



European
Commission

THE ORGANISATION OF RESILIENT HEALTH AND SOCIAL CARE FOLLOWING THE COVID-19 PANDEMIC

Opinion of the
**Expert Panel on effective ways
of investing in Health (EXPH)**

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EXPERT PANEL ON EFFECTIVE WAYS OF INVESTING IN HEALTH

(EXPH)

Opinion on
the organisation of resilient health and social care
following the COVID-19 pandemic

The EXPH adopted this opinion at the 5th plenary on 25 November 2020
after public hearing on 20 October 2020

About the Expert Panel on effective ways of investing in health (EXPH)

Sound and timely scientific advice is an essential requirement for the Commission to pursue modern, responsive and sustainable health systems. To this end, the Commission has set up a multidisciplinary and independent Expert Panel that provides advice on effective ways of investing in health ([Commission Decision 2012/C 198/06](#)).

The core element of the Expert Panel's mission is to provide the Commission with sound and independent advice in the form of opinions in response to questions (mandates) submitted by the Commission on matters related to health care modernisation, responsiveness and sustainability. The advice does not bind the Commission.

The areas of competence of the Expert Panel include, and are not limited to, primary care, hospital care, pharmaceuticals, research and development, prevention and promotion, links with the social protection sector, cross-border issues, system financing, information systems and patient registers, health inequalities, etc.

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The opinions of the Expert Panel present the views of the independent scientists who are members of the Expert Panel. They do not necessarily reflect the views of the European Commission nor its services. The opinions are published by the European Union in their original language only.

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ABSTRACT

The COVID-19 pandemic has raised questions about the resilience of health systems across the globe. Many analyses of its impact and the responses adopted have already been published. The Panel received a mandate to look beyond the current crisis and consider how health systems can prepare better for future threats. Specifically, the mandate requested a new framework for the organisation of health and social care following the COVID-19 pandemic.

This Opinion (1) identifies the building blocks of resilient health and social care systems, (2) explores the elements and conditions for capacity building to strengthen health system resilience, (3) addresses healthcare provision for vulnerable patient groups and how to sustain such provision in a system under stress, and (4) sets out an approach to develop and implement “resilience tests” of Member State’s health systems.

The recommendations target a number of key areas, including: enhancing workforce training and resilience, reviewing research and development and procurement (especially for innovative medicines), identifying and reducing disinformation, fostering inter-professional and inter-sectoral collaboration with community health workers and informal care givers for example, integrating information and communication technologies across care levels and public health, strengthening primary and mental health care, increasing public health focus on psychological distress, debating methods for Member States to collect and share aggregate health data on ethnicity and socioeconomic status, developing and deploying online trainings for frontline health and social care professionals regarding care provision to vulnerable groups, and finally investing from the European Commission in the development and implementation of (a) comprehensive resilience testing of health systems that use qualitative and quantitative data collection methodologies to generate meaningful, actionable results for health system transformation, and (b) corresponding learning communities within and across Member States to share lessons learned through this process.

Keywords: care organisation, health care, social care, building blocks, capacity building, vulnerable groups, health systems resilience, resilience-testing, ‘SARS-CoV-2’, COVID-19

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EXECUTIVE SUMMARY

The COVID-19 pandemic has put national health systems in Europe and beyond under immense pressure. Health systems were largely unprepared for an outbreak of this magnitude. The crisis tested their resilience, in other words, their ability and capacity to absorb, effectively respond and adapt to shocks and structural changes while sustaining day-to-day operations.

Health system resilience has been on the policy agenda for many years and, already, numerous assessments of the responses of health systems in Europe to the COVID-19 pandemic have been published. However, there is a need to look beyond the current pandemic to think about how health systems can prepare better for future crises that threaten the ability to deliver health care. In response, the Expert Panel is requested to provide an opinion on the organisation of resilient health and social care following the COVID-19 pandemic.

We start this Opinion by reviewing the building blocks of a health system, then proposing a new framework to assess the different elements needed to ensure resilience of health systems. Based on these elements, we explore capacities needed for resilient health and social care delivery and the policies to sustain healthcare provision, especially for those who are most at risk in a crisis. Then, we address the concept of vulnerability, and identifying vulnerable groups in the population. Finally, we propose a methodology for undertaking a resilience test of healthcare systems.

We conclude with a series of recommendations regarding the use of European funds to support resilience testing implementation, including development of a manual and toolkit for resilience testing of health systems. A further three recommendations relate to specific issues, highlighting the need to strengthen action on corruption in the health sector, improve procurement during emergencies, and take advantage of the opportunities offered by cross-border collaboration. We also make recommendations regarding preparedness and response to COVID-19-like situations (be prepared and act quickly in order to avoid prolonged and costly containment and mitigation measures; ensure adequate surge capacity; invest in the health workforce; strengthen primary health care and mental health services; ensure close international cooperation). We identify a need for practical guidance on continuity of care, development of digital solutions for self- and home-care, and measures to reduce social and ethnic disparities. In addition, we stress the importance of disaggregated data by sex, age, ethnicity, and socioeconomic status, as well as on comorbidities and long-term care facility residence, as these are essential to take a comprehensive whole-of-society approach to health and social care. Finally, we recommend establishing mechanisms to share best practices in prevention of the spread of infections, in outbreak control, in support and care of

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marginalized groups, in provision of mental health and psychosocial support, and in training of staff working in health and social care settings, while supporting primary care services to reduce vulnerability in the community.

BACKGROUND

The current pandemic caused by coronavirus SARS-CoV-2 poses a threat to every country in the world. The argument for a concerted international response to microorganisms can be summarised as “germs do not respect national borders”. Early in the COVID-19 pandemic, on the 27th of March 2020, members of the EXPH argued in a blog in *BMJ Global Health*, for greater European solidarity and cooperation in the response to COVID-19 (De Maeseneer J, Barros P et al. 2020). Its impact, measured by numbers infected and dying, has varied enormously among and within countries. Some of this was luck. Those countries, such as Italy, that were among the first to receive infected individuals had little time to develop a comprehensive response (Boccia, Cascini et al. 2020). Yet others that saw their first cases sometime later also struggled to control the disease. In the second wave, many EU countries saw higher number of infections, beyond what they experienced in the first wave.

Even the most superficial inspection of the geographical distribution of infections worldwide identifies clusters of countries that have performed well and others that have performed poorly. Most obviously, countries and territories in East Asia, such as Hong Kong, Korea, Taiwan (Han, Chiou et al. 2020), and Vietnam, have done well (Legido-Quigley, Asgari et al. 2020). However, despite limited resources, some countries in Africa, such as Rwanda (Binagwaho 2020) and Liberia, have also managed to avoid the experience of countries that are much wealthier. Both of these groups of countries have one thing in common. They have recent experience of dealing with highly infectious disease outbreaks, in the former case SARS or MERS and the latter Ebola. Consequently, they had put in place a range of measures that meant that they could respond effectively to another serious threat from a novel infectious agent. As some commentators have noted, countries can be divided into those that based their response on a SARS paradigm, in which the goal is elimination of infection, and those that employed an influenza paradigm, based on an acceptance that the disease would ultimately spread through the population with relatively little that could be done. Many of the “SARS countries” had implemented wide-ranging changes to their health systems, including investment in disease surveillance and redesign of health facilities to reduce cross infection. It is now clear that the former have been much more successful than latter.

Some other countries have also been successful in controlling the pandemic. The small island states and the Pacific have an obvious advantage by virtue of their ability to control the relatively low volume of international travel. In some cases, such as Samoa (Thornton 2020), they share with countries in East Asia and Africa the recent experience of threats from infectious diseases, especially measles. In others, political scientists have

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drawn attention to the importance of political leaders who can inspire confidence and generate trust (Newton 2020).

Yet, even in some of the countries that have been most successful in responding to the pandemic, it is clear that there are aspects of vulnerability. While everyone is at risk of infection with the coronavirus, the probability of being infected and, if infection occurs, the consequences for health vary greatly. For example, in several countries, including Belgium, the Netherlands, Spain, Sweden, and the United Kingdom, those living in care homes have been at particular risk (Legido-Quigley, Mateos-García et al. 2020, Rajan, Comas-Herrera et al. 2020). In countries where it has been studied there is a marked social gradient, with poorer people more likely to be in public facing jobs, such as on public transport or as taxi drivers. Also, and in this case in the very few countries where data are available, it is clear that certain minority ethnic groups are especially vulnerable, and while the reasons are still only partially understood (Aldridge, Lewer et al. 2020, Platt and Warwick 2020), it is clear that structural racism plays an important role (Iacobucci 2020). These groups are also especially likely to experience what are termed super-spreading events (Adam, Wu et al. 2020), where they come together in large groups indoors, in some cases in circumstances that involve loud speech, activities now implicated in a growing number of outbreaks, such as those at meatpacking plants. These vulnerable groups are also at risk of spreading the disease widely, especially if they are in irregular employment. Thus, it is now clear that a major factor in the spread of COVID-19 infections among care homes in England was the widespread use of agency staff who might work in several different homes on consecutive days (Rajan, Comas-Herrera et al. 2020). Once infected, the probability of dying grows with increasing age. It is greater among those who are obese and, especially, those with type II diabetes. Consequently, some have argued that food policy has a role to play in strengthening resilience in the face of pandemics such as this.

These considerations point to a role for the health system in strengthening resilient societies in the face of continuing threats of pandemic disease.

The resilience of health systems in the spotlight

The COVID-19 pandemic has put national health systems in Europe and elsewhere under immense pressure. Health systems throughout the world demonstrated different levels of preparedness for an outbreak of this magnitude. The crisis tested their resilience, i.e. the ability and capacity of health systems to absorb, effectively respond and adapt to shocks and structural changes while sustaining day-to-day operations.

Health system resilience has been on the policy agenda for many years (Communication on effective, accessible and resilient health systems, COM(2014)215). Country-specific

recommendations on health systems resilience have been recently put forward to each Member State in the European Semester (Communication on 2020 European Semester: Country-specific recommendations, COM(2020)500). The 2019 *State of Health in the EU* country reports highlighted pre-existing concerns about resilience, and the forthcoming report¹ of the EU Expert Group on Health Systems Performance Assessment (HSPA) identifies tools and methods to assess this performance dimension. The impact of the COVID-19 pandemic on health systems resilience is also the subject of a Commission/OECD report, due by the end of 2020. This report is expected to provide recommendations based on lessons learnt from the crisis. On the 11th of November 2020 the Directorate-General for Research and Innovation, published an Independent Expert Report: “Improving pandemic preparedness and management: Lessons learned and ways forward”, prepared by a Group of Chief Scientific Advisors, the European Group on Ethics in Science and New Technologies and the Special advisor to President Ursula von der Leyen on the response to the coronavirus and COVID-19 (Independent Expert Report 2020).

Analyses (from OECD, WHO, and academic sources) have already been published on the impact of immediate crisis response measures. These included securing medical supply chains, ensuring the availability of health workers, mobilising additional financing, reorganising non-COVID-19 related health services, using digital solutions to monitor and manage COVID-19 cases as well as to provide medical services online (e.g. teleconsultations). The European Observatory COVID Response Monitor provides an extensive body of material on these responses (www.covid19healthsystem.org).

Notwithstanding this extensive literature, there is a need to look beyond the current pandemic and to stimulate a new way of thinking about healthcare organisation in order to better prepare for future crises and other challenges that may affect health care delivery.

Health systems in Member States have responded to rapidly increasing short-term demand for care in a variety of ways during the pandemic. Health system design, coping strategies and management decisions all influenced these dynamics. Even well organised, technologically advanced health systems with high levels of accessibility had difficulties in coping and, even where it seems that health systems have ultimately ‘coped’, this is rarely because of adequate capacity to absorb the surge in health care demand. It has largely been down to (a) confinement measures, which have had severe consequences for the economy, (b) postponement of other health services in order to accommodate COVID-19 patients, including elective procedures, screening, diagnostics tests, and

¹ The HSPA report will be published at https://ec.europa.eu/health/systems_performance_assessment/priority_areas_en

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especially concerning, cancer treatments, and (c) often superhuman efforts by health workers (Wahlster, Sharma et al. 2020).

Looking across health systems, we can see some common challenges related to care delivery and organisation:

- Primary care providers reportedly struggled to ensure continuity of care and found it difficult to switch swiftly to new methods of service delivery (e.g. telemedicine, tele-monitoring and other e-health solutions);
- Hospitals faced great strain due to insufficient capacity, unavailability of adequately trained health workers, and lack of experience in managing an unprecedented emergency;
- Social care facilities, unprepared for protecting residents and struggling to obtain support from authorities, recorded a surge in infections and mortality;
- Weak integration between primary care, outpatient specialist and hospital care and social care resulted in overburdened hospitals in some Member States, while many elderly homes became incubators in the spread of the pandemic;
- Some clinical activities, such as transplant and rehabilitation programmes, came almost to a standstill due to resource and logistical problems;
- Increased risk to patients with rare and complex diseases, not only affecting the access to their usual doctors or medicines but – in case of COVID-19 related complications – access to ICU provision;
- Underdeveloped crisis preparedness resulted in shortages and lack of coordination at national and at EU level, which took time to resolve (e.g. low availability of personal protective equipment, limited laboratory and testing capacity etc.).
- The pandemic and the confinement measures created a psychosocial burden for the population and, especially, the wellbeing of the health workforce.

While the scale and nature of the COVID-19 pandemic may be unprecedented, it is simply the latest manifestation of an unpredictable shock to the health system, with a huge spill over effect on economic, social and government activity. As the first pandemic of this magnitude in a globalised world, it highlighted the dependence of many facets of life on health care and its interconnectedness to other systems such as finance, industry, and trade.

If we are to ensure high quality, accessible healthcare in the European Union in the face of disruptions such as the COVID-19 pandemic, we must go beyond the immediate lessons learnt from the pandemic to look at how we can improve structures and processes in health systems in the longer term. We must use this opportunity to

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transform health systems so that they are stronger and less vulnerable to shocks in the future.

The design of healthcare systems varies significantly across EU Members States, which makes it a challenge to establish a single framework or specific recommendations for transforming them. However, there is an obvious need to develop a conceptual framework that can guide healthcare reform, with particular attention to the organisation of and connections among primary, outpatient specialist, and hospital care and social care. It will be important to reflect on the necessary elements and conditions for capacity-building both at national and EU levels.

This complex framework must encompass several areas, including financing and investment needs, coordination of care, crisis preparedness, health workforce planning, staff retention, working conditions, and mobility, patient safety, and clinical management (across the entire patient pathway). It is also important to determine how to gather, process, use, protect, and ensure the quality of health data and to determine the optimal roles of novel digital solutions such as telemedicine and tele-monitoring.

How can we evaluate the service delivery capacity of primary care, outpatient specialist and hospital care and social care providers and their interaction with public health services? How can primary care, outpatient specialist and hospital care and social care improve preparedness to tackle unpredictable emergencies and high-pressure scenarios? What are the structures, mechanisms and interrelationships for strengthening healthcare provision? What would resilience testing for health systems look like across the EU?

