sobre escopos, formas e estrutura analítica, com abordagem de modelos de governança e projeção de cenários (Príncipe *et al.*, 2023; Puggi *et al.*, 2024; Sampaio; Príncipe; Araujo, 2024), e condicionalidades de gestão no enfrentamento da ESP (Príncipe; Winkler; Ferreira, 2024b), cuja composição pode gerar variáveis de complexidade para modelagem de situação-problema na crise sanitária, como apresentado em outros trabalhos do grupo. Nesse sentido, a capacidade de negociação com as lideranças locais e o

aspecto da segurança física para efetividade de contramedidas na ESP, foram destacados como dimensões associadas ao H-EDRM (Príncipe; Winkler; Ferreira, 2024a).

Os componentes do H-EDRM englobam desafios interdependentes, tais como a complexidade e a resiliência das estruturas de saúde (Khan *et al.*, 2018; Labib, 2021), as estratégias de orientação de planos de ação (Kapiriri *et al.*, 2021; Miglietta *et al.*, 2021) e as condições de partida de um contexto (Angeli; Montefusco, 2020) como os Determinantes Sociais da Saúde (Fiocruz, 2013). O modelo integra avaliação de risco (Deng *et al.*, 2023; Keim, 2018; Raveendran; Renjith; Madhu, 2022) e adoção de contramedidas de mitigação (Strong *et al.*, 2021) na etapa de Prevenção. A Resposta, etapa que depende de planejamento prévio, é condicionada pelo modelo de governança do país (Jing, 2021) e estratégias de governo (Alkan; Kahraman, 2021; Pan *et al.*, 2022) e pela qualidade das evidências para decisão (Groot *et al.*, 2021; Schünemann *et al.*, 2020).

A necessidade de a gestão pública considerar múltiplos processos, atores e conhecimentos imprime uma visão holística e integrada dos domínios da gestão para produzir uma abordagem adaptativa do contexto. Resgata-se, assim, o conceito de Saúde Única, que prioriza o equilíbrio da interface homem-animal-ecossistema e a promoção do bem-estar, por meio de colaboração multissetorial, transdisciplinar e engajamento comunitário (WHO, 2023b). As ameaças de uma emergência encontram nos Determinantes Sociais da Saúde a base para a evolução do risco, pois esse conceito trata de dimensões econômicas, políticas, culturais e ambientais, de como a pessoa nasce, se desenvolve e envelhece, relacionando entre outros fatores, nível de distribuição de renda, desigualdade de gênero e raça, sistema de educação e de proteção social (Fiocruz, 2013).

3 CAPÍTULO 3: ARTIGO 1 - Decision Support Frameworks in Public Health Emergencies: A Systematic Review of Dynamic Models in Complex Contexts

- Artigo publicado.
- Autores: Alex S. Príncipe, Aloísio S. N. Filho, Bruna A. S. Machado, Josiane D. V. Barbosa, Ingrid Winkler, Cristiano V. Ferreira.
- https://doi.org/10.3390/ijerph20176685
- Resumo: As emergências de saúde pública são eventos extraordinários de disseminação de doenças, com consequências sanitárias, econômicas e sociais, que exigem ações coordenadas dos governos e da sociedade. Este trabalho tem como objetivo analisar os escopos, as possibilidades de aplicação, os desafios e as lacunas das estruturas de apoio à decisão na gestão de ESP, usando os componentes da Estrutura de Gestão de Riscos de Emergências de Saúde e Desastres (H-EDRM) e o Modelo de Preparação, Prevenção, Resposta e Recuperação (Modelo PPRR), fornecendo diretrizes para o desenvolvimento de novos modelos. Uma revisão sistemática da literatura foi realizada usando os bases de dados de conhecimento Web of Science, Scopus e Pubmed em estudos publicados entre 2016 e 2023, e trinta e seis artigos foram selecionados. Os resultados mostram uma concentração de estruturas em operações de resposta a emergências de curto prazo, com uma ênfase limitada nos componentes políticos e estratégicos que orientam os atores e as responsabilidades. A administração prioriza as estruturas de monitoramento, avaliação e gerenciamento de informações. No entanto, os modelos precisam superar os desafios da ação multissetorial e interdisciplinar, os diferentes níveis de decisões e atores, o compartilhamento de dados e o desenvolvimento de plataformas comuns de evidências para decisões adequadas às diversas emergências.

International Journal of
Environmental Research and Public Health

MDPI

Review

Decision Support Frameworks in Public Health Emergencies: A Systematic Review of Dynamic Models in Complex Contexts

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Abstract: Public health emergencies are extraordinary events of disease spread, with health, economic, and social consequences, which require coordinated actions by governments and society. This work aims to analyze scopes, application possibilities, challenges, and gaps of decision support frameworks in PHE management, using the components of the Health Emergency and Disaster Risk Management Framework (H-EDRM) and the Preparedness, Prevention, Response and Recovery Model (PPRR Model), providing guidelines for the development of new models. A systematic literature review was carried out using the Web of Science, Scopus, and Pubmed knowledge databases on studies published between 2016 and 2023, and thirty-six articles were selected. The outcomes show a concentration of frameworks on short-term emergency response operations, with a limited emphasis on the political and strategic components that drive actors and responsibilities. Management prioritizes monitoring, evaluation, and information management frameworks. However, the models need to overcome the challenges of multisectoral and interdisciplinary action, different levels of decisions and actors, data sharing, and development of common platforms of evidence for decisions fitted to the various emergencies.

Keywords: public health emergency; framework; management; response; prevention; recovery; preparedness; decision making

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Citation: Príncipe, A.S.; Filho, A.S.N.; Machado, B.A.S.; Barbosa, J.D.V.; Winkler, I.; Ferreira, C.V. Decision Support Frameworks in Public Health Emergencies: A Systematic Review of Dynamic Models in Complex Contexts. *Int. J. Environ. Res. Public Health* **2023**, *20*, 6685. https://doi.org/10.3390/ijerph20176685

Academic Editor: Curt A. Harris

Received: 16 June 2023
Revised: 21 August 2023
Accepted: 25 August 2023
Published: 30 August 2023

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1. Introduction

In March 2020, the World Health Organization (WHO) declared the COVID-19 pandemic a Public Health Emergency (PHE) of International Concern affecting the lives of millions of people on a global scale until May 2023, when the slowing of transmission of the coronavirus (SARS-CoV-2) was achieved, but with attention to its consequences. Health emergencies, especially pandemics, epidemics, and disasters, are extraordinary events of disease spread, with health, social, economic, and political consequences, which require coordinated actions by states and affect, especially, the most vulnerable populations [1]. The interaction of a communicable disease (COVID-19) with other non-communicable diseases, such as diabetes and heart problems, affects health systems in the contexts of socioeconomic inequalities and worsens the overall picture, reinforcing the concept of syndemic, when two or more diseases cause amplified damage, according to the living conditions of a population [2].

In emergency situations, the manager makes decisions under dynamic and chaotic conditions, when interpreting the context under pressure from ethical and political constraints [3], seeking to strengthen strategies for the planning, monitoring, and coordination

of actions, personnel training, resource allocation, infrastructure and logistics, information management, and risk assessment, priority areas for the development of frameworks, methods, and models for decision support [1]. The challenge may be related to the logistics of allocating respiratory ventilators, a scarce resource in emergencies involving severe acute respiratory syndromes, an action that requires the application of ethical principles, the recognition of the capabilities of health systems, and the limitation of access for vulnerable populations [4].

Considering this complexity, the WHO increased its perspective on response, prevention, recovery, prediction, and preparedness mechanisms to achieve an intelligence hub, with multidisciplinary collaboration, multisectoral decision making, global data sharing architectures, and expanded health context analysis capabilities to support health manager decision making [5].

In public health emergencies, such as the COVID-19 pandemic, each country has the challenge of making decisions tailored to the limitations of its health systems and related subsystems, guided by global guidelines such as the WHO standards, the Sustainable Development Goals (SDGs), the Sendai Framework for Disaster Risk Reduction 2015–2030, and the International Health Regulations [1], among others. These are strategic drivers for positioning states in the face of complexity, in a context conditioned by the behavior of individuals, organizations, and the dynamics of systems, when the gap between the plan and the effectiveness of interventions needs to be managed [6,7].

In this sense, frameworks serve as the interface between the decision maker and the problem to be solved, in various formats such as conceptual models, application of multicriteria methods, and systematic literature review. However, governments can adopt their frameworks without regard for system interoperability and information sharing [8]. In further research, it was found that models focused on specific contexts and with little ability for reformulation of interventions [9], difficulty in incorporating historical data into the analysis [10], and calibration of models for long-term scenarios by the uncertainty levels of an emergency [11].

The bounded rationality of decision makers and the behavior of their heuristics and biases in contexts with variables of uncertainty pose a challenge to framework models [3], requiring them to acquire complicated language information and comprehend the hesitations of decision makers [12]. Consensus production among actors' nonlinear preferences, dependency on source conditions, and assessments of benefits and losses present a challenge for group decision making [13]. As an input to the decision process, at all decision levels, models must improve the quality of data regarding how managers apply strategies using low or medium certainty evidence [14–16].

Country planning for an emergency is comprehensive and must begin before the health event, with the challenges of information analysis, expert decision-making approaches and priority setting, choices of methods and models, budget programming, the establishment of a data infrastructure, and evidence production, which condition alert, preparedness, assessment, and crisis control actions, posing a challenge to managers and government structures [17]; therefore, decision frameworks must be adapted to the country's government style [18]. Nonetheless, there still need to be more ethical, scientific, and management factors integrated into strategic action planning [19].

The examined works present the challenges of decision frameworks in emergencies, focusing on a gap between model type, actor expectation, and context constraints, which this article seeks to mitigate by describing the characteristics and requirement constraints to support country governments in developing frameworks for emergencies using a more adaptive approach incorporating the system dynamics of [6] and the reality of the context [20].

In this sense, this work aims to analyze the scopes, application possibilities, challenges, and gaps of decision support frameworks in PHE management using components of the Health Emergency and Disaster Risk Management Framework (H-EDRM) [1] and the Preparedness, Prevention, Response and Recovery Model (PPRR Model) [21,22], providing

guidelines for the development of new models. The article is organized as follows: Section 2 describes the theoretical background, Section 3 details the materials and methods, and Section 4 describes the results, conclusions, and suggestions for future research.

2. Decision Support Frameworks in Public Health Emergencies: Concepts, Complexities, and Managerial Intervention Capacity

In recent decades, the global population has been confronted with recurrent health issues that undermine the ability of governments to respond [23], establishing Public Health Emergencies (PHEs). There are outbreaks, which include an unanticipated growth of a disease in a place, and endemics, which involve infectious agents that are prevalent in a certain geographical area or population. When cases increase in a country or region, the situation is referred to as an epidemic, and state governments proclaim a Public Health Emergency of National Concern (PHENC). The WHO declares a Public Health Emergency of International Concern (PHEIC) when the international scope of an emergency impacts many nations and reaches pandemic proportions [24]. Emergencies emphasize the significance of integrated and multidisciplinary action, considering the One Health concept, which ties human, animal, and ecological health to global health concerns and promotes joint efforts to address a common problem [25].

The WHO guidelines for a public health information center emphasize a predictive perspective to produce better data, better analyses, and better decisions as part of an adaptive, comprehensive, and contextualized approach. Interpreting the context depends on prioritizing risk dynamics rather than managing isolated events, proactive action rather than reactive action, considering the dangers, uncertainties, and vulnerabilities and capacities of each context, as well as involving society and sharing responsibilities. The challenge is directly related to the capacity for resilience in the face of the entropy of the entire health system in an EPS, generated by a scarcity of resources, disputes over political narratives, and indeterminacies between science and common sense [1,5].

As an illustration, the Brazilian government issued an ESPIN in January 2023 due to a lack of assistance to the Yanomami indigenous population, which is characterized by a crisis that requires the mobilization of national strategies in the health, environmental, management, and regulatory dimensions of the territory, in response to the dangers posed by the presence of illegal mining in the Amazon Region [26]. At the global level, the WHO decreed in 2020 the COVID-19 pandemic, a disease caused by the new coronavirus (SARS-CoV-2). This event, along with the H1N1 pandemic (2009), the international spread of polioviruses (2014), the Ebola outbreak in West Africa (2014), the Zika virus (2016), and the Ebola outbreak in Congo (2018) [27], are examples of PHEIC, which, according to the International Health Regulations, are events of risk to the public health of countries and require the involvement of governments and societies [28].

The International Health Regulations, the central instrument for actions to protect countries against the international spread of disease, define public health risk as "the probability that an event will adversely affect the health of human populations, with an emphasis on those that can spread internationally or pose a grave and direct threat" [28]. More than 4500 signals of public health risks are reported annually by the WHO, resulting from natural threats such as earthquakes, cyclones, severe temperatures, and heavy rainfall, environmental degradation, and biological dangers such as airborne and waterborne infections [1].

A PHE is a surprising event generating uncertainty, dealing with turbulent problems, and challenging states' forecasting and protection strategies. There are resilience challenges to restore the previous equilibrium of a situation, which is not always possible or even enough. These are complex decision-making contexts for managers, requiring collaborative relationships and the strengthening of partnerships at all levels, adoption of innovative solutions, and effective communication about risks to achieve a new reality [29].

Decision making in PHEs requires a complexity calculation as close to reality as possible, considering the information available in the time interval of the decision, considering

the scientific, technological, political, and managerial data, when the use of frameworks can mitigate the bounded rationality of the decision makers [30]. This human trait tends to simplify the goal condition while handling complex situations with multiple variables. Frameworks play a role somewhere at the interface between an issue and a decision maker's heuristics and biases [3].

A framework, based on Design Science Research (DSR), is an "artefact" in the form of constructs with conceptual aspects, models that attempt to describe reality, its variables, and their interactions. In the DSR approach, the method relates steps for the execution of actions and analysis and may adopt heuristics and algorithms; instantiation verifies the application of one or more artifacts in the environment, to know the technical feasibility and effectiveness, according to the characteristics of the context [31]. This concept contributes to the application of frameworks to PHEs when it considers, among other aspects, the need to manage different types of health risks, with specific dimensions, characteristics, and impacts on the relationship of the behavior of disease evolution with the limits of the health systems of the countries [1,5].

One of WHO's mechanisms for preparing countries for a PHE is the Health Emergency and Disaster Risk Management Framework (H-EDRM), an expert-developed management framework that reinforces the paradigm of an integrated approach to deal with health emergencies and disaster risks [1], guiding states in Preparedness, Prevention, Response and Recovery measures (PPRR Model) [21,22] for intervention plans. Figure 1 presents the actions required for a country's response and the H-EDRM components, dimensions that articulate and guide the development of frameworks, according to the contexts of decision making in PHEs.

HEALTH AND EMERGENCY DISASTER RISK MANAGEMENT FRAMEWORK – H-EDRM (WHO, 2019)	
MEASURES AT PHE	
Prevention	Response
Recovery	Preparedness
MANAGEMENT COMPONENTS AT PHE	
Policies, Strategies and Legislation	Risk Communication
Planning and Coordination	Health Infrastructure and Logistics
Human Resources	Health and Related Services
Financial Resources	Community Health Capacities
Information and Knowledge Management	Monitoring and Evaluation

- PHE states are guided by an expanded approach to health crises and disaster risk management.
- Expert-prepared | Consistent with SDGs, International Health Regulations and other global guidelines.

Figure 1. H-EDRM—measures and components— Source: Own authorship.

The prevention measures reduce the impact of hazards and risk events on health, especially in the more vulnerable population. Recovery is a slow process that promotes actions to restore community life, such as physical, social, or psychological rehabilitation. The response measures include urgent life-saving support, such as the deployment of workforce, infrastructure, logistics, and communication systems. Preparedness increases

PHE readiness by strengthening the capacity of governments, institutions, and society through proper legislation, resource planning, and community empowerment [21,22].

The H-EDRM Policies, Strategies, and Legislation (H-EDRM-PSL) outline organizational structures, roles, and duties. Planning and Coordination (H-EDRM-P&C) emphasize the integration of health planning at all levels. The Monitoring and Evaluation (H-EDRM-M&E) component tracks risks and the implementation of strategies, programs, and activities. The Information and Knowledge Management (H-EDRM-I&KM) integrates health surveillance, early warning, and evidence-based technical guidance. Health Infrastructure and Logistics (H-EDRM-HI&L) address safe and sustainable health facilities. Human Resources (H-EDRM-HR) build capacity and establish human competencies to address PHEs. The Health and Related Services (H-EDRM-H&RS) component guides actions such as prevention, basic care, rehabilitation, and immunization programs. The Risk Communication (H-EDRM-RC) component reports communication strategies to society, and the Community Health Capacities (H-EDRM-CHC) component assesses community risk prevention, population engagement, and territory planning. Finally, the Financial Resources (H-EDRM-FR) mobilize program budgets, contingency funds, and financial arrangements [1].

As shown in Figure 1, the relationship between intervention measures and management components provides a comprehensive framework for decision making, assessing, and implementing PHE activities. Within a plan with porous borders and interconnected action cycles, it is possible to find an integrated perspective of numerous activities to minimize vulnerabilities and strengthen national plans.

Effective decision making in public health emergencies integrates institutions, public policy, science, and society; integrates multidisciplinary and multisectoral collaboration platforms; bridges knowledge generation and action; overcomes fragmentation; and strengthens the sharing of comprehensive and contextualized data, thereby empowering decision makers to understand and manage health risks. Reliable decisions adopt analytical methods and tools, access collective knowledge, and include cognitive characteristics of the decision maker [5]. The complexity of decision making in conducting programs and projects in a PHE full of uncertainty [29] integrates the behaviors of individuals and organizations, connectivity, dependencies, system dynamics, and context ambiguities [7].

A PHE is a complex process guided by the interdependence of political, social, economic, and health issues, which involves local, regional, and global components [20]. In this way, the framework for decision making in a PHE is developed as a complex adaptive system, which are nonlinear systems conditioned by their initial contexts and agents' interactions [32], categorizing the dynamics of structures and behaviors [6].

3. Materials and Methods

This systematic literature review is a qualitative approach, which allows the identification of key issues in the field [33]. Our study on decision support frameworks in contexts of public health emergencies is exploratory because it is complex and challenges governments and society preparedness. Thus, it is useful to the researcher to investigate variables of this context's complexity which are not yet known [33].

This review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, which aims to "help systematic reviewers transparently report why the review was done, what the authors did, and what they found" [34]. This review is structured into planning, scoping, searching for published research, assessing the evidence base, synthesis, analysis, and writing stages [35]. It has an Open Science Framework registration, https://osf.io/u6xfb (accessed on 15 June 2023). The strategy resulting from this validation process is described in the following sections.

Studies on decision making in PHEs are recent, and a bibliometric analysis indicates an increase since 2014, associated with the intensification of health events, with 73.27% of the publications identified in the last 5 years, with an indication of growth in the coming years. The results indicate that there is little coordination between countries,

institutions, and authors about decision making in PHEs, which raises the possibility of interdisciplinary analysis from a multicultural perspective which is more interpretative of the context of problems that affect the management dimension, especially in countries with populations in situations of economic, social, and environmental vulnerability that intensify in a PHE [36]. In another study on frameworks for evaluating responses to epidemics in low-income countries, the authors highlight the importance of a planned systematic review on the subject, as there are still gaps in the configuration of response mechanisms, with limited structures for evaluating the life cycle of interventions according to the characteristics of the context, without prioritizing iterative processes and the capacity to redesign interventions [9].

This article reports on the general aspects of frameworks. It considers complexity through the interface of individuals and organizations, dependent on the connectivity of systems and the ambiguities and uncertainties of contexts [7]. The intention is to understand the need for frameworks to adapt to different methods of government, local realities, organizational cultures, and societal perspectives and to contribute to studies of decision making in PHEs in a more comprehensive approach of a complex adaptive system, with nonlinear relationships and multiple agents who interpret contexts from different perspectives [37].

In this sense, our article covers the last 7 years in a systematic literature review on aspects and configurations of decision support frameworks in PHEs, which interprets the interface of management problems through the components of the H-EDRM [1] and the PPRR Model [21,22], guided by questions to promote an interdisciplinary analysis of the issues identified, as follows in the planning.

3.1. Planning

Planning defines the scientific knowledge bases that will be investigated in the research [35] as follows: Web of Science, Scopus, and Pubmed. They were selected because they are reputable, multidisciplinary, and worldwide scientific databases with extensive citation indexing coverage and provide the finest scientific publishing data. Scopus includes 87 million curated documents [38]. Web of Science covers more than 87 million records [39], and Pubmed over 35 million citations [40].

3.2. Defining the Scope

In defining the scope, guiding questions were formulated to be addressed to achieve the objective of this study. The text is organized by the H-EDRM and the PPRR model, which address specific topics. The questions guide the analysis of the frameworks studied. These are the following: Q1: How are management decision support frameworks characterized in PHE contexts? Q2: What type of intervention are the frameworks geared towards in a PHE? Q3: What are the challenges and gaps to be overcome by frameworks for strengthening decision making in PHE contexts?

Considering the importance of an integrated view and the boundaries between PPRR measures and the H-EDRM components in PHEs, the identification of the theme should be in more than one H-EDRM, which could accommodate an interdisciplinary approach. However, we tried to locate the article studied in the H-EDRM with the greatest intensity, without prejudice to bringing them closer together in the composition of the texts and analyses.

3.3. Bibliographic Research

In the literature search step, following the questions presented in the scoping, a string is used to query the databases [35]. In these databases, the Title, Abstract, and Keywords fields were searched for publications published between 2016 and 2023, recent years of health emergencies, such as the Zika epidemic (2014–2016), the Wild Yellow Fever epidemic (2017), and the COVID-19 pandemic (2020) [41].

The definition of the search string in the knowledge bases analyzed bibliographies linked to the topic and accessed the Health Sciences Descriptors (DeCS) base (https://decs.bvsalud.org/sobre-o-decs/ accessed on 16 June 2023) to find words and synonyms, resulting in the following string composition: ("public health") OR ("health") OR ("Public Health Administration") AND ("humanitarian") OR (emergenc*) OR ("emergency management") OR ("disaster") OR ("outbreak") AND ("evaluation") OR ("assessment") OR ("appraisal") AND (framework*) OR ("structure") OR ("method") OR ("model") OR ("tool") OR ("mechanism") OR ("technique") AND ("decision-making") OR ("Decision Support Techniques") NOT ("medical"). The search eliminates medical research that has no relation to the areas of management and administration.

The study plan investigated the management of PHE response, prevention, recovery, and preparedness, as well as its synonyms and derivations. The description examines the PHE, as well as its synonyms and derivations; the management, administration, and evaluation frameworks; and the frameworks implemented, which can be mechanisms of different types, approaches, and applications of methodologies and models. The knowledge bases' definition of the search term searched bibliographies utilizing keywords from articles on the subject and the DeCS/MeSH multilingual thesaurus.

3.4. Database Evaluation

In the evaluation stage, the inclusion and exclusion criteria are defined to select the documents that will be relevant for this research, according to the questions chosen in the scope definition [35].

To perform the search for studies related to the research topic, the filters pre-established by the respective databases were prioritized. In the Web of Science, these included Health Care Sciences Services, Medical Informatics, Environmental Sciences, Medicine General Internal, Computer Science, Artificial Intelligence, Emergency Medicine, Multidisciplinary Sciences, Management, Health Policy Services, Nursing, Computer Science Interdisciplinary Applications, Infectious Diseases, Pharmacology Pharmacy, Medicine Research Experimental, Water Resources, Computer Science Information Systems, Environmental Studies, Psychiatry, Social Sciences Interdisciplinary, Operations Research Management Science, Tropical Medicine. In Scopus, these included Social Sciences, Computer Science, Mathematics, Health Professions, Decision Sciences, Business, Management and Accounting, Economics, Econometrics and Finance. For Pubmed, all studies were looked at. After this step of applying the filters, 715 studies were identified.

The selection resulted in the deletion of 661 items after reading the Title, Abstract, and Keywords fields, leaving 54 titles, which, when combined with the suppression of duplicates, produced a total of 32 studies. Then, 4 additional titles from other sources of interest were included, bringing the total number of studies selected for analysis to 36, categorized according to the following exclusion criteria:

- E1: Exclude studies that do not address frameworks for health-related decision making.
- E2: Exclude specialized framework studies irrelevant to management from the fields of epidemiology, biomedicine, and clinical area decisions.
- E3: Exclude non-English-written studies, due to the impossibility of evaluating titles in all languages and English being the predominant language in the knowledge bases searched.
- E4: Exclude research published before 2016.

3.5. Synthesis and Analysis

Figure 2 illustrates the systematic flow in the PRISMA model with the 36 selected studies.

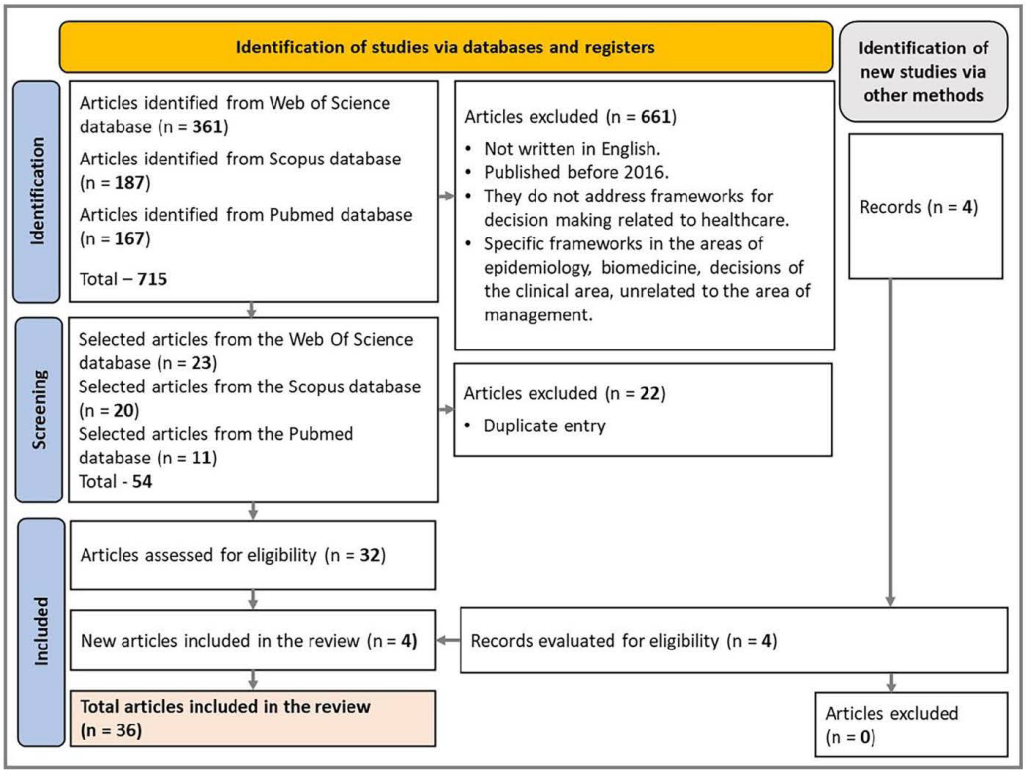


Figure 2. Systematic review flow diagram, adapted from PRISMA [34].

PRISMA only presents the studies chosen to analyze the frameworks. The other references cited are used as a theoretical basis for the terms mentioned in the article. These studies were read and analyzed, seeking to understand the relationships between the results presented to identify patterns, divergences, and research opportunities and to answer the proposed guiding questions. The 36 studies identified after performing the described procedures are summarized in Table 1, identifying the H-EDRM, the PPRR model, and the related theme, which will be analyzed in Section 1.

In total, 24 titles out of the total number of studies included in this study fall between 0.7 and 2.15 on the Journal Citation Indicator (JCI), with 1.0 being the global average [42]. Notably, the H-EDRM WHO Framework [1] does not include JCI, but it is a significant document of guidelines since its components contain categories that will be used to arrange the study described in this article, as shown in Table 1.

Table 1. Studies identified in the systematic literature review. https://bit.ly/3QZ6DUA (accessed on 15 June 2023).

Authors	Year	JCI	Selected Studies—Title	H-EDRM	PPRR Mode	Subject
(Shi et al., 2022)	2022	2.15	An extended multi-attributive border approximation area comparison method for emergency decision making with complex linguistic information	H-EDRM-I&KM	Response	Decision-making method
(Schünemann et al., 2020)	2020	1.69	Using GRADE in situations of emergencies and urgencies: certainty in evidence and recommendations matters during the COVID-19 pandemic, now more than ever and no matter what	H-EDRM-I&KM	Response	Quality of evidence
(Warsame et al., 2020)	2020	1.58	Towards systematic evaluation of epidemic responses during humanitarian crises: a scoping review of existing public health evaluation frameworks	H-EDRM-M&E	Response	Adaptive approach to epidemic intervention cycle
(Alkan & Kahraman, 2021)	2021	1.57	Evaluation of government strategies against COVID-19 pandemic using q-rung orthopair fuzzy TOPSIS method	H-EDRM-M&E	Response	Government strategies
(Pegoraro et al., 2020)	2020	1.56	A hybrid model to support decision making in emergency department management	H-EDRM-H&RS	Response	Reduction of overcrowding
(Hezer et al., 2021)	2021	1.3	Comparative analysis of TOPSIS, VIKOR and COPRAS methods for the COVID-19 Regional Safety Assessment	H-EDRM-M&E	Response	Assessing health security
(Deng et al., 2023)	2023	1.29	A national risk analysis model (NRAM) for the assessment of COVID-19 epidemic	H-EDRM-I&KM	Prevention	Risk analysis
(Bickley & Torgler, 2021)	2021	1.16	A systematic approach to public health-Novel application of the human factors analysis and classification system to public health and COVID-19	H-EDRM-HR	Prevention	Human error
(Labib, 2021)	2021	1.16	Towards a new approach for managing pandemics: Hybrid resilience and bowtie modelling	H-EDRM-P&C	Recovery	Resilience
(McDonald et al., 2020)	2020	1.11	Facemask use for community protection from air pollution disasters: An ethical overview and framework to guide agency decision making	H-EDRM-P&C	Prevention	Ethical values
(Funk et al., 2019)	2019	1.11	Assessing the performance of real-time epidemic forecasts: A case study of Ebola in the Western Area region of Sierra Leone, 2014–2015	H-EDRM-M&E	Response	Evaluating performance of an epidemic
(Jing, 2021)	2021	1.05	Seeking opportunities from crisis? China's governance responses to the COVID-19 pandemic	H-EDRM-PSL	Response	Government strategies
(Khan et al., 2018)	2018	1.02	Public health emergency preparedness: a framework to promote resilience	H-EDRM-P&C	Preparedness	Resilience
(Asadi et al., 2022)	2022	1.01	Evaluation of Factors to Respond to the COVID-19 Pandemic Using DEMATEL and Fuzzy Rule-Based Techniques	H-EDRM-M&E	Response	Assessment of the WHO guiding factors
(Goode et al., 2021)	2021	1	Development of a Rapid Risk and Impact Assessment Tool to Enhance Response to Environmental Emergencies in the Early Stages of a Disaster: A Tool Developed by the European Multiple Environmental Threats Emergency NETwork (EMETNET) Project	H-EDRM-I&KM	Response	Risk assessing
(Huang et al., 2022)	2022	0.93	New method for emergency decision making with an integrated regret theory-EDAS method in 2-tuple spherical linguistic environment	H-EDRM-I&KM	Response	Decision-making method
(Brambilla et al., 2021)	2021	0.93	Flexibility during the COVID-19 Pandemic Response: Healthcare Facility Assessment Tools for Resilient Evaluation	H-EDRM-HI&L	Preparedness	Health facilities—hospitals
(Keim, 2018)	2018	0.89	Assessing Disaster-Related Health Risk: Appraisal for Prevention	H-EDRM-M&E	Prevention	Assessing disaster-related health risk

Table 1. *Cont.*

Authors	Year	JCI	Selected Studies—Title	H-EDRM	PPRR Mode	Subject
(Groot et al., 2021)	2021	0.88	Developing a rapid evidence response to COVID-19: The collaborative approach of Saskatchewan, Canada	H-EDRM-I&KM	Response	Producing evidence
(Gossip et al., 2017)	2017	0.83	Monitoring and evaluation of disaster response efforts undertaken by local health departments: a rapid realist review	H-EDRM-M&E	Response	Monitoring and evaluating the disaster cycle
(Kapiriri et al., 2021)	2021	0.82	A framework to support the integration of priority setting in the preparedness, alert, control and evaluation stages of a disease pandemic	H-EDRM-P&C	Preparedness	Action Plan
(Kayman & Logar, 2016)	2016	0.81	A Framework for Training Public Health Practitioners in Crisis Decision-Making	H-EDRM-HR	Response	Learning for decision making
(Moheimani et al., 2021)	2021	0.8	Assessing the agility of hospitals in disaster management: application of interval type-2 fuzzy Flowsort inference system	H-EDRM-HI&L	Preparedness	Classifying hospitals by level of agility
(Yang & Guo, 2022)	2022	0.73	Evaluation of Emergency Intelligence Capability of Major Public Health Events in Probabilistic Uncertain Language Environment	H-EDRM-I&KM	Preparedness	Emergency intelligence systems
(Pan et al., 2022)	2022	0.67	Assessment model for rapid suppression of SARS-CoV-2 transmission under government control	H-EDRM-M&E	Response	Government strategies
(Strong et al., 2021)	2021	0.67	Building a Bayesian decision support system for evaluating COVID-19 countermeasure strategies	H-EDRM-P&C	Prevention	Countermeasure strategies
(Koonin et al., 2020)	2020	0.66	Strategies to Inform Allocation of Stockpiled Ventilators to Healthcare Facilities During a Pandemic	H-EDRM-HI&L	Response	Allocation of technology
(Raveendran et al., 2022)	2022	0.59	A comprehensive review on dynamic risk analysis methodologies	H-EDRM-M&E	Preparedness	Dynamic risk analysis
(Miglietta et al., 2021)	2021	0.48	Health technology assessment applied to emergency preparedness: a new perspective	H-EDRM-P&C	Preparedness	Action Plan
(Lv et al., 2022)	2022	0.43	A group emergency decision-making method for epidemic prevention and control based on probabilistic hesitant fuzzy prospect set considering quality of information	H-EDRM-I&KM	Prevention	Group decision-making method
(Wang, 2022)	2022	0.42	Grey multiattribute emergency decision-making method for public health emergencies based on cumulative prospect theory	H-EDRM-I&KM	Response	Decision-making method
(Dashtpeyma & Ghodsi, 2021)	2021	0.42	Humanitarian relief chain agility: identification and evaluation of enabling factors	H-EDRM-M&E	Response	Agility capacity of humanitarian aid network
(Onar et al., 2020)	2020	0.32	Multi-criteria spherical fuzzy regret-based evaluation of healthcare equipment stocks	H-EDRM-HI&L	Preparedness	Stock levels of health systems in emergency
(Rathore & Gupta, 2022)	2022	0.3	A fuzzy based hybrid decision-making framework to examine the safety risk factors of healthcare workers during COVID-19 outbreak	H-EDRM-HI&L	Response	Safety risk factors in hospital
(Neville et al., 2016)	2016	0.29	Towards the development of a decision support system for multi-agency decision-making during cross-border emergencies	H-EDRM-I&KM	Response	Sharing critical information
(WHO, 2019)	2019	NI	Health Emergency and Disaster Risk Management Framework	H-EDRM-P&C	Preparedness	WHO strategies

4. Results

This section presents the analysis of the selected frameworks, according to the appendix available at https://bit.ly/3QZ6DUA (accessed on 15 June 2023). The results are organized by the H-EDRM and answer the presented questions. Q1 addresses the characterization of the frameworks: contexts, identification of the H-EDRM and the PPRR model, scope, and method or model of analyses. Q2 identifies the type of intervention by

H-EDRM components and PPRR model measures and the interface between them. Q3 analyzes the gaps and challenges in an interdisciplinary approach. The dynamics observed in our framework study are those located between the causes of a health emergency with its ambiguities and uncertainties and the limits of health systems, whose contexts present challenges for management, based on which we seek to identify their dynamics and sense of intervention, scopes, and relationship of variables and tendencies.

4.1. Frameworks Dynamics: Scope, Intervention, and Gaps

The frameworks are presented in several formats, adopting conceptual structures [10,16,17,20]; the use of methods and modeling with a multicriteria approach [11–13,43–58]; the application of questionnaires with experts and managers working in PHEs, [14,19,23]; and the description of steps and guidelines for guiding the context analysis [1,4,8,9,15,18,59].

Figure 3 presents a set of characteristics of the studies evaluated in this article, observing the objects and formats of the frameworks studied, grouped according to the components of the H-EDRM [1].

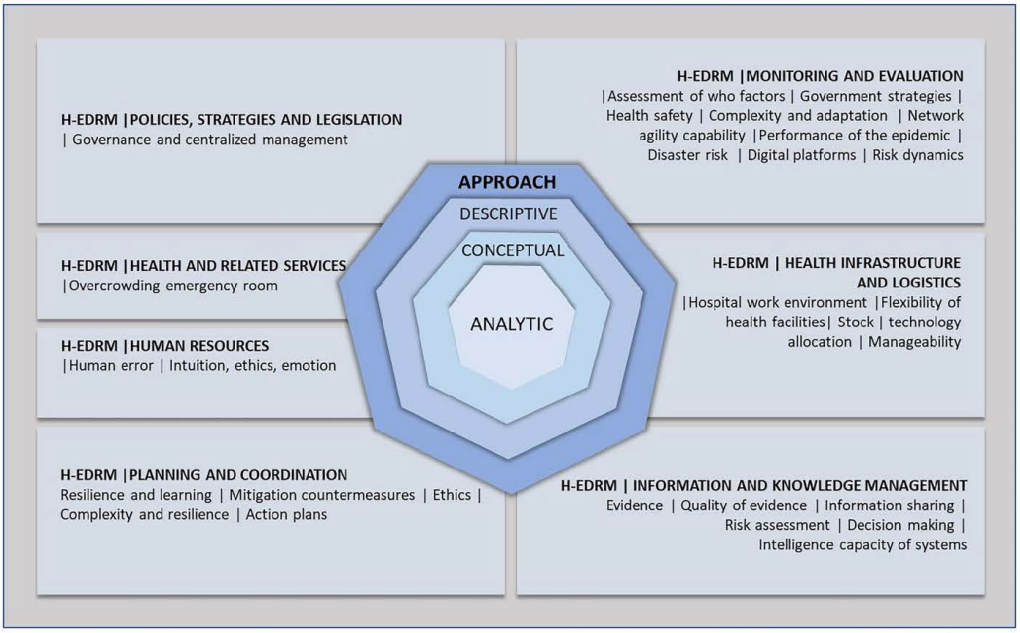


Figure 3. Frameworks: scopes by H-EDRM.

Figure 3 shows the strategic plan for managing PHEs and addresses policies, planning, and coordination related to studies concerned with the resilience of structures [20,47], action plans [16,17], and government strategies [18], as well as ethical values [19] that challenge the positioning of nations in the face of a context of uncertainty, particularly for vulnerable populations.

The dimensions of information and monitoring and evaluation of the results of managers' responses deal with the evolution of risk dynamics that need to be managed in emergencies [10,23,45,52,55,59]. This is a challenge related to the production of evidence to support the best decisions at all levels [12,13,46,57] but with challenges of its own generation and quality [14,15]. Information is an input to the decision-making process, and its sharing between states and health agencies needs to be prioritized [8] so that the re-

sponse is adapted to the reality of the context [9], which implies knowing the government's strategies [43,56] and the WHO's guidelines [58].

The provision of structures and resources focuses on hospitals that are under immediate pressure in PHE situations. The focus is on the agility of adapting physical infrastructure [48] and levels of health security [51], technology allocation [4], and ideal stocks of health supplies [49]. Regarding human resources, studies have focused on the perception of human error in contexts of uncertainty and stress on health professionals [3,60].

A PHE requires the attention of different areas according to the ambiguities and uncertainties of a context, considering a multidisciplinary approach that includes economic, social, psychological, and health impacts [5], which can be observed in the authors' areas of knowledge, such as in the Operation Management Area, Indian Institute of Management Ranchi [51], the School of Economics and Finance, Queensland University of Technology [60], and the Centre for Complexity Science, University of Warwick, Coventry, UK [53]. Figure 3 presents a set of characteristics of the studies evaluated in this article, observing the objects and formats of the frameworks studied, grouped according to the components of H-EDRM [1]. In another analysis, the organization of frameworks by authors and countries, as shown in Figure 4, presents a predominance of Chinese, Canadian, British, and American authors.

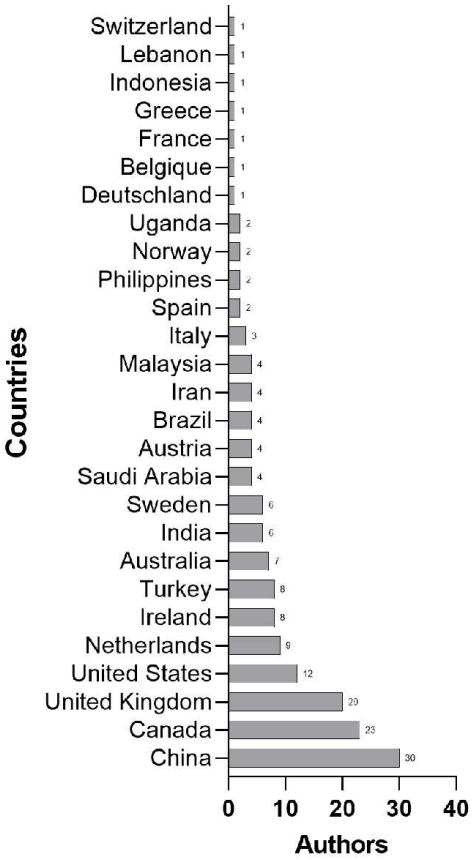


Figure 4. Frameworks: authors by country.

Identifying frameworks using H-EDRM and PPRR Models implies observing permeable borders on their components to look at management dynamics in the context of a PHE. In this sense, Figure 5 shows the frameworks studied associated with an element of the most incredible intensity.

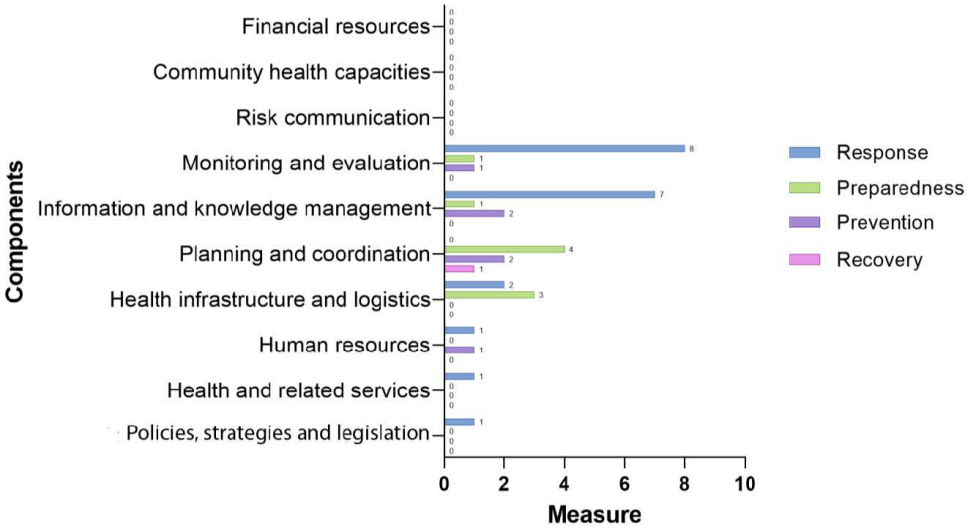


Figure 5. Frameworks by H-EDRM components and measures.

Due to the magnitude that the COVID-19 pandemic has reached since 2020, response efforts predominate, followed by preparedness, prevention, and a recovery measure, suggesting a focus on the system's reaction; however, the strengthening of preparedness activities affects the evolution of all health systems during a crisis, resulting in a more effective response and capacity for resilience to recovery of the health system.

Future research must investigate the conditionality relationship between these actions to determine the extent to which having more preparedness actions can produce more assertive responses and require less time to recover structures and the relationship between measure types and management components, as depicted in Figure 5. In addition, the challenge of decision support frameworks in emergency situations is to increase the attention to the life cycle of a PHE, integrating the management of preparedness, preventive, recovery, and response aspects and overcoming a step-by-step approach [9].

Framework development incorporates decision support concepts, theories, and multicriteria methods, which address the "multidimensional representation of problems with identification of critical information, comparisons of alternatives, and preference structures" [61]. Although this study of decision support frameworks in PHEs does not intend to exhaust the analysis of the limits and shortcomings of multicriteria methods, which would imply considering that synergistic relationships should be strengthened between multicriteria analysis, cognitive psychology, decision-maker behavior, and decision support systems, our work identifies the methods and their applications cited in some studies, as shown in Table 2, whose dynamics will be addressed by H-EDRM as follows.

Table 2. Methods and applications in the evaluated studies. https://bit.ly/3QZ6DUA (accessed on 15 June 2023).

Authors	Year	JCI	H-EDRM	PPRR Mode	Multicriteria Method	Application in the Evaluated Study
(Shi et al., 2022)	2022	2.15	H-EDRM-I&KM	Response	Composition: DHHLTSs, MABAC	Incorporate the decision maker's uncertain information into the evaluation of alternatives, weighting of choice criteria, and ranking of solutions.
(Alkan & Kahraman, 2021)	2021	1.57	H-EDRM-M&E	Response	TOPSIS q-rung orthopair fuzzy method.	Establish alternatives in extended contexts, with a lack of information, and ambiguities, uncertainties, and dissensions among experts.
(Pegoraro et al., 2020)	2020	1.56	H-EDRM-H&RS	Response	Composition: DEMATEL, PROMETHEE II	Address feedback relationships, interdependence, and influences among criteria.
(Hezer et al., 2021)	2021	1.3	H-EDRM-M&E	Response	Comparison: TOPSIS, VIKOR, COPRAS	Ranking alternatives according to the distances between positive and negative ideal solutions (TOPSIS). Sort and select alternatives with conflicting criteria (VIKOR). Ranking alternatives according to importance and utility (COPRAS).
(Deng et al., 2023)	2023	1.29	H-EDRM-I&KM	Prevention	Composition: Bayesian Network (BN), ISM, K2 algorithm.	Establish networks with expert knowledge and case study data from context. Identify network factors and parameters for scenario production and sensitivity analysis.
(Labib, 2021)	2021	1.16	H-EDRM-P&C	Recovery	Resilience modeling and bowtie modeling.	Analyze the interaction between a temporal and causal axis.
(Asadi et al., 2022)	2022	1.01	H-EDRM-M&E	Response	Composition: DEMATEL, Fuzzy	Identify causal relationships between critical factors and elements that impact virus infection.
(Huang et al., 2022)	2022	0.93	H-EDRM-I&KM	Response	Composition: 2-Tuple spherical linguistic term set, CRITIC, EDAS	Address expressions of uncertainty by decision makers, rank alternatives, and establish criteria weights for an optimal solution.
(Moheimani et al., 2021)	2021	0.8	H-EDRM-HI&L	Preparedness	Composition: Literature review; Flowsort with IT2FSs	Incorporate agility factors and linguistic expressions into the analysis. Establish alternatives based on sorted criteria and categories.
(Yang & Guo, 2022)	2022	0.73	H-EDRM-I&KM	Preparedness	Composition: PULTS, VIKOR	Assess intelligence capability in PHE, uncertain probabilistic language environments.
(Strong et al., 2021)	2021	0.67	H-EDRM-P&C	Revention	Bayesian networks	Address uncertainty in dynamic environments in the transition from short term to long term.
(Raveendran et al., 2022)	2022	0.59	H-EDRM-M&E	Preparedness	Dynamic risk analysis (DRA)	Identify the dynamics of risk.
(Lv et al., 2022)	2022	0.43	H-EDRM-I&KM	Prevention	Fuzzy (PHFS). Cumulative Prospect Theory (CPT)	Analyze probabilities of performance of the decision object, integrating decision makers' choices in a risk context.
(Wang, 2022)	2022	0.42	H-EDRM-I&KM	Response	Application of the Cumulative Prospect Theory (TCP).	Weighting functions in contexts of uncertainty and risk for decision gains and losses. Establish the possibility of values for a range or set of variables, rather than exact values.
(Dashtpeyma & Ghodsi, 2021)	2021	0.42	H-EDRM-M&E	Response	Composition: DEMATEL, ANP.	Evaluate interactions between elements and establish consistency ratings.
(Onar et al., 2020)	2020	0.32	H-EDRM-HI&L	Preparedness	Multicriteria spherical fuzzy regret.	Represent the level of hesitation or adherence of decision makers to listed alternatives.
(Rathore & Gupta, 2022)	2022	0.3	H-EDRM-HI&L	Response	Composition: Fuzzy FDM, FAHP, FTOPSIS.	Identify risk factors. Calculate and rank weights of categories and factors according to their importance. Classify hospitals.

4.1.1. Policies, Strategies, and Legislation | H-EDRM-PSL

The H-EDRM-PSL component presents The Analytical Framework of China's Governance Responses to COVID-19 (response), with centralized governance for effective coordination of implemented measures, in a framework that integrates institutional, administrative, coordination, and governance configurations, with rational behavior of the actors, which generate a dynamic to reduce positive entropy in management that compromised government responses during the pandemic [18]. Decision support frameworks in PHEs must consider context-specific characteristics, governance models, and governance structures [20], as in the Chinese model, which prioritizes centralized actions, adjusting national strategies to individuals, called agents [56].

However, as the frameworks established by nations reflect the opinions and circumstances of their authors, the exchange of models between different country realities is not automatic, and it is vital to expand PHE research into the operational and ethical dimensions of models that address the dynamic complexity of management in a context [20]. It is also important to note that "one size fits all" approach strategies present governments with the difficulty of determining the spatial and temporal effects of different measures in relation to the characteristics of populations within the same country or territory, particularly those with greater economic and social vulnerability [56].

What must be investigated is the suitability of frameworks in diverse PHE situations, with models that include characteristics of the nations' governance style in accordance with the degree of centralization of activities. The absence of command and the perception of a PHE as a political game compromises the responses of governments, as in the United States during the COVID-19 pandemic; however, the Chinese experience of more effective control of the pandemic is not easily adopted by other nations because their decision-making contexts differ [18].

4.1.2. Planning and Coordination | H-EDRM-P&C

H-EDRM-P&C addresses mechanisms for planning intervention in an epidemic. The definition of action plans is presented in a framework to support the integration of priority setting in the preparedness, alert, control, and evaluation stages of a disease pandemic, using documentary analysis and incorporating the experiences of health professionals, in an outbreak of the Ebola virus in Uganda [17]. In this study, there is a conceptual framework for developing health emergency preparedness plans using the Health Technology Assessment (HTA) approach, which includes health problem and technology use, safety, clinical effectiveness, cost and economic evaluation, ethical analysis, organizational aspects, and social and legal aspects, but also missing a 360° perspective on interventions in PHE settings, with evidence and best practices, considering different stakeholders in the decision-making process [16].

The countermeasure strategies present a multicriteria decision support system for choosing strategies to mitigate (prevention) the effects of COVID-19 using Bayesian networks to addresses uncertainty in dynamic environments, in the transition from short term to long term. Despite the improvement in multicriteria decision support methods for health emergencies, the scoring adjustment of the attributes of analysis may be harmed in contexts of uncertainty, for dealing with strategies not previously tested and for more uncertain attributes that receive less weight in the analyses, compromising a broad view of the problem [53].

In terms of resilience, managing COVID-19 presented a hybrid approach that identifies causal factors, security barriers, and key lessons using bowtie modelling. Modelling societal resilience in health emergencies integrating causation, barriers, and lessons learned relies on hypothetical scenarios rather than probabilities and immediate problem-solving that is not always possible. Few studies have focused on frameworks for dynamically addressing the context of uncertainty, able to integrate accumulated management experiences from previous health crises to understand how contexts returned *(recovery)* to a state of normality [47]. The resilience framework for PHE preparedness is another example of the

interactions of a complex adaptive system for resilient public health. It is a qualitative study with health professionals in Canada which integrated the dynamic approach of the context's components of ethics, governance, leadership, feedback loops, nonlinearity, self-organization, adaptability, interconnectedness, and risk analysis to promote resilience. The challenge is to consider in the analysis that frameworks developed by countries must reflect their circumstances; this means that the capacity for resilience of a country is related to its preparedness, which conditions the way of response and prevention and recovery measures [20].

Ethics, as a component of the planning and coordination measures in a PHE, also depends on developing ethically robust policies for community protection. The framework of ethical values for planning, policy enactment, and action on disasters, based on a decision guide, includes benefit and harm, effectiveness, precautionary principles, harm from intervention, respect, equity, and trust. The framework is a decision tree that provides guidance on the potential of the crisis, the establishment of recommendations, communications for intervention, and the verification of results, but the achievement of an adequate level of protection (prevention) for the population in public health emergencies, based on evidence, still lacks models that integrate the scientific, ethical, and management dimensions, with social, infrastructure, and logistical factors, for interventions that are appropriate to the context, especially for the least favored populations [19].

In problem analysis, planning for a PHE is a complicated system with interdependent variables [20]. Thus, Multicriteria Decision Support Methods (MCDMs) are used in multidimensional problem representation, the identification of critical information, comparisons of alternatives, and preference structures, being most effective in a combined approach [43,50,58]. Despite the importance of mathematical models for scenario projection, the calibration of probabilities is more reliable for short time frames (two weeks) and is degraded over the long term according to the amount of trajectory uncertainty, intervention strategy, and decision quality in a PHE [11].

4.1.3. Human Resources | H-EDRM-HR

H-EDRM-HR components are strategic resources to face pandemics because they reinforce guidelines for personnel planning, occupational health, personnel safety, and capacity building in technical, epidemiological, diagnostic, service, and communication areas, in all cycles of the PPRR model and even for the H-EDRM components, at all levels [1]. Despite this importance, only two frameworks were identified in our study. There was a human error causal category structure applied for the systematic retrospective analysis of incidents in high-risk domains that includes external and organizational influences, unsafe supervision, and preconditions for unsafe acts (prevention). Considering the need for a more comprehensive approach that understands the human error of the health professional involved in dealing with a PHE at all levels, the model was adapted to include the sociopolitical context, ecological influences, the national regulatory framework, the international regulatory framework, the social environment, and acts of sabotage. Health emergencies occur in turbulent contexts like COVID-19, with redoubled efforts of health professionals and other sectors, which are influenced by psychological, organizational, social, and regulatory frameworks. Despite the interest in knowing these factors, studies of causal chain frameworks to mitigate human error still are topics for future research [60].

The framework for training public health practitioners in crisis decision making was also identified as a necessity for the *response* to a PHE to straighten the decision-making process in complex emergency contexts, guided by the domains of decision theory, ethical principles, and the individual and group emotions of decision makers. The tool was based on the OODA loop (Observe, Orient, Decide, Act), which incorporates intuition and deliberative process in choosing alternatives. Chaos and unpredictability condition decision making in emergencies, establishing a gap between the intuitions, heuristics, and biases of the decision maker. What is missing is a structured analysis of the variables of the context of uncertainty to achieve a more rational and deliberative process. It is a

challenge to be studied to guide the training processes of health authorities in this context. Human resources can also be understood in the face of a PHE by the integration of agents participating in the decision-making process [3].

The alignment of different agents in PHE decision making requires overcoming collective risk framing positioning, nonlinear preferences, dependence on source conditions, and estimation of gains and losses of each actor or group of actors. Additionally, cognitive and complex linguistic information capture presents a challenge. The gaps point to the development of consensus models which integrate psychological factors, information quality, and decision speed. Thus, decision-maker hesitation and perception demand weights and ranking of alternatives in structured analysis to mitigate their bounded rationality [12,13] and achieve an adequate deliberative process through a better integration of heuristics, biases, and analysis of multiple variables [3]. It is difficult to establish comprehensive, systematic, and standardized evaluation indexes in real situations [54], when organizations and governments, individuals, or groups act according to their own policies, resulting in the compromised interoperability of systems and knowledge generation on common challenges, such as cross-border disease transmission [8].

4.1.4. Monitoring and Evaluation | H-EDRM-M&E

In H-EDRM-M&E, the analysis of risk dynamics in contexts of uncertainty requires the development of decision support frameworks with the application of advanced hybrid dynamic methodologies to overcome the shortcomings of conventional probabilistic static models. The framework evaluates risk dynamics in time-dependent contexts and the dynamic variation of process variables, using a dynamic risk analysis (DRA) for mapping, managing, and identifying risk dynamics [52], with the possibility of application in health preparedness measures. In another study, a nomenclature framework for assessing disaster-related health risk was used to evaluate accuracy, historical evidence, uncertainties of context, hazard, its impact and exposure, vulnerability and capacity assessment, and risk characterization. The challenge to be overcome by the analysis frameworks is the development of assessment models with reproducible and validated processes, capable of incorporating available historical data or their absence for prevention and predictions, especially in new events or those extremely rare ones that generate uncertainties—the black swan [10].

Governments strategies are subject to evaluating factors to respond to the COVID-19 pandemic, taking care to apply the guidance factors established by the WHO for countries. The framework uses Decision-Making Trial and Evaluation Laboratory (dematel) and Fuzzy Rule-Based Techniques and identifies causal relationships between factors and critical elements impacting Covid-19 virus infection, like social media sharing, mass crowding control, people movement control, international travel restrictions, distance learning, and economic stimulus measures. However, the study calls attention to the challenge of linking multicriteria decision support methods to the Dematel method to analyze complementary components (factors) influencing the spread of COVID-19, including different statistical techniques with larger sample sizes [58]. The evaluation of the national effectiveness of strategies implemented by governments to address COVID-19 with TOPSIS q-rung orthopair fuzzy method and its association establishes alternatives in extended contexts, with a lack of information, ambiguities, uncertainties, and dissensions among experts. The analysis includes mandatory quarantine, restriction of movement, herd immunity, and early diagnostic testing [43].

The adjusting government strategies to contain SARS-CoV-2 transmission by analyzing the interactions and behaviors of agents integrates geographical factors, climatic factors, displacements, and contacts between agents in public spaces, called residents in quarantine or confirmed cases, the transportation agents, or even the government agent which establishes policies to address the emergency. The model relates the agents, their attributes, and interactions, based on data for simulation in the time and space of the analysis, in multi-agent modeling, which uses the tool Repast Simphony 2.8.1 (Argonne Na-

tional Laboratory, Lemont, IL, USA), developed in the Eclipse Platform and using the Java language. It analyzes the spatial dynamics and produces, from scientific evidence, dynamic feedback about the interactions in time, allowing the government to analyze scenarios and adjust prevention and control actions, adopting effective intervention measures according to the context. The restrictive measures for the population are incorporated according to the behavior of the agents and the dynamics of the contexts, without the prevalence of a one-size-fits-all approach. However, this creates a challenge for governments in knowing the impacts of different measures in space and time, given by the economic and social development of a region [56].

Particularly regarding the humanitarian response in PHE contexts, the identification and assessment of factors facilitating agility capacity in the aid network, the framework includes the timeliness of delivery of products and services, health risk management, long-term needs, health information and donor organization, and government and non-governmental organization policies to face the challenge of overcoming the gaps in verifying the effectiveness of action plans (response). It is an application of a hybrid evaluation approach that combines fuzzy decision trial evaluation laboratory (DEMATEL) and the analytic network process (ANP) to deal with ambiguities, uncertainties, and inaccuracies inherent in the evaluation process. The methods assess interactions between elements and establish reliability ratings [44].

Monitoring and evaluating disaster actions within the scope of the health department (responses) is a framework that generates records for learning and preparing future responses to address emergencies. It is a conceptual framework developed based on a literature review on quality improvement, and it can be applied to enhance the disaster monitoring and evaluation cycle, including stages of documentation, evaluation, dissemination, and implementation of measures, looking at context settings and response mechanisms, focusing on the studies that explain ways of intervention and operation in different contexts [59].

Monitoring and evaluating risk dynamics [10,52], governments strategies [43,58], humanitarian response [44], and disaster [59], means overcoming the gaps in verifying the effectiveness of action plans and living with uncertainties and ambiguities that impact on the vulnerabilities, capacities, and levels of exposure to risk experienced by the populations in a PHE [10], increasing the entropy of the health systems, thus creating a dynamic of variables and responses that require performance monitoring. The evaluation of the performance of an epidemic includes the establishment of real-time evolution and forecasts, trying to verify the assertiveness of interventions with metrics of calibration, sharpness, and biases of the predictions. It is a study of the Ebola epidemic (response) in Sierra Leone (2014), a model combining a mechanistic core (Susceptible–Exposed–Infectious–Recovered, SEIR model) with non-mechanistic variables, observing time series and some level of uncertainty about underlying processes. Despite the importance of mathematical models for decision making and the projection of scenarios in health crises, the calibration of probabilities is more reliable for short periods (two weeks) and is compromised in the long term, depending on the level of uncertainty of the trajectory, the intervention strategies, and the quality of the recommended decisions [11]. In addition to analysis using the Technique for Order Performance by Similarity to Ideal Solution (TOPSIS) to rank alternatives according to the distances between positive and negative ideal solutions, Vise Kriterijumsa Optimizacija I Kompromisno Resenje (VIKOR) to order and select alternatives with conflicting criteria, and the Complex Proportional Assessment (COPRAS) to rank alternatives according to importance and utility, future research should address methods able to generate the optimal solution further from the non-ideal measures which managers face in a PHE [45].

It is known that the performance of health systems in a PHE allows for an adaptive response for epidemics, which addresses the analysis of context, intervention, process, performance, and impact, and a route to performance analysis and optimization of interventions, but the studies show models focused on specific contexts, with low capacity

to reformulate the intervention, frameworks with limited structures for reapplication in different contexts and an iterative approach, missing settings of evaluation of the full cycle of an intervention [9].

4.1.5. Information and Knowledge Management | H-EDRM-I&KM

The H-EDRM-I&KM brings together frameworks to support better evidence for decision making, first on an application by the Emergency Operational Committee (EOC) of the Saskatchewan Health Authority, Canada, to identify COVID-19 policy priorities, providing rapid reviews and evidence reporting, in a web-based data dashboard. The COVID-19 evidence support team produce and sustain the best available evidence on COVID-19 to facilitate the decision making of policymakers, researchers, and clinical practitioners and foster the context-based learning cycle in health, which depends on information sharing; however, an aspect still to be overcome is the performance of experts in isolated silos of their own characteristics, which compromises the integration of knowledge from multiple actors and the generation of quality evidence in the emergency [14]. Another study highlights that the quality of evidence can impact positively or negatively on the effect of decisions, the communication strategies of governments, and the definition of prospective plans; however, studies are needed on how leaders deal with evidence of low or medium certainty in health emergencies. It is the Grading Of Recommendations Assessment, Development And Evaluation (Grade), the product of an open community (www.gradeworkinggroup.org—accessed on 15 June 2023), that checks and makes recommendations on the quality of evidence to support decision making, applied in the context of public health emergencies [15].

A disaster impacts the environment and public health, and it is understood that it requires going through different phases of risk mitigation (preparedness, prevention, recovery and response). However, risk assessment frameworks need to advance the identification of evidence in the early stages of the emergency (response) with the involvement of experts and specialized and multidisciplinary technical contributions. In this way, a methodology was developed to strengthen decision making, communication, planning, and action management to assess risks, an on-line tool that integrates the European Union Civil Protection Mechanism [23]. In another study, a National Risk Analysis Model (NRAM) used in the COVID-19 pandemic scenario projection integrates expert knowledge with real-word facts to provide a broader context. The model incorporates, among other factors, the area affected by the disease, outbreak management and health (prevention) measures, population density, standard of living, youth population distribution, and government efficiency. Its structure used the Bayesian Network (BN), with the interdependence of factors, in association with the Interpretive Structural Modeling (ISM) method and the K2 algorithm, to establish a network analysis structure [55].

The decision-making process to response and prevention plans to the COVID-19 pandemic, according to the studies, requires the application of multicriteria methods for decision support, integrating the expression of uncertainty by decision makers, setting criteria weights for choosing an optimal solution [46], and ranking alternatives based on the quality of available information and on psychological factors of the decision maker [12,13], also the values for a range or set of variables and not exact values [57]. The challenges are the application methods restricted to experts and decision makers and their linguistic expressions, without considering information from different sources and characteristics, which may cause biased results of response ranking for emergencies [46], and the incorporation of the dynamics of the psychological process of decision makers into decision support frameworks on risk propensity or aversion in pandemic processes [57]. The dimensioning of weights for gains and losses of decisions in health emergencies involves a cognitive dimension, capturing complex linguistic information, and understanding the hesitations of decision makers. However, the production of a consensus still needs to be prioritized as an element of collective positioning on vulnerabilities and uncertainties of the context [12]. Consensus production in group decision-making conditions the effectiveness of responses

in contexts of uncertainty, since it deals with the positioning of each decision maker as to the framing of risks, nonlinear preferences, dependence on origin conditions, and the estimation of gains and losses. What remain as aspects to be overcome are the relationship between the models of consensus production, the psychological factors of decision makers, and the quality of available information and the speed of decisions required for prevention and control actions in health emergency [13].

The decision-making process asks for a system of emergency intelligence with the capability to deal with a context full of uncertainty and complexity. In this way, studies have been carried out about interagency decision support systems for sharing critical information in cross-border situations, which addresses the emergency management life cycle, integrating preparedness measures with stages of planning, simulations, and training; response measures using a decision support system and real-time monitoring; and recovery measures for vulnerable groups, highlighting the interoperability of existing systems and end-user-oriented solutions [8]. In another study, a multicriteria decision support method composition of Probabilistic Uncertain Language Term Set (PULTS) with the VIKOR method was developed to evaluate the intelligence capability in large public health event emergencies in probabilistic uncertain language environments; however, few studies address the topic due to the difficulty of establishing comprehensive, systematic, and standardized evaluation indexes of the context's real situation [54].

4.1.6. Health Infrastructure and Logistics | H-EDRM-HI&L

H-EDRM-HI&L presents framework studies on safety risk factors in the hospital environment during COVID-19 in India, using a Fuzzy Delphi Method (FDM). The weights of categories and their respective factors are calculated and ranked based on their criticality using the Fuzzy Analytic Hierarchy Process (FAHP), and the ranking of Indian hospitals is conducted by the Fuzzy Technique for Order of Preference by Similarity to Ideal Solution (FTOPSIS). The preparation of health services for the response to a pandemic integrates guidelines from reference bodies such as the WHO and can adopt multicriteria decision support methods to analyze risk factors. However, the exact definition of the criteria and the attribution of values for analysis of services is a challenge to be overcome due to the dynamics of contexts, ambiguities of expert opinions, and scarcity of resources that affect hospitals mainly during the PHE [51].

A literature review on health care agility to classify hospitals in Tehran, Iran, in the context of disaster and the application of the Flowsort method with IT2FSs (interval type-2 fuzzy sets) build a framework to classify hospitals by level of agility, based on management capacity to deal with disasters in contexts of uncertainty. It verifies the relationships between agility factors and the actions to prepare, mitigate, rebuild, and respond to a disaster situation, including organizational structure, hospital chain management, clinical governance, technological upgrading, market awareness, and trained staff. Hospital agility is a structuring component of health service responses in situations of natural or man-made disasters in terms of how effectively facilities respond to the emergency, with competence, flexibility, and speed [48]. A pandemic in its magnitude affects countries and occupies the limits of physical structures and health services, which means the readjustment of facilities for new uses. The availability of frameworks for assessing the flexibility and resilience of health facilities is scarce for models that minimally address structural, organizational, and technological aspects of the spaces. Hospitals are very pressured structures in PHE contexts, as they suffer from a shortage of human and material resources and quickly need the adaptation of structures, service protocols, and necessary technological innovations, which requires the flexibility analysis of health facilities, addressing hospital structure and façade, and building a plan considering expandability, restrictions, interchangeability, and functionality [62].

