Deliverable D1.2 – Lessons learned for crisis preparedness including health literacy

Version:	2.0
Partner responsible:	UPO
Work package No.:	1
Task No.:	1.1,1.2,1.3,1.4
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Date:	July 15, 2025

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Nature of the Deliverable		
R	Document, report (excluding the periodic and final reports)	X
DEM	Demonstrator, pilot, prototype, plan designs	
DEC	Websites, patents filing, press & media actions, videos, etc.	
OTHER	Software, technical diagram, etc.	

Dissemination Level		
PU	Public, fully open, e.g. web	X
CO	Confidential, only for members of the consortium (including the	

Quality procedure			
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Acknowledgments

The work presented is part of the PREPSHIELD project (https://prepshield-project.eu/), which is funded through the European Union's Horizon Europe research and innovation program under grant agreement no 101168124. Views and opinions expressed are, however, those of the author(s) only and do not necessarily reflect those of the European Union or European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.

Project Summary

PREPSHIELD aims to foster a more holistic and citizen-centric approach to health crisis preparedness and management, by co-creating policy recommendations, methods and an AI-powered platform for crisis management to better prepare for and address health emergencies from a social and societal perspective. To reach this objective, PREPSHIELD will rely on the participation of public authorities, citizens (specifically from vulnerable and non-compliant groups), Civil Social Organizations (CSOs), disaster Relief Organizations (DROs), and healthcare institutions. Based on the needs of these groups, PREPSHIELD will develop recommendations for health crisis preparedness, management and communication as well as tools to simulate future crises through an iterative process, involving various pilots for their evaluation. These pilots will include a communication pilot, tabletop exercises (TTE) and an online exercise, which will include all these stakeholders and take place at different scales in different countries: local (Hamburg, DE), regional (Piedmont, IT) and national (Romania). The online exercise will rely on a PREPSHIELD platform and app (built on the proven CRIMSON platform) to reproduce real-life crisis communication conditions and provide decision-makers with simulations and feedback on the behavior,

wellbeing, capacities, and resources of the other stakeholders. The project brings together a complementary consortium of five universities, two public authorities, one Research and Technology Organization (RTO), two non-profit organizations, one Small Medium Enterprise (SME) and two large enterprises from seven European Union (EU) countries (and Switzerland).

Document Objective and Executive Summary

The COVID-19 pandemic, as the most recent global health disaster, has highlighted significant shortcomings in the preparedness and resilience of health systems worldwide. It has also underscored the broader societal unpreparedness to effectively respond to large-scale public health crises. The crisis exposed delayed responses, fragmented policies, and poor coordination, underscoring the urgent need to strengthen health system resilience and update pandemic preparedness plans.

Notably, the pandemic reaffirmed that such crises do not impact all individuals equally. Vulnerable populations have borne a disproportionate burden of health, social, and economic consequences. In addition to these inequities, the pandemic revealed two additional systemic barriers that impeded effective response efforts. First, limited levels of health literacy among significant portions of the population hindered the understanding and uptake of public health recommendations, resulting in lower or non-compliance with public health measures. Second, the predominance of top-down, centralized decision-making failed to adequately incorporate the diverse needs and experiences of vulnerable and hard-to-reach populations, thereby compromising the inclusiveness and responsiveness of public health interventions. These challenges point to the necessity of critically rethinking current approaches to health crisis preparedness. Given the increasing probability of future epidemics and pandemics, it is imperative to develop more participatory and inclusive

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preparedness frameworks that can more effectively protect the health of all individuals in times of crisis, including those belonging to the most marginalized fringes of the society.

This Deliverable outlines preliminary recommendations for improving crisis preparedness – particularly regarding health literacy – developed through a multi-phase, multi-actor analysis within the framework of Work Package 1 (WP1). These recommendations are grounded in an in-depth understanding of the needs and perceptions of vulnerable and non-compliant groups, as well as those of institutional actors. They directly support PREPSHIELD's core objective to foster a holistic and participatory approach to health crisis preparedness and management, following a whole-of-society perspective.

This document provides an overview of the research activities conducted in the frame of WP1 and the preliminary crisis recommendations that have resulted from these findings, focusing on four key themes: crisis management, communication, health literacy, and healthcare governance. Each recommendation is presented together with key lessons learned and intended target audience and aims at strengthening preparedness efforts.

Importantly, these preliminary recommendations are not intended as "one-size-fits-all" solutions; rather, they represent evidence-informed models designed to be adapted to the specific needs, capacities, and socio-political contexts of diverse European settings. Although primarily informed by challenges encountered in the three project pilot sites – Piedmont, Hamburg, and Romania – their development also incorporated input from actors outside these sites during the WP1 needs analysis, ensuring broader relevance and applicability across Europe in preparation for future outbreaks.

As part of PREPSHIELD's iterative process, these preliminary recommendations will be continuously evaluated and refined through tabletop and online exercises conducted at the

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pilot sites, ultimately culminating in policy recommendations for improving preparedness to outbreaks at the conclusion of the project.

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List of Partners

N°	Participant organization name	Acronym	Country
1	UNIVERSITÀ DEGLI STUDI DEL PIEMONTE ORIENTALE AMEDEO AVOGADRO	UPO	IT
2	RIJKSUNIVERSITEIT GRONINGEN	UG	NL
3	UNIVERSITETET I OSLO	UiO	NO
4	TECHNISCHE HOCHSCHULE KOELN	THK	DE
5	CS GROUP-FRANCE	CSG	FR
6	SOPRA STERIA GROUP	SSG	FR
7	EREVNITIKO PANEPISTIMIAKO INSTITOUTO SYSTIMATON EPIKOINONION KAI YPOLOGISTON	ICCS	EL
8	MINISTERUL AFACERILOR INTERNE	DSU	RO
9	SOCIETATEA NATIONALA DE CRUCE ROSIE DIN ROMANIA	RRC	RO
10	FREIE UND HANSESTADT HAMBURG	FHH	DE
11	EV.-LUTH. MARTIN LUTHER KING- KIRCHENGEMEINDE STEILSHOOP	MLKS	DE
12	EUROQUALITY SAS	EQY	FR
13	UNIVERSITAT ZURICH	UZH	CH

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Abbreviations

CBO: Community based organization

COVID-19: Coronavirus disease 2019

CSO: Civil Society Organization

DRO: Disaster Relief Organization

EU: European Union

EWARS: Early Warning Alert and Response System

FGD: Focus Group Discussion

GDP: Gross Domestic Product

GDPR: General Data Protection Regulation

HMIS: Health Management Information System

NGO: Non-Governmental Organizations

OECD: Organization for Economic Co-operation and Development

PHIS: Public Health Information System

PPE: Personal Protective Equipment

PR: Preliminary Recommendation

PREPSHIELD: Preparedness For Society in Health Crises and Disasters

TTE: Tabletop Exercise

WHO: World Health Organization

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Key concepts and definitions used in the Deliverable

This table provides the main terms and definitions referenced throughout Deliverable to ensure conceptual clarity and consistency.

Concept	**Definition**
Best practice/Preliminary recommendation	An approach or procedure that has been identified as effective and adaptable across different settings.
Civil Society Organization (CSO)	Organizational structure whose members serve the general interest through a democratic process, and which plays the role of mediator between public authorities and citizens (1).
Community-based Organization (CBO)	A non-profit entity that operates within a specific community or geographical area, aiming to address local needs and improve the well-being of its residents (e.g., faith-based organizations). They typically focus on issues impacting the community such as healthcare, education, social services, housing, and community development (2).
Compliance	In the context of health emergencies, compliance refers to the adherence to recommended protective behaviors aimed at limiting the spread of infection, such as regular handwashing, wearing masks in public spaces, maintaining physical distance from others, reducing social interactions, and adhering to the vaccination campaign.
Crisis	A crisis is a situation faced by an individual, group, or organization which they are unable to cope with using normal routine procedures and in which stress is created by sudden change. In the context of this Deliverable, the term “crisis” refers to a broad spectrum of events, ranging from localized outbreaks to large-scale disasters such as the COVID-19 pandemic.
Disaster	A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and

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	capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts (3).
Emergency	"Emergency" is often used in the context of "biological and technological hazards, health emergencies, or hazardous events that do not necessarily result in the serious disruption of the functioning of a community or society" (3). For the purpose of this Deliverable, the term "emergency" and "disaster" will be used interchangeably.
Emergency/Disaster preparedness	The knowledge and capacities developed by governments, response and recovery organizations, communities, and individuals to effectively anticipate, respond to and recover from the impacts of likely, imminent, or current disasters (4).
Health literacy	The ability of individuals to gain access to, understand, and use information in ways which promote and maintain good health for themselves, their families, and their communities (5). Digital health literacy specifically refers to the ability to search, find, understand, and evaluate health information from electronic resources and to use the knowledge gained to solve health-related problems (6).
Inclusivity	Providing equal access to opportunities and resources for people who might otherwise be excluded or marginalized, such as those having physical or intellectual disabilities or belonging to other minority groups. Thus, ensuring equitable involvement regardless of people's background, identity, or circumstances.
Lesson learned	Documented knowledge gained from positive or negative experiences, with the aim of improving future performance.
People-centered approach	Understanding and responding to the needs and values of individuals, often within the context of providing services or support. Connected with people-centered approaches, audience-centered ones focus on understanding and adapting to the

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	specific characteristics and perspectives of a particular group of listeners or viewers to effectively communicate with them.
Risk communication	The real-time exchange of information, advice, and opinions between experts or officials and people who face a hazard or threat to their survival, health, or economic or social wellbeing (7).
Whole-of-government approach	The collaboration between different public bodies extending beyond their respective fields of competence with the aim of providing the public with a combined response from a single body (8).
Whole-of-society approach	The need for all societal actors to cooperate in preventing, protecting against, responding to, and recovering from health emergencies while acknowledging and respecting each stakeholder's roles and contributions to solutions for more citizen-centric approaches (9).

Introduction

Health emergencies have posed significant and recurrent threats, exposing systemic vulnerabilities and generating far-reaching consequences on public health, economies, and societies (10). Europe has experienced multiple epidemics and pandemics over the past century (11). Although the possibility of severe pandemics had been anticipated (12), the Coronavirus disease 2019 (COVID-19) pandemic placed unprecedented strain on healthcare systems and institutions globally, highlighting systemic vulnerabilities and significant gaps in disaster preparedness and response capacities (13). Healthcare facilities struggled to manage the surge of patients amid shortages of critical resources (14–17). Healthcare workers were often forced to manage the pandemic on top of their usual duties (13), frequently with limited preparation (18,19), affecting their mental health (20). The scale and rapid progression of the crisis resulted in delayed responses, fragmented policies, and

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challenges in coordinating effective containment and mitigation strategies (21), highlighting the urgent need to strengthen health system resilience and to improve or create pandemic preparedness plans (22).