QUESTIONS FOR THE EXPERT PANEL

The Expert Panel is requested to provide a concise but meaningful document with analysis and recommendations on the following points:

- a) What are the building blocks to improve care organisation (structures, processes, resources, interrelationships), and what criteria should be used for a continuous evaluation of the appropriateness of service delivery capacity of primary care, outpatient specialist and hospital care and social care?
- b) What are the elements and conditions for capacity building in primary care, outpatient specialist and hospital care and social care that would strengthen their overall robustness to unpredictable events and capacity to ensure access to care and treatment continuity?
- c) How can healthcare provision be sustained for vulnerable patient groups with urgent needs for care/cure, like patients with rare conditions, cancer patients or patients

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on the transplant waiting list, frail elderly, disabled people, refugees, prison populations and others?

d) What would be the criteria to resilience-test health systems for unpredictable high-pressure scenarios, what methodologies and models can be used to carry out such resilience tests, and how can the results of these tests be translated into well-documented analytical approaches and practical guidelines?

1. OPINION

1.1. COVID-19 and the resilience of health systems

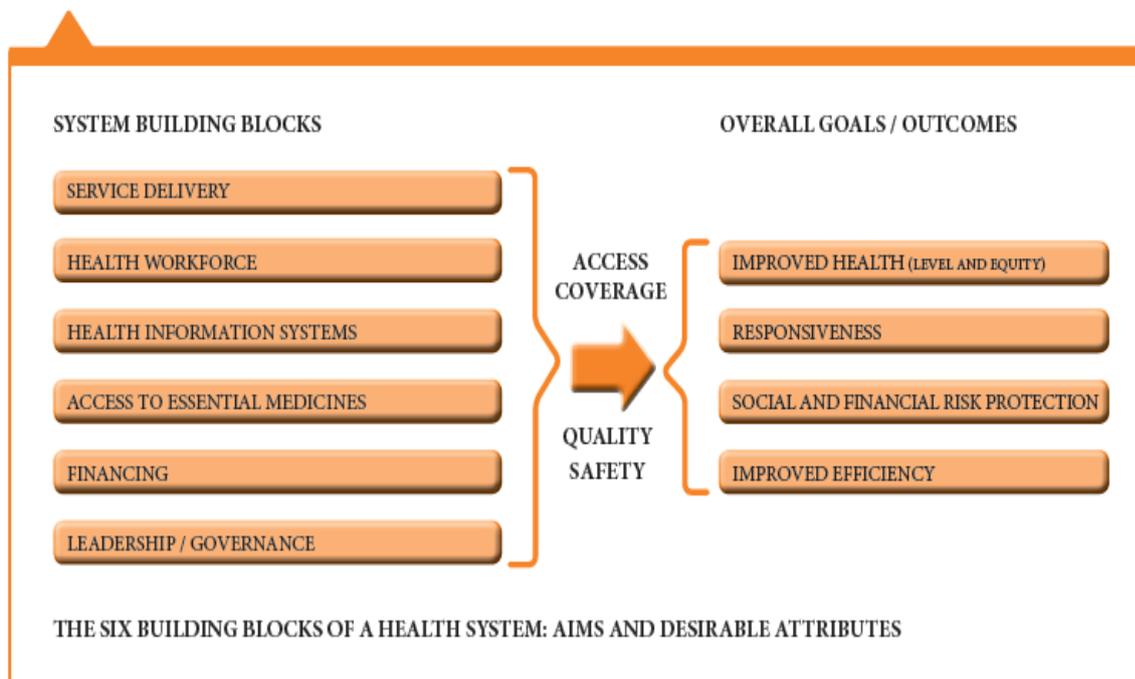
In this chapter we first explore the 'classical' building blocks of a health system and propose criteria to be used for evaluation of all aspects of service delivery.

1.1.1. Building blocks to improve the care organisation

In 2010, WHO presented the 6 core components or 'building blocks' that form the basis of a health system (WHO 2010):

- Health service delivery
- Health workforce
- Health information systems
- Access to essential medicines
- Health systems financing
- Leadership and governance

Figure 1 The WHO six building blocks of a health system



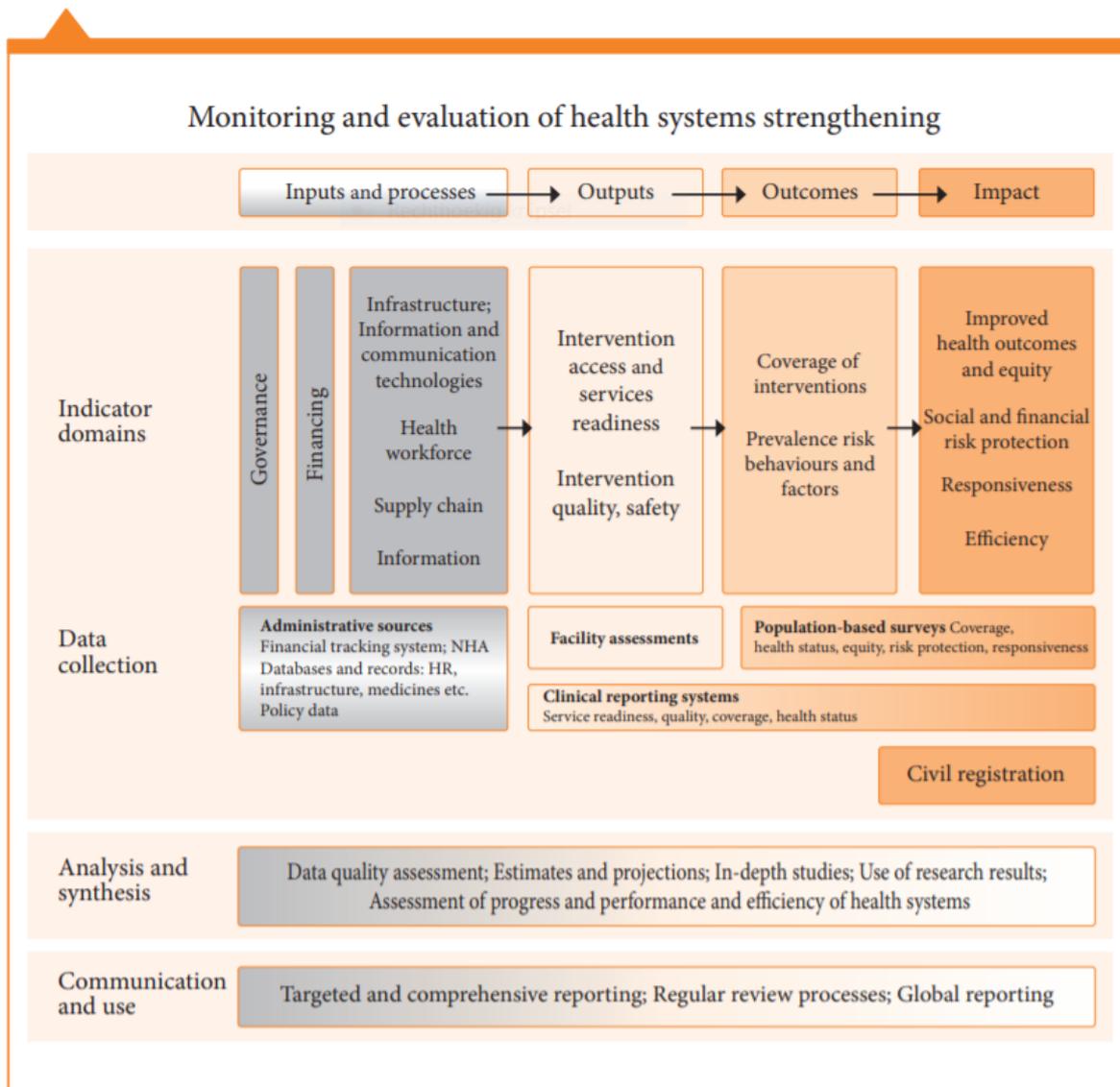
Source: WHO (2010)

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This framework also sets out the goals and outcomes of the system and the processes by which they can be achieved. Although it focuses on the health sector, it recognises that actions in other sectors contribute to health.

In 2009, a joint paper prepared by WHO, the World Bank, the Global Alliance on Vaccines Initiative (GAVI) and the Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM) described a monitoring and evaluation framework to assess strengthening of health systems, with special attention to data collection (Figure 2). This framework has the advantage of unpacking the building blocks of the framework into inputs, outputs and outcomes.

Figure 2 Monitoring and evaluation of health systems strengthening

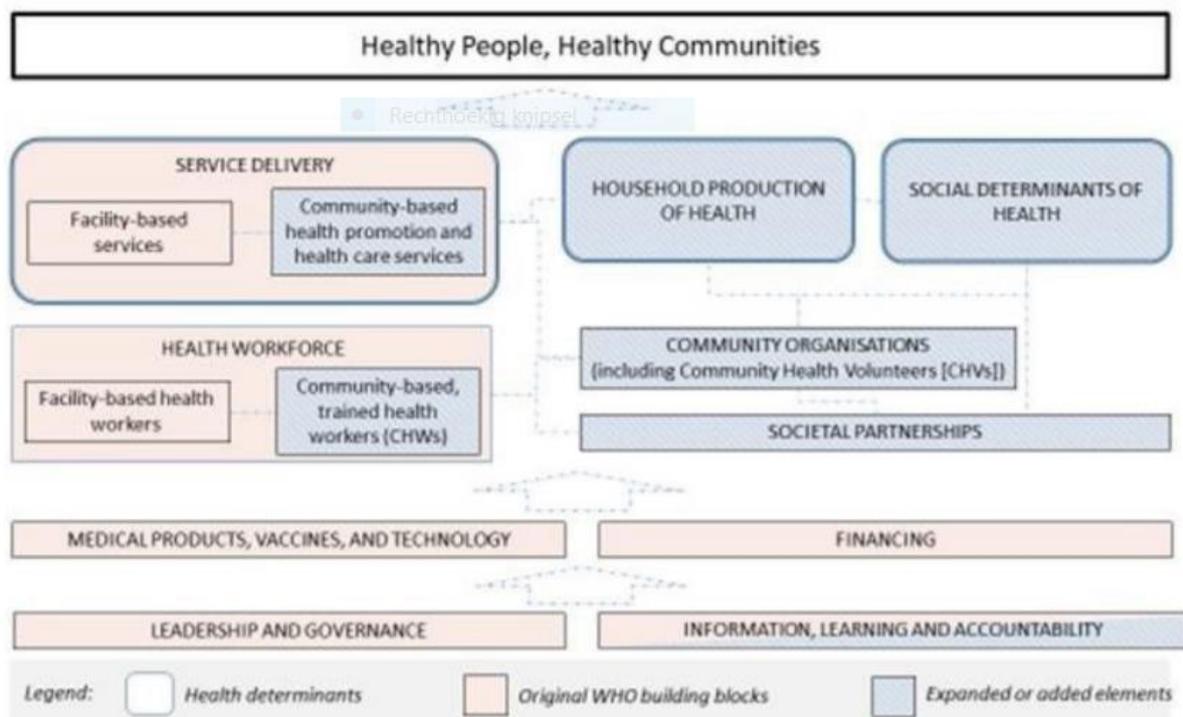


Source: WHO (2009)

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Recently, the static model of the 6 'building blocks' has been expanded by Sacks et al. (2018) to include community services (Figure 3). In their adapted model, they integrate innovations in service delivery (community-based health promotion and healthcare services), health workforce (community-based, trained health workers), emphasize the 'household production of health' and the 'social determinants of health', and the contribution made by community organisations and societal partnerships. This approach acknowledges the role of primary health care, defined as: 'an inclusive, community-led, multisectoral approach to promoting population health and preventing illness, as well as a means to provide curative and rehabilitative services' (WHO 2018). Moreover, the model stresses that households and communities are responsible for many aspects of health care, especially for new-borns and young children, from health education and illness prevention, to provision of treatment or referral to care. Policymakers should be encouraged by the framework to question explicitly the elements and relationships required to build viable and resilient health systems for the era of the Sustainable Development Goals.

Figure 3 'Beyond the building blocks' expanded framework for healthy people and communities

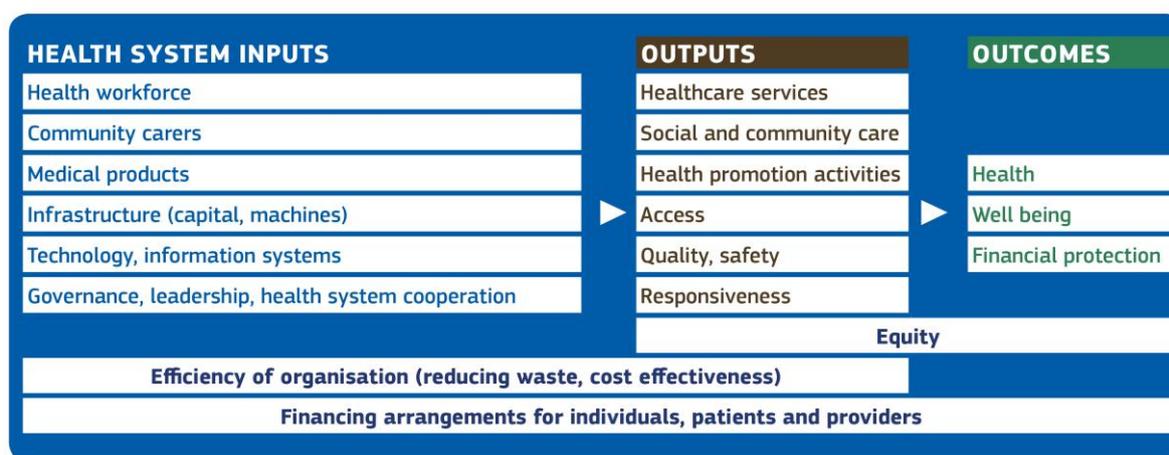


Source: Sacks et al., (2019)

1.1.2. A multidimensional conceptual framework

For the purposes of this Opinion, we build on and integrate some elements of the frameworks discussed in the previous section, and adopt the following one illustrated in Figure 4.

Figure 4 A multidimensional conceptual framework for health systems



Source: the authors.

We use an inputs-outputs-outcomes framework. The “inputs” include health workers and community carers. Workers have to be supported by adequate infrastructure (buildings, primary and secondary care facilities, equipment) and information systems. Governance and leadership help to ensure that everyone works towards a common goal, including cooperation across health systems.

Health and community workers deliver health services, social and community care, and health promotion activities, which we include amongst the “outputs”. Health services must be accessible, of high quality, and responsive to patient needs.

Health services contribute to the health and well-being of patients and individuals, and the rules governing the access to such services (e.g. the absence of co-payments) determine financial protection. Health, well-being and financial protection can be thought of as the final “outcomes” of the health system.