COVID-19 exposed the weaknesses of supply chain systems by the sudden increase in global demand for health supplies, which challenged the limits of production and logistics and increased the need for studies on frameworks for assessing optimal stock levels in

preparedness measures for health emergency contexts. In this way, a decision model about stock levels of health systems in emergency scenarios was developed, using multicriteria spherical fuzzy regret. It represents the level of hesitation or adherence of decision makers to listed alternatives, considering the availability of local production and proximity to production centers, necessary quantity of product or equipment, supply costs, the criticality of use, inventory, and stock maintenance [49].

The spread and speed of cases of a severe acute respiratory syndrome may increase the need for equipment and inputs such as mechanical ventilators and oxygen. A conceptual framework for determining the need for and allocation of ventilators during a PHE was developed (response), capable of planning actions and adequate logistics of equipment, supplies, and qualified personnel in intensive care, analyzing patient demand and the need for adequacy and increase in resources in hospitals, strengthening provisions at federal, state, and local levels. Despite the definition of strategies for technology allocation, frameworks for the situation analysis of the health system need to contemplate the capacity of structures, qualified personnel, and especially ethical principles to serve different population groups [4].

4.1.7. Health and Related Services | H-EDRM-H&RS

H-EDRM-H&RS listed only one study in decision support methods for managers on improvements for the reduction in overcrowding in emergency rooms in Paraná, Brazil, which addresses feedback relationships, interdependence, and influences among criteria, with emphasis on resource utilization, layout efficiency, productivity and technology, in a composition of Decision-Making Trial and Evaluation Laboratory—DEMATEL—and Preference Ranking Organization—PROMETHEE II. The management of the health emergency room to avoid overcrowding deals with problems that are difficult to identify and with patient management factors that cannot be changed quickly; however, according to the complexity of the context, there is a need for the association of multicriteria decision support methods to prioritize alternatives, such as assigning weights, establishing causal relationships between criteria, identifying improvement, and ordering the choices in time [50].

To the best of our knowledge, the studies did not present a specific financial resources framework (H-EDRM-FR); however, it is a strategic resource to provide financing expeditiously and maintain all the programs and measures in different stages of a PHE. The lack of studies also applies to risk communication (H-EDRM-RC), which plays a special role in positioning society in complex contexts of contradictory information that compromises risk mitigation strategies and the protection of citizens, especially vulnerable populations. Communication is closely related to the level of response according to a society's community capacities (H-EDRM-CHC), which includes health professionals and civil society in shared crisis planning with the community [1], but no studies were identified in this area either. The human resources component (H-EDRM-HR), which determines the allocation of skilled employees for the efficacy of PHE initiatives, did not emerge as a priority in the research studied. In terms of infrastructure and logistics (H-EDRM-HI&L), the frameworks emphasize the hospital environment, but the issue could be broadened to include sanitation, transportation, and energy factors that affect the health system, as well as more studies on the supply chain, with a focus on preparedness frameworks for future emergencies.

5. Conclusions

Governments and societies face challenges for assertive decision making in contexts of health emergencies, where the complexity of management lies between the health event's behavior and the health system's limit, implying a multidisciplinary and interdisciplinary, multisectoral, and contextualized approach. In this sense, the framework is at the interface between the decision maker and the problem, which in a context of uncertainty takes on nonlinear and counterintuitive proportions.

The analysis of the frameworks using H-EDRM recorded the prevalence of components in the areas of information and knowledge, monitoring and evaluation, planning and coordination, and infrastructure and logistics; however, policies, strategies and legislation, human resources and services, risk communication, and the community capacity were of a lower priority. In the analysis, response measures predominate, followed by preparedness, prevention, and recovery. This conclusion presents a question for future research, which is the conditionality relationship between measure types and management priorities in a PHE, to verify to what extent strengthening the preparedness action can generate more assertive responses and a shorter recovery time of health structures.

This article does not exhaust the analysis of the gaps in multicriteria methods, as synergistic relationships must be strengthened between multicriteria analysis, cognitive psychology, decision-maker behavior, and decision support systems [61] for a more dynamic approach to the complexity of the decision context, which may be the subject of future research.

In conclusion and based on the analysis of aspects regarding context constraints, the historical perspective of emergency behavior and future impacts, the limits of provision of technologies and infrastructure, governance styles, and decision maker cognition factors, this article presents the following guidelines for the development of decision support frameworks in PHEs:

- Adapt the development of frameworks to the country's governance model, according to its organizational forms, vulnerabilities, and capacities, to mitigate the introduction of models that are disconnected from reality.
- Prioritize ethical aspects in the planning of PHEs in all actions (preparedness, response, prevention, and recovery), with special attention to the most vulnerable populations, incorporating historical data to know the behavior of society in previous events and strengthen the resilience capacity for future emergencies.
- Strengthen policies, strategies, and legislation to prepare the states, prioritizing planning and scenario projection as a conditioning step for response time, improving the effectiveness of interventions and the recovery of health systems.
- Integrate the expectations and hesitations of decision makers at all levels, individual and collective, with frameworks that best interface heuristics and bias and the rationale of context in the face of variables of uncertainty.
- Develop within the framework functions that incorporate community capacity into PHE decision making to produce appropriate responses at all levels and increase the social resilience through collective action to strengthen the capacity of the society to deal with the effects of positive entropy in complex and dynamic PHE contexts.
- Apply methods capable of incorporating the linguistic expressions of the agents, feedback relations, and interdependence among criteria in framework development, making hypotheses and behaviors explicit in the context analysis, due to the uncertainties that compromise the accuracy of predictions.
- Improve evidence sharing and analysis frameworks, with quality analysis and guidance on levels of certainty, to define local strategies aligned to global challenges in PHEs. In this regard, the interoperability of information systems needs to be strengthened.
- Forecast complexity scenarios in all phases of a PHE, continuously confronting the behavior of the health event and the limits of the health services and the supply chain, production, and logistics to develop strategies for allocating strategic inputs to health, including human, cognitive, financial, and technological resources.
- Expand the capacity of the communication frameworks with society, as a strategic action to avoid misinformation and to strengthen sensemaking in society about the interventions.

The studies have shown that the main challenge for the development of frameworks is supporting an adaptive outlook by the manager regarding the complexity of PHE contexts, with tools and mechanisms suited to different circumstances, models of government, and society, since the intervention takes place in a part of a larger reality.

Supplementary Materials: The following supporting information can be downloaded at: https://bit.ly/3QZ6DUA (accessed on 15 June 2023).

Author Contributions: Conceptualization, A.S.P., I.W. and C.V.F.; methodology, I.W. and B.A.S.M.; software, I.W. and B.A.S.M.; validation, A.S.N.F., B.A.S.M., I.W., J.D.V.B. and C.V.F.; formal analysis, A.S.N.F., B.A.S.M., I.W., J.D.V.B. and C.V.F.; investigation, A.S.P., I.W. and C.V.F.; resources, I.W. and C.V.F.; data curation, A.S.P., I.W. and C.V.F.; writing—original draft preparation, A.S.P.; writing—review and editing, A.S.N.F., B.A.S.M., I.W., J.D.V.B. and C.V.F.; visualization, C.V.F.; supervision, I.W. and C.V.F.; project administration, I.W. and C.V.F.; funding acquisition, I.W. and C.V.F. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study is fully available in the Supplementary Materials. The file is available at https://bit.ly/3QZ6DUA (accessed on 15 June 2023).

Acknowledgments: We are thankful for the financial support from National Council for Scientific and Technological Development (CNPq); IW is a CNPq technological development fellow (Proc. 308783/2020-4).

Conflicts of Interest: The authors declare no conflict of interest.

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DECISION SUPPORT FRAMEWORKS IN PUBLIC HEALTH EMERGENCIES: A SYSTEMATIC REVIEW OF DYNAMIC MODELS IN COMPLEX CONTEXTS

Appendix - STUDY FRAMEWORK DESCRIPTIONS, ORGANIZED BY H-EDRM

I - POLICIES, STRATEGIES AND LEGISLATION	
THE ANALYTICAL FRAMEWORK OF CHINA'S GOVERNANCE RESPONSES TO COVID-19	
MEASURE	Response. Public health emergencies. Covid-19. China.
AUTHOR [18]	(JING, 2021)
SCOPE	Analysis of the **Chinese experience** in dealing with Covid-19. Components: institutional settings, government structures, actor strategies, political commitment, instrumental capabilities, strategic leadership. It addresses control, legitimacy of actions and economic growth.
METHOD	Analysis of institutional and governmental configurations. China's emergency governance system is one of centralized management, with decisions concentrated in the leadership for immediate action and necessary reforms.
GAPS | CHALLENGES	The Chinese experience, despite the results achieved, does not fit any country's reality, as these are contexts with distinct characteristics and limitations. What remains to be explored is the suitability of decision support frameworks in different contexts of health emergencies, models that integrate characteristics of the country's governance style, according to levels of centralization of control actions and related political factors.
I - PLANNING AND COORDINATION	
NEW APPROACH FOR MANAGING PANDEMICS: HYBRID RESILIENCE AND BOWTIE MODELLING	
MEASURE	Recovery. Public health emergencies. Covid-19.
AUTHOR [47]	(LABIB, 2021)
SCOPE	**Resilience** modeling and incident learning. A hybrid approach that identifies causal factors, security barriers and key lessons in a logical model.
METHOD	Resilience modeling (bowtie modelling), with interaction between a time axis and causal analysis.
GAPS | CHALLENGES	Modelling societal resilience in health emergencies that integrates causation, barriers and lessons learned relies on hypothetical scenarios rather than probabilities and immediate problem-solving that is not always possible. Few studies have focused on frameworks for dynamically addressing the context of uncertainty, able to integrate accumulated management experiences from previous health crises to understand how contexts returned to a state of normality.
BAYESIAN DECISION SUPPORT SYSTEM	
MEASURE	Prevention. Public health emergencies. Covid-19.
AUTHOR [53]	(STRONG et al., 2021)
SCOPE	Multi-attribute decision support system to evaluate **countermeasure strategies** designed to mitigate Covid-19 effects and balance impacts in the short and medium term.
METHOD	Bayesian networks. In an advancing decision context, it addresses uncertainty in dynamic environments, in the transition from short-term to long-term.
GAPS | CHALLENGES	Despite the improvement of multicriteria decision support methods for health emergencies, the scoring adjustment of the attributes of analysis may be harmed in contexts of uncertainty, for dealing with strategies not previously tested and for more uncertain attributes that receive less weight in the analyses, compromising a broad view of the problem.
CONCEPTUAL FRAMEWORK TO DEVELOP AN OUTBREAK PREPAREDNESS PLAN THROUGH THE HEALTH TECHNOLOGY ASSESSMENT APPROACH	
MEASURE	Preparedness. Public health emergencies.
AUTHOR [16]	(MIGLIETTA et al., 2021)
SCOPE	Conceptual framework to develop preparedness **plans** for health emergencies through the *Health Technology Assessment (HTA)* approach. Components: technology; safety; clinical effectiveness; costs and economic evaluation; ethical analysis; organizational, patient and social aspects; legal aspects. It establishes relation with emergency preparedness components: contact tracing, response procedures, laboratory diagnosis, risk communication.
METHOD	Conceptual framework developed by experts in *Health Technology Assessment (HTA),* infectious disease control and preparedness, from the European Public Health Association (EUPHA).

GAPS | CHALLENGES	One aspect still to be explored is the 360° perspective on interventions in public health emergency settings, with evidence and best practices, considering different stakeholders in the decision-making process.
FRAMEWORK TO SUPPORT THE INTEGRATION OF PRIORITY SETTING IN THE PREPAREDNESS, ALERT, CONTROL AND EVALUATION STAGES OF A DISEASE PANDEMIC	
MEASURE	Preparedness. Public health emergencies. Outbreak of the Ebola virus in Uganda.
AUTHOR [17]	(KAPIRIRI et al., [s.d.])
SCOPE	Establishment of activities in phases **(action plans)** of an epidemic: pre-epidemic preparation, alert, control and evaluation. The framework addresses WHO recommendations.
METHOD	Documentary analysis and incorporating experiences of health professionals and policy makers. Qualitative study 2014 - 2016.
GAPS | CHALLENGES	The priorities generated by the "*rule of* rescue", defined as the rule of rescue or war budget in facing the emergency compromise the other areas of the Health System and the resilience capacity, being necessary to advance in studies of frameworks that integrate all the stages of an emergency and the demands of the health systems.
FRAMEWORK TO DEVELOPMENT OF ETHICALLY ROBUST POLICIES FOR COMMUNITY PROTECTION	
MEASURE	Prevention. Disasters. Air pollution.
AUTHOR [19]	(MCDONALD et al., 2020)
SCOPE	Framework of ethical values for planning, policy enactment and action on disasters, based on a decision guide. Components: benefit and harm, effectiveness, precautionary principle, harm from intervention, respect, equity and trust. It is a decision tree that guides on the potential of the crisis, the establishment of recommendations, communications for intervention and verification of results achieved.
METHOD	Establishing **ethical values** defined from academic experience on public health ethics, social work ethics and environmental sciences, together with professionals in public health emergency response and social care provision.
GAPS | CHALLENGES	The achievement of an adequate level of protection for the population in public health emergencies, based on evidence, lacks models that integrate the scientific, ethical and management dimensions, with social, infrastructure and logistical factors, for interventions that are appropriate to the context, especially for the least favored populations.
RESILIENCE FRAMEWORK FOR PUBLIC HEALTH EMERGENCY PREPAREDNESS	
MEASURE	Preparedness. Public health emergencies. Disasters.
AUTHOR [20]	(KHAN et al., 2018)
SCOPE	Framework of interactions of a complex adaptive system for **resilient** public health. Components: ethics, governance, leadership, emergence, feedback loops, non-linearity, dynamic context, self-organization, adaptability, interconnectedness, planning process, collaborative networks, community engagement, risk analysis, surveillance and monitoring, practices and experiences, resources, capacity to work, communication, learning and evaluation
METHOD	Qualitative study with health professionals in Canada.
GAPS | CHALLENGES	Despite the advance of global guidelines from reference bodies (e.g., WHO) for preparing a resilient public health in health crises, the frameworks developed by countries reflect the opinion of their authors and circumstances, which hinders the sharing of models because of the lack of automatic accommodation in different realities.
HEALTH EMERGENCY AND DISASTER RISK MANAGEMENT FRAMEWORK – H-EDRM	
MEASURE	Preparedness. Public health emergencies.
AUTHOR [1]	(WHO, 2019)
SCOPE	**World Health Organization's Health** Emergency and Disaster Risk Management Framework. Components: policies, strategies and legislation; planning and coordination; human resources; financial resources; information and knowledge management; risk communication; health infrastructure and logistics; health and related services; community health capacities; monitoring and evaluation.
METHOD	Framework built by experts in virtual and face-to-face consultation, under the guidance of the WHO, which guides the States in prevention, recovery, response and preparedness measures for future emergencies and disasters.

GAPS | CHALLENGES	The preparation of countries for public health emergencies does not totally eliminate the dangers, requiring research and development of frameworks for analysis and management of risks and disasters, with an adaptive, comprehensive and contextualized approach to health systems, which prioritizes: risk rather than isolated events, proactive action rather than reactive, scope of related hazards, vulnerabilities and capacities, involvement of society at large, and sharing of responsibilities by the actors (e.g., authorities) .
III - HUMAN RESOURCES	
HUMAN FACTORS ANALYSIS AND CLASSIFICATION SYSTEM (HFACS) TO PROACTIVE INCIDENCE PREVENTION IN THE PUBLIC HEALTH	
MEASURE	Prevention. Public health emergencies. Covid-19
AUTHOR [60]	(BICKLEY; TORGLER, 2021)
SCOPE	Adaptation of the *Human Factors Analysis and Classification System (HFACS)* for the public health context (HFACS-PH). Addresses conditioning factors of **human error** in health emergencies.
METHOD	Adaptation of the *HFACS Framework* method, human error causal category structure applied for systematic retrospective analysis of incidents in high-risk domains. Components: external and organizational influences, unsafe supervision, and preconditions for unsafe acts. The proposed change includes additional error conditions: sociopolitical context, ecological influences, national regulatory framework, international regulatory framework, social environment, and acts of sabotage.
GAPS | CHALLENGES	Health emergencies occur in turbulent contexts, with redoubled efforts of health professionals and other sectors, which are influenced by psychological, organizational, social, regulatory frameworks, unsafe supervision, among others, that cause errors. Despite the interest in knowing these factors, studies of causal chain frameworks to mitigate human error are topics for future research.
FRAMEWORK FOR TRAINING PUBLIC HEALTH PRACTITIONERS IN CRISIS DECISION-MAKING	
MEASURE	Response. Public health emergencies.
AUTHOR [3]	(KAYMAN; LOGAR, 2016)
SCOPE	**Learning for decision-making** in complex emergency contexts, guided by the domains of decision theory, ethical principles, individual and group emotion of decision makers, and OODA Loop.
METHOD	Tool based on *The OODA loop (Observe, Orient, Decide, Act),* which incorporates intuition and deliberative process in choosing alternatives.
GAPS | CHALLENGES	Chaos and unpredictability condition decision-making in emergencies, establishing a gap between intuitions, heuristics and biases of the decision maker, and a structured analysis of the variables of the context of uncertainty, to achieve a more rational and deliberative process. It is a challenge to be studied to guide the training processes of health authorities in this context.
IV - INFORMATION AND KNOWLEDGE MANAGEMENT	
SYSTEM OF EMERGENCY INTELLIGENCE CAPABILITY FULL OF UNCERTAINTY AND COMPLEXITY	
MEASURE	Preparedness. Public health emergencies. Covid-19.
AUTHOR [54]	(YANG; GUO, 2022)
SCOPE	Analysis of the process of operating emergency **intelligence systems** for major public health events. Components: information collection, intelligence service, intelligence processing, and intelligence assurance.
METHOD	Multicriteria Decision Support Methods Composition. *Probabilistic Uncertain Language Term Set (PULTS)* with *VIKOR* method, to evaluate the intelligence capability in large public health event emergencies in probabilistic uncertain language environments.
GAPS | CHALLENGES	Decision-making in public health emergencies depends on the system's intelligence capacity, however, few studies address the topic due to the difficulty of establishing comprehensive, systematic and standardized evaluation indexes of the context's real situation.
NEW METHOD FOR EMERGENCY DECISION-MAKING WITH AN INTEGRATED REGRET THEORY EDAS METHOD IN 2 - TUPLE SPHERICAL LINGUISTIC ENVIRONMENT	
MEASURE	Response. Public health emergencies. Covid-19. China
AUTHOR [46]	(HUANG et al., 2022)
SCOPE	Application of Multicriteria Methods for Decision Support.
METHOD	Composition of Multicriteria **Decision Support Methods**. 2-Tuple spherical linguistic term set, CRITIC method, EDAS method. The proposed model addresses: expression of uncertainty by decision makers, ranking of alternatives, setting criteria weights and choosing the optimal solution for the emergency.

GAPS | CHALLENGES	The application of multicriteria decision support method, restricted to experts and decision makers and their linguistic expressions, without considering information from different sources and characteristics, may cause biased results of response ranking for emergencies.
THE COVID-19 EVIDENCE SUPPORT TEAM (CEST)	
MEASURE	Response. Public health emergencies. Covid-19. Saskatchewan, Canada
AUTHOR [14]	(GROOT et al., 2021)
SCOPE	Producing and sustaining the best available evidence on COVID-19 to facilitate decision-making, by the participation of policymakers, researchers, and clinical practitioners. It fosters the context-based learning cycle in health.
METHOD	Question application by the *Emergency Operational Committee (EOC) of the Saskatchewan Health Authority* to identify Covid-19 policy priorities, providing rapid reviews and evidence reporting. A web-based data dashboard was developed.
GAPS | CHALLENGES	The learning of decision-makers depends on information sharing, however, an aspect still to be overcome is the performance of experts in isolated silos of their own characteristics, which compromises the integration of knowledge from multiple actors and the generation of quality evidence in the emergency.
RAPID RISK AND IMPACT ASSESSMENT TOOL TO ENHANCE RESPONSE TO ENVIRONMENTAL EMERGENCIES IN THE EARLY STAGES OF A DISASTER.	
MEASURE	Response. Environmental disasters.
AUTHOR [23]	(GOODE et al., 2021)
SCOPE	Methodology developed to assess risks and impacts in the early stages of an environmental emergency through expert collaboration, to strengthen decision-making, communication, planning and action management. On-line tool that integrates the European Union Civil Protection Mechanism.
METHOD	Framework developed based on the European Chemical Emergency Network (ECHEMNET) rapid risk assessment methodology for cross-border health threat issues.
GAPS | CHALLENGES	A disaster impacts the environment and public health, understanding that it goes through different phases of risk mitigation (preparedness, prevention, recovery and response), however, risk assessment frameworks need to advance the identification of evidence in the early stages of the emergency, by the association of experts and specialized and multidisciplinary technical contributions.
THE GRADING OF RECOMMENDATIONS ASSESSMENT, DEVELOPMENT AND EVALUATION (GRADE) APPROACH	
MEASURE	Response. Public health emergencies. Covid-19.
AUTHOR [15]	(SCHÜNEMANN et al., 2020)
SCOPE	Method that checks and makes recommendations on the **quality of evidence** to support decision-making, applied in the context of public health emergencies.
METHOD	GRADE - product of an open community (www.gradeworkinggroup.org)
GAPS | CHALLENGES	The quality of evidence can impact positively or negatively on the effect of decisions, the communication strategies of governments and the definition of prospective plans, however, studies are needed on how leaders deal with evidence of low or medium certainty in health emergencies.
S-HELP (SECURING-HEALTH EMERGENCY LEARNING PLANNING)	
MEASURE	Response. Public health emergencies. Disasters.
AUTHOR [8]	(NEVILLE et al., 2016)
SCOPE	Interagency decision support system for **sharing critical information** in cross-border situations, which addresses the emergency management life cycle: preparedness, with stages of planning, simulations and training; response, with the use of decision support system and real-time monitoring; recovery, with attention to vulnerable groups. Components: interoperability standards; integration of existing systems; end-user-oriented solutions; user training for uncertain environments; and risk communication.
METHOD	Development of an information system project, with application of tools for the life cycle approach to emergency management.
GAPS | CHALLENGES	The treatment of cross-border health problems in emergencies is hampered when organizations and governments act differently in their structures, following their policies, compromising the interoperability of systems and information sharing for decision-making and knowledge generation about common challenges.

A GROUP EMERGENCY DECISION-MAKING METHOD FOR EPIDEMIC PREVENTION AND CONTROL BASED ON PROBABILISTIC HESITANT FUZZY PROSPECT SET CONSIDERING QUALITY OF INFORMATION	
MEASURE	Prevention. Public health emergencies. Covid-19.
AUTHOR [13]	(LV et al., 2022)
SCOPE	A **group decision-making method** that approaches the ranking of alternatives, based on the quality of the available information and on the psychological factors of the decision maker in contexts of uncertainty, for preventive and control actions.
METHOD	Probabilistic Fuzzy Hesitant Perspective Set - Fuzzy (PHFS). It analyses probabilities of performance of the decision object, with incorporation of human preferences. To identify the characteristics of the human behavior of the decision maker, the method follows the Cumulative Prospect Theory (CPT), which addresses the choice of decision makers in the context of risk (TVERSKY; KAHNEMAN, 1992).
GAPS | CHALLENGES	Consensus production in group decision-making conditions the effectiveness of responses in contexts of uncertainty, since it deals with the positioning of each decision maker as to the framing of risks, non-linear preferences, dependence on origin conditions, and the estimation of gains and losses, by the Cumulative Prospect Theory. What remains as aspects to be overcome, is the relationship between the models of consensus production, the psychological factors of decision makers, the quality of available information and the speed of decisions required for prevention and control actions in health emergency.
GREY MULTI-ATTRIBUTE EMERGENCY DECISION-MAKING METHOD FOR PUBLIC HEALTH EMERGENCIES BASED ON CUMULATIVE PROSPECT THEORY	
MEASURE	Response. Public health emergencies. Covid-19.
AUTHOR [57]	(WANG, 2022)
SCOPE	Multi-attribute **decision-making method** in public health emergencies, which considers risk and temporality of the decision, through the Cumulative Prospect Theory (CPT) approach (TVERSKY; KAHNEMAN, 1992) and *grey number* (LIU et al., 2012).
METHOD	Application of the Cumulative Prospect Theory (TVERSKY; KAHNEMAN, 1992), which allows weighting functions in contexts of uncertainty and risks for gains and losses of decisions taken, combined with the *grey number* (LIU et al., 2012). It assumes the possibility of values for a range or set of variables and not exact values. The method begins the decision-making process with a problem, establishes a function for possibilities, and assumes a *grey number* that converges to an optimized model of attributes and times for the assumed weights, reaching comprehensive values in perspective (time) for decisions to be made.
GAPS | CHALLENGES	The decision-making process in an emergency happens according to the context, when the decision-maker may change his or her positioning on risk. Despite Cumulative Prospect Theory approaches, the challenge remains to incorporate the dynamics of the psychological process of decision-makers into decision support frameworks on risk propensity or aversion in pandemic processes.
AN EXTENDED MULTI-ATTRIBUTIVE BORDER APPROXIMATION AREA COMPARISON METHOD FOR EMERGENCY DECISION-MAKING WITH COMPLEX LINGUISTIC INFORMATION	
MEASURE	Response. Public health emergencies. Disaster. Earthquake.
AUTHOR [12]	(SHI et al., 2022)
SCOPE	Method for emergency **decision-making** that evaluates the best response to an event, focusing on complex linguistic expressions of information provided by experts.
METHOD	Model developed based on the methods: *Double Hierarchy Hesitant Linguistic Term Sets (DHHLTSs) and the Multi-Attributive Border Approximation Area Comparison (MABAC)*, which incorporate uncertain information from decision makers. The model occurs in three stages: a) evaluate the performance of the alternatives listed; b) determine the weights of the decision criteria, c) establish the prioritization of the solutions found.
GAPS | CHALLENGES	The dimensioning of weights for gains and losses of decisions in health emergencies involves a cognitive dimension, capturing complex linguistic information, and understanding the hesitations of decision-makers. However, the production of consensus as an element of collective positioning on vulnerabilities and uncertainties of the context needs to be prioritized.
NATIONAL RISK ANALYSIS MODEL (NRAM) FOR THE ASSESSMENT OF COVID-19 EPIDEMIC	
MEASURE	Prevention. Public health emergencies. Covid-19.
AUTHOR [55]	(DENG et al., 2023)

SCOPE	Risk analysis and scenario projection model at the national level for the evaluation of Covid-19 - NRAM. Components: affected area, infection, outbreak management measures, health preparedness, monitoring and detection, population density, mass standard of living, distribution of young population, education, level of migration, quality index and accessibility to health care, government efficiency, emergency preparedness and level of national development.
METHOD	Bayesian Network (BN) with *Interpretive Structural Modeling - ISM* and the K2 algorithm. It establishes a network structure that combines expert knowledge with data from practical cases, for a broader view of the context. Factors are identified, and network parameters are established to produce scenarios and analyses sensitivities.
GAPS | CHALLENGES	The positioning of governments in the dynamic context of emergencies needs to incorporate feedback loops on disease behavior (e.g., Covid-19), however, the sensitivity of static short-term indicators to the uncertainties of the environment is a gap to be overcome by decision-making frameworks.
VI - HEALTH INFRASTRUCTURE AND LOGISTICS	
FUZZY BASED HYBRID DECISION-MAKING FRAMEWORK TO EXAMINE THE SAFETY RISK FACTORS OF HEALTHCARE WORKERS DURING COVID-19 OUTBREAK	
MEASURE	Response. Public health emergencies. Covid-19. Working environments in hospitals. India.
AUTHOR [51]	(RATHORE; GUPTA, 2022)
SCOPE	Framework of **safety risk factors in hospital** work environment during an epidemic.
METHOD	In the framework, the safety risk factors are identified by Fuzzy Delphi Method (FDM); the weights of categories and their respective factors are calculated and ranked based on their criticality by Fuzzy Analytic Hierarchy Process (FAHP); and the ranking of Indian hospitals is done by Fuzzy Technique for Order of Preference by Similarity to Ideal Solution (FTOPSIS).
GAPS | CHALLENGES	The preparation of health services for a pandemic integrates guidelines from reference bodies such as the WHO and can adopt multicriteria decision support methods to analyze risk factors. However, the exact definition of criteria and the attribution of values for analysis is a challenge to be overcome, due to the dynamics of contexts, ambiguities of expert opinions and scarcity of resources that affect hospitals.
HEALTHCARE FACILITY ASSESSMENT TOOLS FOR RESILIENT EVALUATION	
MEASURE	Preparedness. Public health emergencies. Covid-19.
AUTHOR [62]	(BRAMBILLA et al., 2021)
SCOPE	**Flexibility analysis of health facilities** - hospitals. Components: form, structure, façade, building plan, expandability, restrictions, technology, interchangeability and functionality.
METHOD	Literature review, case study and usability testing for updating the *OFAT framework (Optimized* Flexibility *Assessment Tool), a* tool for assessing the flexibility of healthcare facilities.
GAPS | CHALLENGES	A pandemic in its magnitude affects countries and occupies the limits of physical structures and health services, which means readjustment of facilities for new uses. The availability of frameworks for assessing the flexibility and resilience of health facilities is scarce, for models that minimally address structural, organizational and technological aspects of the spaces.
DECISION MODEL FOR DEFINING THE INVENTORY LEVELS IN HEALTHCARE SYSTEMS BY CONSIDERING MULTIPLE SCENARIOS SUCH AS OUTBREAKS	
MEASURE	Preparedness. Public health emergencies. Covid-19.
AUTHOR [49]	(ONAR; KAHRAMAN; OZTAYSI, 2020)
SCOPE	Decision model about **stock levels of health systems in emergency scenarios**. Components: availability of local production and proximity to production centers, necessary quantity of product/equipment, supply costs, criticality of use, inventory and stock maintenance.
METHOD	Multi-criteria spherical fuzzy regret. It represents the level of hesitation or adherence of decision makers to listed alternatives.
GAPS | CHALLENGES	Covid-19 exposed challenges of supply chain systems by the sudden increase in demand for health supplies on a global scale and the limits of production and logistics, and the need to advance studies on frameworks for assessing optimal stock levels for health emergency contexts.
CONCEPTUAL FRAMEWORK FOR DETERMINING NEED FOR AND ALLOCATION OF VENTILATORS DURING A PUBLIC HEALTH EMERGENCY	
MEASURE	Response. Public health emergencies. Covid-19
AUTHOR [4]	(KOONIN et al., 2020)

SCOPE	Framework to determine the needs for allocation of ventilators (technology) in health units in the context of pandemic (Covid-19), for planning actions and adequate logistics of equipment, supplies and qualified personnel in intensive care. Components: patient demand, need for adequacy and increase in resources in hospitals, strengthening of provisions at federal, state and local levels.
METHOD	Conceptual framework for **allocation of ventilators (technology)** in health units, with strategies for provisions at the levels of organization of the health system (federal, state, local).
GAPS | CHALLENGES	According to the extension and speed of cases of a severe acute respiratory syndrome, it may increase the need for equipment and inputs such as mechanical ventilators and oxygen. Despite the definition of strategies for technology allocation, frameworks of situation analysis of the health system need to contemplate the capacity of structures, qualified personnel and especially ethical principles to serve different population groups.
HOSPITAL AGILITY FRAMEWORK - INTERVAL TYPE-2 FUZZY FLOWSORT INFERENCE SYSTEM	
MEASURE	Preparedness. Disaster and hospital management. Tehran. Iran.
AUTHOR [48]	(MOHEIMANI et al., 2021)
SCOPE	Framework for **classifying hospitals** by level of agility, based on management capacity to deal with disasters. The Framework verifies the relationships between agility factors and the actions to prepare, mitigate, rebuild and respond to a disaster situation. Factors: organizational structure, leadership, patient belief and hospital insight, hospital chain management, clinical governance, technological upgrading, market awareness, outsourcing, psychological support to customers, and trained staff.
METHOD	Literature review on health care agility; application of the Flowsort method with IT2FSs (interval type-2 fuzzy sets) to incorporate in the analysis the agility factors, linguistic expressions and classify the hospitals. The method establishes alternatives based on criteria and ordered categories.
GAPS | CHALLENGES	Hospital agility is a structuring component of health service responses in situations of natural or man-made disasters how effectively (competence, flexibility, speed) facilities respond to the emergency.
VII - HEALTH AND RELATED SERVICES	
DECISION-MAKING SUPPORT MODEL TO REDUCE EMERGENCY OVERCROWDING - DEMATEL-PROMETHEE II)	
MEASURE	Response. Emergency Room of Cajuru University Hospital - HUC. Paraná. Brazil.
AUTHOR [50]	(PEGORARO et al., 2020)
SCOPE	Composition of decision support methods for managers, on improvements for the **reduction of overcrowding in emergency rooms,** which addresses problem identification, derivation of patient care criteria, projection and prioritization of improvements. Components: resource use, layout efficiency, productivity, work environment, materials, technology, patient safety, patient transfer rate.
METHOD	Composition of Multicriteria Decision Support Methods: Decision-Making Trial and Evaluation Laboratory (DEMATEL) and Preference Ranking Organization (PROMETHEE II). The model addresses feedback relationships, interdependence and influences among criteria, with emphasis on resource utilization, layout efficiency, productivity and technology.
GAPS | CHALLENGES	The management of the health emergency room to avoid overcrowding deals with problems that are difficult to identify and with patient management factors that cannot be changed quickly, however, according to the complexity of the context, there is a need for the association of multicriteria decision support methods to prioritize alternatives, such as assigning weights, establishing causal relationships between criteria, identifying improvements (DEMATEL in the study), and ordering the choices in time (PROMETHEE II in the study).
VIII - MONITORING AND EVALUATION	
DYNAMIC RISK ANALYSIS (DRA)	
MEASURE	Preparedness. Risk analysis. Possibility of application in Health.
AUTHOR [52]	(RAVEENDRAN; RENJITH; MADHU, 2022)
SCOPE	Analysis of **risk dynamics** in time-dependent contexts and dynamic variation of process variables.
METHOD	Dynamic Risk Analysis (DRA): mapping, managing, identifying risk dynamics and using hybrid models in risk analysis.
GAPS | CHALLENGES	The analysis of risk dynamics in contexts of uncertainty requires the development of decision support frameworks with application of advanced hybrid dynamic methodologies, to overcome shortcomings of conventional probabilistic static models.
EVALUATION OF FACTORS TO RESPOND TO THE COVID-19 PANDEMIC USING DEMATEL AND FUZZY RULE-BASED TECHNIQUES.	

MEASURE	Response. Public health emergencies. Covid-19. Malaysia.
AUTHOR [58]	(ASADI et al., 2022)
SCOPE	**Assessment of the WHO-established guiding factors** for countries in Covid-19.
METHOD	Decision-Making Trial and Evaluation Laboratory (dematel) and Fuzzy Rule-Based Techniques. It identifies causal relationships between factors and critical elements impacting Covid-29 virus infection. Components: social media sharing, mass crowding control, people movement control, international travel restrictions, distance learning and economic stimulus measures.
GAPS | CHALLENGES	Challenge to link multicriteria decision support methods to the Dematel method to analyze complementary components (factors) influencing the spread of Covid-19, including different statistical techniques with larger sample sizes.
FRAMEWORK TO EVALUATE GOVERNMENT STRATEGIES FOR A NEW TYPE OF CORONAVIRUS WITH A MCDM METHOD: Q-RUNG ORTHOPAIR FUZZY TOPSIS	
MEASURE	Response. Public health emergencies. Covid-19.
AUTHOR [43]	(ALKAN; KAHRAMAN, 2021)
SCOPE	Evaluation of strategies implemented by governments to address Covid-19, considering the application of multi-criteria decision-making methods. Strategies: mandatory quarantine and strict isolation, restriction of movement, state of emergency, herd immunity, early diagnostic testing; training for social life. Related criteria: physiological, psychological, potential for virus spread, cost and intangible cost, future commitment, time, digital technology and cybersecurity, human rights.
METHOD	TOPSIS q-rung orthopair fuzzy method. It establishes alternatives in extended contexts, with lack of information, ambiguities, uncertainties and dissensions among experts.
GAPS | CHALLENGES	A comparative evaluation of governance strategies in Covid-19, using multicriteria decision support method and different analysis criteria, can explore associations of *q-ROF TOPSIS* methods in future work, looking at the rapidly evolving pandemic context and the effectiveness of national strategies.
COMPARATIVE ANALYSIS OF TOPSIS, VIKOR AND COPRAS METHODS FOR THE COVID-19 REGIONAL SAFETY ASSESSMENT	
MEASURE	Response. Public health emergencies. Covid-19.
AUTHOR [45]	(HEZER; GELMEZ; ÖZCEYLAN, 2021)
SCOPE	Comparison of multi-criteria decision support methods to **assess health security** levels of 100 world regions in COVID-19. It adopts criteria and results from the Deep Knowledge Group (DKG) consortium[1], which assesses safe regions for Covid-19 based on criteria of quarantine efficiency, government efficiency in risk management, monitoring and detection, health preparedness, regional resilience and emergency preparedness.
METHOD	Comparison of methods: Technique for Order Performance by Similarity to Ideal Solution (TOPSIS) - ranks alternatives according to the distances between positive and negative ideal solutions. Vise Kriterijumsa Optimizacija I Kompromisno Resenje (VIKOR) - orders and selects alternatives with conflicting criteria. Complex Proportional Assessment (COPRAS) - ranks alternatives according to importance and utility.
GAPS | CHALLENGES	Despite the study's comparative evaluation of multicriteria decision support methods (TOPSIS, VIKOR and COPRAS in the study) to assess health security levels of regions in a pandemic, future research should address methods able to generate optimal solution further from the non-ideal measures.
FRAMEWORK TO BUILD AN AGILE STRUCTURE WITHIN THE HUMANITARIAN RELIEF CHAIN NETWORK	
MEASURE	Response. Public health emergency.
AUTHOR [44]	(DASHTPEYMA; GHODSI, 2021)
SCOPE	Identification and assessment of factors facilitating **agility capacity in the humanitarian aid network**. Components: Timeliness of delivery of products and services; health risk management; long-term needs of the population; health information technology; medical equipment and drug logistics; transport services; coordination and strategic alliances; structural dynamic flexibility; donor organization; interprofessional communication in health centers; government and non-governmental organization policies.
METHOD	Application of a hybrid evaluation approach that combines fuzzy decision trial evaluation laboratory (DEMATEL) and analytic network process (ANP). It approaches fuzzy set theory to deal with

[1] http://analytics.dkv.global/covid-regional-assessment-200-regions/full-report.pdf

	ambiguities, uncertainties and inaccuracies inherent in the evaluation process. The methods assess interactions between elements and establish reliability ratings.
GAPS | CHALLENGES	Lack of comprehensive studies to assess factors facilitating agility for the humanitarian aid network, needed to improve verification of plans and targets of the actions carried out.
THE ADAPTIVE EPIDEMIC RESPONSE (AER) FRAMEWORK	
MEASURE	Response. Public health emergency. Epidemics.
AUTHOR [9]	(WARSAME; BLANCHET; CHECCHI, 2020)
SCOPE	Adaptive response framework for epidemics, which addresses analysis of context, intervention, process, **performance and** impact, and a route to performance analysis and optimization of interventions.
METHOD	Literature review for incorporating elements converging with an iterative, adaptive and comprehensive **approach to the epidemic intervention cycle.**
GAPS | CHALLENGES	The studies of frameworks to support decisions on epidemics indicate as gaps for future research: models focused on specific contexts, with low capacity to reformulate the intervention; frameworks with limited structures for reapplication in different contexts; iterative approach not valued in the design of frameworks; and absence of frameworks for evaluation of the full cycle of an intervention.
ASSESSING THE PERFORMANCE OF REAL-TIME EPIDEMIC FORECASTS	
MEASURE	Response. Public health emergency. Epidemic. Ebola. Sierra Leone - 2014-15
AUTHOR [11]	(FUNK et al., 2019)
SCOPE	Evaluation of **the performance of an epidemic**, observing real-time evolution and forecasts established. It verifies the assertiveness of interventions. Components (metrics): calibration, sharpness and biases of the predictions.
METHOD	Model combining a mechanistic core (Susceptible-Exposed-Infectious-Recovered - SEIR model) with non-mechanistic variables, observing time series and some level of uncertainty about underlying processes.
GAPS | CHALLENGES	Despite the importance of mathematical models for decision-making and projection of scenarios in health crises, the calibration of probabilities is more reliable for short periods (two weeks), and is compromised in the long term, depending on the level of uncertainty of the trajectory, the intervention strategies and the quality of the recommended decisions.
LOGICAL FRAMEWORK AND STEPS FOR ASSESSING DISASTER-RELATED HEALTH RISK.	
MEASURE	Prevention. Disasters.
AUTHOR [10]	(KEIM, 2018)
SCOPE	Nomenclature framework for assessing **disaster-related health risk**. Components: accuracy, historical evidence, quantifiable public health data and uncertainties; contexts, hazard, impact and exposure analysis; vulnerability and capacity assessment; and risk characterization.
METHOD	Conceptual approach to risk by disaster literature, to compose a framework for risk assessment in disasters.
GAPS | CHALLENGES	The context of disasters and public health emergencies implies assessing risk factors (exposures, vulnerability and capacity). The challenge to be overcome by the analysis frameworks is the development of assessment models with reproducible, well validated processes, capable of incorporating available historical data or their absence for predictions, especially in new events or those extremely rare ones that generate uncertainties (black swan).
MONITORING AND EVALUATION OF DISASTER RESPONSE EFFORTS UNDERTAKEN BY LOCAL HEALTH DEPARTMENTS: A RAPID REALIST REVIEW	
MEASURE	Response. Disasters.
AUTHOR [59]	(GOSSIP et al., 2017)
SCOPE	Framework for monitoring and evaluating actions within the scope of health department responses in disaster contexts. The framework generates records for learning and preparing future responses to address emergencies.
METHOD	Conceptual framework developed based on literature review on quality improvement, and its application to enhance the **disaster monitoring and evaluation cycle** (document, evaluate, disseminate, implement), looking at context settings and response mechanisms.
GAPS | CHALLENGES	Challenge: To develop digital platforms and mechanisms to enhance monitoring, evaluation and efforts of health departments in coping with disasters, based on evidence from studies that explain ways of intervention and operation in different contexts.

ASSESSMENT MODEL FOR RAPID SUPPRESSION OF SARS-COV-2 TRANSMISSION UNDER GOVERNMENT CONTROL	
MEASURE	Response. Public health emergencies. Covid-19. Taiwan
AUTHOR [56]	(PAN et al., 2022)
SCOPE	Model for adjusting **government strategies** to contain SARS-CoV-2 transmission by analyzing the interactions and behaviors of agents. Components: geographical factors, climatic factors, displacements and contacts between agents in public spaces. Agents are classified as the resident, the healthy and those in quarantine or confirmed case. In infrastructure and governance, he is the hospital agent that provides structures and services; the transportation agents in roads, railways and airports; and the government agent, which establishes policies to address the emergency.
METHOD	The model relates the agents, their attributes and interactions, based on data for simulation in the time and space of the analysis. The authors carried out a multi-agent modeling, which uses the tool Repast Simphony 2.8.1 (Argonne National Laboratory, Lemont, IL, USA), developed in Eclipse Platform and Java language. It analyzes the spatial dynamics and produces, from scientific evidence, dynamic feedback about the interactions in time, allowing the government to analyze scenarios and adjust prevention and control actions, adopting effective intervention measures according to the context.
GAPS | CHALLENGES	The restrictive measures for the population are incorporated according to the behavior of the agents and the dynamics of the contexts, without the prevalence of a one-size-fits-all approach. However, this creates the challenge for governments to know the impacts of different measures in space and time, given by the economic and social development of a region.

4 CAPÍTULO 4: ARTIGO 2 - Prospective Strategies to Enhance Resilience for Public Emergencies Preparedness: A Human Resources Management Perspective

- Artigo publicado.
- Autores: Tathiana de Mello Sampaio, Alex Santos Príncipe, Misael Sousa de Araujo.
- https://doi.org/10.34178/jbth.v7i1
- Resumo: esse estudo tem como objetivo identificar estratégias de gestão de recursos humanos que aumentem a resiliência organizacional na preparação para emergências de saúde pública. Para atingir esse objetivo, foi realizada uma pesquisa bibliográfica que abrangeu o período de 2016 a 2023, juntamente com uma análise ambiental externa para extrair fatores contribuintes para o estudo. Os resultados referem-se a estratégias focadas no aprimoramento das habilidades, na promoção da saúde do trabalhador e na garantia da conformidade com as regulamentações para proteger os profissionais. Conclui-se que a pandemia proporcionou experiências valiosas e exemplos positivos que podem aumentar a capacidade de produtividade, com lições aprendidas que são essenciais na preparação para futuras emergências de saúde pública e para práticas que devem ser perpetuadas.

Prospective Strategies to Enhance Resilience for Public Emergencies Preparedness: A Human Resources Management Perspective

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This study aims to identify human resources management strategies that enhance organizational resilience for public health emergency preparedness. To achieve this goal, a literature search was conducted covering the period from 2016 to 2023, along with an external environmental scan to extract contributing factors for the study. The results pertain to strategies focused on enhancing skills, promoting worker health, and ensuring compliance with regulations to safeguard professionals. It is concluded that the pandemic has provided valuable experiences and positive examples that can enhance productivity capacity, with lessons learned that are essential for future public health emergency preparedness and practices that should be perpetuated.
Keywords: Resilience. Emergency Management. Preparedness. Human Resources.

In a world where uncertainties, complexity, and chaos coexist, shaping organizational decisions in the context of health emergencies, addressing these challenges is imperative. According to the International Health Regulations, health emergencies pose significant risks to public health and necessitate a coordinated international response [1], thereby presenting health within an increasingly complex and dynamically adverse scenario. These global challenges demand a thorough analysis tailored to the vulnerabilities of each context, with short-, medium-, and long-term measures in place.The emergence of health emergencies has accelerated in recent years, with diseases like Polio, Ebola, Zika, COVID-19, and Monkeypox affecting global populations [2,3]. Consequently, public health organizations must continuously implement measures to prevent, control, and mitigate harm during outbreaks, epidemics, pandemics, disasters, or when facing population assistance challenges [4], underscoring the need for robust organizational resilience [5,6].

Received on 26 September 2023; revised 22 December 2023.
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J Bioeng. Tech. Health 2024;7(1):63-68
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Organizational resilience must exhibit flexibility and dynamism to support institutions, particularly during times of rapid change and unexpected health crises, enabling swift and effective responses to adversity for survival, growth, and competitive advantage [7]. Beyond mere survival, organizational resilience entails adaptation, proactivity, and seizing opportunities in challenging business environments such as the health sector, rebounding regardless of known or unknown changes [7]. Public health emergencies heighten the complexity of organizational challenges, necessitating a nuanced understanding of global complexities and promoting locally optimal actions, including guidelines for preparing human resources at all levels to cope with health crises.

A key focus of this work is the research on building resilience in health systems [8], with a specific emphasis on preparing human resources. In this regard, the World Health Organization has established the Health Emergency and Disaster Risk Management Framework (H-EDRM) is a mechanism that strengthens an integrated approach to managing health emergencies and disaster risks at national and organizational levels.

In today's knowledge era, human capital, a crucial dimension of intellectual capital, stands as a primary dynamic asset capable of providing a competitive edge. It embodies valuable, rare, inimitable, and irreplaceable attributes that

positively influence organizational resilience [9]. Some scholars have expressed concerns about the preparedness of human resources to act effectively in such situations. The collaboration among various stakeholders and the interconnectedness between sectors to overcome challenges and enhance preparedness for future disasters are focal points [10,11].

Additionally, the availability of information, whether through information systems, communication channels, or digital technologies, plays a pivotal role [10-12]. The significance of this study lies in capturing emerging trends and successful practices for the human capital of public health organizations, structuring them systematically to enable managers to make agile and proactive decisions in the face of future health crises.

Therefore, this study aims to identify human resource management strategies that enhance organizational resilience for public health emergency preparedness.

Materials and Methods

The method proposed in this study comprises two complementary parts: a literature review and an environmental scan. In the literature review, we identified challenges and opportunities in human resources management related to disaster preparedness and public health emergencies, drawing insights from recent events, notably the COVID-19 pandemic. The environmental scan allowed us to observe shifts in the external environment and their potential impact on professionals' work. It enabled us to apply these insights effectively in future public health emergency management.

Literature Research

In this study, we conducted a literature search on the Web of Science database focusing on heightened Public Health Emergencies (PHE) between 2016 and 2023. Our search generated 128 titles using a structured search string for the investigated object. After screening and evaluation by the authors, we selected 14 studies for analysis.These studies provided insights into challenges, gaps, and human resource management strategies that can enhance organizational resilience for public health emergency preparedness.

Environmental Scanning

One crucial step in mapping a potential emergency scenario is conducting an environmental scan to identify and adapt to external changes [13]. This management process involves situational analysis of the external environment, aiding decision-making through information acquisition, analysis, and utilization. It provides valuable insights for directing efforts during existing or imminent crisis events, benefiting organizational learning and performance [14]. Using techniques like STEEP (Social, Technological, Economic, Environmental, and Political) analysis facilitates understanding existing conditions and anticipating future adversities and opportunities for innovation, thereby fostering greater organizational resilience [14].

Results and Discussion

In complex PHE contexts, organizational challenges revolve around incorporating ethical values into decision-making processes within complex adaptive systems filled with ambiguities and uncertainties [16].

Strategic resilience hinges on institutional legacies and values to achieve a future vision.

The COVID-19 pandemic highlighted disruptions in health services due to understaffing, emphasizing gaps in HR planning, governance, information systems adoption, and resource allocation [17]. Addressing these challenges requires expanding staff capacity through training, responsibilities review, skills consolidation, PPE utilization, volunteer team organization, and HR plan management [16].

The World Health Organization established the H-EDRM to strengthen health systems' resilience,

emphasizing personnel planning, occupational health, security, and capacity building across technical, epidemiological, diagnostic, service, and communication areas [18]. This systemic approach comprehensively tackles human resource planning challenges in PHE.

At the organizational level, it prioritizes occupational health actions, multidisciplinary work, workload adaptation, specific staff hiring measures, and intensifying digital technologies to support productive activities [12].

Interagency coordination, interdisciplinary integration, alignment of guidelines, public-private HR strategy agreements, and breaking silos between government areas are essential for coping with health crises [10,19].

Employees' psychological resilience and organizational culture are crucial in public health crises, necessitating a flexible, continuously trained workforce participating in prevention protocols and post-event learning [8].

Based on identified weaknesses, challenges, and gaps from recent studies outlined prospective strategies for human resource preparation and management at the organizational, actors, and employee levels. Table 1 summarizes these strategies and their alignment with the external environment, guiding organizations toward greater resilience for public health emergency preparedness.

In addition to these initiatives, the environmental scanning brought several contributions and reflections that will guide organizations on the need for articulation for future health emergencies in an anticipated way. Figure 1 illustrates the primary core strategy, contributions, and diagnosis for each scope of the STEEP analysis. Through it, we noticed signs of change in careers, organization operations, and human resources management at work, especially when there is an upcoming health emergency. Therefore, the parameters identified and the diagnoses mentioned should be considered when defining the organizational strategy and updating internal policies for worker protection and actions to increase resilience.

Conclusion

The study emphasizes the critical role of organizational resilience in managing Public Health Emergencies (PHEs), particularly highlighted during the COVID-19 pandemic. It reflects on lessons learned from this crisis, revealing vulnerabilities, opportunities, and positive examples that can guide the development of strategies to enhance organizational resilience. The research underscores the centrality of human resources in organizations, including public health agencies, and how various factors discussed in the literature and environmental scanning analysis can impact professionals in their roles. The environmental scanning process highlighted disruptions across social, technological, environmental, economic, and political dimensions, signaling career changes, human resources management, and internal processes and policies.

The identified strategies and positive practices are crucial for implementation to improve organizational preparedness for future public health emergencies. It is imperative to integrate these lessons learned into organizational strategies and policies to foster greater resilience and effectively navigate similar crises in the future.

Acknowledgments

We are thankful for the financial support from the National Council for Scientific and Technological Development (CNPq); IW is a CNPq technological development fellow (Proc. 308783/2020-4).

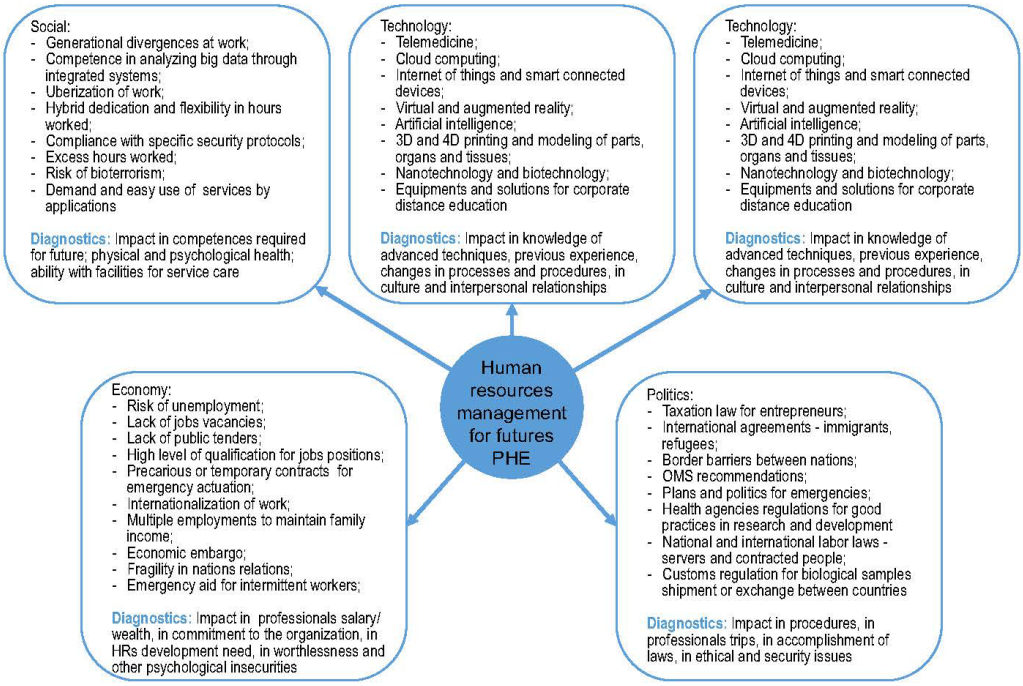
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Table 1. Prospective strategies for public health emergency preparedness.

Dimensions	Strategies	Descriptions	References
Organization	Governance & leadership	Integrated structures, partnerships and responsibilities with clear leadership to support a coordinated and interoperable system	[16,20-22]
	Emergency plan and practices and experiences dissemination for preparedness	Develop a plan through a dynamic, collaborative planning process; invest in testing and practicing plans and processes; Gather rules, regulations, unity of purpose and priority for change and action	[16,21-23]
	Risk analysis	Consolidated knowledge of community hazards and risks, systematics and dynamics of risk events, disasters and emergencies	[16,24]
	Surveillance and monitoring	Timely information to provide situational awareness and guide action	[16,21,22,24]
	Resources	Ensure dedicated resource capacity and mobilization capability	[16]
	Communication and dissemination	A strategy to transmit clear and coherent messages on the networks, to the public and between organizational levels;	[16,23]
	Learning and assessment	Evaluation as a strategy to build resilience	[16]
	Digital technologies and agile processes	Use of digital technologies for increasing effectiveness and efficiency, and for coherent data system for situational awareness	[16,20,22,23]
	Future studies - strategic foresight	Perform scanning of the environment, scenarios to identify future opportunities and threats; visioning methods; appreciation request; focus on ambidexterity; road mapping; activity plans for long-term strategies	[20,21]
Actors	Collaborative networks	Develop strong relationships, partnerships and networks; relationships between government, community organizations, customers, institutions and other kind of businesses	[16,19,21-23]
	Community involvement	Understanding and engaging with the community; contribution on preparedness process improvement; community as a partner on solutions development, enhancing knowledge through relational capital	[16]
Employees	Workforce capacity	Develop skills and support knowledgeable, skilled and resilient staff; recruitment and conduction to activities according to education, training and professional development pathway	[16,19,23]
	Staff engagement	Commitment to work; sense of belonging; mission valence	[20,21]
	Creativity and solutions for preparedness and innovation	Stimulate the creativity of professionals; produce a favorable climate for innovation in products, services and processes.	[20,21]
	Workers' health and psychological resilience	Investing in actions that contribute to the professional life quality inside and outside work; support to staff needs	[19,20]

Figure 1. STEEP analysis based on PH manager's multidisciplinary perspectives.



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5 CAPÍTULO 5: ARTIGO 3 - Diretrizes para Implantação de um Observatório para Emergências de Saúde Pública

- Artigo publicado.
- Autores: Dominic da Veiga Puggi, Alex Santos Príncipe, Bruna Aparecida Souza Machado, Ingrid Winkler, Cristiano Vasconcellos Ferreira.
- https://doi.org/10.55905/oelv22n5-136
- Resumo: Os primeiros anos da década de 2020 ressaltaram a vulnerabilidade das respostas do governo e a confiança do público nas autoridades políticas, científicas e médicas. Tem sido observado que uma infodemia tem acompanhado as epidemias modernas. Para lidar com a apreensão do público, é necessária uma atitude decisiva, multidisciplinar, interdisciplinar e integrada, que requer análises profissionais completas. Neste sentido, uma ferramenta importante para informar planos de ação, intervenções governamentais e tomada de decisões durante futuras emergências de saúde pública, são os observatórios de saúde pública. Este artigo tem como objetivo apresentar um conjunto de diretrizes para implementação de observatórios de emergência de saúde pública. Para isto foram estudados observatórios no setor de saúde pública e urbana e tecnologias relevantes para uma referência cruzada. As diretrizes propostas são aderentes aos padrões internacionais de melhores práticas e, ao mesmo tempo, considera os contextos nacionais. Este artigo também pretende tratar do papel essencial da tecnologia e da colaboração no estabelecimento e manutenção de um observatório de saúde. Foi observada uma falta de dados concretos e atualizados durante a realização da pesquisa analisando observatórios e os efeitos da desinformação na confiança pública.

REVISTA OBSERVATORIO DE LA ECONOMIA LATINOAMERICANA

ISSN: 1696-8352

Diretrizes para implementação de um observatório para emergências de saúde pública

Guidelines for implementation of a public health emergency observator

Lineamientos para la implementación de un observatorio de emergencias en salud pública

DOI: 10.55905/oelv22n5-136

Receipt of originals: 04/02/2024
Acceptance for publication: 04/22/2024

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ISSN: 1696-8352

RESUMO
Os primeiros anos da década de 2020 ressaltaram a vulnerabilidade das respostas do governo e a confiança do público nas autoridades políticas, científicas e médicas. Tem sido observado que uma infodemia tem acompanhado as epidemias modernas. Para lidar com a apreensão do público, é necessária uma atitude decisiva, multidisciplinar, interdisciplinar e integrada, que requer análises profissionais completas. Neste sentido, uma ferramenta importante para informar planos de ação, intervenções governamentais e tomada de decisões durante futuras emergências de saúde pública são os observatórios de saúde pública. Este artigo tem como objetivo apresentar um conjunto de diretrizes para implementação de observatórios de emergência de saúde pública. Para isto foram estudados observatórios no setor de saúde pública e urbana e tecnologias relevantes para uma referência cruzada. As diretrizes propostas são aderentes aos padrões internacionais de melhores práticas e, ao mesmo tempo, considera os contextos nacionais. Este artigo também pretende tratar do papel essencial da tecnologia e da colaboração no estabelecimento e manutenção de um observatório de saúde. Foram observadas uma falta de dados concretos e atualizados durante a realização da pesquisa analisando observatórios e os efeitos da desinformação na confiança pública.

Palavras-chave: Emergências de Saúde Pública, Observatório, Tomada de Decisão, Tecnologia.

ABSTRACT
The first years of the 2020s highlighted the vulnerability of government responses and the public's trust in political, scientific and medical authorities. It has been observed that an infodemic has accompanied modern epidemics. To deal with public apprehension, a decisive, multidisciplinary, interdisciplinary and integrated attitude is needed, which requires thorough professional analysis. In this sense, an important tool for informing action plans, government interventions and decision-making during future public health emergencies are public health observatories. This article aims to present a set of guidelines for implementing public health emergency observatories. To this end, observatories in the public and urban health sector for cross-referencing. The proposed guidelines adhere to international standards of best practice while taking into account national contexts. This article also aims to address the essential role of technology and collaboration in establishing a health observatory. A lack of concrete and up-to-date data was observed during the course of the research regarding observatory analysis and the effects of misinformation in public trust.

Keywords: Public Health Emergencies, Observatory, Decision-Making, Technology.

RESUMEN
Los primeros años de la década de 2020 pusieron de relieve la vulnerabilidad de las respuestas gubernamentales y la confianza del público en las autoridades políticas, científicas y médicas. Se ha observado que una infodemia ha acompañado a las epidemias modernas. Para hacer frente a la aprensión pública se necesita una actitud decisiva, multidisciplinaria, interdisciplinaria e integrada, que requiere un análisis profesional

ISSN: 1696-8352

exhaustivo. En este sentido, una herramienta importante para informar los planes de acción, las intervenciones gubernamentales y la toma de decisiones durante futuras emergencias de salud pública son los observatorios de salud pública. Este artículo tiene como objetivo presentar un conjunto de pautas para la implementación de observatorios de emergencias de salud pública. Para ello, se crearán observatorios del sector salud público y urbano para el cruce de referencias. Las directrices propuestas se ajustan a las normas internacionales de mejores prácticas y al mismo tiempo tienen en cuenta los contextos nacionales. Este artículo también pretende abordar el papel esencial de la tecnología y la colaboración en el establecimiento de un observatorio de salud. Durante el curso de la investigación se observó una falta de datos concretos y actualizados sobre el análisis del observatorio y los efectos de la desinformación en la confianza pública.

Palabras clave: Emergencias de Salud Pública, Observatorio, Toma de Decisiones, Tecnología.

1 INTRODUCTION

Public health emergencies are defined just as much by their consequences to health as they are by their causes and precipitating events (NELSON et al., 2007). A public health emergency (PHE) refers to a situation that poses significant risk to the health and well-being of a population, requiring an urgent and coordinated response to protect and mitigate the impact on public health. It is characterized by an extraordinary threat to public health that can be caused by infectious diseases, natural disasters, chemical or radiological accidents, bioterrorism or other hazards. Carmo, Penna, and Oliveira (2008) describe any event that presents: "a risk of spreading or disseminating diseases to more than one Federated Unit (State or Federal District), with priority of immediately notifiable diseases and other public health events (regardless of nature or origin), found, after risk assessment, that may require an immediate national response" (CARMO et al., 2008, p.22).

To deal with PHEs, it is important to note that governments have access to guides and information made available by the World Health Organization, such as the Emergency response framework (2017) and Guide for establishing health observatories (2016), as well as their own guideline documents, made by government sectors responsible for health, such as the Brazilian Ministry of Health's Public Health

ISSN: 1696-8352

Emergency Response Plan (2014). However, although these documents are detailed, each emergency situation ends up having its own peculiarities. Territory, available resources, cultural barriers, organizational levels and political climate are all challenges present in pandemics and health crises in general, requiring a contextualized approach.

The arrival of the digital age has fundamentally transformed the landscape of health information dissemination, presenting new opportunities and governance challenges. Today, disinformation spreads rapidly through various online platforms, and it is of the utmost importance to have effective mechanisms to guide government responses and distinguish between false information and that guided by scientific evidence. A health observatory, based on knowledge, data and international best practices, emerges as a mechanism to support evidence-based policymaking, combat the spread of misleading or malicious information, and clarify situations during times of crisis and panic.

Public trust in emergency response strategies is the fundamental basis of an effective health system, as it represents society's certainty in the institutes, authorities, health professionals and information responsible for safeguarding and promoting health.

Science-based information is vital for individuals to follow recommendations, guidelines and regulations, and for full strategic communication, in the concept of risk communication, which guides the population regarding diseases, symptoms, and treatment protocols. Community involvement in health initiatives and campaigns is the guarantee that health services and resources are distributed equitably and fairly, regardless of their origin, socio-economic status or other factors.

Despite the importance of trustworthy information, skepticism can arise for various reasons, such as the proliferation of false information that occurred in the Covid-19 pandemic, characterizing an infodemic. Previous cases of unethical behavior, such as medical experimentation without consent or discriminatory practices, have previously undermined trust in health systems, especially among marginalized communities, such as the study of untreated syphilis in black men in Tuskegee, Alabama, in the United States (JONES, 2008), or the forced sterilization of indigenous women in Canada and the United States (PEGORARO, 2015). Conflicts of interest, where financial or political motivations

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influence health policies, question the impartiality of scientific recommendations.

In this sense, this article highlights the need to establish a public health observatory model focused on emergencies and crises, using international examples such as the Global Health Observatory (GHO) of the World Health Organization, the Observatoire suisse de la santé (OBSAN) of Switzerland, and the Surveillance Resource Center (SRC) of the CDC of the United States of America. An observatory of this topic will serve as a centralization of health-related data, filtered and peer-reviewed information, and evidence-based reports and investigations to contextualize reality for society, in particular to support decision-making by governments and by analyzing and disseminating accurate and up-to-date health information to guide them in public health plans and policies. By comparing these international examples, we aim to identify key features and good practices to create the guidelines for an effective system for future emergencies.

It should be noted that proposing an observatory model per se is not within the scope of this article, but rather proposing guidelines for proposing a model, which could be a future study. These guidelines can be understood as being orientations and/or instructions to guide the behavior or actions of organizations in implementing an observatory in this area of PHE management.

In addition, this article aims to highlight the essential role of technology and collaboration in establishing a health observatory. Technological advances are essential for handling large amounts of health data and facilitating the rapid dissemination of accurate information to the public. Interdisciplinary collaboration involving health professionals, data analysts, communication experts and policy makers will ensure an appropriate approach, enriching the functionalities and impact of the observatory for the guidance of society. The concepts of observatory, public trust, public health and public health emergencies were also investigated, as well as the technologies that help create and maintain a health observatory: electronic health records (EHR), health information exchange (HIE), wearable health technologies, Big Data analytics, geographic information systems (GIS) and mobile health applications (mHealth).

Proposing guidelines for the design of a public health emergency observatory is

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in line with the immense need for evidence-based decisions in the field of public health during times of crisis. To this end, definitions of observatories and public health emergencies are first presented. This is followed by a survey of observatory models and technologies used. And finally, the proposed guidelines.

2 THEORETICAL BACKGROUND

The definition of an observatory is uncertain and has evolved over the years as practice and concepts have developed. Wilkinson and Hemmings (2003) showed that although the practice began in 1974 in Ile de France with the Observatoire Régional de Santé Île-de-France, there was no consensus on what the term meant in this context. The word observatory has a connotation of something purely passive: for example, an organization or system that simply observes the public or data, which, according to the authors, is a myth, as observatories identify themselves as "proactive researchers, providing strong policy messages that inform policy-making" (Wilkinson; Hemmings, 2003, p.324).

This uncertainty of established identity has affected the use of services by users, investors and partners, their attributions and scopes, and collaboration on a national and international scale (Wilkinson; Hemmings, 2003).

The work of both authors is cited in several other works. Castillo-Salgado, Aspinall, and Jacobson (2016) comment that although the model has continued and spread rapidly, the original 2003 question still remained unanswered a decade later. According to them, the number of observatories had already passed 150, and despite several attempts, there was no exact definition. Initial efforts included "providing relevant, high-quality regional health information to the observatories' host areas, synthesizing existing data and defining specific areas for data collection, strong networks for data access, comparative autonomy and setting priorities for their work" (Aspinall et al. 2016, p.1).