The COVID-19 pandemic disproportionally affected "vulnerable groups", who were at higher risk due to their socio-demographic characteristics and Social Determinants of Health (SDH) (23–25). For example, women were disproportionately affected by the pandemic, facing higher infection risks as the majority of the global healthcare and frontline workforce (26), while also bearing greater socioeconomic burdens (27,28) and experiencing a sharp rise in gender-based violence (27,29–31). Migrants, especially those living in overcrowded conditions (32–35), faced greater disadvantages during the pandemic and were more likely than nationals to be hospitalized or die from COVID-19 (36,37). They were already facing structural barriers in access to care and found themselves further excluded from healthcare systems, with restricted access to testing, treatment, and vaccination (38,39). Moreover, although containment measures such as lockdowns were implemented by governments to safeguard public health, these often backfired on marginalized groups such as migrants, people with informal jobs, unhoused individuals, and the Roma community, exacerbating their housing, work-related, and economic precarity (40–42). Importantly, the pandemic underscored the critical importance of adopting an intersectional lens to understand how overlapping identities interact to exacerbate vulnerabilities and intensify the adverse impacts of a health crisis (38,43–45).

Other elements influence how effectively individuals and communities can respond. For instance, the COVID-19 pandemic brought to light the critical issue of health literacy as a factor influencing the effectiveness of public health responses. Health literacy refers to the ability of individuals to gain access to, understand, and use information in ways which promote and maintain good health for themselves, their families, and their communities (5).

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It encompasses the knowledge, motivation, and competencies required to seek, comprehend, evaluate, and apply health information to make informed decisions regarding healthcare, disease prevention, and health promotion (46). Poor health literacy is an underestimated problem globally, leading to greater challenges in controlling the spread of pandemics and epidemics (47,48). In Europe, nearly half of adults reported having problems with health literacy (49). During the pandemic, the problem was exacerbated even more by the so-called 'infodemic', where people struggled to navigate, understand, appraise and use appropriately the vast amount of COVID-19-related information, including being able to detect misinformation (48).

The COVID-19 pandemic exposed pronounced disparities in health literacy, particularly among migrants and socioeconomically vulnerable populations, and especially at the intersection of the two (50,51). These groups often faced substantial barriers in accessing, understanding, and complying with public health information due to language difficulties and limited technology access (50). Additional barriers, including low educational attainment and insufficient digital competencies, further exacerbate these challenges (52). Migrants from lower socioeconomic statuses were identified as being more affected by fake news on social media due to lower levels of health literacy hindering their ability to identify relevant information (49,51). Despite the wide dissemination of COVID-19 information, low health literacy compounded with content and delivery methods frequently misaligned with the needs and realities of diverse communities, leading to reduced compliance with preventive measures (53,54). In the context of COVID-19, compliance refers to the adherence to recommended protective behaviors aimed at limiting the spread of infection, such as regular handwashing, wearing masks in public spaces, maintaining physical distance from others, reducing social interactions, and receiving the COVID-19 vaccination. Non-compliance attitudes can be explained by several factors, including the individual's

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perceived likelihood of getting infected and of developing severe symptoms of COVID-19, together with benefits of preventive measures, trust in government, science, health authorities, and the belief in conspiracy theories (55). On another level, non-compliance could also be connected to other factors detached from individuals' willingness to adhere to protective behaviors, such as conditions causing cognitive impairment, that in elderly people living with dementia or other neurodegenerative conditions could hinder their ability to comply with handwashing, face masking, and other restrictions (56,57).

Therefore, the expression "non-compliant groups" is not aimed at stigmatizing individuals not following restrictions. Coversely, it was employed to adhere with the terminology employed in the Grant Agreement and to describe the nonadherence with prescribed norms, for the aforementioned reasons. Non-compliance may stem from limited access to accurate, comprehensive, and operationally relevant health information, often exacerbated by the assumption that individuals are health literate, namely, capable of acquiring, understanding, and appropriately using health-related information. Healthcare professionals tend to overestimate patients' health literacy levels (58). This tendency is found to be particularly pronounced among patients from ethnic minority groups, further reinforcing disparities in healthcare delivery and outcomes (59).

Studies show that individuals with low health literacy were significantly less likely to adhere to preventive behaviors, and that migrant populations struggled to navigate evolving guidance during the COVID-19 pandemic (60,61). Although digital health initiatives and community-based approaches – which involve trusted local actors such as community health workers, faith leaders, or Non-Governmental Organizations (NGOs) to deliver culturally relevant health information – have demonstrated potential in bridging these gaps, many European health systems, governments, and public health authorities remain

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insufficiently equipped to effectively support and sustain health literacy among vulnerable populations during health emergencies (62).

The COVID-19 pandemic also exposed the limitations of top-down, centralized, and bureaucratic response models. Even before the pandemic, the World Health Organization (WHO) had emphasized the importance of a whole-of-society approach to address complex health emergencies, advocating for the active participation of all different segments of the society in preparedness and response efforts, including vulnerable citizens. During the pandemic, many civil society organizations (CSOs) and community-based organizations (CBOs) frequently stepped in to fill the gaps left by institutional actors (38). Although ambitious in its intent, the "whole-of-society" approach proved difficult to integrate into the response frameworks of governmental ministries and regional bodies (12).

As the most recent global health disaster, the COVID-19 pandemic presents a crucial opportunity to critically assess past response shortcomings. To facilitate more effective and resilient management of future health emergencies, it is imperative to rigorously analyze past experiences and turn challenges into actionable, evidence-based lessons. This approach aligns with WHO recommendations and is reflected in the After-Action Review (AAR) methodology – a qualitative evaluation of the actions taken during a public health crisis aimed at identifying and documenting best practices and challenges encountered (63).

In other words, the post-pandemic period represents a critical opportunity to enhance preparedness (4) and constitutes the momentum for learning across multiple dimensions. This involves not only recognizing the limitations of top-down responses, but also acknowledging the essential role played by CSOs and CBOs actors in disaster preparedness and response (12) – while ensuring that inclusivity is upheld by actively considering the needs, experiences, and contributions of vulnerable and non-compliant groups, also in preparation for future outbreaks. This is of paramount importance considering that Europe is currently

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facing a significant resurgence of well-known infectious diseases, with 2024 recording the highest number of measles cases in the past 25 years (64). The frequency and intensity of epidemics, pandemics, and other outbreaks are projected to increase in the coming years, driven and amplified by the combined effects of climate change and globalization (12).

In this context of reflection and opportunity for improvement, the PREPSHIELD project aims to strengthen pandemic preparedness, including by promoting a "whole-of-society" and "whole-of-organizations" approach, encouraging collaboration across all sectors in managing health emergencies (9,65). For these reasons, PREPSHIELD aims to develop policy recommendations drawn up by different stakeholders such as vulnerable and non-compliant groups, CSOs, Disaster Relief Organizations (DROs), and healthcare institutions. Importantly, PREPSHIELD emphasizes the participation of individuals affected by intersectional vulnerability factors for deepening the understanding of their lived experiences and to engage them in co-producing knowledge and formulating tailored policy responses (66,67), also targeting the preparedness phase, making sure they are inclusive, holistic, effective, and sustainable (68).

PREPSHIELD crisis preparedness preliminary recommendations, that will be presented in this Deliverable, are focused on four main thematic areas: health literacy, current challenges in crisis management, healthcare governance, and communication in health emergencies. A central emphasis will be placed on addressing barriers to health literacy, particularly among vulnerable and non-compliant populations. While systemic preparedness is crucial, individual preparedness is also important, and improving health literacy within these groups could facilitate increased adherence to healthcare guidelines, thereby contributing to improved health outcomes and more effective management of health emergencies. These recommendations are intended to be applicable to a wide range of crises, from localized outbreaks to large-scale disasters such as the COVID-19 pandemic.

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Notably, our crisis preparedness recommendations will be complemented by those related to management and communication, which will be presented in the subsequent Deliverable 1.3, prepared by colleagues from UiO.

PREPSHIELD pilot sites

The PREPSHIELD project has identified three pilot sites with complementary characteristics, enabling the implementation and testing of its solutions across different scales and diverse contexts. Pilot tests will be conducted at the local level in the Steilshoop neighborhood of Hamburg (Germany), the regional level in the Piedmont Region (Italy), and the national level in Romania. This selection allows the project to evaluate its developing crisis preparedness strategies within varied social, cultural, and economic environments, ensuring that the solutions are adaptable and effective across multiple settings and governance structures. A brief overview of the three pilot sites is presented below.

Hamburg, Steilshoop (Germany)

Hamburg, Germany's second-largest city, is a metropolitan hub with a population of approximately 1.78 million inhabitants and plays a crucial role in international trade and logistics. Within Hamburg, Steilshoop is a neighborhood where over half of the population consists of migrants, and unemployment rates are significantly higher than the city's average. Steilshoop is marked by a high level of social cohesion, supported by close-knit families, active community clubs, and diverse religious communities. The neighborhood's strong local identity is deeply shaped by its multicultural character and is further enriched by a significant presence of small businesses that contribute to its economic and social vitality.

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Germany is characterized by a generally high governmental trust. According to the Organization for Economic and Co-operation and Development's (OECD) latest survey of 41 countries, 36% of Germans expressed moderate-to-high trust in national government, slightly below the OECD average of 39% (69). As a local-scale pilot site, Hamburg can benefit from the "proximity" bonus effect (70), making local authorities generally more trusted by citizens than national authorities. Germany is also a Federal Republic and a country with one of the strongest regional powers. This institutional weight was demonstrated during the COVID-19 pandemic, for which the *Länders* (e.g., federal states) had almost exclusive control over healthcare and at administrative and operational levels. This national context and the specific position of Hamburg as both a local entity and a *Länder* with strong decisional power make Hamburg an interesting pilot study.

Piedmont Region (Italy)

Piedmont is a region located in North-West Italy, with a population of approximately 4 million people. Piedmont is an upper-mid income region, with a regional Gross Domestic Product (GDP) per capita 17% higher than the OECD regional average and in 2018 a 2% higher than the OECD average overall. In the same year, Piedmont's GDP per capita reached EUR 31 445, placing it 135th out of 387 OECD regions and 12th out of 20 Italian regions. Piedmont's GDP per capita is comparable to Tuscany and Friuli-Venezia Giulia (Italy), Aragon (Spain), Lisbon (Portugal), Schleswig-Holstein (Germany), and North Middle Sweden (Sweden) (71).

COVID-19 and Mpox have strained the healthcare system in Piedmont. The region has taken steps to increase hospital capacity, improve workforce resilience, and develop new strategies for responding to infectious disease outbreaks.

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With a 39% of trust in national government in the OECD's enquiry, and a 32nd on 41 ranking, Italy can be considered a moderate to low governmental trust country (72). Italy's trust gap between national and regional authorities is among the lowest in Europe, while remaining significant to the study with a 5.07 percentage point (72). The country is also characterized by a history of strong regional identities, which in some cases can be manifested through the expression of desire for more autonomy, and even independence. However, if, according to the study, regional authorities are more trusted than the Italian state, municipalities remain the geographically closest entity to the citizens, and consequently, the most trusted. The Piedmont region pilot site therefore constitutes an interesting in-between, as an intermediary between the local and national scale in a moderate to low trust national context.