We also identify three additional elements of the framework that affect either inputs/outputs, outputs/outcomes, or inputs/outputs/outcomes. i) Equity is a ubiquitous health system objective, but inequalities persist both in the healthcare delivery (output) and in health or other outcomes. The sources of such inequalities can be traced to inequalities in some of the inputs, such as imbalances in health workers between rural and urban areas, but these impact patients only indirectly through delivery, access, and quality (the outputs). ii) Efficiency, through improved organisation and delivery of health

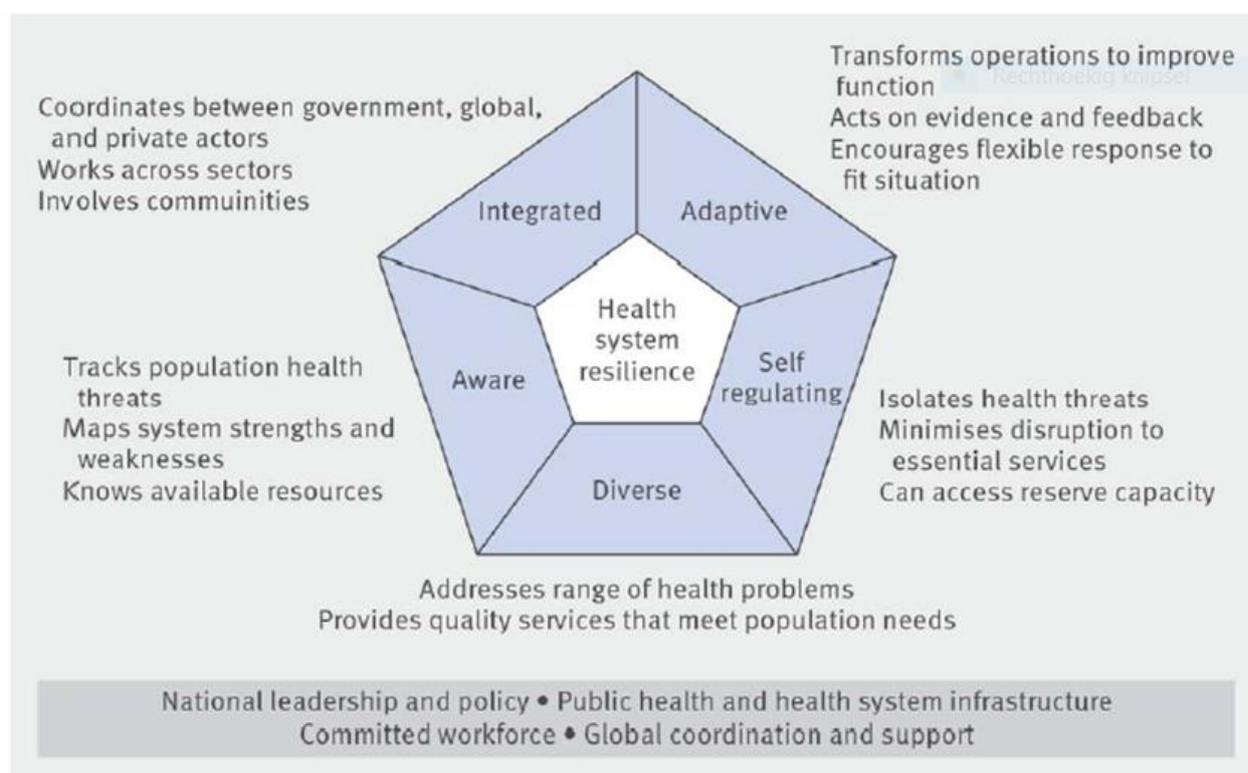
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and community services, can also improve outcomes through better access, quality and responsiveness. For examples, reducing waste can reduce healthcare spending without affecting health outcomes. Cost-effectiveness analysis can help to free up resources for a given budget, which can be reinvested in additional services that will improve health outcomes; or, it can improve the composition of services provided. iii) Financing arrangements affect both users and providers of health care. Existing and potential future patients contribute to the financing of the health system through taxes and social insurance contributions. The resources collected are redistributed to providers under a wide range of financial arrangements (capitation, activity-based funding, pay for performance, etc.).

1.1.3. Assessing the resilience of health systems

Kruk et al. defined health system resilience as “the capacity of health actors, institutions, and populations to prepare for and effectively respond to crises; maintain core functions when a crisis hits; and, informed by lessons learnt during the crisis, reorganize if conditions require it” (Kruk, Myers et al. 2015). As illustrated in Figure 5, resilient health systems are aware, integrated, diverse, self-regulating and adaptive.

Figure 5 Resilient health system framework



Source: Kruk et al., 2017

Resilience of health system addresses the absorptive capacity, the adaptive capacity and the transformative capacity (Kruk, Ling et al. 2017).

The *absorptive capacity* relates to the capacity of a health system to continue to deliver the same level (access, quality and equity) of healthcare services and protection to populations despite the shock using the same level of resources and capacities. *Adaptive capacity* is the capacity of the health system actors to deliver the same level of healthcare services with fewer and/or different resources, which requires making organisational adaptations. Finally, the *transformative capacity* describes the ability of health system actors to transform the functions and structure of the health system to respond to a changing environment.

1.1.4. European initiatives on resilience of health systems

In 2017 the European Commission's Joint Research Centre (JRC) published a first conceptual framework on resilience, which provided the theoretical foundation for a substantive assessment published in 2018 titled: "*The resilience of EU Member States to the financial and economic crisis – what are the characteristics of resilient behaviour?*" (Alessi, Benczur et al. 2018). In their research, the JRC adopted a broad conception of resilience, stating that:

"A resilient system (or society) can face shocks and persistent structural changes in such a way that it does not lose its ability to deliver societal well-being in a sustainable way (i.e., deliver current societal well-being, without compromising that of future generations)".

The Expert Group on Health System Performance Assessment (HSPA) has developed the following working definition of health system resilience:

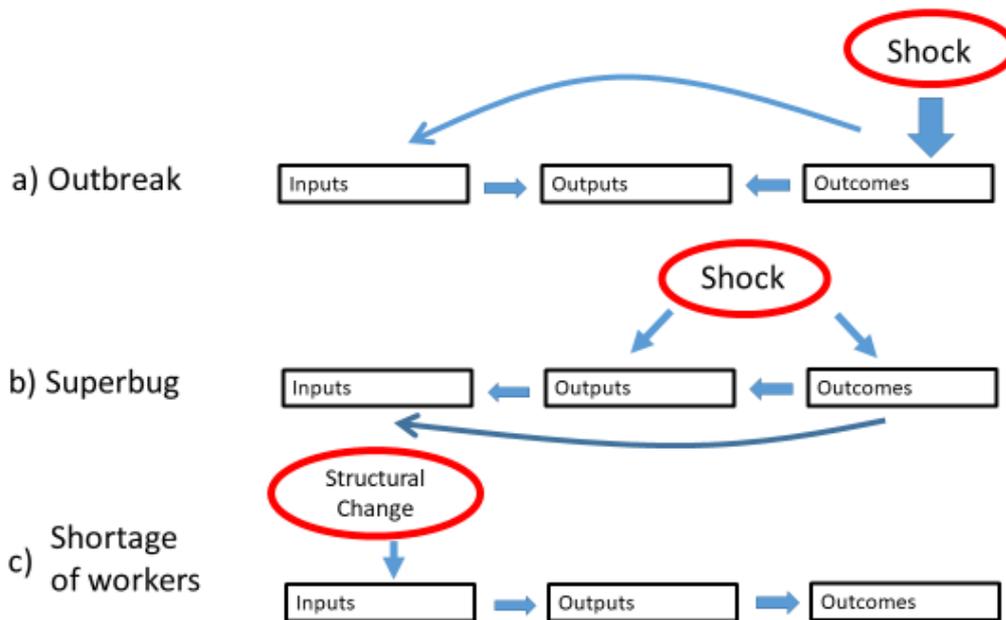
"Health system resilience describes the capacity of a health system to (a) proactively foresee, (b) absorb, and (c) adapt to shocks and structural changes in a way that allows it to (i) sustain required operations, (ii) resume optimal performance as quickly as possible, (iii) transform its structure and functions to strengthen the system, and (possibly) (iv) reduce its vulnerability to similar shocks and structural changes in the future".

We can relate the resilience of a health system to the building blocks (the inputs and outputs) in our framework in Figure 4, and their relation to outcomes. Shocks or structural changes can affect either the outcomes, the outputs, the inputs or a combination of them. The shock will then trigger a response from the inputs and/or outputs, which will affect outcomes. Some impacts are immediate, while others are downstream in response to the impacted area. Three examples are illustrated in Figure 6. An outbreak of an infectious disease affects population health (an outcome), and the health system needs to respond through a change in the organisation of the workforce and its resources (the inputs), which will affect the delivery of the services (outputs), but

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will also impact directly on the ability to maintain the delivery of services (Figure 6a). A superbug caused by weak safety procedures in the delivery of hospital services (outputs) have immediate effect on patient health outcome, which in turn triggers corrective and containment measures in service delivery and organisation of the medical workforce (Figure 6b). The chronic shortage of certain type of workers (an input) can affect health system ability to deliver services and improve health outcomes (Figure 6c). The resilience of health systems is discussed in more detail in Section 1.4, where the framework in Figure 4 is operationalized within the context of resilience testing of Member State health systems.

Figure 6 Response of a health system to shocks or structural change



1.2. Conditions for capacity building of resilient health and social care

The disruptions of health and social care services experienced during the COVID-19 crisis are a sign of suboptimal resilience of our health systems and of weaknesses due to artificial demarcations between health and social care. The resilience of a health system flows, to a considerable extent, from its governance structures and processes. Governance can be thought of as comprising five linked elements – transparency, accountability, participation, integrity, and capacity –, often known by the acronym TAPIC (Greer, Wismar et al. 2016). In the following sections, key aspects of resilient health and social care will be discussed.

1.2.1. Responding to unintended consequences

One major concern during and after the COVID-19 crisis is that, in addition to the direct effect on infected individuals, there have been indirect and unintended consequences for patients in need of health care (Douglas, Katikireddi et al. 2020). The COVID-19 pandemic has also highlighted significant needs and gaps in terms of chronic disease care delivery and organisation. Due to fear of being infected, many patients in need of health care have avoided seeking care from healthcare providers, in both primary and secondary care, with emergency departments in hospitals experiencing large drops in attendances even for patients with strokes and heart attacks. Moreover, providers had to put on hold many non-emergency treatments such as hip and knee replacements to avoid the risk of infecting patients and increase capacity to treat COVID-19 patients. A survey by WHO (2020) found that 64% of 159 surveyed countries reported decreased inpatient volume due to cancellation of elective care, the most common cause of disruption. This was followed by 45% of countries reporting closure of population-level screening programmes. Urgent care was also affected. Several countries, such as Italy, reported that admissions for acute myocardial infarction were significantly reduced during the COVID-19 pandemic, with a parallel increase in fatality and complication rates (De Rosa, Spaccarotella et al. 2020). Another example, in the Netherlands the number of people newly diagnosed with cancer dropped by 25% as a result of the lockdown (IKNL 2020). This is despite many countries prioritizing cancer, cardiovascular and diabetes services.

To address these disruptions, health systems have responded in a number of ways to maintain at least some continuity of care. One common approach is the use of telemedicine to replace in-person consultations where a physical examination is not essential. There has also been triaging to identify those patients in greatest need to find possible solutions for them, such as care in other settings. Another common approach is

task shifting, with roles being redesigned and reallocated (Expert Panel on Effective Ways of Investing in Health 2019, van Schalkwyk, Bourek et al. 2020).

The WHO (2020) has identified patients with chronic conditions as a group that may be particularly affected by these disruptions, with increased risk of mortality. Some people living with chronic conditions are no longer receiving appropriate treatment or are unable to access medicines during the COVID-19 pandemic. For these patients, maintaining physical distancing (thereby reducing unnecessary exposure) and alleviating fears that might prevent them from seeking medical care are key. Community care and home care offer such benefits, which are crucial to ensure the continuity and quality of treatments of these patients at home during the pandemic. Some measures ensuring appropriate community and home care were taken by some European countries at regional and national levels during the pandemic and those measures should be shared as best practice across Member States and replicated throughout the EU-27 to protect vulnerable chronic disease patients. There is therefore a need for practical guidance and sharing of best practices on the continuity of health and community services and development of digital solutions that can support self-care and home care. Remote prescription of medicines is being facilitated, making them available through an e-prescription, some issued by a more diverse range of professionals and drawing on best practice in task shifting internationally (van Schalkwyk, Bourek et al. 2020).

In addition to the short-term unintended effects, health systems will have to respond to the medium- and long-term effects of COVID-19 following from economic downturn and higher unemployment. Recessions are known to be associated with increases in mental illness such as depression (Gili, Roca et al. 2013, Banks, Karjalainen et al. 2020), which can be long-lasting, and higher number of suicides (Reeves, McKee et al. 2015). Individuals with existing mental health conditions, and who experience multiple disadvantages are likely to be particularly affected, widening health inequalities. Higher demand for mental health services will increase pressures in a segment of the health system that has been historically underfunded and where access is limited and waiting times are long (OECD 2020). This higher demand for mental health services is likely to be only partially offset by any reduction in accidents such as traffic fatalities arising from lower economic activities that arise in economic downturns (Wegman, Allsop et al. 2017), and lower incidence of conditions such as asthma associated with lower air pollution (Khreis, Kelly et al. 2017). There is growing concern that health systems may have to make provision for very large numbers of patients with long-term health problems arising from COVID-19 infections, the so-called Long COVID (Alwan 2020, Greenhalgh, Knight et al. 2020).

1.2.2. Integrating and using different forms of information for actionable decision-making

Since the outset of the COVID-19 pandemic, countries have faced common capacity constraints, both to gain access to necessary information (e.g. availability of up-to-date data) and make use of this for decision-making. The lack of knowledge of the virus and the limited availability of essential up-to-date evidence contributed, among others, to the resulting *infodemic* of misinformation (WHO 2020) and flood of *amateur epidemiologists* (Frieden 2020).

The need for i) access to appropriate data (measurement capacity), ii) the system to manage information (information governance capacity) and iii) the ability to deliver knowledge for its use (delivery – data use – capacity) are among the core capacity needs that have been exposed and require investment.

Box 1 Key areas for investing in capacity

Measurement capacity is the ability to generate the right information using consistent, standardized definitions and data gathering mechanisms, including at patient-level, including traditionally excluded groups, capturing what is happening in the health system and beyond, as well as public- and patient-reported perceptions and experiences.

Information governance capacity is the ability to integrate and cascade information rapidly and accurately across the health system and beyond, recognising the provisions in the General Data Protection Regulation (GDPR) that enable data flows for purposes of safeguarding public health.

Delivery (data use) capacity is the ability to deliver knowledge through trusted actors and public-facing information platforms.

Measurement capacity

Data on health determinants and vulnerable populations

Meaningful disaggregation of data – by sex, age, ethnicity, race, socio-economic status, comorbidities, long-term care facility residence – is critical in order to ensure equity-driven decision-making. From a technical perspective, existing information systems should be able to be adapted to accommodate the required disaggregation (Nutti, Vola et al. 2016).