According to Gattini (2009), a health observatory is a virtual platform, a national center that conducts comprehensive observations and produces systematic reports on aspects of population health and health systems to support health policies and plans. The

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observatory integrates, without replacing, the results or functions of information, monitoring and surveillance systems, allowing for a comprehensive, coherent and solid overview, simultaneously covering the health situation, the determinants influencing health and the functioning of health systems, including information on different sectors while developing as a national and integrated management tool, supporting the work of political and high-level decision-makers in public health and health systems (Gattini, 2009).

Many of the initial public health observatory projects, although they varied depending on the region, tended to cover the same objectives: identifying gaps in health information, increasing accessibility to data, facilitating the use of evidence by working with all levels of government, and supporting evidence-based policies and practices (Hunter et al., 2000).

When national health information is available, it is rarely in a single, easily accessible source. Often, this information is fragmented in different libraries, virtual documentation centers, research centers and monitoring and surveillance systems. This function of synthesizing information ends up being a large part of the identity of a health observatory (Gattini, 2009).

There are various types of observatories within the health field, such as the Belo Horizonte Urban Health Observatory, which deals with socio-environmental issues in the municipality, or the Barcelona Health and Policy Impact Observatory, which focuses on both health and the effects of legislation on it and existing inequalities. However, for this article, the interest lies in the management of public health emergencies.

The level of each emergency can vary, but it is generally characterized by escalating abruptly, requiring rapid mobilization of resources and coordination of efforts, leading to disruptions in daily life, economic crises, social unrest, and by intensified response measures such as disease surveillance, quarantines and isolation, public communications, case identification and contact tracing.

Along these lines, in May 2023, the Independent Advisory and Oversight Committee for the World Health Organization's Health Emergencies Program released its report on PHEs considering the period from May 2022 to April 2023, listing the following

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situations that may or may not lead to a public health emergency: "the coronavirus disease (COVID-19) pandemic, multi-country outbreaks of mpox (monkeypox), global cholera outbreaks, floods in Pakistan, Sudan virus disease in Uganda, Marburg virus disease, drought and food insecurity in the Greater Horn of Africa, humanitarian crisis in the Sahel region of Africa, the Ukraine emergency, the earthquake in the Syrian Arab Republic and Türkiye, and other protracted emergencies and humanitarian crises" (Ammar et al. , 2023, p.3).

Emergency management is a topic of great interest to the administrative governance sector and the public health sector. Emergencies, such as natural disasters, accidents or pandemics, can be extremely damaging in terms of property and lives, and minimizing casualties and damage is only possible with effective emergency and crisis management.

The state, according to articles 5 and 6 of the Brazilian Constitution, guarantees the safety and health of its citizens (BRASIL, 1988), and emergency management is a fundamental aspect of fulfilling this duty (Khan et al., 2018), both legally and ethically, and it is in the state's best interest to promote stability after an incident. Significant inter-agency coordination is also required between the federal, state, ministerial and military levels, as well as the need for a strategic level of crisis communication to ensure that the public is well informed. A sense of chaos will negatively affect public confidence in the administration, diminishing crisis mitigation efforts.

According to the literature, emergency management includes four phases, described in Table 1: preparedness (PHEP), response, recovery and mitigation.

Table 1 - Phases and descriptions of emergency management

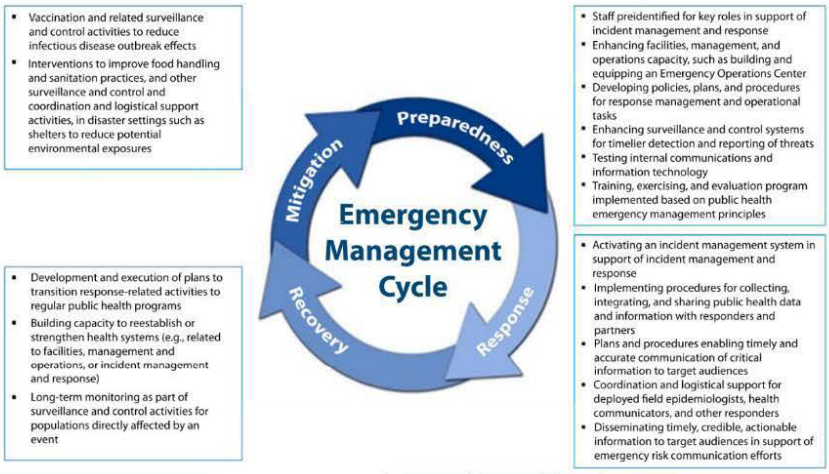
Phase	Description
Preparedness	Occurs before and during an event and focuses on building or maintaining the capacity of a team, systems, and infrastructure, as well as carrying out planning, training, and exercising.
Response	Occurs when recognizing a hazard that threatens to overwhelm day-to-day functions or capabilities.
Recovery	Occurs during and after the response. It covers efforts to return or adapt to "new" normal conditions after an event.
Mitigation	It is the reduction of losses or risks of danger and the control of expected damage. It can take place before, during and after an event.

Source: Rose D, Murthy S, Brooks J et al. (2017). Adapted by the autor.

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Rose et al. (2017) demonstrate in Figure 1 each phase of the PHE management cycle and cite examples that may or may not happen during each phase, such as testing and training during the Preparedness phase, implementation of procedures during the Response phase, long-term monitoring during the Recovery phase, and health interventions during the Mitigation phase.

Figure 1 - Examples of public health emergency management (PHEM) activities in all phases of the emergency management cycle



Source: Rose D, Murthy S, Brooks J et al. (2017).

According to Mayer et al. (1995), it is during these crisis and risk situations that the need for trust becomes real. Trust is understood as a certain willingness on the part of one party to be vulnerable to the actions of another, based on the expectation that they will carry out a specific action regardless of their ability to monitor or control that other party (Mayer et al., 1995). Public trust, however, is the trust of a group or person in an institution or social system. It is a generalized attitude, partly influenced by experiences with representatives of institutions or systems and partly influenced by the media, whether mainstream or social. Public trust, in turn, influences how people come into contact with health systems, whether public or private. There is also the aspect of interpersonal trust: trust between individuals, which will also affect public trust. (Van Der Schee et al., 2007)

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The interest of this article on the topic lies in the negative effect of a lack of public trust in public authorities and policies, especially the lack caused by misinformation, and how the observatory can help combat it.

Briony and David (2019) have two distinct definitions: health misinformation and health disinformation. Health misinformation is knowledge that is contrary to the consensus of the scientific community on a concept or application, as the veracity of facts tends to change frequently due to new evidence, techniques and methods. Health disinformation is the deliberate or coordinated effort to knowingly circulate erroneous information for financial or political gain. Given that healthcare is a domain with enormous financial incentives at stake, it ends up being an attractive location for intentional disinformation (Swire-Thompson; Lazer, 2020).

According to Chou, April, and Klein (2018), this disinformation, which then affects public trust, promotes skepticism towards medical guidelines, having adverse effects on public health. The authors cite as an example not only the Ebola outbreak in 2014, where there was open hostility towards health professionals that made it difficult to control the epidemic, but also the increasingly prevalent anti-vaccine publications on social networks that legitimize the debate on vaccine safety, which may contribute to the reduction in vaccination rates that led to the return of measles in both the United States and Brazil (Chou et al., 2018).

Public trust is the basis of relationships between patients and professionals, enabling open communication and facilitating more accurate diagnosis and effective treatment. Horn and Kersaidou (2020) point out that, in 2013, the UK government implemented a plan to connect health and social care data across the NHS (National Health System) called care.data, with various objectives, such as economic growth and transparency for the general public.

Within a few months, more than a million patients opted out of the new system and, in 2016, it was discontinued, all due to concerns that NHS data would be shared with private commercial companies (Horn; Kersaidou, 2020). Gille et al. (2015) writes that trust is fundamental to the delivery of health services, exemplifying how unproven links between vaccines, intestinal diseases, and autism were publicized by the media in the late

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1990s in the UK, causing low vaccination coverage and disease outbreaks due to a lack of trust (Gille et al., 2015). Blendon et al. (2015) stated that without increasing public trust, many policy decisions affecting patient care will be made by those who would not consider the perspective of the medical profession itself (Blendon et al., 2015).

During the Munich Security Conference in February 2020, WHO Director-General Tedros Adhanom Ghebreyesus was quoted as saying: "We are not just fighting an epidemic; we are fighting an infodemic. Fake news spreads faster and more easily than this virus, and it's just as dangerous" (Ghebreyesus, 2020). Defined by the WHO as an overabundance of information, whether accurate or not, the infodemic is a modern challenge, making it difficult to find reliable sources and safe guidance. The damage of an infodemic is two-sided, harming both the public's health with false prevention measures and false cures, and the public's trust in the health system and in public authorities and policies (Who, 2020).

The success of an observatory is intrinsically linked to the trust that individuals and communities have in the integrity, transparency and ethical practices of the data collection, analysis and storage processes.

3 SURVEY OF AVAILABLE OBSERVATORIES

It is difficult to determine the exact number of health observatories worldwide, as it can vary depending on the definition, scope and whether they have been appropriately named as such. When considering health observatories as entities that systematically collect, analyze and disseminate health-related data and information, there is a wide list of possible bases for a future observatory. In addition, the current state and existence of health observatories can change over time as new initiatives are established or existing ones evolve or dissolve due to loss of public and financial support.

Table 2 shows a search carried out using keywords such as "observatories", "surveillance", "health systems" on Google and Google Scholar, as well as following examples studied in other articles. The search detailed existing scopes and the alignment of their objectives with their description, as well as showing the growing trend to form

new observatories in the health area, organized chronologically.

Table 2 - Existing observatories, description and example of objectives

Name, city, country, year established	Description	Example of Objectives
London Health Observatory (LHO), London, England (2001-2013)	A previously integral part of the network of twelve public health observatories in the UK and Ireland. The LHO produced data, information, and intelligence on the health and healthcare of the then 7.8 million people living in London.	It provided information, data and understandable interpretations to be used by policy-makers and the public to influence health and reduce health inequalities. It also provided a health knowledge signposting service and carried out training and capacity building for health professionals.
Swiss Health Observatory (OBSAN), Neuchâtel, Switzerland (2001)	A center of expertise, services and information supported by the Confederation and the cantons. Started as part of the national health policy dialog.	Provides scientific analysis and information on population health, the health system, and population health policy. Provides customized analysis and consulting services to partners and stakeholders.
Belo Horizonte Urban Health Observatory (OSUBH), Belo Horizonte, Brazil (2002)	A partnership between the Federal University of Minas Gerais (UFMG) and the Municipality of Belo Horizonte. Focused on acquiring in-depth knowledge about urban health through scientific research to understand the social and environmental conditions of urban life, creating an empirical basis for determining urban health interventions.	Produces research related to the urban scenario. It contributes to the training of academics and health professionals. Systematically analyzes health events and their determinants. It produces methods for measuring the attributes of the urban context. It also establishes a data warehouse for the systematic analysis of health data.
Nairobi Urban Health and Demographic Surveillance System (NUHDSS), Nairobi, Kenya (2002)	Pioneering demographic and urban health surveillance system established in two slum communities in Nairobi because they have the worst health and socio-economic outcomes of any group in Kenya.	It provides a platform to investigate the long-term health and socio-economic consequences of living in urban slums. It seeks to be a global center of excellence and a consistent source of scientific evidence for policy and action on population, health and education in Africa.
Bangladesh Urban Health Network (BUHN), Dhaka, Bangladesh (2009)	A civil society network that regularly engages in advocacy, working as a political pressure organization to bring together different actors in the urban health sector to collaborate on health equity issues, running social media campaigns to raise public awareness and organizing conferences with other organizations.	It promotes the generation, exchange and application of high-quality urban health knowledge to achieve health equity in urban environments across the country.
Surveillance Resource Center (SRC), Atlanta, USA (approx. 2010)	A website that allows the surveillance community to easily access and share useful methods, tools, legal, ethical and regulatory guidance to improve surveillance practice and serve as a web-based management system.	Provides easy access to guidance developed by the CDC and its partners to improve surveillance practice. It allows analysis, usage and collection of data to drive prevention in public health.

Source: Author (2023).

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Table 3 - Existing observatories, description and example of objectives (continued)

Name, city, country, year established	Description	Example of Objectives
Global Health Observatory (GHO), Geneva, Switzerland (2010)	Created by the World Health Organization, the GHO contains health-related statistics for more than 1000 indicators from almost 200 Member States. Many of these indicators are used to monitor progress towards the Sustainable Development Goals. It can be searched by theme, category, indicator or country. Includes metadata on most indicators.	Shares data on global health, including statistics by country and information on specific diseases and health measures.
Australian Urban Observatory, Melbourne, Australia (2013)	Created by the Royal Melbourne Institute of Technology to bring together the link between city design, policy and planning with health and well-being using liveability indicators, developed by a multidisciplinary team of academic researchers.	Collects urban liveability indicators, providing access to multiple data sources in one place. Saves money and time in obtaining and analyzing data - a range of indicators provides users with a clear understanding of the situation in each of Australia's twenty-one largest cities.
Chilean Public Health Observatory, Santiago, Chile (approx. 2014)	OCHISAP is considered an informational support tool for the community's knowledge of health-related issues, as well as providing relevant evidence for health-related management and actions.	It makes relevant population health information available to the entire community in order to motivate them to actively participate in health issues and guide them in the development of health policies and decisions.
Asia-Pacific Observatory on Health Systems and Policies (APO), New Delhi, India (approx. 2015)	Based in the WHO regional office for South-East Asia, it is a collaborative partnership of interested governments, international agencies, foundations and researchers that promotes evidence-informed health systems policies regionally and in all countries of the Asia-Pacific region.	IIt collaboratively identifies priority health system issues in the region. Develops and synthesizes relevant research to support and inform evidence-based policy development in the countries involved. Engages in national dialogue with key stakeholders, be they governments, development partners, civil societies or academia.
Fiocruz Observatory on Science, Technology and Innovation in Health, Rio de Janeiro, Brazil (2016)	Data science initiative of the Oswaldo Cruz Foundation (Fiocruz) to collect, process, analyze and make available, in open access, data and information, supporting the institutional mission and the consolidation of the Brazilian Unified Health System (SUS).	It contributes to research management and the formulation of institutional policies in the area. It supports institutional development, providing strategic information to support decision-making. Promotes the availability of various data and indicators relevant to the health area.
Observatory of Health and Policy Impact (OBSIP), Barcelona, Spain (2020)	A tool to monitor the state of health in the city and the inequalities between neighborhoods and social groups and the impact on health of certain policies carried out by the City Council. It aims to be a way of promoting transparency and auditing public policies.	It monitors the state of health of people living in Barcelona and the factors that determine it, taking into account any existing inequalities. It assesses the impact of municipal policies on health and its determinants, as well as their impact on social inequalities in health.

Source: Author (2023).

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The identified observatories, which range from monitoring health trends to generating medical research, function as dynamic hubs that transform raw data into actionable insights. The use of technology in healthcare not only increases our understanding of complex problems in this area, but also guides more informed decision-making. As the volume of data continues to increase, these observatories act as good tools to guide policymakers in the health sector.

Finally, it should be noted that there is a lack of observatories specifically focused on general crises and PHEs. The technologies implemented in the observatories are discussed below.

4 TECHNOLOGIES EMPLOYED IN OBSERVATORIES

There are various methods for acquiring and collecting data, which is one of the main functions of an observatory. Among the main methods used in this area are: Big Data Analytics (BDA), Health Information Exchange (HIE), Electronic Health Records (EHR), Geographic Information System (GIS), mobile health (mHealth) and wearables.

All have certain factors and possible disadvantages in common, described below in each section of the article, but advantageous possibilities for the coming years in the area of PHE management, which would be part of the responsibility of a public health emergency observatory. Although they all require financial investments, they vary according to availability and local socio-economic contexts.

Many of the observatories listed rely on information such as data, articles and reports provided by external sources and their own members to prepare dissemination materials. For example, Fiocruz's Brazilian Climate and Health Observatory (OCS), operates based on a model explained by Barcellos et al. (2016).

4.1. BIG DATA

Big Data can be defined as a set of data large enough to make it difficult to interpret. According to Dash et al. (2019 apud LANEY, 2001) "data was growing in three

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different dimensions: volume, velocity and variety. Big in Big Data is indicative of its sheer volume. Velocity indicates the rate at which data is collected and made available for further analysis; on the other hand, variety refers to the different types of organized and unorganized data that any company or system can collect, such as transaction-level data, video, audio, text, or log files. These three Vs have become the standard definition of big data" (Dash et al., 2019, p.2-3, apud Laney, 2001).

This evolution of data has required new techniques and effective solutions for processing and analyzing Big Data. These solutions, known as Big Data Analytics (BDA), can play a decisive role in any observatory, providing both specific information and identifying trends, patterns and correlations. This is noteworthy given the scope of observatories that can reach millions of people, as London's LHO did.

Predictive modeling using Big Data could help predict the spread of a disease and estimate the demand for health resources, which are often inadequately distributed in an emergency, such as the allocation of medical professionals, hospital beds, vaccines, ventilators and mechanical respirators and other relevant resources.

BDA enables real-time monitoring of health-related data streams, including trends in hospital admissions, emergency room visits, laboratory results and other datas, providing a dynamic understanding of emergency progression and stage. Another invaluable potential is to help with contact tracing by analyzing data from mobile devices and social media to keep the movement of individuals in mind. This online tracking can also help assess public perception, concerns and misinformation. This can be used to adapt communication strategies, address concerns and combat possible malicious actors.

However, there is a serious danger to privacy and security when using BDA in this way. Robust anonymization techniques need to be implemented and adherence to ethical data practices should be mandatory to ensure that individual privacy is maintained while still being able to extract desirable information. Dash et al. (2019) states that more appropriate software and hardware still needs to be developed to support this analysis of this 'endless sea' of information, as well as ensuring easy visualization for users, however, recent advances have been demonstrated in machine learning, deep learning, data mining, and predictive analytics tools and their ability to identify trends, clusters and anomalies.

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4.2 HIE AND RES

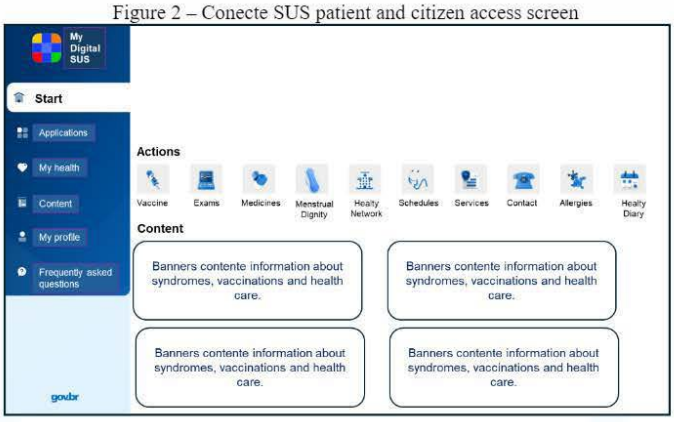
Dixon (2016) points out that Health Information Exchange (HIE) has two distinct meanings as a verb and a noun. HIE, as illustrated in Figure 4, refers both to the action of physically exchanging data and information with authorized stakeholders, such as hospitals, laboratories, pharmacies, urgent care centers and many others, and to the organizations, private or governmental, that are responsible for handling this exchange due to legal and privacy concerns, since the vast majority of data involves sensitive and confidential information.

Although the data itself can be in various formats, the most logical format would be the Electronic Health Record (EHR). The concept of an EHR, according to Hoerbst and Ammenwerth (2010), is that of a comprehensive, cross-institutional collection of a patient's history, allowing authorized participants to engage not only in current medical treatment, but also in the patient's overall health situation, while allowing them to access and manage health-related data. This, combined with HIE, can help the health sector improve the coordination of patient care, reduce errors and have an enhanced health data management experience while simultaneously enabling continuous sharing between other teams or stakeholders, such as observatories.

To illustrate the use of this technology, citizens, health professionals and managers in Brazil have access to Conecte SUS, the Ministry of Health's initiative to digitally strengthen the principles and guidelines of the SUS, as illustrated in Figure 2.

It's possible to make a comparison between HIE, RES and BDA by connecting the fact that, for the purposes of the observatory, much of the data would be RES sent via HIE in such volume, variety and speed that it could be considered Big Data during emergency situations. The same problem of privacy, security, and ethics still remains, but the Brazilian government has already taken the first steps to address this situation by creating its own system and platform in 2020, the Rede Nacional de Dados em Saúde (RDNS), whose goal of serving as a platform for information systems aligns with health repositories and observatories.

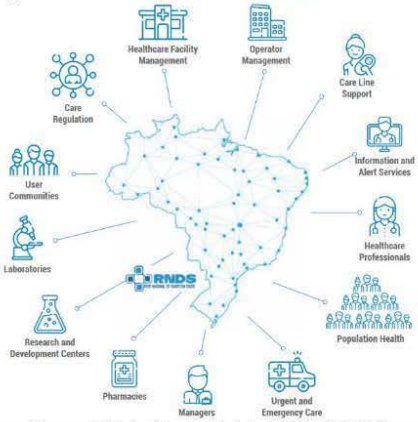
Figure 2 – Conecte SUS patient and citizen access screen



Source: Author. Adaped from Ministério da Saúde – ConecteSUS (2023).

The RDNS, presented in Figure 3, is a network that connects actors and data, establishing a national information platform, connecting health unit and operator management, support for lines of care, alert services, health professionals, population health data, emergency and urgent care services, research and development centers, pharmacies, laboratories, online communities, and health care regulations.

Figure 3 – Graphical representation of the National Health Data Network (RDNS) and its scope.



Source: Ministério da Saúde - RNDS (2023).

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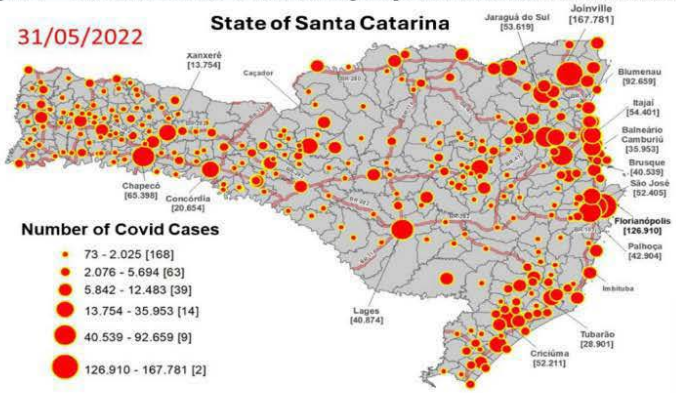
4.3 GIS

The interest in GIS, or Geographic Information System, for the purposes of this article is in using Maguire's (1991) partial definition of a representation of reality as geographic features for decision support systems that emphasize modeling and analysis for authority figures, such as the use of administrative boundaries for census counts.

"When diseases can spread so quickly, information needs to move even faster. This is where map-based dashboards become crucial" (Boulos, Geraghty, 2020, p.2). By combining GIS with web services, users can utilize and visualize an impressive amount of data without the need for a central hosting or processing service, which allows for rapid dissemination of information (Boulos; Geraghty, 2020).

As an example, Figure 4 illustrates a UDESC initiative to geographically visualize the evolution of the COVID-19 pandemic in Santa Catarina, Brazil, using the Boletim do Diário Oficial do Governo do Estado de Santa Catarina. The number of cases per municipality is visually represented by the size of each circle, according to its legend. The GIS proved successful during the Covid-19 pandemic, even at the beginning, with experts writing article after article trying to predict and demonstrate the rates of spread in real time in support of the WHO and local governments.

Figure 4 – Confirmed COVID-19 cases during the pandemic in Santa Catarina, Brazil.



Source: UDESC (2022).

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GIS is a tried and tested method that many observatories rely on due to its versatility, reliability and ease of use, both for the experienced and the layman. It serves as an interesting tool for topics such as population analysis or outbreak mapping, while also communicating visually with the public to convey the geographical impact of an emergency, illustrate trends and explain mitigation strategies that would otherwise be potentially overlooked by complex texts that wouldn't have the same reach or dissemination potential.

Certain problems, although mitigable, can arise with the use of GIS, such as the privacy and security concerns mentioned earlier, as with any system that deals with this type of data. However, due to its nature, there are also wider socio-economic and political contexts that can be omitted, forgotten or misunderstood, which can lead to misguided decision-making at all levels. Countries with distinct rural and urban areas may find themselves unable to include both communities at the same level, with the same quality or with the same accuracy, and even at city level you may find the same division between urban and suburban centers and neighborhoods. Users can also misinterpret spatial patterns and draw inappropriate conclusions depending on the quality of the communication sent along with the GIS visualization. On an international scale, there can be issues related to data sovereignty, ethics and the different regulatory frameworks between them (Elwood, 2006).

It is possible to address these concerns through various means, such as transparent communication, adherence to ethical practices and regulations, and an emphasis on community involvement as it is key to creating and maintaining public trust in the use of technology.

4.4 MHEALTH AND HEALTH WEARABLES

Akter and Ray (2010) define mobile health services (mHealth) as the general use of mobile or portable devices, such as smartphones, tablets and wireless technologies, in the provision of health services and health data management. mHealth is considered a personalized and interactive service that is strongly linked to eHealth, or electronic health

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services, as a subset of it.

mHealth encompasses a wide variety of applications and services that take advantage of mobile technology resources, such as mobile apps, text messaging and telemedicine consultations, with the aim of improving health outcomes, enhancing the delivery of health services and empowering individuals to take an active role in managing their health. This technology emerges as a response to inadequate services in emerging countries, and the focus on it is its own capacity as a powerful tool for gathering information, such as symptoms, cases and emergencies, as well as disseminating it, such as vaccination campaigns or health advice through alerts and push notifications.

For the health sector itself, this technology can be used for mobile surveys or feedback collection, data aggregation and analysis, supply chain management, multilingual and accessible communication, and as logistical support for health professionals, all of which are of interest to a health observatory, especially since telemedicine is already employed by SUS as of 2022 (Law 14.510/2022).

Linked to mHealth is the concept of wearable health technology. Dunn et al. (2018) define wearables, as devices that allow continuous health monitoring outside a clinic, enabling the development of algorithms for automated prediction of health events, especially in chronic conditions such as arrhythmia, also known as irregular heartbeat. These devices are equipped with sensors and similar technology that track various physiological parameters, activities and behaviors.

Sandvik (2019) further explores that wearables can also be passive apps that can be downloaded to smartphones, tablets and smartwatches to help with geographical orientation or more sophisticated multifunctional devices that also record various data streams, including biomarkers (such as heart rate).

These apps and devices can be designed to allow users to keep a record of their online activity or communicate with third-party websites that monitor and analyze activity, to facilitate data synchronization. Operating at the evolving interfaces between biological and sensor technology, wearable devices provide measurement, selection, sorting, readability, calculability and visibility. Increasingly, they are also instruments for drug delivery or reproductive control, such as menstrual cycle tracking apps.

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Wearables have gained significant popularity in recent years due to their potential, such as promoting proactive health management among enthusiasts, providing real-time health information for patients in chronic situations (DUNN et al., 2018).

Wearables can offer distinct advantages, such as remote monitoring of patients, early detection and alerts of abnormalities, information for public health surveillance in aggregate form, and communication and coordination between emergency teams and individuals. Aggregated data is of particular interest to an observatory, but there are significant financial barriers to using and relying on it in a major way, especially given the lack of proliferation of these wearables in Brazil due to their high local cost.

Many of the potential problems with the technologies listed are those of privacy and the ethical use of confidential and private information, which is of great interest in the health area. Although there are ethical practices and legislation protecting citizens, there is no universal guarantee that malicious actors will not gain undue access to benefit financially, especially since many of these actors are interconnected to the technology being used. The sale of health data, ad targeting and marketing, employment and insurance discrimination, the creation and sale of health dossiers, fraudulent misrepresentation and ransomware attacks are just a few examples of seriously harmful actions that bad faith actors can commit.

5 GUIDELINES FOR THE IMPLEMENTATION OF A PUBLIC HEALTH OBSERVATORY

Cross-referencing the technologies employed, their ethical concerns, public trust and existing observatories that serve as examples of robust and long-lasting health data centers leads to proposing guidelines for possible future Public Health Emergency Observatories (PHEO). Planning for public health emergencies is a complex process that can require a great deal of logistical and inter-agency coordination, depending on the level of the crisis. These guidelines will serve to answer future questions, such as what characteristics, functionalities and elements an OESP should possess to assist and collaborate with government agencies during public health emergencies, aligning the

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observatory's goals with the needs of the government and the public.

Table 4 - Guidelines for Implementation

Fundamental	Based on the observatories studied and the technologies used
Guidelines	
• Contemplate data and information to support measures in all phases of a public health emergency, including the prevention phase, the response phase, the mitigation phase and the recovery phase; • Define a chain of command and clear communication channels within the observatory to ensure coordination and seamless decision-making during emergency situations; • Influence health policymakers using up-to-date data; • Implement quality assurance measures to ensure the accuracy and reliability of the data collected; • Accept, manage and adequately communicate to the public and its target audiences policies, strategies, legislation, coordination plans, human resources, financial disclosures, risks, state of health infrastructure and logistics, availability of health and related services, community health capacities;	
Fundamental	Based on the observatories studied and the technologies used
Guidelines	
• Use risk assessment tools and modeling techniques to predict the potential impact of health emergencies; • Provide training in effective risk communication strategies to equip responders to communicate complex health information to diverse audiences; • Integrate with existing public health systems to facilitate a seamless response to emergencies; • Coordinate efforts with healthcare providers, laboratories and other relevant entities; • Analyze data to identify trends, patterns and emerging health issues; • Using easy-to-use and understand platforms and tools to share information; • Promoting health education to empower individuals and communities to make informed decisions and proactively prepare for emergencies; • Regularly evaluate the effectiveness of emergency response measures and adjust strategies based on evaluations to improve future response capabilities; • Conduct thorough analysis after each emergency and identify successes and areas for improvement to refine future response strategies; • Integrate innovative technologies for data collection, analysis and communication and stay ahead of technological advances to enhance observatory capabilities; • Be able to manage a comprehensive knowledge database while monitoring and evaluating current and future public health emergencies; • Incorporate all its data into its measures, plans and risk assessments; • Be aware of possible accessibility inequalities in information, plans and measures. • Facilitate international collaboration by actively sharing information with neighboring countries; • Engage in joint efforts to deal with health threats that transcend national borders	
Fundamental	Based on the effects of communication on the reputation, longevity and efficiency of an observatory
Guidelines	

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• Actively participate in global research networks focused on public health emergencies and contribute to the collective knowledge base through collaborative research initiatives; • Collaborate with communication experts to ensure that information is clear, accurate and accessible; • Create and maintain an online presence that encourages community engagement while being strongly monitored for off-topic, unproductive, inflammatory and harmful discussions; • Establish open communication and assist in establishing communications between and with government bodies, health institutions and other observatories.

Source: Author (2024).

Table 5 - Guidelines for Implementation (continued)

Fundamental	Based on the effects of public confidence in the health sector
Guidelines	
• Earn, cultivate and maintain public trust through frequent communications, transparent reports and recommendations; • Involve the community in the design, implementation and evaluation of public health programs. • Comply with ethical standards and strictly defined laws to handle public data without creating a conflict of interest that damages public trust	

Source: Author (2024).

Finally, in proposing these guidelines, we reiterate the importance of integrating proven technologies and best practices in the development of any future observatory.

5 CONCLUSIONS

In this article, a gap was identified in the public health sector dealing with emergencies, and while there have been government and community measures to combat infodemics and coordinate efforts during most PHEs, there is a financial, moral and legal incentive to mitigate future pandemics in any proven effective way.

By studying existing international success models and considering technological aspects and collaboration, it is possible to shape a public health information ecosystem that not only informs government responses, but also combats the proliferation of misinformation, promoting a more participatory, honest and inclusive society.

Observatories serve as a frontline tool for public authorities, and the creation of one specifically for public health emergencies is plausible. It is very likely that there will be a significant return on the efficiency of the Brazilian health system and on improving the quality of response to public health emergencies from health surveillance systems in

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this investment in mitigating public health emergencies and crises, but more research on the subject will be needed to determine concrete data.

The proposed guidelines can help in proposing a public health emergency observatory, meeting the needs of society.

This work has also identified that there are opportunities for future studies to obtain answers regarding the real damage that disinformation can cause, how far the consequences of letting infodemics be born and grow can go, and the public's general knowledge on the subject of observatories, public health measures, the value of public data and much more.

The lack of concrete data on these issues was a gap in the development of the work. Many scientific articles that analyzed and collected details and data on health observatories were also out of date, even though it had only been a few years, which could mean a dangerous lack of longevity for these types of projects, probably due to a lack of visibility. It is hoped that by drawing attention to this issue, it may encourage new perspectives in the public health sector and in the prevention of future pandemics, as well as the creation of a proper model of observatories for public health emergencies.

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6 CAPÍTULO 6: ARTIGO 4 - Strategic Decisions in Public Health Emergencies: Management Conditionality based on WHO Guidelines

- Artigo não publicado.
- Autores: Alex S. Príncipe, Ingrid Winkler, Cristiano V. Ferreira.
- Abstract: Public health emergencies (PHE) provide challenges for health management and governments. They jeopardize risk management, require rapid responses in complex scenarios, and determine the allocation of resources and access to vital products and services. The International Health Regulations (IHR) provides a framework for World Health Organization (WHO) Member States to improve their capacity for emergency preparedness, prevention, response, and recovery the health system. The article aims to identify and analyse the conditionalities that health management faces in the context of emergencies, focusing on the IHR, the Country Cooperation Strategies (CCS), and other WHO documents, as well as to provide guidelines to support the decision-making of strategic public health managers. An integrative review was carried out using the Web of Science, Scopus, Pubmed knowledge databases, and who documents to analyse conditionalities of the components of management in health emergency and disaster risk. The result shows 631 conditionalities with a greater concentration on planning and coordination, information, and knowledge management, and less emphasis on risk communication and sustainable financing. The results reinforce equity as an essential component that conditions health emergency management policies and strategies, which depends on global coordination and the incorporation of laws and resources at the local level to maintain minimum capacities required by the IHR, and to protect individual and collective rights with culturally adapted measures and according to the health determinants of the context.

Type of the Paper (Article, Review)

Strategic Decisions in Public Health Emergencies: Management Conditionality based on WHO Guidelines.

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Abstract: Public health emergencies (PHE) provide challenges for health management and governments. They jeopardize risk management, require rapid responses in complex scenarios, and determine the allocation of resources and access to vital products and services. The International Health Regulations (IHR) provides a framework for World Health Organization (WHO) Member States to improve their capacity for emergency preparedness, prevention, response, and recovery the health system. The article aims to identify and analyse the conditionalities that health management faces in the context of emergencies, focusing on the IHR, the Country Cooperation Strategies (CCS), and other WHO documents, as well as to provide guidelines to support the decision-making of strategic public health managers. An integrative review was carried out using the Web of Science, Scopus, Pubmed knowledge databases, and who documents to analyse conditionalities of the components of management in health emergency and disaster risk. The result shows 631 conditionalities with a greater concentration on planning and coordination, information, and knowledge management, and less emphasis on risk communication and sustainable financing. The results reinforce equity as an essential component that conditions health emergency management policies and strategies, which depends on global coordination and the incorporation of laws and resources at the local level to maintain minimum capacities required by the IHR, and to protect individual and collective rights with culturally adapted measures and according to the health determinants of the context.

Keywords: Public health emergency; management; decision-making; equity; International Health Regulations; WHO pandemic agreement. Country Cooperation Strategy.

Citation: To be added by editorial staff during production.

Academic Editor: Firstname Lastname

Received: date
Revised: date
Accepted: date
Published: date

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Key Messages

- The field of administration has intensified studies into decision-making models and the effectiveness of results in PHE, given the intensification of health events over the last five years. PHE has jeopardized countries' minimum necessary capacities.
- The challenge is systemic, it does not depend on conditionalities restricted to the pandemic moment, and it reaches out to the socio-environmental vulnerabilities determined in contexts of weakened health systems.
- More than opportunities, the management area has a duty to improve tools, practices, and decision-making systems to deal with future emergencies, considering the scarcity of resources and the expectations of different actors.
- The results indicate that equity is the central structuring element that challenges countries' strategies and even the effectiveness of guideline instruments such as the International Health Regulations.

1. Introduction

Addressing PHE requires governments and society to work together to implement policies, plans, and laws, allocate human and financial resources, organize services, and provide infrastructure and logistics capabilities. This complexity includes the incorporation of information, communication, and knowledge management as critical components of health-care systems' preparedness, prevention, response, and recovery processes. These procedures are intended to address the risks posed by diseases, environmental disasters, and hazards that endanger human lives, animals, and ecosystems, and establish conditionalities for managing the health emergency [1].

In this context, the WHO is the governing body that advises Member States on health issues, considering the diverse situations of financial, technological, cognitive, and human resources [2]. This implies diagnosis and adjustment plans for investments, regulatory and governance structures, and the reaction team's expertise. An unstable or organized health system faces issues such as the COVID-19 pandemic (2020-2023), which has harmed the economy and social wellbeing [3]. Management complexity is conditioned by the dynamics of response systems, the behaviour of individuals and groups, and the limits of the context [4], such as political instability and the management of different emergencies at the same time [5].

Conditionality is a subject of ex-ante evaluations, which maps the causes and justifying the intervention, and ex-post evaluations, verifying the consequences based on indicators [6], and for health it means the governments' commitment to preparing the health system. It is based on the concept of conditionality of the requirements imposed by the International Monetary Fund on countries receiving financial assistance [7].

The challenge is characterized by a syndemic, which occurs when communicable and noncommunicable diseases coexist in a setting of socioeconomic vulnerability and health system fragility [8]. This requires a systemic approach to decision-making that incorporates the dynamics of the context's social and environmental determinants as well as multisector interactions, such as hospitals, laboratories, and health production complexes, to rapidly adapt to a new reality [9].

Considering the need to strengthen decision-making processes and the sharing of conditionalities based on the countries' vision and WHO guidelines for PHE, there are gaps in the exchange of recommendations and best practices that need to be filled to strengthen a systematic approach, combine management expertise, and support Member States' health capacity [10]. Specific investigations and evaluations of critical areas such as human resources, logistics, and health investment are required [11], as is recognizing lessons learned by health systems to increase society's resilience in PHE [12].

In this sense. the WHO adopts guidelines and instruments that guide Member States in preparing for PHE, such as the International Health Regulations (IHR) [13] and the Pandemic Agreement which is being developed based on lessons from COVID-19, led by the Intergovernmental Negotiating Body [14], and addresses systemic gaps and challenges in dealing in PHE intending to promote equity in preparedness measures [2]. The IHR addresses the capacities [15] of national legislation, policy, and financing; coordination and communication of national focal points; surveillance; risk communication; human resources; laboratory services; points of entry; zoonotic events; food safety; chemical events; radio nuclear emergencies [13], [16]. WHO member states develop Country Cooperation Strategies (CCS), which are guidelines that align with IHR capacity development. Their implementation can differ based on the timely availability of financial resources, readiness with qualified human resources and continuous assessment of gaps by experts in emergency preparedness. [11].

In this sense, the article aims to identify and analyse the conditionalities that health management faces in the context of emergencies, focusing on the IHR, the Country Cooperation Strategies (CCS), and other WHO documents, as well as to provide guidelines to support the decision-making of strategic public health managers.

2. Public health emergency and systemic approach: Concepts, Complexities and Conditionalities of Management

A PHE is an extraordinary event, a possible or real risk to public health that requires coordinated action by governments. The WHO establishes it when it is of international concern, and by local governments when it is of national relevance [13], [16]. The PHE is defined by the presence or imminence of a sickness, event, or dangerous condition, serious occurrence, or persistent handicap that requires the declaration of an emergency and the adoption of appropriate response measures [17].

The PHE of international concern as a pandemic, considers the impact of the event on public health, its unexpected emergence, the potential for spread, and the risk to travel and trade when countries must notify the authorities. The definition of a PHE follows a graded risk approach based on the complexity of the context, and its declaration means an economic and social challenge, making the process of establishing and living with the PHE complex [18].

A public health risk is the likelihood that an incident will have a negative impact on health [13], e.g. climate change, environmental degradation, rising temperatures and humidity that promote arboviruses, and violence caused by wars and social conflicts [1]. Floods and droughts affect drinking water reserves and increase the risk of waterborne illnesses, making basic sanitation systems more difficult to maintain [19]. In 2023, one in every twenty people globally required humanitarian aid, up 25% from 2022 and more than doubling the 135 million who needed emergency assistance in 2018, signalling a long-term concern for governments [20].

Health surveillance plays a strategic role in PHE, as it integrates levels of care and health promotion based on population characteristics and social determinants when faced with a risk, to establish a response through the adoption of practices, methods, and technologies for organizing the health system, with the participation of society, linking the epidemiological, environmental, health and workers' health dimensions [21], and genomic surveillance, which monitors pathogens and supports personalized interventions, based on tools and data connectivity for PHE preparedness and response [22].

Supporting surveillance strategies, the management area works to ensure the effectiveness of actions to control health threats and respond to emergency plans, structuring operations centres, maintaining information and monitoring systems, preparing laboratories and hospitals, supporting communication between stakeholders (managers, academia, the market, and society), training strategies, simulation exercises and strengthening the research and production chain for health supplies, in a continuous cycle before, during and after a health crisis [23].

To that end, the WHO established the Health Emergency and Disaster Risk Management Framework (H-EDRM) [1], a management structure designed to strengthen an integrated approach to addressing PHE by combining health-related effort and resources with a comprehensive vision of the health system's preparedness, prevention, response, and recovery measures.

Preparedness improves the health system's readiness in the face of PHE by directing the capacity of the government, institutions, and society through appropriate legislation, resource planning, and community empowerment. During the response stage, all efforts are focused on saving lives, particularly in the workforce, infrastructure and service, logistics, and communication system components. Prevention stage aims to reduce the impact of a health-risk occurrence, specifically among the most vulnerable populations. The recovery efforts seek to rebuild the healthcare system and life in society [24], [25].

The H-EDRM is separated into management components, as seen in **Figure 1** Policies, Strategies, and Legislation (H-EDRM-PSL) establishes norms, responsibilities, and institutional capacity to direct operations. This level of organization works with Planning and Coordination (H-EDRM-P&C) to coordinate health activities with international, national, regional, and local partners [1].

HEALTH AND EMERGENCY DISASTER RISK MANAGEMENT FRAMEWORK - HEDRM (WHO, 2019)	
MEASURES AT PHE	
Prevention	Response
Recovery	Preparedness
MANAGEMENT COMPONENTS AT PHE	
Policies, Strategies and Legislation	Risk Communication
Planning and Coordination	Health Infrastructure and Logistics
Human Resources	Health and Related Services
Financial Resources	Community Health Capacities
Information and Knowledge Management	Monitoring and Evaluation

- PHE states are guided by an expanded approach to health crises and disaster risk management.
- Expert-prepared | Consistent with SDGs, International Health Regulations and other global guidelines.

Figure 1. H-EDRM - Measures and Components – Source: [26]

As a structural component of the overall process, Information and Knowledge Management (H-EDRM-I&KM) prioritizes databases to support decision-making, alert and health surveillance system preparation, and an evidence-based approach. It maintains a permeable boundary with all the H-EDRM components, particularly Risk Communication (H-EDRM-RC), which develops a communication strategy with society, staff, government, academia, reference institutions, and the market, ensuring the circulation of scientifically information, detecting rumours early, and managing disinformation [1]. Risk communication depends on the level of health literacy achieved by the population, considering how the individual accesses, understands and carries out critical thinking about health information, based on their accumulation with the practice of well-being, depending on the cultural perspective and about the health system in which they live [27]. When a population group participates in PHE planning, the information and knowledge generated, as well as the appropriate communication strategy, have an impact on the Community Health Capacity component (H-EDRM-CHC), which aims to strengthen the community with a focus on risk prevention [1].

The Health Infrastructure and Logistics component (H-EDRM-HI&L) conditions the emergency response by guiding the establishment of a safe and sustainable health environment as well as the timely provision of strategic supplies such as vaccines, medicines, diagnostic kits, and personal protective equipment. This component works in combination with the structure of Health and Related Services (H-EDRM-H&RS), which brings together prevention and health promotion programs, primary care, medium and high complexity care, and immunization services to form a basis of the infrastructure for dealing with emergencies. In Brazil, the system of products and services follows the concept of the Health Economic-Industrial Complex, which is made up of subsystems based on chemistry and biotechnology, mechanics, electronics, and materials, as well as services, information, and connectivity. This systemic and interdependent vision of producing resources for health strengthens economic and social development [28].

As a central element of the entire government response, the Human Resources component (H-EDRM-HR) works to develop the human competence needed to fulfil the

emergency management cycle, from leadership training and strategic governance to front-line service staff, such as the laboratory, hospital, and health surveillance service [1].

Clearly, planning for PHE across the preparedness-prevention-response-recovery cycle demands the allocation of financial resources. To this purpose, the Financial Resources component (H-EDRM-FR) calls for the establishment of an extraordinary investment fund for a contingency plan, which may be funded by special government resources, societal donations, and international financial and cooperative agreements. Finally, Monitoring and Evaluation (H-EDRM-M&E) follows the evolution of the health risk and program implementation, with a permanent evaluation of the installed capacity and the Member State's strategy implementation results [1].

Management in PHE deals with the uncertainty and complexity of the context, due to the unpredictability and evolution of risk. The health system suffers from inadequate infrastructure, a scarcity of resources, a lack of coordination and alignment of strategies among countries and international organizations, and disparities in access to health services [29]. Additionally, the interaction of social, cultural, political, and environmental factors contributes to unexpected events that transcend borders [19].

The complexity of variables presents in preparing for PHE requires a systemic view of the management domains to produce an adaptive approach to the context [26]. This is consistent with the concept of One Health, which emphasizes balancing the human-animal-environment interface through multisector, transdisciplinary collaboration and community engagement [2]. To manage vulnerability in a PHE, governments need to consider the concept of the Social Determinants of Health, which addresses economic, political, cultural, and environmental dimensions, as well as how a person is born, develops, and ages, among other factors such as income distribution, gender and racial inequality, the education system, and social protection [30].

Social determinants are related to the health system's resilience, which depends on learning from events caused by extreme and unpredictable changes, with ex-ante actions of preparation, scenario projection, and resource provisioning, and ex-post, post-event evaluations and identification of points for improvement [12]. Resilience as a process follows a cycle of crisis anticipation, response, and adaptation [31], as well as recovery in complex and turbulent situations [32]. A resilient health system integrates knowledge, anticipates uncertainty in unexpected events, analyses the dynamics of the systems influencing the health crises, and has legitimacy for the actions taken [33].

3. Materials and Methods

The study is an integrative review that use different research designs to produce a synthesis of available knowledge on a topic, depending on the sample size, with guiding questions that direct the analysis [34]. It follows the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), which supports the reviewer in transparently reporting the reason for the review, what was done and what was found [35]. The review is divided into stages: planning, defining the scope, searching the literature, assessing the evidence base, synthesizing, analysing, and writing up [36].

This requires a qualitative approach, allowing for the identification of challenges and gaps on the subject, as well as an exploratory approach because the complexity of the management conditionalities in the context of PHE are not yet fully understood, which is a challenge for the preparation of governments and society [37]. It has an Open Science Framework registration, https://doi.org/10.17605/OSF.IO/U6XFB (accessed on 05 November 2024). The strategy resulting from this validation process is described in the following sections.

3.1. Planning

Planning defined the scientific knowledge bases investigated in the research [36]. Web of Science, Scopus and Pubmed, were chosen because they are reputable,

multidisciplinary, worldwide scientific databases with broad indexing coverage of scientific publication data. Scopus includes 87 million curated documents [38], Web of Science covers beyond 87 million records [39] and Pubmed over 35 million citations [40].

3.2. Defining the scope

When defining the scope, guiding questions were formulated, as follows:

- Q1: What management conditionalities have the WHO provided to Member States in the recent decade to support decisions in dealing with PHE, as outlined in the IHR and other related documents?
- Q2: What are the countries' cooperation strategies for emergency management, defined in national strategies with the WHO, according to the guidelines presented by the Organization?
- Q3: What are the challenges to be overcome to increase WHO Member States' management capacities in facing PHE, considering the country strategies and the management conditionalities, through H-EDRM framework categories?

In this paper, management conditionalities address two dimensions. First, the causes of the problems described in the context of a PHE, such as the scarcity of resources and the deficiencies of health production complexes, as well as the WHO guidelines and Member States' strategies for achieving minimum capacities to deal with health crises (ex-ante). Second, the conditionalities produced after the health crisis, which influence a permanent cycle of reviewing preparedness-prevention-response-recovery processes (ex-post), as described in **Figure 2**. Therefore, health management conditionality is understood as an object of public policy, which promotes a systemic effect and a commitment of countries to global health.

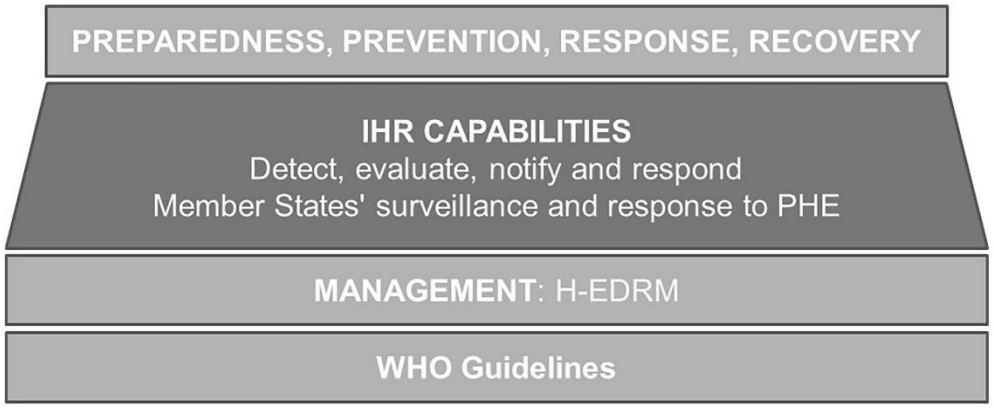


Figure 2. Management Conditionalities in PHE - Research Sources

The IHR strengthens countries' capacity to detect danger, assess risk, notify authorities, and promote quick responses. For this work, the H-EDRM presents components for health system preparedness, considering the management area's systemic approach and interaction with other WHO guidelines, to support governments during pandemics and inter-pandemics.

To this end, the study organized the conditionalities into the components of the H-EDRM [1] which guides the planning and decision-making of strategic-level public managers in PHE, such as ministries of health, local governments, and international organizations. The analysis included the following sources: (a) WHO guidelines, such as the IHR, the Pandemic Agreement and other documents; (b) Country Cooperation Strategies [41], to determine countries' perspectives on the guidelines established for dealing with

emergencies; and (c) articles from the WOS, Scopus and Pubmed knowledge bases, which deal with the relationship between PHE and management.

Given the importance of an integrated vision and the boundaries between the H-EDRM components in PHE, the WHO guideline, country strategy, conditionalities could be identified across multiple H-EDRM, not least due to the required interdisciplinary approach. In this way, after assessing the points of interest for the research and reaching a consensus in group meetings, the researchers localized the conditionalities in the H-EDRM of greatest intensity, without prejudice to bringing them together in the analysis and composition of the text.

3.3. Searching the literature

In the literature search, following the questions stated in the scope, a character string was employed to query the databases [36], titles published between 2014 and 2024, recent years of health emergencies, e.g. Zika (2014 - 2016), Wild Yellow Fever (2017) and COVID-19 (2020) [42].

Studies on decision-making in PHE show that bibliometric analysis has been increasing since 2014, which relates to the intensification of health events, with 73.27% of publications in the past 5 years and signs of growth in the future. According to the findings, there is little coordination between countries, institutions, and authors on decision-making in PHE, highlighting the need for interdisciplinary analysis of problems that affect management, particularly in countries with vulnerable populations [43].

The knowledge bases' Title, Abstract, and Keywords fields were searched, with a focus on PHE that determines the limits of government systems, as seen in the COVID-19 pandemic; the management area, which records various types of conditioning factors for PHE, as described by the H-EDRM [1]; and the IHR, the main instrument that guides WHO Member States in strengthening capacities for PHE, integrated with other guideline documents. Search strings: ("public health emergenc*") AND ("management") AND ("international health regulations").

3.4. Assessing the evidence base

In the evaluation stage, inclusion and exclusion criteria were defined to select the relevant documents for the research [36] in the knowledge bases and WHO websites: 14 files of WHO guidelines, 111 files of Member State strategies. In the knowledge bases there were 214 studies in WOS, Scopus and Pubmed and the selection resulted in the exclusion of 176 items after reading the Title, Abstract and Keywords fields, leaving 38 titles, which, added to the suppression of duplicates, produced a total of 28 studies. An additional 16 titles from other sources of interest were then included, bringing the total number of studies selected to 169, according to the following criteria.

Table 1. Inclusion (I) and exclusion (E) criteria

Database	Criteria: Inclusion (I); Exclusion (E)
(a) Guidelines files sourced from WHO websites.	I1: Main IHR and WHO Pandemic Agreement guidelines. I2: Updated guidance document on management topics. I3: Guidance document on specific population groups (e.g. vulnerable populations).
(b) Country Co-operation Strategy files sourced from WHO websites.	I1: Member State document with strategies for PHE. E1: Member State documents that do not mention a PHE strategy.
(c) Studies sourced from WOS, Scopus and Pubmed.	E1: Study that does not address the management of a PHE. I1: Management-related study with an emphasis on the IHR.
All studies	E1: Document published before 2014. E2: Study not written in English, due to the impossibility of evaluating titles in all languages, English being the predominant language in the knowledge bases searched.

Source: Own authorship

As illustrated in **Table 1**, the WHO database is the source for consulting management guidelines and strategies for each Member State, as shown by the final date of archive and study updates. Although the file updates have various dates, the research planning period (2014–2024) has been prioritized.

3.5. Synthesizing and Analysing

Figure 3 illustrates the systematic flow in the PRISMA model with the 169 selected records.

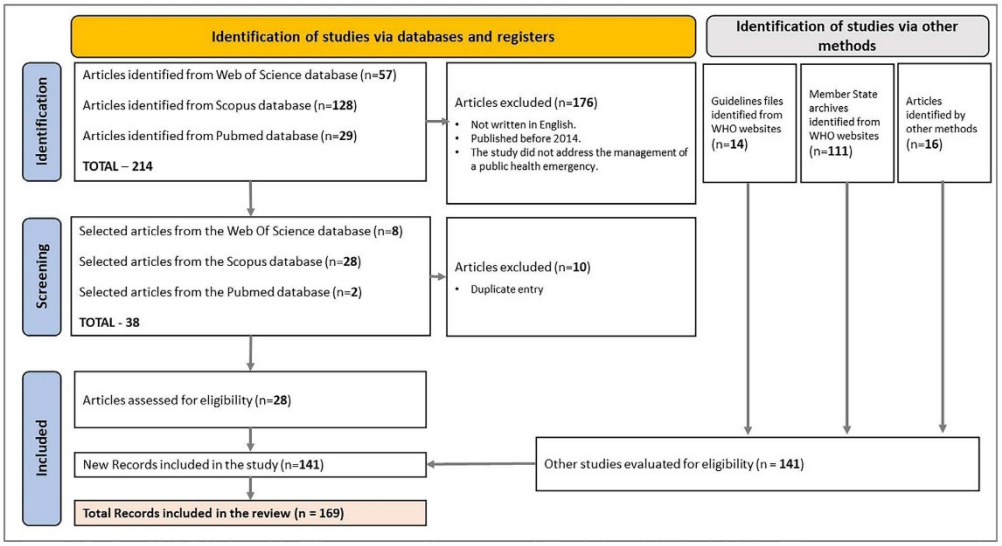


Figure 3 - Integrative Review Flowchart - Source: adapted from PRISMA [35].

PRISMA presents the studies and reports read and analysed, with the goal of understanding the linkages between the presented results, identifying trends, divergences, research opportunities, and answering the guiding questions. **Table 2** provides a summary of the identified studies in the knowledge bases and analysed by the researchers, related to the H-EDRM components.

Table 2. Studies identified in the integrative literature review. 316

Author	Publication Year	JCI	H-EDRM	Selected Studies-Title
[11]	2020	21.68	H-EDRM-I&KM	Health security capacities in the context of COVID-19 outbreak: an analysis of International Health Regulations annual report data from 182 countries
[44]	2021	21.68	H-EDRM-FR	Tracking development assistance for health and for COVID-19: a review of development assistance, government, out-of-pocket, and other private spending on health for 204 countries and territories, 1990-2050
[45]	2016	3.50	H-EDRM-RC	Risk communication as a core public health competence in infectious disease management: Development of the ECDC training curriculum and program
[46]	2022	2.4	H-EDRM-PSL	Good Law to Fight Bad Bugs: Legal Responses to Epidemics
[47]	2016	2.11	H-EDRM-PSL	Ebola, Zika and the International Health Regulations - implications for Port Health Preparedness
[48]	2021	2.11	H-EDRM-I&KM	Managing borders during public health emergencies of international concern: a proposed typology of cross-border health measures
[49]	2021	2.11	H-EDRM-I&KM	A survey of International Health Regulations National Focal Points experiences in carrying out their functions
[17]	2020	2.11	H-EDRM-PSL	Spatial and temporal distribution of infectious disease epidemics, disasters and other potential public health emergencies in the World Health Organization Africa region, 2016-2018
[50]	2023	2.11	H-EDRM-M&E	Assessing public health preparedness and response in the European Union- a review of regional simulation exercises and after-action reviews
[51]	2017	1.71	H-EDRM-P&C	CDC Support for Global Public Health Emergency Management
[52]	2017	1.71	H-EDRM-P&C	Contributions of the US centres for disease control and prevention in implementing the global health security agenda in 17 partner countries
[53]	2017	1.71	H-EDRM-P&C	US centres for disease control and prevention and its partners' contributions to global health security
[18]	2020	1.68	H-EDRM-P&C	Public health emergencies of international concern: A historical overview
[54]	2022	1.60	H-EDRM-P&C	Reconceptualizing successful pandemic preparedness and response: A feminist perspective
[29]	2017	1.21	H-EDRM-H&RS	Public health emergencies of international concern: global, regional, and local responses to risk
[55]	2019	1.10	H-EDRM-RC	Progress in public health risk communication in China: Lessons learned from SARS to H7N9
[56]	2017	1.05	H-EDRM-PSL	Pandemic legislation in the European Union: Fit for purpose? The need for a systematic comparison of national laws

Source: Own authorship. 317

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Table 2. Studies identified in the integrative literature review (continued).

Author	Publication Year	JCI	H-EDRM	Selected Studies-Title
[57]	2019	1.05	H-EDRM-CHC	Earlier detection of public health risks - Health policy lessons for better compliance with the International Health Regulations (IHR 2005): Insights from low-, mid- and high-income countries
[58]	2020	0.45	H-EDRM-PSL	International health regulations and covid-19 pandemic, challenges and gaps
[59]	2020	0.97	H-EDRM-RC	From guidance to practice: Promoting risk communication and community engagement for prevention and control of coronavirus disease (COVID-19) outbreak in China
[60]	2020	0.84	H-EDRM-PSL	Political Intrusions into the International Health Regulations Treaty and Its Impact on Management of Rapidly Emerging Zoonotic Pandemics: What History Tells Us
[12]	2022	0.72	H-EDRM-M&E	Success and challenges of health systems resilience-enhancing strategies for managing Public Health Emergencies of International Concerns (PHEIC): A systematic review protocol
[61]	2022	0.70	H-EDRM-M&E	Strengthening Biorisk Management Capacities in Burkina Faso: Contribution of the Global Health Security Agenda
[62]	2020	0.70	H-EDRM-HR	Challenges in Public Health Rapid Response Team Management
[63]	2020	0.66	H-EDRM-RC	Rethinking the COVID-19 pandemic: Back to public health
[19]	2020	0.64	H-EDRM-HI&L	Pandemics, regional outbreaks, and sudden-onset disasters
[64]	2022	0.17	H-EDRM-PSL	The World Health Organization and the challenge of sharing administrative powers
[10]	2014	NI	H-EDRM-PSL	Global health security agenda and the international health regulations: Moving forward

Source: Own authorship.

Table 3 shows the titles of the WHO guidelines on which the researchers based their analysis. They are titles that guide member states through the challenges of management, integrating regulations and agreements, analysis components, population profile, country strategies, surveillance system, emergency preparedness cycle and strengthening country capacities.

Table 3. WHO guidelines in the review.

Author	WHO Guidelines - Publication Year	Selected Studies-Title
[13]	2016	International Health Regulations - Third Edition (2005)
[1]	2019	Health Emergency and Disaster Risk Management Framework.
[65]	2019	Guidance Note on Health Disaster Risk Management with Indigenous Peoples.
[41]	2020	Country Cooperation Strategy Guide 2020.

Source: Own authorship.

Table 3. WHO guidelines in the review (continued).

Author	WHO Guidelines - Publication Year	Selected Studies-Title
[5]	2021	WHO presence in countries, territories and areas 2021 Report.
[3]	2020	Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027.
[2]	2023	Proposal for negotiating text of the WHO Pandemic Agreement
[66]	2023	Public health emergencies: preparedness and response.
[20]	2023	Strengthening health emergency prevention, preparedness, response and resilience.
[16]	2023	Report of the Review Committee regarding amendments to the International Health Regulations (2005).
[67]	2023	WHO benchmarks for strengthening health emergency capacities.
[22]	2022	Global genomic surveillance strategy for pathogens with pandemic and epidemic potential
[24]	2002	Environmental health in emergencies and disasters: a practical guide.
[27]	2021	Health Promotion Glossary of Terms 2021

Source: Own authorship.

Table 4 shows the Member States selected for analysis that were available for consultation in the country cooperation reports, which amount to 112 documents. Countries without this report or which are not WHO member states were not analysed, which is a limitation of our research. From these reports, the researchers were able to identify strategies in the countries' priorities for tackling PHE and analyse those related to management areas. Although the reports were organized by country, the analysis followed the categories of the H-EDRM components chosen to organise the work, as presented in Section 4.

Table 4. WHO Member States chosen for the study.

WHO Region	Member States
African	Algeria; Angola; Botswana; Burundi; Cape Verde; Cameroon; Central African Republic; Chad; Comoros; Congo; Côte D'Ivoire; Equatorial Guinea; Eritrea; Ethiopia; Gabon; Gambia; Ghana; Guinea; Guinea-Bissau; Kenya; Liberia; Madagascar; Mali; Mauritania; Mauritius; Mozambique; Namibia; Niger; Rwanda; Senegal; Seychelles; Sierra Leone; Togo; Uganda; United Republic of Tanzania; Zambia; Zimbabwe
Americas	Antigua and Barbuda; Barbados; Belize; Brazil; Colombia; Cuba; Dominica; Dominican Republic; Ecuador; Grenada; Guyana; Honduras; Mexico; Nicaragua; Paraguay; Saint Kitts and Nevis; Saint Lucia; Saint Vincent and the Grenadines; Suriname; Trinidad and Tobago
Eastern Mediterranean	Afghanistan; Bahrain; Egypt; Iran; Iraq; Jordan; Lebanon; Morocco; Oman; Pakistan; Qatar; Saudi Arabia; Sudan; Syrian Arab Republic; Tunisia; United Arab Emirates

Table 4. WHO Member States chosen for the study (continued).

WHO Region	Member States
European	Belgium; Israel; Switzerland
South-East Asia	Bangladesh; Bhutan; India; Indonesia; Maldives; Myanmar; Nepal; Republic of Korea; Sri Lanka; Thailand; Timor-Leste
Western Pacific	Australia; Cambodia; China; Cook Islands; Fiji; Kiribati; Lao People's Democratic Republic; Malaysia; Mariana Islands; Marshall Islands; Micronesia (Federated States of); Mongolia; New Caledonia; Niue; Palau; Papua New Guinea; Philippines; Samoa; Solomon Islands; Tonga; Tuvalu; Vanuatu; Viet Nam; Wallis and Futuna

Source: Own authorship.

4. Results and Discussion

The study produced 631 records of management conditionalities, organised by the H-EDRM categories, which are available for access in the Appendix at http://bit.ly/3UrR6gE. They are summarized in **Figure 4**, which shows the themes of points of attention for analysis. There are priorities of the Member States (CCS) for planning (H-EDRM-P&C), information (H-EDRM-I&KM) and infrastructure (H-EDRM-HI&L), while the WHO guidelines focus on infrastructure (H-EDRM-HI&L), policies (H-EDRM-PSL) and monitoring (H-EDRM-M&E). Although infrastructure is a critical point in countries' capacities, the study points to the challenge of filling the gaps between WHO guidelines and government strategies, which are often not achieved due to technical or even budgetary incapacity (H-EDRM-FR) in low- and middle-income countries. It could be a subject for future research.

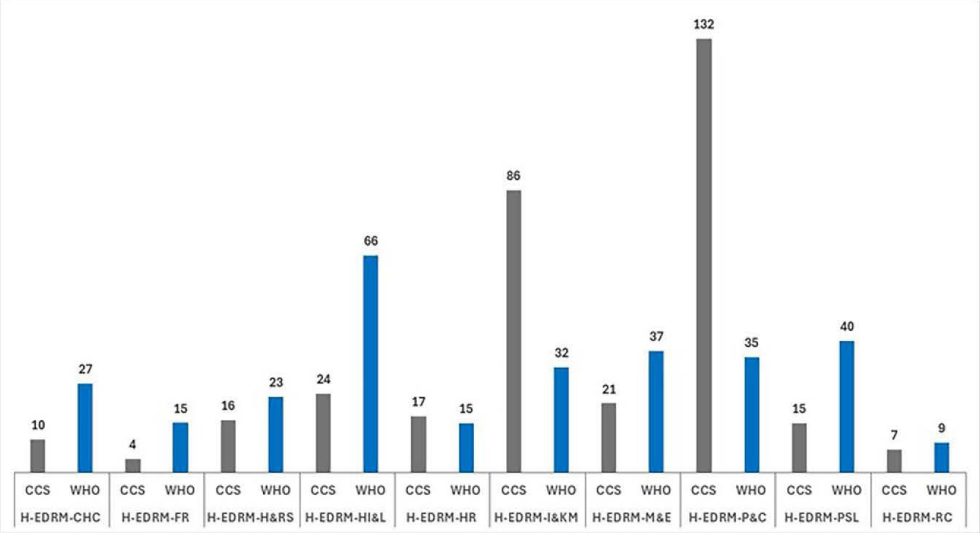


Figure 4. Graph Who Guidelines and Country Cooperation Strategy - by H-EDRM - Source: Own authorship.

The points of attention are analysed below, with the following designation:

- (W) WHO guidelines related to Question 1, on the management conditionalities for Member States to decisions in the PHE;
- (C) Member State Strategies, which according to Question 2;
- (W&C), representing common points.

Analysing W, C and W&C in the light of the literature allows us to identify challenges and gaps related to Question 3, which are presented by the H-EDRM, as shown below.

4.1. Policies, Strategies, and Legislation (H-EDRM-PSL)

Table 5 presents the policy, strategy, and legislation conditions that define rules and norms of conduct for PHE, which affect all aspects of management. It is necessary to assume that equity is a basic principle for global health at all stages of PHE, and that it is not enough to have it as a universally applicable principle [16], but to ensure, among other priorities, patient and workforce safety, with guidelines for specific segments, e.g. indigenous people, quilombos, riverine populations, and slum populations, as population strategies [68]. The policies' comprehensiveness and adaptability to different nations with varying income levels and health situations is notable [20].