Romania

The third pilot site, Romania, has a national focus. On January 1st, 2023, the resident population was about 19 million people (73). The country is positioned in the category of emerging economies, with a high degree of complexity and a specialized workforce, and, in 2020 and 2022, it has been classified as a "high-income economy", according to World Bank reports. With the end of 2022, Romania's economy is ranked 10th in the European Union (EU), in terms of size, and 7th, in terms of strength, when GDP is adjusted to purchasing power parity (73). The Romanian national pilot study constitutes the largest scale of the PREPSHIELD project and therefore the less likely to benefit from the "proximity bonus" increasing citizens' political trust. Romania's trust gaps percentage point between regional and national authorities is of 16.43 and a 2023 survey on citizens' trust in Romanian institutions places its president, government, and parliament, underneath the Army and the Church with respectively 29,8%, 17.4%, 70,4% and 62,5% of trust (74). This pilot study thus complements the previous two.

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Methodology

Overview of Work Package 1

To inform preliminary recommendations for improved crisis preparedness (D1.2), as well as management and communication (D1.3), activities carried out within the framework of WP1 focused on conducting a comprehensive needs analysis to gain a deeper understanding of the needs, perceptions, and proposed strategies of vulnerable and non-compliant groups, as well as those of key institutional stakeholders, including policymakers, healthcare professionals, and public authorities involved in health crises response (D1.1). In doing so, the resulting preliminary recommendations are grounded in the lived experiences and perspectives of a wide range of societal actors, in alignment with a whole-of-society approach to health emergency preparedness, management, and communication.

WP1 research activities consisted of a series of interconnected tasks, including the collection and analysis of both primary and secondary data, aimed at developing a comprehensive, multi-actor understanding of the challenges, needs, and perceptions arising from past health crises. WP1 was structured into five distinct Tasks. Table 1 provides an overview of the different Tasks, Subtasks, data collection methods, and contexts.

In this Chapter, a description of the different Subtasks and the methodologies employed will be provided.

Table 1. Overview of the different subtasks, data collection methods, and partners involved in WP1.

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Task	Subtask	Data collection methods	Context
Task 1.1 Needs and perceptions of vulnerable and non-compliant groups with regards to health crises	*S1.1.1 Literature review to identify vulnerable and non-compliant groups and their barriers*	Integrative literature review	Europe
	Subtask 1.1.2 Survey study on the needs and barriers of vulnerable and non-compliant groups	Survey and interviews with vulnerable individuals, care providers, and health professionals	Pilot sites: Hamburg, Piedmont, Romania
Task 1.2 Institutional needs with regards to health crises	*Subtask 1.2.1 Learning from past experiences of healthcare institutions and policymakers*	Systematic review of reviews of the literature, historical overview, and grey literature analysis	Europe
	Subtask 1.2.2 Challenges to overcome for healthcare institutions and policymakers	In-depth interviews with key stakeholders	Pilot sites (Hamburg, Piedmont, Romania), France, Slovenia

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	Subtask 1.2.3 Improving governance of healthcare institutions and policymaking in the future	Focus group discussion	Pilot sites (Hamburg, Piedmont, Romania), Germany Spain, Sweden
Task 1.3 Best practices for communication in health crises	*S1.3.1 Literature review*	Systematic literature review	Europe
	S1.3.2 Expert interviews	Expert interviews	Pilot sites (Hamburg, Piedmont, Romania)
Task 1.4 Best practices for inclusive health crisis preparedness	/	Physical meeting; Expert consultation for validation	Europe
Task 1.5 Best practices for inclusive health crisis management	/	Physical meeting	Europe

WP1 activities contributed to the development of three distinct deliverables, including the present one, complementing each other to provide a comprehensive understanding of crisis preparedness, management, and communication. Specifically, UG is responsible for the 'Need Analysis' Deliverable (D1.1), which outlines the needs of the different actors during health crises, providing the basis for evidence-informed recommendations. The present Deliverable (D1.2) focuses on reporting lessons learned for crisis preparedness, while the final Deliverable (D1.3), prepared by UiO, will address lessons learned for inclusive crisis

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management and communication. Preliminary recommendations resulting from these Deliverables are designed to strengthen both preparedness and management by enhancing proactive readiness and capacity-building prior to crisis, as well as facilitating more effective, timely, and coordinated responses during emergencies. Importantly, preparedness, management, and communication strategies will be informed by the needs of diverse stakeholders, with particular attention to vulnerable and non-compliant groups.

Task 1.1: Needs and perceptions of vulnerable and non-compliant groups with regards to health crises

This Task aimed at understanding the needs and experiences of individuals belonging to vulnerable and non-compliant groups with regards to pandemics and epidemics.

Subtask 1.1.1 Literature review to identify vulnerable and non-compliant groups and their barriers

UG conducted an integrative review to synthesize literature, including review articles, primary research, and grey literature (e.g., report from WHO, OECD and United Nations Office for Disaster Risk Reduction), across various disciplines and methodologies in order to explore how vulnerability has been defined and operationalized, and what barriers to compliance with health recommendations have been identified among vulnerable populations during past health crises in Europe. The literature review served also to understand the psychological barriers to engagement with health recommendations during emergencies.

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The search relied on three major databases (Web of Science, Scopus, and PubMed), chosen for their broad indexing of peer-reviewed journals across the social sciences, public health, and biomedical fields, making them suitable for capturing diverse study designs related to vulnerability, compliance, and epidemic or pandemic contexts. The search was restricted to studies published in English between 2009 and 2024 to capture both the H1N1 pandemic and more recent events such as COVID-19 and Monkeypox outbreaks. Only studies focusing on Europe were included, to ensure geographical relevance to the policy and social context of interest.

After the screening phase, 51 studies were retained for qualitative synthesis. Different research questions served as a guide to identify in the analyzed literature vulnerability factors, as well as their underlying causes, to describe the patterns and determinants of compliance and non-compliance, to understand barriers to compliance among vulnerable groups, and to identify strategies for support and engagement of vulnerable groups.

Subtask 1.1.2 Survey study on the needs and barriers of vulnerable and non-compliant groups

This Subtask consisted of two main components, namely a survey and interviews.

UG prepared and conducted a survey study to empirically validate the insights from the literature review, with attention to vulnerable groups, with targeted strategies in the three pilot sites. The aim was to understand the barriers to compliance with health recommendations during past outbreaks (e.g., epidemics, pandemics) for individuals, neighborhoods, and communities. The survey dissemination in the three pilot sites (Piedmont, Hamburg, and Romania) was completed thanks to the support of UPO, MLKS, and RRC. The survey was conceptualized and developed in English by UG and translated in

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the different languages of the three pilot sites by partners (UPO, MLKS, RRC).

Survey dissemination was conducted in the months of April and May 2025. The survey was distributed on Qualtrics, consisted of multiple choice, Likert scales, and open questions, including on participants' experiences during COVID-19, trust and risk perception, technology acceptance, health literacy, and demographics, where participants could disclose information on their gender, socioeconomic status, immigrant background, mental or physical disability, or on them being informal caregivers.

Following UG instructions, the online survey was disseminated both physically, through flyers translated in the local languages of the three pilot sites reporting a QR code (Figure 1), and digitally, via links distributed through emails, social media posts, and messaging apps in the local language of each pilot site. The distribution strategies, relying on purposive sampling, were tailored to reflect the specific social, cultural, and technological realities of each location, ensuring the widest possible reach and engagement. As a result, dissemination methods varied across the three pilot sites, employing a diverse mix of channels suited to the local contexts and specifically designed to reach vulnerable populations identified in *Subtask 1.1.1*. For Hamburg, local NGOs and social services, parish newsletters and church networks, as well as pharmacies, doctors, and clinics. For the Piedmont region, university buildings, newsletters, hospitals, General Practioner (GP) offices, mosques and churches, supermarkets, shops, ethnic shops, bus stops, and train stations were used as distribution settings and complemented dissemination through professional networks of UPO research team. For Romania, dissemination relied on the Romanian Red Cross (RRC) branches and involved Equality, Generosity, Abilities, and Liberty (E.G.A.L.) centers in vulnerable areas across the country (e.g., Babadag, Botoșani, Craiova) and trusted local figures. For Hamburg and Romania dissemination also involved

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direct contact or calls with participants as well as support for survey completion through the assistance of volunteers – for example, in Romania with the involvement of the Red Cross.

The target sample size, as defined by UG, was approximately 50 to 150 participants per pilot site. In practice, the actual number of participants ranged from 88 in Germany, 198 in Piedmont, and 112 in Romania.

Figure 1. Survey flyer

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The survey was complemented by interviews with vulnerable individuals, care providers, and health professionals to identify working strategies to improve access to health information and to remove compliance barriers. Interviews with vulnerable individuals and with caregivers (n = 19) were conducted in person by the UPO research team in Piedmont and online or via phone call by the UG research team in Romania and Hamburg. In Piedmont,

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interviews involved elderly people (n = 2), migrants (n = 3), and caregivers (n = 3). In Hamburg, individuals with chronic illness or disability (n = 2), elderly (n =1), migrants (n =2), and people from a lower socioeconomic status (n = 2) were interviewed. In Romania, interviews were carried out with caregivers (n = 1), and vulnerable individuals (n = 4), including a single mother (n = 1), a retired woman (n = 1), a person of Roma ethnicity (n = 1), and an elderly person (n = 1).

For data collection directly from health professionals, the interview guide for *Subtask 1.2.2* conducted by UPO was integrated with questions concerning *Subtask 1.1.2*. The anonymized transcripts of the interviews conducted by UPO were later shared with the UG research team to analyze and to complement their findings.

Task 1.2: Institutional needs with regards to health crises

This Task aimed at understanding the needs and challenges of healthcare facilities as well as those of professionals engaged in the response to past health emergencies.

Subtask 1.2.1 Learning from past experiences of healthcare institutions and policymakers

UPO conducted a literature review, and, with support from UZH, an historical overview and a grey literature review to identify gaps in healthcare facilities' response in previous health emergencies (e.g., epidemics and pandemics) in Europe.

To synthesize the large amount of recent literature available on pandemics and epidemics, which had a surge during the COVID-19 pandemic, UPO conducted a systematic review of reviews investigating gaps in healthcare facilities' response to outbreaks in Europe using databases PubMed, Scopus, and Web of Science. The search strategy combined terms related to outbreaks (e.g., "epidemic", "pandemic", "outbreak"), healthcare settings (e.g.,

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"health facility", "hospital", "intensive care unit"), and gaps (e.g., "challenge", "gap", "difficulty"). Reviews included (n = 22) were published in English between 2009 and 2024, focused on the European context, and to be included had to describe gaps or challenges in the response to COVID-19, H1N1, measles, influenza or seasonal flu, or Mpox at healthcare facility level. Relevant data were extracted and thematically analyzed according to the 4S Framework (Stuff, Staff, Space and System) by Anesi et al. (75), which helps to organize and understand the key elements needed for an effective healthcare response during emergencies. The framework focuses on four main areas:

- **Staff,** which refers to the personnel involved in care delivery and hospital operations;
- **Stuff,** meaning the physical equipment required to deliver care and support healthcare delivery;
- **Space**, referring to the physical spaces for patient care, and
- **System,** which can be conceptualized as planning and leadership activities implemented to operationalize and optimize a response effort.