Data on health determinants (e.g. income, living conditions, social networks) is essential to understand health inequities and thus support development of responses that are appropriately targeted to those in most need.

The pandemic has highlighted the importance of gathering data by ethnicity. The UK is the only European country that consistently does so. Others, like Belgium and Germany, have legal barriers to doing so, many dating to abuses in the early 20th century. Beyond Europe, there are examples of COVID-19 case reporting by ethnicity, such as state-level

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(e.g. Florida (Florida Department of Health 2020)) and city-level (e.g. New York (NYC Health 2020)) surveillance in the US and in New Zealand which provides a national example of case-reporting by ethnic groups (New Zealand Ministry of Health 2020) (e.g. Maori, Pacific peoples, Asian, Middle Eastern/Latin American/African (MELLA), European or others). The preparedness of a country is dependent on this detailed understanding of the population (including those who are undocumented). It is simply impossible to know whether disease burden and access to care are equitable without data. The Expert Panel recommends that a debate be initiated on ways of overcoming the current unacceptable situation in which many Member States are unable to develop policies that respond to the particular needs of ethnic minorities because they lack appropriate data. It is accepted that there are complex issues involved, but this is a situation that is completely unjustified.

Information on and beyond the health system

In a pandemic, data on the health system and its management of resources and all regular services, as well as data beyond the health system including the social and economic implications, are of critical importance (Blanchet, Nam et al. 2017, WHO Regional Office for Europe 2020). A focus solely on the epidemiological context perpetuates narrow bio-medical decision-making and hinders an integrated whole-of-society approach to setting priorities. Linkage of multiple databases across sectors is necessary to inform decision-making, both for people with and without disease, not least to enable the risk adjustment necessary to interpret findings. In most cases, this would require implementing routine data collection in routine systems of care (e.g. GP information systems), and to strive for integrated electronic records systems. Such data collection should also capture information on the kind of diagnostic results from patients, understanding that different diagnostic tools (e.g. PCR, Antigen, or Antibody) perform different functions for decision-making at the individual, population, and policy levels.

Cross-country standardized information

A lack of standardized information (e.g. differences in testing policies, definitions of mortality and cases, varied practices in coding causes of death, reporting of co-morbidity) paired with limited alignment between countries on how to standardize these processes, contribute to uncertainty in decision-making and misinterpretation across countries (Burgner, Ikizler et al. 2020). The one source of weekly excess mortality in Europe, EuroMoMo (<https://www.euromomo.eu/>), includes only 18 EEA states plus the UK, with Germany represented by only two regions. This is an unacceptable gap in the evidence needed to inform policy in Europe.

Public and patient reported data

Risk perceptions influence the judgments individuals make on threats and can adversely affect public adherence and response to information communicated by authorities. WHO has developed a behavioural insights tool to gather public knowledge and risk perceptions (WHO Regional Office for Europe 2020); collecting this information is considered a core pillar for transition planning (WHO Regional Office for Europe 2020). Countries are recommended to put in place appropriate “listening devices” (e.g. surveys, online polls) that allow health authorities to gauge the population’s response and behaviour in an ongoing and real-time manner, and to measure the impact of disinformation and misinformation on the population. This intelligence enables health authorities to anticipate how the public will react to pilot measures with certain segments of the population, and to adjust and mitigate early and fast. In most countries, data collected from the public and patients is scarce, despite its importance in the context of a pandemic where levels of anxiety are elevated. Patient-reported experiences and outcome measures should be regularly surveyed and integrated in clinical practice (De Maeseneer and Boeckxstaens 2012). Special attention should also be given to collecting data on the experiences and well-being of healthcare professionals in order to inform interventions to ensure the health workforce remains healthy (Fiorillo and Gorwood 2020).

Information governance/management capacity

Guidance by health authorities (e.g. through protocols and case management) is an important part of health information governance in dealing with a pandemic.

Primary care has a key role to play in providing patient-level data during and after a crisis, as its information infrastructure can identify risk groups, monitor adherence, and provide care according to needs, as well as detect newly infected patients (de Lusignan and Williams 2020). A major challenge is the disconnect between hospital and primary care IT systems, as only a few countries have fully integrated interprofessional IT systems (e.g. UK and Finland).

An integrated information system linking primary, secondary, and long-term care is critical for effective monitoring. It requires person-centred electronic records, where patient and providers – in conformity with the provisions related to public health in the GDPR – have access. Some countries offer experiences of scale-up of existing information systems, such as Finland (Findata) and South Korea (HIRA), showing how their information infrastructure can be put at the service of the nation to manage a crisis (OECD 2020). Many countries and regions have adapted their data privacy provisions to increase opportunities for data sharing during the COVID-19 pandemic, consistent with the GDPR (Kringos, Carinci et al. 2020).

Data and knowledge integration for patient triage and risk stratification

The efficient use of knowledge and integration of data by healthcare systems is essential for a resilient system, allowing it to identify high-risk groups. These include patients with an increased risk of adverse outcomes at times when intensive care units are operating at maximum capacity. Adverse cardiovascular and thrombo-embolic events are associated with COVID-19, with increased risk of myocardial infarction, myocarditis, heart failure, arrhythmias or pulmonary embolism (Roberts, Levi et al. 2020). It is important to have access to data on physiological parameters that assess cardiac injury (troponin and natriuretic peptides), markers of inflammation (C-reactive protein, ferritin, IL-6, lymphocyte count and procalcitonin), and of coagulation activation (D-dimer, prothrombin time) (Abooughdir, Kirwin et al. 2020, Al-Ani, Chehade et al. 2020, Del Valle, Kim-Schulze et al. 2020, Ponti, Maccaferri et al. 2020).

Clinical decision support systems (CDSS) that integrate clinical data and biomarkers, using algorithms to support assessment of severity scores, offer promising developments to assist clinicians with prognostication of patients and prioritization for critical care. However, it is necessary to subject these approaches to careful evaluation before using them in routine practice (Cheng, Papenburg et al. 2020, McRae, Simmons et al. 2020).

Data science and artificial intelligence (AI) are emerging as important aids for healthcare professionals responding to unpredictable events in several ways (Alimadadi, Aryal et al. 2020, OECD 2020, Vaishya, Javaid et al. 2020). AI powered search tools can provide updated and curated information to health workers but can also be a means to identify common characteristics with previous pandemics as well as specific traits of novel outbreaks. Integration of evidence with clinical symptoms can facilitate remote triage of patients, making more efficient use of primary care and critical care facilities (Kricka, Polevikov et al. 2020). The development of digital tools based on AI could make it possible to better control and coordinate the flow of patients to healthcare facilities through preliminary referral of moderate to high risk patients and the planning of diagnostic referral video visits. The potential impact of AI on process enhancement could also include a more efficient use of capacities by re-designing care pathways within hospitals and care facilities but also by stimulating dynamic care pathways between primary care and secondary / or tertiary hospitals, maximizing the use of resources as well as potentially favourable effects on clinical outcomes.

AI might also facilitate early diagnosis through data integration of clinical, radiological, and laboratory data (Gruson, Bernardini et al. 2020, Mei, Lee et al. 2020).

However, several challenges need to be considered for an efficient use of AI in unpredictable events such as appropriate integration of patient's goals and preferences and contextual information, and prevailing legal frameworks including GDPR

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requirements. Ensuring that the information governance framework is adapted to the processing of data by AI systems should be an upfront consideration in the design and implementation of data frameworks to enable the benefits of AI systems to be realised in healthcare delivery. The application of AI in an 'unpredictable, new context' also runs the risk of producing 'more of the same', excluding innovative approaches driven by 'human intelligence and creativity'.

Figure 7 Data integration and artificial intelligence for unpredictable events

The benefits of data integration and artificial intelligence for unpredictable events				
Triage and process enhancement	Early diagnosis	Risk assessment and Monitoring	Knowledge curation and research acceleration	Prevention
The needs before use by health systems				
Definition of the legal framework	Integration of privacy requirements	Setting of Ethical regulation		

Delivery (data use) capacity

In the context of a public health crisis such as a pandemic, effective communication of clear and timely information is crucial (WHO 2005, WHO 2018, OECD 2020). When communication is not clear and timely, the many unknowns create space for rumours to develop and panic to set in (e.g. *Plandemic* (Frenkel S, Decker B et al. 2020)). It is challenging for governments to control this and to counteract disinformation. Honesty and transparency, including acknowledgement of what is unknown, is critical (Forman, Atun et al. 2020). This includes considerations of who should provide key information and how it is delivered. It is essential to recognise and address misunderstandings and cognitive biases on the receiving end of the communication. The public attitude to pandemic responses, in particular, is influenced by the ability to understand less intuitive concepts such as exponential growth (Lammers, Crusius et al. 2020).

Need for independent trusted advisory structures

The public favours information delivered by technical leaders (McFadden, Malik et al. 2020) and the impact of informational campaigns can be increased by using trusted spokespeople (Quinn, Parmer et al. 2013). Social brokers can help coordinate actors in times of crises, bridging different groups (Blanchet, Nam et al. 2017). Following concerns about secrecy of the official advisory system in the UK, an independent group was established, leading to publication of membership of the official groups and their minutes. This Independent Scientific Advisory Group on Emergencies (<https://www.independentsage.org/>) continues to publish policy briefs and hold weekly

press conferences and, while its advice generally coincides with the official groups, it is able to challenge government policies and answer questions that concern the public. With an unprecedented engagement from the general public, COVID-19 has demonstrated even more the need for trusted online sources of health information, an area where the EU could play a greater role.

Actionable public-facing information platforms

Being able to explain information to the public is especially important in the context of a crisis that asks for behaviour change (WHO 2020, WHO Regional Office for Europe 2020). It is often the severity of COVID-19, not the probability of contracting, it that weighs most when individuals decide to adopt preventative measures such as vaccination (Sadique, Devlin et al. 2013). The narrative of a disease resonates more than statistics. Mechanisms like web-based public dashboards – as a hub of timely, visual and sometimes interactive data – are one way to communicate the severity of a pandemic and its evolution. A review of 159 COVID-19 dashboards developed for international, national, regional and municipal use globally, found the common features of actionable dashboards include simple techniques that illustrate data trends (e.g. use of colour coding, size variation, icons, etc.) and use interpretive text to explain the meaning (Ivanković, Barbazza et al. 2020).

1.2.3. Disseminating knowledge and good practice

While health professionals have a responsibility to keep up-to-date with developments at all times, this is especially so during a pandemic. There was, inevitably, considerable uncertainty about how to manage COVID-19 at the beginning of the pandemic but, in a relatively short period of time, the situation has changed dramatically. At the risk of simplification, the newly emerging evidence of importance to health professionals can be divided into what is important to reduce the risk of transmission, to treat infected patients, and to address the psycho-social context of COVID-19 at the level of individuals and communities.

Recognition of the extent of transmission in the asymptomatic or pre-symptomatic phase of the disease, coupled with an understanding of the important role of airborne transmission, led to changes in the use of personal protective equipment and other infection control measures. In the second case, it rapidly became clear that what was at first thought to be a form of viral pneumonia was much more complicated. Rather, COVID-19 was, in some cases, presenting as a complex multisystem disease (Roberts, Levi et al. 2020). Initially puzzling respiratory parameters, including the ability of patients to tolerate unusually low oxygen saturation levels, were explained in part by the recognition that there was often widespread vascular involvement, with

hypercoagulability. In some individuals, endothelial dysfunction was followed by a cytokine storm, which was often a terminal event. Because of this increasing knowledge, it was realised that placing patients on ventilators too early could actually worsen the respiratory function. Similarly, the importance of anticoagulating hospitalised patients was identified. The UK, whose response to the pandemic has been problematic in many ways, stands out as an exemplar of linking research to practice. Early in the pandemic, the RECOVERY trial was established, with a high proportion of hospitalised patients being entered into a series of clinical trials. This has already led to several important findings, including the lack of effectiveness of hydroxychloroquine and the beneficial effects, in appropriate patients, of dexamethasone. In retrospect, it is now clear that a substantial number of the early deaths could have been avoided, but only using the evidence that is available now. It is, however, likely that there are still many patients receiving sub-optimal treatment.

Clearly, it is important that evidence from research is translated into clinical practice. There is widespread variation within European countries in the development of clinical guidelines and their dissemination (Legido-Quigley, Panteli et al. 2012). European organisations bringing together clinical specialists could have an important role in this process but, so far, this has been limited, although there are a few examples. The European Society of Cardiology has produced what it describes as “guidance”, reflecting the limited amount of research available to meet the evidential standard expected in formal guidelines (European Society of Cardiology 2020). As of July 2020, the European Respiratory Society has compiled an inventory of national guidelines for different aspects of the management of COVID-19 but, as far as can be seen from their website, has not developed a synthesis (European Respiratory Society 2020).

In the absence of an international mechanism to exchange scientific knowledge² among all relevant actors (including the health and social care sector and the life science industry), it is important for all disciplines at the European-level to build a scientific community that is able to bring together, synthesize, share clinical evidence, and jointly drive R&D forward. The COVID-19 pandemic has demonstrated that cross-sector collaboration and partnership in R&D are key to quickly mobilise resources to address unmet needs to their full extent, calling for close life-science industry collaboration and investment in Public-Private Partnerships among all relevant stakeholders. This would stimulate better and faster coordination of public and private R&D efforts, resulting in meaningful healthcare innovation that creates benefits to patients, healthcare professionals, health systems, and society.

² The COVID-19 Clinical Management Support System (CMSS) which is linked to European Reference Networks and is intended for medical professionals: https://ec.europa.eu/health/ern/covid-19_en

It is beyond the scope of this Opinion to examine in detail the process by which emerging evidence on the management of COVID-19 has been synthesised and used to develop clinical guidelines in each country. However, especially given the limited capacity in many of the smaller countries, it will be very important to undertake a review of how these processes took place, if they did at all. It will also be important to examine the extent to which, given the complex multisystem nature of this infection, information was shared between different specialties. This review will have to take into account the substantial differences that exist in the organisation of the medical profession in each country, and in particular the role that medical organisations play in clinical quality, in addition to the more traditional roles of professional regulation and trade union activities (Risso-Gill, Legido-Quigley et al. 2014).

1.2.4. Anticipating and coping with uncertainties and unplanned events

There is often considerable uncertainty about biological hazards, defined as “the process or phenomenon of organic origin or conveyed by biological vectors, including exposure to pathogenic micro-organisms, toxins and bioactive substances that may cause loss of life, injury, illness or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage” (UNISDR 2009). Other uncertainties involve knowledge gaps and how they are approached (probabilistic and evaluative orientations), influenced by coping mechanisms, and organisational culture. Uncertainties in probabilistic orientations during unplanned events are related to not only biomedical, but also social and psychological factors and the impact of inevitably limited resources. Capacity and ability to anticipate and cope with uncertainties and unplanned events is part of the adaptive resilience of the system (Carpenter, Walker et al. 2001, Madni and Jackson 2009, Somers 2009). It is a key element of the general ability of a system to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions (UNISDR 2009). This ability is determined by the degree to which the system has the necessary resources and can organize itself both prior to and during times of need.