Table 5 - Management - Policies, Strategies and Legislation - Conditionalities for PHE

• IHR (W&C) • Health equity (W) • Population characteristics (C) • Patient safety (W) • HR Security (W) • PHE in sectoral policies (W) • Social Determinants of Health (W&C) • Legislation for the RSI (W) • Quick policy update (W) • Technology transfer (W) • Administrative and financial legislation (W) • Public-private partnership (W) • Supply management and logistics (C) • Management models	• Cross-border agreement (W) • International humanitarian law (C) • Refugees and immigrants (C) • Head of State leads PHE (W) • National - global governance alignment (W) • Coordination of public safety and health authorities (W) • Post-PHE recovery (W) • Evidence-based prevention and management of PHE (C) • Disaster risk management (C)
W - World Health Organization | C - Country Strategy and Cooperation | W&C – Commonalities	

Source: Own authorship.

The WHO has a key role to play in achieving coordinated action in different realities and contexts [66], but it is expected to improve its performance in health surveillance, in a more effective coordination of the response phase, strengthening mechanisms for guidance about distribution of pharmacological and non-pharmacological measures, technologies and health supplies, and intermediation to achieve more sustainable international financial assistance to Member States [16].

The implementation of the IHR requires the status of political commitment from the authorities, effective adherence to the guidelines for achieving capacities by the Member States [16], [58], [60], with technical, managerial, and financial support from developed countries to low- and middle-income countries.

In the legislative dimension, there is a challenge between the sovereignty of a Member State to legislate and act in its context, and the need to comply with and implement a set of international rules. It characterizes the limits of understanding that the relationship between a country's request for help and the need to justify the inability to implement a reference recommendation, can occur due to limited resources and technical incapacity, when different types of support will be needed to structure the minimum capacities of a health system for PHE [16], [58].

The strategy for tackling PHE depends on integration with other policies and multisectoral practices [3], such as those dealing with risk management of all types, particularly those arising from the effects of climate change, wars, and diseases caused by zoonoses [69], [70], [71]. Context analysis recognizes the social, environmental, and economic determinants of health as structuring elements for control and prevention measures, exposing

a region's capacities and weaknesses [2] as they are indicators of the quality of life of populations that reinforce health resilience [72], [73].

The agility of actions in PHE relates to the capacity to implement regulations, practices, and management processes within a legal, administrative, and appropriate financial structure [2], as well as mechanisms for rapidly updating norms, standards, and policies [20]. A regulatory procedure is expected to incentive private sector support (public-private partnership) and the transfer of technology to manufacture inputs [3], and additional actions converging with legislative instruments to implement the IHR [67]. In this sense, Member States identify challenges in the adequacy of regulatory capacity that supports supply management and logistics activities in PHE, which require fast track to purchase in a context of global scarcities of products and services [74].

PHE transcends geographical, cultural, social, and economic boundaries, being a democratic health problem that reaches different realities, requiring managers to be careful with international agreements, such as health surveillance and immunization programs, as well as the sharing of strategic information on PHE in a context of cross-border actions [3]. In Member States facing war or armed conflict, management must comply with international humanitarian law in relation to attacks on health facilities [75] and immigrant and refugee policies [76].

The legal basis for managing a PHE encompasses the individual and the collective, the public and the private, as well as the organization of Member States and institutions, all of which are articulated to ensure optimal and cohesive activities while respecting authority. Individual rights apply to judgements on restricting travel, monitoring people, quarantine states, and the effectiveness of vaccination efforts. The government's decision requires proper legal foundations to improve rapid responses without jeopardizing resource utilization and accountability due to the employment of fragile procedures [46], [47].

The strengthening of the IHR over national legislation helps to overcome the challenge of bringing national governance structures closer together in the context of PHE, with the articulation of national plans, especially for countries in an economic bloc or region that share intergovernmental agreements, with the goal of balancing the protection of public health and the functioning of trade relations and international traffic, such as border control and the preservation of rights in PHE [56].

In this sense, global and national strategies challenge experts on centralized or decentralized management models, with expectations of a more democratic WHO role or an intrusive and centralizing role of power, coercive decision-making, and greater control, a discussion that runs into legal and compliance limitations in the jurisdictions. As a result, a more participatory approach is required because, while reference organizations' technical expertise is critical in dealing with PHE, centralized decision-making power can result in a lack of diversity of perspectives and fail to incorporate the social, political, economic, and cultural factors that influence an effective response. However, when dealing with urgency and uncertainty in PHE, time is a limiting factor for shared decisions, necessitating investments in communication between decision-makers, defining responsibilities and protocols, and implementing preparedness actions to strike a balance between acting quickly and ensuring the participation of all actors [64].

In the WHO's conditionalities that impact governance, the reinforcement of PHE response decisions at head of state level, the alignment of national strategies with global governance [3], and the articulation of health and public safety authorities during the emergency [67], were mentioned. Another focus is on developing strategies for the recovery of the health system and society after the pandemic, a large-scale management process that requires significant resources and long-term planning [2].

The countries' expectations point to the need to develop evidence-based policies, standards, and guidelines as elements to strengthen the prevention and management of communicable diseases [77] and disaster risk management [71], [78].

4.2. Planning and Coordination (H-EDRM-P&C)

The H-EDRM-P&C component develops global, national, and local action plans based on the policies, strategies, and regulations that lead PHE management efforts, as described in **Table 6**. The planning responds to the risk with a multisectoral approach and is based on an assessment of the critical capacities of a context [13], [20], [67], especially those of social and economic vulnerability [65] according to their strengths and weaknesses [69], [73], [75], [79], [80], [81], [82], [83], [84], [85], [86], [87], [88], [89], [90], and evidence-based One Health approach, linking human-animal-environment health [74], [76]. Gender inequality and other identity issues must be addressed, otherwise, inadequate services and communication difficulties would arise, jeopardizing emergency control efforts [54].

Table 6. Management - Planning and Coordination - Conditionalities for PHE

• Intersectoral - multisectoral action (W&C) • National critical capacity plan (W&C) • Health plan adapted to climate change (C). • Vulnerable population (W) • Planning evidence based and One Health (W&C) • Rapid risk assessment (W) • Risk of danger, emergency, and disaster (W) • Preparedness-prevention-response-recovery cycle (W&C) • Contingency plan at the point of entry (W&C) • Structured Health Surveillance System (W&C) • Early detection of potential disease (C)	• Health care and infrastructure components (W) • Emergency medical team (C) • PHE Operating Centre (W) • Knowledge sharing (W) • Trustworthy leadership (W) • Research, development, and innovation capacity (W) • Process quality (W) • Climate change and environmental risks (C) • Food safety (C) • Humanitarian assistance (C) • Cross-border co-operation (C) • Violence, gender, and age group (C)
W - World Health Organization | C - Country Strategy and Cooperation | W&C – Commonalities	

Source: Own authorship.

In other analyses, a PHE's response capacity is determined by the planning of health infrastructure and services to ensure equitable access to strategic health supplies such as vaccines, diagnostic kits, and medicines, resources that condition emergency preparedness [51], [52], [53].

The IHR, as a planning guide for Member States, is coordinated by specialist teams [20], [67], and meets the objectives of identify risk profiles and measuring emergency and disaster preparedness [67]. The preparedness-prevention-response-recovery cycle must therefore align with the capabilities established by the IHR [91], [92], [93] such as the establishment of focal points and strategic interaction with the WHO [74], [75], [76], [81], [83], [85], [87], [89], [90], [91], [93], [94], [95], [96], [97], [98], [99], [100], [101], [102], [103], [104], [105], [106], [107], [108], [109], [110], [111], [112], [113], [114], [115], [116], [117], [118], [119], [120], [121], [122], [123], [124], [125], [126], [127], [128], [129], [130], [131], [132], [133], [134], [135], [136], [137], [138].

The WHO conditionalities prioritize the planning of the health monitoring system, with the implementation of contact tracing, quarantine, and isolation measures in accordance with PHE severity, requiring diverse management methods for different categories of risk and affected populations [3]. The Member States' strategies focus on a health surveillance system capable of early detection of diseases that have the potential to constitute a PHE [74], [75], [76], [82], [96], [98], [103], [109], [111], [118], [136], [139], [140], [141], [142], [143], [144], [145].

Thus, bilateral, regional, and international cooperation can be applied to support national planning by transferring technical, scientific, legal, and technological information

across Member States to strengthen a broader and more integrated surveillance state [2]. Additionally, governments are focusing on long-term intersectoral disease prevention and control plans [119], [132], [146], [147], [148], [149], [150], [151], [152].

In PHE infrastructure planning, WHO [20], [67] and Member States prioritize the establishment of Public Health Emergency Operations Centres [136]. Furthermore, the availability of healthcare components and adequate infrastructure should be highlighted [3], also the contingency planning of ports and emergency medical professionals' capacity [136], to establish procedures in accordance with regional quarantine laws [76], [136].

Moreover, the WHO includes the capacity for research, development, and innovation of health solutions as planning objectives [67], as well as the definition of reliable leadership for PHE and quality assurance mechanisms and procedures [20]. The need for Member States to prioritize the ability to address climate change, environmental hazards, disasters, and health impacts has been identified [74], [94], [110], [113], [117], [122], [129], [136], [138], [153], [154], [155], [156], [157].

4.3. Information and Knowledge Management (H-EDRM-I&KM)

According to the conditionalities described in **Table 7**, information and knowledge are key components of the PHE decision-making process, and they rely on data-sharing protocols for network action [3], [20], which in turn systematically subsidizes health surveillance actions [67].

Table 7. Management - Information and Knowledge Management - Conditionalities for PHE.

• Networked data and information (W) • Systematization of health surveillance data (W) • Risk management in the national structure (C) • Patient flow (W) • Inventory of hazard risks in communities (W) • Culturally appropriate information - e.g. Indigenous people (W) • Vulnerability and capacity mapping (C) • Genomic surveillance of pathogens with potential for PHE (W) • Risk detection system (C) • Digital health and data science (W)	• Integrated health surveillance system (W&C) • Interoperability (W) • Analytical capacity and collaborative intelligence for decision-making (W) • Multi-sector understanding of vulnerabilities on an integrated platform (W&C) • Health surveillance in the One Health approach (C) • Innovation and research ecosystem (W&C) • Sharing lessons learnt (W) • Risk assessment, risk communication and reference laboratory (C) • Information for humanitarian action (C)
W - World Health Organization | C - Country Strategy and Cooperation | W&C – Commonalities	

Source: Own authorship.

Pathogen-orientated decision-making based on real-time data, rather than just diseases and historical data, is a point of attention that strengthens the role of the health surveillance system. The goal is to establish a more responsive strategy to PHE that is based on scientific knowledge and reduces disinformation. The challenge of interoperability and effectiveness of information and communication technology systems and practices is tailored to the limitations of each context [16]. The knowledge enables the management of catastrophe risks with an impact on health, based on the existing national data-sharing mechanisms and an effective assessment of the hazard affecting the health crisis [86], [92], [108], [112], [124].

An assessment of Member States' strategies for working in partnership with the WHO in the context of COVID-19 reports challenges in international co-operation and collaboration between national agencies, such as access to data and timely funding needed to deal with national lockdowns on the movement and shortages of goods and services [5]. Strategic-level leaders must deal with restrictions in intersectoral collaboration between countries including limited information systems, both of which are crucial for creating national goals [49].

Managers' analytical capacity, based on a multidisciplinary and multisectoral approach to context vulnerabilities and capacities, along with demographic, environmental, social, and economic aspects, provides collaborative intelligence in decision-making [3], [20]. Member States prioritize health surveillance as part of a One Health strategy [74], [90], [138], [145], [152], which is supported by data in health information platforms within the context of PHE [90], [133], [135], [158], [159], [160], [161], [162].

In this regard, digital health and data science platforms and technologies stand out [2], [13], [20], as do integrated preparedness and response systems [20], and genomic surveillance systems for pathogens with epidemic and pandemic potential [3]. The Member States call attention to disease surveillance in general [70], [76], [77], [78], [81], [88], [90], [95], [104], [112], [131], [133], [159], [160], [163], [164], [165] and systems for detecting and assessing the risk of outbreaks [88], [101], [108], [116], [124], [150], [166], [167], [168], [169], [170].

The integration of data, information, and knowledge contributes to the innovation and research ecosystem of accessible technologies, enabling the development of health solutions in the context of PHE [20]. This ecosystem can encourage technical collaboration to support research in priority areas [166], increase laboratory capacity for evidence-based disease surveillance [92], and develop technologies for predicting, detecting, and confirming a PHE [90], [138].

All knowledge generated in PHE provides the foundation for risk mitigation measures, such as patient flow management [3] for vulnerable populations or those to require special attention, e.g. Indigenous peoples [2], [65]. As a result, the management of context-specific data and information supports the mapping of weaknesses and strengthens the intersectoral capacity for risk management, as outlined in the Member States' strategies [86], [103], [114], [115], [120], [158], [163], [171].

In another analysis, the strategy for future preparedness evaluates lessons learnt, as recommended by the WHO [20], however, this knowledge lacks criteria for classifying lessons learnt in management. As an example, a study presents categories for researching border legislation, which allows comparison between jurisdictions. It is organized into movement of people, products, and animals; information control; health services; and infrastructure [48].

The integration of risk assessment and communication information, and reference laboratory networks, enables society to receive advice on crisis response measures, such as disease testing capacity of a region [90], [119], [138]. Another highlight is the exchange of information on humanitarian actions with partners, with the possibility of obtaining technical and financial assistance, implying the development of donation and accountability mechanisms for societal participation in a public-private partnership to tackle PHE [113].

4.4. Health Infrastructure and Logistics (H-EDRM-HI&L)

Table 8 presents the infrastructure and logistics conditionalities. A set of procedures dedicated to PHE, including a logistics system and supply chain, with transparency of costs and contractual terms, is necessary to preserve the integrity of the process and avoid holding the manager accountable for inconsistent management measures [2], [20], [67]. The use of dual-purpose manufacturing platforms is proposed as a means of diversifying the national industry's production line in response to an emergency health demand, such as the provision of mechanical ventilators for respiratory syndromes [20]. In other

analysis, vaccination programmes in PHE might require cold chain assistance, transport, vaccination centres, and dedicated human resources, depending on the vaccine technology [3]. This is especially important for indigenous groups, who require infrastructure and services that are culturally suited to their requirements [65].

Table 8. Management - Health Infrastructure and Logistics - Conditionalities for PHE.

• Transparency of the logistics and supply system (W&C) • Technical co-operation and logistical support (W) • Multilateral and regional purchasing mechanisms (W) • Long-term operational support for services (C) • Dual-purpose manufacturing platform (W) • Infrastructure of the national vaccination programme (W&C) • Culturally appropriate service - e.g. Indigenous people (W) • Access to safe blood (C) • Clean air, clean water, and safe food (C)	• Resilient health service in PHE (W) • Safe and quality environment in the health unit (W&C) • Health technology management (C) • Emergency medicine (C) • Infection control in hospitals and healthcare facilities (C) • Laboratory capacity (C) • Humanitarian aid for supplies and equipment (W) • Urban health conditions and rural-urban migration (C) • PHE and disaster management (C)
W - World Health Organization | C - Country Strategy and Cooperation | W&C – Commonalities	

Source: Own authorship.

Member States reinforce concerns regarding the supply chain, drugs, and key supplies, such as personal protection equipment and hospital products [75], [142]. Furthermore, adequate nutrition, clean air, and drinking water [74], [97], access to safe blood [130] , long-term logistical assistance [88], and extended immunization campaign for different regions and patient profiles [77], [97].

The WHO promotes for resilient critical services to ensure safe clinical care in PHE [20]. The challenge for Member States' strategies is to manage health technology [90], implement emergency medicine [93], and structure health programs to address climate change [137]. A resilient, safe, and quality environment in healthcare facilities [2], [3], [13], [20], [67] is linked to hazard mapping and vulnerability assessment [164], such as hospital infection control [122], [132], laboratory capacity for emerging pathogens and epidemic-prone diseases [77], [97], [133], and the strengthening of public health laboratory networks for communicable disease surveillance [104].

Technical collaboration and logistical support between countries, international and regional procurement procedures, and humanitarian relief with access to transportation, supplies, and equipment can all help optimize PHE infrastructure [2], [13]. Disaster management [126] and rescue management [97] were identified as infrastructure and logistical strategies in the Member States' analysis, as were urban health conditions and rural-urban migration, all of which have an impact on health services [137].

4.5. Human Resources (H-EDRM-HR)

Human resources are the main response component of a PHE, as described in **Table 9**. The conditionalities include the managing national response plans with a multidisciplinary and multisectoral team [13], health personnel trained in clinical management [90], specialized emergency medical staff [133], and organized rapid response team [62] whose participation, empowerment, safety, and well-being must be preserved [2]. It is necessary to establish dedicated teams for PHE [82], [89], [90], [102], [128], [162], [172] and to value the health of workers who face physical and mental pressures in the PHE [73].

Table 9. Management - Human Resources - Conditionalities for PHE.

• Multidisciplinary team in the PHE response plan (W&C) • Specialized emergency medical team (C) • Workers' Health - participation, empowerment (W&C) • Safety, and well-being of health professionals (W&C) • Mapping essential functions (W) • Human Resources retention strategy (W) • Personnel relocation protocol (W) • Volunteer engagement (W) • National IHR focal point established and active (W)	• Human Resources to implement the IHR (W) • Human Resources trained in epidemiological surveillance and data management (C) • Health professionals and community leaders working together - e.g. indigenous people (W) • Training government officials (C) • Stakeholder and timely humanitarian response (C) • Capacity of institutions to deal with climate change (C)
W - World Health Organization | C - Country Strategy and Cooperation | W&C – Commonalities	

Source: Own authorship.

In the context of labour shortages, the WHO guidelines call for the mapping of essential functions [2], [3], [20], workforce development and retention mechanisms [20], staff redeployment to priority sectors, and volunteer recruitment [3]. Furthermore, promote the training of IHR implementation staff, national IHR focal points [67], and professionals who interact with the parties involved and the WHO. For specific population groups, such as indigenous peoples, the WHO recommends preparing doctors, health professionals, and community leaders to collaborate in PHE [65].

Member States cite training government agents for decisions in complex PHE contexts as points of attention [97], [133], training health institutions to deal with climate change [141], and training health surveillance professionals in data management to strengthen monitoring and emergency responses [71], [119]. At the strategic level, it guides the development of stakeholder capacity for timely humanitarian responses [146].

4.6. Health and Related Services (H-EDRM-H&RS)

One of the priorities stated in **Table 10** is the continuity of essential health services before, during, and after a PHE [2], [20], [67], which includes the treatment of chronic infectious illnesses, HIV, and TB, as well as uninterrupted antibiotic supply [3]. Furthermore, broad vaccination coverage as part of the country's existing national programme aids emergency immunization efforts, which require a network, flow, and skilled workers [67]. These consist of challenges concerning to the complexities of varied demographic profiles and risk levels [108], as well as the decrease in morbidity and mortality [173]. The vulnerability of specific groups, such as refugees and natural disaster victims [174], requires adapted management, health services in accessible locations, and the engagement of community leaders [3], with the objective of establishing a legitimate healthcare system [127] that enhances citizens' comprehension of context-specific measures [33].

Table 10. Management - Health and Related Services - Conditionalities for PHE.

• Continuity of essential services (W&C) • Access to medical countermeasures (W) • Services in accessible locations (W) • Vaccination coverage (W) • Reduction of morbidities and mortalities (C) • Vulnerability of refugees (C)	• Disaster victims (C) • Resilient health system (C) • Testing for priority diseases (W) • Services at entry points (W) • Integrated laboratory diagnostic network (W&C) • One Health education plans (W&C)
W - World Health Organization | C - Country Strategy and Cooperation | W&C – Commonalities	

Source: Own authorship.

The WHO underlines the need of guaranteeing access to essential medical countermeasures [13] and the readiness of public and private diagnostic capacity [20], with a focus on national networks of public health laboratories that support government plans [153]. The availability of laboratory tests for disease detection is a priority [67], with rapid diagnosis and appropriate medical services at points of entry, e.g. port health capacities [13], to strengthen the health surveillance system and outbreak management [137]. It is strategic to establish an integrated approach to environmental surveillance [75], [76] and epidemiological [68] with a laboratory network for the identification of pathogens [20], adding international partners [20]. Special attention to benefit sharing, with fair, timely and equitable access to products and technologies developed from access to pathogen samples [16].

The guidelines for workforce preparedness and training services for emergencies and disasters [153] indicate the need for permanent One Health education plans to broaden the understanding of professionals and society about the magnitude of the complexity variables of a PHE [2], [3], [13], [20], [67].

4.7. Risk Communication (H-EDRM-RC)

Risk communication, as a Member State competence in IHR capacities, contributes to a comprehensive understanding of health risk. It is a public health strategy based on accurate information, scientific evidence, and secure communication structures, promoting trust between health authorities and society [45]. **Table 11** shows the points of attention in this regard.

Table 11. Management - Risk Communication - Conditionalities for PHE.

• National communication plan (W&C) • Risk communication system (W) • Community engagement (W&C) • Multichannel, timely and evidence-based communication (W&C)	• Disinformation (W&C) • Communication with the WHO (W)
W - World Health Organization | C - Country Strategy and Cooperation | W&C – Commonalities	

Source: Own authorship.

A risk communication system with transparency and community engagement, associated with health surveillance, risk assessment, and corrective measures, subsidizes information and communication plans throughout PHE [3], [67], in a multichannel dialogue based on evidence [20] to overcome disinformation [2], [3], [67] and the dissemination of rumours [59], a phenomenon that has marked the social dynamics of coping with the COVID-19 pandemic.

In communication management, it is difficult to orient the people during a pandemic, often due to a lack of understanding of what public health means. In this sense, the PHE strategy focuses on strengthening advocacy for risk communication in society [137] and health literacy, as primary strategies for prevention and broadening understanding of

topics such as the importance of vaccines, isolation measures, hygiene habits, and healthy living in interpandemic times [63].

Cultural and linguistic obstacles, a lack of access to technology, and safe mass communication systems all pose challenges to PHE [55]. WHO health information programs must provide evidence-based multisectoral data that is tailored to the population and context to facilitate timely communication [20], [65], [67]. Another study found that depending on the type of country's governance model, communication measures unified by government systems in an authoritarian and centralized manner can benefit risk communication techniques [59]. This is a critical aspect that could be further investigated in future research.

Member States' policies focus on controlling public communication [173], the effectiveness of communication between actors, and community engagement as part of a comprehensive communication plan against the infodemic in pandemic circumstances [90]. This effectiveness extends to hospitals, laboratories, and health service networks, which are areas of direct response to society and the front lines in tackling PHE. Another topic is the communication with the WHO regarding the evolution of risks that have the potential to cause PHE [13], which includes early alerts regarding the severity of the situation based on risk management of various types [88].

4.8. Community Health Capacity (H-EDRM-CHC)

Concerns have been raised about how the population will deal with the evolution of a PHE in its contexts and profiles, both urban and rural, particularly in the most vulnerable regions, in terms of raising awareness of an imminent risk, and community engagement mechanisms [1]. The structuring of local health services integrated into primary health care in following a community-orientated guideline, stands out [20]. **Table 12** describes, among others, the emphasis on inclusive management [2], [20], [67] (WHO 2023e, 2023a, 2023c), community involvement in the planning of essential public health services and the social determinants of health [3], [175].

Table 12. Management - Community Health Capacity - Conditionalities for PHE.

• Community-level public health network (W&C) • Community-oriented preparedness (W&C) • Assessing the profile, vulnerabilities, and capacities (W&C) • Inclusive management and community engagement (W) • Public health planning and the social determinants of health (W&C) • Quality of care, associated with community experience (C)	• Risk education in communities - e.g. Indigenous (W) • Community risk management, prioritising key areas (W&C) • Social protection policy (W) • Security in affected communities (physical integrity) (W) • Purchase of essential goods and services (W) • Primary health care (W) • Promoting healthy living in communities (C)
W - World Health Organization | C - Country Strategy and Cooperation | W&C – Commonalities	

Source: Own authorship.

Early detection of a potential public health risk can be achieved by ensuring community readiness through establishing regular information and communication channels, training of point to interact with community networks and health surveillance bodies. This will facilitate the assessment of the event and prompt notification to the WHO in case of a potential public health risk [57].

Integrating community experience with scientific knowledge to generate evidence on the quality of care in PHE [135], such as risk reduction educational sessions in Indigenous

communities and the building trust with community leaders [65], are community-specific strategies [175]. To that aim, WHO focus on activities to develop a multisectoral workforce [20], [67], the establishment of a community-level public health network [145], and building local capacity to implement emergency contingency plans [176].

Managing the evolution of PHE risk in the community [20] demands an all-hazards approach [123] and national disaster management capabilities in a specific setting [109]. When developing risk response strategies, it is crucial to consider the most important health demands, ensuring access to sufficient food, and maintaining the economic stability of households [176]. In addition, social protection policies aim to tackle the social, economic, and health consequences by ensuring the safety and well-being of citizens, as well as providing essential goods and services [20].

4.9. Financial Resources (H-EDRM-FR)

The Member State's financial capacity to invest in preparedness actions addresses the need for additional resources for the PHE, which prioritizes emergency and disaster management programmes, defines contingency funds with societal participation, and mobilizes resources before, during, and after the health event [1]. **Table 13** highlights the partnership mechanisms with potential funders [164], and other points of attention.

Table 13. Management - Financial Resources - Conditionalities for PHE.

• Sustainable funding for timely response (W&C) • Resources dedicated to implementing the IHR (W) • Timely mobilization of capacity to increase resources (W) • Partnership with potential donors (C)	• Flexible rules for the use of resources and financial prudence (W&C) • Investment in research (W) • Investment in production parks, laboratory networks and services (W)
W - World Health Organization ǀ C - Country Strategy and Cooperation ǀ W&C – Commonalities	

Source: Own authorship.

The guidelines emphasize the establishment of sustainable funding for adequate response based on equity [2], [13], [67], according to the national preparation plan [174], with timely resource mobilization [2], [3]. Prioritizing permanent services over those required for PHE is critical, as is promoting transparency in the secure application of investments [44].

Within the framework of the IHR, specific resources are required for its implementation [67] such as the contingency plan for assessing risks and Member State capacities [20]. It is a common strategy between the WHO and Member States to adopt flexible rules for implementing PHE spending while maintaining financial prudence [2], e.g. disasters context, which require agility in the definition and application of resources [74].

In this sense, the WHO emphasizes the importance of structuring the capacities of the country's health industrial complex, prioritizing investments in research and development, improving the quality of health services [2], [20] and investing in production park facilities, laboratory networks and service units, to strengthen national sovereignty during the period of resource scarcity in PHE [2], [3].

According to WHO and World Bank estimates, emergency preparedness requires around $30 billion in investments per year, and innovative funding structures for attempt the challenges of rapidly allocating resources necessitate. To this purpose, the WHO established a Pandemic Fund in 2022 to strengthen Member States for prevention, preparedness, response, and recovery capacities in low- and middle-income countries [20].

4.10. Monitoring and Evaluation (H-EDRM-M&A)

The H-EDRM-M&A component monitors and assesses policies, human, financial, and infrastructural resources, and services in a multisectoral approach, using indicators and goals to support strategic positioning in the detection and control of health risks [1].

Looking at the points in **Table 14**, H-EDRM-M&A provides early warning and scientific evidence to verify the effectiveness of the measures adopted [2], [3], [13], [20], [67], to evaluate the surveillance system itself [105], and to review the health system's capacities regularly, in accordance with IHR guidelines [20]. Monitoring must strengthen the link between Member State focal points and WHO contact points for the IHR [13].

Table 14. Management - Monitoring and Evaluation - Conditionalities for PHE.

• Health surveillance system (W&C) • Periodic review of health system capacities (W) • Inclusive and transparent monitoring and evaluation system (W) • Accountability matrix (W) • Rapid risk assessment to declare the start of PHE (W) • Culturally appropriate early warning system - e.g. indigenous people (W) • Sanitary safety capacity (C)	• Simulation exercises (C) • Integration of Member State focal point and WHO (W) • RSI capacity assessment (C) • Operations Centre active in pandemic and inter-pandemic cycles (W) • Control of infectious, endemic, and occupational diseases - e.g. HIV/AIDS, tuberculosis, and hepatitis (C) • Monitoring new or evolving outbreaks (C)
W - World Health Organization | C - Country Strategy and Cooperation | W&C – Commonalities	

Source: Own authorship.

The WHO guidelines emphasize an inclusive and transparent monitoring and evaluation system [2], [20], an accountability matrix [13], rapid risk assessment [20], [100], [144], [147], and the generation of culturally and linguistically appropriate early warnings [65]. The challenge for Member States' strategies is to assess health security capability throughout the preparedness-prevention-response-recovery cycle, improve prevention and control mechanisms, and share information [76], [88], [126], [144], [145], [152], [177], [178]. Another analysis emphasizes the importance of monitoring the control of infectious, endemic, and occupational diseases such as HIV/AIDS, TB, and hepatitis in context, as well as risk factors for new outbreaks [117], [145]. The WHO complements the guidelines by recommending the establishment of operations centres during pandemic and inter-pandemic cycles as a constant state of alert for monitoring future PHE [2].

When assessing the laboratory capacity, it is recommended that the Member State establish national legislation on biosafety to strengthen pathogen prevention practices, as well as staff training and the adoption of a system to monitor the effectiveness of processes, including facilities, workflows, waste treatment, documentation management and risk management protocols [61].

There are a few tools available to measure Member States' capacity to cope with PHE, such as the International Health Regulations (2005) Monitoring and Evaluation framework [179] . The model includes the IHR States Parties Self-Assessment Annual Report for indicators, the After-Action Review for post-event qualitative evaluation, and the Simulation Exercise for validation of the preparedness system. To promote PHE readiness, the Member States have implemented the Joint External Evaluation, a process that conducts a rigorous assessment of weaknesses in the human and animal health systems. [82], [105], [119], [149].

Despite its importance, the evaluation tool faces challenges in analysing the health situation due to the complexity of the country's preparedness and response system, such as non-standardized indicators and a lack of data systems, as well as insufficient resources

to make the necessary changes. In this case, it is prudent to increase the players' responsibilities, data production flows, and standards on interoperable platforms [50].

In this sense, the study recorded a larger set of conditioning factors for defining policies and strategies, which makes it possible to propose general guidelines for governments when dealing with emergencies:

- In the management of all types of health risks, strengthen sectoral management strategies based on population characteristics, with consideration for social and environmental determinants of health, prioritizing patient, and health professional care, and employing evidence-based clinical management that is both appropriate and culturally adapted.
- In national-global governance, establish a legal framework that converges with the agility of emergency management in line with the International Health Regulations, and strengthen the mechanisms for importing strategic inputs, technology transfer for product development and integrated action for border protocols, especially international humanitarian law in regions of armed conflict.
- Establish a perpetual planning cycle that includes the stages of preparedness, prevention, response, and recovery, with the goal of rapidly identifying potential hazards. This objective can be accomplished by utilizing an interdisciplinary framework that focuses on the One Health approach, particularly in devising strategies tailored to climate-related issues, zoonotic illnesses, and situations marked by extreme violence and conflict.
- Implement a knowledge-generating centre in management for PHE with a database for risk analysis, context monitoring, and prospecting exercises, equipped with an intelligence service to facilitate decision-making during pandemic and inter-pandemic situations, in accordance with national vulnerabilities and capacities to be studied by innovation ecosystems, by national research, or that which emerges from international collaborations.
- Qualify the management practices with optimized human and financial resources, technologies, and processes for a timely and transparent response, with the participation of society and the leadership of the emergency at head of state level, with the aim of strengthening the health system, in particular logistics and the strategic supply chain, hospital, and laboratory services, among other critical management points in a health crisis.
- Plan the allocation of resources that guarantees equitable access to countermeasures and medical services, including diagnostic tests and vaccinations, for all segments of the population, preserving the conditions of economic and social vulnerability, gender, race, and accessibility, guaranteeing social participation, without compromising the maintenance of essential services.
- Implement a communication policy to improve society's understanding of health, before, during and after emergencies, as a strategy to engage the population in adopting the measures implemented, with evidence-based communication to avoid misinformation and favour risk mitigation.
- Develop a sustainable financing strategy for dealing with the emergency, supported by resources available from governments and from humanitarian action, dedicated to strengthening the capacities prioritize by the IHR, supported by adequate legislation for a timely response that preserves financial prudence.

5. Conclusions

In conclusion, the management conditions for tackling a PHE, whether from the perspective of the WHO guidelines or the strategies adopted by countries, depend on the starting conditions of the context, the dynamics of the systems involved and the interaction of actors working in different dimensions of the emergency. It is a challenge that connects the dynamics of the global production system for health goods and services with local production strategies.

The goal of equity must be at the centre of a systemic, adaptive and multi-variable approach that projects the alertness of management, at a level that distances itself from a merely instrumental and mechanistic bias, ignorant of the reality of the social and economic context, and which compromises the intention of strategic guidance instruments.

The International Health Regulations, as a non-coercive guidance instrument, need to be improved, with the expectation that the WHO's role will advance provision strategies to strengthen the national capacity of the member state, which experiences technical, budgetary and health policy gaps in the preparedness plan, often unprepared for a complex context marked by uncertainties that impact management before, during and after the emergency.

A holistic view of health management conditionalities in PHE is shaped differently in the preparedness of high-, middle- and low-income countries, but it affects everyone. In this sense, the effectiveness of more centralized or decentralized models of government, with greater or lesser economic power, is a subject for future research, considering the minimum capacities for responding to PHE. Future research could also include studies on interoperable databases to support government decisions and strengthen coordinated actions, as well as the definition of analytical frameworks that integrate data on health determinants, vulnerabilities, and the capacities of health systems to tackle PHE.

Supplementary Materials: The following supporting information can be downloaded at: http://bit.ly/3UrR6gE (accessed on 05 November 2024)

Author contributions: Conceptualization, A.S.P., I.W. and C.V.F.; methodology, I.W. and C.V.F.; validation, A.S.P., I.W. and C.V.F.; formal analysis, A.S.P and C.V.F.; investigation, A.S.P., I.W. and C.V.F.; resources, I.W. and C.V.F.; data curation, A.S.P., I.W. and C.V.F.; writing—original draft preparation, A.S.P.; writing—review and editing, I.W. and C.V.F.; visualization, C.V.F.; supervision, I.W. and C.V.F.; project administration, I.W. and C.V.F.; funding acquisition, I.W. and C.V.F. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study is fully available in the Supplementary Materials. The file is available at http://bit.ly/3UrR6gE (accessed on 05 November 2024).

Acknowledgments: The authors are thankful for the financial support from National Council for Scientific and Technological Development (CNPq); IW is a CNPq technological development fellow (Proc.308783/2020-4). We acknowledge all insights and comments received from the colleagues from Oswaldo Cruz Foundation. Special thanks to Fiocruz for supporting the training of leaders for Brazil's public health system and for global health.

Conflicts of Interest: The authors declare no conflict of interest.

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APPENDIX 1 - STRATEGIC DECISIONS IN PUBLIC HEALTH EMERGENCIES: MANAGEMENT CONDITIONALITY BASED ON WHO GUIDELINES.

All WHO records studied (source - Author | April 2024)

1 - H-EDRM-CHC - COMMUNITY HEALTH CAPACITY

1. **Strengthen the community-level public health network, fulfil the public health responsibilities of medical institutions and innovate the medical and prevention synergy mechanism. |** H-EDRM-CHC | Western Pacific Region | China | Year_Deadline: 2026 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
2. **Promote health and identify, prevent and reduce risk factors, and strengthen community action through promotion of healthy lifestyles and behaviours. |** H-EDRM-CHC | African Region | Congo | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
3. **Support health needs of affected populations and adapt the response, and to ensure the coordination of actions between the Ministry of Health and the different departments involved in crisis management |** H-EDRM-CHC | African Region | Equatorial Guinea | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
4. **Strengthen local capacities to implement the contingency plan for epidemic preparedness and response. |** H-EDRM-CHC | African Region | Equatorial Guinea | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
5. **Support the development of national capacities for disaster risk management, including the effective management of health related aspects of humanitarian disasters. |** H-EDRM-CHC | African Region | Kenya | Year_Deadline: 2019 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
6. **Support the national and sub-national level capacity building process on emergency preparedness by considering that the community will be first responders and implementation of the emergency response framework. |** H-EDRM-CHC | South-East Asia Region | Maldives | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
7. **Risk and vulnerable populations |** H-EDRM-CHC | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496
8. **Multisectoral mechanisms to effectively engage communities and civil society in decision-making. |** H-EDRM-CHC | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf
9. **Channels for listening and developing and delivering strategies and activities. |** H-EDRM-CHC | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2
10. **Systematic sharing of data and feedback with communities. |** H-EDRM-CHC | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2
11. **Effective risk communication and community involvement - reliable, evidence-based multi-channel communication. |** H-EDRM-CHC | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

12. **Community health emergency risk management, including vulnerability and capacity mapping. |** H-EDRM-CHC | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2
13. **Community-orientated detection, alert, surveillance and response and essential community health services, integrated into primary health care. |** H-EDRM-CHC | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2
14. **¶Structured community health workforce and its connections with local leaders. |** H-EDRM-CHC | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2
15. **¶Research agenda defined with the participation of the community. |** H-EDRM-CHC | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2
16. **¶Integration of best practices in community involvement in governance, coordination and partnership with relevant sectors. |** H-EDRM-CHC | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2
17. **¶Multi-sector business continuity plans for possible negative health, economic and social consequences of response measures. |** H-EDRM-CHC | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2
18. **¶Maintaining intersectoral coordination and decision-making mechanisms. |** H-EDRM-CHC | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2
19. **¶Vector control and monitoring of sanitation, water and hygiene conditions in communities. |** H-EDRM-CHC | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2
20. **¶Risk prevention system for the community, with an evidence-based approach to social and public health measures. |** H-EDRM-CHC | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2
21. **¶Inclusive mechanism for distributing, planning and coordinating vaccines. |** H-EDRM-CHC | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2
22. **¶Social protection policies to deal with social, economic and health impacts, based on regular risk and vulnerability assessments. |** H-EDRM-CHC | not applicable | not applicable | Year_Deadline: 2023 | WHO -

Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

23. **¶Goods and services for well-being and social protection, including systems for the acquisition, pre-response and supply of essential goods and services to communities. |** H-EDRM-CHC | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2
24. **¶Physical and digital infrastructure to guarantee business continuity and livelihoods. |** H-EDRM-CHC | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2
25. **¶Legislation and social standards to encourage formal employment and reduce precariousness in contexts of vulnerability. |** H-EDRM-CHC | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2
26. **¶Funds to support affected and at-risk communities. |** H-EDRM-CHC | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2
27. **¶Policies and services to provide social support based on education and food security for children. |** H-EDRM-CHC | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2
28. **¶Community health services and mental health. |** H-EDRM-CHC | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2
29. **¶Safety and security of staff and protection of staff and affected communities, including protection from sexual exploitation, abuse and harassment. |** H-EDRM-CHC | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2
30. **¶Systems and structures to involve communities in planning, decision-making and implementation, especially in the management of essential public health functions and social determinants of health |** H-EDRM-CHC | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959
31. **¶Participatory educational sessions on risk reduction in schools and with community groups. |** H-EDRM-CHC | not applicable | not applicable | Year_Deadline: 2019 | PAHO - Guidance Note on Health Disaster Risk Management with Indigenous Peoples. Accessed: 13 April 2024. https://iris.paho.org/handle/10665.2/51383
32. **¶Relationships of trust with key community leaders and decision-makers prior to interventions. |** H-EDRM-CHC | not applicable | not applicable | Year_Deadline: 2019 | PAHO - Guidance Note on Health Disaster Risk Management with Indigenous Peoples. Accessed: 13 April 2024. https://iris.paho.org/handle/10665.2/51383
33. **¶Community task force with roles and responsibilities assigned according to cultural traditions and perspectives. |** H-EDRM-CHC | not applicable | not applicable | Year_Deadline: 2019 | PAHO - Guidance Note on

Health Disaster Risk Management with Indigenous Peoples. Accessed: 13 April 2024. https://iris.paho.org/handle/10665.2/51383

34. **¶Profile the health situation of individuals and communities, linking people's health needs to the health system. |** H-EDRM-CHC | Western Pacific Region | Palau | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
35. **¶Develop capacities of communities on health planning to ensure health needs and challenges are reflected in national policies strategies and plans. |** H-EDRM-CHC | Western Pacific Region | Palau | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
36. **¶Make linkages between community experience/knowledge/evidence generation on quality of care from frontline workers and central level policy units. |** H-EDRM-CHC | South-East Asia Region | Sri Lanka | Year_Deadline: 2023 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
37. **¶Implement an all-hazards approach across all sectors and communities, to address hazards such as natural and human-caused disasters, vector and food-borne diseases, climate change and antimicrobial resistance. |** H-EDRM-CHC | Region of the Americas | Trinidad and Tobago | Year_Deadline: 2021 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

2 - H-EDRM-FR - FINANCIAL RESOURCES COMPONENT

38. **¶Promote advocacy for mobilization of the resources needed to implement the national plan on preparedness for and response to emergencies, epidemics and disasters. |** H-EDRM-FR | African Region | Guinea | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
39. **¶Strengthen national emergency programs supported by a well-resourced and efficient WHO Health Emergencies Program. |** H-EDRM-FR | Eastern Mediterranean Region | Jordan | Year_Deadline: 2019 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
40. **¶Mobilisation of financial resources for the implementation of IHR obligations. |** H-EDRM-FR | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496
41. **¶Financing mechanism for equity in health emergency preparedness and response. |** H-EDRM-FR | not applicable | not applicable | Year_Deadline: 2023 | WHO - Report of the Review Committee regarding amendments to the International Health Regulations (2005). Accessed: 27 January 2024. https://apps.who.int/gb/wgihr/pdf_files/wgihr2/A_WGIHR2_5-en.pdf
42. **¶Sustainable financing. |** H-EDRM-FR | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496
43. **¶Financial and technical support for developing countries. |** H-EDRM-FR | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf
44. **¶Investment in research and development of public health priorities. |** H-EDRM-FR | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf
45. **¶Public and private sector investment in facilities in production parks. |** H-EDRM-FR | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf
46. **¶Timely and scalable mobilisation of the capacity to increase financial resources: collaboration between the health, financial and private sectors, and domestic financing. |** H-EDRM-FR | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf
47. **¶Sustainable bilateral and multilateral financing mechanisms. |** H-EDRM-FR | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf
48. **¶Financial resources for international co-operation and assistance, based on the principle of solidarity, |** H-EDRM-FR | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf
49. **¶Donations from philanthropic organisations and foundations and other voluntary monetary contributions. |** H-EDRM-FR | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf
50. **¶Global and regional R&D funding mechanism to finance rapid R&D efforts when an outbreak is declared. |** H-EDRM-FR | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2
51. **¶Mapping of existing financial resources and identification of additional sources for prioritised actions and identification of gaps. |** H-EDRM-FR | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

52. **¶Public funding mechanism and systems for mobilising resources from the private sector and partner agencies. |** H-EDRM-FR | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959
53. **¶Flexible decision-making and spending rules to meet the financial demands of the emergency response while maintaining financial prudence. |** H-EDRM-FR | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959
54. **¶Adequate funding and mobilisation of resources to build and modernise laboratory networks for emergencies. |** H-EDRM-FR | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959
55. **¶Strengthen partnership and harmonization with interested and potential partners and donors. |** H-EDRM-FR | Eastern Mediterranean Region | Pakistan | Year_Deadline: 2017 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
56. **¶Ensure protection from catastrophic health expenditures. |** H-EDRM-FR | Western Pacific Region | Philippines | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

3 - H-EDRM-H&RS - HEALTH AND RELATED SERVICES

57. **¶Maintain highly sensitive acute flaccid paralysis (AFP) surveillance to detect all cases and conduct environmental surveillance to ensure that no wild poliovirus cases go un-detected. |** H-EDRM-H&RS | Eastern Mediterranean Region | Afghanistan | Year_Deadline: 2019 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
58. **¶Provide technical assistance to strengthen epidemiological surveillance of STIs and HIV/AIDS. |** H-EDRM-H&RS | African Region | Algeria | Year_Deadline: 2019 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
59. **¶Strengthen diagnosis, surveillance, outbreak management and advocacy of AMR, zoonotic, dengue and other vector- borne diseases, food safety including bio-safety and bio-security systems. |** H-EDRM-H&RS | South-East Asia Region | Bhutan | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
60. **¶Manage crises and risks associated with emergencies and disasters, through strengthening national capacities for emergency preparedness; assistance for response plans in the health sector and improvement in hospital safety. |** H-EDRM-H&RS | African Region | Central African Republic | Year_Deadline: 2017 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
61. **¶Strengthen health actions in response to complex emergencies and natural disasters in order to reduce preventable morbidity and mortality. |** H-EDRM-H&RS | Region of the Americas | Colombia | Year_Deadline: 2014 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
62. **¶Prevent and mitigate the effects of disasters with the health institution. |** H-EDRM-H&RS | Region of the Americas | Cuba | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
63. **¶Contribute to the evaluation of health institutions considering the concept of safe institutions. |** H-EDRM-H&RS | Region of the Americas | Cuba | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
64. **¶Prepare capacity-building for emergencies and disasters in the health sector |** H-EDRM-H&RS | Region of the Americas | Dominican Republic | Year_Deadline: 2017 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
65. **¶Strengthen national epidemiological surveillance system, which includes the national network of public health laboratories, for the purposes of detection, intervention and protection of public health. |** H-EDRM-H&RS | Region of the Americas | Dominican Republic | Year_Deadline: 2017 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
66. **¶Strengthen the capacity of the health sector to create a resilient health system to reduce the effects of emergencies, disasters and public health events. |** H-EDRM-H&RS | Region of the Americas | Ecuador | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
67. **¶Reduce vulnerability of refugees, displaced persons, and host populations affected by epidemics, emergencies, crises and conflicts and the victims of natural disasters. |** H-EDRM-H&RS | African Region | Guinea | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
68. **¶Strengthen human and institutional capacity to address climate change, disaster preparedness and response. |** H-EDRM-H&RS | Region of the Americas | Guyana | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
69. **¶Promote access of populations affected by health emergencies to essential life-saving health services and public health interventions. |** H-EDRM-H&RS | Eastern Mediterranean Region | Jordan | Year_Deadline: 2019 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
70. **¶Enhance infection prevention and control; Anti-microbial resistance (AMR); Influenza surveillance. |** H-EDRM-H&RS | Eastern Mediterranean Region | Lebanon | Year_Deadline: 2023 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

71. **¶Support continuous capacity-building for health personnel on clinical management for priority diseases, required for handling public health emergencies of international concern. |** H-EDRM-H&RS | South-East Asia Region | Nepal | Year_Deadline: 2027 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
72. **¶Case management capacity for IHR relevant hazards. |** H-EDRM-H&RS | not applicable | not applicable | Year_Deadline: 2021 | WHO - International Health Regulations (2005): State Party Self-assessment annual reporting tool, second edition. Accessed: 14 April 2024. https://iris.who.int/rest/bitstreams/1400382/retrieve
73. **¶Capacity for Infection Prevention and Control and chemical and radiation decontamination. |** H-EDRM-H&RS | not applicable | not applicable | Year_Deadline: 2021 | WHO - International Health Regulations (2005): State Party Self-assessment annual reporting tool, second edition. Accessed: 14 April 2024. https://iris.who.int/rest/bitstreams/1400382/retrieve
74. **¶Access to essential health services. |** H-EDRM-H&RS | not applicable | not applicable | Year_Deadline: 2021 | WHO - International Health Regulations (2005): State Party Self-assessment annual reporting tool, second edition. Accessed: 14 April 2024. https://iris.who.int/rest/bitstreams/1400382/retrieve
75. **¶Core capacity requirements at all times for designated airports, ports and ground crossings. |** H-EDRM-H&RS | not applicable | not applicable | Year_Deadline: 2021 | WHO - International Health Regulations (2005): State Party Self-assessment annual reporting tool, second edition. Accessed: 14 April 2024. https://iris.who.int/rest/bitstreams/1400382/retrieve
76. **¶Effective public health response at points of entry. |** H-EDRM-H&RS | not applicable | not applicable | Year_Deadline: 2021 | WHO - International Health Regulations (2005): State Party Self-assessment annual reporting tool, second edition. Accessed: 14 April 2024. https://iris.who.int/rest/bitstreams/1400382/retrieve
77. **¶Appropriate medical service, facilities and protocols in harbours and airports. |** H-EDRM-H&RS | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496
78. **¶Assessment and assistance to affected travellers or animals at points of entry into the country. |** H-EDRM-H&RS | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496
79. **¶A place to quarantine suspicious travellers. |** H-EDRM-H&RS | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496
80. **¶Medical examination, vaccination or other prophylactic measure for travellers. |** H-EDRM-H&RS | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496
81. **¶Guaranteed access to the necessary medical countermeasures, observing the regulation of non-state actors and considerations related to jurisdiction. |** H-EDRM-H&RS | not applicable | not applicable | Year_Deadline: 2023 | WHO - Report of the Review Committee regarding amendments to the International Health Regulations (2005). Accessed: 27 January 2024. https://apps.who.int/gb/wgihr/pdf_files/wgihr2/A_WGIHR2_5-en.pdf
82. **¶Primary health care. |** H-EDRM-H&RS | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf
83. **¶Essential and routine health services during pandemics. |** H-EDRM-H&RS | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf
84. **¶Allocation of resources for clinical outbreaks, supported by risk-specific contingency plans and capacity assessments. |** H-EDRM-H&RS | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2
85. **¶Mapping the needs, capacities and gaps in essential health services. |** H-EDRM-H&RS | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-

extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

86. **¶Mobilisation of adequate additional technical and operational resources for essential health services. |** H-EDRM-H&RS | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2
87. **¶Implementation of alternative service delivery models. |** H-EDRM-H&RS | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2
88. **¶Health facilities and critical health infrastructure to increase resilience, based on risk and vulnerability assessments. |** H-EDRM-H&RS | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2
89. **¶Arrangements for the treatment of chronic infectious diseases such as HIV and TB, uninterrupted supply of antimicrobials. |** H-EDRM-H&RS | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959
90. **¶Screening people at the country's points of entry/regions. |** H-EDRM-H&RS | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959
91. **¶Elective procedures and treatments that can be postponed to free up resources and essential health services. |** H-EDRM-H&RS | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959
92. **¶Mental health support systems for communities and respondents affected by the crisis, especially populations in vulnerable situations. |** H-EDRM-H&RS | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959
93. **¶Psychosocial and mental health services for vulnerable populations. |** H-EDRM-H&RS | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959
94. **¶Health services in accessible locations and with the engagement of community leaders to increase the use of services for vulnerable populations. |** H-EDRM-H&RS | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959
95. **¶Strengthen national capacity in managing risks including emergency preparedness and health sector response |** H-EDRM-H&RS | Eastern Mediterranean Region | Oman | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

4 - H-EDRM-HI&L - HEALTH INFRASTRUCTURE AND LOGISTICS COMPONENT

96. **¶Procure essential medicine and supplies to urgently respond to health emergencies. |** H-EDRM-HI&L | Eastern Mediterranean Region | Afghanistan | Year_Deadline: 2019 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
97. **¶Provide direct in-country planning and implementation support for polio vaccination campaigns per year, including the specific vaccination to high risk mobile population. |** H-EDRM-HI&L | Eastern Mediterranean Region | Afghanistan | Year_Deadline: 2019 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
98. **¶Establish urban health to meet growing needs of urban population and rural-urban migration. |** H-EDRM-HI&L | South-East Asia Region | Bhutan | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
99. **¶Strengthen health adaptation plans for climate change. |** H-EDRM-HI&L | South-East Asia Region | Bhutan | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
100. **¶Manage emergency and disaster. |** H-EDRM-HI&L | Region of the Americas | Brazil | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
101. **¶Strengthen quality of laboratory testing of emerging pathogens and outbreak-prone diseases. |** H-EDRM-HI&L | South-East Asia Region | India | Year_Deadline: 2023 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
102. **¶Prepare emergency medicine, rapid detection, and rapid response to emergency situations. |** H-EDRM-HI&L | European Region | Israel | Year_Deadline: 2025 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
103. **¶Provide support to build capacity to increase access to safe blood and blood products and quality transfusion practices including comprehensive laboratory facilities. |** H-EDRM-HI&L | South-East Asia Region | Maldives | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
104. **¶Strengthen laboratory capacity for early detection of epidemic-prone diseases. |** H-EDRM-HI&L | African Region | Mauritania | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
105. **¶Strengthen the immunization programme: self-evaluation system for data quality; integrate new vaccines and surveillance of diseases targeted. |** H-EDRM-HI&L | African Region | Mauritania | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
106. **¶Adopt a sectoral health and nutrition plan for emergencies. |** H-EDRM-HI&L | African Region | Mauritania | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
107. **¶Update the contingency and organizational plans and emergency rescue management. |** H-EDRM-HI&L | African Region | Mauritania | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
108. **¶Strengthen the supply chain and logistics services. |** H-EDRM-HI&L | Eastern Mediterranean Region | Morocco | Year_Deadline: 2027 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
109. **¶Strengthen priority areas related to health technology management, such as biomedical equipment and facilities necessary for oxygen supply, as part of pandemic preparedness. |** H-EDRM-HI&L | South-East Asia Region | Nepal | Year_Deadline: 2027 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
110. **¶Multisectoral collaboration mechanism for food safety events. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2021 | WHO - International Health Regulations (2005): State Party Self-assessment annual reporting tool, second edition. Accessed: 14 April 2024. https://iris.who.int/rest/bitstreams/1400382/retrieve

111. **¶System for routing and transporting samples. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2021 | WHO - International Health Regulations (2005): State Party Self-assessment annual reporting tool, second edition. Accessed: 14 April 2024. https://iris.who.int/rest/bitstreams/1400382/retrieve

112. **¶Implement laboratory biosafety and biosecurity regime. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2021 | WHO - International Health Regulations (2005): State Party Self-assessment annual reporting tool, second edition. Accessed: 14 April 2024. https://iris.who.int/rest/bitstreams/1400382/retrieve

113. **¶Access to laboratory testing capacity for priority diseases. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2021 | WHO - International Health Regulations (2005): State Party Self-assessment annual reporting tool, second edition. Accessed: 14 April 2024. https://iris.who.int/rest/bitstreams/1400382/retrieve

114. **¶Resources for detection and alert of chemical events. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2021 | WHO - International Health Regulations (2005): State Party Self-assessment annual reporting tool, second edition. Accessed: 14 April 2024. https://iris.who.int/rest/bitstreams/1400382/retrieve

115. **¶Capacity and resources for radiological emergencies and nuclear accidents. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2021 | WHO - International Health Regulations (2005): State Party Self-assessment annual reporting tool, second edition. Accessed: 14 April 2024. https://iris.who.int/rest/bitstreams/1400382/retrieve

116. **¶Staff specialised in laboratory analysis of samples and logistical assistance. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496

117. **¶Transport, entry, exit, processing and destination of biological substances and specimens for diagnostic purposes; reagents and other diagnostic materials used for verification and response purposes. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496

118. **¶Vessel Health Control Certificates. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496

119. **¶Guidelines for the certification of ports and airports. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496

120. **¶Sanitary conditions in harbours and airports. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496

121. **¶Inspection of luggage, cargo, containers, means of transport, goods, postal parcels and human remains. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496

122. **¶Provision or facilitation of technical co-operation and logistical support between States Parties. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496

123. **¶Surveillance and access to rapid diagnostics at points of entry: trained personnel, digital technology and defined standard operating procedures. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Report of the Review Committee regarding amendments to the International Health Regulations (2005). Accessed: 27 January 2024. https://apps.who.int/gb/wgihr/pdf_files/wgihr2/A_WGIHR2_5-en.pdf

124. **¶Laboratory capacities and public health diagnostics. Laboratory biosafety. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

125. **¶Access to drinking water, sanitation and hygiene. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf
126. **¶Waste management in healthcare facilities. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf
127. **¶Qualified research infrastructure. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf
128. **¶Supply chain for research. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf
129. **¶Equitable and affordable access to health technologies. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf
130. **¶Strengthen of national health systems. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf
131. **¶Global logistics and supply chain network. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf
132. **¶Strategic stocks. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf
133. **¶Multilateral and regional purchasing mechanisms. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf
134. **¶Transparency of costs, prices and contractual terms throughout the supply chain. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf
135. **¶Humanitarian aid - access: means of transport, supplies, equipment, international humanitarian law. Principles of humanity, neutrality, impartiality and independence in the provision of humanitarian assistance. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf
136. **¶Effective diagnostics and laboratory capacity for genomic and pathogen surveillance. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2
137. **¶Scalable clinical care during emergencies protection of health professionals and patients maintenance of essential health services. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2
138. **¶Scalable manufacturing platforms. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2
139. **¶Coordinated supply chains and emergency distribution. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-

extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

140. **¶Management of facilities and provision of services integrated with public health surveillance. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

141. **¶National point-of-care diagnostic distribution plans developed and aligned with public health surveillance and clinical care strategies and guidelines. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

142. **¶Routinely updated and validated central register of public and private diagnostic capacity. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

143. **¶Quality management systems for on-site testing. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

144. **¶Agreed pathogen control measures, including inventory standards, containment, equipment operation and maintenance. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

145. **¶National networks of laboratories and diagnostics connected to networks, international partners. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

146. **¶National and international systems for accessing and sharing the benefits of biological materials, supported by rapid transport capacity. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

147. **¶Integrated surveillance infrastructure in national public health service organisations. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

148. **¶Quality standards for healthcare facilities and infrastructure, including specific requirements for prioritised risks. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

149. **¶Resilient essential services for the provision of safe, quality clinical services (including shelter, water, food, electricity, medical oxygen and information and communication technology). |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-

extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

150. **¶Mapping the needs of medicines and essential supplies through established stock management and control systems. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

151. **¶Maintenance of critical infrastructure, engineering controls, supplies and equipment in healthcare facilities. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

152. **¶Mechanisms, protocols and infrastructure for the safe sharing of biological samples and data on pathogens. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

153. **¶National manufacturing plan based on national needs (mapping of threats and vulnerabilities, demand forecast) and mapping of resources and capacities. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

154. **¶Dual-purpose manufacturing by integrating emergency capacity into the production of non-emergency products. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

155. **¶Allocations that are timely, efficient, transparent and underpinned by collective agreements, international instruments and political commitment to equitable access to adequate resources. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

156. **¶Simplified export and import processes for medical countermeasures. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

157. **¶Operational logistics, including the establishment and maintenance of infrastructure and core processes, including accommodation, emergency health logistics and procurement. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

158. **¶Vaccination systems, including cold chain, transport services, vaccination centres and additional human resources. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

159. **¶Vaccination logistics for vulnerable populations, those deprived of their liberty, the sick and those living in hard-to-reach places. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2022 | WHO -

Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

160. ¶**Incident management centres to manage the impact of health emergencies, including the allocation of patients and resources (Emergency Operations Centres - EOCs) |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

161. ¶**Innovative healthcare delivery mechanisms, such as home care, expansion of telemedicine and alternatives to hospitals, including mobile clinics. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

162. ¶**Integration of infection prevention and control with the sanitation and hygiene system of healthcare facilities and the efficient management of healthcare waste. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

163. ¶**Timely and sustained supply of Personal Protective Equipment. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

164. ¶**Supply chains for resilience to interruptions in national and international supplies. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

165. ¶**Incident management rooms with details of the assets available to manage emergencies. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

166. ¶**Public health laboratory systems with adequate equipment, supplies, reagents, protocols and personnel |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

167. ¶**Genomic surveillance facilities. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

168. ¶**Mechanisms for rapidly sharing information and samples at national, sub-national and international level. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

169. ¶**Digital technologies for electronic health records. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

170. ¶**Decontamination, emergency sanitation, wastewater and solid waste management systems. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

171. ¶**Integrated regional network of laboratories to increase capacity for quality-assured diagnostics and genomic surveillance |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

172. **¶Modernisation of the community's critical infrastructure with culturally appropriate materials. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2019 | PAHO - Guidance Note on Health Disaster Risk Management with Indigenous Peoples. Accessed: 13 April 2024. https://iris.paho.org/handle/10665.2/51383

173. **¶Use of renewable energy and other sources and measures to adapt to and mitigate the impact of climate change. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2019 | PAHO - Guidance Note on Health Disaster Risk Management with Indigenous Peoples. Accessed: 13 April 2024. https://iris.paho.org/handle/10665.2/51383

174. **¶Culturally acceptable transport methods. |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2019 | PAHO - Guidance Note on Health Disaster Risk Management with Indigenous Peoples. Accessed: 13 April 2024. https://iris.paho.org/handle/10665.2/51383

175. **¶Supplies and medicines (traditional and non-traditional). |** H-EDRM-HI&L | not applicable | not applicable | Year_Deadline: 2019 | PAHO - Guidance Note on Health Disaster Risk Management with Indigenous Peoples. Accessed: 13 April 2024. https://iris.paho.org/handle/10665.2/51383

176. **¶Conduct hazard mapping and vulnerability health assessments at district and selected health facilities. |** H-EDRM-HI&L | Eastern Mediterranean Region | Pakistan | Year_Deadline: 2017 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

177. **¶Improve access to clean air, safe water and safe food. |** H-EDRM-HI&L | Western Pacific Region | Philippines | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

178. **¶Strengthen national capacities to develop and implement plans and policies to reduce environmental risks to health, including waste management and vector control. |** H-EDRM-HI&L | African Region | Sierra Leone | Year_Deadline: 2021 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

179. **¶Strengthen the public health laboratory network as part of the communicable diseases surveillance and control system at federal and state level. |** H-EDRM-HI&L | Eastern Mediterranean Region | Sudan | Year_Deadline: 2017 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

180. **¶Support the development of transitional strategies for post-conflict and early recovery actions that are linked to humanitarian interventions during the acute emergency phase. |** H-EDRM-HI&L | Eastern Mediterranean Region | Sudan | Year_Deadline: 2017 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

181. **¶Ensure proper coordination mechanism to better respond to emergency needs, particularly logistic support and provision of basic health needs |** H-EDRM-HI&L | Eastern Mediterranean Region | Syrian Arab Republic | Year_Deadline: 2013 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

182. **¶Provide supplies, logistics and operational support for all graded and protracted health emergencies, and build capacity in humanitarian supply chain management within national health authorities. |** H-EDRM-HI&L | Western Pacific Region | Tonga | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

183. **¶Strengthen infection control procedures in hospitals and health facilities. |** H-EDRM-HI&L | Western Pacific Region | Vanuatu | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

184. **¶Strengthen capacity for service delivery including the provision of immunization through quality assurance and prudent use of vaccines and pharmaceuticals in humans. |** H-EDRM-HI&L | Western Pacific Region | Viet Nam | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

185. **¶Strengthen diagnostic and laboratory capacity and risk communication. |** H-EDRM-HI&L | Western Pacific Region | Viet Nam | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

5 - H-EDRM-HR - HUMAN RESOURCES COMPONENT

186. **¶Implement the human resource plan, particularly the creation of a critical mass of employees trained in epidemiological surveillance and data management at the municipal level, and who are able to use new technologies. |** H-EDRM-HR | African Region | Angola | Year_Deadline: 2019 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
187. **¶Carry out supervisory and training activities among staff to prevent disease. |** H-EDRM-HR | African Region | Guinea-Bissau | Year_Deadline: 2016 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
188. **¶Train a contingent of epidemic intelligence officers to increase country capacity in investigating and responding to outbreaks. |** H-EDRM-HR | South-East Asia Region | India | Year_Deadline: 2023 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
189. **¶Develop specialized emergency medical teams to respond to health emergencies in the region and beyond. |** H-EDRM-HR | South-East Asia Region | India | Year_Deadline: 2023 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
190. **¶Promote contingency planning and response capacity development including support to regular drills of emergency response teams. |** H-EDRM-HR | Eastern Mediterranean Region | Lebanon | Year_Deadline: 2023 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
191. **¶Strengthen capacity of stakeholders in preparedness and timely humanitarian response to health emergencies in Liberia. |** H-EDRM-HR | African Region | Liberia | Year_Deadline: 2011 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
192. **¶Strengthen capacities to prepare for, and respond to, public health events caused by common epidemic-prone and emerging diseases, environmental hazards and climate change. |** H-EDRM-HR | Western Pacific Region | Mariana Islands | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
193. **¶Establish a dedicated team to prepare for and respond to emergencies and disasters. |** H-EDRM-HR | Western Pacific Region | Marshall Islands | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
194. **¶Capacity-building for Ministry of Health personnel. (SP5) |** H-EDRM-HR | African Region | Mauritania | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
195. **¶Facilitate institutional capacity building of training institutions to train Rapid Response Teams. |** H-EDRM-HR | African Region | Mauritius | Year_Deadline: 2019 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
196. **¶Develop a skilled workforce for surveillance, risk assessment and response. |** H-EDRM-HR | Western Pacific Region | Mongolia | Year_Deadline: 2021 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
197. **¶Rope in trained epidemiologists to ensure performance and quality of surveillance, investigation and risk assessment at national and subnational levels. |** H-EDRM-HR | South-East Asia Region | Nepal | Year_Deadline: 2027 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
198. **¶Improve emergency medical team deployment, pre-hospital and hospital care, including community resilience, hub and satellite hospital networking, information management through a decision support system. |** H-EDRM-HR | South-East Asia Region | Nepal | Year_Deadline: 2027 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
199. **¶Human Resources to implement IHR (2005) capacities. |** H-EDRM-HR | not applicable | not applicable | Year_Deadline: 2021 | WHO - International Health Regulations (2005): State Party Self-assessment annual reporting tool, second edition. Accessed: 14 April 2024. https://iris.who.int/rest/bitstreams/1400382/retrieve
200. **¶National public health emergency response plan, with multidisciplinary/multisectoral teams. |** H-EDRM-HR | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496

201. **¶Continuing education in One Health. |** H-EDRM-HR | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

202. **¶Multidisciplinary workforce in inter-pandemic periods. |** H-EDRM-HR | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

203. **¶Pre-, in- and post-service education and training. |** H-EDRM-HR | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

204. **¶Engagement, participation, empowerment, safety and well-being of all health and care professionals. |** H-EDRM-HR | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

205. **¶Sustainability of the workforce at sub-national, national and regional level. |** H-EDRM-HR | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

206. **¶Health workforce resilience through training, standard operating procedures and support structures for workforce health and wellbeing. |** H-EDRM-HR | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

207. **¶Mapping of occupations that carry out essential public health functions, estimates of the need for multidisciplinary labour, based on risk, vulnerability and capacity assessments. |** H-EDRM-HR | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

208. **¶Workforce education, development and retention strategies based on service needs, gap assessments and national health workforce policies. |** H-EDRM-HR | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

209. **¶Experts with adequate training to anticipate and assess the magnitude of the danger, such as meteorologists, geoscientists and epidemiologists. |** H-EDRM-HR | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

210. **¶Mapping of Human Resources in different geographical locations, to target capacities for additional workload in an emergency context. |** H-EDRM-HR | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

211. **¶Mobilisation Additional human resources from the private sector and public volunteers. |** H-EDRM-HR | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

212. **¶Protocols for transferring staff through staff transitions and induction of new employees, and regulatory approvals for transferring tasks and engaging volunteers. |** H-EDRM-HR | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

213. **¶Traditional and non-traditional medical and mental health professionals and community leaders. |** H-EDRM-HR | not applicable | not applicable | Year_Deadline: 2019 | PAHO - Guidance Note on Health Disaster Risk Management with Indigenous Peoples. Accessed: 13 April 2024. https://iris.paho.org/handle/10665.2/51383

214. **¶Strengthen capacity and coordination to address workers' health. |** H-EDRM-HR | Region of the Americas | Suriname | Year_Deadline: 2016 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