All the included reviews focused on the COVID-19 pandemic, highlighting a gap in the documentation of challenges in the response to outbreaks at healthcare facility level prior to that period. For "system", the most highlighted challenges were connected to telemedicine, for "staff" increased workload, mental health, and task shifting or redeployment, for "stuff" resource shortages, and for "space" space limitations and repurposing in Intensive Care Units (ICUs) or Emergency Departments (ED).

UZH conducted a historical overview aimed to identify recurring healthcare facility challenges, response strategies, and contextual lessons learned relevant to modern preparedness planning from pandemics occurring in Europe prior to 2009. The analysis sought to identify patterns of system stress, adaptive practices, and gaps in preparedness during respiratory pandemics such as the 1918-1920 influenza, the 1889-1890 "Russian Flu",

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the 1957 “Asian Flu”, the 1968-1970 “Hong Kong Flu”, and the 1977 “Russian Flu”. The search targeted peer-reviewed studies published in English through PubMed, Scopus, and Web of Science, using strings that combined terms related to disease (e.g., “Spanish flu”, “Asian flu”), healthcare (e.g., “hospitals”, “ICU”), and response descriptors (e.g., “challenges”, “gap”, “impact”). The search covered pandemics from 1889 to 2008. A total of 108 articles were initially retrieved and screened. After removing duplicates and applying inclusion criteria, 28 articles were retained for final analysis. These focused mainly on the 1918-1920 influenza pandemic but also “Asian Flu” (1957), “Hong Kong Flu” (1968), and “Russian Flu” (1977). The fragility of hospital systems was provoked by the absence of predefined coordination and surge strategies, as well as by severe staff shortage, which worsened as many physicians and nurses themselves became ill or died (76). Care capacity was expanded through repurposing of existing infrastructures (77–80), also in collaboration with the Red Cross, underscoring the need for pre-established protocols and inter-institutional partnerships to enable rapid spatial adaptation when needed. Later pandemics, such as 1957 “Asian Flu” and 1968 “Hong Kong Flu” (81,82) increased emergency admissions and general practitioner workload (83).

A grey literature review was conducted by UZH and aimed at examining reports from European governmental agencies related to the burden on the healthcare system during pandemics. The search was not limited to a specific timeframe and included both historical and recent outbreaks. A wide range of platforms were screened, including websites of the European Centre for Disease Prevention and Control (ECDC), WHO Europe, OECD, the European Commission, European Observatory on Health System and Policies, European Health Management Association (EHMA), European Public Health Alliance (EPHA), Standing Committee of European Doctors (CPME), European External Action Service (EEAS), Health Emergency Preparedness and Response (HERA), and Global Research Collaboration for

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Infectious Disease Preparedness (GloPID-R). Search strategies varied depending on the platform. On portals such as Google Scholar and OpenGrey, structured search queries were used. For most institutional websites, manual searches were conducted using basic terms such as “Influenza”. All web pages and subpages were carefully scanned for documents that met the inclusion criteria, even partially.

Despite an extensive effort, very few documents were found, and most of those only partially matched the scope of this task. No detailed information on challenges or lessons learned at the healthcare facility level was available, and for this reason, the review did not result in findings that could be meaningfully analyzed.

Subtask 1.2.2 Challenges to overcome for healthcare institutions and policymakers

To identify the challenges faced by professionals in the management of previous epidemics and pandemics, UPO conducted ten in-depth, semi-structured interviews with key stakeholders from the pilot sites (Piedmont, Romania, Hamburg) and from other European countries (Slovenia, France). Participants were selected using purposive sampling, focusing on individuals with relevant experience and who could provide relevant insights. Recruitment of participants from countries other than the pilot sites relied on partners from Horizon Europe Project MountAdapt, demonstrating cross-project exchange.

Interviews were conducted from April to May 2025, in English or Italian, online. Understanding the specific challenges encountered by professionals in their respective contexts was essential not only for identifying common patterns and context-specific particularities, but also for critically reflecting on past shortcomings and formulating targeted, evidence-based preliminary recommendations to strengthen future crisis preparedness.

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Interviews focused on different themes, namely the key informants' professional background, as well as the challenges and lessons learned in the domains of resources, human resources, provision of health services, logistics, health literacy and communication, and data collection.

The professionals interviewed represented a diverse range of geographic and professional backgrounds. Participants came from Romania (n = 3), Hamburg (n = 2), Piedmont (n = 2), Slovenia (n = 2), and France (n = 1). Their expertise spanned public health (n = 5), healthcare delivery (n = 2), health emergency and crisis management (n = 2), and policymaking (n = 1).

More specifically, the group included: two family doctors, one nurse, two public health officials, one epidemiologist, one pharmacist (both involved in the regional crisis unit in Piedmont), two emergency physicians, and one policy maker. This diverse composition offers valuable insights into crisis preparedness and response from both frontline and strategic perspectives.

Subtask 1.2.3 Improving governance of healthcare institutions and policymaking in the future

This Subtask aimed to organize one focus group discussion with relevant stakeholders from the pilot sites and other European countries to brainstorm solutions to better manage and improve healthcare governance in future health emergencies. The research team from UPO combined this subtask with T1.4, that will be described in the following sections.

To identify key challenges experienced during past health crises, UPO conducted one focus group discussion with relevant stakeholders (n = 7) from the pilot sites (Hamburg, Piedmont, Romania) and other European settings (Germany, Spain, Sweden). Members of the Advisory Board were also invited to participate. The objective was to engage key informants in

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reflecting on and proposing potential strategies and solutions to overcome identified barriers and enhance healthcare governance in future health emergencies (e.g., pandemics and epidemics). Focus Groups Discussion (FGD) participants were religious leaders (n = 2), communication experts (n = 2), healthcare professionals (n = 2), and researchers (n = 1).

Task 1.3: Best practices for communication in health crises

This Task aimed at understanding how communication activities were developed during past epidemics and pandemics, as well as describing the challenges faced by professionals involved in these initiatives.

Subtask 1.3.1 Literature review

A systematic search was conducted by UiO in academic journal databases (e.g., Scopus and Web of Science), to identify relevant literature using keywords related to health and crisis communication strategies, health crises (e.g. “pandemic,” “disaster,” “emergency,” “risk,” “crisis,”) and trust building and uncertainty (e.g. “trust”, “credibility”, “trustworthy”).

In total, 81 English language peer-reviewed journal articles on health crisis communication and published between 2011 and 2025 were included. The majority were published in 2020 or later and were focused on COVID-19. Others dealt with H1N1, *Escherichia coli*, Legionnaires’ disease, Ebola, and Smallpox. Most articles used quantitative methods, such as surveys or experiments, closely followed by qualitative methods, such as interviews.

Subtask 1.3.2 Expert interviews

To identify country/region specific factors, 11 semi-structured interviews with 12 professionals involved in the communication and management of the pandemic in Hamburg (n = 3), the Piedmont region (n = 4), and Romania (n = 4) were conducted by UiO research

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team. The interviews focused on the management and communication strategies used during previous health crises, as well as strategies to communicate uncertainty and build trust and trustworthiness.

Interviewees were from different professional backgrounds, namely religious leaders, communication experts, professionals involved in emergency and crisis management, doctors, and project managers.

Task 1.4 and Task 1.5 Best practices for inclusive health crisis preparedness and management

These Tasks aimed at developing preliminary best practices based on the findings of previous tasks within WP1.

Preliminary best practices were developed based on the findings of WP1 and after a discussion together with UG and UiO, which took place during the physical meeting in Novara, at UPO's headquarters, in the month of June, with the aim to establish common recommendations for inclusive health emergency management (*T1.5*), as well as common recommendations on health emergency preparedness (*T1.4*) – the focus of this Deliverable – focusing on health literacy, current challenges in crisis management, and healthcare governance and communication in health emergencies.

To comply with *Task 1.4 Best practices for inclusive health crisis preparedness*, external experts from PREPSHIELD Advisory Board were later consulted and involved in the validation of a list of preliminary recommendations for enhancing health emergency preparedness, inclusive of the needs of vulnerable and non-compliant groups.

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Further details on the proceedings of the physical meeting held in Novara, as well as the collaborative development of the best practices, are provided in the following section.

PREPSHIELD Preliminary recommendations for crisis preparedness

Development and validation of the PREPSHIELD Best Practices/Preliminary recommendations

The development of all preliminary recommendations followed a multi-method, iterative, and collaborative process, informed by the findings of the various WP1 activities previously outlined.

The first draft of the preliminary recommendations was collaboratively developed by researchers from UG, UPO, and UiO involved in *Tasks 1.1*, *1.2*, and *1.3*, drawing directly on the findings generated through these activities. Specifically, the results of these Tasks – and their translation into initial preliminary recommendations – were presented and discussed by each partner during the physical meeting held in June at UPO's headquarters in Novara. This process ensured that the perspectives and needs of all societal actors, including emergency responders, policymakers, vulnerable and non-compliant groups, were considered in the formulation of the preliminary recommendations. During the meeting, partners discussed the proposed preliminary recommendations in an open and collaborative environment. This exchange enabled a thorough comparison of findings and identification of overlapping, divergent, and complementary elements. The outcomes of this participatory discussion were consolidated into a single document that was circulated to a larger team within the Consortium for feedback. Subsequently, the preliminary recommendations were refined and evaluated through the FGD, during which strategies to overcome identified challenges were further explored. This session involved experts from the three pilot sites as well as members of the Consortium Advisory Board and was followed by

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a consultation with the Consortium's Advisory Board, as outlined in *Task 1.4*. This multi-phase collaborative approach ensures that the preliminary recommendations presented here are grounded both in scientific evidence and in practical insights derived from contextualized field experiences. Moreover, this co-creative approach supports PREPSHIELD's citizen-centric lens, which emphasizes the essential inclusion of the needs of various societal actors, especially those vulnerable and non-compliant, in accordance with the whole of society approach.

How are preliminary recommendations structured and presented in this Deliverable?

This Deliverable presents preliminary recommendations related to crisis preparedness (*T1.4*), including health literacy – specifically, the preliminary PREPSHIELD crisis recommendations which are detailed in the following section. They span different areas, namely crisis management, communication, health literacy, and healthcare governance. Table 2 reports a summary of the macro areas, as well as the corresponding preliminary recommendations.

Table 2. Macro areas and preliminary recommendations identified during the activities of WP1.

Macro areas	**Preliminary recommendations**
Crisis management	1. Center-led and coordination approach 2. Digitalization of the information and dissemination system 3. Inclusive coordination 4. Data collection digitalization 5. Data protection and security standards

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Communication	6. Clear and coordinated risk communication 7. Communication facilitators 8. Audience-centered messages and delivery 9. Positive and transparent communication 10. Multilingual and multicultural communication
Health literacy	11. Use of visual aids 12. Simple and people-centered language 13. Support for low-literacy populations 14. Digital health literacy and equitable access to technology 15. Training for emergency responders
Healthcare governance	16. Adaptive Healthcare Capacity and Services Repurposing 17. Infection control through spatial separation 18. Continuity of care 19. Quality of care 20. Clear protocols for health staff organization and working conditions 21. Staff availability and redeployment 22. Staff psychological support 23. Staff training 24. Availability of resources 25. Distribution of supplies 26. Resource procurement

As previously mentioned, preliminary recommendations focused on inclusive crisis management and communication will be covered in detail in the UiO deliverable (D1.3). However, it is essential to highlight the continuity between preparedness and response, which cannot be viewed as isolated phases within the broader disaster management cycle

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(84). In the context of PREPSHIELD, health crisis management is interpreted as the response to the crisis itself and, for this reason, distinct from preparedness on which this deliverable focuses. Nevertheless, as preparedness and response are deeply interconnected and response is directly influenced by the level of preparedness, the preliminary recommendations on the response strategies explored in Deliverable 1.3 (D1.3) build on the foundation laid during the preparedness phase, reflecting the continuity of the disaster management cycle (84). Thus, D1.3 should be viewed as an essential complement to D1.2, with both providing a more detailed account of how best practices evolve and adapt during a crisis.