One of the main components of organisational resilience is “redundancy”, retaining resources in a form that is sufficiently flexible to cope with whatever unanticipated harms might emerge (Wildavsky 1988). The impacts of uncertainties and unplanned events can be absorbed by slack, or “superfluous” resources (Meyer 1982). In economics, accumulation of reserves for unanticipated contingencies is recognized as a prevention strategy to increase flexibility in critical situations and as an indicator of financial management capacity (Hou and Moynihan 2008). Strategic and operational capacity

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planning at international, national, regional, and local levels, with active involvement of provider organisations and other stakeholders in the planning process, is one of the major tools for building active resilience in healthcare systems. Strategic planning includes ensuring appropriate capacity, while operational planning refers to translation of strategic plans into action, including allocation and distribution of “redundant” resources. In Europe, cross-border sharing and redeployment strategies are recommended for inclusion in operational planning activities.

Strong primary care systems form the foundation of any emergency response (e.g. through triage, testing, isolation and support) as the “front door” of the health system (Dunlop, Howe et al. 2020), working closely with hospitals where those who are severely ill will be treated (McDaniels, Chang et al. 2008, Paturas, Smith et al. 2010). However, hospitals are especially vulnerable to crises because of their limited capacity and the challenges in adapting their complex operations, which involve large quantities of highly specialised staff and equipment (Milsten 2000, Pan American Health Organization 2000).

Capacity of healthcare systems to cope with uncertainties and unplanned events involves structural components (e.g., facility infrastructural safety), non-structural components (e.g., staff, equipment, medication), health service components (e.g., medical response and treatment, surge capacity, continuity of medical service) and disaster management capabilities (e.g., plans and procedure, crisis communication). These components form a two-tier hierarchy: resources and management. Resources refer to the staff, infrastructure, technology, and financial issues, whereas management includes strategic leadership, programme and process management as well as the creation of networks. Each of these categories has certain operational and adaptive aspects that must be established and maintained (Horton, Alexaki et al. 2003). These aspects include resourcefulness and redundancy as “means”, and robustness and rapidity as “ends” of the healthcare system active resilience concept, as proposed by Bruneau et al. and adapted by Zhong et al. (Zhong, Clark et al. 2014).

One serious constraint on a health system’s ability to cope with unplanned events is a lack of flexibility in the face of a “more-severe-than-expected” event with consequences that were unanticipated. During such events, challenges facing the system include allocation of lifesaving resources, protection of health workers, insufficient space and staffing for delivering critical care, laboratory and testing capacities, inappropriately constructed and staffed nursing homes, and others. Resulting uncertainties affect other capacities of the health system: performance capacity, personal capacity, workload capacity, supervisory capacity, facility capacity, support service capacity, structural capacity and role capacity (Potter and Brough 2004).

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The capacity to anticipate and cope with uncertainties and unplanned events in the health sector depends more specifically on:

- the set of concrete assets, including those which are “superfluous” or slack in “normal” operational conditions, such as those stockpiled for crises (e.g. hospital beds, ICU equipment, ventilators, dialysis machines, personal protective equipment, testing reagents, and others);
- the existing critical equipment and staff (e.g. trained first responders, laboratory personnel, epidemiologists, respiratory therapists, and others) and supplementary sources to be mobilized (e.g. the military);
- the routine systems of pooling and resource reappropriation, including means to redeploying staff, resources, and assets designated for other purposes.

During the COVID-19 pandemic, a perceived need for ventilators raised the question of their availability and allocation among hospitals in many countries (Davenport 2020, Yang, Yu et al. 2020). This posed many challenges and demanded effective coordination of distribution of essential equipment and supplies. Other events of major public health concern, for example mass poisonings, demonstrated that limited availability of antidotes, e.g. fomepizole, or dialysis facilities, required strict triage rules for patients (whom to treat and with what priority), coordination of patient flows and distribution of scarce equipment (Zakharov, Pelclova et al. 2014, Hassanian-Moghaddam, Zamani et al. 2019). Furthermore, overspecialization in health care poses a risk to flexibility and adaptability in a crisis (Anderlini 2018).

Capacity to anticipate and cope with uncertainties and unplanned events requires effective data collection and analysis. Deciding on the appropriate scale of activity (balancing the need for routine efficiency with surge capacity), getting the right people or resources at the right time, setting triage priorities, and locating re-deployable people or resources all assume the availability of relevant and timely information and the capacity to analyse it rapidly (Ansell, Keller et al. 2009). Data collection protocols, surveillance systems, electronic management systems to support contact tracing, implementation of quarantine, infection control measures, communication systems, resources allocation protocols / policies are the necessary links in the crisis response chain to an unplanned event. Lack of timely information sharing within national healthcare systems, for example, across public and private health sectors, as well as internationally, directly affects the ability of a system to meet demands during unplanned events such as pandemics.

In summary, capacity to anticipate uncertainties contributes to the resilience of the healthcare systems. This capacity requires strategic planning, maintaining a degree of

redundancy of key resources in the public health response chain, an ability to deploy resources and staff rapidly, and effective coordination of responses.

1.2.5. Managing interdependence and cooperation of different actors

Just as the clinical response to COVID-19 is complex, requiring the coordinated action of many different medical, nursing, and technical specialists (Roberts, Levi et al. 2020), so is the wider health system response. As has been noted previously, in a number of countries those living in long-term care facilities have experienced very high death rates. Also, some countries have struggled with fragmentation of their healthcare and public health systems. One lesson from the pandemic has been the importance of coordination across these interfaces.

Despite the diversity of health systems in Europe, this is an area where it is easier to set out principles and provide concrete recommendations. A response to an emergency requires a wide range of actors to undertake a complex mix of functions working in a coordinated manner. The actions of any one actor can have consequences for other actors and the health system as a whole. A soft systems approach (Plsek and Greenhalgh 2001) can provide general insights into health system function because performance is influenced, and to a considerable extent constrained, by the initial roles and responsibilities of these actors. Interactions within the soft system are subject to positive and negative feedback loops, and the association between an action and its outcome is often non-linear. For instance, the system may exhibit threshold effects, in which there is no outcome until a defined amount of effort is exerted, and ceiling effects, in which additional effort no longer impacts the outcome.

The health system is comprised of a large number of subsystems, each interacting with each other (Checkland 1976). Each system and subsystem involves a transformation, for example the treatment of patients, transforming them from ill to healthy, or the procurement of equipment, obtaining items from one place and supplying them to another, or the undertaking of tests, transforming samples into results. These transformations are undertaken by actors, such as clinical teams, logistics and procurement experts, or laboratory workers. Each system has customers, who are the beneficiaries of the transformation, such as patients or health workers waiting for equipment. The systems also have owners, who are responsible for its existence and continuation. Finally, each system acts within environmental constraints, such as financial limits or capacity constraints, and according to norms and expectations (sometimes termed 'Weltanschauung', or vision of the world necessary for the system to operate). Each of these systems within the health system should be connected by clear lines of communication and accountability, as well as data flows.

In the current pandemic, it has been apparent that these principles of soft systems function have often been largely ignored. Health workers have struggled with the consequences of procurement failures. Results of investigations have failed to reach those who need to take action on them (Rajan, Cylus et al. 2020). Vulnerable patients have been discharged from hospitals to long-term care facilities without any accompanying information.

This fragmentation has contributed substantially to the high mortality experienced in some countries, in particular in long-term care facilities that, in effect, fell outside the formal system with no one in authority having a comprehensive view of what was happening.

It is beyond the scope of this Opinion to propose how this can be remedied, given that each country, and sometimes each region within countries, has their own organisational structures and established lines of communication and accountability. What is important is that, in an emergency, someone has an overall view of how the different elements come together. Construction of a formal map of this system is a first step, but it not sufficient. It is also necessary to ensure that the formal system documentation corresponds to the reality on the ground. This requires working closely with those who support the transformations across different interacting subsystems. This word can draw on principles of coproduction (Conte and Davidson 2020), coupled with scenario analyses that identify a range of situations that the system must deal with and trace the pathways that must be followed to achieve the intended goal. For example, if a child in a school develops symptoms suggestive of COVID-19, what subsequent sequence of events will unfold across the health system?

A systems approach has been successfully applied to immunisation (Rechel, Richardson et al. 2018) and cancer screening systems (Turnbull, Prialx et al. 2018). Adopting a systems approach is especially relevant to address the challenges facing health care systems of the future, in which increasing ageing populations with complex multi-morbidity require care from different specialties and in different care settings, and have care needs that go beyond those traditionally delivered within the formal health system.

1.2.6. Building or developing legitimate institutions, measures and norms that are socially accepted

An effective response to a pandemic or any other major emergency impacting on health involves a partnership between government and the public. Governments, hopefully based on the best scientific advice, will identify measures that they believe should be taken and then decide on how they will be implemented. There is a spectrum from legislation with punitive sanctions to recommendations that leaves decisions to the

discretion of the individual. Whatever their form, the measures seek to bring about changes in the behaviour of individuals and communities.

Individual and community behaviour change will only succeed if it is based on trust and relationships, whereby the public trust their political leaders to make the right decisions and their leaders trust the public to do what is being advised. Unfortunately, there are many reasons why trust may be eroded.

Political leaders are not entitled to trust as a right, instead they must earn it and work to retain it. For the public to have trust in them, they must demonstrate that they are acting in the interests of those that they, in theory, represent and not in the interests of others. There is extensive literature, most notably the work of Naomi Klein, documenting out how politicians have exploited crises for their own interests and the interests of those to whom they have present or future financial links (Klein 2007). There is also considerable evidence from the current pandemic illustrating how decisions, for example in the area of procurement, seem to have been made to benefit those with links to politicians rather than in pursuit of value for money and effectiveness (McKee 2020). Especially when people are suffering, a perception of corruption will rapidly undermine public trust.

The public also have a right to expect that those who make decisions do so on the best available evidence. Clearly, in a novel situation, such as that arising when a new virus strikes, there will be a great deal of uncertainty. Views on the most appropriate responses will differ, but there will often be an acceptance of the difficulties involved. What is important, however, is that decisions are logically coherent. For example, many people will find it difficult to understand why opening of bars and restaurants is prioritised over schools. Advice on physical distancing, especially when it changes, should be accompanied by some basic explanation of the evidence on disease transmission that has influenced what is being proposed. Information should be given by those who are trusted. Sometimes it will be politicians, as in Scotland and New Zealand, and sometimes it will be scientists. However, it is important that scientists do not allow themselves to be co-opted as props by politicians who are pursuing their own agendas. Whoever is the public face of information, he/she must be perceived as being competent, which is not always the case (Russell 2020).

It is also important that the application of policies be consistent. In the UK, there was a marked reduction in trust in government when an adviser to the Prime Minister acted in a way that many people believed was a breach of the rules, especially when there were no repercussions. While accounts of individuals in the public eye breaching the rules can be found in many countries, for example the notorious golf dinner in Ireland, they have often been followed by swift action, including resignations.

Trust in governments varies widely across Europe, both among countries and within them. In particular, there are differences between countries where politics is consensual and those where it is highly partisan. Thus, in the UK, there are substantial differences in attitudes to pandemic and its responses between those who supported and opposed Brexit in the 2016 referendum (Duffy and Allington 2020). The role of partisanship has been examined in most detail in the United States, where there are clear associations between political allegiance and both of the seriousness with which the pandemic is viewed and the willingness to accept restrictions (Albertazzi and McDonnell 2008). A related consideration is the extent to which different groups in society see the political elite as representing their particular interests. The social contract between government and the people can vary within a country, for example when those living in a particular region see the national government as failing to represent their interests.

Such divisions risk being accentuated by a relatively recent phenomenon, social media. Social media makes it possible to undermine trust in institutions using messaging that can spread rapidly to tens of thousands of people. This has typically been associated with the anti-vaccine movement (Wang, McKee et al. 2019), but can already be seen in relation to the COVID-19 pandemic. The motivation for those spreading such messages varies, and in many cases those involved have no interest in the particular topic but rather are seeking to undermine trust in democratic institutions. Their efforts can be combated by ensuring that those giving advice are trusted and, ideally, by examining their messages to identify any vulnerabilities to misinterpretation and cognitive biases. Ultimately this will require action by the social media platforms, some of which have been more willing to act than others (Wang, McKee et al. 2019).

1.2.7. Procuring and distributing the necessary resources

Prudent governments and health authorities will plan in advance for emergencies, such as major epidemics and natural disasters. This will include stockpiles of essential equipment, although it is important to recognise that such stockpiles must be continually replenished, pointing to the need for effective processes to manage them. Effective and sustainable stockpiling of medical technologies should focus on ensuring availability of needed devices and services all along the continuum of care where needed for patients and at any (unforeseeable) place and point in time. Yet, no matter how well prepared health systems are, there will be times when they have to engage in emergency procurement; in the current pandemic emergency procurement has included ventilators, personal protective equipment (PPE), diagnostic equipment, and medicines. Consequently, it is important that emergency planning include provisions for emergency procurement but, unfortunately, even when such exercises have been undertaken, this topic has not always been included. (Public Health England 2017).

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This section draws on the ongoing work from the Expert Panel's Opinion on public procurement, which examines this issue in more detail (Expert Panel on Effective Ways of Investing in Health 2020). The Directive on public procurement includes provisions to set aside some of the usual requirements, such as prior publication of invitations to tender, but only in exceptional circumstances, for example when there is an urgent need for, for instance, "vaccines or emergency equipment". This includes when there is extreme urgency brought about by events that are unforeseeable. However, there are strict criteria that must apply if this approach is to be taken. The 2014 Directive envisages that there may be circumstances in which some of the rules of procurement are set aside. These include the scope to substantially reduce deadlines in restricted procedures, to adopt a negotiated procedure without publication, to make a direct award to a preselected provider (provided they are the only one able to deliver what is required), or even to consider alternative solutions for engaging with the market. These measures should, however, only be used "insofar as is strictly necessary where, for reasons of extreme urgency brought about by events unforeseeable by the contracting authority, the time limits for the open or restricted procedures or competitive procedures with negotiation cannot be complied with."

Beyond these processes, the European Union has developed a mechanism for joint procurement of medical countermeasures, set out in Article 5 of Decision 1082/2013/EU on serious cross-border threats to health. The Joint Procurement Agreement (JPA) sets out practical arrangements governing the mechanism, defines the decision-making process with regard to the choice of procedures, and organises the assessment of the tenders and the award of the contract. The EU has also created a strategic medical stockpile and distribution mechanism under the umbrella of the EU Civil Protection Mechanism (rescEU). This includes ventilators, PPE, vaccines and therapeutics and laboratory supplies. It is currently hosted by six Member States (Denmark, Germany, Greece, Hungary, Romania and Sweden) (European Commission 2020). There is now considerable experience with the widespread use of these processes during the current COVID-19 pandemic. This has revealed a number of problems. Thus, the JPA has been criticised for its inability to respond rapidly in a fast-moving situation, its use inclusion of only a few pre-selected suppliers (thereby excluding small and medium enterprises), and the absence of coordination mechanisms so that the demand for the same equipment is multiplied through different procurement mechanisms (local, regional, national, and European). However, there is a need for further learning, building on emerging findings from the Horizon 2020 European Innovative Procurement of Health Innovation (EURIPHI) project, for example (European wide Innovation Procurement in Health Care 2020).