215. **¶Enhance national preparedness plan for emergencies and national disasters including the availability of skilled emergency health managers and technical staff. |** H-EDRM-HR | Eastern Mediterranean Region | Syrian Arab Republic | Year_Deadline: 2013 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

216. **¶Establish a national health emergency operation centre and emergency medical teams. |** H-EDRM-HR | South-East Asia Region | Timor-Leste | Year_Deadline: 2025 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

217. **¶Develop a health preparedness, response, and recovery plan including training of health professionals for response at all levels to emergencies and natural disasters. |** H-EDRM-HR | Eastern Mediterranean Region | United Arab Emirates | Year_Deadline: 2017 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

6 - H-EDRM-I&KM - INFORMATION AND KNOWLEDGE MANAGEMENT

218. **¶To update the National Strategic plan for integrated disease surveillance and response (IDSR) and to expand the national strategy to all municipalities, integrating information from vertical programmes and community participation (community-based surveill |** H-EDRM-I&KM | African Region | Angola | Year_Deadline: 2019 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

219. **¶Achieve the minimum core capacities for alert and intervention required by the International Health Regulations (2005) |** H-EDRM-I&KM | African Region | Burundi | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

220. **¶Support the implementation of strategies and technical advice in the area of information management for detection, verification, evaluation and coordination of the response to public health emergencies in accordance with the International Health Regulatio |** H-EDRM-I&KM | African Region | Central African Republic | Year_Deadline: 2017 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

221. **¶Support multisectoral and international cooperation to establish One Health mechanisms to promote human, animal and environmental health. |** H-EDRM-I&KM | Western Pacific Region | China | Year_Deadline: 2026 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

222. **¶Encourage the use of health information to the decision-making process in public health emergency. |** H-EDRM-I&KM | Region of the Americas | Dominican Republic | Year_Deadline: 2017 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

223. **¶Supporting real time surveillance through enhancing both indicator based surveillance and the event-based surveillance. |** H-EDRM-I&KM | Eastern Mediterranean Region | Egypt | Year_Deadline: 2014 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

224. **¶Strengthen resourced and efficient system for detection and risk assessment of outbreaks and events/emergencies. |** H-EDRM-I&KM | African Region | Eritrea | Year_Deadline: 2021 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

225. **¶Strengthen the country's capacity to conduct comprehensive surveillance with emphasis on a robust early warning system and adequate preparedness to mount a rapid, predictable and effective response to major epidemics and pandemics. |** H-EDRM-I&KM | African Region | Gambia | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

226. **¶Strengthen the national capacity to manage public health risks associated with emergencies and adequately respond to threats and emergencies with public health consequences. |** H-EDRM-I&KM | African Region | Gambia | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

227. **¶Strengthen the prevention of and response to epidemics of cholera and possibly Ebola virus and other emerging diseases. |** H-EDRM-I&KM | African Region | Guinea-Bissau | Year_Deadline: 2016 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

228. **¶Strengthen early detection and management of neglected disease, risk factors, mental health, violence and injuries. |** H-EDRM-I&KM | Region of the Americas | Guyana | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

229. **¶Strengthen capacities for implementation of the International Health Regulations (IHR). |** H-EDRM-I&KM | South-East Asia Region | India | Year_Deadline: 2023 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

230. **¶Strengthen prevention and preparedness for response and recovery from all types of emergencies. |** H-EDRM-I&KM | South-East Asia Region | India | Year_Deadline: 2023 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

231. **¶Operationalize digital health and information platform to effectively manage data for decision-making. |** H-EDRM-I&KM | South-East Asia Region | India | Year_Deadline: 2023 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

232. **¶Support nationwide roll-out of integrated disease surveillance programme using the real-time platform. |** H-EDRM-I&KM | South-East Asia Region | India | Year_Deadline: 2023 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

233. **¶Integrate environmental variables in Integrated Health Information Platform. |** H-EDRM-I&KM | South-East Asia Region | India | Year_Deadline: 2023 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

234. **¶Strengthen laboratory capacities for disease surveillance to promote evidence-based decision-making. |** H-EDRM-I&KM | South-East Asia Region | Indonesia | Year_Deadline: 2019 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

235. **¶Promote all-hazard approach in improving preparedness plan for emergencies and disaster risk reduction activity. |** H-EDRM-I&KM | South-East Asia Region | Indonesia | Year_Deadline: 2019 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

236. **¶Coordinate and strengthen surveillance system (emerging and reemerging diseases) including the use of forecasting and predictive techniques. |** H-EDRM-I&KM | Eastern Mediterranean Region | Iran (Islamic Republic of) | Year_Deadline: 2014 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

237. **¶Strengthen control of communicable disease and national preparedness for dealing with epidemic and pandemics. |** H-EDRM-I&KM | Eastern Mediterranean Region | Iraq | Year_Deadline: 2017 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

238. **¶Mitigate risks from high-threat infectious hazards. |** H-EDRM-I&KM | Eastern Mediterranean Region | Jordan | Year_Deadline: 2019 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

239. **¶Provide the link between country and the WHO Health Emergencies Programme in effectively responding to health emergencies in the country. |** H-EDRM-I&KM | Western Pacific Region | Kiribati | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

240. **¶Implement early warning alert and response system: simplifying reporting mechanisms; secure interoperable real-time electronic system. |** H-EDRM-I&KM | Eastern Mediterranean Region | Lebanon | Year_Deadline: 2023 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

241. **¶Enhance disaster risk reduction, preparedness, response and recovery through information sharing on humanitarian action with partners. |** H-EDRM-I&KM | Western Pacific Region | Malaysia | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

242. **¶Set up a multisectoral approach to respond to events that may constitute public health emergencies. |** H-EDRM-I&KM | Western Pacific Region | Micronesia (Federated States of) | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

243. **¶Implement indicator- and event-based surveillance system in place to detect public health threats with systematic data analysis, risk assessment and reporting. |** H-EDRM-I&KM | Western Pacific Region | Micronesia (Federated States of) | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

244. **¶Strengthen linkages among risk assessments of public health events and emergencies, risk communication, and public health laboratory and response systems for timely and informed decision-making. |** H-EDRM-I&KM | Western Pacific Region | Mongolia | Year_Deadline: 2021 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

245. **¶Make better use of new technologies for new prediction, detection and verification of country capabilities. |** H-EDRM-I&KM | Eastern Mediterranean Region | Morocco | Year_Deadline: 2027 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

246. **¶Build capacity to combat false and misleading information. |** H-EDRM-I&KM | Eastern Mediterranean Region | Morocco | Year_Deadline: 2027 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

247. **¶Strengthen Health surveillance and epidemiological surveillance as part of a "One Health" approach. |** H-EDRM-I&KM | Eastern Mediterranean Region | Morocco | Year_Deadline: 2027 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

248. **¶Implement an integrated disease surveillance system |** H-EDRM-I&KM | African Region | Mozambique | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

249. **¶Translate the lessons learnt from the COVID-19 pandemic and other recent emergencies to health security systems, working at all levels of the country for enhancing the national IHR capacities. |** H-EDRM-I&KM | South-East Asia Region | Nepal | Year_Deadline: 2027 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

250. **¶Deploy digital health technologies and innovations to support preparedness for, response to and recovery from public health emergencies and natural disasters. |** H-EDRM-I&KM | South-East Asia Region | Nepal | Year_Deadline: 2027 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

251. **¶Implement national Mult hazard health emergency preparedness and response plan, informed by strategic assessment of risk with multisectoral engagement and accountability. |** H-EDRM-I&KM | South-East Asia Region | Nepal | Year_Deadline: 2027 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

252. **¶Build a national framework for alert and response system, based on indicator-based surveillance and event-based surveillance, supported by data inputs from animal and environmental health sectors. |** H-EDRM-I&KM | South-East Asia Region | Nepal | Year_Deadline: 2027 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

253. **¶Integrate climate and epidemiological dynamics to monitor and forecast the probability of the expansion of climate-sensitive diseases. |** H-EDRM-I&KM | South-East Asia Region | Nepal | Year_Deadline: 2027 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

254. **¶Support analysis and risk assessment for acute public health events to inform national and local decision-making to trigger timely and appropriate public health actions and risk communication. |** H-EDRM-I&KM | South-East Asia Region | Nepal | Year_Deadline: 2027 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

255. **¶Strengthen the institutional capacity centre operation and health desks for national ownership and sustainability of health emergency management services at all levels. |** H-EDRM-I&KM | South-East Asia Region | Nepal | Year_Deadline: 2027 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

256. **¶Implement a strategic national multisectoral, multisource, risk assessment, surveillance and laboratory plan that uses a One Health approach for an enhanced national early warning, alert, event detection and response framework. |** H-EDRM-I&KM | South-East Asia Region | Nepal | Year_Deadline: 2027 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

257. **¶Develop national plans and critical core capacities for all-hazard health emergency preparedness and disaster risk management. |** H-EDRM-I&KM | Western Pacific Region | New Caledonia | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

258. **¶Develop and maintain in-country expertise in vulnerability mapping, information management, risk assessment, emergency operations, risk communication and response logistics. |** H-EDRM-I&KM | Western Pacific Region | New Caledonia | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

259. **¶Develop of intersectoral risk management capabilities. |** H-EDRM-I&KM | Region of the Americas | Nicaragua | Year_Deadline: 2021 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

260. **¶Support development and implementation of an integrated disease surveillance and response plan, with a view to effectively implementing the International Health Regulations (IHR 2005). |** H-EDRM-

I&KM | African Region | Niger | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

261. ¶**Early warning function: indicator- and event-based surveillance. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2021 | WHO - International Health Regulations (2005): State Party Self-assessment annual reporting tool, second edition. Accessed: 14 April 2024. https://iris.who.int/rest/bitstreams/1400382/retrieve

262. ¶**Mechanism for event management (verification, risk assessment analysis, investigation). |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2021 | WHO - International Health Regulations (2005): State Party Self-assessment annual reporting tool, second edition. Accessed: 14 April 2024. https://iris.who.int/rest/bitstreams/1400382/retrieve

263. ¶**Detection of extraordinary events, associated with alert routines and notification to the authorities. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496

264. ¶**Information on the traveller's destination, itinerary and health conditions. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496

265. ¶**Genetic sequence data for surveillance, risk assessment, response and ongoing research, with epidemiological and surveillance information and sharing of pathogen samples. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2023 | WHO - Report of the Review Committee regarding amendments to the International Health Regulations (2005). Accessed: 27 January 2024. https://apps.who.int/gb/wgihr/pdf_files/wgihr2/A_WGIHR2_5-en.pdf

266. ¶**Pre-arranged multilateral model of access and benefit sharing that determines rapid access to information, with fair, timely and equitable access to the benefits arising from access to pathogen samples. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2023 | WHO - Report of the Review Committee regarding amendments to the International Health Regulations (2005). Accessed: 27 January 2024. https://apps.who.int/gb/wgihr/pdf_files/wgihr2/A_WGIHR2_5-en.pdf

267. ¶**Interoperability of data systems, compatible and capable of continuous exchange between different technological platforms. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2023 | WHO - Report of the Review Committee regarding amendments to the International Health Regulations (2005). Accessed: 27 January 2024. https://apps.who.int/gb/wgihr/pdf_files/wgihr2/A_WGIHR2_5-en.pdf

268. ¶**Multisectoral and coordinated data interoperability. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

269. ¶**Factors that promote disease at the human-animal-environment interface. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

270. ¶**Evidence based on science. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

271. ¶**Standards and guidelines for preventing zoonoses. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

272. ¶**Interoperable early warning and timely notification systems. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

273. ¶**Digital health and data science platforms and technologies. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

274. ¶**Knowledge translation and evidence-based communication tools. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

275. **¶Infodemics management. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

276. **¶Database of diseases with pandemic potential. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

277. **¶WHO Pathogen Access and Benefit Sharing System (WHO PABS) |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

278. **¶Integrated national surveillance of diseases, threats and vulnerabilities. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

279. **¶Accelerated R&D. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

280. **¶Capacity for timely and adequate routine public health surveillance. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

281. **¶Multisectoral understanding of vulnerabilities - demographic, environmental, social and economic factors in health risks, based on local contexts. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

282. **¶Sharing lessons learnt to inform strategic investments in strengthening surveillance capacity. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

283. **¶Digitisation of surveillance data and processes from the point of data collection, to promote integration, interoperability and flexibility. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

284. **¶Innovation and research ecosystem that meets the need for accessible and scalable technologies for developing laboratory systems in a sustainable way. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

285. **¶Scalable, distributed and evolving technical interfaces for secure data linking, integration and intelligence sharing between systems. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

286. **¶Global collaborative agenda on the development of data collection, management, analysis and modelling tools. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening

health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

287. **¶Analytical capacity, integrating contextual understanding and modelling insights to strengthen risk assessment, with shared resources and intelligence and feedback mechanisms. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

288. **¶National network between sectors, organisations and fields of expertise to establish protocols for sharing data, information and intelligence. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

289. **¶Decision-making - Analytical capacity, integrating contextual understanding and modelling insights to strengthen risk assessment. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

290. **¶Integrated protocols, tools and platforms for activating, coordinating and exchanging information in outbreak deployment mechanisms at national, regional and global level. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

291. **¶Inventory of local risks and hazards in the community - territory. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2019 | PAHO - Guidance Note on Health Disaster Risk Management with Indigenous Peoples. Accessed: 13 April 2024. https://iris.paho.org/handle/10665.2/51383

292. **¶Culturally appropriate information on hazards and risks, integrated into the analysis of the public health situation. |** H-EDRM-I&KM | not applicable | not applicable | Year_Deadline: 2019 | PAHO - Guidance Note on Health Disaster Risk Management with Indigenous Peoples. Accessed: 13 April 2024. https://iris.paho.org/handle/10665.2/51383

293. **¶Implement emergency preparedness and response plans, guidelines and relevant standard operating procedures. |** H-EDRM-I&KM | Eastern Mediterranean Region | Pakistan | Year_Deadline: 2017 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

294. **¶Develop and regularly update the health emergency management information system. |** H-EDRM-I&KM | Eastern Mediterranean Region | Pakistan | Year_Deadline: 2017 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

295. **¶Improve disaster preparedness and response. |** H-EDRM-I&KM | Western Pacific Region | Papua New Guinea | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

296. **¶Improve preparedness for surveillance and epidemics. |** H-EDRM-I&KM | Western Pacific Region | Papua New Guinea | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

297. **¶Strengthen technical cooperation to improve health information systems, especially vital statistics at regional and national level; increasing equitable access to information, sharing information and, and use of evidence-based information on health for de |** H-EDRM-I&KM | Region of the Americas | Paraguay | Year_Deadline: 2013 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

298. **¶Increase technical cooperation to promote research in priority areas, including health system research and operational research, based on ethical principles. (SP5) |** H-EDRM-I&KM | Region of the

Americas | Paraguay | Year_Deadline: 2013 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

299. **¶Implement technical cooperation to collect, compile and analyse social and economic data related to health, disaggregated by sex, age, ethnic group, income. |** H-EDRM-I&KM | Region of the Americas | Paraguay | Year_Deadline: 2013 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

300. **¶Maintain and increase capacity in detection and control of preventable diseases by vaccines, emerging infectious and re-emerging infectious diseases, neglected and zoonotic diseases, and other communicable diseases, which are significant in the country du |** H-EDRM-I&KM | Region of the Americas | Paraguay | Year_Deadline: 2013 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

301. **¶Support the implementation of country One Health Approach |** H-EDRM-I&KM | Western Pacific Region | Philippines | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

302. **¶Promote evidence-informed policy-making and planning in support of achieving national and global targets. |** H-EDRM-I&KM | Western Pacific Region | Philippines | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

303. **¶Strengthen the use of evidence for early warning, preparedness and response to emergencies and disasters. |** H-EDRM-I&KM | African Region | Rwanda | Year_Deadline: 2018 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

304. **¶Strengthen capacity to prevent and control epidemic diseases and other public health emergencies through the implementation of an effective and efficient national epidemiological surveillance system. |** H-EDRM-I&KM | African Region | Rwanda | Year_Deadline: 2018 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

305. **¶Strengthen capacity to address health emergencies and environmental threats and risks |** H-EDRM-I&KM | Region of the Americas | Saint Kitts and Nevis | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

306. **¶Strengthen capacity to address disaster management and risks |** H-EDRM-I&KM | Region of the Americas | Saint Kitts and Nevis | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

307. **¶Strengthen capacity to address climate change and health impacts. |** H-EDRM-I&KM | Region of the Americas | Saint Lucia | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

308. **¶Strengthen capacity to address health emergencies and environmental threats and risks. |** H-EDRM-I&KM | Region of the Americas | Saint Lucia | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

309. **¶Strengthen capacity to address disaster management and risks |** H-EDRM-I&KM | Region of the Americas | Saint Lucia | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

310. **¶Strengthen capacity to address climate change and health impacts. |** H-EDRM-I&KM | Region of the Americas | Saint Vincent and Grenadines | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

311. **¶Strengthen capacity to address health emergencies and environmental threats and risks. |** H-EDRM-I&KM | Region of the Americas | Saint Vincent and Grenadines | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

312. **¶Strengthen capacity to address disaster management and risks |** H-EDRM-I&KM | Region of the Americas | Saint Vincent and Grenadines | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

313. **¶Generate knowledge and evidence that for sustainable scaling up of interventions and development of supportive policies. |** H-EDRM-I&KM | South-East Asia Region | Sri Lanka | Year_Deadline: 2023 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

314. **¶Share lessons learnt for wider dissemination within and beyond countries. |** H-EDRM-I&KM | South-East Asia Region | Sri Lanka | Year_Deadline: 2023 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

315. **¶Use of the digital dividend for the betterment of health and development of populations. |** H-EDRM-I&KM | South-East Asia Region | Sri Lanka | Year_Deadline: 2023 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

316. **¶Strengthen the epidemiological surveillance system and facilitate the incorporation of the existing different surveillance activities into a comprehensive national surveillance system. |** H-EDRM-I&KM | Eastern Mediterranean Region | Sudan | Year_Deadline: 2017 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

317. **¶Strengthen people-centred health systems, public health capacities and emergency preparedness, surveillance and response. |** H-EDRM-I&KM | European Region | Switzerland | Year_Deadline: 2018 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

318. **¶Participate in national, regional and global collaborations, initiatives, instruments or frameworks relevant to PHE. |** H-EDRM-I&KM | South-East Asia Region | Thailand | Year_Deadline: 2026 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

319. **¶Support national action plan for health security implementation, in line with the lessons learnt from COVID-19 response. |** H-EDRM-I&KM | South-East Asia Region | Timor-Leste | Year_Deadline: 2025 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

320. **¶Support control of communicable diseases, including epidemic- and pandemic-prone diseases. |** H-EDRM-I&KM | African Region | Togo | Year_Deadline: 2013 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

321. **¶Implement regional framework for action for disaster risk management for health. |** H-EDRM-I&KM | Western Pacific Region | Tonga | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

322. **¶Test the country's outbreak alert and emergency response systems through after-action reviews, exercises and joint external evaluation. |** H-EDRM-I&KM | Western Pacific Region | Tonga | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

323. **¶Strengthen institutional capacities for surveillance of emerging and re-emerging diseases and notifiable diseases. |** H-EDRM-I&KM | Eastern Mediterranean Region | Tunisia | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

324. **¶Build capacities to respond to environmental hazards, the effects of climate change, and the health consequences of disasters. |** H-EDRM-I&KM | Western Pacific Region | Tuvalu | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

325. **¶Strengthen capacities to prepare for and respond to public health events caused by common epidemic-prone and emerging diseases. |** H-EDRM-I&KM | Western Pacific Region | Tuvalu | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

326. **¶Promote IHR minimum core capacities for all-hazard alert and response, in the spirit of the One Health approach and multi-sectoral strategy. |** H-EDRM-I&KM | African Region | Uganda | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

327. **¶Support integration of health disaster risk management into national frameworks for effective all-hazard disaster assessment & risk management to promote building of systems and community resilience to disasters. |** H-EDRM-I&KM | African Region | Uganda | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

328. **¶Increase capacity to manage health risks of emergencies and build resilience, including adequate preparedness for rapid and effective response to health-related disasters and emergencies and major epidemics and pandemics using the One Health approach. |** H-EDRM-I&KM | African Region | United Republic

of Tanzania | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

329. **¶Strengthen surveillance systems and border control in alignment with IHR (2005). |** H-EDRM-I&KM | Western Pacific Region | Vanuatu | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

330. **¶Strengthen country's capacity to emergencies including strengthening of the national surveillance systems. |** H-EDRM-I&KM | Western Pacific Region | Viet Nam | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

331. **¶Develop evidence-based policies standards and guidelines to strengthen the prevention and management of communicable diseases. |** H-EDRM-I&KM | Western Pacific Region | Viet Nam | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

332. **¶Strengthen capacities and programmes to prepare for, and respond to, public health events caused by common epidemic-prone and emerging diseases, vaccine preventable diseases, environmental hazards and climate change. |** H-EDRM-I&KM | Western Pacific Region | Wallis And Futuna | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

333. **¶Enhance capacity for early detection and prompt response to epidemic and pandemic prone diseases. |** H-EDRM-I&KM | African Region | Zambia | Year_Deadline: 2021 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

334. **¶Improve capacity for Emergency Risk and Crisis Management through maintenance of Inter Agency coordination committee on health (ICC) |** H-EDRM-I&KM | African Region | Zambia | Year_Deadline: 2021 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

335. **¶Enhance capacity for early detection and prompt response to epidemic and pandemic prone diseases. |** H-EDRM-I&KM | African Region | Zimbabwe | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

7 - H-EDRM-M&E - MONITORING AND EVALUATION

336. **¶Conduct a Joint External Evaluation (JEE) for IHR core capacity requirements, in collaboration with WHO. |** H-EDRM-M&E | Eastern Mediterranean Region | Bahrain | Year_Deadline: 2018 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
337. **¶Conduct an in-depth assessment of the current surveillance and response system, following the JEE, with a view to establishing an event-based surveillance system for real-time detection of health threats. |** H-EDRM-M&E | Eastern Mediterranean Region | Bahrain | Year_Deadline: 2018 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
338. **¶Monitor new and evolving outbreaks such as Zika and take the appropriate response measures. |** H-EDRM-M&E | Region of the Americas | Belize | Year_Deadline: 2021 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
339. **¶Conducting Health Impact Analysis. |** H-EDRM-M&E | South-East Asia Region | Bhutan | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
340. **¶Prepare, monitor and response to emergencies and disasters |** H-EDRM-M&E | Region of the Americas | Brazil | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
341. **¶Improve epidemic prevention and control capabilities and mechanisms; and coordinate regular and targeted epidemic prevention and control and emergency response domestically and internationally. |** H-EDRM-M&E | Western Pacific Region | China | Year_Deadline: 2026 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
342. **¶Strengthen the prevention and control of infectious, endemic and occupational diseases, such as HIV/AIDS, tuberculosis and hepatitis. |** H-EDRM-M&E | Western Pacific Region | China | Year_Deadline: 2026 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
343. **¶Monitor epidemic trends and risk factors. |** H-EDRM-M&E | Western Pacific Region | China | Year_Deadline: 2026 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
344. **¶Support multisectoral and rapid health assessments in emergencies and disasters and develop resource mobilization plans. |** H-EDRM-M&E | African Region | Comoros | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
345. **¶Develop national public health emergency response plans. |** H-EDRM-M&E | Eastern Mediterranean Region | Egypt | Year_Deadline: 2014 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
346. **¶Establish national capacity to manage public health risks posed by emergencies. |** H-EDRM-M&E | African Region | Gabon | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
347. **¶Implement initial rapid assessments and ongoing evaluations following disasters, to quickly identify health needs and mobilize resources. |** H-EDRM-M&E | African Region | Madagascar | Year_Deadline: 2013 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
348. **¶Strengthen health impact assessments and similar tools to respond to an increasingly diverse range of environmental health issues and concerns. |** H-EDRM-M&E | Western Pacific Region | Malaysia | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
349. **¶Provide technical support to conduct a Joint External Evaluation (JEE) for IHR compliance and implementation of the JEE recommendations. |** H-EDRM-M&E | African Region | Mauritius | Year_Deadline: 2019 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
350. **¶Implement national plan for emerging infectious diseases and public health emergencies, considering priority actions from the Joint External Evaluation. |** H-EDRM-M&E | Western Pacific Region |

Mongolia | Year_Deadline: 2021 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

351. **¶Implement Joint External Evaluation (JEE) of International Health Regulations and National Action Plan for Health Security. |** H-EDRM-M&E | South-East Asia Region | Myanmar | Year_Deadline: 2018 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

352. **¶Initiate biennial exercises to test pandemic preparedness. |** H-EDRM-M&E | Western Pacific Region | Niue | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

353. **¶Vaccination certificates. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496

354. **¶Liaison between State Party Focal Points (Responsible Institution) and WHO IHR Contact Points. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496

355. **¶Register of IHR Experts. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496

356. **¶Periodic evaluation of surveillance capacity - a Universal Periodic Health Review. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2023 | WHO - Report of the Review Committee regarding amendments to the International Health Regulations (2005). Accessed: 27 January 2024. https://apps.who.int/gb/wgihr/pdf_files/wgihr2/A_WGIHR2_5-en.pdf

357. **¶Matrix of evaluation and accountability of States Parties for actions carried out. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2023 | WHO - Report of the Review Committee regarding amendments to the International Health Regulations (2005). Accessed: 27 January 2024. https://apps.who.int/gb/wgihr/pdf_files/wgihr2/A_WGIHR2_5-en.pdf

358. **¶Public health emergency operations centres (inter-pandemic and pandemic periods). |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

359. **¶Appropriate simulation exercises. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

360. **¶An inclusive, transparent, effective and efficient monitoring and evaluation system. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

361. **¶Peer review mechanism to assess capacities and gaps. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

362. **¶Collaborative approaches to event detection, risk assessment and response monitoring. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

363. **¶Infection prevention and control with the adoption of alternative telemedicine services, human resources training and adequate storage processes. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

364. **¶Mechanisms for the rapid and routine updating of definitions, norms, standards and policies based on emerging hazards and the availability of new medical countermeasures. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-

extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

365. **¶Continuous specialised and interdisciplinary learning through regular training and simulations based on the local risk profile. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

366. **¶Periodic review of the system's capabilities and performance through intra-action and after-action reviews and simulation exercises. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

367. **¶Standardised methods for hazard identification, warning, rapid risk assessment and classification to declare the start of the emergency. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

368. **¶Monitoring mechanisms to track delivery and impact in relation to emergency response plans. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

369. **¶Mechanisms for collaboration and regulation with the private sector, civil society organisations, non-governmental organisations, community-based organisations, influencers and academic institutions. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

370. **¶Exceptional administrative and financial practices for times of emergency. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

371. **¶Mechanisms for a "One Health" approach through joint efforts and the exchange of information. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

372. **¶Surveillance systems with early warning, adaptable to changing information needs before and during emergencies. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

373. **¶Genomic surveillance of pathogens with epidemic and pandemic potential. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

374. **¶Data management for analysing the epidemiological situation and making timely public health decisions. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

375. **¶Collaborative intelligence in public health through the synthesis and analysis of information from various sources for risk assessment and decision-making. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

376. **¶Timely international sharing of information on acute public health events. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

377. **¶Cross-border collaboration and the mechanism for sharing information for decision-making. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

378. **¶Data systems to monitor and follow up on vaccination implementation. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

379. **¶Construction of simulation exercise scenarios to manage patient flow, based on multi-risk risk assessment. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

380. **¶Systems for coordinating partners such as civil society organisations and academic institutions to mobilise additional technical and material resources when necessary. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

381. **¶Dynamic listening systems for the authorities' responses to citizens and the fight against disinformation. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

382. **¶Agile and resilient laboratory systems through training, establishing hierarchical networks, interoperable data management systems and integrated laboratory and surveillance systems. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

383. **¶National research capacity on climate change and its impacts on the regions. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

384. **¶Continued epidemiological research to monitor the emergence of variants. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

385. **¶Infodemics management. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

386. **¶Network of policy-makers, professionals and researchers to collaborate in the generation and dissemination of knowledge by strengthening knowledge management networks. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

387. **¶Community assessments from a multicultural perspective to understand how they perceive concepts such as dangers and risks. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2019 | PAHO - Guidance Note on Health Disaster Risk Management with Indigenous Peoples. Accessed: 13 April 2024. https://iris.paho.org/handle/10665.2/51383

388. **¶Culturally and linguistically appropriate early warning systems with the participation of communities. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2019 | PAHO - Guidance Note on

Health Disaster Risk Management with Indigenous Peoples. Accessed: 13 April 2024. https://iris.paho.org/handle/10665.2/51383

389. ¶**Community health status from an intercultural perspective and local traditions. |** H-EDRM-M&E | not applicable | not applicable | Year_Deadline: 2019 | PAHO - Guidance Note on Health Disaster Risk Management with Indigenous Peoples. Accessed: 13 April 2024. https://iris.paho.org/handle/10665.2/51383
390. ¶**Support vulnerability risk assessments for infectious hazards/disaster risk management. |** H-EDRM-M&E | Western Pacific Region | Solomon Islands | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
391. ¶**Strengthen country capacity for event-based and syndromic surveillance for routine/post-disaster monitoring. |** H-EDRM-M&E | Western Pacific Region | Solomon Islands | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
392. ¶**Strengthen public health emergency monitoring and evaluation systems. |** H-EDRM-M&E | South-East Asia Region | Thailand | Year_Deadline: 2026 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
393. ¶**Establish and evaluate post-disaster early warning, alert and response systems. |** H-EDRM-M&E | Western Pacific Region | Tonga | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

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394. ¶**Assist in the development of National and Provincial Emergency Preparedness and Response (EPR) strategies and plans, supporting trauma care and mass casualty management, and emergency primary healthcare, including national and regional capacity building. |** H-EDRM-P&C | Eastern Mediterranean Region | Afghanistan | Year_Deadline: 2019 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
395. ¶**Coordinate preparedness and response to natural and man-made disasters. |** H-EDRM-P&C | Eastern Mediterranean Region | Afghanistan | Year_Deadline: 2019 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
396. ¶**Support National Disease Surveillance and Response (NDSR) in the early detection of epidemics and provide support for preparedness and response to influenza pandemics. |** H-EDRM-P&C | Eastern Mediterranean Region | Afghanistan | Year_Deadline: 2019 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
397. ¶**Strengthen capacity to address Climate change and health impacts. |** H-EDRM-P&C | Region of the Americas | Antigua and Barbuda | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
398. ¶**Strengthen capacity to address health emergencies and environmental threats and risks. |** H-EDRM-P&C | Region of the Americas | Antigua and Barbuda | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
399. ¶**Strengthen capacity to address disaster management and risks. |** H-EDRM-P&C | Region of the Americas | Antigua and Barbuda | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
400. ¶**Develop a road map for improving existing capacities for prevention, detection and response to health security threats, based on the findings of the Joint External Evaluation (JEE) mission. |** H-EDRM-P&C | Eastern Mediterranean Region | Bahrain | Year_Deadline: 2018 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.
401. ¶**Strengthen health system resilience to protect health and mitigate effects of health emergencies including disease outbreaks and manage effects of climate change. |** H-EDRM-P&C | South-East Asia Region | Bangladesh | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

402. **¶Capacity of the Climate Change Health Promotion Unit (CCHPU) of MoH&FW strengthened and National Adaptation Plan for the Health Sector (H-NAP) implemented |** H-EDRM-P&C | South-East Asia Region | Bangladesh | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

403. **¶Strengthen the National capacity on emergency preparedness and control of disease outbreaks, including surveillance, laboratory support and case management. |** H-EDRM-P&C | South-East Asia Region | Bangladesh | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

404. **¶Strengthen IHR Core Capacity including at points of entry and quarantine zones. |** H-EDRM-P&C | South-East Asia Region | Bangladesh | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

405. **¶Strengthen National capacity on early warning systems, operating health emergency operations centres and emergency medical teams. |** H-EDRM-P&C | South-East Asia Region | Bangladesh | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

406. **¶Strengthen institutional capacity on AMR containment and food safety interventions. |** H-EDRM-P&C | South-East Asia Region | Bangladesh | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

407. **¶Strengthen capacity to address Climate change and health impacts. |** H-EDRM-P&C | Region of the Americas | Barbados | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

408. **¶Strengthen capacity to address health emergencies and environmental threats and risks. |** H-EDRM-P&C | Region of the Americas | Barbados | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

409. **¶Strengthen capacity to address disaster management and risks. |** H-EDRM-P&C | Region of the Americas | Barbados | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

410. **¶Emergency preparedness, surveillance and response |** H-EDRM-P&C | European Region | Belgium | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

411. **¶Strengthen the coordination of the preparedness and response mechanisms to address health emergencies including natural disasters (hurricanes and earthquakes), and the impact of climate change. |** H-EDRM-P&C | Region of the Americas | Belize | Year_Deadline: 2021 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

412. **¶Implement the IHR external evaluation recommendations which include preparing a multisectoral roadmap linking existing institutional and operational planning mechanisms and structures and increasing horizontal cooperation with other countries. |** H-EDRM-P&C | Region of the Americas | Belize | Year_Deadline: 2021 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

413. **¶Strengthen IHR and emergency risk management including bio-safety and bio-security. |** H-EDRM-P&C | South-East Asia Region | Bhutan | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

414. **¶Eliminate malaria, MTCT of HIV, - syphilis and hepatitis B, leishmaniasis and other NTD, sustain elimination of leprosy, measles, and accelerate end TB strategy |** H-EDRM-P&C | South-East Asia Region | Bhutan | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

415. **¶Strengthen national capacity to implement the polio eradication and endgame strategic Plan through sensitive polio surveillance, polio virus containment and certification, introduction of inactivated polio vaccine (IPV) and oral polio vaccine (OPV) withdr |** H-EDRM-P&C | African Region | Botswana | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

416. **¶Strengthen country's capacity to respond to disasters, disease outbreaks and other acute public health emergencies including the implementation of the international health regulations and effective surveillance and preparedness. |** H-EDRM-P&C | African Region | Botswana | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

417. **¶Implement the International Health Regulations - 2005. |** H-EDRM-P&C | Region of the Americas | Brazil | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

418. **¶Promote capacity-building for the development and implementation of operational plans in accordance with WHO recommendations for strengthening national resilience and preparedness, in relation to pandemic influenza and epidemic and emerging diseases. |** H-EDRM-P&C | African Region | Burundi | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

419. **¶Conduct the Joint External Evaluation (JEE) and support the national capacity building to fulfil the required competencies for the 2005 IHR enforcement. |** H-EDRM-P&C | African Region | Cabo Verde | Year_Deadline: 2021 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

420. **¶Implement the national integrated surveillance system and response. |** H-EDRM-P&C | African Region | Cabo Verde | Year_Deadline: 2021 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

421. **¶Build capacity to detect and respond to health security events. |** H-EDRM-P&C | Western Pacific Region | Cambodia | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

422. **¶Promote surveillance of epidemiologic tendencies at the different levels of the health pyramid. |** H-EDRM-P&C | African Region | Cameroon | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

423. **¶Implement the International Health Regulation. |** H-EDRM-P&C | African Region | Cameroon | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

424. **¶Implement the WHO programme for the management of health emergency situations at country level. |** H-EDRM-P&C | African Region | Cameroon | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

425. **¶Support the country for the effective implementation of the plan for the eradication of polio. |** H-EDRM-P&C | African Region | Cameroon | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

426. **¶Strengthen the system of surveillance and response to priority epidemic-prone diseases (Integrated Disease Surveillance and Response). |** H-EDRM-P&C | African Region | Central African Republic | Year_Deadline: 2017 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

427. **¶Strengthen surveillance and achieve the required immunity threshold in the population to interrupt transmission of poliomyelitis. |** H-EDRM-P&C | African Region | Central African Republic | Year_Deadline: 2017 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

428. **¶Implement operational plans in line with WHO recommendations on strengthening resilience and national preparedness with respect to: (i) epidemic and emerging diseases; (ii) support for disease control and the prevention, treatment and surveillance of pand |** H-EDRM-P&C | African Region | Chad | Year_Deadline: 2013 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

429. **¶Improve risk warning and emergency response capabilities. |** H-EDRM-P&C | Western Pacific Region | China | Year_Deadline: 2026 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

430. **¶Development contingency plans to manage emergencies and disasters, including epidemics of emerging diseases. |** H-EDRM-P&C | African Region | Congo | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

431. **¶Build capacity to detect, prepare for and respond to public health emergencies under International Health Regulations IHR (2005). |** H-EDRM-P&C | Western Pacific Region | Cook Islands | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

432. **¶Support national efforts to implement IHR. |** H-EDRM-P&C | African Region | Côte D'Ivoire | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

433. **¶Maintain gains made towards certification of polio eradication |** H-EDRM-P&C | African Region | Côte D'Ivoire | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

434. **¶Strengthen national capacities for health risk management, including prevention, preparedness, action and recovery. |** H-EDRM-P&C | African Region | Côte D'Ivoire | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

435. **¶Support the different components of health surveillance. |** H-EDRM-P&C | Region of the Americas | Cuba | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

436. **¶Support the implementation of IHR. |** H-EDRM-P&C | Region of the Americas | Cuba | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

437. **¶Strengthen capacity to address Climate change and health impacts. |** H-EDRM-P&C | Region of the Americas | Dominica | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

438. **¶Strengthen capacity to address health emergencies and environmental threats and risks. |** H-EDRM-P&C | Region of the Americas | Dominica | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

439. **¶Strengthen capacity to address disaster management and risks. |** H-EDRM-P&C | Region of the Americas | Dominica | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

440. **¶Strengthen mechanisms for coordination and humanitarian assistance for health in disasters. |** H-EDRM-P&C | Region of the Americas | Dominican Republic | Year_Deadline: 2017 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

441. **¶Contribute to the development and maintenance of the basic capacities of the International Health Regulations and the strengthening of monitoring, evaluation and notification of public health events of national and international importance. |** H-EDRM-P&C | Region of the Americas | Ecuador | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

442. **¶Supporting the national laboratory system in detecting and characterizing pathogens causing epidemic disease, including both known and novel threats. |** H-EDRM-P&C | Eastern Mediterranean Region | Egypt | Year_Deadline: 2014 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

443. **¶Develop strategic prevention and control plan for zoonotic disease using the one health approach. |** H-EDRM-P&C | Eastern Mediterranean Region | Egypt | Year_Deadline: 2014 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

444. **¶Strengthen IHR public health core capacities at designated points of entry in country. |** H-EDRM-P&C | Eastern Mediterranean Region | Egypt | Year_Deadline: 2014 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

445. **¶Develop migrant sensitive health policies that incorporate a public health approach and equitable access to health services to refugees and migrants without discrimination or stigmatization. |** H-EDRM-P&C

| Eastern Mediterranean Region | Egypt | Year_Deadline: 2014 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

446. **¶Support long-term intersectoral strategy to prevent and control infectious diseases and events. |** H-EDRM-P&C | African Region | Eritrea | Year_Deadline: 2021 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

447. **¶Enhance preparedness for public health emergency. |** H-EDRM-P&C | African Region | Ethiopia | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

448. **¶Strengthen disease surveillance systems at national and subnational levels. |** H-EDRM-P&C | African Region | Ethiopia | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

449. **¶Detect, assess and respond to common epidemic-prone diseases, and establish arrangements with regional partners for early technical assistance in the event of a transnational threat or disaster. |** H-EDRM-P&C | Western Pacific Region | Fiji | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

450. **¶Promote the minimum core capacities required by the International Health Regulations (2005) for all-hazard alert and response. |** H-EDRM-P&C | African Region | Gabon | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

451. **¶Support national efforts in implementing the minimum core capacities required by the International Health Regulations (2005) for all-hazard alert and response. |** H-EDRM-P&C | African Region | Gambia | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

452. **¶Contribute to attainment of IHR (2005) minimum core capacities for all-hazard alert and response. |** H-EDRM-P&C | African Region | Ghana | Year_Deadline: 2018 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

453. **¶Strengthen capacity to address climate change and health impacts. |** H-EDRM-P&C | Region of the Americas | Grenada | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

454. **¶Strengthen capacity to address health emergencies and environmental threats and risks. |** H-EDRM-P&C | Region of the Americas | Grenada | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

455. **¶Strengthen capacity to address disaster management and risks. |** H-EDRM-P&C | Region of the Americas | Grenada | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

456. **¶Support implementation of activities in connection with the national IHR plan. |** H-EDRM-P&C | African Region | Guinea-Bissau | Year_Deadline: 2016 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

457. **¶Improve capacity to respond to new, emerging and re-emerging diseases and emergencies |** H-EDRM-P&C | Region of the Americas | Guyana | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

458. **¶Support assessment of IHR core capacity and facilitation of development of national and subnational IHR plans. |** H-EDRM-P&C | South-East Asia Region | India | Year_Deadline: 2023 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

459. **¶Strengthen emergency preparedness and post disaster response. |** H-EDRM-P&C | South-East Asia Region | Indonesia | Year_Deadline: 2019 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

460. **¶Improve cross-border coordination, particularly for communicable disease control. |** H-EDRM-P&C | Eastern Mediterranean Region | Iran (Islamic Republic of) | Year_Deadline: 2014 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

461. **¶Strengthen implementation of the International Health Regulations |** H-EDRM-P&C | Eastern Mediterranean Region | Iran (Islamic Republic of) | Year_Deadline: 2014 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

462. **¶Improve international health regulations. |** H-EDRM-P&C | European Region | Israel | Year_Deadline: 2025 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

463. **¶Strengthen prevention, preparedness for, response to and recovery from all emergencies: acute public health events and disasters |** H-EDRM-P&C | European Region | Israel | Year_Deadline: 2025 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

464. **¶Assess critical gaps in preparedness for health emergencies, including in core capacities under the International Health Regulations (2005) and in capacities for all-hazard health emergency risk management. |** H-EDRM-P&C | Eastern Mediterranean Region | Jordan | Year_Deadline: 2019 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

465. **¶Establishing mechanisms of response for emerging, re-emerging and established epidemic-prone diseases /conditions. |** H-EDRM-P&C | African Region | Kenya | Year_Deadline: 2019 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

466. **¶Enhance national International Health Regulations (2005) core capacities. |** H-EDRM-P&C | Western Pacific Region | Kiribati | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

467. **¶Plan interventions to prevent and cope with negative impacts of climate change on health, including water and food safety. |** H-EDRM-P&C | Western Pacific Region | Kiribati | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

468. **¶Implement national work plan for emerging infectious diseases and public health emergencies 2016–2020. |** H-EDRM-P&C | Western Pacific Region | Lao People's Democratic Republic | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

469. **¶Coordinate joint action for health activities. |** H-EDRM-P&C | African Region | Liberia | Year_Deadline: 2011 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

470. **¶Fill critical gaps in health response, including gender-based violence. |** H-EDRM-P&C | African Region | Liberia | Year_Deadline: 2011 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

471. **¶Strengthen the engagement of the health sector with national and state systems and organizations responsible for disaster risk management, ensuring sufficient ongoing IHR (2005) capacities. |** H-EDRM-P&C | Western Pacific Region | Malaysia | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

472. **¶Support implementation of recommendations of JEE evaluation and build national capacity to attain and sustain IHR core capacity. |** H-EDRM-P&C | South-East Asia Region | Maldives | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

473. **¶Strengthen surveillance and response capacities for epidemics: technical support to implement the International Health Regulations; surveillance and prevention of noncommunicable diseases. |** H-EDRM-P&C | African Region | Mali | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

474. **¶Collaborate to achieve IHR (2005) core capacities. |** H-EDRM-P&C | Western Pacific Region | Marshall Islands | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

475. **¶Strengthen integrated disease surveillance capacities and preparedness and response to epidemics, and implement the International Health Regulations (IHR 2005) |** H-EDRM-P&C | African Region | Mauritania | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

476. **¶Implement national preparedness plan, incorporating the medical and non-medical response. |** H-EDRM-P&C | African Region | Mauritius | Year_Deadline: 2019 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

477. **¶Develop Standard Operating Procedures for implementation of events based surveillance. |** H-EDRM-P&C | African Region | Mauritius | Year_Deadline: 2019 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

478. **¶Consolidate inter-sectorial actions on health promotion, disease and injury prevention. |** H-EDRM-P&C | Region of the Americas | Mexico | Year_Deadline: 2018 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

479. **¶Strengthen interventions for protection against health risks. |** H-EDRM-P&C | Region of the Americas | Mexico | Year_Deadline: 2018 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

480. **¶Promote an incident management system for coordinated response capacity and establish links between the International Health Regulations (2005) national focal point, the emergency operations centre , and non-health sector centre and WHO centre. |** H-EDRM-P&C | Western Pacific Region | Mongolia | Year_Deadline: 2021 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

481. **¶Implement assessment of health risks related to environmental degradation and climate change, as well as the standardization and control of population exposure thresholds to these risks. |** H-EDRM-P&C | Eastern Mediterranean Region | Morocco | Year_Deadline: 2027 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

482. **¶Strengthen capacity building for the implementation of the International Health Regulation (IHR) and preparedness for health emergencies. |** H-EDRM-P&C | Eastern Mediterranean Region | Morocco | Year_Deadline: 2027 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

483. **¶Strengthen key capabilities of the International Health Regulations. |** H-EDRM-P&C | African Region | Mozambique | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

484. **¶Strengthen system resilience for public health emergencies, including cross-border control. |** H-EDRM-P&C | African Region | Mozambique | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

485. **¶Enhance preparedness, surveillance and response for disasters and health emergencies. |** H-EDRM-P&C | South-East Asia Region | Myanmar | Year_Deadline: 2018 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

486. **¶Strengthen health cluster coordination in collaboration with Ministry of Health & Sports. |** H-EDRM-P&C | South-East Asia Region | Myanmar | Year_Deadline: 2018 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

487. **¶Enhance capacity for disaster risk assessment, reduction, preparedness, response and early recovery and strengthen health emergency coordination mechanisms at all levels. |** H-EDRM-P&C | African Region | Namibia | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

488. **¶Build core capacity for IHR (2005) requirements. |** H-EDRM-P&C | African Region | Namibia | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

489. **¶Enhance the national capacity for managing health security threats, using an all-hazard approach, and building resilient health systems at federal and subnational levels. |** H-EDRM-P&C | South-East Asia Region | Nepal | Year_Deadline: 2027 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

490. **¶Develop basic capacities for compliance with the International Health Regulations. |** H-EDRM-P&C | Region of the Americas | Nicaragua | Year_Deadline: 2021 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

491. **¶Support prevention, preparedness and response to epidemics and disaster management: capacity-building for resilience and suitable preparedness for quick, predictable and effective interventions in response to large-scale epidemics or pandemics; capacity t |** H-EDRM-P&C | African Region |

Niger | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

492. **¶National IHR focal point functions under IHR. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2021 | WHO - International Health Regulations (2005): State Party Self-assessment annual reporting tool, second edition. Accessed: 14 April 2024. https://iris.who.int/rest/bitstreams/1400382/retrieve

493. **¶Multi-sectoral IHR coordination mechanisms. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2021 | WHO - International Health Regulations (2005): State Party Self-assessment annual reporting tool, second edition. Accessed: 14 April 2024. https://iris.who.int/rest/bitstreams/1400382/retrieve

494. **¶Planning for emergency preparedness and response mechanism. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2021 | WHO - International Health Regulations (2005): State Party Self-assessment annual reporting tool, second edition. Accessed: 14 April 2024. https://iris.who.int/rest/bitstreams/1400382/retrieve

495. **¶Management of health emergency response operation. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2021 | WHO - International Health Regulations (2005): State Party Self-assessment annual reporting tool, second edition. Accessed: 14 April 2024. https://iris.who.int/rest/bitstreams/1400382/retrieve

496. **¶Emergency resource mobilization. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2021 | WHO - International Health Regulations (2005): State Party Self-assessment annual reporting tool, second edition. Accessed: 14 April 2024. https://iris.who.int/rest/bitstreams/1400382/retrieve

497. **¶Plan of minimum capacities of States Parties to fulfil the IHR. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496

498. **¶Temporary recommendations for health measures implemented by the State Party in the event of emergencies of international concern. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496

499. **¶Permanent recommendations of health measures for periodic or routine application to prevent the spread of diseases. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496

500. **¶Access to and availability of health products, technologies and knowledge. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2023 | WHO - Report of the Review Committee regarding amendments to the International Health Regulations (2005). Accessed: 27 January 2024. https://apps.who.int/gb/wgihr/pdf_files/wgihr2/A_WGIHR2_5-en.pdf

501. **¶Recommendations concerning persons, baggage, cargo, containers, means of transport, goods and postal parcels. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496

502. **¶National coordination mechanisms. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2023 | WHO - Report of the Review Committee regarding amendments to the International Health Regulations (2005). Accessed: 27 January 2024. https://apps.who.int/gb/wgihr/pdf_files/wgihr2/A_WGIHR2_5-en.pdf

503. **¶Bilateral, regional, multilateral and international co-operation. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

504. **¶Equitable geographical distribution of global product production. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

505. **¶Public health, intellectual property and trade. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

506. **¶Production of pre-pandemic and pandemic diagnostics, vaccines and therapies. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

507. **¶Licensing or technology transfer agreements. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

508. **¶Transfer of technical, scientific and legal knowledge and technology between States Parties. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

509. **¶Risk-based demand analysis, with methodologies for estimating the need for medical products. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

510. **¶Affirmation of institutional responsibilities for leadership, coordination and response to health emergencies. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

511. **¶Quality assurance mechanisms and processes for emergency surge capacities. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

512. **¶Trusted leadership in health emergencies incorporated into the competent national structure. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

513. **¶National planning informed by dynamic and holistic capacity assessments, based on evolving capabilities and vulnerabilities. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

514. **¶Prioritised action and readiness plans to achieve the strategic objectives. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

515. **¶Operational and service delivery plans integrated with existing strategies and programmes. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

516. **¶Costing operational plans and estimating resource requirements. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

517. **¶Multisectoral response coordination mechanism established and coordination infrastructure - Public health emergency operations centres. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline:

2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

518. **¶Evidence-based multisectoral emergency response plans and technical strategies for operational response. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

519. **¶Plans and procedures for responding to multiple risks with a definition of roles, responsibilities, systems and mechanisms for response. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

520. **¶Planning for expanded surveillance, contact tracing, quarantine and isolation, allowing for evidence-based and risk-based calibration of public health social measures. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

521. **¶Contingency plan at Entry Points in the region: communication strategy, infrastructure, sorting equipment, PPE, and qualified personnel available. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

522. **¶Contingency plans to increase the availability of healthcare components, design systems to manage the flow of admissions and provide quality services (hospitals). |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

523. **¶Contingency plans for the rapid expansion of infrastructure through makeshift hospitals, quarantine and isolation centres. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

524. **¶Emergency response plan for the family/community. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2019 | PAHO - Guidance Note on Health Disaster Risk Management with Indigenous Peoples. Accessed: 13 April 2024. https://iris.paho.org/handle/10665.2/51383

525. **¶Particularities of indigenous peoples in situations of vulnerability. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2019 | PAHO - Guidance Note on Health Disaster Risk Management with Indigenous Peoples. Accessed: 13 April 2024. https://iris.paho.org/handle/10665.2/51383

526. **¶Planning considering the social, physical and economic systems of the community. |** H-EDRM-P&C | not applicable | not applicable | Year_Deadline: 2019 | PAHO - Guidance Note on Health Disaster Risk Management with Indigenous Peoples. Accessed: 13 April 2024. https://iris.paho.org/handle/10665.2/51383

527. **¶Strengthen the core capacity of the International Health Regulations, 2005 (IHR) in surveillance, biosafety/biosecurity, points of entry, laboratory quality management, infection control and chemical/radiological events. |** H-EDRM-P&C | Eastern Mediterranean Region | Oman | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

528. **¶Promote technical Guidance to strengthen and improve preparedness and response plans for all hazards |** H-EDRM-P&C | Eastern Mediterranean Region | Oman | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

529. **¶Implement strategy for emerging diseases and public health emergencies and disaster risk management for health. |** H-EDRM-P&C | Western Pacific Region | Philippines | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

530. **¶Ensure core capacities developed under IHR (2005) are sustained over time. |** H-EDRM-P&C | Western Pacific Region | Philippines | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

531. **¶Support the national health cluster response in emergency situations following natural and human-induced disasters. |** H-EDRM-P&C | Western Pacific Region | Philippines | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

532. **¶Advocate for so-called green health-care facilities and the reduction of carbon emissions, and support the Government in anticipating and addressing risks associated with climate change. |** H-EDRM-P&C | Western Pacific Region | Philippines | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

533. **¶Enhance national core capacities under the International Health Regulations and implementing the Post JEE National action plan. |** H-EDRM-P&C | Eastern Mediterranean Region | Qatar | Year_Deadline: 2018 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

534. **¶Support implementation of International Health Regulations (IHR 2005) to strengthen national preparedness in detection and response to public health event of international concerns. |** H-EDRM-P&C | Western Pacific Region | Republic of Korea | Year_Deadline: 2023 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

535. **¶Utilize regional strategy for emerging diseases and public health emergencies, as a framework for building national capacity to detect, prepare for and respond to public health emergencies under International Health Regulations (2005). |** H-EDRM-P&C | Western Pacific Region | Samoa | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

536. **¶Review and test disaster risk management plans through simulation exercises. |** H-EDRM-P&C | Western Pacific Region | Samoa | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

537. **¶Maintain vigilant surveillance to prevent and control communicable diseases, such as MERS-CoV and during mass gatherings. |** H-EDRM-P&C | Eastern Mediterranean Region | Saudi Arabia | Year_Deadline: 2021 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

538. **¶Support management of interventions offering additional protection against epidemic- and pandemic-prone diseases through effective surveillance. |** H-EDRM-P&C | African Region | Senegal | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

539. **¶Support preparedness and management of crises and emergencies under International Health Regulations (2005). |** H-EDRM-P&C | African Region | Senegal | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

540. **¶Strengthen the national capacity to prevent, detect and respond to health security threats in line with the International Health Regulations (IHR) |** H-EDRM-P&C | African Region | Seychelles | Year_Deadline: 2021 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

541. **¶Support achievement of IHR core capacities, including the nationwide establishment of integrated disease surveillance and response system for infectious diseases and other disease threats. |** H-EDRM-P&C | African Region | Sierra Leone | Year_Deadline: 2021 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

542. **¶Support the development and implementation of preparedness and response measures for public health risks associated with disasters. |** H-EDRM-P&C | African Region | Sierra Leone | Year_Deadline: 2021 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

543. **¶Support coordination, preparedness and response by developing/refining standard operating procedures. |** H-EDRM-P&C | Western Pacific Region | Solomon Islands | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

544. **¶Prevent, detect and respond to public health threats considering the International Health Regulations (IHR). |** H-EDRM-P&C | South-East Asia Region | Sri Lanka | Year_Deadline: 2023 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

545. **¶Support accelerated implementation of the International Health Regulations (2005). |** H-EDRM-P&C | Eastern Mediterranean Region | Sudan | Year_Deadline: 2017 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

546. **¶Improve management of emergencies and disasters. |** H-EDRM-P&C | Region of the Americas | Suriname | Year_Deadline: 2016 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

547. **¶Cooperate with WHO in the area of disease surveillance, early and rapid alert, risk assessment and response. |** H-EDRM-P&C | European Region | Switzerland | Year_Deadline: 2018 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

548. **¶Support simulation exercises and community preparedness. |** H-EDRM-P&C | Eastern Mediterranean Region | Syrian Arab Republic | Year_Deadline: 2013 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

549. **¶Identify, analyse and prioritize gaps and strategic actions and take essential steps by all relevant partners to boost and sustain PHE capacities at national and provincial levels. |** H-EDRM-P&C | South-East Asia Region | Thailand | Year_Deadline: 2026 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

550. **¶Enhance IHR core capacity, including coordination, points of entry and quarantine. |** H-EDRM-P&C | South-East Asia Region | Timor-Leste | Year_Deadline: 2025 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

551. **¶Develop national plans and core capacities for all-hazards health emergency preparedness and disaster risk management. |** H-EDRM-P&C | Western Pacific Region | Tonga | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

552. **¶Support national efforts to meet the required core capacities of the International Health Regulations. |** H-EDRM-P&C | Region of the Americas | Trinidad and Tobago | Year_Deadline: 2021 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

553. **¶Strengthen the capacity of the system to deal with humanitarian emergencies, particularly in risk areas, by developing and/or completing contingency plans, ensuring their dissemination and facilitating the provision of available resources. |** H-EDRM-P&C | Eastern Mediterranean Region | Tunisia | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

554. **¶Build core capacities required for IHR (2005) in Ministry of Health, Community Development, Gender, Elderly and Children, and local government authorities, for all-hazard alert and response. |** H-EDRM-P&C | African Region | United Republic of Tanzania | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

555. **¶Coordinate national health clusters in emergencies and strengthen response, recovery, and preparedness plans and procedures. |** H-EDRM-P&C | Western Pacific Region | Vanuatu | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

556. **¶Improve alert and response capacities through strengthened coordination mechanisms, and maintenance of IHR core capacities including Port Health capacities. |** H-EDRM-P&C | African Region | Zambia | Year_Deadline: 2021 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

557. **¶Support efforts to reduce risks to food safety through development and implementation of food safety standards and guidelines; and enhanced multi-sectoral collaboration. |** H-EDRM-P&C | African Region | Zambia | Year_Deadline: 2021 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

558. **¶Improve alert and response capacities through strengthened coordination mechanisms, IHR (2005) and the development and maintenance of IHR core-capacities including Port Health capacities. |** H-

EDRM-P&C | African Region | Zimbabwe | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

559. ¶**Improve capacity for emergency risk and crisis management. |** H-EDRM-P&C | African Region | Zimbabwe | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

560. ¶**Support efforts to reduce risks to food safety. |** H-EDRM-P&C | African Region | Zimbabwe | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

9 - H-EDRM-PSL - POLICIES, STRATEGIES, AND LEGISLATION

561. **¶Advocate for International Humanitarian Law (IHL) in regards to attacks on health facilities and healthcare workers. |** H-EDRM-PSL | Eastern Mediterranean Region | Afghanistan | Year_Deadline: 2019 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

562. **¶Strengthen core capacities for IHR (2005) implementation based on recommendations of the Joint External Evaluation for detection of Public Health Emergencies of International Concern (PHEICs), risk assessment and risk communication. |** H-EDRM-PSL | Eastern Mediterranean Region | Afghanistan | Year_Deadline: 2019 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

563. **¶STI/HIV/AIDS - Support the development and implementation of specific strategies for child and adolescent health. |** H-EDRM-PSL | African Region | Algeria | Year_Deadline: 2019 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

564. **¶Develop an epidemic and disaster risk management policy and strategy, and national capacity-building for appropriate risk management. |** H-EDRM-PSL | African Region | Angola | Year_Deadline: 2019 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

565. **¶Evaluation of national capacity for risk management, risk mapping, strengthening of early warning mechanisms, preparation and appropriate response to emergencies and disasters at the provincial level and in areas on the border with neighbouring countries. |** H-EDRM-PSL | African Region | Angola | Year_Deadline: 2019 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

566. **¶Strengthen national systems against infectious disease threats and support regional emergency preparedness, surveillance and response including compliance with the International Health Regulations (2005) and the regional implementation of the WHO Health E |** H-EDRM-PSL | Western Pacific Region | Australia | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

567. **¶Support the development of national policy on emergencies, and mechanisms to coordinate emergency and humanitarian aid interventions. |** H-EDRM-PSL | African Region | Congo | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

568. **¶Address the environmental determinants of health, human security and reduce vulnerability to imminent emergencies and disasters with the aim of improving the health status and quality of life. |** H-EDRM-PSL | Region of the Americas | Honduras | Year_Deadline: 2013 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

569. **¶Develop policy, strategies and technical guidance, information management, communication and operational systems needed at all levels to detect, verify, assess /coordinate the response to important public health hazards, risks and events according to 2005 |** H-EDRM-PSL | African Region | Kenya | Year_Deadline: 2019 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

570. **¶Strengthen health-system adaptation to climate change by developing legal and institutional frameworks and developing the capacities of regional water and sanitation structures. |** H-EDRM-PSL | African Region | Mauritania | Year_Deadline: 2015 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

571. **¶Support the review and development of legislation and policies that are required to enable the country to strengthen its capacity to fulfil its obligation as per the International Health Regulations 2005. |** H-EDRM-PSL | South-East Asia Region | Nepal | Year_Deadline: 2027 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

572. **¶Legislation, laws, regulations, policy, administrative requirements or other government instruments to implement the IHR (2005). |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2021 | WHO - International Health Regulations (2005): State Party Self-assessment annual reporting tool, second edition. Accessed: 14 April 2024. https://iris.who.int/rest/bitstreams/1400382/retrieve

573. **¶Financing for the implementation of IHR capacities. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2021 | WHO - International Health Regulations (2005): State Party Self-assessment annual reporting tool, second edition. Accessed: 14 April 2024. https://iris.who.int/rest/bitstreams/1400382/retrieve

574. **¶Financing mechanism and funds for the timely response to public health emergencies. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2021 | WHO - International Health Regulations (2005): State Party Self-assessment annual reporting tool, second edition. Accessed: 14 April 2024. https://iris.who.int/rest/bitstreams/1400382/retrieve

575. **¶Collaborative effort on activities to address zoonoses. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2021 | WHO - International Health Regulations (2005): State Party Self-assessment annual reporting tool, second edition. Accessed: 14 April 2024. https://iris.who.int/rest/bitstreams/1400382/retrieve

576. **¶National legislation and the State Party's international obligations to implement the IHR. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496

577. **¶Secrecy and anonymised processing of personal data, as required by national legislation. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496

578. **¶Land border capabilities plan. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496

579. **¶Bills and other legal and administrative provisions. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496

580. **¶Coherence between health and trade policies, starting with greater integration with the WTO to prioritise public health. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2023 | WHO - Report of the Review Committee regarding amendments to the International Health Regulations (2005). Accessed: 27 January 2024. https://apps.who.int/gb/wgihr/pdf_files/wgihr2/A_WGIHR2_5-en.pdf

581. **¶Comprehensive, inclusive, multi-sectoral and resourced national plans and strategies. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

582. **¶One Health Approach. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

583. **¶Universal health coverage. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

584. **¶Rehabilitation and recovery strategies for the post-pandemic health system. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

585. **¶Geographically diverse capacities and institutions for research and development. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

586. **¶Co-creation of technology and joint venture, in collaboration with scientists and/or research centres. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

587. **¶Clinical trial policies. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

588. **¶Waiver of royalties on the use of technology for the production of products. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

589. **¶Regulatory approvals and authorisations, guaranteeing the quality, safety and efficacy of products. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

590. **¶Legal, administrative and financial structures to support emergency regulatory approvals. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

591. **¶Management of indemnities and liability for compensation for damage caused by vaccines without fault. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

592. **¶Cooperation with competent international and regional intergovernmental organisations in the formulation of effective measures, procedures and guidelines, based on scientific evidence and fulfilling the human rights of all people. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

593. **¶Comprehensive national plans - pre, post and inter-pandemic. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

594. **¶Social, environmental and economic determinants of health and the conditions of vulnerability that contribute to the emergence and spread of pandemics. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

595. **¶Multisectoral capacities at the intersection of health security, primary health care and health promotion. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

596. **¶Risk-based biosafety guidelines, standards and regulations for the safe sharing of samples, reagents, pathogens, materials and genetic sequence data. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

597. **¶Legislation and policies for patient and workforce safety, with specific risk standards and best practices for assessment, infrastructure planning and service design. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

598. **¶Access to countermeasures in an integrated preparedness and response system linked to collaborative surveillance, safe and scalable clinical care, community protection and emergency coordination. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

599. **¶Adaptable manufacturing regulatory requirements and procedures during emergencies. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

600. **¶National policies to implement pre-negotiated technology transfer, access and benefit sharing, licence agreements and financing. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

601. **¶Policy on the use of medical countermeasures guided by available scientific evidence. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

602. **¶Response to Public Health Emergencies raised to the level of heads of state and government. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

603. **¶Resources, regulatory and administrative changes. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

604. **¶PHE integrated into multisectoral policies, actions and practices, as national risk reduction strategies. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

605. **¶Regulatory controls for public and private sector management institutions, including health institutions and agencies. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

606. **¶Regulations that become applicable during emergencies to speed up the licensing of diagnostic kits, medicines and vaccines and emergency accreditation of workforces and facilities - in accordance with national policy and standards. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

607. **¶International agreements and collaborations for cross-border immunisation, surveillance, vaccine efficacy studies and information sharing. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

608. **¶Regulatory and negotiated processes to involve the private sector in accessing additional resources for PHE. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

609. **¶Regulations and legal frameworks to enforce infection prevention and control requirements and policies, supported by accreditation systems or other mechanisms. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

610. **¶Public-private partnership. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

611. **¶Regional Health Emergency Council in line with the Global Health Emergency Council. |** H-EDRM-PSL | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

612. **¶Support efficient and effective regulatory capacity, procurement, and management of supplies and logistics. |** H-EDRM-PSL | Western Pacific Region | Philippines | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

613. **¶Ensure the availability of relevant policies, strategies and capacities for disaster risk management (DRM) in the health sector. |** H-EDRM-PSL | African Region | Rwanda | Year_Deadline: 2018 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

614. **¶Strengthen the social determinants of health. |** H-EDRM-PSL | Region of the Americas | Suriname | Year_Deadline: 2016 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

615. **¶Review, develop and update legislation, policies and guidelines in accordance with International Health Regulations (2005). |** H-EDRM-PSL | Western Pacific Region | Vanuatu | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

10 - H-EDRM-RC - RISK COMMUNICATION

616. **Strengthen advocacy and risk communication on communicable diseases. |** H-EDRM-RC | South-East Asia Region | Bhutan | Year_Deadline: 2024 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

617. **Develop risk communication strategy during outbreaks, epidemic and pandemic. |** H-EDRM-RC | Eastern Mediterranean Region | Egypt | Year_Deadline: 2014 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

618. **Strengthen public health emergency response system and the public health emergency risk communication. |** H-EDRM-RC | African Region | Ethiopia | Year_Deadline: 2020 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

619. **Establish a risk communication system with the capacity to manage public, internal and partner communication for all phases of public health emergencies. |** H-EDRM-RC | Western Pacific Region | Micronesia (Federated States of) | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

620. **Strengthen the mechanisms and platforms for coordination and collaboration among relevant stakeholders for risk communication and community engagement with evidence-based infodemic management. |** H-EDRM-RC | South-East Asia Region | Nepal | Year_Deadline: 2027 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

621. **Capacity for emergency risk communications. |** H-EDRM-RC | not applicable | not applicable | Year_Deadline: 2021 | WHO - International Health Regulations (2005): State Party Self-assessment annual reporting tool, second edition. Accessed: 14 April 2024. https://iris.who.int/rest/bitstreams/1400382/retrieve

622. **Communication plan with hospitals, clinics, ports, airports, land border crossings, laboratories, and other areas to disseminate information and recommendations. |** H-EDRM-RC | not applicable | not applicable | Year_Deadline: 2016 | WHO - International Health Regulations Third Edition (2005). Accessed: 5 March 2024. https://www.who.int/publications/i/item/9789241580496

623. **Communication of relevant information to the WHO, based on public health risk events (scientific and epidemiological information). |** H-EDRM-RC | not applicable | not applicable | Year_Deadline: 2023 | WHO - Report of the Review Committee regarding amendments to the International Health Regulations (2005). Accessed: 27 January 2024. https://apps.who.int/gb/wgihr/pdf_files/wgihr2/A_WGIHR2_5-en.pdf

624. **Science, public health and the population's knowledge of pandemics, based on scientific evidence for effective and timely risk assessment and public communication. |** H-EDRM-RC | not applicable | not applicable | Year_Deadline: 2023 | WHO - Proposal for negotiating text of the WHO Pandemic Agreement. Accessed: 27 January 2024. https://apps.who.int/gb/inb/pdf_files/inb7/A_INB7_3-en.pdf

625. **Multi-sector data sources, adapted to the target audiences and the national or local context, to generate actionable insights. |** H-EDRM-RC | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

626. **Open communication with routinely published surveillance results. |** H-EDRM-RC | not applicable | not applicable | Year_Deadline: 2023 | WHO - Strengthening health emergency prevention, preparedness, response and resilience. Accessed: 27 January 2024. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/emergency-preparedness/who_hepr_wha2023-2

627. **Proactive communications with stakeholders at all levels, with feedback mechanisms. |** H-EDRM-RC | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

628. **Risk communication systems and the ability to enable timely and transparent communication, linked to surveillance, risk assessment and corrective measures. |** H-EDRM-RC | not applicable | not applicable | Year_Deadline: 2022 | WHO - Regional strategic roadmap on health security and health system resilience for emergencies 2023-2027. Accessed: 29 January 2024. https://www.who.int/publications/i/item/9789290209959

629. **Communication with the population through culturally appropriate channels; risk information available in all appropriate languages.** | H-EDRM-RC | not applicable | not applicable | Year_Deadline: 2019 | PAHO - Guidance Note on Health Disaster Risk Management with Indigenous Peoples. Accessed: 13 April 2024. https://iris.paho.org/handle/10665.2/51383

630. **Enhance core public health functions needed for early warning, incident management and risk communication.** | H-EDRM-RC | Western Pacific Region | Tonga | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

631. **Enhance the core public health functions needed for early warning, incident management and risk communication.** | H-EDRM-RC | Western Pacific Region | Tonga | Year_Deadline: 2022 | WHO - Country Cooperation Strategy. Accessed: 14 April 2024. https://www.who.int/countries/country-presence.