Each preliminary recommendation is presented alongside its key lessons learned and intended target audience. These lessons reflect critical insights gained from previous health emergencies, highlighting both successes and challenges that inform more effective preparedness and response strategies. By integrating these lessons, this Deliverable ensures that recommendations are firmly grounded in real-world experience and evidence. The lessons learned derive primarily from the findings of activities conducted within WP1 and may also include reflections on their alignment or divergence from existing literature. On the other hand, specifying the target audience not only provides focused guidance but also identifies which stakeholders — such as policymakers, public health authorities, community organizations, or healthcare professionals — are responsible for implementation. Defining these roles and responsibilities fosters accountability and a more targeted approach, increasing the likelihood that the recommendations will be effectively translated into concrete actions and that the lessons learned will drive continuous improvement in crisis preparedness and management.

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Importantly, these preliminary recommendations are not intended as "one-size fits all" solutions; instead, they reflect evidence-informed models that are meant to be tailored to the specific local needs, capacities, and different sociopolitical contexts within Europe. While they are primarily informed by the challenges experienced by the actors within the three main pilot sites — Hamburg, Piedmont, and Romania — their structure and the inclusion of actors outside these pilot sites in the need analysis phase of WP1 ensure their broader applicability across diverse European settings.

Preliminary crisis preparedness recommendations – next steps

In a later phase of the PREPSHIELD project, these best practices will be shared as part of the training with participants in the Tabletop Exercises (TTE) at each of the three pilot sites (*Task 3.1*, *Task 3.3*) prior to their participation. This will enable them to apply preliminary recommendations during the exercises and to evaluate their feasibility and impact. In a later stage, as part of the activities of WP4, the preliminary recommendations and the results of their evaluation will serve to plan improvements (*Task 4.1*). The improved preliminary recommendations will be shared again with participants (*Task 3.1*) before they take part in an online exercise using the PREPSHIELD platform and App, enabling for a final evaluation of the preliminary recommendations and their impacts in the scenarios (*Task 3.5*), ultimately feeding into WP4, where policy recommendations for health crisis preparedness and response (*Task 4.2*), inclusive communication in crisis (*Task 4.3*) and recommendations for knowledge transfer to other disasters (*Task 4.4*) will be produced.

When it comes to communication-related preliminary recommendations, these will be also tested in online survey experiments in different regions and focusing on high/low trust contexts as well as minority/majority population groups (*Task 3.2*). The findings of these

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experiments will be analyzed together with the qualitative oriented ones of the TTE and crisis simulation, evaluating message strategies and identifying problematic communicative aspects (*Task 3.2*). The analysis of the results will serve to plan improvements for the next evaluation phase (*Task 3.5*). The identified communication strategies will be shared before the online exercises with public authorities. During the exercises they will communicate with citizens, CSOs, DROs, and healthcare institutions through the PREPSHIELD platform and app.

Preliminary recommendations (PR) for crisis preparedness- Theme: Crisis management

PR1: Center-led and coordinated approach

Establish a centralized coordination mechanism (e.g., national or regional crisis unit) to oversee health emergency planning through a whole-of-government approach. This body should facilitate pre-crisis agreements on roles, responsibilities, and shared protocols across national, regional, and local actors. It must also ensure that local health authorities are equipped and empowered to adapt plans to their specific contexts, including mechanisms for resource-sharing, information exchange, and joint simulation exercises. Establish a clear chain of command to define who leads coordination during a health crisis.

Lessons learned

Interviews conducted under *Subtask 1.2.2 revealed* that past health crises, especially COVID-19, were marked by coordination challenges, largely due to the absence of an effective crisis management approach. In federal or decentralized systems (e.g., Germany or Spain)

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the feasibility of implementing a coordinated and centralized approach is hindered by the way in which the system itself is organized. For instance, during the COVID-19 pandemic, as emerged from the FGD, Germany experienced significant challenges in providing a unified response because of its federal system, for instance, when establishing public health restriction rules. In contrast, some examples of a centralized approach demonstrated that clear direction and accountability, including a "whole-of-government" strategy that breaks down silos, enable comprehensive resource mobilization and coordinated action, making it an effective strategy. The Piedmont region in Italy offers a positive example, as it demonstrated an effective centralized coordination at the regional level, while maintaining operational ties with local authorities, enabling a contextualized response. Thus, a key lesson learned emerged from the PREPSHIELD project is the importance of establishing a predefined coordination framework, tailored to the type of crisis (e.g., pandemic or epidemic or specific outbreak such as dengue or influenza) that clearly identify and designates leadership roles. In addition, the type of centralized coordinated approach should be tailored to governance structures (e.g., centralized, decentralized, or federal system). Lastly, past examples highlighted the need to empower local health authorities to ensure that responses are tailored to specific community needs and realities, leveraging on-the-ground expertise and enabling more effective and context-sensitive interventions.

Target audience

National, regional and local health authorities, crisis response coordination bodies, Ministry of Health

Implementation tier: immediate to short-term implementation – High priority

This recommendation is a prerequisite for enabling effective implementation of downstream actions

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such as PR2, PR3, PR4, PR5, PR6-PR10, PR16-17, PR20-PR26. In this case, PR1 is a foundation and enabling recommendation that directly supports at least 18 out of 26 especially those related to digital system and data governance, inclusive management, communication, human resource adaptation, and resource allocation.

PR2: Digitalization of the information and dissemination system

Establish a centralized and digital platform to host all official health guidelines and protocols that need to be shared, with built-in features for rapid communication of updates, when guidelines are not yet available. Conduct regular briefings and training to build familiarity with how the platform will be implemented during a crisis. Create designated focal points (e.g. medical directors, senior nurses) responsible for managing the system within each facility and offering support in case of need.

Lessons learned

The COVID-19 pandemic created significant uncertainty due to rapidly evolving knowledge about virus transmission, safety protocols, and public health policies. This left many healthcare workers unsure about how to manage patients and how best to protect themselves from infection, as reported in many articles included in the literature review conducted within *Subtask 1.2.1* (14,15,18,85–89). The pandemic also underscored the urgent need for digitalization to enhance the speed and clarity of information dissemination. For example, in Romania, a strong dependence on phone calls and paper-based systems hindered real-time coordination during the pandemic. However, the effective rollout of digital infrastructure is often obstructed by limitations in procurement procedures. In some settings, procurement decisions have resulted in the purchase of low-quality products or failed to incentivize investment in durable, high-performing systems. Thus, EU-level

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investment and technical guidance can play a critical role in supporting member states' digital transitions as part of broader health crisis preparedness strategies.

Target audience

National, regional and local health authorities, Crisis response coordination bodies, Ministry of Health

Implementation tier: short-term and long-term implementation - High priority

This recommendation is a prerequisite for enabling effective implementation of downstream actions, mainly for PR4 and PR5, and it is dependent on the implementation of PR1.

PR3: Inclusive coordination

Establish inclusive coordination structures that include advisory committees composed of civil society, local actors, and representatives of vulnerable groups to establish feedback mechanisms regarding health measures for clarity and feasibility.

Lesson learned

An effective crisis response necessitates a bidirectional flow of information and influence – top-down for strategic guidance and bottom-up for contextual understanding and tailored implementation. Conversely, past crises, especially from the results emerged from the interviews within *Subtask 1.1.2,* highlighted a significant deficit in citizen consideration. As emerged from the FGD *(Subtask 1.2.3)*, in some contexts, depending on the government structure and political setting (e.g., more hierarchical), there are significant barriers to collaboration with CSOs and faith-based organizations, deeply rooted in political cultures that resist shared decision-making. For instance, a German faith-based organization

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reported difficulties in this type of collaboration. However, given the well-known advantages of involving CSOs in crisis management efforts, it is worthwhile to invest in building partnerships during the preparedness phase as representatives can also serve as intermediaries to communicate the rationale behind decisions and foster trust at the community level. Lastly, this approach aligns with WHO public health best practices, which emphasize community engagement as essential for effective preparedness and response (90).

Target audience

Policy makers, government leaders, national, local, regional health authorities, CSOs representatives, local leaders

Implementation tier: short-term implementation – medium priority

This recommendation, while not strictly foundational, significantly improves the quality and inclusiveness of response measures once coordination structures are in place. It is a prerequisite mainly for communication, so for PR6 to PR10, and it is dependent on the implementation of PR1.

PR4: Data collection digitalization

In the preparedness phase, invest in the development of a unified reporting system that links local, regional, and national health authorities for data collection and sharing (e.g., vaccination rate, positive cases, ICU occupancy bed rate) to support decision-making and resource allocation. Create a standardized data reporting format—such as a pre-configured online spreadsheet—to harmonize data categories, formats, and reporting intervals (e.g., hourly or daily), enabling consistent and efficient data analysis. The system should remain active

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beyond crisis time, and system monitoring during ordinary times could ensure it stays functional and up to date, avoiding the risk of it becoming outdated or failing when most needed.

Lessons learned

Insights from practitioners during the FGD (*Subtask 1.2.3*) emphasized that establishing a new data entry system during an emergency is not feasible. This highlights the importance of investing during the preparedness phase in an automated data collection system integrated with electronic health records (EHRs). A centralized reporting system ensures consistency and enables standardized analysis of data, which can support comparability across levels. In addition, the availability of timely data can facilitate the decision-making process for the distribution of resources. A consistent reporting system is useful to ensure the usability of data sets over time and guarantee continuous updates of reporting system mechanisms. This is in accordance with the WHO Public Health Information Services (PHIS) Toolkit (91), which suggests the use of Early Warning Alert and Response Systems (EWARS), that could be viewed as a complement to the HMIS (Health Management Information System). However, minimal overlap between EWARS and PHIS has been encouraged. Beyond crisis situations, a HMIS should function as the routine health information system collecting comprehensive and ongoing health data on a monthly or quarterly basis, including service delivery, morbidity, mortality, and health workforce statistics.

Target audience

National and regional health authorities, Disaster response coordination bodies, Ministry of Health

Implementation tier: short to medium term – high priority

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It is a foundational structure that should be built and piloted in non-crisis time to be operational when needed. It is mainly dependent on the implementation of PR1, and PR4.

PR5: Data protection and security

Establish clear data protection protocols and cybersecurity standards for all digital tools used in health crisis management (e.g. surveillance systems, contact tracing, vaccination databases, data collection systems), and ensure that national regulations are in line with EU data protection regulations (e.g., The General Data Protection Regulation (GDPR) - Regulation (EU) 2016/679).