The conventional procurement procedures have, as a central goal, greater transparency as a means of reducing the risk of corruption. Hence, it would be expected that

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suspension of these procedures would pose a risk of abuse (Group of States against corruption (GRECO) 2020). This concern has been justified by experience, with accounts of bribery and insider dealing, even in countries where this has been uncommon. In the healthcare sector, bribery makes medical services more expensive and of a lower quality, leading to unequal access to medical care and undermining trust in health services.

This makes it essential to establish anti-corruption and governance tools focused on transparency, oversight, and accountability, as described in a recent review published in association with WHO (Kohler and Dimancesco 2020). Transparency is one of the most important means for preventing corruption in the public sector, especially in emergencies. This requires increased capacity and public accountability of state institutions entrusted with regulatory and control functions in relation to the management of public resources. This can be achieved by implementing measures to strengthen integrity and the management of conflicts of interest with respect to persons entrusted with key decision making roles, including through responsive monitoring and compliance mechanisms.

Box 2 Short term measures to reduce risks with procurement in an emergency

- Maintaining and retaining documentation of procurement processes
- Developing detailed guidelines on procurement strategies under a crisis
- Putting further emphasis on contract management, so that established procedures are applied to reinforce accountability and transparency
- Favouring existing collaborative procurement instruments such as framework agreements
- Ensuring maximum openness of information, including open data
- Setting up a central price and supplier tracking system for key products and services
- Subjecting all emergency procurement processes to audit and oversight.
- Adapting audit and oversight strategies, as well as analyses of potential corrupt patterns in relation to the COVID-19 situation, where bargaining powers of the public and the private sectors are drastically reversed, including effects on competition
- Respecting sunset clauses in place for the emergency procurement rules and extending only after applicable approvals (e.g. parliamentary oversight)

Source: (OECD 2020)

The OECD has proposed a series of short-term measures to minimise the risk of procurement failures in an emergency (Boxes 2 & 3) (OECD 2020). These are designed to ensure transparency while recognising the urgency to obtain the necessary goods and services.

Box 3 Long term measures to reduce risks with procurement in an emergency

- Reviewing existing emergency procurement legislation to ensure that it is relevant for future global health emergencies
- Using or expanding existing e-procurement platforms to record transactional information on the procurement of emergency items
- Allowing remote access by auditors and oversight bodies to all procurement records
- Ensuring an appropriate cadre of trained public officials who have the skills to carry out an emergency procurement procedure
- Preparing mechanisms to address future supply-chain disruptions for critical goods or services
- Creating digital and easily accessible tools to allow the public to track all emergency purchases

Source: OECD (2020)

Unfortunately, there are many examples from the current pandemic that point to abuse by officials and politicians in some countries. In these circumstances, civil society organisations can play an important role in holding public authorities accountable. An example is the work of the Good Law Project in England that has initiated a judicial review of a number of procurement decisions by UK authorities during the COVID-19 pandemic (Good Law Project 2020).

1.2.8. Protecting mental health (of population and health workers)

Measures such as physical distancing and self-isolation, necessary to interrupt transmission of infection, can have a profound impact on mental health. Many risk factors for increased psychological distress during the COVID-19 pandemic have been documented, including age, gender, pre-existing chronic illness, employment status, having inadequate housing conditions and supplies during a quarantine period (e.g. food, water, clothes), and poor or inadequate information from health authorities. Aggravated levels of psychological distress should be recognised as a public health priority that requires a rapid adoption of clear behavioural strategies to reduce the burden of disease and the dramatic mental health consequences of this outbreak (European Commission 2020, Serafini, Parmigiani et al. 2020). COVID-19 also highlighted pre-existing gaps in access to mental health care. There are huge disparities in coverage of mental health services across Europe (European Commission 2019).

The COVID-19 pandemic has also placed enormous pressure on many health workers, working long hours in very challenging circumstances. Some will have had to make difficult choices about who will have access to scarce resources. Some will have contracted the illness themselves or seen close colleagues become infected, and in some cases dying. They may have had to self-isolate, placing pressures on their families and

their relationships. Others, who are not on the frontline, have also faced psychological pressures associated with remote working and the resultant isolation. Those affected are at significant risk of long-term mental illness, especially if they are unable to obtain appropriate support. One particular concern in the current pandemic is the phenomenon known as moral injury (Greenberg, Docherty et al. 2020). This is more often seen in combat situations, where an individual feels a sense of guilt or shame because they are unable to provide the care or security they would normally deliver to another, for example because of a shortage of resources. This can be managed by provision of individualised support and avoiding false reassurance but examining the challenges involved. Creation of a supportive environment, with a particular focus on individuals who risk falling between the gaps and who failed to engage with support systems, can also address the consequences of moral injury in healthcare workers.

Researchers in the UK have identified four elements that should form part of a recovery plan for healthcare worker mental health (Greenberg, Brooks et al. 2020). The first is to ensure that individuals are given thanks, both written and verbally, which recognises the situations that they have confronted and provides information on opportunities for psychological support. The second is the use of return-to-normal interviews by supervisors who are confident in speaking about mental health. These interviews facilitate an understanding of the experiences of the staff member, as well as other factors arising from their personal and family life that might add to their stress, and the development of personalised support plans. The third is active monitoring of those exposed to potentially traumatic effects, and particularly those who, for other reasons, might be at particular risk of mental illness. This type of case finding should be proactive and can be facilitated by online reporting systems. Finally, group discussions can offer a mechanism for mutual support. One particular type, Schwartz rounds, offer an opportunity for clinical and nonclinical staff to discuss the emotional and social aspects of their work (Flanagan, Chadwick et al. 2020).

1.2.9. Ability to retain, prepare, distribute and flexibly increase staff capacity

One of the most important assets of a resilient health system is the existence of a trained, motivated and well-supported health and care work force within the context of a strong primary care system working alongside family carers, community partners and local networks of support. Strong primary care is central in addressing a crisis such as a pandemic at the population level, as evidenced during COVID-19 (Binkin, Salmaso et al. 2020, Ohannessian, Duong et al. 2020, WHO 2020). To build primary care capacity, countries should invest to guarantee adequate numbers of appropriately qualified staff who are well-inserted in the broader health and social care system. Furthermore, health

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eco-systems must have more training opportunities at the community-level and policies that encourage leadership by health professionals at the local level.

General health system preparation for any unexpected event includes ensuring that appropriate levels of staffing for doctors, nurses and other healthcare personnel are sufficient and adequately distributed. This is required to respond to sudden events (while buying time to increase capacity and providing the necessary flexibility) and to avoid disruptions in access to and continuity of regular care. A WHO survey performed in May 2020 among 159 Ministries revealed major disruptions in services for the prevention and treatment of chronic conditions as a result of the COVID-19 pandemic. Chronic conditions-related clinical staff were deployed to provide COVID-19 relief and insufficient staff to provide services were reported by 39% and 31% respectively of the countries as a major reason for service disruptions for those with chronic condition such as renal and neurological disorders (WHO 2020).

Responding to a sudden event within the context of existing shortages of staff and resources, or of routine operation on maximum capacity, may exacerbate existing gaps in access to care and undermine the response (Thomas, Sagan et al. 2020). While a degree of excess (or 'surge') capacity in preparation for a specific potential unexpected event could allow an effective response to a rapid increase in demand, surge capacity might also be counterproductive by increasing system vulnerability to other unanticipated events and negatively impact patient safety (e.g. if minimum volume standards cannot be met) (Thomas, Sagan et al. 2020).

Maintaining adequate levels of staff can be challenging. This may be particularly difficult for small countries, where professionals often receive specialist training abroad, resulting in a depletion of human resources if staff decide not to return to their home country upon training completion. The development of in-country specialist training programmes and accreditation procedures, as well as agreements with institutions providing training in various countries could enhance a country's ability to retain health professionals while simultaneously offering a wide variety of training options that guarantee adequate care for the population. The EU should engage in a process with Member States to create stronger cross-border solidarity and capacity assessment that helps to avoid unequitable brain-drain.

A lack of sufficiently skilled staff may also result from structural under-appreciation and insufficient support of health and care professionals via absenteeism and/or low motivation. Social care workers and nurses are just as essential to population health as doctors, while they still lack a comparable pay, recognition, and career development in most health systems. The under-appreciation of the social care sector has become even more apparent in the policy responses during the initial crucial phases of the COVID-19

pandemic (Bignal and Vaughan 2017). In most countries, the needs of the elderly were overlooked within a context of already existing institutional and geographical fragmentation of long-term care provision in most European countries (Spasova, Baeten et al. 2018). Prevention of illness and care for elderly and other vulnerable people, and primary care (e.g. for chronic patients) was often de-prioritized in favour of hospital-based treatment. This contributed to the quick, and initially unrecognised but rapidly fatal, spread of the virus in residential and domiciliary settings (Coote 2020).

Increasing investments in social care and support and assuring that the needs of all age groups are covered in social protection systems are crucial to realise inclusive growth, tackle inequalities and ensure that all citizens can contribute to society (Social Protection Committee 2015, Bignal and Vaughan 2017). If the existing level and distribution of staff capacity is insufficient to cope with a sudden surge in demand in a way that meets these needs, several possible short-term and long-term strategies to increase workforce capacity could be implemented.

Short-term strategies include asking health professionals to work extra hours, for instance moving from part-time to full-time work, modifying work schedules and cancelling leaves of absence. Medical and nursing students can be called upon to work in clinical practice. Retired, inactive or foreign-trained but unregistered health professionals could be brought into the workforce. Private sector workers could be redeployed into the public sector. Volunteers can be recruited to support the response. Temporary repurposing of staff is another alternative. These measures would need to be underpinned by emergency legislation. Incorporating new, reactivated, or repurposed professionals into the health and care workforce requires rapid, standardized training. Such training may need to be delivered via distance learning, especially during a pandemic, and address the clinical and technical challenges of caring for particular patient groups and protection against risks (e.g. infection).

A longer-term strategy to increase staff capacity could involve changing the skill-mix of health workers, for instance finding alternatives to hospital-based care and shifting primary care tasks to nurses and pharmacists (Expert Panel on Effective Ways of Investing in Health 2019), and making greater use of health technology to deliver care, for example electronic prescriptions (Thomas, Sagan et al. 2020). These solutions to reorganise health and social care would recognise the important role that community pharmacists in many countries have played in ensuring continuity of care, as well as the work of informal carers, whose contributions have been described by the organisation EUROCARERS. Implementing novel methods of service delivery, such as teleconsultations, should be considered as one possible solution. However, the intended and unintended consequences (e.g. digital divide) of the innovation should be carefully

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assessed before including it into long-term health and social care organisation (Thomas, Sagan et al. 2020).

The social and emotional aspects of care provision and the potential for professional burnout in the face of unexpected events must also be addressed. Some health professionals will be front line responders to unexpected events, which they may need to endure for long periods of time. Hence, they need to be well-supported (e.g. through staff support mechanisms, helplines), their safety needs to be ensured (e.g. through sufficient and appropriate protective equipment; adequate testing for infectious diseases, also when diagnostic capacity is insufficient for widespread testing), and their well-being, job satisfaction and absenteeism closely monitored. Vulnerable health professionals, such as those with long-term medical problems (e.g. those on immune-suppressors, cancer treatment, diabetes, hypertension or asthma), should be identified and may be considered to be moved to non-patient-facing roles in times of certain unexpected events (WHO 2020). During the COVID-19 pandemic, key risk reducing factors for health professionals and their families included: procuring, stocking and providing personal protective equipment with training in proper use; providing hotel accommodation for people working in exposed environments; reducing face-to-face interaction; promoting teleconsultation; providing digital tools to reduce face-to-face interaction while maintaining quality of care; and implementing electronic prescriptions (WHO 2020).

Both the current and future health and care workforce needs to be prepared through training to deliver health care in disrupted, overburdened and rapidly changing environments in times of crisis. It will require incorporation of critical thinking into education and more focus on generalism (at least in undergraduate training) to stimulate the workforce to be creative and avid lifelong learners, adapting to the situations around them. The current and future health and care workforce, and those who educate them, must reflect on the upstream causes of the level of preparedness of health systems to past crises. A paradigm shift is needed among educators and professionals to acknowledge that the health workforce is responsible both for individual health and population health (De Maeseneer, Fisher et al. 2020). Education is needed on the social determinants of health, with emphasis on interprofessional and cross-sector collaboration. 'Super specialisation' of staff in training (e.g. specialised nurses) is threatening their generalist skills and knowledge, and will result in difficulties for redeployment when needed (SARWGG 2015). Skill-based training should be expanded to incorporate new skills. Value-based training should foster interprofessional and intersectoral solidarity and trust. In summary, a well-trained health and care workforce is central to health system resiliency to future unexpected events (Azzopardi-Muscat and Kluge 2020, De Maeseneer, Fisher et al. 2020).

1.2.10. Spreading the load across facilities

As a rule, European governments participate in planning healthcare capacities. This is in contrast, for instance, to fragmented healthcare arrangements such as in the United States. This governmental participation in healthcare, in general, allows European healthcare capacities to be managed in a more concerted way. For example, the joint work of the Belgian federal and federated entities on hospital emergency planning in 2016 enabled a rapid increase of hospital capacity during the COVID-19 pandemic (European Observatory on Health Systems and Policies 2020). There, an integration of services in the health system and across other sectors was of crucial importance to absorb and adapt to the shock (Hanefeld, Mayhew et al. 2018).

More details about recent efforts to exploit the potential in spreading the load across different types of facilities are presented below.

Primary and community care

During the first wave of the pandemic, critical care provided in the hospital ICU wards received most attention. At the same time, the efforts of primary care should be overlooked. In some countries, these primary care providers were and are strongly involved in combating infection and disease consequences in numerous ways: implementing a triage system in a coordinated and transparent manner, testing, supporting quarantine, providing psycho-social response. Some public authorities in Europe established fever clinics as the primary care arrangements. In Oslo, with the highest infection rate in Norway, 'fever clinics' were opened to take care of the patients referred by the GPs or by the emergency out-of-hours clinics (European Observatory on Health Systems and Policies 2020). In spring 2020, Lithuania also organized a set of fever clinics led by the local GPs. GP respiratory clinics in Australia may serve as another example of triage strategy to clinically assess people with mild to moderate COVID-19 symptoms (a fever, cough, shortness of breath, a sore throat and/or tiredness) (Australian Government Department of Health 2020).