7 CAPÍTULO 7: ARTIGO 5 - Framework de apoio à decisão do gestor público de nível estratégico da saúde em emergências de saúde pública

- Artigo não publicado.
- Autores: Alex S. Príncipe, Ingrid Winkler, Cristiano V. Ferreira.
- Resumo: Os estudos sobre processos de decisão em situações de complexidade das emergências de saúde pública se intensificaram nos últimos 5 anos, pela ocorrência de eventos sanitários que desafiam os governos e sociedades, sobretudo a intenção de desenvolvimento de modelos mais adaptativos e iterativos a partir das capacidades e vulnerabilidades de um contexto. Este artigo tem como objetivo desenvolver um framework de produção de cenários para intervenções adaptadas ao nível de complexidade dos sistemas de saúde, por uma abordagem integrada da Dinâmica de Sistemas com o Framework Cynefin, capaz de posicionar o gestor público de nível estratégico da saúde em um caminho de transições sobre estados de complexidade da gestão nas emergências. O desenvolvimento do Framework de Apoio à Decisão em Emergência de Saúde (FADES) seguiu as etapas de revisão sistemática de literatura, pesquisa documental nas diretrizes da Organização Mundial da Saúde sobre condicionalidades dos países na gestão das emergências, e a realização de grupo focal com especialistas de saúde pública para analisar a proposta do modelo em uma série de artigos. O FADES foi aplicado ao caso do desabastecimento de oxigênio medicinal na cidade de Manaus, Amazonas, Brasil, na pandemia da COVID-19. Os resultados revelam que uma abordagem adaptativa das decisões está condicionada por um estado permanente de monitoramento dos determinantes da saúde, na interface do comportamento da doença com os limites do sistema de saúde.

Article

Framework de apoio à decisão em Emergência de Saúde (FADES)

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Resumo: Os estudos sobre processos de decisão em situações de complexidade das emergências de saúde pública se intensificaram nos últimos 5 anos, pela ocorrência de eventos sanitários que desafiam os governos e sociedades, sobretudo a intenção de desenvolvimento de modelos mais adaptativos e iterativos a partir das capacidades e vulnerabilidades de um contexto. Este artigo tem como objetivo desenvolver um framework de produção de cenários para intervenções adaptadas ao nível de complexidade dos sistemas de saúde, por uma abordagem integrada da Dinâmica de Sistemas com o Framework Cynefin, capaz de posicionar o gestor público de nível estratégico da saúde em um caminho de transições sobre estados de complexidade da gestão nas emergências. O desenvolvimento do Framework de Apoio à Decisão em Emergência de Saúde (FADES) seguiu as etapas de revisão sistemática de literatura, pesquisa documental nas diretrizes da Organização Mundial da Saúde sobre condicionalidades dos países na gestão das emergências, e a realização de grupo focal com especialistas de saúde pública para analisar a proposta do modelo em uma série de artigos. O FADES foi aplicado ao caso do desabastecimento de oxigênio medicinal na cidade de Manaus, Amazonas, Brasil, na pandemia da Covid-19. Os resultados revelam que uma abordagem adaptativa das decisões está condicionada por um estado permanente de monitoramento dos determinantes da saúde, na interface do comportamento da doença com os limites do sistema de saúde.

Keywords: Tomada de decisão; emergência de saúde pública; sistemas complexos; Dinâmica de Sistemas; Cynefin Framework; Covid-19.

Citation: To be added by editorial staff during production.

Academic Editor: Firstname Lastname

Received: date
Revised: date
Accepted: date
Published: date

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1. Introdução

A emergência de saúde pública (ESP) é um evento complexo que exige ação coordenada dos países diante de um risco que afeta adversamente a vida das populações em âmbito local ou internacional (WHO, 2016a), e que compromete a resiliência da sociedade. Governos e instituições responsáveis pelo processo de decisão lidam com interrupções da cadeia de suprimentos, com a urgência de novas formas de trabalho e segurança do trabalhador, implementação de planos de contingência, estratégias de comunicação em massa e limitação financeira causada pela redução de receitas, o que exige gerenciar os riscos emergentes em resposta à crise, como aconteceu na pandemia de Covid-19 (Yahia-Marzouk; Jin, 2023). Essa pandemia decretada pela Organização Mundial da Saúde (OMS), em 2020, gerou mais de 7 milhões de mortes no mundo, comprometeu a expectativa de vida ao nascer e de vida saudável, e estagnou os avanços nos Objetivos de Desenvolvimento Sustentável (ODS), com impactos desiguais conforme a realidade de cada nação (WHO, 2024).

A economia registrou recessões, perdas de empregos e desaceleração no crescimento, sendo a vacinação em massa a chave para superar essa pandemia e as consequências

econômicas, mas essa estratégia encontrou desafios de acesso equitativo e limites dos centros de produção (Sachs *et al.*, 2022). Uma emergência de saúde pública (ESP) configura um contexto de incertezas para os tomadores de decisão e formuladores de políticas, pela sobrecarga de informações, desafios transversais, interdependências e interações complexas que integram diferentes áreas e exigem novos modelos e capacidades estratégicas e operacionais (Habegger, 2010).

A decisão na ESP acontece em contexto não-linear, que exige uma abordagem iterativa vai além de uma simples relação de causa e efeito e considera descontinuidades, bifurcações, ruídos e paradoxos nos processos de decisão subjacentes à emergência (Almeida Filho, 2006). Nesse ambiente, os frameworks de decisão atuam na interface do problema de saúde pública com as heurísticas e vieses do decisor, que direcionam escolhas e comportamentos (Kayman; Logar, 2016), exigindo um cálculo representativo dos componentes de uma realidade, considerando informações científicas, tecnológicas, políticas e de gestão disponíveis no intervalo de tempo da decisão, para atenuar a racionalidade limitada do decisor (Spiegel; Caulliraux, 2013) e amparar uma visão de futuro, uma produção de cenários que considere passado e futuro como condicionalidades de um presente em movimento, de construção de respostas, e que não é desafiado apenas por uma intervenção descontextualizada (Gadelha *et al.*, 2016).

A produção de cenários como exercício dinâmico simula a realidade para apoiar a decisão (Gomes; Gomes, 2019), e integra a abordagem de longo prazo, com geração de sentido na sociedade sobre os desafios da gestão no processo saúde-doença, que é transdisciplinar e incorpora diversidade, processos históricos e fragilidades da sociedade na caracterização de uma nova emergência (Almeida Filho, 2006). Neste sentido, o planejamento de longo prazo lida com a dinâmica dos sistemas, com as limitações do contexto e com o comportamento de indivíduos e grupos (Project Management Institute, 2014). Como dimensão estruturante da visão de futuro e da resposta às ESP e à efetividade das contramedidas adotadas para mitigação de risco, é mister considerar no cálculo da decisão os determinantes sociais da saúde, que representam as condições sociais, culturais, políticas, econômicas e ambientais onde as pessoas nascem, crescem, vivem, trabalham e envelhecem, integrando habitação, educação, emprego, renda e o ambiente físico e social (BIREME, 2023; WHO, 2021).

Os determinantes comerciais da saúde abrangem os efeitos positivos e negativos que as entidades comerciais têm sobre a saúde humana, considerando modelo de negócios, práticas e produtos, e atores de mercado, que podem comprometer a equidade com impacto direto nos sistemas de saúde (Friel *et al.*, 2023; Gilmore *et al.*, 2023). Para esse desafio, o poder do Estado tem papel definidor nas políticas públicas do sistema produtivo, como é o conceito do Complexo Econômico-Industrial da Saúde – CEIS no Brasil, uma visão sistêmica e interdependente da produção de recursos para a saúde que fortalece o desenvolvimento econômico e social, nos subsistemas de indústria, serviços e informação e conectividade (Gadelha, 2021).

Os estudos sobre as dinâmicas que compõem essa complexidade e são objetos de frameworks de apoio à decisão em ESP têm ampliado nos últimos anos por conta dos eventos registrados, como a epidemia de Ebola na África Ocidental (2013), Zika e Chikungunya (2014) em diversos países, Sarampo no Brasil (2018) e outras emergências causadas por condições extremas do clima e desastres ambientais (Carmo, 2020). Em 2020, a pandemia da Covid-19 registrou desafios de gestão em diferentes níveis de realidade, com sobrecarga do sistema de saúde diante de desigualdades sociais e econômicas, falta de investimento e estratégias de informação e comunicação dissonantes da necessidade de

integração e coordenação de uma crise sanitária, em abordagem mais abrangente e colaborativa (Portela; Reis; Lima, 2022).

Um estudo de revisão de literatura constatou que 73,27% das publicações sobre tomada de decisão em situações de ESP, nos últimos 5 anos, focaram em sistemas de apoio à decisão, teorias prospectivas e métodos multicritérios. Esses estudos abordaram desafios relacionados à falta de informações completas e precisas no início de eventos de saúde, à complexidade das emergências devido ao grande volume de dados e às opiniões conflitantes entre os envolvidos, bem como à consistência das decisões em grupo. Além disso, foram identificados desafios de aplicação prática de modelos algorítmicos e de transposição dos resultados teóricos para o mundo real, incluindo a necessidade de lidar com a incerteza, com dados quantitativos, qualitativos e linguísticos (Hou *et al.*, 2021). Modelos de tomada de decisão em ambientes de alto risco e tempo restrito registram terminologias divergentes, necessidade de lidar com mudanças rápidas e de intensificar métodos de feedback e aprendizado contínuo (Launder; Penney, 2023).

Em outra análise, políticas públicas podem perder a validade diante de dados emergentes ou consequências inesperadas, exigindo abordagem de tomada de decisão flexível e adaptativa, que acate a possibilidade de consequências imprevisíveis e desproporcionais das decisões em ambientes não-lineares, e possibilite intervenções a partir das características de um contexto, devido à alta dependência dos sistemas em suas condições iniciais e das regras dos agentes de decisão. Existem lacunas na concepção de modelos abrangentes do ciclo de intervenção de uma ESP, de preparação, prevenção, resposta e recuperação dos sistemas de saúde, com foco maior para intervenção e priorização durante a implementação. Registra-se a necessidade de avançar numa abordagem iterativa para avaliações cíclicas, visando melhorar o desempenho das decisões nas ESP (Warsame; Blanchet; Checchi, 2020).

Nesse sentido, o presente artigo tem o objetivo de desenvolver um framework de produção de cenários para intervenções adaptadas ao nível de complexidade dos sistemas de saúde, por uma abordagem integrada da Dinâmica de Sistemas (Sterman, 2000) com o Framework Cynefin (Snowden; Boone, 2007).

A Dinâmica de Sistemas (Sterman, 2000) é uma metodologia que explora futuros possíveis (Meadows, 2008), e permite compreender a estrutura e os padrões de mudança em sistemas complexos ao longo do tempo, considerando feedbacks, atrasos e interações entre diferentes variáveis, identificando como elas se influenciam mutuamente e como intervenções podem afetar o sistema na totalidade (Yearworth, 2020). O Framework Cynefin é uma estrutura que posiciona o decisor em um caminho de transições para decisão a partir de estados de complexidade, numa abordagem adaptativa do contexto, observando os domínios simples, complicado, complexo, caótico (Snowden; Boone, 2007).

2. Material e Métodos

O Framework de Apoio à Decisão em Emergência de Saúde (FADES) foi elaborado a partir de consultas às bases de conhecimento Web of Science, Scopus e Pubmed, selecionadas por serem bases de dados científicas respeitáveis, multidisciplinares e mundiais, com ampla cobertura de indexação de dados de publicações científicas, que resultaram em artigos desse grupo de estudo que embasam seu desenvolvimento, com análise do estado da arte de métodos e modelos de decisão em emergências de saúde pública (Príncipe *et al.*, 2023) e mapeamento de condicionalidades da gestão baseadas em diretrizes da OMS (Príncipe; Winkler; Ferreira, 2024).

A partir da fundamentação teórica, a estrutura analítica do modelo foi definida e avaliada por especialistas/gestores, pela realização de grupos focais. Os resultados, descritos no Apêndice 1, estão organizados por questão no formato Q00XX-C, com a seguinte identificação: (Q00) identifica a questão; (XX) identifica o participante; e (E) identifica o grupo focal exploratório; e (C) o grupo focal confirmatório.

O grupo focal exploratório abordou com os participantes a complexidade das decisões relacionadas à dimensão cognitiva e à racionalidade limitada do decisor (Spiegel; Caulliraux, 2013), o modelo de Preparação, Prevenção, Resposta e Recuperação nas emergências de saúde pública (Q01) (Freitas; Silva; Alpino, 2021; WHO, 2002) e os componentes de gerenciamento de emergências e desastres da OMS (Q05) (WHO, 2019). Para a análise do contexto foram consideradas as vulnerabilidades, capacidades e nível de exposição da população ao risco na emergência (Q04) (Freitas, 2023; Freitas; Silva; Alpino, 2021), os subsistemas do Complexo Econômico-Industrial da Saúde (CEIS) como categoria de análise do sistema produtivo (Q02) (Gadelha, 2021), e os níveis de atenção básica, de média e de alta complexidade (Q03) (CONASS, 2007).

As questões estão estruturadas como elementos convergentes ao conceito de integrais saúde-enfermidade-atenção, como trama de pontos sensíveis, numa abordagem plural, em forma de cadeia de causalidades e diferentes níveis de complexidade (Almeida Filho, 2000, 2006).

O grupo focal confirmatório avaliou a aplicação do modelo, cuja etapa teve como objeto um estudo de caso da cidade de Manaus, estado do Amazonas, Brasil, que sofreu com o desabastecimento de oxigênio nos hospitais durante as fases iniciais da pandemia da COVID-19. Questões relacionadas à complexidade das decisões nas emergências (Q01), a abordagem conceitual do modelo (Q02), e aplicação do modelo (Q03) foram discutidas com os especialistas. Na avaliação, aspectos relacionados à concepção do modelo, aplicabilidade, completeza, requisito temporal, reusabilidade e adaptação foram adotados.

3. Descrição do Modelo

O Framework de Apoio à Decisão em Emergência de Saúde (FADES) visa a produção de cenários para intervenções adaptadas ao nível de complexidade dos sistemas de saúde, que considera na análise de uma situação-problema as potencialidades de um risco além de um evento isolado, avaliando acúmulos de vulnerabilidades e capacidades de um contexto numa abordagem permanente dos macroprocessos de Preparação, Prevenção, Resposta e Recuperação, como processos interconectados para atingir objetivos estratégicos na ESP (WHO, 2019). Sua estrutura apresenta etapas de análise do contexto, conforme a situação-problema, como apresentado na Figura 1.

Figura 1. Framework de Apoio à Decisão em Emergência de Saúde. 176



3.1 DESCREVER O CONTEXTO DA EMERGÊNCIA DE SAÚDE PÚBLICA		
ATIVIDADES	OUTCOMES	RECURSOS
a) Tipificar a emergência	Dimensão do problema	OMS, Governo
b) Identificar o risco	Riscos associados	Literatura, notas oficiais

3.2 DESCREVER A SITUAÇÃO-PROBLEMA DE GESTÃO A SER INVESTIGADA		
ATIVIDADES	OUTCOMES	RECURSOS
a) Identificar o macroprocesso	Abrangência da análise	Modelo PPRR
b) Definir a questão focal	Problema definido	H-EDRM (Gestão)

3.3 MAPEAR AS CONDICIONANTES DE GESTÃO DA SITUAÇÃO-PROBLEMA		
ATIVIDADES	OUTCOMES	RECURSOS
a) Descrever capacidades	Capacidades mapeadas	Políticas; evidências
b) Descrever vulnerabilidades	Limites mapeados	Diagnóstico do contexto

3.4 MODELAR A SITUAÇÃO-PROBLEMA COM A DINÂMICA DE SISTEMAS		
ATIVIDADES	OUTCOMES	RECURSOS
a) Identificar variáveis	Levantamento inicial	Especialistas, literatura
b) Identificar causas e efeitos	Diagrama causal	Especialistas, literatura
c) Parametrizar o modelo	Mapa sistêmico	Especialistas, literatura Dados, parâmetros
d) Projetar cenários, tendências	Cenários de análise, comportamentos	Especialistas, literatura

3.5 INTERPRETAR O DOMÍNIO DE COMPLEXIDADE DA SITUAÇÃO-PROBLEMA PELO FRAMEWORK CYNEFIN		
ATIVIDADES	OUTCOMES	RECURSOS
a) Analisar cenários	Complexidade identificada	Especialistas, Gestores
b) Planejar a rota de transição	Rota de análise definida	Especialistas, Gestores

3.6 EFETIVAR A TOMAR A DECISÃO A PARTIR DA SITUAÇÃO-PROBLEMA		
ATIVIDADES	OUTCOMES	RECURSOS
a) Estabelecer diretrizes	Planos, estratégias	Políticas; evidências
b) Retroalimentar a análise	Feedback das decisões	Relatórios de situação

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Fonte: Elaborado pelo autor (2024). 178

O FADES é um framework que contribui para ampliar a capacidade de compreensão do gestor público de nível estratégico da saúde para a decisão, e tem como pressupostos:

a) o contexto de uma ESP é eivado de incertezas que comprometem a capacidade de decisão dos governos, por interdependência e interações complexas dos setores envolvidos (Habegger, 2010);

b) a efetividade das estratégias na ESP está relacionada à produção de sentido nos decisores e sociedade sobre o efeito das decisões em ambiente em constante evolução, exigindo abordagem adaptativa (Angeli; Montefusco, 2020);

c) a projeção de cenários em ambientes de incerteza favorece a análise de alternativas de contexto e simulação da realidade (Gomes; Gomes, 2019; Habegger, 2010), em ambiente não-linear de lógica difusa sobre as interações do processo saúde-doença-cuidado, que não está contido em relações simples de causa e efeito e de abordagem cartesiana (Almeida Filho, 2006);

d) a decisão sobre um desafio desconhecido requer experimentar inferências a partir de heurísticas e vieses do decisor (Kayman; Logar, 2016; Spiegel; Caulliraux, 2013) e incorporar na análise evidências de baixa ou média certeza (Groot *et al.*, 2021), num cálculo mais próximo de uma realidade que se transforma rapidamente no curso da crise;

e) a importância dos modelos matemáticos para a tomada de decisão e projeção de cenários em crises de saúde é fundamental, mas a calibração de probabilidades é mais confiável para curtos períodos e fica comprometida no longo prazo pelo nível de incerteza e estratégias de intervenção dos atores da decisão (Funk *et al.*, 2019);

f) a efetividade das respostas na ESP depende de condições de partida de um contexto e da evolução das interações dos atores em um sistema adaptativo complexo (Angeli; Montefusco, 2020), que considera o comportamento de eventos passados e múltiplas variáveis para analisar alternativos de futuro (Homer; Hirsch, 2006).

As condições de partida de um contexto, em abordagem por tipo de emergência e condições do sistema de saúde, geram insumos para modelagem de uma situação-problema nas emergências de saúde pública.

> *"Porque, se a gente não incorporar alguns elementos de base, nós vamos, muitas vezes, ficar de mãos atadas no que diz respeito à dimensão de preparação. Não é à toa que no pós-pandemia (COVID-19), nunca se falou tanto de preparação. E eu não preciso esperar a próxima pandemia. O que está acontecendo com as Queimadas no Brasil? O que aconteceu na condição do Rio Grande do sul (Brasil)?" (Grupo Focal - Q02PB-C)*

> *"A questão da estrutura, por exemplo, dos serviços de saúde pública no território brasileiro, como é o caso do oxigênio. Doença respiratória requer, no mínimo, uma condição para isso (sobre a COVID-19)." (Grupo Focal - Q02DC-C)*

O FADES está baseado nos conceitos da Pesquisa Operacional Soft (PO Soft), que derivam da Pesquisa Operacional (PO), porém, incorporam métodos e metodologias que analisam complexidades e situações não determinísticas de incertezas na trajetória para uma nova perspectiva, que estrutura os problemas antes de resolvê-los. Nessa abordagem, os atores da decisão declaram eventos relevantes sem a obrigatoriedade de causas a efeitos de associar números, adotando diagramas que representam redes de interação, identificando casualidades e influências. É um campo de abordagem que lida com a subjetividade dos atores sobre um problema que não está bem definido e requer investigação (Gomes; Gomes, 2019).

A Soft Systems Methodology (SSM), uma abordagem do campo da PO Soft, apresenta etapas para a decisão que estuda o mundo real por seus sistemas e tenta melhorá-los, como a proposta do FADES. A metodologia segue um fluxo de aplicação a partir de uma situação-problema não estruturada, que em etapa seguinte ganha contornos para sua declaração (situação-problema expressa), sendo eleitos os sistemas relevantes que compõem a análise. Na sequência, são observados modelos conceituais e comparados com a situação do mundo real, alcançando possíveis mudanças consoante o contexto (desejáveis e culturalmente viáveis), o que possibilitará a decisão para melhorar uma situação-problema. A SSM assume que as preferências individuais dos atores da decisão não são combinadas e prevalece um debate construtivo. O gestor descreve a situação como ela é, ocorrendo em seguida a comparação com outras situações de referência, sendo possível a associação com ferramentas de programação para modelagem (Gomes; Gomes, 2019). As seções a seguir descrevem as etapas do FADES, com base no fluxo da SSM.

3.1 Etapa 1 - Descrever o contexto da emergência de saúde pública

O contexto apresenta os elementos iniciais para compreender a situação-problema e reúne pontos para a eleição de variáveis para a modelagem, como descrito a seguir.

a) **Tipificar a emergência**: identificar dimensão e características a partir de atos de governos e institutos de referência. Uma pandemia configura uma emergência de importância internacional, decretada pela Organização Mundial de Saúde.; um surto ocorre quando se registra um aumento repentino de uma doença numa região; a endemia representa uma presença constante de doença em uma área geográfica ou grupo populacional; e a epidemia é caracterizada a partir de surtos repentinos em um país que não eram previamente reconhecidos, ou quando ocorre um aumento rápido do número de novos casos de uma doença endêmica previamente existente (BIREME, 2023);

b) **Identificar o risco**: a partir da dimensão da ESP, considerar a propagação de doenças que podem afetar a saúde pública, a partir de perigos biológicos (ar, água, vetores, contato humano-animal), geofísicos (e.g. terremoto, tsunami, deslizamento de terra), hidrológicos (e.g. inundações), meteorológicos (e.g. temperatura extrema, chuva, vento), climáticos (seca, incêndio), e aqueles produzidos pelo homem (e.g. derramamento químico, falhas de barragem, mineração, poluição do ar, e as violências) (WHO, 2019).

Um risco à saúde pública é a "probabilidade de um evento afetar adversamente a saúde das populações humanas, com ênfase naquele que pode se espalhar internacionalmente ou representar um perigo sério e direto" (WHO, 2016a), caracterizando um desafio interdisciplinar na relação da saúde humana, animal e dos ecossistemas, na perspectiva de uma única saúde (Winck *et al.*, 2022). O risco é compreendido como produto de uma ameaça ou perigo em relação ao nível de exposição e de vulnerabilidades, em razão da capacidade de resposta do sistema de saúde (Freitas, 2023).

Nesse sentido, definir o que é emergência, onde começa e como termina não é uma tarefa simples, pois depende da realidade de um contexto. Um sistema de saúde pode viver em fragilidades que já significam uma emergência de saúde local, porém, não atendida e que se intensifica diante dos impactos de uma nova crise sanitária, como a Emergência em Saúde Pública de Importância Nacional (ESPIN) em decorrência da desassistência à população Yanomami, decretada pelo Ministério da Saúde do Brasil em 2023 (Brasil; Ministério da Saúde, 2023), que foi destaque no grupo focal com especialistas.

> *"No caso, a emergência Yanomami é uma emergência de desassistência. Então toda essa ideia de que tenho uma estrutura ali funcionando antes, quando não tem, né? Isso é um*

> *questionamento que até a gente conversava muito, de que precisaria para definir o que é a emergência? De caracterizar melhor, ainda mais num país que tem um sistema único de saúde, né?" (Grupo Focal - Q01AP-E)*

Os especialistas concordam que a considerar o tipo de emergência, a evidência disponível, a informação e a decisão em tempo oportuno, exige estruturas de análise para simulações e efeitos de demonstração, uma característica dos sistemas especialistas (Akabane, 2018), sobre os limites da gestão e a complexidade que isso gera para o enfrentamento da emergência sanitária.

> *"Então, depende muito da característica do que é apresentado enquanto emergência, mas eu acho que há o tripé da evidência, da informação, é o tempo oportuno. Isso é muito importante". (Grupo Focal - Q01DC-C)*

A complexidade da gestão na ESP pode estar condicionada por recessões, perdas de empregos, desaceleração no crescimento da economia, comprometimento de cadeia de suprimentos e resistência às contramedidas adotadas para mitigação do risco. Outrossim, pode ocorrer a desinformação da sociedade e um posicionamento equivocado de autoridades, com impactos acentuados para as populações em situação de vulnerabilidade social, como indígenas e refugiados sem acesso a cuidados de saúde, como aconteceu na pandemia da Covid-19 (Sachs *et al.*, 2022).

3.2 Etapa 2 - Descrever a situação-problema de gestão a ser investigada

Para caracterizar uma situação-problema de gestão na ESP, adota-se o Health Emergency and Disaster Risk Management Framework (H-EDRM), estrutura elaborada pela OMS com a participação de especialistas, que estabelece uma abordagem para a gestão de emergências de saúde e riscos de desastres e combina esforço multissetorial e recurso de saúde, com visão abrangente dos macroprocessos de Preparação, Prevenção, Resposta e Recuperação do sistema de saúde, e componentes de gestão (WHO, 2019), como apresentado na Figura 2. Com essa estrutura, define-se a situação-problema e a abrangência da análise:

a) **Identificar o macroprocesso**: definir a abrangência da análise, como uma ação de preparação, prevenção, resposta ou de recuperação do sistema de saúde;

b) **Definir a questão focal**: direcionar o foco da análise de gestão, no horizonte temporal da análise (semanas, meses, anos) a partir dos componentes do H-EDRM, conforme apresentado na Figura 2.

A questão focal ou questão de pesquisa é o que orienta a análise, definida a partir de múltiplas fontes, como experiências de especialistas, debates políticos no governo e questões da literatura, quando uma lacuna precisa ser investigada (Creswell; Creswell, 2021), com a intenção de conhecer comportamentos e estruturas do problema que se planeja investigar (Meadows, 2008; Sterman, 2000).

Figura 2.Health Emergency and Disaster Risk Management Framework.



Fonte: Elaborado pelo autor (2024), a partir de (WHO, 2019).

O ciclo dos macroprocessos e componentes de gestão gera pontos de iteração, com acúmulo de conhecimento de cada etapa, um processo de refinamento de ações em resposta a um contexto complexo, que envolve experimentação, adaptação e aprendizado contínuo a partir da análise de múltiplas variáveis (European Commission, 2021). Experiências anteriores atuam como condicionalidades para projetar um panorama da crise sanitária e observar o comportamento das estruturas de gestão no longo prazo.

> *"Eu acho que uma dificuldade nessa complexidade é a gente ter um panorama do que nós já aprendemos. Quais são os ganhos que nós tivemos com outras emergências, com outras situações em que nós precisamos colocar todos os nossos esforços?" (Grupo Focal - Q01PC-C)*

> *"A gente estava com essa emergência em relação à COVID-19, tivemos a emergência Yanomami, e agora, mais recentemente, tivemos a emergência no Rio Grande do Sul. A gente precisa, eu acho, ter um panorama de tudo o que a gente aprendeu e o que a gente, como gestor, conseguiu organizar a partir dessas experiências anteriores." (Grupo Focal - Q01PC-C)*

Em outra análise, conforme apreciação do grupo focal confirmatório, heurísticas e vieses são valorizadas nas decisões do gestor como base para lidar com o risco nas emergências, o que direciona escolhas e comportamentos (Kayman; Logar, 2016) observando eventos similares anteriores, especialmente no momento inicial da crise, quando prevalece ausência de informações, incertezas, urgências e evidências ainda não confirmadas e de baixa ou média certeza (Groot *et al.*, 2021).

> *"De qualquer modo, um processo decisório, especialmente no ambiente de emergência, ela é uma decisão, todos falaram isso, uma decisão debaixo de um risco. Um grau de*

> *risco em que você toma a decisão, ainda que não tenha o domínio pleno das informações, mas o contexto impõe a decisão. O que significa, obviamente, um determinado grau de experiência de acúmulo, de conviver com momentos anteriores, onde você já esteve diante de condições similares, né?" (Grupo Focal - Q01PB-C)*

O comportamento de fluxos e recursos na ESP está relacionado às prioridades estabelecidas na etapa de Preparação, que desenvolve planos de contingência e protocolos de resposta, estabelece sistema de alerta precoce e comunicação de risco e faz o mapeamento de infraestrutura e recursos essenciais, em convergência com as políticas e estratégias do sistema de saúde. Tempo e recursos investidos na etapa de preparação condicionam o ciclo dos macroprocessos e componentes na resposta ao evento sanitário. A preparação para as emergências tem o desafio de promover uma abordagem equitativa, ante a força do poder econômico que faz a diferença, como ocorreu na pandemia de Covid-19 e destacado por especialistas nos grupos focais.

> *"Estávamos preparando um hospital aqui para estar pronto (na Covid-19). Comprar ventilador. E a China? Não. Olha, estou devolvendo seu dinheiro, né? Porque foi quando os Estados Unidos compraram os ventiladores (pulmonares) e pagaram 3 vezes mais. Então, os interesses econômicos sobrepuseram a necessidade, né?" (Grupo Focal - Q01FS-E)*

> *Um outro exemplo é a compra de respiradores. Eu estive no encontro de saúde pública em Cuba, logo depois da pandemia (COVID-19), há 2 anos, e uma das coisas colocadas foi que eles tinham dinheiro, mas não tinham de onde comprar respiradores. Eles conseguiram depois uma doação da China, só que a China é do outro lado do planeta; e Cuba, uma ilhazinha no Caribe; sendo que os Estados Unidos estão ali pertinho; então, são problemas que se sobrepõem muitas vezes às ações da gestão, e que reforçam essa complexidade na hora da tomada de decisão." (Grupo Focal - Q02PC-C)*

A etapa de preparação acontece em visão sistêmica (Meadows, 2008; Sterman, 2000) e integra: preocupação do gestor, processo de organização do sistema de saúde, planejamento abrangente da interdisciplinaridade da saúde com outras áreas em abordagem multisetorial, e ação articulada de especialistas e gestores, conforme as condições preexistentes de um contexto.

> *"As emergências têm que olhar para a tomada de decisão do gestor do sistema. O sistema, ele é complexo se eu não tenho planejamento, se eu não tenho uma organização. A gente viu que todas aquelas metas da Organização Mundial da Saúde na hora da preparação, eu já preciso ter algo muito antes feito, não é? Então, se eu não tenho organização, se eu não tenho Planejamento, é muito complexo, realmente." (Grupo Focal - Q02DC-C)*

A etapa de Prevenção implementa medidas de redução de riscos e vulnerabilidades sensíveis à realidade do país e direciona práticas de saúde para prevenir os efeitos de uma emergência. E ainda, monitora indicadores, fortalece o sistema de vigilância em saúde e conscientiza a comunidade sobre a importância de medidas preventivas. Na etapa de Resposta, ocorre a ativação dos planos de emergência e de mobilização de recursos, prestação de assistência aos níveis de atenção à saúde (atenção primária, de média e de alta complexidade), operação logística e comunicação com as populações afetadas, visando salvar vidas. Na Recuperação, recursos são investidos na reconstrução das estruturas do serviço de saúde e relacionados, de modo melhor e mais seguro, a partir de danos causados, para incorporar lições aprendidas e fortalecer a resiliência da sociedade no enfrentamento de futuras emergências (Freitas; Silva; Alpino, 2021; WHO, 2002, 2019).

> *"Não estou tirando a relevância de todos esses aspectos na emergência, não, mas eu estou chamando atenção que para que você atue de forma oportuna em uma emergência, seja ela qual for, você tem que organizar todos esses tópicos aí antes da emergência acontecer." (Grupo Focal - Q05EL-E)*

> *"E quando eu falo, uma atuação oportuna, vem desde você dotar aquela estrutura da capacidade necessária para monitorar, para identificar potencial ameaça, para intervir de forma oportuna, para tomar uma decisão do ponto de vista técnico, do ponto de vista de gestão, para você contar com os recursos para desenvolver as ações de resposta, que desenvolve também, o processo de recuperação." (Grupo Focal - Q01EL-E).*

No H-EDRM, o componente **Políticas, Estratégias e Legislação** estabelece normativa, responsabilidade e competência institucional para direcionamento de esforços, em conjunto com o **Planejamento e Coordenação** das áreas para integração de estratégias de saúde, devendo estar atento ao contexto internacional (WHO, 2019). Conforme destacado por Q01EL-E e reforçado por Q01AP-E, a preparação para uma ESP precisa integrar políticas públicas de um país e os desafios mais amplos de uma sociedade, sob pena de sofrer por passivos históricos de políticas não efetivas, como aconteceu com os povos indígenas na Covid-19 no Brasil.

> *"No caso indígena, é, eu diria que tem um pressuposto, que é uma coisa muito anterior, que são os marcos e a defesa e a política pública de proteção de direitos específicos que, se não estiverem andando, nada disso adianta." (Grupo Focal - Q01AP-E)*

Como um componente estratégico, os **Recursos Humanos** desenvolvem a competência humana necessária ao atendimento do ciclo de gestão da emergência, desde o nível de formação de liderança e governança estratégica, até a equipe de serviço de linha frente, como laboratório, hospital e serviço de vigilância em saúde (WHO, 2019).

O componente Recursos Humanos considera a interseção da resiliência psicológica do colaborador e a cultura organizacional em que está inserido, pelo forte componente de saúde mental exigido no enfrentamento da emergência, como também fatores políticos, sociais, econômicos, tecnológicos e ambientais do contexto (Sampaio; Príncipe; Araujo, 2024). A preparação dos recursos humanos depende de legislação adequada nos níveis da federação, com proteção social para o profissional e sua família em caso de algum problema. Isso implica considerar aspectos de vida social, de vínculo empregatício, de capacitação e de saúde mental, principalmente aos profissionais de linha de frente.

> *"A gente sempre tem profissionais de saúde em campo numa situação de emergência, esses profissionais de saúde vão para campo sem nenhum respaldo, muitas vezes sem, sequer, um vínculo; e sem nenhum seguro de vida, sem nenhum seguro saúde e sem nenhuma capacidade de ter respaldado à sua família." (Grupo Focal - Q05EL-E)*

Os **Recursos Financeiros** estabelecem fundos de investimentos extraordinários para planos de contingência de emergência, com fontes de governo e outras fontes, visando desenvolver capacidades e implementar programas e atividades dos macroprocessos, em geral (WHO, 2019).

O componente **Gestão da Informação e do Conhecimento** prioriza base de dados para tomada de decisão, prontidão do sistema de alerta e de vigilância em saúde e análise de evidências (WHO, 2019), sendo estratégico para a efetividade da governança das ações no território, em todas as etapas de uma ESP (Q01NM-E). O desafio está relacionado à preservação e à promoção da transparência das informações de saúde, e à integração de tecnologias para melhorar a coleta, análise e disseminação de dados de saúde (Puggi *et al.*, 2024). A informação do contexto como base para tomada de decisão atempada em regiões

de grande extensão e diferentes formas de organização, envolve a realidade de mais de um estado e guarda fronteiras com outros países.

> *"Você não consegue tomar uma decisão dentro da gestão se você não tiver a informação precisa do que você tem de realidade, não é? A gente observa muito isso na região da Amazônia Legal, onde você tem dificuldades, inclusive, de ter as informações em tempo oportuno." (Grupo Focal - Q01DC-C)*

O componente **Comunicação de Risco**, a partir de informações e bases de dados, desenvolve estratégias de comunicação com a sociedade conforme o perfil populacional, para evitar desinformação a partir de evidências científicas (WHO, 2019).

> *"Então, a partir do momento em que você tem uma explosão de uma doença que ela não é conhecida, onde não se tinha a receita, é, você, pelo menos tem a governança da informação, a governança do seu território para que, dentro dos macroprocessos, você realmente possa traçar um plano que ele seja real e estruturado (Grupo Focal - Q01NM-E)*

A **Infraestrutura e Logística de Saúde** orienta a instalação de ambiente de saúde seguro e sustentável e a provisão de insumo estratégico em tempo eficaz (e.g. vacina, medicamento, kit diagnóstico), que, juntamente com o componente **Serviços de Saúde e Relacionados,** atua na prevenção e promoção da saúde, ou seja, na atenção básica e de média e de alta complexidade (WHO, 2019). O planejamento ou a etapa de resposta na pandemia precisa considerar os serviços regulares e o tratamento de outras doenças da população, sob pena de agravar fragilidades existentes do sistema de saúde (Q03EL-E).

> *"Eu acho que um dos aspectos que são bem desafiadores quando a gente fala de níveis de atenção na situação de emergência, por exemplo, é você garantir que haja o atendimento, a organização para o atendimento da demanda vinda da emergência e também dar continuidade às demandas que são de rotina." (Grupo Focal - Q03EL-E)*

A preparação dos serviços de saúde, em todos os níveis da federação, compreende as causas, não pandêmicas, que acometem uma população (Q03NM-E), bem como a necessidade de serviços culturalmente adaptados, como os povos indígenas que seguem para internação acompanhados da família (Q03AP-E), o que impactará diretamente as estratégias e os resultados que se planeja alcançar nas ESP.

> *"Então, hoje, quando a gente sabe que as causas externas, elas estão matando muito mais do que as neoplasias, é, nós estamos olhando isso com uma emergência de saúde pública." (Grupo Focal - Q03NM-E)*

> *"Então é isso que ela está colocando, ou no caso do subsistema de saúde indígena, além desses níveis de atenção, você tem que ter unidade de apoio, por exemplo, essa pessoa sai do território indígena para ficar morando, fazendo um tratamento de câncer, né? É, e como você garante, não é só a pessoa paciente, vai ser a pessoa e a família inteira." (Q03AP-E)*

Nese sentido, o componente **Capacidades Comunitárias** visa o fortalecimento da comunidade com foco na prevenção de risco, quando ocorre a participação de um grupo populacional no planejamento da emergência, como estratégia para efetividade das medidas adotadas (WHO, 2019), o que pode envolver apoio aos Agentes Comunitários de Saúde (ACS) e fortalecimento de um sistema de vigilância de base comunitária (Freitas, 2023)

O **Monitoramento e a Avaliação** acompanham a evolução do risco à saúde e a implementação de programas, com avaliação permanente da capacidade instalada e do resultado alcançado na implantação das estratégias pelos países (WHO, 2019).

Duas novas categorias foram propostas à estrutura do H-EDRM pelo Grupo Focal, a segurança das regiões para garantir a implantação das contramedidas de saúde necessárias ao enfrentamento das emergências; e a negociação com lideranças locais para a implantação de ações no território, como os povos indígenas. Essa categoria vai além de participação social e implica conhecer atores e dinâmicas de uma região (Q05AP-E).

> *"No caso indígena que não fica evidente que tem que ter, é a questão que eu falei da negociação com lideranças em termos de impactação, e isso não é participação comunitária, é outra coisa, né? É uma instância de negociação política necessária no caso." (Grupo Focal - Q05AP-E)*

> *"A outra questão é a questão da segurança, né? No caso Yanomami. Uma emergência numa área de conflito armado, né? Isso na gestão é, a questão da segurança, era um fator agravante para os profissionais de saúde." (Grupo Focal - Q05AP-E)*

3.3 Etapa 3 - Mapear as condicionalidades de gestão da situação-problema.

Nesta etapa, conforme a questão focal, são identificadas as condicionalidades de gestão:

a) **Descrever capacidades**: informar as características do sistema de saúde, observando as políticas e estratégias estabelecidas pelos governos;

b) **Descrever vulnerabilidades**: identificar os pontos que, diante de um perigo, ampliam o risco para saúde pública, como as especificidades de perfis populacionais; considerar diagnóstico existentes sobre o sistema de saúde.

O estudo de Príncipe; Winkler; Ferreira (2024)[1] relaciona condicionalidades de gestão por H-EDRM para as emergências de saúde pública, baseado nas diretrizes da OMS e nas estratégias dos Estados-Membros (WHO, 2020) para fortalecimento das capacidades mínimas colocadas pelo Regulamento Sanitário Internacional, principal instrumento que orienta o compromisso dos países em respostas à propagação internacional de doenças (WHO, 2016a), como o resumo apresentado na Figura 3.

[1] Artigo submetido a revista – em análise

Figura 3 - Variáveis de Complexidade em Gestão do Sistema de Saúde – Por H-EDRM.



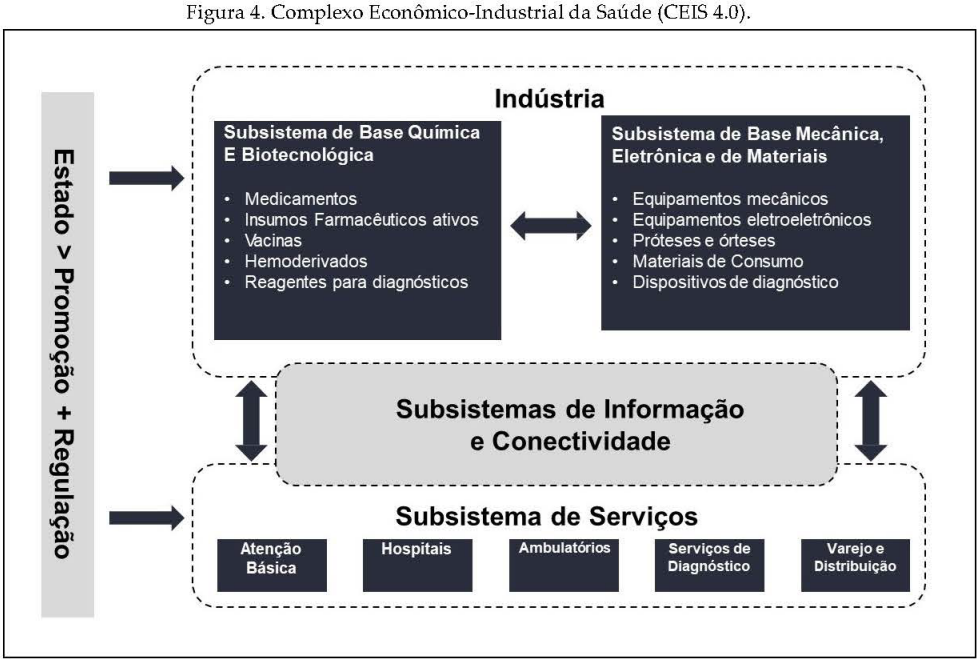
Fonte: Elaborado pelo autor (2024), a partir (Príncipe; Winkler; Ferreira, 2024).

Quando ocorre uma emergência de saúde pública, as capacidades, vulnerabilidades e o nível de exposição de uma população ao risco, a partir de um perigo, podem significar a diferença entre quem é mais afetado pela doença e quem tem melhores condições de enfrentá-la, a depender, por exemplo, dos Determinantes Sociais da Saúde (BIREME, 2023; WHO, 2021) e dos determinantes comerciais da saúde (Gilmore *et al.*, 2023), sendo necessária uma abordagem interdisciplinar na modelagem do problema, como destacado por especialista no grupo focal.

> *"Sobre a outra questão que você estava falando nessas emergências, nessa questão de determinantes sociais e desigualdades, ela é uma coisa complexa, porque, na verdade, a emergência exacerba isso, não é? Quer dizer, traz à tona um quadro social que já existia há mais tempo." (Grupo Focal - Q04LG-E)*

No âmbito dos componentes Infraestrutura e Logística de Saúde e Serviços de Saúde e Relacionados, o Complexo Econômico-Industrial da Saúde possibilita observar variáveis de complexidade do sistema produtivo, numa visão sistêmica e interdependente da produção de bens e serviços (Gadelha, 2021), como mostra a Figura 4.

Figura 4. Complexo Econômico-Industrial da Saúde (CEIS 4.0).



Fonte: (Gadelha, 2021).

O subsistema de base química e biotecnológica é composto por medicamentos, insumos farmacêuticos ativos, vacinas, hemoderivados e reagentes para diagnóstico. O subsistema de base mecânica, eletrônica e de materiais engloba equipamentos mecânicos, eletroeletrônicos, próteses e órteses, materiais de consumo e dispositivos de diagnóstico. No subsistema de serviços se encontra a atenção básica, hospitais, ambulatórios, serviços de diagnóstico, varejo e distribuição. Todo o CEIS se integra por um subsistema de informação e conectividade (Gadelha, 2021).

O complexo produtivo de saúde articula subsistemas que expressam múltiplas variáveis de análise para estruturação das capacidades de um sistema de saúde, cuja

preparação em escala global relaciona as políticas de um país, a integração de atores públicos e privados, questões normativas, valores éticos e de equidade (Q01AC-E).

> *" Porque, quando você fala nas indústrias, e aí está dentro do complexo do CEIS, você trabalha não só a indústria pública, como a indústria privada, mas você tem uma fragilidade muito grande. É, são entes que estão em patamares totalmente diferente." (Grupo Focal - Q01AC-E)*

Preparar a gestão da saúde para uma emergência implica lidar com uma situação-problema a partir da coexistência de danos, de uma sindemia (Horton, 2020), fruto da não efetividade de políticas de forma atempada, das assimetrias nacional e internacional na produção de bens e serviços para a saúde, dos interesses políticos e da disputa de poder que marcam os momentos pandêmicos e interpandêmicos. Nessa complexidade, a visão sistêmica (Meadows, 2008; Sterman, 2000) permite observar os pontos críticos afetados no contexto da crise sanitária, a partir de uma visão ampla dos integrais de saúde-enfermidade-atenção (Almeida Filho, 2000, 2006), e fortalecer a capacidade de intervenção do gestor.

> *"A questão de problemas que são externos à gestão e que nós não temos a governança sobre eles, como foi a questão, por exemplo, citada sobre a compra das vacinas; que o mundo rico comprou todas as vacinas e não sobrou vacina para os pobres, não é. A gente viu que a África não tinha planejamento de nenhuma vacinação, porque não eram países competitivos economicamente, né? Como que um modelo pode dar conta disso, dos problemas que são inerentes à nossa gestão, e mais os problemas que são externos, os problemas que a gente não tem governança?" (Q02PC-C)*

> *"Eu quero ao mesmo tempo, valorizar essa estrutura, mas dizer que ela é condicionada, porque ela traz uma robusta estrutura, mas ela segue sendo condicionada (pelo contexto)." (Q03PB-C)*

> *"Apesar de todo esse contexto, tudo aquilo que a pandemia (COVID-19) nos trouxe e demais questões: nós tivemos, a pandemia de COVID-19, mas em paralelo nós estávamos enfrentando o problema com dengue, Zika; a gente tem hoje Monkeypox e outras problemáticas virais, fora a questão ambiental; o impacto da mudança climática que estamos acompanhando. Na verdade, um processo de amadurecimento e entendimento de tudo isso, de se trabalhar na perspectiva para além até do processo de preparação." (Q02VF-C)*

Destaca-se o princípio da equidade como condicionalidade estruturante que orienta as estratégias de gestão em todo o ciclo de preparação e resposta para uma ESP, pois exige dos governantes um olhar sobre problemas ainda não resolvidos no sistema de saúde e sobre as desigualdades no enfrentamento da crise sanitária (Príncipe; Winkler; Ferreira, 2024). A equidade em saúde reforça o atendimento aos indivíduos de acordo com suas necessidades, definida como "*ausência de diferenças sistemáticas potencialmente curáveis em um ou mais aspectos da saúde em grupos ou subgrupos populacionais definidos socialmente, economicamente, demograficamente ou geograficamente*" (Macinko; Starfield, 2002, p.1, tradução nossa). Um princípio basilar para a saúde global em todas as etapas de uma ESP (WHO, 2023), que garante entre outras prioridades, a segurança do paciente e da força de trabalho, com diretrizes para segmentos específicos, como os indígenas, quilombolas, populações ribeirinhas e população de favela (WHO, 2016b).

Na eleição de sistemas relevantes para a modelagem de uma situação-problema em ESP, o *Quadro 1* apresenta exemplos de variáveis de condicionalidades observadas conforme as características de um contexto, e são estruturantes para uma modelagem que visa entender o comportamento que as políticas de equidade podem alcançar em

determinados contextos. Elas são inseridas na modelagem, conforme a questão focal e a situação-problema.

Quadro 1 - Exemplos de variáveis para modelagem do contexto de saúde.

Determinação da Saúde	Variáveis de Interesse	Fonte
Determinantes biológicos	genética; idade; sexo; predisposição genética; condições de saúde	(WHO, 2021)
Estilo de Vida	atividade física; tabagismo; consumo de álcool; uso de drogas	(WHO, 2021)
Fatores ambientais	qualidade do ar; água potável; exposição a substâncias tóxicas; condições de moradia; acesso a espaços verdes	(WHO, 2021)
Determinantes psicossociais	condições emocionais; apoio social; nível de educação;	(WHO, 2021)
Determinantes ocupacionais	empregabilidade; condições de trabalho; riscos ocupacionais; segurança no local de trabalho	(WHO, 2021)
Determinantes econômicos	nível de renda; desigualdade econômica	(WHO, 2021)
Subsistema de Base Química e Biotecnológica:	medicamentos; insumos farmacêuticos ativos; vacinas; hemoderivados; reagentes para diagnósticos.	(Gadelha, 2021)
Subsistema de Base Mecânica, Eletrônica e de Materiais	equipamentos mecânicos; equipamentos eletroeletrônicos; próteses e órteses; materiais de consumo; dispositivos de diagnóstico	(Gadelha, 2021)
Subsistema de Serviços	atenção básica; hospitais, ambulatórios; serviços de diagnóstico; varejo e distribuição	(Gadelha, 2021)
Governança	Política; regulamentações; participação da sociedade civil; cooperação internacional; participação do setor público na oferta nacional;	(Gilmore *et al.*, 2023)
Determinantes Comerciais da Saúde	Negócios, práticas e produtos, e atores de mercado	(Friel *et al.*, 2023; Gilmore *et al.*, 2023),

Fonte: Elaborado pelo autor (2024)

A pandemia da Covid-19 enfrentou desafios de capacidade dos sistemas produtivos, que gerou iniquidade no atendimento de demandas das populações para acesso a testes e vacinas (Gilmore *et al.*, 2023). Em outra análise, verificou-se resistência na implantação de contramedidas para mitigar os efeitos da pandemia, o que poderia estar relacionado ao nível de literacia em saúde de uma população, uma variável relacionada a comunicação de risco que considera como o indivíduo acessa, compreende e realiza pensamento crítico sobre informação de saúde, a partir de seu acúmulo com a prática de bem-estar, consoante a perspectiva cultural e a situação do sistema de saúde em que vive (WHO, 2021).

3.4 Etapa 4 - Modelar a situação-problema com a Dinâmica de Sistemas.

Para desenvolver modelos conceituais que serão comparados com o mundo real, com possibilidade de inferências para promover mudanças culturalmente viáveis segundo o contexto (Gomes; Gomes, 2019), o FADES adota a Dinâmica de Sistemas, um método que permite aprendizagem a partir de sistemas complexos, realiza simulações para conhecer pontos críticos de uma situação-problema e explora perspectivas de futuro (Meadows, 2008; Sterman, 2000).

As atividades dessa etapa na estrutura do FADES estão descritas a seguir:

a) **Identificar variáveis**: a modelagem requer um levantamento de variáveis de interesse com especialistas e com base na literatura, para a análise a partir de uma situação-problema, definida a priori e que vai guiar a investigação;

b) **Identificar causas e efeitos:** a partir das variáveis de interesse é elaborado um diagrama causal com o relacionamento entre causa e efeito, quando possível,

como descrito na Figura 5; essa etapa pode ser realizada com um programa de simulação para modelagem, como o Vensim (Ventana Systems, 2024);

c) **Parametrizar o modelo**: nessa etapa são estabelecidos parâmetros numéricos tais como indicadores, taxas e índices descritos do Apêndice 2, e equações de relacionamento entre variáveis para compor um mapa sistêmico do modelo, com geração de gráficos sobre o comportamento do sistema (Martín García, 2024). São observados estoques e fluxos das variáveis em análise (Sterman, 2000), conforme os integrais saúde-enfermidade-atenção (Almeida Filho, 2000, 2006). A disponibilidade de dados da vigilância epidemiológica (e.g. nascidos vivos, morbidade, mortalidade), do sistema produtivo de bens e serviços (e.g. complexo produtivo da saúde), da rede hospitalar (e.g. leitos) e dos determinantes sociais da saúde (e.g. perfil populacional, ambiental, socioeconômicos) que representam a complexidade da preparação para uma ESP.

d) **Projetar cenários:** a partir do mapa sistêmico e gráficos de comportamento do modelo são realizadas simulações sobre a situação-problema, observando tendências a partir da dinâmica do modelo, utilizando o sistema Vensim.

A Tomada de decisão atempada em pontos de interferência de um contexto, de forma parametrizada, requer uma abordagem interdisciplinar das dimensões que integram a complexidade, para uma mudança de rota no comportamento das estruturas de gestão na emergência sanitária, sobre os integrais de saúde-enfermidade-atenção (Almeida Filho, 2000, 2006)

> *"Uma decisão significa uma mudança de rota. Significa uma intervenção sobre algo que poderia ser entendido como um dado. O curso natural. Então, óbvio que entendendo uma decisão num ambiente de complexidade significa, portanto, o ambiente onde várias dimensões estão interagindo simultaneamente. É razoável que você, com base em experiência e em alguma estrutura, valorize o conjunto daquelas dimensões." (Grupo Focal - Q01PB-C)*

Na Dinâmica de Sistemas, os integrais podem ser entendidos como o estoque que concentra a memória da história dos fluxos de mudança de um sistema, e atua como amortecedor de choque dos comportamentos. O fluxo entre os integrais é um material ou informação que entra ou sai de um estoque durante um período de tempo. Feedback loop é o mecanismo que permite que uma mudança em um estoque afete um fluxo de entrada ou saída desse mesmo estoque. Os atrasos são os períodos relativos às taxas de mudanças do sistema; é o tempo necessário para uma ação ter impacto total no sistema. Loops de **reforço** promovem um crescimento exponencial de um estoque e reforçam a direção da mudança. E os loops de balanço drenam um estoque e podem promover um equilíbrio no modelo (Meadows, 2008). Essas são as principais estruturas da Dinâmica de Sistemas que permitem estabelecer estratégias sobre o modelo em análise.

Na saúde, a Dinâmica de Sistemas apoia os formuladores de políticas e profissionais de saúde a entender e responder a emergências de saúde pública, na simulação de propagação de doenças, estratégias de vacinação e planejamento de acesso a bens e serviços, considerando os fatores que influenciam a saúde da população em seus contextos (Azar, 2012).

A Dinâmica de Sistemas permite ao decisor entender a mudança ao longo do tempo por meio de parâmetros, num modelo de representação de processos que estuda a dinâmica dos estados de um sistema (Martín García, 2024). Uma abordagem que se concentra em compreender a estrutura e os padrões de um sistema, considerando feedback, atrasos e interações, identificando como as variáveis se influenciam mutuamente e como

intervenções podem afetar o sistema na totalidade (Yearworth, 2020), um desafio pontuado por especialista na apreciação do Grupo Focal da pesquisa, de como o gestor pode acompanhar a evolução dos planos e estratégias na emergência.

> *"Ele (o modelo apresentado) vai naquelas flechinhas, mas se você pegar Foucault (Michel), por exemplo, Foucault, a proposta dele, que é um caleidoscópio, quer dizer, na medida em que você mexe uma peça, você mexe tudo e você não consegue voltar. Sequência de imagens difíceis de você acompanhar e você estruturar uma resposta para aquilo (a pandemia)." (Grupo Focal - Q01LG-E)*

3.5 Etapa 5 - Interpretar o domínio de complexidade da situação-problema pelo Framework Cynefin

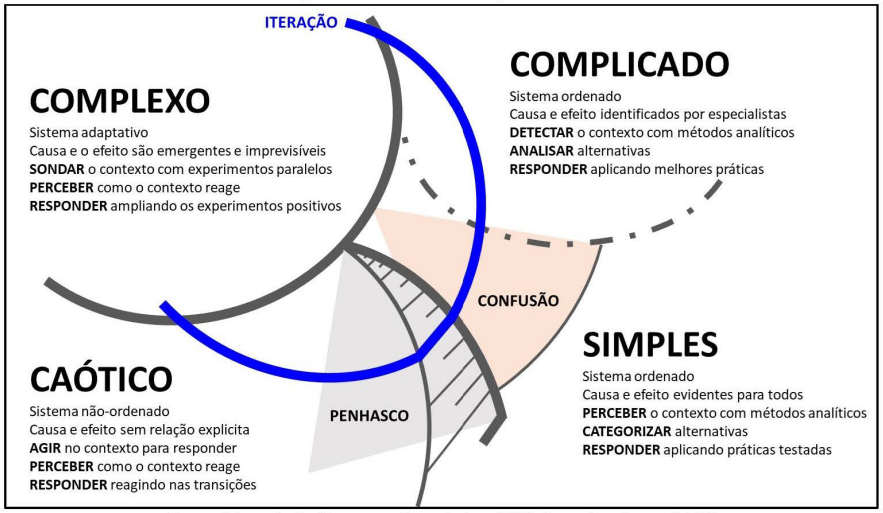
No FADES, a interpretação da complexidade acontece a partir dos gráficos gerados pela Dinâmica de Sistemas, cuja análise e resultados se enquadram nos domínios do Framework Cynefin, como segue nas etapas:

a) **Analisar cenários**: interpretar os gráficos e as tendências da situação-problema e a associar ao nível de complexidade de decisão do Cynefin, o que acontece com a participação de especialistas;

b) **Planejar uma rota de transição**: a partir da complexidade identificada, estabelecer um caminho de transições da situação-problema para um domínio mais ordenado possível, como ilustrado na Figura 5.

Cynefin é uma estrutura de naturalização de sensemaking em decisões complexas, um processo pelo qual a sociedade, indivíduos e grupos, interpretam experiências vividas com a capacidade de analisar e compreender informações, dados e conhecimentos emergentes para tomada de decisão (Turner *et al.*, 2023).

Figura 5 - Framework Cynefin



Fonte: Adaptado de (European Commission, 2021; Snowden; Boone, 2007)

Na dimensão dos sistemas ordenados encontra-se o domínio SIMPLES, onde causa e efeito são evidentes para todos. Na resposta aos desafios, são aplicadas práticas comprovadas, o contexto é percebido pela adoção de métodos analíticos, entretanto, com atenção à complacência à adesão rígida às práticas passadas. Ocorre a categorização de

alternativas para a superação de um problema (European Commission, 2021; Snowden; Boone, 2007).

O domínio COMPLICADO, ainda no campo dos sistemas ordenados, envolve situações em que há múltiplas respostas possíveis, mas sem obviedade imediata, quando causa e efeitos são percebidos por especialistas. O foco está na análise de alternativas para responder a uma situação-problema, podendo divergir de melhores práticas pelas constantes mudanças no contexto, diferente do SIMPLES, que apenas as categoriza para eventos previsíveis (European Commission, 2021; Snowden; Boone, 2007).

No domínio COMPLEXO, que depende de um sistema adaptativo na trajetória do problema, aparentemente causa e efeito são emergentes e imprevisíveis, e as soluções emergem à medida que a situação evolui, pois as respostas não são facilmente identificadas, devendo ser objeto de aprendizado contínuo e feedback. Os decisores são orientados a observar padrões emergentes e responder conforme o contexto, com sensibilidade para um modo mais experimental de gestão, inclusive, capaz de gerar inovação. É o domínio dos desconhecidos – desconhecidos, onde o contexto deve ser sondado ou testado com experimentos paralelos para perceber seu comportamento e responder com reforço das experiências mais positivas obtidas nos ensaios (European Commission, 2021; Snowden; Boone, 2007).

O domínio CAÓTICO é o do inconcebível, do sistema não-ordenado, onde causa e efeito são impossíveis de determinar, pois a mudança é contante e não existe padrão gerenciável de respostas corretas. A comunicação de cima para baixo é imperativa, sem tempo de colher opiniões. É o domínio da resposta rápida e de alta tensão, que lida com turbulência no contexto, onde a autoridade é centralizada para restabelecer a ordem (European Commission, 2021; Snowden; Boone, 2007).

É o domínio que exige agir na crise, assumir riscos e lidar com incertezas para posicionamentos em condições adversas e estar preparado para o efeito das decisões que não se pôde aferir antes sobre seus impactos, que coloca o desafio analisar rapidamente experiências do passado, condicionalidades do presente e expectativas de futuro (Gadelha *et al.*, 2016).

> *"E não vai adiantar tomar uma decisão achando que vai correr menor ou maior risco. Em alguns momentos você consegue avaliar esse grau de risco, mas em outros momentos, não. Mas, você tem que tomar aquela decisão naquele momento." (Grupo Focal - Q01AM-C)*

> *"O que não pode deixar de ter é a tomada de decisão, independente do ambiente que se esteja, um ambiente controlado, um ambiente emergencial; a tomada de decisão ela tem que acontecer, ou seja, não podemos ter a omissão da decisão; seria mais complicado a não tomada de decisão." (Grupo Focal - Q01AM-C)*

No centro da Figura 5 se encontra o estado de confusão, que significa indefinição, inclinação à dúvida e objeção, um impasse na investigação que levará a situação-problema para uma transição pelos domínios Simples, Complicado, Complexo e Caótico, gerando um efeito de iteração com a aprendizado que se acumula pelas etapas percorridas (European Commission, 2021), como marcado pela linha azul.

Existem fronteiras que orientam as transições entre ordem e desordem, sendo mudanças que requerem recursos e energia, observando relações de causa e efeito, posicionamento de restrições e caracterização do evento num contexto, para os quais existem formas de agir, adaptar, sondar, sentir, responder, analisar e categorizar, sendo combinadas conforme o domínio. Um movimento crítico de complexidade acontece quando situações de respostas simples e de experiências acumuladas são negligenciadas. Isso leva ao

domínio caótico, ocasionando o que os autores citam como efeito penhasco de mudança repentina e não gradual, marcada em cinza na Figura 5. Ocorre quando uma situação conhecida ou possivelmente controlada despenca de maneira vertiginosa para a pior das situações. Essa transição abrupta é desafiadora, pois a estratégia que funciona em um domínio pode não ser eficaz em outro domínio, requerendo reconhecimento e adaptação rápida a novas condições e exigências (European Commission, 2021; Snowden; Boone, 2007).

O penhasco ou colapso assimétrico ocorre quando não se reconhece os sinais de instabilidade e necessidade de adaptabilidade das práticas existentes pela mudança no ambiente. Outras formas de transição podem ser observadas. Transição por imposição do caótico ao simples, quando o caos impõe restrições antes não aceitas para gerar estabilidade e ordem, podendo alcançar rigidez momentânea, e retornar ao ambiente caótico. A melhoria incremental resulta na transição repetida do simples ao complicado, resultando em aperfeiçoamento teórico e inovação. A transição por exploração, do domínio complicado_ao complexo, permite a redução do controle central sem interromper as conexões, para gerenciar novas ideias e processos de melhoria. E o efeito just-in-time entre o domínio complexo e o complicado, que seleciona padrões úteis no espaço complexo e estabiliza no espaço ordenado, numa ação de transferência de conhecimento para resolução de problemas (Fierro; Putino; Tirone, 2018).

3.6 Etapa 6 - Efetivar a tomada de decisão a partir da situação-problema

Como estrutura de apoio à decisão, o Framework Cynefin reconhece que decisões são tomadas destacando a necessidade de abordagens diferentes para lidar com contextos em cada um dos domínios (French, 2023), o que pode implicar:

a) **Estabelecer diretrizes**: elaborar planos e estratégias a partir da complexidade identificada, com base em políticas de governo e evidências científicas (hipóteses, eventos correlatos);

b) **Retroalimentar a análise**: realizar feedback das decisões tomadas a partir de relatório de situação, e alimentar o mapa sistêmico da situação-problema quando necessário.

Para o domínio caótico onde não existe relação explícita entre causa e efeito, a primeira medida é agir na crise e na etapa seguinte conduzir a situação-problema para outros domínios. Nesse caso, a Dinâmica de Sistemas realizará a modelagem integrando o resultado das decisões tomadas, visando subsidiar a análise de variáveis para que uma situação mais crítica alcance outro domínio mais ordenado na estrutura Cynefin. No estado de confusão e indefinição, sem informações para uma parametrização mínima do modelo, o diagrama causal tem papel estruturante nas primeiras etapas de visualização das possíveis dinâmicas que impactam a situação-problema no contexto.

4. Resultados e Discussão

O FADES foi aplicado ao caso da cidade de Manaus, no estado do Amazonas, Brasil, que sofreu com o desabastecimento de oxigênio nos hospitais durante as fases iniciais da pandemia de Covid-19.

4.1 Contexto do Sistema de Saúde de Manaus

Manaus foi uma das primeiras cidades do Brasil a sofrer impactos da pandemia de Covid-19 em seu sistema de saúde, uma doença causada pelo coronavírus SARS-CoV-2, em maio de 2020. A cidade protagonizou um evento de falta de oxigênio medicinal nos hospitais e insuficiência de leitos que estavam concentrados na capital, o que ocasionou a morte de pessoas por asfixia. O contexto registrou problemas de gestão, com decisões

equivocadas sobre a capacidade de abastecimento de oxigênio na região diante do crescimento acelerado da demanda. Um problema aparentemente simples de fornecimento de um insumo, mas que alcançou uma dimensão caótica no enfrentamento de uma síndrome respiratória. Os três níveis de governo estavam cientes e não conseguiram responder de forma adequada à crise, o que ocasionou um comprometimento do planejamento das ações e gerou apuração de responsabilidades pelo Ministério Público do Estado do Amazonas. O risco foi ampliado para as populações em situação de vulnerabilidade e aquelas que precisam de serviços culturalmente adaptados (Brasil, 2021).