Lessons learned

When implementing data collection mechanisms, as happened in the past COVID-19 crisis, it is essential to uphold individuals' fundamental rights in the digital age. In accordance with the GDPR (92), data should be collected ethically, only when necessary, and in line with data protection principles to ensure privacy and security. However, insights from the FGD (Subtask 1.2.3) revealed that in some countries, such as Romania, data literacy remains low, particularly within public administration. Additionally, in certain contexts, national regulations are even more restrictive than the GDPR (e.g., Italy), which can lead to inconsistencies or implementation challenges. Therefore, during the preparedness phase, it is crucial to develop national data governance frameworks that are both aligned with EU legislation and transparent in their application, even when stricter national rules are pursued.

Target audience

Hospital managers, ministry of health, local, regional and national health authorities, Central government.

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Implementation ties: Immediate to Short-Term | Foundational Prerequisite

This is a non-negotiable foundational requirement for any digital solution handling personal or health-related data. It should be in place before any digital system (see PR2 or PR4) is created.

PREPSHIELD Preliminary recommendations for crisis preparedness – Theme: Communication

PR6: Clear and coordinated risk communication

Develop and pre-test communication protocols and message templates for timely communication that prioritize clarity, avoiding technical language, and establish a clear chain of command that designates official spokespersons and provides training in communication for them.

Lessons learned

Preparedness requires communication strategies to be in place before a health crisis occurs. This includes having ready-to-use templates, clearly defined roles, and trained spokespersons equipped to deliver key health messages to the public. However, findings from the FGD (*Subtask 1.2.3*) revealed that in some contexts, communication is undervalued and often regarded as an afterthought, rather than being embedded as a core pillar of the preparedness phase. The review conducted by UiO (*Subtask 1.3.1*) further underscored that contradictory or unclear information led to non-compliance. To address this, establishing a coordination framework that defines roles (e.g., spokesperson) and responsibilities could improve communication flows across all relevant stakeholders. Moreover, communication should be institutionalized and seen as a strategic competency rather than a support function for the delivery of timely information during preparedness and response.

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Target audience

Local health, regional and national authorities, crisis communication units, crisis response coordinator, civil protection

Implementation ties: Immediate to Short-Term - High Priority

This recommendation is actionable during the preparedness phase and is critical for timely and coordinated communication during crises. Its implementation is relatively low in resource intensity but high in strategic value. It is a prerequisite for PR7, PR8, PR9, and PR10, and it is dependent on the implementation of PR1.

PR7: Communication facilitators

Establish and maintain partnerships between public authorities and community-based facilitators and local CSOs that have long-standing relationships and established trust within the communities they serve to co-develop communication strategies, build trust, and ensure inclusive preparedness planning, particularly for vulnerable populations.

Promote cross-sector collaboration among governmental institutions, health authorities, and civil society well before a crisis occurs. Support this process through the systematic mapping and regular updating of community actors and networks, ensuring information remains accurate and reflects evolving local dynamics.

Lessons learned

It is well-known in the literature that delivering communication through familiar and accountable local actors ensures that messages are more likely to be trusted, understood, and accepted, especially by hard-to-reach or marginalized communities. This approach also plays a key role in limiting the spread of misinformation.

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In addition, the literature review suggested that sustained trust in the government and other public entities increased compliance (93,94). For instance, research conducted within WP1 highlighted that in many contexts, trusted local actors – such as parish staff in Hamburg – played crucial roles during past crises, being already recognized as trustworthy by their communities. However, they often operated independently of formal authorities due to a lack of established links or official recognition. However, to make communication more effective and co-develop information strategies, formal collaboration protocols should be established between organizations identified at the local level and local authorities. This aligns also with WHO guidelines which identify community engagement as a core component of risk communication and recommends its activation within 24 to 72 hours of an emergency (90,95).

Target audience

Local health, regional and national authorities, crisis communication units, crisis response coordinator, civil protection

Implementation ties: Immediate to Short-Term - High Priority

This recommendation is a prerequisite for PR8 and PR10; it should be initiated in the preparedness phase and maintained with ongoing relationship building. It is essential to promote trust-building and effective communication with vulnerable groups, and it is also dependent on the implementation of PR1, and PR6.

PR8: Audience-centered messages and delivery

Identify and use a variety of communication channels to effectively reach diverse audiences with different preferences (e.g., channels, formats) and information needs. Map the local

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communication landscape to identify the most appropriate channels for different population groups. Develop customized message formats (e.g., posters, short videos) that are suited to these specific audiences. Additionally, establish partnerships with local media outlets to broaden message dissemination, and leverage digital media, including through the potential involvement of trusted influencers, to enhance visibility and engagement.

Lessons learned

Interviews conducted under *Subtask 1.3.2* have shown that different audiences build trust through different communication channels, as each group shows different types of (mis)trust in media, and has also been related to specific beliefs and levels of compliance. Using multiple communication channels can ensure a broader and more equitable reach. However, in some contexts, such as Romania, the use of informal tools, such as a WhatsApp group managed by the Ministry of Health to communicate with the media, proved ineffective and exclusionary. Therefore, preparedness strategies should reinforce the mapping of local communication channels and the establishment of clear standards for collaboration, particularly between local authorities and media outlets, including local media.

Target audience

Local health, regional and national authorities, crisis communication units, crisis response coordinator, civil protection

Implementation ties: immediate to short-term implementation- High priority

This should be activated in the preparedness phase as it ensures broad, inclusive, and effective communication during a crisis. This recommendation depends on the implementation of PR1 and PR7.

PR9: Positive and transparent communication

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Design communication strategies that combine transparency with positive and empathetic framing by developing message templates and communication guidelines that emphasize positive and collective action. Communication strategies should also avoid excessive or overwhelming messaging (e.g., "media bombing") that may lead to public fatigue or anxiety. Engage psychologists, mental health professionals, and community leaders in advance to ensure messaging is emotionally sensitive and grounded in trust.

Lessons learned

Evidence from the interviews conducted under *Subtask 1.3.1* revealed that communication strategies centered on fear, blame, and individual responsibility, often framed in punitive or guilt-inducing terms, contributed to heightened anxiety and emotional distress among the public. Findings from our interviews are also supported by the literature (96,97). In contrast, avoidance of fear-based tones and transparency about the real situation can improve trust and compliance. However, as it emerged from the FGD (*Subtask 1.2.3*), in some contexts, such as Romania, transparent and empathetic messaging were described as effective due to cultural preferences for authority or fear-based communication, which is often associated with credibility and respect. Compounding this, politicians prioritizing visibility over accuracy undermine public trust and the clarity of health messaging. Therefore, transparency should be balanced with messaging styles that resonate locally.

Target audience

Local health, regional and national authorities, crisis communication units, crisis response coordinator, civil protection

Implementation ties: immediate to short-term implementation- High priority

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This should be activated in the preparedness phase and refined over time. It depends on the implementation of PR1, and PR6.

PR10: Multilingual and multicultural communication

Identify the most commonly spoken languages and cultural groups within the local population and establish partnerships with CBOs to support culturally relevant message development and dissemination, as well as ensuring co-development of communications protocols and templates.

Lessons learned

According to most of the interviews conducted within WP1 and to WHO guidelines for Emergency Risk Communication Policy and Practice (90), culturally sensitive and multilingual communication can improve trust, comprehension, and reduce misinformation and non-compliance. In addition, effective communication does not imply only simple translation, but also cultural adaptation to ensure relevance and clarity within different communities.

The example of multilingual outreach in Romania that emerged from the FGD (*Subtask 1.2.3*) was highly effective when led by trusted individuals within cultural and minority groups. This highlights the importance of identifying and activating trusted messengers in the preparedness phase and establishing partnerships with CBOs that already have the trust of those they serve. In addition, this communication strategy supports health literacy, as, while it is delivered through communication systems, the goal is to improve people's ability to understand and act on health information - a key aspect of health literacy - by trying to remove systemic barriers such as language and cultural barriers.

Target audience

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Local health, regional and national authorities, crisis communication units, emergency response coordinator, civil protection

Implementation ties: immediate to short-term implementation- High priority

This should be activated in the preparedness phase to ensure that crisis communication is equitable, inclusive, and trusted across diverse population groups. This recommendation depends on PR1, PR6, and PR7.

Preliminary recommendations - Theme: Health literacy

PR11: Use of visual aids

Develop and pre-test culturally appropriate visual aids (e.g., illustrated instructions, infographics) as part of emergency preparedness materials, ensuring they are accessible to individuals with low literacy or limited language proficiency.

Lessons learned

It is well known that visual aids are a viable option for improving comprehension of health information, especially for vulnerable populations with low health literacy as well as language or cognitive barriers. Visual aids could be considered excellent tools to bridge the gap between communication and comprehension. Interviews conducted under *Subtask 1.3.2* with members of the Red Cross in all three pilot sites highlighted how their brand image generated trust among the public, and how posters and graphics were used to effectively communicate in public spaces. These findings align with research showing that infographics are especially successful in simplifying data and generating engagement, when compared to other types of social media posts (98).

Target audience

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Local health, regional and national authorities, crisis communication units, emergency response coordinator, civil protection

Implementation ties: immediate to short-term implementation - High priority

This recommendation is a prerequisite for PR10, PR12 and PR13, as it ensures that critical information reaches everyone, including low-literacy people and non-native speakers.

PR12: Simple and people-centered language

Integrate the "universal precautions" approach into health communication planning by assuming that all people have limited health literacy. Develop protocols for communication that envision using plain language and simple structures to ensure that messages are understandable to all.

Lessons learned

An inclusive approach to the design of communication messages ensures that everyone, regardless of their level of education, language proficiency, and background can understand and act according to the emergency health measures, increasing compliance to health measures, and reducing confusion and misinformation.

Supporting this, the findings of the survey conducted by UG (*Subtask 1.1.2*) demonstrated that up to half of participants in the three pilot sites (i.e., Hamburg, Piedmont region, and Romania) faced limitations in health literacy, underscoring the urgent need for communication strategies that are accessible and easy to understand.

When it comes to information sharing, it is also important to not overload the general population with information, especially of a technical nature. As emerged from the interviews conducted under *Subtask 1.2.2*, overloading the public with information can confuse them and reduce trust. During the preparedness phase, it is essential to establish

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communication protocols to preselect and prioritize essential information for public dissemination, especially for people with low literacy.

Target audience

Local health, regional and national authorities, crisis communication units, emergency response coordinator, civil protection

Implementation ties: immediate to short-term implementation- High priority

This recommendation is a prerequisite for PR13 and PR15, as clarity and audience-centered communication is essential, and it is part of the protocols in which emergency responders must be trained.

PR13: Support for low-literacy population

Identify communities or population groups with high prevalence of low health literacy using indicators such as education level, language barriers, or past service access difficulties, and establish partnerships with local CSOs or religious institutions to develop targeted outreach strategies. Establish collaboration between public authorities and community actors and train local community actors, healthcare workers, or volunteers to assist individuals in understanding medical information, and completing health-related forms.

Lessons learned

Overall, the survey results (*Subtask 1.1.2*) demonstrated that up to half of participants in the three pilot sites had difficulties in reading health documents, required assistance, and showed reduced confidence when in need of completing health records and medical documentation.