Moreover, as containment measures were lifted, the role of GPs in controlling the spread of COVID-19 in the community has become increasingly important due to their key role in testing and contact tracing (European Commission 2020), as well as meeting post-COVID diagnosis care needs and addressing the care needs of the general population. Targeted interventions for influenza, COPD, CHF, diabetes, UTI and cellulitis in primary care settings can help keep people well and reduce preventable hospital admissions (Stavropoulou, Palmer et al. 2020). In many countries, general practitioners joined forces with other primary care and welfare organisations to set up the care needed by the population during the pandemic (de Sutter, Llor et al. 2020). Recent literature

review also proved that community services play an important role in the provision of palliative care during pandemics, such as COVID-19 (Mitchell, Maynard et al. 2020).

Inpatient health care

During the COVID-19 pandemic, some health authorities created additional capacity specifically for COVID-19 treatment. Many countries stopped provision of elective services, yet delivery of urgent and essential services was often still compromised by increase flows of redirected patients and demanding safety requirements. This excessive pressure on hospitals to treat infected patients resulted in a need to establish reserve capacities. Resource mobilization and redistribution of the load within and outside health sector was required. Cross-border hospital collaborations (e.g. between the Netherlands and Germany) were started or – if already existing – re-activated, to share the care of infected patients (European Observatory on Health Systems and Policies 2013).

To mitigate shortages, some European countries made use of capacities of private facilities. For instance:

- In Denmark, the law stipulates that private hospitals and clinics must be part of the general capacity in an emergency situation;
- In Spain, all ICU beds from private hospitals were added to the regions' healthcare capacities;
- In Ireland, an agreement with private hospitals assured an accessibility of all private beds (European Observatory on Health Systems and Policies 2020).

To mitigate shortages, patients were transferred from the most infected territories, whose hospitals were overwhelmed, to areas experiencing less shortages. For instance:

- In France, there was a nationwide mobilization of trains, helicopters, jets and even a warship to transfer patients from the worst affected eastern regions;
- In Spain, three high-speed trains were converted to transfer critical patients to less occupied hospitals;
- Some of the regions most affected in Europe dispatched patients to hospitals in Germany, Switzerland, Luxembourg and Austria.

In the United States, where providers can make more independent decisions on healthcare delivery, capacity management focused on the tools for predicting needs for particular hospitals and on coordinating activities of local Capacity Command Centers or Rapid Response Teams (Begley 2020). Recently, the CDC published the guidance for medical planners and healthcare facilities, especially rural ones, on the establishment of Relief Healthcare Facilities as "*licensed healthcare facilities (e.g., hospitals, long-term acute care hospitals, long-term care facilities, and other licensed inpatient healthcare*

facilities) that accept patient transfers or share extra resources to extend conventional standards of care to as many people as possible during a crisis and therefore minimize the use of crisis standards of care” (CDC 2020). In Europe, there was an accelerated transfer of patients from the hospital to rehabilitation units in order to redistribute patients from the surge hospitals (Peiffer-Smadja, Lucet et al. 2020).

The pandemic re-focused attention on the “hospital at home” model, though mostly for patients in need of hospitalization for reasons other than COVID-19. The “hospital at home” approach is considered to be more patient-centred, safer and more efficient compared to staying in crowded inpatient facilities (Nundy and Patel 2020). It is a particularly effective alternative for select patients with neuromuscular diseases and respiratory tract infections (Vianello, Savoia et al. 2013). Although additional evidence is needed, the “hospital-at-home” model could be a solution for health care systems managing a surge in demand and specifically for those who are deemed to be lower risk or those who have been monitored for a period of time in a traditional setting. During the pandemic, patients’ and carers’ attitudes towards the “hospital at home” approach have significantly improved, potentially because of the perceived increased risk of attending hospitals in person and/or the progress in telemedicine that can better support healthcare delivery at home (Hensher, Rasmussen et al. 2020). By shifting some treatments and care from the hospitals into the community setting, community and home care enable hospitals to free up some capacity and resources and to allocate these to ICU and more critical patients in the different phases of the pandemic.

Alternate care settings

The Alternate Care Sites approach provides medical care for patients according to disease severity levels in non-traditional environments like converted premises or mobile field hospitals (U.S. Department of Health & Human Services 2020). In Europe, this strategy was used during the COVID-19 pandemic:

- In Milan, Italy, large existing industrial spaces or trade fair buildings were converted into hospitals during the most urgent phase of the response. More long-term policies have been adopted across regions to place some discharged patients requiring low intensity surveillance in re-adapted hotels or dormitories.
- In Budapest, Hungary, a temporary facility was established in the city’s exhibition buildings.
- In Croatia, patients with non-severe symptoms were accommodated in non-medical facilities such as student campus dormitories and sports halls.

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- In Germany, a Hospital Emergency Plan released by the Government and the federal states allows for the use of provisional facilities such as rehabilitation facilities, hotels, and public halls.
- In Flanders, Belgium, 'intermediate care' between hospitals and home care was organized using "switch centres". These centres took into account the needs of discharged patients who, for social or medical reasons, were not yet able to go home. The result helped to balance hospital and primary care capacities.

Social care facilities

Patients may be discharged to elderly homes or other care facilities to free-up hospital capacities for more severe cases. However, recent painful experience showed that mandatory testing and temporary isolation are needed to prevent from infection outbreaks due to transfer of people who are infected with the SARS-CoV-2 virus. In Belgium and many other countries, a strategy was put into place to test all patients before they could enter a nursing home. Nursing homes are densely populated entities, with limited or no possibility for 'compartmentalisation', and low paid staff. Hence, care homes struggled to care for infected patients.

The lessons learned with respect to social care facilities include the utility of integrated approaches to resource allocation (e.g., rapid access to medicines and personal protective equipment), responsiveness in access to needed expertise, inclusion of care homes in guidance and service design (King's Fund 2020), and development of integrated budgets including both health and social care.

Strategic public-private partnerships and collaborations

The words "Test, test, test" highlight the importance of PCR testing for early diagnosis of the infection. In almost all European countries, testing capacities for PCR were saturated in the early stages of the pandemic, with shortages of reagents and equipment. A lack of collaboration between public and private laboratories was also evident. Concerted European action is needed to stimulate novel forms of public-private partnerships to respond in a socially accountable way to nationwide demand in case of crisis, but also to trigger an integrated / merged solutions involving both primary care and hospital players.

1.2.11. Separating patients at risk and infected from other patient while assuring care continuity

Facility design and procedures

Health facilities, like any institutions that bring together large numbers of people for prolonged periods of time, can act as institutional amplifiers of disease. Thus, once an infection enters, it can spread rapidly among all those present. At the beginning of the

pandemic, cruise liners acted in this way, providing a warning that, unfortunately, was not always recognised. As institutions remain open to the communities around them, through the movement of staff and visitors, they can spread infection more widely. Therefore, infection control is always a high priority. The challenges with infection control are particularly great in the case of coronavirus, given the relatively long incubation period and the propensity for spread among those who are asymptomatic or pre-symptomatic. Consequently, while there is a risk of infection in a community, as indicated by continuing incidence of disease, it is important to find ways to minimise the risks within a health facility.

Key aspects of facility re-design at the primary care level involved preparing the clinic (e.g. identifying high risk patients, assessing and restocking supplies), communication with patients (e.g. asking about symptoms during reminder calls, rescheduling non-urgent appointments, posting signs in the facility about preventive actions), preparing the waiting area and patients rooms, placing staff at the entrance to ask patients about their symptoms, separating sick patients with symptoms (for instance via use of designated elevators for transport), and taking specific actions after patients have been assessed (e.g. frequently cleaning touched surfaces, providing at home instructions, notifying health departments) (CDC 2020).

At the inpatient care level, capacities for rapid diagnosis and appropriate management of infected patients without interrupting routine care (e.g. by treating them in separated, specialised care settings within the hospital or in different buildings) were needed. Such capacities are relevant to address future shocks facing the health and care system, such as the increasing prevalence of healthcare-associated infections and the challenges related to multi-drug resistant organisms.

Some of those countries that had experience with SARS had redesigned many of their health facilities and procedures in its aftermath (Legido-Quigley, Mateos-García et al. 2020). For instance, health authorities in Singapore invested heavily in additional isolation facilities and implemented new procedures in public hospitals. In Singapore General Hospital, it is protocol for patients entering the hospital or the emergency department are asked about their travel history, history of fever, and any other symptoms (Lateef 2009). Patient temperatures are recorded and documented. Anyone who has a fever or answers the questions in a way that suggests they may be at risk must be taken to a separate part of the emergency department. This occurs even before the patient is triaged. These separate fever areas have been designed to minimise the risk of infection. Careful attention has been paid to the ventilation system, including air flows. Where possible, rooms have negative pressure ventilation are separated from

coroners by anterooms to minimise the spread of droplets during opening and closing of doors.

In Singapore, these design features were backed up by rigorous infection control procedures, including a well-developed contact tracing system. Such a system should build on an integrated, population-oriented IT system, accessible (in conformity with GDPR-regulations) to all stakeholders, including the citizens. Moreover, a complementarity between central strategies (e.g. call centres) and local actions (e.g. home visits, community-based analysis of potential clusters, support for people in isolation and quarantine) is essential. Local approaches have the advantage of 'short information trajectories', as well as trust by the population when local care providers and other local actors are involved. Separate from the general hospitals, a purpose-built 330 bed infectious disease management facility was also built, with integrated laboratory and epidemiologic functions (Lin, Lee et al. 2020).

Telemedicine

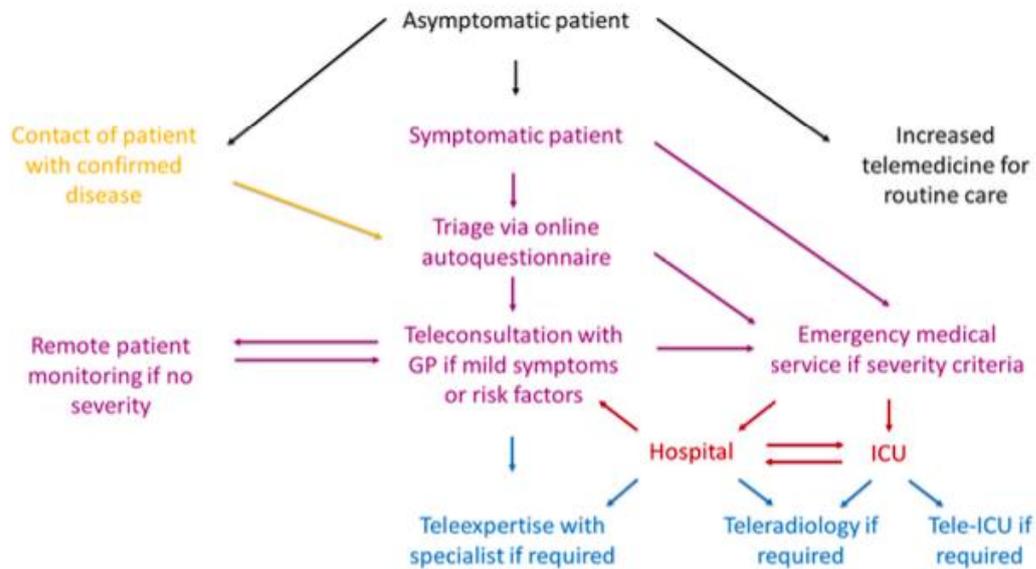
Telemedicine appears as an important component of a novel model of care with high importance for distance monitoring and empowerment of patients, for separation patients at risk and infected from other patient while assuring care continuity during unexpected events and for providing rapid response to people needing medical assistance (Contreras, Metzger et al. 2020, HAS 2020, Hollander and Carr 2020). Telemedicine also allows multidisciplinary team consultation and inter-consultation service for clinicians and pharmacists.

Before the COVID-19 pandemic, the use of telemedicine was limited, with many regulatory and reimbursement barriers (Expert Panel on effective ways of investing in Health 2019). Now, telemedicine is emerging as an indispensable resource to support surveillance of patients and ensure continuity of care of vulnerable patients with multiple chronic conditions. Many hospitals and healthcare facilities documented an important increase of the number of telemedicine visits within days following the institution of novel coronavirus pandemic restrictions on in-person clinical encounters (Greenhalgh, Koh et al. 2020, Ohannessian, Duong et al. 2020, Rockwell and Gilroy 2020). Telemedicine services have been used to reduce overcrowding of health facilities while reducing exposure to potentially infectious patients (Bashshur, Doarn et al. 2020, Hollander and Carr 2020), for example by triaging of patients before they arrive in the emergency department, facilitating remote assessment in primary care, and offering means for distance monitoring and counselling (tele-oncology, tele-cardiology etc.) (Shirke, Shaikh et al. 2020). Telemedicine also seems to have potential in the care of mental illness (Chevance, Gourion et al. 2020, Talevi, Socci et al. 2020, Zhou, Snoswell et al. 2020).

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Figure 8 provides a conceptual framework for the use of telemedicine during the COVID-19 pandemic.

Figure 8 Conceptual framework of telemedicine for the coronavirus disease



Source: (O'hannessian, Duong et al. 2020)

The pandemic has led to much greater use of telemedicine, which seems to have gained considerable acceptance by patients during this time (Viers, Pruthi et al. 2015, Portnoy, Waller et al. 2020). However, implementation of telemedicine services took several weeks or months (European Commission 2020, Olesch 2020, Omboni 2020). The importance of investment in infrastructures is crucial and the COVID-19 pandemic exposed differences in preparedness among countries. Furthermore, laws and regulations still need to evolve to facilitate reimbursement for and adoption of telemedicine (American Medical Association 2020). Telemedicine has the potential to reduce costs and increase access to, and quality of, health services, but strategic vision, sustained investment, policies to advance trust and education, and supportive financing models are needed (Australian Government Department of Health 2020, Dashplus 2020, Wicklund 2020). The prerequisites to efficiently integrate telemedicine to strengthen health and social care are summarized in Table 1.

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Table 1 Prerequisites for the efficient integration of telemedicine

Prerequisites for the efficient integration of Telemedicine
<ul style="list-style-type: none">- Digital health literacy, skills and trust among the general population, patients and healthcare workers- Robust infrastructure and networks for connectivity and communication- Standardisation of solutions and interoperability with the provider IT system or, if available, the electronic health record of the health system- Strategy and operational plan guiding health care providers to switch to outpatient teleconsultations and increase tele-expertise and remote patient monitoring- Staff and patients training on the recommended use of telemedicine- Observation of prevailing institutional norms, protocols, and quality assurance mechanisms in place, including prompt reporting of adverse events, proper documentation, and follow-up- Equivalent level of quality of care- Data-sharing mechanism to integrate telemedicine data with epidemiological surveillance.- Interconnection between telemedicine services operating at hospitals and those deployed in primary care- Appropriate regulation and financing models and investment in skills, systems, and infrastructure, not just in the time of the pandemic, but to digitally transform health systems

Implementation of telemedicine should include an assessment of the intended and unintended consequences (Thomas, Sagan et al. 2020), with a understanding of the differential impacts on vulnerable groups. The next section details the concept of vulnerability and considerations for adequate care provision to vulnerable groups.