4.2 Situação-Problema – Desabastecimento de Oxigênio na COVID-19

O início da crise em Manaus caracterizou a necessidade de reforçar o macroprocesso de resposta à pandemia. A capacidade de leitos foi um ponto crítico (Q05NM-E) como objeto de recomendação do Conselho Nacional de Saúde do País (abril/20), com adoção de medidas urgentes de caráter econômico, social e sanitário para proteção da sociedade, em especial a suficiência de leitos de UTI e CTI, e equipes intensivistas devidamente capacitadas (Conselho Nacional de Saúde - Brasil, 2020), uma complexidade ratificada pelo grupo focal. Nesse sentido, a questão focal dessa investigação é: Que comportamento alcançou o sistema de saúde de Manaus com o oxigênio disponível na região em 2020, no início da Covid-19?

> *"Infraestrutura de saúde, logística, nenhum plano de nenhum estado do país, de nenhuma capital do país, tinha suprimento de oxigênio. Porque é uma realidade que nunca se vivenciou e se imaginou você tendo um plano de contingência, você ter que trabalhar trazendo usina e você ter que trabalhar furando poço aí para poder ter maior produção de oxigênio, em nenhum momento." (Grupo Focal - Q05NM-E)*

4.3 Condicionalidades da Gestão

Capacidades: Dedicação dos profissionais de saúde, especificamente da área de enfermagem que se tornou referência sobre orientações gerais à população na pandemia (Ferreira; Junior, 2022). Manaus concentra maior rede hospitalar e 89% dos serviços de média complexidade do Amazonas (Salino; Ribeiro, 2023).

Vulnerabilidades: Recursos humanos: sobrecarga de trabalho, escassez de equipamentos de proteção, exposição diária ao vírus e adoecimento mental dos profissionais de saúde. Gestão deficiente: falta de uma gestão eficaz, resultando em falta de recursos, infraestrutura precária e desorganização no enfrentamento da pandemia (Ferreira; Junior, 2022). Indicadores sociais, econômicos e de saúde muito desiguais e condições de vida amplamente desfavoráveis para a maioria da população: baixa renda e escolaridade, condições de trabalho precárias, altas taxas de violência, exposição a doenças infecciosas, ausência de saneamento básico e acesso limitado aos serviços de saúde, por ocupação dos espaços geográficos e questões de logística (Salino; Ribeiro, 2023).

4.4 Modelagem da Situação-Problema de Manaus

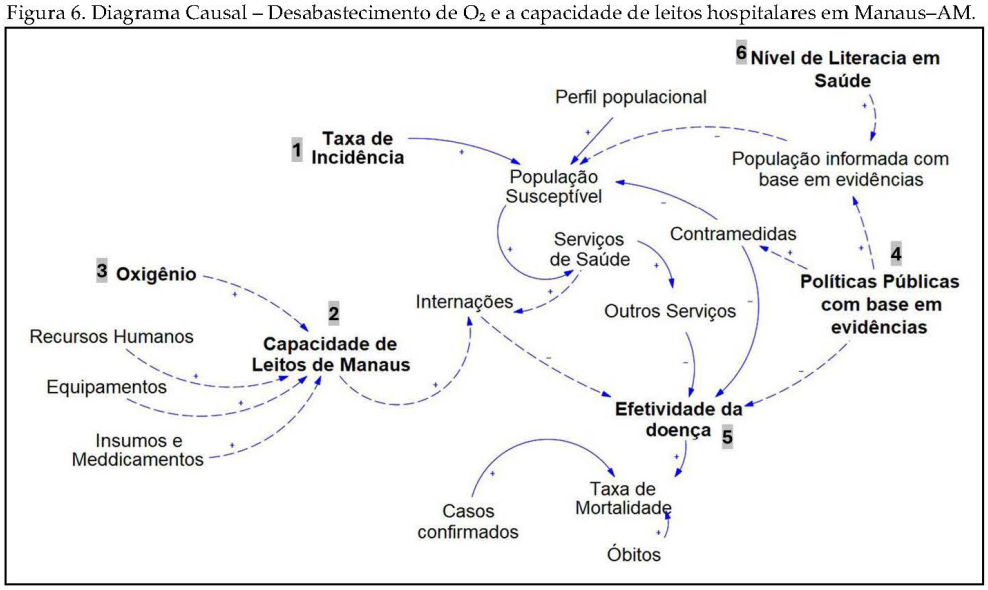
A partir das capacidades e vulnerabilidades identificadas, variáveis de interesse foram elencadas para a análise, como mostra a Figura 6.

4.4.1 Variáveis e diagrama de causa e efeito

A Figura 6 apresenta no diagrama causal uma primeira abordagem do relacionamento das variáveis da situação-problema. O perfil populacional informa as características da população, como os povos indígenas presentes na região. O nível de literacia em saúde de Manaus permite identificar a suscetibilidade da população em acatar as medidas de controle necessárias ao enfrentamento da pandemia, conforme as políticas adotadas com base em evidência. Os casos confirmados da doença, número de óbitos e taxa de

mortalidade, estão relacionados a evolução do comportamento da doença. No âmbito dos componentes de gestão do H-EDRM, infraestrutura e logística representam na análise, a capacidade de leitos de Manaus, o insumo oxigênio, equipamentos, recursos humanos e outros insumos e medicamentos. No H-EDRM Saúde e serviços Relacionados, as internações e serviços de saúde são variáveis de análise, as quais também estão relacionadas ao Subsistema Serviços – Hospitais, como CEIS.

Figura 6. Diagrama Causal – Desabastecimento de O_2 e a capacidade de leitos hospitalares em Manaus–AM.



Fonte: Elaborado pelo autor (2024).

O diagrama causal estabelece uma relação de causa e efeito entre as variáveis, quando uma polaridade positiva é representada por um sinal (+), e indica uma relação diretamente proporcional entre as varáveis, de aumento ou redução. Em outro sentido, o sinal (-) significa um crescimento inversamente proporcional entre as variáveis (Sterman, 2000). Na Figura 6, as setas pontilhadas significam as relações de causa e efeito das capacidades ou vulnerabilidades para enfrentamento da doença. E as setas contínuas representam as variáveis de comportamento da doença. São observados comportamentos possíveis, como segue:

a) O aumento da taxa de incidência (1) de uma população, como descrito do Apêndice 2, aumentará a população susceptível à doença, elevando a necessidade de serviços de saúde.

b) Para os casos que demandam internação, a capacidade de leitos (2) estará diretamente relacionada à disponibilidade de recursos humanos, equipamentos, medicamentos e insumos, principalmente de oxigênio (3), uma condicionalidade para o contexto de uma Síndrome Respiratória Aguda Grave (SRAG). Esse insumo implica um monitoramento constante das capacidades do país e exercícios de simulação, conforme o comportamento das taxas da doença num período.

c) Em análise complementar, as políticas públicas (4) definidas com base em evidências são inversamente proporcionais à efetividade da doença (5) na relação

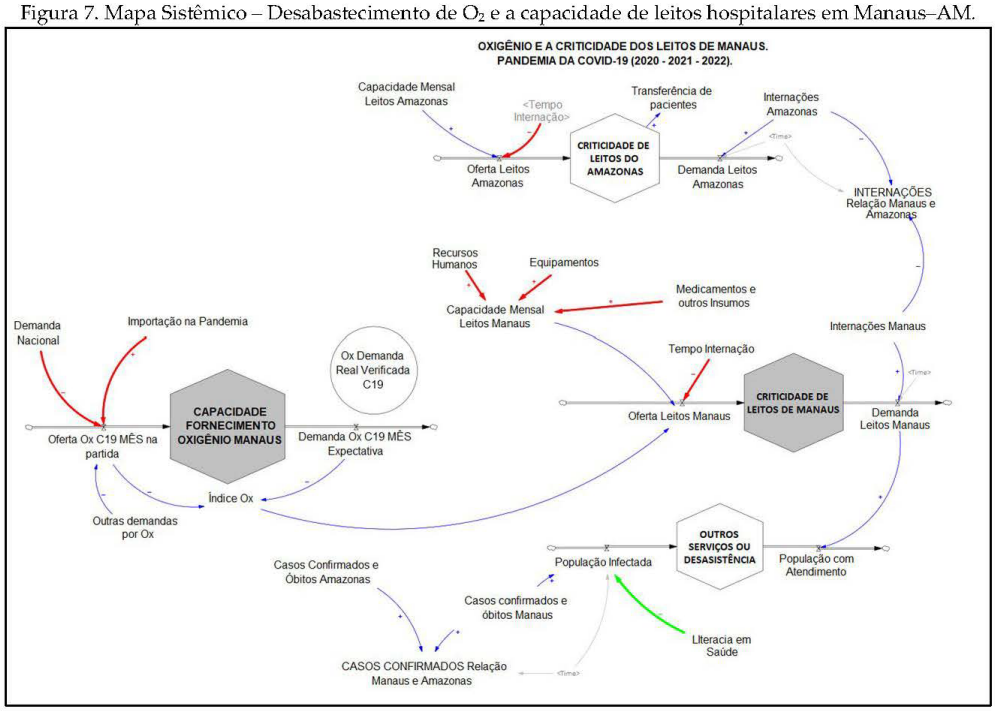
entre óbitos e casos confirmados na população (taxa de mortalidade – Apêndice 2), pois uma aumenta no sentido de redução da outra.

d) Essas políticas estão diretamente relacionadas com a efetividade de possíveis contramedidas a partir de uma população bem-informada, por exemplo, a partir do nível de literacia em saúde (6) de uma população, conceito que reúne competências cognitivas e sociais, e a capacidade da pessoa para acessar, compreender, avaliar e aplicar informações para decidir sobre cuidados com saúde e qualidade de vida (Ministério da Saúde de Portugal, 2023).

4.4.2 Parâmetros

A partir da análise anterior foi definido um mapa sistêmico da situação problema, com os estoques e fluxos das capacidades do sistema hospitalar de Manaus, apresentado na Figura 7. Nesse momento, a análise se deteve às variáveis de interesse relacionadas a situação-problema, com dados e equações de representação da realidade para o caso estudado - desabastecimento de oxigênio e o impacto na oferta de leitos. O detalhamento das equações e parâmetros estão descritos no Apêndice 3. Alguns pontos não parametrizados foram mantidos no mapa, pois são pontos de inferência em potencial para o comportamento do modelo, e estão marcados em vermelho.

Figura 7. Mapa Sistêmico – Desabastecimento de O_2 e a capacidade de leitos hospitalares em Manaus–AM.



Fonte: Elaborado pelo autor (2024).

O mapa sistêmico apresenta estoques que se relacionam na análise, possibilitando inferências sobre o comportamento do modelo.

- A oferta de oxigênio na data de partida (2020) em Manaus pode ser inversamente proporcional à demanda nacional pelo contexto da pandemia, mas

pode se beneficiar de possíveis importações, sendo dois pontos de inferência no modelo.

- A capacidade mensal de leitos disponíveis para os atendimentos na Covid-19, além do oxigênio, depende do tempo de internação da doença, como também de pessoal qualificado e disponível, e de medicamentos e outros insumos e equipamentos.
- Destaca-se a necessidade de ventiladores pulmonares no planejamento das emergências de SRAG, o que implica conhecer as capacidades instaladas do sistema de saúde, prover pessoal qualificado para uso, garantir princípios éticos para distribuição equitativa, outrossim, o planejamento da indústria nacional (Koonin *et al.*, 2020). A Figuras 7, 8, 9 e 10 apresentam exemplos de comportamentos do modelo.

4.4.3 Cenários - Domínios de Complexidade da situação-problema

A partir da modelagem os dados são representados em gráficos gerados pelo sistema de simulação, o que permite interpretar o comportamento da situação. Nessa etapa, os especialistas e gestores realizam simulações sobre a realidade projetada no tempo, quando novos dados, hesitações, vieses e heurísticas podem ser experimentados por gestores e especialistas, utilizando as funcionalidades do programa de simulação.

Conforme os cenários da análise de Manaus, a situação foi enquadrada no domínio caótico do Framework Cynefin, que demandava ação imediata na crise como primeiro passo na rota de transições para outros domínios de complexidade, como apresentado na Figura 5.

O exercício foi realizado no pós-crise, com dados do início da pandemia em 2020, seguindo 2021 e 2022, sobre o comportamento da situação nos hospitais da região, que ainda não foi superada, destacado no grupo focal confirmatório.

> *"A coisa continua do mesmo jeito, ou seja, não houve aprendizado ou não se quis tirar aprendizado." (Q02AM-C); "(...) se eu tiver uma COVID-20, hoje, dentro do Amazonas, eu não tenho de novo os serviços. Eu não tenho acesso ao oxigênio, eu não tenho acesso a leitos de UTI e CTI." (Q03DC-C)*

Nesse sentido, o grupo apresentou 60% de concordância total e 40% de concordância parcial sobre a efetividade da aplicação do FADES ao caso de Manaus, sendo um ponto de destaque por (Q03PB-C), que a modelagem é apresentada de forma retrospectiva, com informações pós-evento pandêmico, mas com potencial, de forma antecipatória, para a prospecção de futuros eventos semelhantes na região, integrando dados epidemiológicos e de gestão. Nesse sentido, o participante (Q03PC-C) destaca a relação da modelagem integrando o indicador - número efetivo de reprodução da infecção (Re ou Rt) – que representa *"o número médio de indivíduos infectados, por cada infectado nas condições existentes em um momento determinado"* (Domingos Zaparolli, 2020).

> *"Neste caso, o exemplo está modelado de modo retrospectivo." (Q03PB-C)*

> *"Então você poderia, pelo que eu estou entendendo, fazer uma análise preventiva, vamos dizer assim; a gente avaliaria, por exemplo, o "R" da infecção naquele momento; aí você pode prever que daqui a uma semana você vai ter x casos novos e você lançaria ali. E aí você prevê quanto de oxigênio você precisaria para aquele número de pacientes no tempo?" (Q03PC-C)*

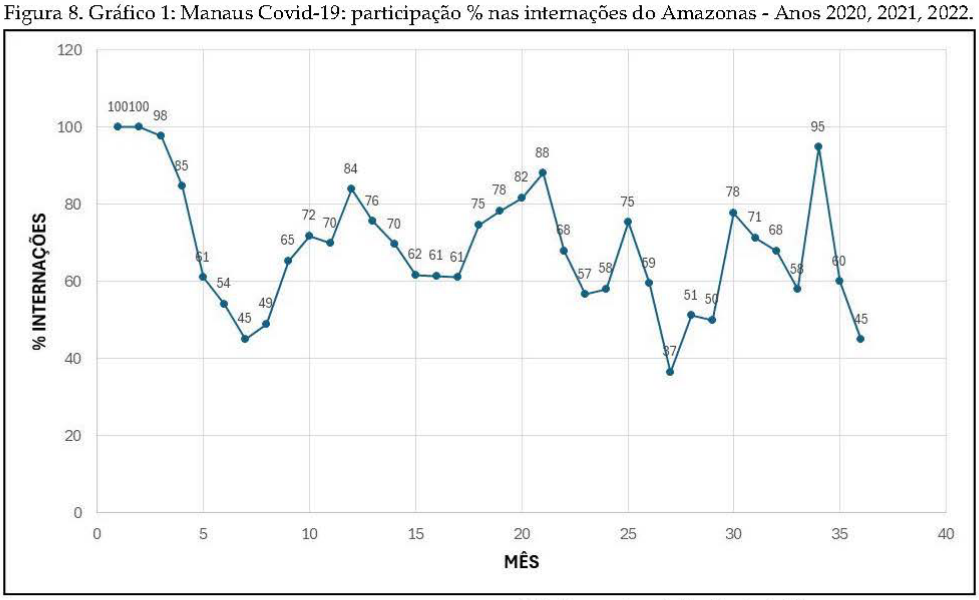
> *"A estrutura, eu estou falando de modo genérico, ela dá conta do que é simples, ela dá conta do que é complicado. É um sinal de que eu tenho uma estrutura e na medida que*

essas dimensões existem (H-EDRM), eu tenho a dinâmica decisória sobre aquilo que é rotina, e estou atento às dinâmicas de ameaças, que, portanto, precisam considerar a dimensão de preparação." (Q03PB-C)

Essa é uma característica da Dinâmica de Sistemas (Meadows, 2008; Sterman, 2000), que permite integrar variáveis e informações, quantitativas e qualitativas, de passado, presente e futuro, com taxas, índices, indicadores de saúde e do contexto da população em risco, na constituição de um modelo dedicado a representar uma situação-problema e permitir ao gestor intervenções adaptadas ao nível de complexidade de um sistema de saúde. Essa afirmação na estrutura do FADES teve concordância total de 80% e parcial de 20% pelos participantes do grupo focal confirmatório.

Em seguida, verificou-se que o comportamento do que aconteceu na capital Manaus foi representativo do estado do Amazonas, como demonstra a participação acima de 50% das internações na capital, na maior parte dos meses, como apresentado na Figura 8. No período de maio a julho de 2020, e de fevereiro a maio de 2022, a participação das internações em Manaus reduziu para o total do estado, o que pode significar intensificação das internações em outras regiões.

Figura 8. Gráfico 1: Manaus Covid-19: participação % nas internações do Amazonas - Anos 2020, 2021, 2022.



Fonte: Elaborado pelo autor (2024) a partir de SIVEP - sraghospitalizado_07fev24

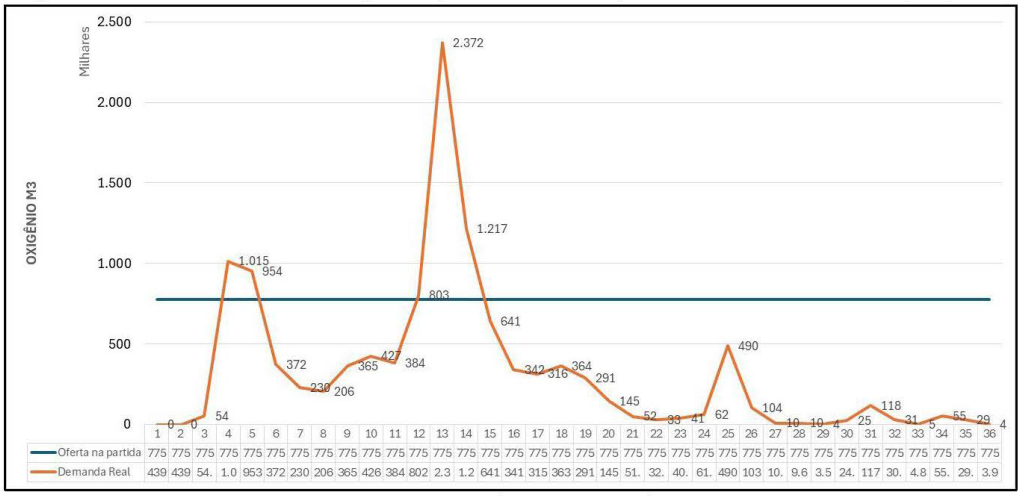
O contexto indicava um avanço rápido da doença pelos boletins epidemiológicos, um quadro que alcançou em 2020, primeiro ano da pandemia de Covid-19, uma taxa de mortalidade de 92,77 por 100 mil/habitantes para o Brasil, 127,52 para o Amazonas e 154,85 para Manaus. Em 2021, a capital alcançou a taxa de 280,65 por 100/mil/habitantes (Brasil; Ministério da Saúde, [*s. d.*]). A taxa de mortalidade significa a proporção entre a frequência absoluta de óbitos e o número de indivíduos expostos ao risco de morrer, no mesmo período e local (Almeida Filho; Barreto, 2024).

A situação anunciava um contexto caótico na estrutura Cynefin (European Commission, 2021), um domínico do sistema não ordenado, quando era necessário agir na crise, mas se verificou um acúmulo de danos: a transmissibilidade do vírus era alta, existia um

acesso precário ao sistema de saúde, e havia desinformação e políticas públicas inadequadas, o que se intensificou com a falta de um insumo básico, o oxigênio, o que foi pauta da mídia nacional e internacional, de posicionamento dos órgãos competentes e de uma Comissão Parlamentar de Inquérito da Pandemia, do Senado Federal do Brasil (Brasil, 2021).

A oferta na partida, em 2020, era de 775.000 m³/oxigênio/mês como mostra a Figura 9. Ao considerar o ajuste realizado para a provisão de oxigênio nos anos 2020, 2021 e 2022, o fornecimento alcançou 2,3 milhões m³/oxigênio em jan./21 (mês 13), o mês mais crítico registrado. Não se tratava apenas dos limites de produção do insumo, mas de questões de logística e a configuração que a pandemia alcançou na região, especialmente para as populações em situação de vulnerabilidade, como os povos indígenas. Nota-se um incremento entre o mês 12 (dez/20) e 14 (fev./21), com efeito, a partir da época de final de ano e de uma condução ineficaz da crise na região (Brasil, 2021).

Figura 9. Gráfico 2: Manaus Covid-19: Oxigênio - capacidade de oferta na partida e demanda real - Anos 2020, 2021, 2022.

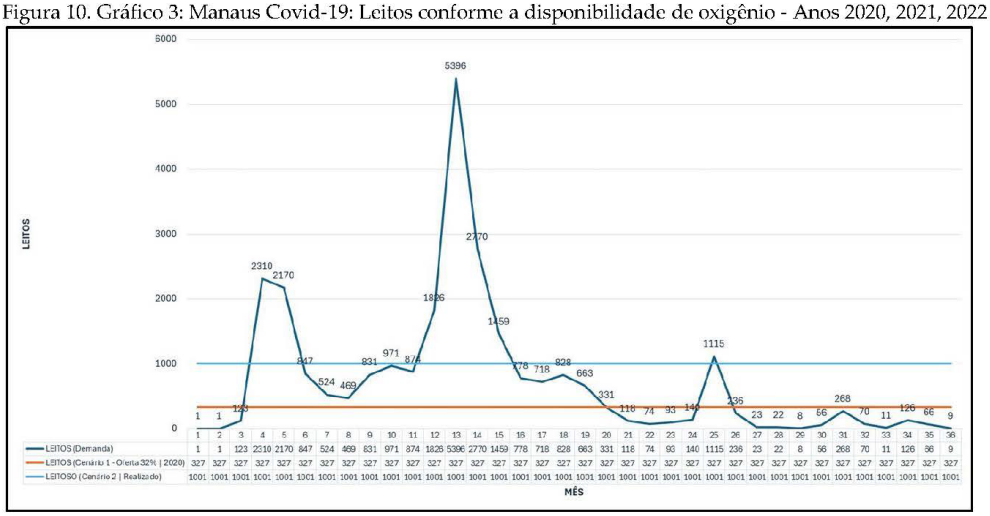


Fonte: Elaborado pelo autor (2024) a partir de (Brasil, 2021).

As limitações impactaram no uso dos leitos no início da pandemia, como mostra a Figura 10. A demanda de oxigênio para os 1001 leitos disponíveis para Covid-19, conforme dados do Plano de Contingência Estadual de maio de 2020 (cenário 2), considerando respectivos tempos de internação, alcançaria 76.500 m³/dia, mas a capacidade máxima das fornecedoras locais era de 25.000 m³/dia, ou seja, 32,8% do necessário para o contexto, e atenderia apenas 327 leitos do total (cenário 1 – situação na partida).

Essa situação comprometia a situação de partida, até para possíveis ampliações de leitos que ocorreram com a transformação de leitos clínicos, cirúrgicos, entre outros, em leitos de UTI para doentes com Covid-19, mas sem registrar mudanças expressivas ante a necessidade da crise (Salino; Ribeiro, 2023).

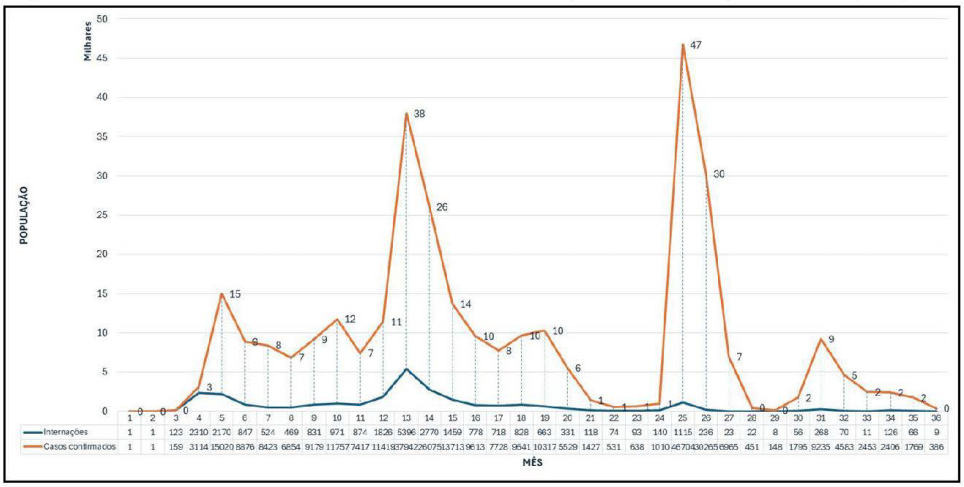
Figura 10. Gráfico 3: Manaus Covid-19: Leitos conforme a disponibilidade de oxigênio - Anos 2020, 2021, 2022



Fonte: Elaborado pelo autor (2024), a partir de (Brasil; Ministério da Saúde, 2024)

As empresas informaram não ter como prever o avanço da doença. Nota-se que existia em 2020 uma quantidade máxima de 1001 leitos possíveis para ocupação, e um indicador de 7,2 m³/oxigênio/paciente/dia para internação, podendo chegar a 86 m³/oxigênio/paciente/dia em casos graves (Cerqueira *et al.*, 2022; Super Interessante, 2021), portanto, esperava-se um planejamento mais efetivo da situação para os casos confirmados da doença, como apresentado na Figura 11.

Figura 11. Gráfico 4: Manaus Covid-19: Casos Confirmados - Internações - e não internações - Anos 2020, 2021, 2022



Fonte: Elaborado pelo autor (2024), a partir de (Brasil, 2024)

Como apresenta a Figura 11, a gravidade do problema pode ser verificada pela relação entre o número de casos confirmados e o que foi o comportamento das internações em Manaus, com um acúmulo de mais de 280 mil casos (91,6% do total de casos), como

demonstrado no Apêndice 3, refletindo situações de outras naturezas: pessoa infectada não precisou de internação em Manaus, foi transferida para fora da capital, ou mesmo chegou a óbito sem nenhum tipo de atendimento.

4.5 Tomada de decisão no caso de Manaus

O processo de decisão diante do caos gerado pelo desabastecimento de oxigênio em Manaus, associado às vulnerabilidades, exigiu que os governantes agissem na crise em resposta a complexidade, com medidas para ampliar a quantidade e leitos e insumos, o que se mostrou insuficiente para o contexto, o qual alcançou picos do problema nos três anos de análise. Um planejamento inicial com retroalimentação de dados, a partir das decisões, poderia amortecer o efeito das ondas da doença.

5 Conclusão

A aplicação do FADES no contexto de Manaus, durante a pandemia de Covid-19, permitiu observar que as variáveis de complexidade da gestão, como quantidade de leitos e oxigênio, já estavam disponíveis para análise e posicionamento das autoridades, pelas características de uma SRAG que atingia o país e o mundo, com estudos relacionados ao tema.

Nesse sentido, uma abordagem prospectiva e menos reativa da gestão, com base no estudo da capital amazonense, permitiria observar as projeções epidemiológicas e relacionar o comportamento da doença com o limite do sistema de abastecimento de oxigênio de Manaus, evitando mortes por ausência de planejamento prévio e evidente descaso das autoridades, o que gerou um efeito penhasco na estrutura Cynefin, que faz desabar os domínios de práticas simples no caos da emergência, como foi não cuidar de uma ação de logística com base em ampliação de demanda.

Em circunstâncias de evidências de baixa ou média certeza, a área de gestão pode experimentar a ideia de um "laboratório de gestão", como preconizava FORRESTER (1961), no início da Dinâmica de Sistemas. Essa experimentação permite verificar o efeito das decisões tomadas ou não, numa visão sobre as estruturas e comportamentos das capacidades, vulnerabilidades e níveis de exposição de uma população à doença, visando fortalecer todas as etapas do ciclo de preparação, prevenção, resposta e recuperação dos sistemas de saúde e da vida em sociedade.

Pela trajetória percorrida e elementos mapeados no caso de Manaus, na perspectiva de futuros contextos, a modelagem de experiências anteriores pode gerar efeito iterativo e aprendizagem, que registra experiências e conhecimentos e parâmetros para futuras emergências, portanto, uma situação que não precisa acontecer novamente no Brasil.

Para além de uma abordagem quantitativa dos recursos, a efetividade de um modelo construído a partir da dinâmica de sistemas permite modelar a realidade e acatar as hesitações dos diferentes campos de análise, com informações científicas, epidemiológicas, de gestão e das áreas inerentes para superar uma situação-problema. A Dinâmica de Sistemas confere um lugar já experimentado como metodologia no campo da saúde, mas cuja integração com o Framework Cynefin estabelece um caminho para ação, conforme o domínio de complexidade de um contexto.

A integração da Dinâmica de Sistemas com o Framework Cynefin atende ao desafio de uma abordagem adaptativa, pois associa a visão de logo prazo sobre o comportamento das variáveis de complexidade, com a urgência da intervenção, das decisões que conduzem a situação-problema de saúde na ESP, de domínios menos ordenados para mais ordenados. Essa associação favorece uma hierarquia de decisões e a comunicação entre os

decisores a partir da modelagem, fortalecendo a produção de sentido do processo decisório na sociedade, em contexto de emergência sanitária.

Como desafios para futuras pesquisas, destaca-se a organização de bases de dados de gestão, com variáveis de complexidade dos determinantes de saúde, sociais, comerciais e ambientais, para interagir de forma permanente com as bases de dados epidemiológicos, considerando a natureza dos eventos sanitários, sejam de origem biológica, geofísica, hidrológica ou meteorológica, especialmente os eventos climáticos que impactam as populações em situação de vulnerabilidade. Destacam-se, ainda, as variáveis relacionadas às violências provocadas pelo homem, como as guerras que comprometem as estruturas dos sistemas de saúde, sobre as quais os exercícios de gestão para decisões complexas podem ajudar.

Supplementary Materials: The following supporting information can be downloaded at: xx.xx.xx

Author Contributions: Conceptualization, A.S.P., I.W. and C.V.F.; methodology, I.W. and C.V.F.; software, A.S.P.; validation, I.W. and C.V.F.; formal analysis, I.W. and C.V.F.; investigation, A.S.P., I.W. and C.V.F.; resources, I.W. and C.V.F.; data curation, A.S.P., I.W. and C.V.F.; writing—original draft preparation, A.S.P.; writing—review and editing, I.W. and C.V.F.; visualization, C.V.F.; supervision, I.W. and C.V.F.; project administration, I.W. and C.V.F.; funding acquisition, I.W. and C.V.F. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable

Data Availability Statement: The data presented in this study is fully available in the Supplementary Materials. The file is available at xx.xx.xx (accessed on 15 June 2023).

Acknowledgments: We are thankful for the financial support from National Council for Scientific and Technological Development (CNPq); IW is a CNPq technological development fellow (Proc.308783/2020-4).

Conflicts of Interest: The authors declare no conflict of interest.

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Relatório

Grupo Focal

1. Objetivo do Grupo Focal

Pesquisar a opinião de especialistas sobre o modelo conceitual do Framework de apoio à decisão em Emergência de Saúde (FADES) e reunir insumos para seu desenvolvimento, e avaliar a aplicação do modelo em um caso da pandemia da COVID-19. Uma revisão da literatura integra o presente artigo, associada à realização de dois grupos focais, um exploratório e outro confirmatório, para o desenvolvimento do FADES.

Pesquisador responsável: Alex Santos Príncipe. Projeto de pesquisa registrado na Plataforma Brasil, parecer número 5.895.015, como parte do curso de doutorado do Programa de Pós-graduação em Gestão de Tecnologias Industriais do Centro Universitário SENAI CIMATEC. Orientadores: Prof. Dr. Cristiano Vasconcellos Ferreira. Prof.ª. Dra. Ingrid Winkler.

2. Pressupostos Metodológicos

O desenvolvimento do FADES está baseado na *Design Science Research (DSR)*, que aproxima teoria e prática para unir o rigor da pesquisa científica à relevância da pesquisa aplicada desenvolvida no âmbito das organizações. Na DSR o artefato é algo construído pelo homem, que organiza componentes do ambiente interno para atingir objetivos em um determinado ambiente externo. Artefatos podem ser construções (vocabulários e símbolos), modelos (abstrações e representações), métodos (algoritmos e práticas) ou instanciações de sistemas implementados e protótipos (DRESCH; LACERDA; JUNIOR, 2015).

O FADES é um artefato desenvolvido para apoiar a tomada de decisão do gestor público de nível estratégico da saúde que atua nas instâncias de governo (ambiente interno), em ações de gestão na preparação, prevenção, recuperação e resposta ao enfrentamento de uma emergência de saúde pública (WHO, 2021a), que permite intervenções adaptadas ao nível de complexidade do contexto (ambiente externo).

O grupo focal é uma técnica de coleta de dados de natureza qualitativa, que acontece em sessões estruturadas e busca as considerações de um grupo de pessoas que interagem sobre uma ideia ou evento, cujo insumo pode apoiar o desenvolvimento de artefatos, sendo exploratório quando visa a criação ou confirmatório, para a demonstração da utilidade dos artefatos (DRESCH; LACERDA; JUNIOR, 2015). Como citam Creswell e Creswell (2021) sobre as entrevistas qualitativas, o grupo focal pode envolver de 6 a 8 entrevistados, que são orientados por questões abertas para suscitar concepções e opiniões sobre um tema.

Os dois grupos, confirmatório e exploratório, foram compostos pelos mesmos perfis descritos a seguir, mas com diferentes participantes, pois na abordagem qualitativa os indivíduos que fornecem informações para o planejamento da pesquisa não devem atuar nos instrumentos de follow-up (CRESWELL; CRESWELL, 2021). A composição dos grupos teve a participação de gestores públicos de nível estratégico da saúde pública do Brasil, visando conhecer suas experiências e mapear as condicionantes da decisão em contextos de emergências sanitárias, neste caso, a COVID-19. Os perfis estão descritos a seguir:

a) Um gestor com experiência junto à Organização Mundial da Saúde / Organização Pan-Americana da Saúde, para aportar a dimensão da saúde global na tomada de decisão do gestor público de nível estratégico da saúde numa emergência de saúde pública.
b) Um gestor da área pública do Complexo Econômico-Industrial da Saúde (CEIS), que possibilite abordar a complexidade da produção de insumos estratégicos para a saúde no Brasil, no contexto de uma emergência de saúde pública.

c) Um gestor do quadro de uma instituição pública de referência para a saúde, que apresente os dilemas da tomada de decisão do gestor público de nível estratégico no contexto de complexidade de uma emergência de saúde pública. A instituição pública escolhida foi a Fundação Oswaldo Cruz (Fiocruz).
d) Um gestor da área de vigilância em saúde com atuação na pandemia da COVID-19, pois é uma área que analisa a relação da evolução da doença com os limites dos sistemas locais, abordagem colocada pela OMS na perspectiva de um hub de inteligência para tomada de decisão em emergências de saúde pública (WHO, 2021a).
e) Um gestor com atuação em gabinete de crise (salas de situação) na pandemia da COVID-19, com o objetivo de apresentar a experiência da decisão coletiva de gestores estratégicos da saúde e especialistas, sobre problemas pandêmicos.
f) Um gestor/especialista com atuação em Emergência em Saúde Pública recente na situação de Manaus, Amazonas, Brasil, que é o lócus do caso estudado na aplicação do FADES.

Os procedimentos de análise de dados visaram extrair sentido do texto e envolveram segmentar, desconstruir e reconstruir os dados (CRESWELL; CRESWELL, 2021). Nesse sentido, foi empregada análise não numérica de texto, com tipo de interpretação consistindo em temas e padrões para conhecer as experiências dos participantes com as decisões nas emergências de saúde pública. O nível de concordância com a estrutura do modelo desenvolvido (FADES), na etapa confirmatória do grupo focal, foi objeto de um questionário em escala Likert aplicado em formato eletrônico, como descrito no Quadro x.

Os grupos focais aconteceram em modalidade virtual, com uso da plataforma Teams e agendamento planejado junto aos participantes, via e-mail. A dinâmica do grupo foi gravada mediante consentimento dos participantes, o que permitiu a transcrição do conteúdo e análise com apoio do Microsoft Excel, que foi organizado por questões e categorias preestabelecidas, como descrito a seguir.

3. Grupo Focal Exploratório

A análise dos resultados está organizada por questão no formato Q00XX-E, com a seguinte identificação:

- Q00 - identifica a questão, como segue:
  a. (Q01) - Modelo de Preparação, Prevenção, Resposta e Recuperação (FREITAS; SILVA; ALPINO, 2021; WHO, 2002, 2019);
  b. (Q02) - Complexo Econômico-Industrial da Saúde (GADELHA, 2021);
  c. (Q03) níveis de atenção básica, de média e de alta complexidade em saúde (CONASS, 2007);
  d. (Q04) - Condicionantes de risco para um contexto, com abordagem de capacidades, vulnerabilidades e níveis de exposição, para compreender os impactos das emergências (FREITAS, 2023); e
  e. (Q05) - *Health Emergency and Disaster Risk Management Framework* (WHO, 2019).
- XX - identifica o participante
- E - identifica Grupo Focal Exploratório

3.1. Roteiro de Discussão

O Quadro 1 apresenta o planejamento do Grupo Focal Exploratório, que contribuiu com reflexões sobre o tema da pesquisa a partir de um conjunto de questões apresentadas pelo pesquisador para debater lacunas, desafios, convergências e divergências sobre temas apresentados aos participantes.

Quadro 1 - Roteiro Grupo Focal Exploratório.

Questão - Etapa	Objetivos e Conceitos Relacionados
Termo de Consentimento Livre Esclarecido	Apresentar a forma de participação no Grupo Focal.
Objetivo Geral do Grupo Focal	Relatar o objetivo geral do Grupo Focal
Complexidade das decisões de gestão na emergência sanitária.	Analisar elementos da complexidade das decisões relacionados à dimensão cognitiva; e à racionalidade limitada do decisor (SPIEGEL; CAULLIRAUX, 2013)
Questão 1: O modelo PPRR apresenta uma visão abrangente das medidas necessárias ao enfrentamento da complexidade nas emergências sanitárias?	Explorar o modelo de Preparação, Prevenção, Resposta e Recuperação como macroprocessos da gestão nas emergências sanitárias (PPRR) (FREITAS; SILVA; ALPINO, 2021; WHO, 2002)
Questão 2: A produção de bens e serviços (insumos estratégicos para a saúde) é um componente de capacidade ou de vulnerabilidade de um contexto para enfrentamento da Emergência. Os subsistemas do CEIS são abrangentes para a complexidade do que ocorre numa emergência?	Analisar a percepção do grupo sobre o Complexo Econômico-Industrial da Saúde (CEIS) como categorias de análise do sistema produtivo (GADELHA, 2021).
Questão 3: Sobre os níveis de atenção no território. Eles são abrangentes para a organização dos serviços na complexidade de uma emergência?	Analisar a percepção do grupo sobre a complexidade nos níveis de atenção. 1 - Atenção básica; 2 - Média complexidade; 3 - Alta complexidade (CONASS, 2007).
Questão 4: A interpretação de um território por suas capacidades, vulnerabilidades e níveis de exposição que afetam o indivíduo, é suficiente em contextos de emergência? Considere o conceito de risco à Saúde definido pelo Regulamento Sanitário Internacional: "a probabilidade de um evento afetar adversamente a saúde das populações humanas, com ênfase naquele que pode se espalhar internacionalmente ou representar um perigo sério e direto" (WHO, 2016)	Explorar a percepção do grupo sobre condicionantes do risco nas emergências. 1 – Capacidades; 2 – Vulnerabilidades; 3 - Nível de Exposição (FREITAS, 2023; FREITAS; SILVA; ALPINO, 2021)
Questão 5 - Na área de gestão, a OMS criou o *Health Emergency and Disaster Risk Management Framework* (H-EDRM). Seus componentes são suficientes para a abordagem da gestão numa emergência?	Avaliar a percepção do grupo sobre componentes de gestão nas emergências: 1 - Políticas, estratégias e legislação; 2 - Planejamento e coordenação; 3 - Recursos humanos; 4 - Gestão de informações e do conhecimento; 5 - Infraestrutura de saúde e logística; 6 - Comunicação de risco; 7 - Recursos financeiros; 8 - Saúde e serviços relacionados; 9 - Capacidades comunitárias para a saúde; 10 - Monitoramento e avaliação (WHO, 2019).
Questão 6 - Vamos comentar sobre fronteiras, sobreposições e condicionalidades entre as categorias apresentadas.	Verificar relações entre as categorias apresentadas.
Comentários finais	

Fonte: Elaborado pelo autor (2024).

Os temas abordados foram analisados nas questões apresentadas e os resultados descritos no item 3.2.

3.2. Questões e Análise de Resultados

Questão 1 - Questão 1: O modelo PPRR apresenta uma visão abrangente das medidas necessárias ao enfrentamento da complexidade nas emergências sanitárias?

Análise: Desafio de integrar as variáveis em todo o ciclo PPRR (WHO, 2019) e relacionar interdependências.

> *"É, essa é uma pergunta bem desafiadora, porque assim, o modelo em si, ele é um modelo importante, mas é difícil você falar se ele é ou não suficiente como macroprocesso, porque para você pensar em estratégias de preparação, de prevenção, de resposta e de recuperação para um evento multirrisco, digamos assim, independente de qual tipologia seja, você tem que ver que variáveis e fatores ali são interdependentes, não é?" (Q01EL-E)*

Análise: Monitoramento do comportamento das estruturas para uma resposta atempada em visão sistêmica (MEADOWS, 2008; STERMAN, 2000), articulando dimensões de gestão, científica e política, para decisão em tempo eficaz.

> *"E quando eu falo, uma atuação oportuna, vem desde você dotar aquela estrutura da capacidade necessária para monitorar, para identificar potencial ameaça, para intervir de forma oportuna, para tomar uma decisão do ponto de vista técnico, do ponto de vista de gestão, para você contar com os recursos para desenvolver as ações de resposta, que desenvolve também o processo de recuperação." (Q01EL-E)*

Análise: Um modelo condicionado pela dificuldade de fazer interagir todas as etapas dos macroprocessos PPRR (FREITAS; SILVA; ALPINO, 2021; WHO, 2002), que consideram múltiplas dimensões, disciplinas, atores e políticas de um contexto.

> *"Eu acho um modelo bastante interessante, bastante completo. O problema é você conseguir percorrer toda a cadeia que está envolvida nesse modelo. Então, na minha percepção, ele é um modelo que pode ser suficiente. Só que ele tem muitos aspectos envolvidos." (Q01EL-E)*

> *"Mas assim, é necessário você partir de algum modelo, principalmente dentro do macroprocesso para que você consiga organizar. É, ou talvez um exemplo, mas, não seja tão diretamente relacionado quando a gente fala de uma pandemia, porque aí eu digo que uma pandemia é algo que você não espera; e quando nós tivemos essa pandemia, a gente falou de emergência." (Q01AC-E)*

Análise: Conforme a dimensão, a preparação pode depender de uma orquestração mais ampla entre países, e isso pode não acontecer. Para uma pandemia, as lideranças e governos deveriam agir antes para um *preparedness* mais ampliado, que fortaleça a prontidão dos sistemas de saúde diante da emergência (FREITAS; SILVA; ALPINO, 2021; WHO, 2002).

> *"E pela falta de organização da própria resposta que o mundo tinha por alguns momentos, ela (pandemia COVID-19) trouxe algumas certezas para nós, que você não pode ser dependente de um único país para produzir insumos para todo mundo". (Q01AC-E)*

Análise: Ao mesmo tempo existem questões locais dos sistemas produtivos, e as regulações de cada país que surgem como variável na perspectiva de preparação, que

encontram os limites de cada contexto, no âmbito dos complexos produtivos de saúde(GADELHA, 2021) e dos determinantes comerciais da saúde (GILMORE et al., 2023).

> *"É, dificuldades claras que você teria que ter feito muito antes, e ser preparado, para você, é, resolver isso. Só que assim, seguindo para falar de uma pandemia, então, ninguém poderia imaginar que poderia faltar isso." (Q01AC-E)*

Análise: Desafio de um modelo prescritivo não considerar as vulnerabilidades de um contexto. Um *preparedness* prescritivo ampliado, de condicionalidades pasteurizadas e globais a partir de organismos de referência, pode não ser possível, o que exige diferentes formas de prevenir e responder a uma emergência sanitária. A prescrição pode ser estática e a realidade é dinâmica, o que exige observar estruturas e comportamentos em análise sistêmica (MEADOWS, 2008; STERMAN, 2000)

> *"Os marcos, eles são prescritivos. Eles não são realmente estruturantes. É complicado, porque você tem uma fotografia prescritiva, e você tem uma dinâmica da realidade que às vezes não está estruturada para isso, não é?" (Q01LG-E)*

Análise: Alterar uma peça da realidade estabelece efeito sistêmico, como acontece numa emergência de saúde pública, com impactos, causas e efeitos transversais na sociedade.

> *"Ele (o modelo apresentado) vai naquelas flechinhas, mas se você pegar Foucault, por exemplo, Foucault, a proposta dele, que isso é um caleidoscópio, quer dizer, na medida em que você mexe uma peça, você mexe tudo e você não consegue voltar atrás. Sequência de imagens difíceis de você acompanhar e você estruturar uma resposta para aquilo." (Q01LG-E)*

Análise: Sim, é positivo o modelo PPRR (FREITAS; SILVA; ALPINO, 2021; WHO, 2002), do ponto de vista da gestão, mas com visão ampliada.

> *"Ele permite esse raciocínio administrativo, então ele tem uma utilidade muito grande do ponto de vista administrativo, obrigado." (Q01LG-E)*

Análise: Emergência por desassistência explicita todas as fraquezas a priori, portanto, uma preparação que falhou antes como sociedade, que não estruturou o básico. Definir o que é emergência, onde ela começa e como começa não é simples, pela realidade de cada contexto (WILDER-SMITH; OSMAN, 2020). Um sistema de saúde pode viver em fragilidades que já significam uma emergência de saúde local, porém, não atendida, e que se intensifica diante dos impactos de uma nova emergência de saúde pública, como aconteceu com a população indígena Yanomami, Amazonas, Brasil (BRASIL, 2023)

> *"No caso, a emergência Yanomami é uma emergência de desassistência. Então, toda essa ideia de que tenha uma estrutura ali funcionando antes, quando não tem." (Q01AP-E)*

> *"Isso é um questionamento que até a gente conversava muito, de que precisaria definir o que é a emergência? De caracterizar melhor ainda mais num país que tem um sistema de saúde?" (Q01AP-E)*

Análise: O modelo PPRR (FREITAS; SILVA; ALPINO, 2021; WHO, 2002) precisa incorporar as políticas existentes e estar dentro da construção de diretrizes gerais para a sociedade, sob pena de comprometer sua efetividade na preparação para emergências de saúde pública.

> *"Isso fala para mim também de um outro aspecto que eu acho em outros problemas, como talvez a mudança climática vá trazer, é que que esse modelo ele não fala muito claramente da influência de contextos políticos e de interesses políticos econômicos na configuração do problema e na solução." (Q01AP-E)*

Análise: A efetividade do PPPR (FREITAS; SILVA; ALPINO, 2021; WHO, 2002) é dependente da existência de políticas públicas de forma ampla, considerando desafios da sociedade, como aconteceu com os povos indígenas na COVID-19, que sofreram mais por passivos históricos de políticas não efetivas em suas realidades.

> *"No caso indígena, eu diria que tem um pressuposto, que é uma coisa muito anterior, que são os marcos, a defesa e a política pública de proteção de direitos específicos que, se não estiver andando, nada disso adianta." (Q01AP-E)*

Análise: O modelo PPRR (FREITAS; SILVA; ALPINO, 2021; WHO, 2002) é dependente do tempo de negociação política. Não é simples alcançar a efetividade de uma decisão nesse sentido, pois existe uma variável tempo para as respostas que precisa ser considerada.

> *"Então, esses modelos, eles não pensam no time, em certos cenários, como a questão de que tem que ter negociação. É a negociação do que vai ser feito, como vai ser feito, o tempo da resposta e o tipo de medida que o gestor, na decisão dele técnica, toma." (Q01AP-E)*

Análise: A preparação da resposta encontra desafios para promover uma abordagem equitativa, pois ocorre a prática de lei de guerra no contexto da emergência de saúde pública, como a Defense Production Act de 1950 (UNITED STATES. CONGRESS., 1950), lei americana que confere ao governo dos EUA a autoridade para priorizar e alocar recursos necessários para a segurança nacional, especialmente em tempos de guerra ou emergências nacionais. Nesse contexto, a força do poder econômico faz a diferença, e pode comprometer a equidade no acesso a bens e serviços, como aconteceu na COVID-19 (SACHS et al., 2022).

> *"Estávamos preparando hospital aqui para estar pronto (na COVID-19), comprar ventilador. E a China disse, estou devolvendo seu dinheiro. Foi quando os Estados Unidos compraram os ventiladores e pagaram 3 vezes mais. Então, os interesses econômicos sobrepuseram a necessidade." (Q01FS-E)*

Análise: O lugar da informação como elemento estratégico sobre o território para estar preparado, agir na crise e superar obstáculos. A gestão da informação e do conhecimento que prioriza base de dados, mantém a prontidão do sistema de alerta e de vigilância em saúde, a interface de atores e processos, e o posicionamento do sistema de governança nas emergências de saúde pública (WHO, 2019).

> *"Então, quando a gente vai trabalhar esses macroprocessos, muitas vezes eles nos ajudam e abrem os olhos do gestor para a necessidade da informação. Então, uma das coisas que a COVID-19 nos trouxe é que nós precisamos estar cada vez mais conhecendo informação do nosso território". (Q01NM-E)*

> *"Então, a partir do momento em que você tem a explosão de uma doença que não é conhecida, onde não se tinha uma receita, você, pelo menos tem a governança da informação, a governança do seu território para que, dentro dos macroprocessos, você realmente possa traçar um plano que seja real e estruturado." (Q01NM-E)*

Análise: Um modelo de PPRR (FREITAS; SILVA; ALPINO, 2021; WHO, 2002) efetivo precisa alinhar as dimensões estratégica, tática e operacional, principalmente a questão logística em grandes regiões, como o Amazonas.

> *"Lá no slide anterior, quando você colocou visão estratégica, os macroprocessos estão atuando mais na área tática e operacional do que na parte estratégica. Então, na visão do gestor, estrategicamente ele tem que considerar toda a realidade, inclusive as questões logísticas." (Q01NM-E)*

Questão 2: A produção de bens e serviços (insumos estratégicos para a saúde) é um componente de capacidade ou de vulnerabilidade de um contexto para enfrentamento da Emergência. Os subsistemas do CEIS são abrangentes para a complexidade do que ocorre numa emergência?

Análise: Integrar a perspectiva pública e privada no PPPR (FREITAS; SILVA; ALPINO, 2021; WHO, 2002), quando se fala de insumos e medicamentos à luz de uma questão normativa

> *"Porque quando você fala nas indústrias, e aí está dentro do complexo do CEIS, você trabalha não só a indústria pública, como a indústria privada; você tem uma fragilidade muito grande; são entes que estão em patamares totalmente diferentes."(Q02AC-E)*

Análise: O desafio do complexo produtivo de bens e serviços (GADELHA, 2021) para a saúde em todo o país, como política para o PPRR (FREITAS; SILVA; ALPINO, 2021; WHO, 2002). Um desafio também de logística e das contas públicas. Exemplo – o custo de fazer chegar um parafuso nos lugares mais distantes do país, pode não justificar o investimento.

> *"O custo para você levar um parafuso inviabiliza o seu orçamento. A preparação de ações é isso. A gente queria levar, mas não vai levar, porque o custo da logística inviabiliza qualquer ação."(Q02AP-E)*

Análise: Atores políticos influenciam nas ações de preparação, portanto, dar efetividade ao modelo PPRR (FREITAS; SILVA; ALPINO, 2021; WHO, 2002) é conhecer a dinâmica das regiões do país.

> *"O conflito de interesse é algo que é fácil manejar no Rio de Janeiro e São Paulo, porque as pessoas não se conhecem; mas numa cidade, por exemplo, como Boa Vista, todo mundo se conhece; você vai manejar conflitos de interesse em negociações políticas de serviço público, econômicas ou com interesses, inclusive os ilegais, por exemplo." (Q02AP-E)*

Análise: As etapas de preparação e resposta para a emergência de saúde pública diante de questões nacionais, de governo, ou do próprio Ministério da Saúde que ainda não estão resolvidas, e que assumem uma realidade diferenciada pelas características do território, como acontece na logística para bens e serviços no Amazonas.

> *"Porque não é só vontade política ou do gestor, mesmo entendendo essa necessidade, mas perpassa por todo o desafio de conseguir fazer com que, em regiões onde você tem percursos de 15 dias fluviais, ou você tem 3 horas de aviação, você conseguir manter estrutura de alta complexidade e fazer disso territórios onde as pessoas consigam ter um fluxo terapêutico ordenado. Porque o Ministério da Saúde ainda não consegue alcançar e não consegue ter um financiamento diferenciado para isso, não é SAMU, é uma outra política."(Q02NM-E)*

Análise: O desafio da logística do país em tempo comum se intensifica em emergência de saúde pública. Que nível de preparação podemos ter para isso? O desafio de infraestrutura e logística para a provisão de insumo estratégico em tempo eficaz, considerando as características das regiões do país (WHO, 2019).

> *"Com isso, a gente sobrecarrega o planejamento e o sistema por falta de opção. E se a gente chega numa época dessa, de emergência, em que a gente não consegue nem o básico? O país, a infraestrutura, ela tem que se preparar para isso, se não, não adianta dizer que vai ter fábrica, vai ter pessoa capacitada, se a gente não consegue transitar o mínimo." (Q02FS-E)*

Análise: A conceituação de CEIS (GADELHA, 2021) teve uma abordagem diferente em anos anteriores nos Estados Unidades da América. O conceito pode ter significado diferente, conforme o país, o que dificulta o entendimento sobre uma preparação mais

global dos sistemas produtivos de saúde com afirmação de equidade, que reforça o atendimento aos indivíduos de acordo com suas necessidades, um princípio basilar para a saúde global em todas as etapas de uma emergência (WHO, 2023a).

> *"Essa ideia (do CEIS) é interessante aqui no Estados Unidos. Quando fala complexo da saúde, o pessoal pensa exatamente o contrário, diametralmente oposto. E eu não sei se em outros países têm, mas eu acho que esse é um problema; quando você não tem comparabilidade nos sistemas, é difícil." (Q02LG-E)*

Questão 3: Sobre os níveis de atenção no território. Eles são abrangentes para a organização dos serviços na complexidade de uma emergência?

Análise: O planejamento ou a ação de resposta na emergência de saúde pública, que integra estratégias de saúde e atores (WHO, 2019), precisa considerar os serviços regulares e o tratamento de outras doenças da população, sob pena de agravar fragilidades existentes do sistema de saúde.

> *"Eu acho que um dos aspectos que são bem desafiadores quando a gente fala de níveis de atenção na situação de emergência, por exemplo, é você garantir que haja o atendimento, a organização para o atendimento da demanda vinda da emergência e também dar continuidade às demandas que são de rotina." (Q03EL-E)*

Análise: Os níveis de atenção são afetados por um aumento repentino de demanda, por exemplo, um desastre que gera a emergência. O atendimento em situação de caos (domínio caótico) é diferenciado, considerando o que é rotina e o que se revelou como complexidade na emergência de saúde pública (SNOWDEN; BOONE, 2007).

> *"Por exemplo, você faz com que as unidades de saúde e serviços de saúde continuem funcionando em sua plenitude, mesmo que essa plenitude seja fragilizada durante uma emergência, como existe a situação de desastres. Como existem muitas vítimas, exige uma abordagem mais especializada, como ocorre na exposição a um determinado produto químico, né?" (Q03EL-E)*

Análise: A preparação dos níveis de serviço deve ser um ponto permanente para fortalecimento das respostas em todos os níveis de uma emergência de saúde pública (WHO, 2019), com pessoal qualificado e experiente. Porém, equipes importantes são descontinuadas dos serviços essenciais em momento não pandêmico, como os agentes comunitários de saúde que conhecem a realidade da saúde na ponta do sistema, na linha de frente, aquele que cuida de uma urgência básica e que atua nas equipes de saúde da família.

> *"Quantas equipes hoje os gestores têm? É, eu queria é fazer uma junção com a primeira pergunta em relação aos macroprocessos, porque na hora em que a gente olha para os níveis de atenção; onde está o agente comunitário de saúde raiz? Aquele lá do tempo em que a gente fazia a integração de equipe de saúde da família, que hoje a gente não visualiza. O que realmente a gente entende ser urgência básica e que deve ser atendido na atenção básica." (Q03NM-E)*

Análise: O desafio de preparar as estruturas do sistema para as causas externas, como as violências coletivas marcadas por guerras e conflitos que geram emergências e crises humanitárias (KRUG; WORLD HEALTH ORGANIZATION., 2002).

> *"Emergência em saúde pública num ponto de prevenção, preparação e da recuperação dentro da organização de cada ponto aqui do sistema. Então hoje, quando a gente sabe que as causas externas, elas estão matando muito mais do que as neoplasias, nós estamos olhando isso com uma emergência de saúde pública." (Q03NM-E)*

> *"Então, é uma discussão muito profunda que perpassa como nós estamos encarando os problemas coletivos frente às situações que nós já nos acostumamos praticamente a ver, que não é algo tão catastrófico e emergente, como foi a COVID-19, mas não deixa de*

estar entre as principais causas de morbimortalidade, que é o crónico, as doenças externas e o paciente indígena." (Q03NM-E)

Análise: Atenção primária culturalmente adaptada para as demandas de um subsistema de saúde indígena com particularidades na prestação de serviços, como o acompanhamento da família dos enfermos, com apontamentos sobre hospedagem e regras de convívio do espaço hospitalar (PAHO, 2019).

"Então é isso que ela está colocando: no caso do subsistema de saúde indígena, além desses níveis de atenção, você tem que ter unidade de apoio, por exemplo, essa pessoa sai do território indígena para ficar morando, fazendo um tratamento de câncer. Como você garante, não só a pessoa paciente, mas a família inteira." (Q03AP-E)

Questão 4: A interpretação de um território por suas capacidades, vulnerabilidades e níveis de exposição que afetam o indivíduo, é suficiente em contextos de emergência? Considere o conceito de risco à saúde definido pelo Regulamento Sanitário Internacional: "a probabilidade de um evento afetar adversamente a saúde das populações humanas, com ênfase naquele que pode se espalhar internacionalmente ou representar um perigo sério e direto (WHO, 2016)**"**

Análise: Uma única variável é insuficiente para explicitar as vulnerabilidades de um contexto ou a situação de saúde. Os Determinantes Socais da Saúde (DSS), que representam as condições sociais, culturais, políticas, econômicas e ambientais onde vive uma população (BIREME / OPAS / OMS, 2023; WHO, 2021b), são entendidos em abordagem interdisciplinar e sistêmica, portanto, a partir da integração de diferentes dimensões e variáveis.

"E agora a questão colocando dentro da condicionante de risco, quando a gente fala do problema do oxigênio, quando a gente fala do problema que aconteceu em Manaus, Amazonas; muito tempo depois começaram-se as discussões correlacionando isso com os determinantes sociais, porque em todo momento é sempre encarado como uma ausência de planejamento, mas é muito além disso. Então, a gente precisa ter realmente uma lupa no problema, por que como é que você acha que uma única variável é responsável por uma situação?" (Q04NM-E)

"Com certeza, os determinantes sociais hoje e as evidências científicas mostram isso: quando a gente vai discutir acesso, quando a gente vai discutir condições de vida, quando a gente vai discutir o nível educacional, quando a gente vai discutir as condições sociais da população, quando a gente coloca a população indígena num local onde tem maior população e a forma como ela é distribuída." (Q04NM-E)

Análise: Vulnerabilidades, capacidades e nível de exposição (FREITAS; SILVA; ALPINO, 2021) são condicionadas pelo tipo de perigo que impacta a emergência, um perigo reforçado como categoria de análise. Parte disso pode ser trabalhado, mas um perigo ou ameaça acontece sem aviso para a magnitude do impacto que vai alcançar; e o máximo é tentar lidar com ele.

"Aí, além das capacidades, das vulnerabilidades e da exposição, eu adicionaria um aspecto que é fundamental, que é o tipo de perigo, ameaça, para a qual uma determinada localidade ou algumas pessoas estão expostas. Não é você considerar as condições de vida ou a dinâmica de um determinado território?" (Q04EL-E)

"Isso é fundamental para que você compreenda o risco que está ali presente e também compreenda todos esses aspectos para que consiga influenciar nessas condições de risco." (Q04EL-E)

Análise: O desafio de tratar as singularidades dos DSS nos diferentes contextos responde a diferentes tipos de risco (WHO, 2019). Isso pode tensionar os esforços de modelagem a partir de frameworks, na perspectiva de uma dinâmica ampliada e de larga escala,

que precisa contemplar dimensões do contexto, o que pode implicar na disponibilidade e acesso a dados.

> *"É, se eu estou olhando da esfera federal, eu tenho que conhecer todos os aspectos que estão ali presentes, e que são fundamentais para um decisor da esfera federal. Mas eu também tenho ali a comunidade, o bairro, uma determinada localidade, um município, uma regional de saúde, um estado, uma macrorregião, então a gente tem que pensar que são escalas diferentes que a gente tem que observar para que olhar com certa singularidade para todos esses fatores, que envolvem tanto os determinantes quanto os elementos que compõem o cenário de risco. Então, eu acho que, conhecer essa dinâmica é fundamental e chama atenção para um outro aspecto relacionado ao risco também." (Q04EL-E)*

> *"Eu acho que essa questão do risco e dos determinantes sociais, ela deveria servir como arcabouço para qualquer planejamento; imagino nessas últimas situações emergenciais, tanto COVID-19 quanto a questão Yanomami."(Q04FS-E)*

> *"Sobre a outra questão que você estava falando nessas emergências, nessa questão de determinantes sociais e desigualdades, ela é uma coisa complexa, porque na verdade, a emergência exacerba isso, não é? Quer dizer, traz à tona um quadro social que já existia há mais tempo." (Q04LG-E)*

Análise: O desafio de superar a exaustão das estruturas pós emergência que afetou a dinâmica da vida. O conceito de resiliência por uma lente de reconstruir melhor para alcançar uma nova realidade (ANSELL; SØRENSEN; TORFING, 2021).

> *"Porque você adotou medidas que vão resultar, que vão continuar após a emergência, às vezes para pior, porque a pouca capacidade que você tinha, quando tinha, foi ali exaurida e você não teve condições de se restabelecer, então, acho que esse é outro elemento também importante de a gente observar nessa abordagem." (Q04EL-E)*

Análise: Os povos indígenas interpretam a vida com outras lentes, veem o risco da doença como um ataque múltiplo, que coloca à prova a vida em um contexto de fragilidades preexistentes, que são as condições de partida de um contexto (ANGELI; MONTEFUSCO, 2020), que gera um impacto ampliado e desigual.

> *"É, no caso Yanomami é a mesma coisa; toda a emergência sanitária decorrente da ausência da proteção territorial e da invasão que gerou uma bola de neve, de problemas ambientais, de transmissão de malária, de transição de COVID-19, de produção de álcool, de introdução de arma, e de fechamento de unidades de saúde pela situação de conflitos e segurança." (Q04AP-E)*

Análise: Ocorre uma visão reducionista ao tratar o problema da desassistência em território Yanomami pela presença do mercúrio (BRASIL, 2023). Outras questões estão relacionadas ao garimpo ilegal. O mercúrio impacta, mas não existe evidência direta disso. A ausência de uma abordagem sistêmica e de um sistema de vigilância do mercúrio, com coleta, análise e registro gera essa dificuldade.

> *"Em consequência, o garimpo não é sinônimo de Mercúrio, é uma redução muito grande tratar assim. É chegar a malária, é destruir o ambiente onde vai ter a roça. É poluir o rio, é contaminar, sim, de mercúrio. Daí também a questão do mercúrio. Foi uma coisa que eu fui tentando entender efetivamente." (Q04AP-E)*

Questão 5: Na área de gestão, a OMS criou o *Health Emergency and Disaster Risk Management Framework* (H-EDRM). Seus componentes são suficientes para a abordagem da gestão numa emergência?

Análise: H-EDRM (WHO, 2019) deve ser trabalhado de forma permanente em todos os níveis interfederativos, não restrito ao momento de uma emergência de saúde pública, para alcançar uma preparação mais efetiva da gestão.

> *"Não estou tirando a relevância de todos esses aspectos na emergência, não, mas eu estou chamando atenção que para que você atue de forma oportuna em uma emergência, seja ela qual for, você tem que organizar todos esses tópicos aí antes da emergência acontecer." (Q05EL-E)*

Análise: A preparação do Recursos Humanos (WHO, 2019) depende de legislação adequada nos níveis da federação, com proteção social para o profissional e sua família em caso de algum revés. Isso implica considerar aspectos de vida social, de vínculo empregatício, de capacitação, de saúde mental, principalmente aos profissionais de linha de frente.

> *"A gente sempre tem profissionais de saúde em campo numa situação de emergência. Esses profissionais de saúde vão para campo sem nenhum respaldo, muitas vezes sem sequer um vínculo e sem nenhum seguro de vida, sem nenhum seguro saúde e sem nenhuma capacidade de ter respaldado a sua família." (Q05EL-E)*

Análise: A infraestrutura para emergência de saúde pública (WHO, 2019) sofre os desafios de logística e pode não ser viável para algumas regiões, como a implantação de hospitais de campanha.

> *"Outro aspecto: a questão de você ter infraestrutura com capacidade para atuar em emergência, nós tivemos no Ministério da Saúde, por exemplo, comprando hospitais de campanha para que fosse utilizado em emergência. Só o gerador do hospital de campanha pesava 200 kg. Você não conseguia levá-lo para lugar nenhum." (Q05EL-E)*

Análise: Segurança foi proposta como nova categoria ao H-EDRM (WHO, 2019), pois é elemento definidor de áreas de conflito armado e guerras que impactam nas ações de saúde no território.

> *"A outra questão é a questão da segurança no caso Yanomami, uma emergência numa área de conflito armado. Na gestão, a questão da segurança era um fator agravante para os profissionais de saúde." (Q05AP-E)*

Análise: Negociação com lideranças foi proposta como nova categoria ao H-EDRM (WHO, 2019). Não se trata de participação comunitária, mas de negociação política necessária ao enfrentamento da emergência de saúde pública.

> *"No caso indígena, o que não fica evidente que tem que ter é a questão da negociação com lideranças em termos de impactação. Isso não é participação comunitária, é outra coisa, é uma instância de negociação política necessária no caso." (Q05AP-E)*

Análise: A dimensão local/regional deve ser um ponto de atenção na aplicação do H-EDRM (WHO, 2019), pois existem particularidades no contexto que requerem um olhar mais adaptado, sendo possível observar padrões emergentes e a complexidade local (EUROPEAN COMMISSION, 2021; SNOWDEN; BOONE, 2007).