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In contexts such as Romania, as it emerged from the FGD (S*ubtask 1.2.3*), low systemic health literacy limits the public's ability to understand and act on preparedness guidance. Meanwhile, in Hamburg, government reluctance to collaborate with civil society due to the decision to have more "centralized" and "controlled" messaging undermined the potential of trusted community actors to support outreach.

By identifying at-risk populations during the preparedness phase and providing training to community health care workers, targeted support could be provided during the response phase, increasing trust and decreasing the risk of excluding individuals from participating in emergency measures and services. Therefore, governments should invest in health literacy of the population by establishing education campaigns in the preparedness phase, together with collaboration protocols with CSOs that could act as a support during the response phase.

Target audience

Local health, regional and national authorities, crisis communication units, emergency response coordinator, civil protection

Implementation ties: immediate to short-term implementation- High priority

This recommendation is dependent on PR11, PR12, and support for PR15. Visual aids (PR11) and simple language (PR12) are prerequisites for the support of low literacy populations, and emergency responders must be trained in this (PR15).

PR14: Digital health literacy and equitable access to technology

Promote digital literacy (also called 'digital alphabetization') among patients and their caregivers through training programs focused on basic digital skills, including how to use

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video call platforms, and how to search for online information (e.g. regulations). Ensure equitable access to digital tools by providing or subsidizing devices (e.g., tablets, smartphones) and internet connectivity, especially for vulnerable populations (e.g., elderly, rural communities).

Lessons learned

Findings from WP1 showed that people with strong digital health literacy skills can find, evaluate, and understand health information online, reducing misinformation and confusion (99). Navigating digital health tools is essential, as a lot of health services now rely on apps, portals, or online systems for appointments, medication refills, or remote consultations. Without digital skills, people may miss care or misinterpret guidance. In addition to enabling access to care, the use of online platforms can create virtual support networks, peer groups, and encourage regular check-ins to promote social connection and mental well-being during isolation or crises.

A key lesson learned is that bridging the digital divide must be a priority in the preparation phase. This includes investing in subsidized digital devices and offering targeted digital literacy training to ensure that all segments of the population can benefit from digital health tools and remain informed and connected during emergencies.

Target audience

Local health, regional and national authorities, crisis communication units, emergency response coordinator, civil protection

Implementation ties: immediate to short-term implementation - Medium to high priority

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This recommendation is dependent on the context, in some context digital literacy might be more needed than in others, depending on whether telehealth is a major mode of delivery care or if communication is done through digital means, hence the medium to high priority. This is also a prerequisite for PR18.

PR15: Training for emergency responders

Include training emergency responders such as health care staff and public communicators on health literacy principles such as the use of plain language, visual communication and inclusive design into their curricula. Involve community leaders in the co-design phase of health literacy principles for communication to make them more contextually based.

Lessons learned

Many professionals are unaware of the barriers to health literacy and how they impact understanding and compliance. Embedding health literacy in their educational paths can provide consistency and clarity when translating health measures into a plainer language. This aligns with WHO recommendations (100), as health literacy is essential for health promotion and for reducing health inequalities. Therefore, incorporating training in health literacy into the curricula of emergency responders and healthcare professionals ensures that those responsible for delivering health information are equipped with skills to make the delivery of information more inclusive and clearer.

However, as it emerged from the FGD (*Subtask 1.2.3*), in some context, such as in Romania, there is resistance at institutional level against having any type of health literacy educational initiative (e.g., sex ed and other health literacy). This highlights the importance of framing health literacy not as a political or ideological issue, but as a core competency for improving crisis preparedness and equitable access to care.

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Target audience

Local health, regional and national authorities, crisis communication units, emergency response coordinator, civil protection

Implementation ties: immediate to short-term implementation - High priority

Training frontline communicators and responders is a critical priority in both routine and emergency health contexts; however, this must be implemented during the preparedness phase. This recommendation is dependent on PR12 and PR13, as the training content should focus on the use of simple, people-centered language and strategies to support low-literacy populations, in collaboration with civil society organizations and religious leaders.

Preliminary recommendations for crisis preparedness - Theme: Healthcare Governance

PR16: Adaptive Healthcare Capacity & Services Repurposing

Establish and maintain a flexible system for scaling healthcare capacity by pre-identifying and building an inventory of convertible spaces (e.g., recovery rooms, outpatient units) at the national, regional, and local levels despite infrastructure limitations, maintaining a catalogue of critical resources (e.g., ventilators, oxygen supply), contextually defining standard operating capacity and setting clear surge thresholds (e.g., nurse-to-patient ratios, ICU bed occupancy, availability of trained staff) and developing a flexible surge response plan adaptable to the crisis type (e.g., pandemic vs. civil epidemic). Develop a national inventory of potential surge spaces and critical care assets across regions.

Lessons learned

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According to the findings of the literature review conducted within *Subtask 1.2.1*, during the COVID-19 pandemic, high patient volumes, limited supplies, and constrained space demanded adaptive strategies to optimize critical care capacity. Health systems responded with resource reallocation (101) and spatial reorganization (15,102), often employing creative solutions (89) to overcome acute shortages. For instance, neonatal and portable ventilators were designated for pediatric patients, preserving standard ventilators for adult use (15). Several pediatric intensive care units restructured their layouts to manage both pediatric and adult patients within the same space, while others shifted entirely to adult care (15,102).

However, as emerged from the FGD (*Subtask 1.2.3*), in some cases, aging hospital buildings and unconvertible spaces might limit effective surge response. Therefore, in the preparedness phase, it is essential to assess the physical infrastructures to check for physical spaces which could accommodate surges. This highlights the necessity of flexible, context-driven approaches to managing surges during large-scale public health emergencies, as also emphasized by reports from the WHO (103,104) and the ECDC (105).

Target audience

Ministry of health, local, regional and national authorities, and hospital management

Implementation ties: immediate to short-term implementation - High priority

This is a very high priority recommendation, as it constitutes the backbone of every emergency, and this should be already planned in the preparedness phase. It is dependent on PR1, hence a clear coordination mechanism, and it is the prerequisite for PR17, PR18, PR21, PR24 and PR25.

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PR17: Infection control through spatial separation

Identify and designate clean and contaminated zones in all relevant clinical and non-clinical areas in advance. Develop detailed layout plans tailored to specific transmission routes of pathogens (e.g., for airborne diseases this means dedicated negative pressure rooms and advanced air filtration; for bloodborne pathogens, rigorous sharps handling and immediate disinfection are key; for oro-fecal infections stringent hand hygiene protocols and thorough environmental cleaning are essential) that allow for physical separation of patients based on infection risk levels and distinct transmission routes. Develop plans and adapt them to the specific transmission routes for the potential set up of infrastructures for donning and doffing stations at key transition points, and map infection control workflows to repurpose shared areas that minimize staff cross-traffic between contaminated and non-contaminated areas.

Lessons learned

The ECDC (72,74,82) emphasized that the separation of suspected patient cases by infection risk level into distinct zones, supported by dedicated Personal Protective Equipements (PPE) stations, was pivotal in preventing nosocomial transmission during outbreaks. Real-world experiences during the COVID-19 pandemic further reinforce the urgency of these infections spatial control measures. For instance, as it emerged from the literature review conducted within *Subtask 1.2.1*, in Türkiye and Italy, the inadequate separation of patients with different risk profiles significantly contributed to operational confusion and transmission risks in EDs (87). Moreover, many facilities struggled with unclear boundaries between clean and contaminated areas, undermining both patient and staff safety (87). As a result, many healthcare systems are now institutionalizing spatial separation, donning and doffing infrastructures, and workflow zoning as integral components of facility preparedness and surge response planning. However, as emerged

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from the FGD (*Subtask 1.2.3*), infrastructure constraints can limit the capacity for spatial separation. Therefore, identifying in advance the limitations and opportunities for space adaptation together with a detailed implementation roadmap, outlining the specific roles and action for the actuation of the spatial separation, is essential.

Target audience

Ministry of Health, Local, regional and national authorities, and hospital management

Implementation ties: immediate to short-term implementation - High priority

This preliminary recommendation is of extremely high priority when health emergencies are caused by infectious agents, in order to prevent health-facility based transmission. It is dependent on PR1 and PR16 to guarantee the proper use of surge spaces.

PR18: Continuity of care

Develop and implement clear standards and protocols to ensure the continuity of essential health services during a crisis, focusing on preventive care and chronic disease management. Support primary care teams by embedding the use of telemedicine, training staff in digital health tools (e.g., teleconsultations and digital prescriptions), and preparing systems for remote service delivery – particularly in underserved areas – to support chronically ill patients at high risk of infection and to alleviate hospital burden.

Lesson learned

Disruption of non-COVID care revealed the importance of safeguarding chronic and preventive care, and technological tools were efficient for ensuring the continuity of care (107). Therefore, telemedicine is a viable tool to support the continuity of care, especially when used in primary care to shift away burden from hospitals. However, according to what

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has emerged from the FGD (*Subtask 1.2.3*), some vulnerable groups, such as the elderly, might face some digital barriers. Therefore, by incorporating telemedicine into preparedness plans to decentralize care, it is essential to consider also more accessible alternatives, like phone-based consultations or home visits, when possible, to overcome potential digital barriers.

Target audience

Ministry of health, local, regional and national authorities, and hospital management

Implementation ties: immediate to short-term implementation - High priority

Ensuring the continuity of essential services is a high priority. However, the effective use of digital health solutions depends on the population's level of digital health literacy. Therefore, PR14 (promoting digital health literacy) is a prerequisite for the successful implementation of this recommendation. Additionally, this recommendation serves as a prerequisite for PR19, as maintaining service continuity directly contributes to the overall quality of care.

PR19: Quality of care

Establish and maintain a robust digital communication system that enables real-time, secure interaction between patients, families, and healthcare staff during a health crisis. Ensure that hospital-issued devices, such as tablets and portable phones, are available across all departments, particularly in critical care areas, end of life care, and isolation rooms under visitation restrictions. Develop hospital policies for scheduling and documenting remote communications to ensure regular and meaningful virtual access between patients and their families, and families with care teams.

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Lessons learned

Maintaining communication between patients and their families during a health crisis is essential for preserving patient dignity, supporting staff morale, and sustaining trust. During emergencies such as the COVID-19 pandemic, strict infection control protocols often limit or eliminate in-person visits, isolating patients and placing a heavy emotional burden on both families and healthcare providers. Literature review findings (*Subtask 1.2.1*) revealed that health staff expressed concern that patient isolation could hinder care (20), particularly in critical care and end-of-life scenarios. To address this, establishing meaningful and effective virtual interactions—especially for those in high-risk or isolation settings—was consistently identified as a best practice (87,89,102). Structured digital communication platforms not only ensured patients could stay connected with loved ones, but also helped reduce staff stress by facilitating transparent, compassionate care delivery under restricted conditions. While maintaining communication among families, patients, and staff is crucial, the FGD (*Subtask 1.2.3*) highlighted that without clear organization and protocols this can add extra pressure to already burdened staff. Therefore, in the preparedness phase, it is essential to establish a structured communication system, with hospital-issued tablets, portable phones, and clear scheduling protocols.

Target audience

Ministry of health, Local, regional and national authorities, and hospital management

Implementation ties: short-term to medium-term implementation - Medium to High priority

Depending on the type of crisis the priority is medium to high. For instance, when visitation restrictions are required because of an infectious disease outbreak, it is more of a priority

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over situations where physical access is not restricted. It is also dependent on the continuity of care (PR19).

PR20: Clear protocols for health staff organization and working conditions

Establish clear and flexible staffing protocol frameworks for emergencies that outline role assignments, shift rotations, breaks, and on-call duties. Rather than fixed schedules, these adaptable frameworks can be quickly adjusted to the crisis's scale, nature, and duration, with clear communication ensuring real-time updates and staff coordination. This approach speeds up response, reduces confusion, and minimizes staff fatigue. When possible, establish policies that envision extra financial compensation and social welfare support (e.g., childcare or elderly care) for staff to prevent frontline workers from being burnt out due to increased work.

Lessons learned

As emerged from the interviews (*Subtask 1.2.2*), a lack of structure and disorganized working conditions were key contributors to emotional distress and burnout among health workers during the COVID-19 pandemic. Clearly defined roles and predictable schedules provide staff with a sense of direction and control, reduce uncertainty, and support psychological safety, as stressed by several scholars (108,109). In addition, the findings from the interviews emphasize the importance of structured staffing systems to maintain both operational efficiency and staff well-being during health emergencies.

Target audience

National and regional health authorities, emergency response coordination bodies, Ministry of Health

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Implementation ties: short-term to medium-term implementation - High priority

In any crisis situation efficient and flexible staff mobilization is of high priority, and it is dependent on a clear coordination structure (PR1). At the same time, clear protocols are a prerequisite for staff availability and redeployment (PR21), and staff psychological support (PR22).

PR21: Staff availability and redeployment

Clearly define the essential competencies required for surge response roles, such as providing critical care, managing ventilators or triaging patients, and maintaining a dynamic competence-based pool of certified staff personnel across departments. Provide regular simulation-based training to assess adaptability and readiness for new role transitions. Designate emergency preparedness officers to oversee readiness efforts. Create a registry of specialized personnel which could train staff during emergencies.

Lessons Learned

Certain hospital departments and regions were disproportionately affected by the pandemic. Therefore, redeploying staff both within hospitals and among different hospitals may be an effective strategy, as underscored by WHO and other scholars (110,111). However, the COVID-19 crisis also highlighted that redeployment, that is the reassignment of staff alone, is not sufficient. As discussed in the FGD (*Subtask 1.2.3*), ensuring the effectiveness of redeployment necessitates the presence of experienced personnel, such as ICU nurses, to guide and supervise less experienced redeployed staff. This approach helps maintain the quality of care while also reinforcing the confidence and capability of the broader healthcare team.

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Target audience

Hospital management, institutional leadership

Implementation ties: short-term to medium-term implementation - High priority

Effective surge staffing is of high priority, and it is dependent upon clear coordination structures and staff availability (PR1 & PR21).

PR22: Staff psychological support

Institutionalize staff mental health support systems by establishing peer support networks (e.g. designate a coordinator or mental health leader to supervise peer supporters), ensuring access to mental health professionals, and integrating stress reduction programs into routine healthcare delivery.

Lessons Learned

The COVID-19 pandemic highlighted the urgent need for structured psychological support for healthcare workers. Many findings from the literature review (*Subtask 1.2.1*) highlighted that lack of emotional support, compounded by unclear working conditions, was a major cause of burnout and team breakdown. Evidence consistently shows that effective mental health support, especially when peer-based, easily accessible, and non-stigmatizing, strengthens team trust, cohesion, and resilience (14,89,112).

This aligns closely with the WHO *Guidelines on mental health at work* (113), which emphasize the need for institutionalized support systems, focusing on the importance of preventative strategies, early access to care and leadership involvement in safeguarding worker well-being (114).

Target audience

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Hospital management, institutional leadership

Implementation ties: short-term to medium-term implementation - Medium to High priority

Staff psychological support is essential to be guaranteed during the emergency phase; however, it should be institutionalized in the preparedness phase. It is dependent on the context and crisis-type, hence the medium to high priority. In addition, it is dependent upon clear coordination structures, clear protocols for health staff organization, and staff training (PR1, PR20, PR23).

PR23: Staff training

Introduce mandatory integrated training on emergency preparedness and ethical decision-making for all clinical staff, embedded within the core curriculum of clinical education and ongoing organizational training programs. Establish simulation-based and scenario-driven exercises to strengthen both individual and team-level preparedness.

Lessons learned

As highlighted in the interviews (*Subtask 1.2.2*), the uncertainty caused by the COVID-19 pandemic in terms of continuously changing knowledge about transmission, safety measures, and policies led to staff being unsure on how to manage patients and how to protect themselves from transmission. This showed the importance of continuous training of health staff on evolving evidence or new treatments available, as well as adaptation of treatments due to lack of available resources. In addition, ethical training is essential to prepare healthcare professionals, and particularly nurse and clinical managers, to address complex dilemmas such as resource allocation, prioritization of care, end-of-life decisions,

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and consent in crisis conditions, thereby supporting morally sound and context-sensitive decision-making frameworks.

Target audience

Ministry of health, local, regional and national authorities, and hospital management

Implementation ties: short-term to medium-term implementation - High priority

Staff training is essential to build capacity over time based on the evolving evidence-base about the health crisis. However, staff training protocols, especially about ethical dilemmas are of high priority and should be envisioned in the preparedness phase, as part of the educational curriculum of health professionals. In addition, it is dependent upon PR1, and it is a prerequisite for PR22, as it contributes to health care staff wellbeing and prevention of burnout and stress during emergencies.

PR24: Availability of resources

Develop national and regional stockpile policies with clearly defined minimum thresholds for critical supplies (e.g., PPE, oxygen, essential medications, ventilators, and diagnostic tests). Establish a multi-level supply governance system that links hospitals, regional authorities, and national agencies to ensure coordinated stockpiling and distribution of essential items.

Additionally, identify and prepare robust alternative supply chains to ensure quality equipment and to avoid reliance on a single country or supplier, as overdependence poses a significant risk to supply security during a crisis.

Lessons learned

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Lack of stockpiling led to resource scarcity during the COVID-19 pandemic (115). In response, the Special Committee on the COVID-19 pandemic of the European Parliament suggests better coordination to enable timely stockpiling and calls the Member States to establish a clear sustainable stockpiling strategy, aimed at building complementary EU and national medical reserves for pandemic preparedness and response, while avoiding waste of resources (115). However, insights from the FGD (*Subtask 1.2.3*) highlighted that political will could be a potential challenge when it comes to stockpiling policies. Therefore, ensuring long-term readiness requires not only sustained political commitment, but also strong interagency coordination to uphold the quality and reliability of medical stockpiles.

Target audience

Ministry of health, Local, regional and national authorities, and hospital management

Implementation ties: short-term to medium-term implementation - High priority

Securing the availability of resources is essential during a crisis and of high priority and it requires sustained fundings and coordination to support the stockpiling; hence, it is dependent on PR1, and PR26, while a prerequisite for PR25, for the effective distribution of supplies.

PR25: Distribution of supplies

Develop a targeted distribution strategy that identifies which departments (e.g., ICU, ED, isolation wards) should be prioritized for critical supplies (e.g., PPE, oxygen, medications). Create distribution maps and logistics protocols for supplies and equipment within the facility and across regional networks.

Coordinate distribution efforts with regional health authorities to prevent duplication or gaps in supply allocation.

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Lesson learned

Limited resources must be distributed strategically, as the global dependence on specific geographic regions for supply procurement led to significant challenges during the COVID-19 pandemic. In the absence of clear distribution strategies and coordinated approaches with regional health authorities, duplication, bottlenecks, and supply gaps can occur, even when stockpiles are sufficient. Therefore, during the preparedness phase, it is essential to establish clear distribution protocols and ensure effective coordination within regional health systems. In parallel, the Special Committee on the COVID-19 pandemic of the European Parliament recommends focusing on developing and enhancing local production capacities to strengthen existing infrastructure and existing capacities (115).

Target audience

Ministry of health, Local, regional and national authorities, and hospital management

Implementation ties: short-term to medium-term implementation - High priority

For the strategic distribution of supplies, resources availability and procurement are essential, hence it is dependent on PR25, and PR26 and a clear coordination mechanism, (PR1). Protocols for their effective distribution should be established before the crisis onset, in the preparedness phase.

PR26: Resource procurement

Establish clear, legally compliant procurement, that is the acquirement of goods, and tender procedures in advance, including pre-approved supplier lists, emergency contracting mechanisms, and transparent evaluation criteria to enable rapid purchasing during a crisis.

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Clearly specify the type of materials that may be needed during a crisis (e.g., ventilators, vaccines) to facilitate rapid and effective purchasing.

Lesson learned

As highlighted in some of the interviews (*Subtask 1.2.2*) the COVID-19 pandemic exposed challenges such as contracts not fully complying with procurement laws, delayed publication of emergency awards, and over-reliance on single suppliers causing bottlenecks. Addressing these issues through legal measures is vital to strengthening procurement resilience during health emergencies (116,117). This includes using emergency tools pre-authorized in the preparedness phase, engaging multiple suppliers to diversify supply chains, and centralized coordination among authorities to help streamline procurement and avoid competition.

However, as emerged from the FGD (*Subtask 1.2.3*), resilience is not only connected with legal and structural preparedness; it also requires operational specificity. Broad or overly ambitious procurement plans fail to account for the different legal, logistical, and technical requirements associated with various materials, such as ventilators, PPE, vaccines, or medications. Therefore, effective preparedness should envision the creation of item-specific procurement protocols, outlining distinct processes for categories such as medical devices, pharmaceuticals, and consumables.

Target audience

Ministry of health, Local, regional and national authorities, and hospital management

Implementation ties: short-term to medium-term implementation - High priority

The effective distribution and availability of resources is a high priority and is directly linked to their

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procurement and to procurement structures that should be put in place in the preparedness phase. Hence, this is prerequisite for PR24 e PR25, but it is dependent on a clear coordination structure (PR1).

Conclusion

The COVID-19 pandemic demonstrated that health systems and societies worldwide were unprepared for such a large-scale emergency. Therefore, the post-pandemic period provides a crucial opportunity to reflect on lessons learned and to identify areas for improvement. PREPSHIELD, particularly through WP1, aimed to conduct an in-depth analysis of the challenges faced by different segments of society – especially vulnerable and non-compliant groups – along with their needs and expectations, to enhance preparedness and management for future health crises.

This Deliverable presents 26 preliminary recommendations on crisis preparedness, based on insights gained from one year of WP1 activities. These included three literature reviews, one survey, three qualitative studies involving interviews, and one focus group discussion, as well as consultations with the Consortium Advisory Board. The resulting recommendations are grouped and presented into four key areas: crisis management, healthcare governance, risk communication, and health literacy.

To ensure these recommendations are both feasible and relevant, they will be tested in table-top exercises at three pilot sites, as well as in a communication pilot. The findings will

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then be further refined and validated through an online pilot in the same locations, ultimately contributing to the development of policy recommendations.

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