> *"Um plano de contingência construído no Amazonas, principalmente no enfrentamento à COVID-19, eles foram construídos dentro destes eixos e discutidos com a Opas. Então, cada eixo (componentes H-EDRM) desse aqui abria de acordo com a realidade." (Q05NM-E)*

Análise: O abastecimento de oxigênio foi uma questão nacional e não houve planejamento para esse aumento de demanda no Brasil e especificamente em Manaus

(FERREIRA; JUNIOR, 2022), mesmo sendo o contexto de uma Síndrome Respiratória Aguda Grave, situação em que o oxigênio medicinal é reconhecido como um medicamento essencial, sem substituto e crucial para o manejo da hipoxemia (WHO, 2023b)

> *"Infraestrutura de saúde, logística: nenhum plano de nenhum estado do país, de nenhuma capital do país, tinha suprimento de oxigênio. Porque é uma realidade que nunca se vivenciou e se imaginou tendo um plano de contingência, você ter que trabalhar trazendo usina e você ter que trabalhar furando poço aí para poder ter maior produção de oxigênio, em nenhum momento." (Q05NM-E)*

Análise: Deve haver um balanço entre o que significa responsabilidade do gestor e os impactos inesperados de uma emergência de saúde pública, como uma pandemia que afeta a sociedade, pois algum nível de inadequação vai surgir. A gestão que cuida da regularidade tem o desafio de cuidar do extraordinário. O processo regular pode não ser suficiente, dada a natureza da emergência de saúde pública, como aconteceu com o fornecimento de oxigênio. A efetividade da governança na emergência requer uma abordagem multissetorial (WHO, 2021a) e sistêmica da saúde, que inclui comportamentos de saúde e risco, fatores ecológicos e sistemas de entrega relacionados à saúde (HOMER; HIRSCH, 2006), sobre os integrais saúde-enfermidade-atenção (ALMEIDA FILHO, 2000, 2006).

> *"Dentro da área da saúde, o que é governança do gestor? Na parte de infraestrutura, quando a gente tá discutindo infraestrutura, nós estamos discutindo saúde. Você tem que ter conhecimento, mas até que momento, dentro de um eixo de plano de contingência, de um eixo de emergência em saúde pública, você vai olhar só para o setor da saúde? Porque se a gente tem, na concepção da Opas, que saúde não é ausência de doença, mas é um conjunto de fatores, então você precisa ter intersetorialidade." (Q05NM-E)*

Questão 6: Vamos comentar sobre fronteiras, sobreposições e condicionalidades entre as categorias apresentadas.

Análise: O framework proposto pode abordar as características das populações e grupos especiais, como os povos indígenas, não pode pasteurizar a análise.

> *"É verdade que por um lado é a revelação de um quadro social existente, mas também é verdade que você, para enfrentar no contexto da emergência, todo esse quadrinho que você estava mostrando aí, ele é diferente quando você trata, por exemplo, de população indígena, a gestão tem que ser diferente. O indivíduo é diferente. O contexto é diferente, você tem que ter esses dois parâmetros, né?" (Q06LG-E)*

4. Grupo Focal Confirmatório

A análise dos resultados está organizada por questão, no formato Q00XX-C, com a seguinte identificação:

- Q00 - identifica questão, como segue:
  a. (Q01) - Complexidade das decisões de gestão na emergência sanitária;
  b. (Q02) - Abordagem conceitual do FADES;
  c. (Q03) - Aplicação do FADES.
- XX - identifica o participante
- C – identifica Grupo Focal Confirmatório

4.1. Roteiro de Discussão

O Quadro 2 apresenta o planejamento do Grupo Focal Confirmatório, que avaliou a estrutura de análise e a aplicação do FADES ao caso do desabastecimento do oxigênio em Manaus (AM - Brasil) na COVID-19.

Quadro 2 - Roteiro Grupo Focal Confirmatório.

Blocos	Objetivos e Conceitos Relacionados
Apresentação participantes	Integrar o Grupo.
Termo de Consentimento Livre Esclarecido	Apresentar a forma de participação no Grupo Focal.
Objetivo Geral do Grupo Focal	Relatar o objetivo geral do Grupo Focal
Bloco I: Complexidade das decisões de gestão na emergência sanitária.	Analisar elementos da complexidade das decisões relacionados à dimensão cognitiva e à racionalidade limitada do decisor |(SPIEGEL; CAULLIRAUX, 2013).
Bloco II: Avaliação da abordagem conceitual do FADES.	Explorar os conceitos que compõem o FADES: Modelo PPRR e H-EDRM (FREITAS; SILVA; ALPINO, 2021; WHO, 2002, 2019); Dinâmica de Sistemas (STERMAN, 2000; MEADOWS, 2008); Cynefin Framework (SNOWDEN; BOONE, 2007); Complexidade em Saúde e integrais de Saúde-Enfermidade-Atenção (Almeida Filho, 2000, 2006); 1 – Capacidades; 2 – Vulnerabilidades; 3 - Nível de Exposição (Freitas et al., 2021); Determinantes Sociais da Saúde (BIREME / OPAS / OMS, 2023; WHO, 2021); Determinantes Comerciais da Saúde (FRIEL et al., 2023; GILMORE et al., 2023). CEIS (Gadelha, 2021)
Bloco III: Aplicação do FADES ao caso de desabastecimento do oxigênio em Manaus (AM - Brasil) na COVID-19.	Analisar a estrutura do FADES aplicado ao caso de Manaus: Aplicabilidade, completeza, requisito temporal, reusabilidade e adaptação.
Exemplos: o FADES na etapa de Preparação - no fortalecimento do ciclo PPRR na emergência de Saúde Pública.	Abordar a aplicação do FADES em outros casos de emergências: Complexo produtivo da saúde; Dengue no Brasil; Determinantes Sociais da Saúde e o comportamento da doença.
Comentários finais	

Fonte: Elaborado pelo autor (2024).

Os temas abordados foram analisados conforme os blocos apresentados e os resultados descritos no item 4.2.

4.2. Questões e Análise de Resultados

Após a realização de Grupo Focal foi realizada uma análise de conteúdo das falas dos participantes e aplicado um questionário de avaliação do FADES – ***Quadro 3*** , que teve como objetivo verificar pontos de atenção sobre o modelo proposto. O questionário foi composto de perguntas usando a escala Likert para conhecer o nível de concordância dos participantes (discordo totalmente, discordo parcialmente, nem concordo - nem discordo, concordo parcialmente, concordo totalmente) sobre os seguintes aspectos:

- Abordagem conceitual - verifica se os conceitos adotados na concepção do FADES são conhecidos e passíveis de entendimento. Segue a definição operacional do conceito, que descreve um fenômeno com clareza para estabelecer instruções e realizar experiências semelhantes (Lakatos & Marconi, 2000).
- Aplicabilidade – define a característica do que se consegue aplicar, é um dos critérios que determinam se o resultado de uma pesquisa pode ser utilizado efetivamente em um ambiente. Está relacionada às práticas baseadas em evidência, que consideram a relevância contextual, a decisão informada e a integração de evidências, relacionando as condições específicas de um contexto (BOOTH; BRICE, 2003; WILSON, 2010)
- Completeza – analisa o conjunto de requisitos que representa a totalidade das necessidades de um produto (PMI, 2021, p.142). Verifica se a estrutura analítica do FADES pode representar a relação entre o comportamento da doença no contexto e os impactos na gestão.
- Requisito temporal – avalia a informação prospectiva, a tendência emergente que direciona a tomada de decisão. Considera o desempenho de prazos como medida de eficiência entre um plano programado (preparação) e o executado (resposta, prevenção e recuperação) (FREITAS; SILVA; ALPINO, 2021; PMI, 2021; WHO, 2002), e representa uma perspectiva cíclica e sistêmica que retroalimenta a análise (MEADOWS, 2008; STERMAN, 2000).
- Reusabilidade e adaptação – estrutura uma modelagem a partir de categorias predefinidas, capazes de atender necessidades específicas no desenvolvimento de modelos para diferentes contextos (ROMANO, 2003). A reusabilidade possibilita escolher, ajustar e adaptar a abordagem da governança e dos processos de uma situação-problema à complexidade do ambiente (PMI, 2021).

O *Quadro 3* apresenta o questionário organizado pelos aspectos citados.

Quadro 3 - Questionário de avaliação do modelo FADES.

Aspecto	Questão	Objetivo
Conceitual	1 - Você pratica abordagem sistêmica nas decisões durante as emergências sanitárias?	Verificar a importância da visão sistêmica, interdisciplinar e multisetorial nas decisões do gestor na emergência de saúde pública.
Conceitual	2 - Suas heurísticas e vieses têm peso nas decisões que participa nas emergências sanitárias?	Conhecer a importância das heurísticas e vieses na tomada de decisão.
Conceitual	3 - Simulações sobre a complexidade dos recursos de gestão de um sistema de saúde fortalecem a preparação para as emergências sanitárias?	Conhecer a potencial do FADES como simulador de gestão para as emergências de saúde pública: projeção de cenários, análise de tendência.
Aplicabilidade	4 - A aplicação do FADES ao caso de Manaus (AM) na pandemia de COVID-19, apresentou a complexidade do desabastecimento de oxigênio na região?	Avaliar a aplicação do FADES no caso de Manaus.
Aplicabilidade	5 - A visão sistêmica pode ser útil para a comunicação de risco no contexto de uma emergência sanitária?	Verificar a aplicação do FADES como gerador de sensemaking, e sua relação com estratégias de comunicação de risco na emergência de saúde pública.
Completeza	6 - A estrutura de análise do FADES possibilita ao gestor intervenções adaptadas ao nível de complexidade dos sistemas de saúde e seus contextos? Ela integra: componentes de gestão (H-DERM - WHO) e Determinantes de Saúde (sociais, ambientais, econômicos, comerciais).	Avaliar a integração dos conceitos escolhidos para compor as categorias de análise FADES.
Completeza	7 - O FADES pode apoiar as salas de situação e centros de operações nas emergências sanitárias?	Verificar robustez do modelo para os espaços de decisão: sala de situação, Centros de Operações e outros.
Temporal	8 - O modelo de Preparação, Prevenção, Resposta e Recuperação pode ser um ciclo permanente no enfrentamento das emergências sanitárias?	Verificar a efetividade de um monitoramento permanente, com aplicação do FADES ao modelo PPRR, para verificar o desempenho dessas etapas e observar tendências no comportamento das estruturas do sistema de saúde.
Reusabilidade	9 - O FADES pode ser adaptado para diferentes realidades de sistemas de saúde no enfrentamento das emergências sanitárias?	Verificar se o FADES colabora com uma das lacunas identificadas na pesquisa - a dificuldade de reaplicação dos modelos para diferentes realidades.
	10 - Apresente um comentário ao desenvolvimento do FADES.	

Fonte: Elaborado pelo autor (2024).

Os resultados da análise de conteúdo das falas e dos níveis de concordância estão apresentados nas questões relacionadas aos temas.

Bloco I: Complexidade das decisões de gestão na emergência sanitária

Análise: A complexidade de decisão condicionada pelo tipo de emergência sanitária, sobre as evidências disponíveis no início da crise, conforme o contexto e a necessidade de respostas rápidas. Considerar o tipo de emergência, a evidência disponível, a informação e a decisão em tempo oportuno, exige estruturas de análise para simulações e efeitos de demonstração, uma característica dos sistemas especialistas (AKABANE, 2018) sobre os limites da gestão e a complexidade que isso gera para o enfrentamento da emergência sanitária. A simulação e seu efeitos de demonstração teve 100% de concordância para os participantes, como mostra a *Figura 1*.

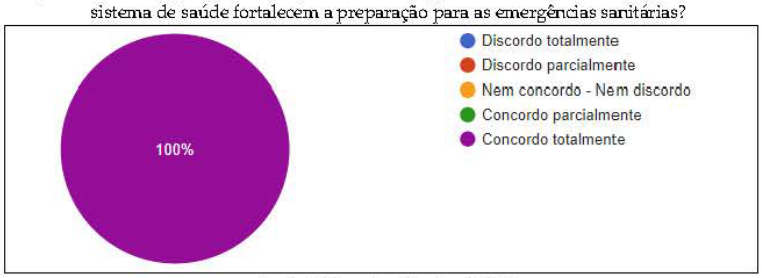
> *"A complexidade da tomada de decisão, ela vai muito do que é apresentado naquele momento como emergência, né?" (Q01DC-C)*

> *"Então, depende muito da característica do que é apresentado enquanto emergência, mas eu acho que há o tripé da evidência, da informação, e do tempo oportuno. Isso é muito importante". (Q01DC-C)*

> *"Depende muito da característica da emergência, mas eu acho que a tomada de decisão, ela precisa estar baseada em evidências que você já tem. Ela precisa conter a realidade que você está vivendo." (Q01DC-C)*

> *"Eu concordo com os colegas, com o que foi falado antes, mas acho a questão da complexidade, ela é uma das coisas que a DC falou disso, eu acho que tem a questão do momento, o contexto, a rapidez." (Q01VF-C)*

Figura **1** - Gráfico questão: Simulações sobre a complexidade dos recursos de gestão de um sistema de saúde fortalecem a preparação para as emergências sanitárias?



Fonte: Elaborado pelo autor (2024).

Análise: A informação e os dados do contexto disponíveis para enfrentamento da crise sanitária (WHO, 2019), como base para tomada de decisão atempada em regiões de grande extensão e diferentes formas de organização, envolve a realidade de mais de um estado e guarda fronteiras com outros países.

> *"Você não consegue tomar uma decisão dentro da gestão se você não tiver a informação precisa do que você tem de realidade, não é? A gente observa muito isso na região da Amazônia legal, onde você tem dificuldades, inclusive, de ter as informações em tempo oportuno." (Q01DC-C)*

> *"E a outra coisa é que o gestor precisa conhecer o seu processo de organização numa tomada de decisão." (Q01DC-C)*

Análise: A experiência e o aprendizado anterior são condicionantes para projetar um panorama da crise sanitária e observar o comportamento das estruturas de gestão no longo prazo, num efeito de iteração de acúmulo de conhecimento para o processo de decisão (EUROPEAN COMMISSION, 2021).

> *"Em qualquer tomada de decisão a gente precisa também levar em consideração experiências anteriores. A gente às vezes comete os mesmos erros, né? É, às vezes o contexto*

muda, claro, um pouco. Não é necessariamente o mesmo, mas a gente comete sempre os mesmos erros." (Q01PC-C)

"Eu acho que uma dificuldade nessa complexidade é a gente ter um panorama do que nós já aprendemos. Quais são os ganhos que nós tivemos com outras emergências, com outras situações em que nós precisamos colocar todos os nossos esforços?" (Q01PC-C)

"Muitas vezes você precisa ter uma resposta, uma decisão muito centrada, um conjunto de elementos que às vezes não são os elementos futuros daquilo que você precisa ter, mas você precisa tomar isso como geral da complexidade." (Q01VF-C)

"A gente estava com essa emergência em relação a COVID-19, tivemos a emergência Yanomami, e agora, mais recentemente, tivemos a emergência no Rio Grande do sul. A gente precisa, eu acho, ter um panorama de tudo o que a gente aprendeu e o que a gente, como gestor, conseguiu organizar a partir dessas experiências anteriores." (Q01PC-C)

Análise: Tomada de decisão atempada em pontos de interferência de um contexto, de forma parametrizada, com abordagem interdisciplinar das dimensões que integram a complexidade, para mudança de rota no comportamento das estruturas de gestão na emergência sanitária, sobre os integrais de saúde-enfermidade-atenção (ALMEIDA FILHO, 2000, 2006)

"Uma decisão significa uma mudança de rota. Significa uma intervenção sobre algo que poderia ser entendido como um dado. O curso natural. Então, óbvio que entendendo uma decisão num ambiente de complexidade significa, portanto, o ambiente onde várias dimensões estão interagindo simultaneamente. É razoável que você, com base em experiência e em alguma estrutura, valorize o conjunto daquelas dimensões." (Q01PB-C)

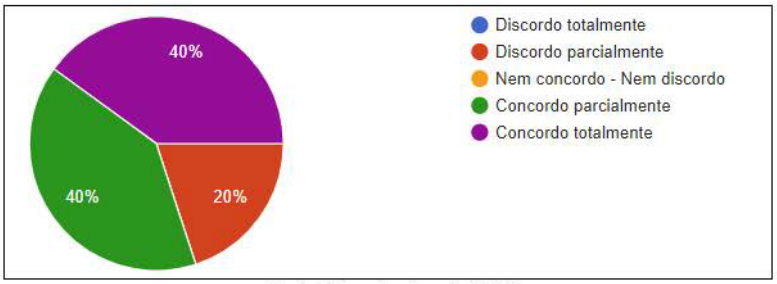
Análise: Heurísticas e vieses valorizadas nas decisões do gestor como base para lidar com o risco nas emergências, o que direciona escolhas e comportamentos (KAYMAN; LOGAR, 2016), observando eventos similares anteriores, especialmente no momento inicial da crise, quando prevalece ausência de informações, incertezas, urgências e evidências ainda não confirmadas e de baixa ou média certeza (GROOT et al., 2021). Na avaliação, 40% dos participantes concordam totalmente, 40% concordam parcialmente sobre a importância de suas heurísticas e vieses; e 20% discordam parcialmente, como apresentado no *Figura* 2, o que pode estar relacionado com o nível de complexidade de uma decisão que requer maior consenso entre pares ou a confirmação de evidências.

"De qualquer modo, um processo decisório, especialmente no ambiente de emergência, ela é uma decisão, todos falaram isso, uma decisão debaixo de um risco. Um grau de risco em que você toma a decisão ainda que não tenha o domínio pleno das informações, mas o contexto impõe a decisão. O que significa, obviamente, um determinado grau de experiência de acúmulo, de conviver com momentos anteriores, onde você já esteve diante de condições similares, né?" (Q01PB-C)

"E mais, de qualquer modo, significa algo que impõe prontidão, né? No sentido de que não é necessário esperar o melhor momento do ponto de vista de acúmulo de informações para que aquela decisão seja tomada." (Q01PB-C)

"É preciso, de fato, ter uma prontidão é saber correr risco no sentido de que você está interferindo na realidade de baixo de um determinado grau, digamos, de pressão, de urgência, é um pouco isso do meu ponto de vista." (Q01PB-C)

Figura 2 – Gráfico questão: Suas heurísticas e vieses têm peso nas decisões que participa nas emergências sanitárias?



Fonte: Elaborado pelo autor (2024).

Análise: Agir na crise é assumir riscos e lidar com incertezas para posicionamentos em condições adversas ou aparentemente sob controle, e estar preparado para o efeito das decisões que não se pôde aferir antes sobre seus impactos, um olhar sobre experiências do passado, condicionalidades do presente e expectativas de futuro (GADELHA et al., 2016).

> *"Tem a complexidade na decisão, tanto em ambiente de emergência quanto no ambiente que as vezes a gente entende que está controlado, né?" (Q01AM-C)*

> *"Essa complexidade, eu vejo que o gestor que estiver naquele momento ali, ele vai ter que ter um grande discernimento para a decisão, que deve ser a melhor a ser tomada." (Q01AM-C)*

> *"E não vai adiantar tomar uma decisão achando que vai correr menor ou maior risco. Em alguns momentos você consegue avaliar esse grau de risco, mas em outros momentos, não. Mas, você tem que tomar aquela decisão naquele momento." (Q01AM-C)*

> *"Então, às vezes a gente toma uma decisão para resolver aquele problema emergencial, e algumas vezes, essa decisão, ela vai ter consequências que naquele momento não foi possível se aferir." (Q01AM-C)*

> *"O que não pode deixar de ter é a tomada de decisão, independente do ambiente que se esteja, um ambiente controlado, um ambiente emergencial; a tomada de decisão ela tem que acontecer, ou seja, não podemos ter a omissão da decisão; seria mais complicado a não tomada de decisão." (Q01AM-C)*

Bloco II: Avalição da abordagem conceitual do FADES.

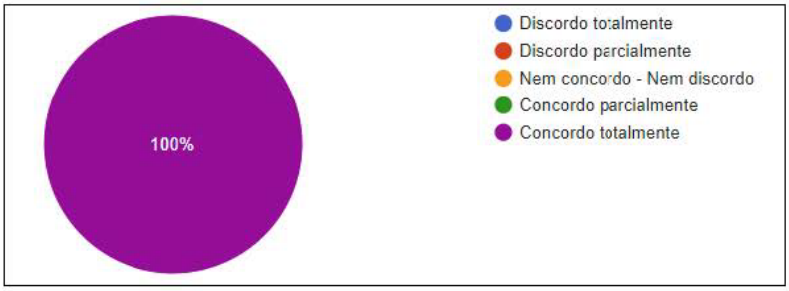
Análise: O framework como interface entre o decisor e o contexto de emergência sanitária, que cumpre papel ao integrar informações e apoiar a decisão diante da complexidade do contexto (PRÍNCIPE et al., 2023), reforçando a visão sistêmica do gestor, como mostra a *Figura 3*.

> *"Eu acho que a estrutura, não há dúvida, que procura capturar a complexidade. Não há como não dispor de algum instrumento, de alguma condição que permita interação diante de ambientes complexos e mesmo diante de ambientes de caos, né? Caótico, que foi a situação lá de Manaus." (Q02PB-C)*

> *"Todos nós aqui participamos de processos decisórios no ambiente da pandemia de natureza institucional coletiva, né? Não estamos falando aqui da decisão que eu tomo - se eu vou assinar um documento assim ou assado – eu estou falando de enfrentamento de ambiente complexo, de emergência, que possui complexidade e que um muitas vezes vai se apresentar como caótico. O que significa? É uma exigência muito mais robusta de natureza instrumental, de natureza de informações para efeito de tomada de decisão, é isso." (Q02PB-C)*

> *"Então, eu acho que esse sistema, ele vem também para trazer essa facilidade, de como colocar tudo isso para o gestor tomar uma decisão. E nós precisamos lembrar que a gestão da saúde é muito complexa, porque a maioria das vezes as pessoas não entendem de saúde pública." (Q02DC-C)*

Figura 3 – Gráfico questão: A visão sistêmica pode ser útil para a comunicação de risco no contexto de uma emergência sanitária?



Fonte: Elaborado pelo autor (2024)

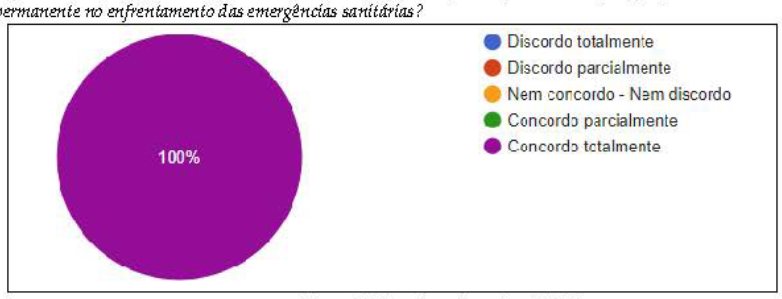
Análise: A etapa de Preparação (WHO, 2019) acontece em visão sistêmica (MEADOWS, 2008; STERMAN, 2000) e tem o desafio de integrar: preocupação do gestor, processo de organização do sistema de saúde, de planejamento abrangente da interdisciplinaridade da saúde com outras áreas em abordagem multisetorial, e ação articulada de especialistas e gestores, que impactam na gestão da emergência de saúde pública conforme condições preexistentes de um contexto. A questão foi apresentada aos participantes e avaliada na *Figura 4*.

> *"Daí essa proposição: se nós olharmos alguns anos atrás, eu não preciso ir muito longe, ainda que existisse, nós pouco nos preocupávamos com a dimensão de preparação." (Q02PB-C)*

> *"Mas eu acho que eu queria trazer, sobre o modelo apresentado, é que, ele, a complexidade dele, pode nos trazer principalmente para a gestão, para tomada de decisão do gestor, algo que precisa estar explícito naquele processo: como que eu vou compartilhar o poder da decisão se eu não me preparei, se eu não tenho um processo organizativo?" (Q02DC-C)*

> *"As emergências têm que olhar para tomada de decisão do gestor do sistema. O sistema, ele é complexo se eu não tenho planejamento, se eu não tenho uma organização. A gente viu que todas aquelas metas da Organização Mundial da Saúde na hora da preparação, eu já preciso ter algo muito antes feito, não é? Então, se eu não tenho organização, se eu não tenho Planejamento, é muito complexo, realmente." (Q02DC-C)*

Figura 4 – Gráfico questão: O modelo de Preparação, Prevenção, Resposta e Recuperação pode ser um ciclo permanente no enfrentamento das emergências sanitárias?



Fonte: Elaborado pelo autor (2024)

Análise: Uma situação-problema de gestão na emergência de saúde pública depende de abordagem interdisciplinar e multisetorial e das condições de partida do contexto (WHO, 2021a), e sofre impacto da coexistência de danos na concepção de uma sindemia (HORTON, 2020), a partir da não efetividade de políticas de forma atempada, das assimetrias nacional e internacional na produção de bens e serviços para a saúde, dos interesses políticos e da disputa de poder que marcam os momentos pandêmicos e interpandêmicos. Nessa complexidade, a visão sistêmica (MEADOWS, 2008; STERMAN, 2000) apresentada na *Figura 5*, permite observar os pontos críticos que serão afetados no contexto, a partir de uma visão ampla dos integrais de saúde-enfermidade-atenção (ALMEIDA FILHO, 2000, 2006), e fortalecer a capacidade de intervenção do gestor.

> *"A questão de problemas que são externos à gestão, e que nós não temos a governança sobre eles, como foi a questão, por exemplo citada sobre a compra das vacinas; que o mundo rico comprou todas as vacinas e não sobrou vacina para os pobres, não é. A gente viu que a África, lá não tinha planejamento de nenhuma vacinação, porque não eram países competitivos economicamente, né? Como que um modelo pode dar conta disso, dos problemas que são inerentes à nossa gestão, e mais os problemas que são externos, os problemas que a gente não tem governança?" (Q02PC-C)*

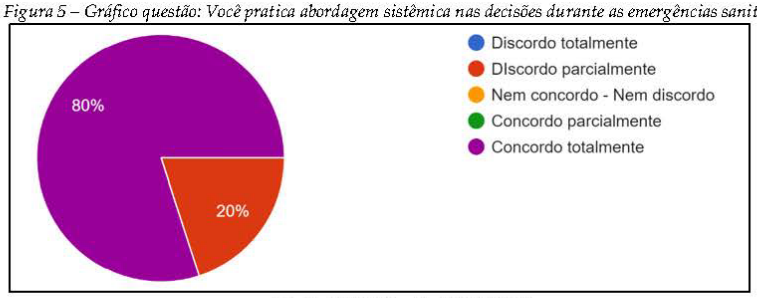
> *"Um outro exemplo é a compra de respiradores. Eu estive no encontro de saúde pública em Cuba, logo depois da pandemia (COVID-19), há 2 anos atrás, e uma das coisas colocadas foi que eles tinham dinheiro, mas não tinham de onde comprar respiradores. Eles conseguiram depois uma doação da China, só que a China é do outro lado do planeta; e Cuba, uma ilhazinha no Caribe; sendo que os Estados Unidos estão ali pertinho; então, são problemas que se sobrepõem muitas vezes à gestão é às ações da gestão, e que reforçam essa complexidade na hora da tomada de decisão." (Q02PC-C)*

> *"Apesar de todo esse contexto, tudo aquilo que a pandemia (COVID-19) nos trouxe e demais questões: nós tivemos, a pandemia de COVID-19, mas em paralelo nós estávamos enfrentando o problema com dengue, zika; a gente tem hoje monkeypox e outras problemáticas virais, fora a questão ambiental; o impacto da mudança climática que estamos acompanhando. Na verdade, um processo de amadurecimento e entendimento de tudo isso, de se trabalhar na perspectiva para além até do processo de preparação." (Q02VF-C)*

> *"Então, eu tenho gestores que não conhecem a complexidade do processo de uma emergência. Ele pode ter vários especialistas, mas se o gestor não tiver imbuído daquele processo de conhecimento para tomada de decisão, não me adianta muito." (Q02DC-C)*

> *"A gente efetivamente vê muita discussão, mas infelizmente muito pouco de aprendizado, para se tornar em ações efetivas no combate a tudo isso. E esse é um grande problema que impacta no processo decisório, porque não é uma responsabilidade única de um único Ministério, por exemplo, do Ministério da Saúde. É uma responsabilidade de governo e uma responsabilidade interinstitucional." (Q02VF-C)*

Figura 5 – Gráfico questão: Você pratica abordagem sistêmica nas decisões durante as emergências sanitárias?



Fonte: Elaborado pelo autor (2024).

Análise: Condições de partida de um contexto como componente de um sistema adaptativo complexo (ANGELI; MONTEFUSCO, 2020), que considera o comportamento de eventos passados e múltiplas variáveis para analisar alternativos de futuro (HOMER; HIRSCH, 2006), numa abordagem por tipo de emergência e condições do sistema de saúde que gera acúmulos de aprendizagem para tomada de decisão.

> *"Porque, se a gente não incorporar alguns elementos de base, nós vamos, muitas vezes ficar de mãos atadas no que diz respeito à dimensão de preparação. Não é à toa que no pós-pandemia (COVID-19), nunca se falou tanto de preparação. E eu não preciso esperar a próxima pandemia. O que está acontecendo com as queimadas no Brasil? O que aconteceu na condição do Rio Grande do Sul (Brasil)? Todo mundo agora usa o termo extraordinário: ninguém esperava, ninguém previu?" (Q02PB-C)*

> *"A questão da estrutura, por exemplo, dos serviços de saúde pública no território brasileiro, como é o caso do oxigênio. Doença respiratória requer, no mínimo, uma condição para isso. O pós-pandemia da COVID-19 nos traz também alguns pensamentos, que é, eu desmontei estruturas de unidade de terapia intensiva no Brasil inteiro." (Q02DC-C)*

> *"A condição da COVID-19 deveria ter nos ensinado muita coisa, não é? E parece que o Brasil não olha os serviços de saúde, não têm olhado para isso, porque as pactuações do passado não foram refeitas." (Q02DC-C)*

> *"A gente não olha para as evidências, mas agora parece que estamos olhando um pouco mais para o momento de preparação, como a PC disse anteriormente, para o que não fazer. O que eu aprendo do que eu já fiz de errado, né? Quais são as experiências que eu aprendo nesse processo?" (Q02DC-C)*

Análise: O problema de desabastecimento de oxigênio na cidade de Manaus (SALINO; RIBEIRO, 2023), Amazonas, Brasil, expressa as fragilidades históricas do sistema de saúde da região, que sofre com outros desafios climáticos e de condições geográficas que impactam a saúde da população.

> *"No estado do Amazonas, como é que está hoje? Vocês podem até se surpreender, mas a coisa continua do mesmo jeito ou seja, não houve aprendizado ou não se quis tirar aprendizado. Nós estamos aqui vivendo uma das maiores estiagens, com problemas dessa questão das queimadas, tá? Ontem mesmo nós tivemos aqui, essa semana, dias de quase não conseguir respirar o ar por conta de tão poluído que está, e nós continuamos com o sistema colapsado. Nós não temos resposta a algo que já não é mais extraordinário." (Q02AM-C)*

> *"Isso não é mais extraordinário aqui no estado, aqui na região, isso é um caso que acontece todos os anos, em anos mais severos ou anos menos severos, mas acontece em todos os anos. Aqui nós temos a natureza, ela tem essa característica. Nós vamos ter grandes cheias e vamos ter grandes vazantes; nos últimos 2 anos estamos tendo grandes*

estiagens, mas tivemos antes disso as maiores cheias do estado, e nós continuamos tendo os mesmos problemas no sistema de saúde, né?" (Q02AM-C)

Análise: O H-EDRM (WHO, 2019) como estrutura analítica de abordagem dos componentes de gestão na emergência sanitária.

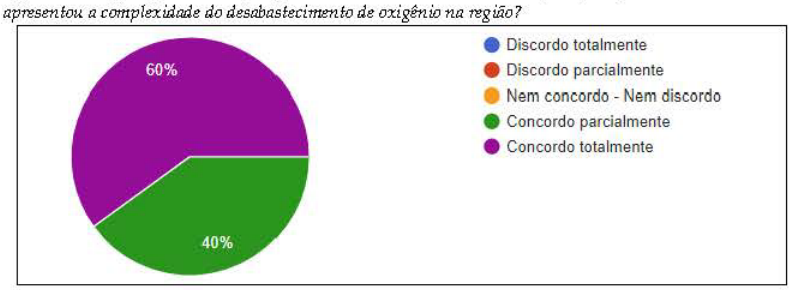
"A gente tem um grande problema que eu acho que se coloca, então eu acho que você apresenta um modelo que certamente vai poder nos ajudar muito, principalmente com a categorização que se coloca ali, que o modelo apresenta e que ajuda a gente nesse processo de análise, de enquadramento para poder justamente trabalhar à frente." (Q02VF-C)

Bloco III: Aplicação do FADES ao caso do desabastecimento de oxigênio em Manaus (AM, Brasil) na COVID-19.

Análise: Visão sistêmica de longo prazo sobre as fragilidades do complexo produtivo da saúde (GADELHA, 2021), pela modelagem de uma situação-problema, confrontando o comportamento da doença com os limites do sistema de saúde. Nessa análise, 60% dos participantes concordam que o FADES apresentou a complexidade do problema e 40% concordam parcialmente - *Figura 6*.

"Então você poderia, pelo que eu estou entendendo, fazer uma análise preventiva, vamos dizer assim; a gente avaliaria, por exemplo, o "R" da infecção naquele momento; aí você pode prever que daqui a uma semana você vai ter x casos novos e você lançaria ali. E aí você prevê quanto de oxigênio você precisaria para aquele número de pacientes no tempo?" (Q03PC-C)

Figura 6 – Gráfico questão: A aplicação do FADES ao caso de Manaus (AM) na pandemia de COVID-19, apresentou a complexidade do desabastecimento de oxigênio na região?



Fonte: Elaborado pelo autor (2024).

Análise: O desafio de aplicação do modelo usando a Dinâmica de Sistemas (MEADOWS, 2008; STERMAN, 2000), com variáveis (informações) de passado, presente e futuro. Destacou-se que o exemplo apresentou uma análise no momento pós-pandêmico, mas que poderia ter sido feito à época com dados epidemiológicos disponíveis pelos centros de referência (2020,2021), associado a um diagnóstico do sistema de gestão para atendimento de uma síndrome respiratória aguda grave. O exercício pode contribuir para desafios futuros naquela região.

"Neste caso, o exemplo está modelado de modo retrospectivo. (Q03PB-C)

"A coisa continua do mesmo jeito ou seja, não houve aprendizado ou não se quis tirar aprendizado." (Q02AM-C).

"Quando você tem, no caso da COVID-19, que você consegue fazer um pouco com que a regionalização siga um processo mais descentralizado, você tem a não efetivação desses leitos, porque agora, se eu tiver uma COVID-20, hoje, dentro do Amazonas, eu não tenho de novo os serviços. Eu não tenho acesso ao oxigênio, eu não tenho acesso a leitos de UTI e CTI." (Q03DC-C)

"A estrutura, eu estou falando de modo genérico, ela dá conta do que é simples, ela dá conta do que é complicado. É um sinal de que eu tenho uma estrutura e na medida que essas dimensões existem (H-EDRM), eu tenho a dinâmica decisória sobre aquilo que é rotina, e estou atento às dinâmicas de ameaças, que, portanto, precisam considerar a dimensão de preparação." (Q03PB-C)

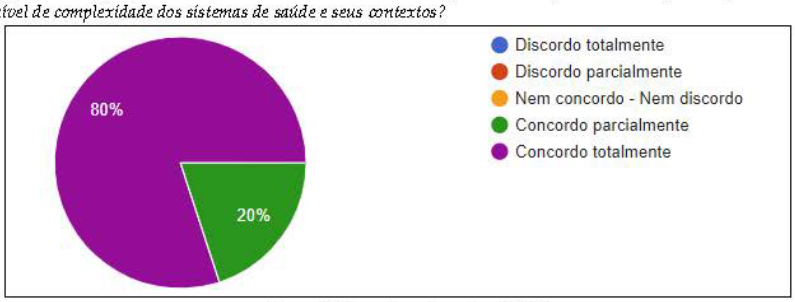
Análise: Dinâmica de Sistemas (MEADOWS, 2008; STERMAN, 2000) e Cynefin (SNOWDEN; BOONE, 2007) na modelagem e interpretação do contexto, com desafio de parametrizar do contexto simples ao caótico, as condicionalidades a partir de experiências anteriores, para produzir uma abordagem prospectiva. Concordaram totalmente com intervenções adaptadas ao nível do contexto pelo FADES, 80% dos entrevistados, e 20% concordaram parcialmente, como apresentado no *Figura 7*.

"Às vezes, o olhar para uma experiência do que não deu certo vai me dar muito mais subsídios para uma tomada de decisão certa. Agora, no caso das emergências, eu acho que a tensão do momento é, o processo organizativo, a falta de comunicação de risco, tudo isso nos leva ao que a gente chama do simples ao caos, né?" (Q03DC-C)

"Eu acho que a gente pode estar pensando, num amadurecimento realmente de todo esse processo. Eu fico imaginando como a gente aplica essa modelagem para questões que estão surgindo. Quanto que isso pode adiantar a gente para esse enfrentamento? Esse processo pode funcionar como um processo preditivo, um processo que ajuda na preparação." (Q03VF-C)

"Eu acho que o grande "Q" que a metodologia apresenta, é que possa nos fazer avançar nesse sentido – de que a gente não cometa os mesmos erros. Você consegue ver todas as variáveis, as condicionantes que estão ali e a partir disso, você tem essa visão clara do processo como um todo, e com isso pode avançar nas indecisões e internalizar, e não cometer os erros que você cometeu anteriormente." (Q03VF-C)

Figura 7 – Gráfico questão: A estrutura de análise do FADES possibilita ao gestor intervenções adaptadas ao nível de complexidade dos sistemas de saúde e seus contextos?

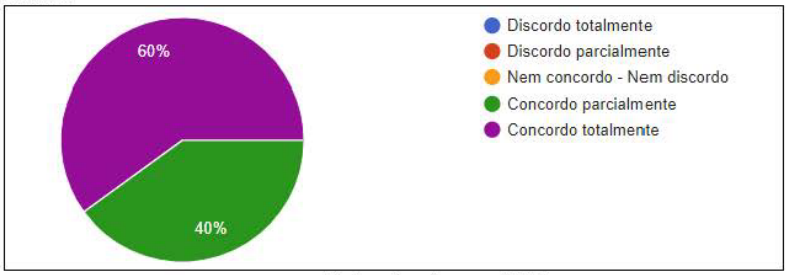


Fonte: Elaborado pelo autor (2024).

Análise: Salas de situação em saúde como espaço de decisão que demanda estrutura de análise (OPAS, 2010), que aborda a interação de diferentes naturezas de informação para apoiar a apreciação do grupo sobre uma situação-problema e o comportamento do contexto, sendo a estrutura do FADES adequada para apoiar essa instância para 60% dos participantes com concordância total, e 40% com concordância parcial - *Figura 8*.

"Então, quem sabe ter essa ferramenta para, nem digo somente a tomada de decisão dos gestores, especificamente, mas quem sabe, desses grupos de comitê de crise; às vezes eu brinco que você faz os comitês de crise e eles não sabem para onde vão, porque eles não têm formas de colocar todas as informações para tomada de decisão." (Q03DC-C)

Figura 8 – Gráfico questão: O FADES pode apoiar as salas de situação e centros de operações nas emergências sanitárias?



Fonte: Elaborado pelo autor (2024)

Análise: Necessidade de considerar para efetividade do modelo proposto, as condições de partida de um contexto (ANGELI; MONTEFUSCO, 2020) mais próximo e as condicionalidades da arquitetura de saúde global, a lógica do sistema produtivo (GADELHA, 2021; GILMORE et al., 2023; SACHS et al., 2022), do modelo de governança dos países (PRÍNCIPE et al., 2023) e de políticas públicas para a efetividade das decisões, a partir da aplicação do modelo FADES. Dos participantes, a *Figura 9* informa que 80% concordam que o FADES pode ser adaptado para diferentes realidades de sistemas de saúde no enfrentamento das emergências sanitárias, considerando os pontos relatados; e 20% concordam parcialmente.

> *"Veja que eu estou botando um conjunto de condicionamentos para depois dizer, esse framework fica em pé. Mas não existe o framework sem que o conjunto desses elementos estejam, digamos, pavimentado, né? Eu vou simplificar totalmente. Se eu não sei comprar papel higiênico, eu não vou saber se quer quantos leitos eu tenho dentro do meu hospital, qual é a rotatividade desses leitos? Qual é a taxa de permanência, qual é não sei o quê, e por aí vai, de tal modo que eu tenha, de fato, elementos estruturados sobre os quais eu me permita uma capacidade decisória frente a riscos que não estão no dia a dia. É o risco da emergência e o risco do caos para além da emergência, né? Ou do caos dentro da emergência, vamos falar desse modo." (Q03PB-C)*

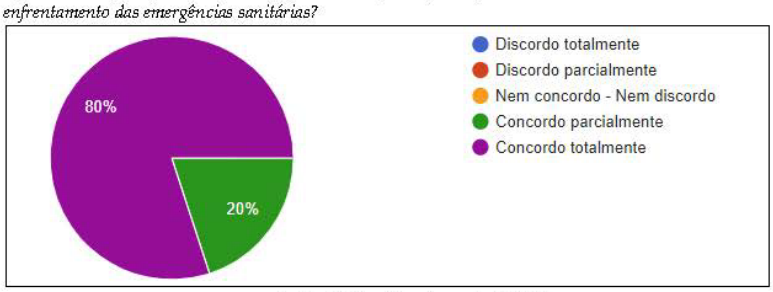
> *"Eu quero ao mesmo tempo valorizar essa estrutura, mas dizer, ela é condicionada, porque ela traz uma robusta estrutura, mas ela segue sendo condicionada." (Q03PB-C)*

> *"Então, eu estou colocando isso para dizer que, do ponto de vista de um processo decisório dessa complexidade, os elementos – e aí eu vou de novo na preparação – se eu não tiver estrutura prévia, de preparação, e é por isso que essa dimensão está sendo totalmente valorizada agora. " (Q03PB-C)*

> *Por que o Acordo da Pandemia não foi assinado? É porque eu não quero, porque eu não tenho um modelo, eu tenho tudo isso, mas não foi esse lado. Não foi assinado porque a grande parte dos países centrais, as grandes empresas, o diabo a quatro, eles dão a vacina, mas não querem transferir a vacina para frente." (Q03PB-C)*

> *"Então, eu quero pegar o que foi dito e colocar o que eu acho fundamental: tudo que você analisou de Manaus, não houve impacto nenhum hoje, numa preparação para algo que a gente vê a cada ano, que é a questão da emergência, da seca, e você não tem acesso da população a nada, não é? Não têm acesso a água potável." (Q03DC-C)*

Figura 9 – Gráfico questão: O FADES pode ser adaptado para diferentes realidades de sistemas de saúde no enfrentamento das emergências sanitárias?



Fonte: Elaborado pelo autor (2024).

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Parâmetros, Indicadores, Performance

O Apêndice 2 apresenta nos Quadros 1, 2 e 3, exemplos de indicadores de saúde, enfermidade e atenção, com parâmetros de performance para alguns índices que podem contribuir com a relação com a modelagem da situação-problema de gestão.

Quadro 1 - Indicadores de Saúde

Índice de Desenvolvimento Humano Ajustado à Desigualdade (IDH-AD) (UNDP, 2024)	
Descrição	Variáveis e parâmetros
Mede o nível de desenvolvimento humano quando a desigualdade é contabilizada. O IDH-AD considera as desigualdades nas dimensões do IDH (saúde, educação, renda) ao "descontar" o valor médio de cada dimensão de acordo com seu nível de desigualdade.	• Desenvolvimento Humano • Saúde, educação, renda • Parâmetro: (menor) **0 – 1** (maior)
Índice de Gini (IPEA, 2004)	
Mede o grau de concentração de renda em determinado grupo. Indica a diferença entre os rendimentos dos mais pobres e dos mais ricos.	• Renda • Parâmetro: (igualdade) **0 – 1** (concentração)
Índice de Pobreza Multidimensional (MPI) (UNDP, 2023)	
Lançado em 2010 pelo Programa das Nações Unidas para o Desenvolvimento (PNUD) e pelo Oxford Poverty and Human Development Initiative (OPHI), o MPI avança no Objetivo de Desenvolvimento Sustentável 1 (SDG 1). Construído a partir de 10 indicadores que abrangem saúde, educação e padrão de vida.	• Pobreza • Parâmetro: (menor) **0 – 1** (maior) • Nutrição, Mortalidade infantil, escolaridade, frequência escolar, gás de cozinha, saneamento, água potável, eletricidade, Habitação, ativos suficientes (bens duráveis).
Índice de Vulnerabilidade Social (IVS) (IPEA, 2015)	
Construído a partir de indicadores do Atlas do Desenvolvimento Humano (ADH) no Brasil. Aborda situações indicativas de exclusão e vulnerabilidade social no território brasileiro, com base em dezesseis indicadores estruturados em três dimensões: infraestrutura urbana, capital humano e renda e trabalho.	• Infraestrutura urbana, capital humano e renda e trabalho. • Parâmetro: (menor) **0 – 1** (maior)

Fonte: Elaborado pelo autor (2024).

Quadro 2 - Indicadores de Enfermidade.

Indicador de Morbidade (IM) (Almeida Filho; Barreto, 2024)	
Descrição	Variáveis
Proporção entre número de casos de uma doença e a população (número de habitantes ou de pessoas que estão expostas à doença em um lugar e tempo definidos) (p. 428).	• População. Local. Tempo. • Número de casos. Causas da doença. • Variáveis: sexo, idade, cor da pele, etnia, grupo social. • Parâmetro: contextualizado
Taxa de Prevalência (TP) (Almeida Filho; Barreto, 2024)	
Descrição	Variáveis
Relação entre o número de casos conhecidos (novos e antigos) e a população de origem dos casos, em um lugar referido, e num período de tempo (dia, mês, ano).	• População doente. Local. Tempo. • Parâmetro: contextualizado
Taxa de Incidência (TI) (Almeida Filho; Barreto, 2024)	
Descrição	Variáveis
Intensidade com que uma doença acontece na população, medindo a ocorrência de casos novos.	• População doente. Local. Tempo. • Parâmetro: contextualizado
Indicador de Mortalidade (TM)	
Descrição	Variáveis
Proporção entre a frequência absoluta de óbitos e o número de indivíduos expostos ao risco de morrer (população exposta), no mesmo período de referência e no mesmo local (p.453)	• População doente. Local. Tempo. • Parâmetro: contextualizado

Fonte: Elaborado pelo autor (2024).

p.2

Quadro 3 - Indicadores de Atenção - Por H-EDRM.

Políticas, Estratégias e Legislação (PEL) (WHO, 2024)	
Descrição	Variáveis
• Política, plano de ação e legislação. • Diretrizes de cuidados avançados • Leis que protejam os direitos das pessoas	• Política, Plano • Diretriz • Lei
Planejamento e Coordenação (PEC) (WHO, 2024)	
• Padrões, diretrizes, protocolos de coordenação de cuidados • Centro Nacional de Coordenação • Mecanismos de coordenação do nível de cuidado entre setores	• Padrão, diretriz, protocolo • Coordenação nacional • Coordenação intersetorial
Recursos Humanos (RH) (WHO, 2024)	
• Sistema de apoio contínuo à força de trabalho em saúde • Disponibilidade e quantidade de mão-de-obra humana especializada • Número de profissionais de saúde por tipo de ocupação	• Força de trabalho • Mão-de-obra especializada • Profissionais por tipo de ocupação
Gestão de Informações e Conhecimentos (GIC) (WHO, 2024)	
• Existência de um sistema de vigilância em saúde • Investimento governamental • Informações de políticas de governo disponíveis • Dados no banco de dados nacional • Dados sobre a prestação e utilização de serviços	• Sistema de vigilância • Investimento de governo • Políticas • Banco de dados • Serviços
Recursos Financeiros (RF) (WHO, 2024)	
• Benefícios financeiros/proteção social • Apoio financeiro previsto para mitigação das ações	• Benefícios • Apoio financeiro
Infraestrutura de Saúde e Logística (IEL)	
• Política nacional de tecnologia em saúde	• Política Nacional • Desenvolvimento tecnológico • CEIS
Monitoramento e Avaliação (M&A) (WHO, 2024)	
• Avaliação da vulnerabilidade e adaptação às alterações climáticas e à saúde • Metas para monitorar a implementação do plano nacional de demência	• Vulnerabilidades • Determinantes da Saúde • Metas
Saúde e Serviços Relacionados (SSR) (WHO, 2024)	
• Serviços de apoio na comunidade (e.g. diagnóstico) • Número de pessoas que recebem apoio • Nível de implementação dos serviços de apoio	• Serviços na comunidade • Beneficiados • Nível de implementação (efetividade
Comunicações de Risco (CR)	
• Estratégia nacional de comunicação dos riscos	Estratégia
Capacidades Comunitárias para Saúde (CCS) (WHO, 2024)	
• Serviços de saúde ou assistência social de base comunitária • Apoio governamental à ação comunitária • Treinamento para agentes comunitários	• Assistência social • Apoio de governo • Agentes comunitários capacitados

Fonte: Elaborado pelo autor (2024).

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APÊNDICE – 3 – EQUAÇÕES E PARÂMETROS MODELAGEM – CASO OXIGÊNIO MANAUS

Artigo: Framework de apoio à decisão em Emergência de Saúde – FADES

(01) CAPACIDADE FORNECIMENTO OXIGÊNIO MANAUS

- Equação: = INTEG (Oferta Ox C19 MÊS-Demanda Ox C19 MÊS, valor inicial 15000)
- Units: Insumo
- DINÂMICA: Verificar a capacidade de abastecimento de oxigênio em Manaus no total de 36 meses, conforme os limites de fornecimento. Base para concepção de estratégias.

(02) Capacidade Mensal Leitos Amazonas

- Equação: = 1789
- Units: Leito
- DADOS: FVS - Plano_de_contigencia_coronavirus_-_versao_02052020

(03) Capacidade Mensal Leitos Manaus=

- Equação: 1001*(((Equipamentos*1)+(Medicamentos e outros Insumos*1)+(Recursos Humanos*1))/3)
- Units: **undefined**
- DINÂMICA: Informar a capacidade de leitos disponíveis mensalmente. Considera Recursos Humanos, Equipamentos, Insumos e Medicamentos disponíveis, por média ponderada, com pesos definidos conforme a importância do item.
- DADOS:FVS - Plano_de_contigencia_coronavirus_-_versao_02052020

(04) Casos Confirmados e Óbitos Amazonas

- Equação: ([(0,0)-(10,10)],(1,1),(2,1),(3,350),(4,10158),(5,72248),(6,58890),(7,60234),(8,38712),(9,38060),(10,44714),(11,33034),(12,45626),(13,132762),(14,97144),(15,66314),(16,43306),(17,31284),(18,31342),(19,29246),(20,15138),(21,4390),(22,2624),(23,4312),(24,7738),(25,192126),(26,87402),(27,15428),(28,1816),(29,1176),(30,4632),(31,41286),(32,15918),(33,5204),(34,5418),(35,9228),(36,2468))
- Units: Pessoa
- DINÂMICA: Registrar número de pessoas infectadas em 36 meses no Amazonas. Casos confirmados inclui óbitos.
- DADOS – Ministério da Saúde - COVID-19 NO BRASIL - https://infoms.saude.gov.br/extensions/covid-19_html/covid-19_html.html

(05) Casos confirmados e óbitos Manaus

- Equação: ([(0,0)-(10,10)],(1,1),(2,1),(3,159),(4,3114),(5,15020),(6,8876),(7,8423),(8,6854),(9,9179),(10,11757),(11,7417),(12,11419),(13,37942),(14,26075),(15,13713),(16,9613),(17,7728),(18,9641),(19,10317),(20,5529),(21,1427),(22,531),(23,638),(24,1010),(25,46704),(26,30265),(27,6965),(28,451),(29,148),(30,1795),(31,9235),(32,4583),(33,2453),(34,2406),(35,1769),(36,386))
- Units: Pessoa

- DINÂMICA: Registrar número de pessoas infectadas em Manaus em 36 meses. Casos confirmados inclui óbitos. DADOS - Ministério da Saúde COVID-19 NO BRASIL. https://infoms.saude.gov.br/extensions/covid-19_html/covid-19_html.html

(06) CASOS CONFIRMADOS Relação Manaus e Amazonas

- Equação:= (Casos confirmados e óbitos Manaus(Time)/Casos Confirmados e Óbitos Brasil(Time))*100
- Units: Pessoa
- DINÂMICA: Relacionar o percentual de Manaus no contexto Brasil nos 36 meses.

(07) CRITICIDADE DE LEITOS DE MANAUS

- Equação:= INTEG (Oferta Leitos Manaus-Demanda Leitos Manaus, valor inicial 308)
- Units: **undefined**
- DINÂMICA: Verificar a criticidade de leitos em Manaus pela relação entre oferta e demanda em cada tempo (36 meses). Não é uma leitura cumulativa, pois leitos não podem ser armazenados. Pode ser entendido como transferência de doentes para atendimento fora do estado, ou sinalizar para ampliação de leitos complementares em Manaus.

(08) CRITICIDADE DE LEITOS DO AMAZONAS

- Equação:= INTEG (Oferta Leitos Amazonas-Demanda Leitos Amazonas, valor inicial 2565)
- Units: Leito
- DINÂMICA: Verificar a criticidade de leitos no Amazonas pela relação entre oferta e demanda em cada tempo (36 meses). Não é uma leitura cumulativa, pois leitos não podem ser armazenados. Pode ser entendido como transferência de doentes para atendimento fora do estado, ou sinalizar para ampliação de leitos complementares no AM.

(9) Demanda Leitos Amazonas

- Equação:=Internações Amazonas(Time)
- Units: Leito
- DINÂMICA: Registrar a demanda de leitos no Amazonas em 2020,2021,2022.

(10) Demanda Leitos Manaus

- Equação:=Internações Manaus(Time)
- Units: Leito
- DINÂMICA: Registrar a demanda de leitos de Manaus em 2020,2021,2022.

(11) Demanda Nacional

- Equação:=1
- Units: Insumo
- DINÂMICA: Inferir sobre capacidade de fornecimento de oxigênio das empresas da região para Manaus, com o fornecimento de outros estados; ou mesmo a instalação de usinas de oxigênio em complexos hospitalares da região (futuras emergências).

(12) Demanda Ox C19 MÊS

- Equação:=2.3715e+06
- Units: Insumo
- DINÂMICA: Relacionar a Demanda de oxigênio total - nos 36 meses.
- DADOS - Relatório CPI COVID-19. (BRASIL, 2021).Registros de dados gerais indicam que as empresas da região informaram capacidade máxima de 25.000 m3 de oxigênio/dia,quando a demanda era de 76.500 m3/dia. Cálculo realizado para 31 dias.

(13)Equipamentos

- Equação:=1
- Units: Equipamento
- DINÂNICA: Inferir sobre a capacidade de fornecimento de equipamentos para demanda instalada, reposições e de crescimento de leitos. Considera fornecimento local, nacional e importações; e reconversão da indústria para atendimento da necessidade. Exemplo - Respiradores Pulmonares.

(14) FINAL TIME

- Equação:= 36
- Units: Month
- The final time for the simulation.

(15) Importação na Pandemia

- Equação:=1
- **Units**: Insumo
- **DINÂMICA**: Inferir sobre capacidade de fornecimento de oxigênio das empresas da região para Manaus, com o fornecimento de outros países.

(16) INITIAL TIME

- Equação:= 1
- Units: Month
- The initial time for the simulation.

(17) Internações Amazonas

- Equação: ([(0,0)-(10,10)],(1,1),(2,1),(3,135),(4,2815),(5,3692),(6,1657),(7,1210),(8,1001),(9,1328),(10,1398),(11,1288),(12,2281),(13,8195),(14,4379),(15,2488),(16,1385),(17,1261),(18,1154),(19,889),(20,425),(21,147),(22,126),(23,176),(24,252),(25,1570),(26,431),(27,69),(28,50),(29,18),(30,83),(31,405),(32,109),(33,22),(34,136),(35,118),(36,24))
- Units: Leito
- DINÂMICA: Informar a quantidade de internações nos 36 meses. Registrada. Em perspectiva futura pode projetar a necessidade pelas taxas de exposição da população. Exemplo: taxa de incidência, que verifica a proporção entre o número de casos novos de uma doença, ocorridos em um intervalo de tempo determinado, e a população exposta ao risco de adquirir a referida doença no mesmo período, e no mesmo local, multiplicado o resultado por uma potência de 10.Naomar/Mauricio. Epidemiologia & Saúde - Fundamentos, Métodos e Aplicações (p. 437). Guanabara Koogan. Edição do Kindle. DADOS: SIVEP - sraghospitalizado_07fev24

(18) Internações Manaus

- Equação: ([(0,0)-(10,10)],(1,1),(2,1),(3,123),(4,2310),(5,2170),(6,847),(7,524),(8,469),(9,831),(10,971),(11,874),(12,1826),(13,5396),(14,2770),(15,1459),(16,778),(17,718),(18,828),(19,663),(20,331),(21,118),(22,74),(23,93),(24,140),(25,1115),(26,236),(27,23),(28,22),(29,8),(30,56),(31,268),(32,70),(33,11),(34,126),(35,66),(36,9))
- Units: Leito
- DINÂMICA: Informar a quantidade de internações nos 36 meses. Registrada. Em perspectiva futura pode projetar a necessidade pelas taxas de exposição da população. Exemplo: taxa de incidência, que verifica a proporção entre o número de casos novos de uma doença, ocorridos em um intervalo de tempo determinado, e a população exposta ao risco de adquirir a referida doença no mesmo período, e no mesmo local, multiplicado o resultado por uma potência de 10.Naomar/Mauricio. Epidemiologia & Saúde - Fundamentos, Métodos e Aplicações (p. 437). Guanabara Koogan. Edição do Kindle. DADOS: SIVEP - sraghospitalizado_07fev24

(19) INTERNAÇÕES Relação Manaus e Amazonas

Equação: = (Internações Manaus(Time)/Internações Amazonas(Time))*100

Units: Leito

DINÂMICA: Analisar a participação de Manaus na demanda de internações do Amazonas - nos 36 meses.

(20) Índice Ox

- Equação:= (Oferta Ox C19 MÊS/Demanda Ox C19 MÊS)
- Units: Insumo
- DINÂMICA: Verificar a capacidade de fornecimento de oxigênio das empresas da região para Manaus. Pode estar relacionada com estratégias complementares de fornecimento de outros estados ou importação de outros países; ou mesmo a instalação de usinas de oxigênio em complexos hospitalares da região (futuras emergências).

(21) LIteracia em Saúde

- Equação:= 1
- Units: Pessoa
- DINÂMICA: Registrar o nível de literacia de uma região que pode impactar no reconhecimento da população para contramedidas de controle da doença, como restrição de circulação, uso de máscaras, suscetibilidade para medidas com base científica (tratamentos, medicamentos, vacinas, diagnóstico). Relaciona parâmetros de educação e saúde já existente na região. CONCEITO: A literacia em saúde (LS) é um conjunto de competência cognitiva, social e de capacidade individual e coletiva no acesso, compreensão e utilização de informações que promovam e mantenham boas condições de saúde. Ela engloba a capacidade das pessoas de obter, processar e compreender informações básicas sobre saúde, necessárias para tomar decisões adequadas em relação à sua saúde. A LS pode ser dividida em diferentes níveis, como literacia funcional, comunicativa e crítica, cada uma com habilidades específicas que permitem às pessoas agir de forma mais autônoma e consciente em relação à sua saúde. https://downloads.editoracientifica.org/articles/210504454.pdf

- Improving health literacy in populations provides the foundation on which citizens are enabled to play an active role improving their own health, engage successfully with community action for health, and push governments to meet their responsibilities in addressing health and healthequity.https://www.who.int/activities/improving-health-literacy. OMS.

(22) Medicamentos e outros Insumos

- Equação:=1
- Units: Insumo
- DINÂNICA: Inferir sobre a necessidade de insumos e medicamentos para tratamento nos hospitais.

(23) Oferta Leitos Amazonas

- Equação:= Capacidade Mensal Leitos Amazonas/Tempo Internação
- Units: Leito.
- DINÂMICA: Registrar a capacidade de leitos no Amazonas em 2020,2021,2022.

(24) Oferta Leitos Manaus

- Equação:= Capacidade Mensal Leitos Manaus/Tempo Internação
- Units: Leito
- DINÂMICA: Registrar a capacidade de leitos de Manaus em 2020,2021,2022. Considerar tempo de internação para a doença.
- DADOS: (Plano de Contingência Estadual para Infecção Humana pelo SRAS-CoV-2 (COVID-19) - FUNDAÇÃO DE VIGILÂNCIA EM SAÚDE DO AMAZONAS, 2020) 1. Leitos SUS: são aqueles utilizados no âmbito do SUS, pelo qual conceitua-se por leitos de internação hospitalar ativos, disponíveis para internação do paciente do SUS. O quantitativo é informado pelo gestor, exceto no caso dos leitos complementares, que é resultado do processo de habilitação, explicado abaixo. 2. Leitos não SUS: é o resultado direto da subtração dos Leitos Existentes e Leitos SUS realizado automaticamente pelo CNES. Portanto o quantitativo nunca é informado pelo gestor municipal e estadual. No caso dos leitos complementares (leitos de Unidade de Terapia Intensiva -UTI e Unidade de Cuidados Intermediários UCI), o significado do conceitos alteram em decorrência da existência de processo de habilitação de leitos complementares pelo Ministério da Saúde. Portaria de Consolidação nº 03/GM/MS, de 28 de setembro de 2017 ePortaria nº 1.300/GM/MS, de 23 de novembro de 2012

(25) Oferta Ox C19 MÊS

- Equação:= (775000*Demanda Nacional*Importação na Pandemia)-Outras demandas por Ox
- Units: Insumo
- DINÂMICA: Relacionar a Oferta de oxigênio total - nos 36 meses.
- DADOS - Relatório CPI COVID-19. (BRASIL, 2021).Registro de dados gerais indicam que as empresas da região informaram capacidade máxima de 25.000 m3 de oxigênio/dia, quando a demanda era de 76.500 m3/dia. Cálculo realizado para 31 dias.

(26) Outras demandas por Ox

- Equação:= 0
- Units: Insumo
- DINÂNICA: Relacionar o impacto de outras demandas de oxigênio do serviço de saúde de Manaus, na oferta de Ox para C-19.

(27) OUTROS SERVIÇOS OU DESASISTÊNCIA

- Equação:= INTEG (População Infectada-População com Atendimento,1)
- Units: Pessoa
- DINÂMICA: Registra o acúmulo de pessoas infectadas que não foram internadas em Manaus. Algumas possibilidades: a) Não precisou ou não teve acesso a nenhum atendimento médico; b) falecimento sem atendimento médico; c) foi transferido para atendimento fora de Manaus.

(28) Ox Demanda Verificada C19

- Equação: ([(0,0)-(10,10)],(1,439),(2,439),(3,54058),(4,1.01523e+06),(5,953968),(6,372250,(7,230294),(8,206122),(9,365218),(10,426747),(11,384116),(12,802513),(13,2.3715e+06),(14,1.21739e+06),(15,641219),(16,341925),(17,315555),(18,363900),(19,291383),(20,145472),(21,51860),(22,32522),(23,40873),(24,61529),(25,490034),(26,103720),(27,10108),(28,9669),(29,3516),(30,24612),(31,117784),
(32,30764),(33,4834),(34,55376),(35,29006),(36,3955))
- Units: Insumo
- DINÂMICA: Relacionar a Demanda verificada de oxigênio nos 36 meses.
- DADO: Cálculo com base no tempo 13 (jan/21) - Demanda = 76500. Internação 5.396. Valor de 14,11 m3 de oxigênio por leito (76.500/5.396).

(29) População com Atendimento

- Equação:= Demanda Leitos Manaus
- Units: Pessoa
- DINÂMICA: Registrar número de internações para quantidade de pessoas infectadas em 36 meses.

(30) População Infectada

- Equação:=(Casos confirmados e óbitos Manaus(Time))*Literacia em Saúde
- Units: Pessoa
- DINÂMICA: Registrar número de pessoas infectadas em 36 meses.Casos confirmados inclui óbitos.

(31)Recursos Humanos

- Equação:=1
- Units: Pessoa
- DINÂNICA: Inferir sobre a capacidade de RH disponível, observando número de profissionais disponíveis, adoecimentos, óbitos e jornada de trabalho.

(32) SAVEPER

- Equação:= TIME STEP
- Units: Month [0,?]
- The frequency with which output is stored.

(33)Tempo Internação

- Equação:=1
- Units: Month
- DINÂNICA: inferir sobre o tempo de internação para a doença.

(34) TIME STEP

- Equação:= 1
- Units: Month [0,?]
- The time step for the simulation.

(35) Transferência de pacientes

- Equação:= CRITICIDADE DE LEITOS DO AMAZONAS*1
- Units: Leito

8 CAPÍTULO 8: CONCLUSÃO

O desenvolvimento do FADES implicou um olhar com diferentes lentes sobre as ESP, para alcançar os objetivos do trabalho. O grupo focal avaliou positivamente a estrutura do modelo, que analisa condicionalidades de gestão na ESP, mas que está condicionado pelo modelo de governo, suas políticas e estratégias de saúde, para além da saúde e do contexto nacional, especialmente ao tratar de uma pandemia de impactos globais.

Os modelos e estruturas de decisão em saúde nas ESP, quando não integram a dinâmica do agravo e os impactos no sistema de saúde, analisando capacidades e vulnerabilidades históricas que se intensificam em momentos de incerteza, produzem visão reducionista do ciclo de preparação com comprometimento da equidade. Este foi o resultado do caso analisado referente ao desabastecimento de oxigênio nos hospitais de Manaus, no contexto da emergência de uma síndrome respiratória. Isso gera um acúmulo de danos na emergência, com riscos à resposta, aos esforços de mitigação e de recuperação das estruturas da sociedade em todos os níveis de renda, evidenciando mais a ausência de perspectiva sistêmica do que de poder econômico e científico, que pode não alcançar a efetividade de decisões assertivas numa crise sanitária.

Condicionalidades de países e diretrizes de organismos internacionais, com destaque para a OMS, têm o desafio de equalizar o uso de bens e serviços de saúde conforme as condições de partida de um contexto, cuja reação é dependente da coexistência de emergências que marcam os sistemas de saúde. Sem planejamento prévio e estruturas analíticas de preparação para a ESP, as respostas ficam comprometidas, os indicadores de morbidade e mortalidade se intensificam e os custos e tempos de reconstrução são maiores, complexidade que se acentua pela imprevisibilidade sobre a próxima emergência, podendo estabelecer um continuum de emergências e um olhar permanente da gestão para os integrais de saúde-enfermidade-atenção.

A integração da Dinâmica de Sistemas com a Estrutura Cynefin, na composição do FADES, reforçou a perspectiva sistêmica para a decisão do gestor, mas aspectos foram destacados como desafios do modelo: integrar variáveis de nível estratégico, tático e operacional para efeito das decisões, considerar a participação da comunidade na eleição de variáveis de complexidade, e a efetividade do modelo condicionada pelas macropolíticas de governo, mais ou menos centralizadas, e pela dimensão do indivíduo para o exercício de modelagem de uma situação-problema de gestão.

Conclui-se que a preparação para futuras emergências considera passado e futuro como condicionalidade de um presente dinâmico e alcança uma nitidez possível na análise do contexto, mas lida com “borrosidades” na trajetória, e com sinais de baixa nitidez entre causa e efeito, o que exige confrontar múltiplas variáveis de complexidade. Os instrumentos de modelagem buscam representar e entender o contexto, mas seguindo o princípio de que um modelo é uma simplificação ou abstração da realidade e não pode capturar todas as

complexidades dos sistemas que representa, reforçando a permanente permeabilidade das fronteiras de análise na trajetória das decisões em sistemas complexos.

Nesse sentido, futuras pesquisas deverão ser realizadas sobre a relação entre poder econômico e científico e a efetividade da resposta na ESP, as estratégias mais ou menos centralizadas e a assertividade das decisões na crise sanitária, a preparação do sistema produtivo nacional e a dependência externa de insumos para a saúde, e a interoperabilidade de bases de dados epidemiológicos e de gestão para planejamento da resposta por tipo de emergência, para fortalecer capacidades mínimas de um sistema de saúde conforme as características do evento sanitário.

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