1.3. How can healthcare provision be sustained for vulnerable people

1.3.1. An introduction to vulnerability

Infectious diseases, which are spread by either bacterial or viral agents, are omnipresent. Epidemiologists use various terms to describe the spread and rate of new cases of an infectious disease. An outbreak describes the sudden occurrence of a disease in a community – either a new disease never experienced before or numbers of cases higher than expected for that community. When a disease is present permanently in a region or population (e.g., dengue), it is known as an endemic. When there is an outbreak that affects many people at one time and can spread through one or many communities (e.g., Ebola), it is known as an epidemic. A pandemic, like the case of the H1N1 flu virus, is an epidemic that spread across different continents.

On March 11, 2020, the World Health Organization declared COVID-19 as a pandemic, referring to its pan-global reach. In the framework of infectious disease management, interventions centred on interrupting means of viral transmission to control the spread of the SARS-CoV-2 pathogen. The view of a pandemic is often limited to the biomedical or epidemiological dimension. However, as data described in this section will show, the virus's lethality depend on factors extrinsic to the virus itself. Therefore, based on current knowledge, the current crisis is better described as a syndemic (Singer and Clair 2003).

A syndemic refers to the interaction of multiple epidemics that ultimately exacerbate the disease burden in certain populations and increase health vulnerability. According to a Lancet commentary, *“syndemics are characterised by biological and social interactions between conditions and states, interactions that increase a person’s susceptibility to harm or worsen their health outcomes”* (Horton 2020).

This, then, becomes the definition of “vulnerable group”. These are groups of people who are disproportionately exposed to risk and those disproportionately affected by risk, e.g., experiencing more severe outcomes. From the biological perspective, there is an interaction between SARS-CoV-2 and other, non-communicable diseases. But a more comprehensive definition takes into account the social and environmental conditions, past and present, influencing the health of individuals and populations. Vulnerable groups include elderly individuals, those with ill health and comorbidities, individuals who are homeless or under-housed, and also people from various socioeconomic groups who may struggle to effectively cope physically, mentally, and/or financially with COVID-19 or with the societal impact of COVID-19 (The Lancet 2020). In a recent communication to the European Parliament, the Council, the European Economic and Social Committee and the

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Committee of the Regions, the European Commission classifies people vulnerable to COVID-19 into three categories (European Union 2020):

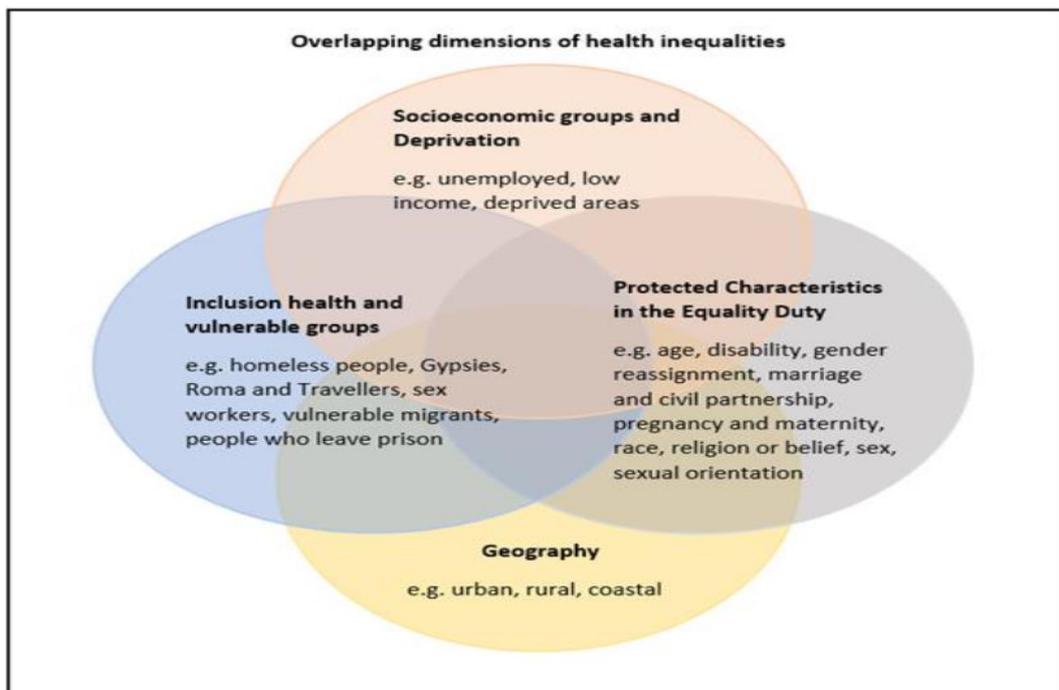
- (a) Medically vulnerable, such as the elderly and those with underlying health conditions,
- (b) Socially marginalized, such as those residing or working in certain physical settings prone to high density and reduced ability to physical distance or a reduced financial budget for protective measures (such as people in poverty), and
- (c) Professions which entail closer proximity to confirmed or suspected COVID-19.

We can add two additional categories to the above:

- (d) Mentally / psychologically vulnerable, and
- (e) Economically vulnerable.

As suggested by the term syndemic, some individuals may fall into more than one of these vulnerable groups and experience multiple vulnerabilities. Underlying causes of healthy inequity will exacerbate vulnerability. Figure 9 illustrates how various dimensions that contribute to health inequities may overlap, and therefore increase vulnerability to COVID-19 and its societal impact.

Figure 9 Overlapping dimensions of health inequalities



Source: Public Health England. COVID-19 Suggestions for mitigating the impact on health inequalities at a local level. (Public Health England 2020)

Conceptualizing COVID-19 as a syndemic provides the opportunity to re-visit the issue of health inequalities and to explore the vicious cycle between health and poverty. COVID-

19 exposes and amplifies inequalities, thus reinforces the cycle of vulnerability. Data from the UK's Office for National Statistics highlight how more deprived the areas experienced greater mortality (Marmot and Allen 2020). And COVID-19 took advantage of disinvestment in public services following the global financial crisis in many countries so that *"imposed on pre-existing health inequalities and policies of austerity, [it] had contributed to the grim and unequal health pictures"* (Marmot and Allen 2020). The implications are that the public health community must play a key role in ensuring that the principles of health equity and social justice are guiding the responses to the COVID-19 crisis (Smith and Judd 2020). Therefore, at the end of this section, we argue that an assessment of the effectiveness and efficacy of European strategies aiming to reduce vulnerability in these special groups is warranted. First, we will examine the role of diverse contexts at social and individual levels and then we will describe specific vulnerable groups according to the five categories proposed above.

1.3.2. The role of diverse contexts

The evolution and the impact of COVID-19 had varied across affected countries, with response and impact in the Global South less well understood (Van Damme, Dahake et al. 2020). This can partly be attributed to the different vulnerable groups across settings and, generally, to the different health and social care contexts. Natale and colleagues (2020) emphasize that COVID-19 transmission depends on both socio-economic and individual level factors. They state that *"contacts occur in the context of social interactions, which vary along macro- (culture, wealth, access to technology) and micro-parameters (age, gender, type of occupation, character traits)"*. These factors influence adherence to key control measures, like physical distancing, in specific contexts, and thus impact on exposure to the virus in vulnerable groups (Natale, Ghio et al. 2020).

Race/ethnicity, in particular, is an individual level biological factor with cultural and socio-economic components that has been found to be related to COVID-19 infection and mortality. In New York City, African Americans have higher rates of COVID-19 diagnosis and mortality (Dorn, Cooney et al. 2020). In a large cohort in Louisiana, 76.9% of the patients who were hospitalized with COVID-19 and 70.6% of those who died were African American, whereas African Americans comprise only 31% of the analysed population. However, race was not associated with higher in-hospital mortality after adjustment for differences in sociodemographic and clinical characteristics on admission. Pre-existing health conditions were risk factors for hospitalization, also indicating the unequal access to health care and to public healthcare measures associated with race in the US (Price-Haywood, Burton et al. 2020). Data from a population-based surveillance system of laboratory-confirmed COVID-19-associated hospitalizations among persons of all ages in 14 US states showed that African American populations were disproportionately affected

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by COVID-19 (Garg, Kim et al. 2020). Again, illustrating overlapping vulnerabilities, African Americans at high risk of severe illness were more likely than Caucasians to live in households containing health sector workers. Among Hispanic adults at high risk of severe illness, 64.5% lived in households with at least one worker who was unable to work at home, versus 56.5% among African Americans and only 46.6% among Caucasians (Selden and Berdahl 2020). More nuanced interpretation of available epidemiological data is warranted, given these poignant examples of how one individual may fall into multiple vulnerable group categories that compound his/her risk.

Similar trends have been identified in Europe. In the UK, African-British and minority ethnic (BAME) groups were most likely to have COVID-19 diagnosed, while the lowest diagnosis rates were in white ethnic groups. Death rates were highest among people in black and Asian ethnic groups. The risk of death among people of Bangladeshi ethnicity was twice that among people of white British ethnicity, while people of Chinese, Indian, Pakistani, other Asian, Caribbean, and other black ethnicity had a 10-50% higher risk of death than white British people (Public Health England 2020). Socio-economic disadvantage, high prevalence of chronic diseases and the impact of long-standing racial inequalities may be key explanations for these findings (Independent SAGE 2020). The age-standardised mortality rate of deaths involving COVID-19 in the most deprived areas of England double those in the least deprived areas (Office of National Statistics 2020).

These health inequities are not limited to COVID-19 diagnosis and mortality. A recent report issued by the Independent Scientific Advisory Group for Emergencies (SAGE) indicates that *"the COVID-19 pandemic is not just a health crisis; it is also a social and economical one, which in turn will also have a longer term impact on health. It is already clear that this burden of the pandemic is not equal across all population groups"* (Independent SAGE 2020). There was a clear socioeconomic gradient in the number of adverse events experienced during the first weeks of lockdown in the UK, with lower socioeconomic status associated with more adverse events, especially those impacting on finances (including loss of employment or decrease in income) and ability to meet basic needs (including access to food and medications) but less for medical consequences of infection (Wright, Steptoe et al. 2020). The first analysis done in Spain, corresponding to Catalonia, shows that the lower the socioeconomic level, the higher the rates of COVID-19 infection and mortality, both among men and women (Agència de Qualitat i Avaluació Sanitàries de Catalunya 2020).

In Spain, at the time of writing, political leaders have selectively confined those in poorer neighbourhoods of Madrid that are experiencing high rates of infection (Blasco 2020). These neighbourhoods have higher proportions of manual workers, people in unstable employment, and migrants with or without legal status in the country. Many in these

neighbourhoods face economic difficulties limiting their ability to buy masks and sanitizing gel or they must access public transport to get to work. They often live in overcrowded houses and are reluctant to visit healthcare centres out of fear of losing their jobs and/or residency. After an intense political battle, Madrid has agreed to use objective indicators to decide which neighbourhoods to confine, independent of their socio-economic status. However, the use of these indicators for enhanced risk control does not address the health determinants underlying the higher prevalence in the first place.

A recently published paper from Australia (Khalatbari-Soltani, Blyth et al. 2020) emphasizes that, *“to identify groups who are most likely to have poor outcomes, high-quality data on socioeconomic factors are urgently needed, which will have important implications in the development of public health measures”*. All the above demonstrate that it is imperative for European regions collect high quality data relevant to population socioeconomic factors with the aim to identify vulnerable groups and facilitate effective healthcare policy.

1.3.3. Identifying vulnerable groups: Which specific groups warrant special attention?

(a) Medically vulnerable, such as the elderly and those with underlying health conditions

The risk of severe COVID-19 if an individual becomes infected is known to be higher in older individuals and those with underlying health conditions. About one in five individuals worldwide could be at increased risk of severe COVID-19 either because of age without an underlying condition or because of underlying health conditions, without consideration of other potentially overlapping risk factors such as ethnicity or socioeconomic status (Clark, Jit et al. 2020).

Elderly people. Aging is related to elevated systemic levels of pro-inflammatory cytokines, including IL-6, IL-8, TNF- α , IL-13, IFN γ , as well as acute phase proteins (Meftahi, Jangravi et al. 2020). Ample studies reported a chronic mild inflammation in aging, which is described as “inflamm-aging” (Meftahi, Jangravi et al. 2020). This phenomenon can promote other age associated disorders, including diabetes mellitus, Alzheimer’s disease, and atherosclerosis-related diseases. These are all conditions that enhance the severity of COVID-19 manifestation. Accordingly, increased generation of pro-inflammatory markers and “inflamm-aging” have a critical role in the process of cytokine storm in severe COVID-19 patients and enhanced mortality risk (Meftahi, Jangravi et al. 2020).

Elderly people are also a vulnerable group in terms of the impact of measures to reduce transmission of the virus. Social isolation among older adults is an important public health concern because of their heightened risk of cardiovascular, autoimmune, neurocognitive, and mental health problems. Social disconnection puts older adults at greater risk of depression and anxiety (Gerst-Emerson and Jayawardhana 2015). Self-isolation will disproportionately affect elderly individuals whose only social contact is out of the home, such as at day care venues, community centres, and places of worship (Santini, Jose et al. 2020). Those who do not have close family or friends, and rely on the support of voluntary services or social care, could be placed at additional risk, along with those who are already lonely, isolated, or secluded. This effect will be felt greatest in more disadvantaged and marginalised populations, which should be urgently targeted for the implementation of preventive strategies (Armitage and Nellums 2020).

People living with disabilities. People living with disabilities, including physical, mental, intellectual, or sensory disabilities, are less likely to access health services, and more likely to experience greater health needs, worse outcomes, and discriminatory laws and stigma. Neurological disorders rank third in terms of disability, accounting for 13% of total DALYs and comprise an important group in the category (Deuschl, Beghi et al. 2020). They might have inequities in access to public health messaging. They might suffer disruptions in service provision (e.g. assistance for delivery of food, medication, and personal care). And they might be at increased risk of infection or severe COVID-19 because of existing comorbidities, and might face additional barriers to health care during the pandemic (Armitage and Nellums 2020).

People with underlying chronic diseases and frailty. The guidelines from the World Health Organization and the European Centre for Disease Prevention and Control (2019) define the prognostic factors for COVID-19. These are: age 70 years and older, cardiovascular disease, cancer, COPD, severe asthma, and diabetes. Chronic disease patients are more vulnerable to severe complications and higher mortality rates have been observed amongst COVID-19 patients with pre-existing conditions across Europe (ECDA 2020, Kluge, Wickramasinghe et al. 2020). Heart diseases are believed to be more important detrimental risk factors for COVID-19 patients than hypertension (Guzik, Mohiddin et al. 2020, Wu and McGoogan 2020). Research has shown that hypertension itself is not a factor for poor prognosis (Schiffirin, Flack et al. 2020). Chronic kidney diseases (CKD) patients are more susceptible to COVID-19 and have worse outcomes than other chronic diseases. COVID-19 adds constant stress for CKD patients because of the need for isolation to prevent and the lower survival chance in case of infection (Hilbrands, Duivenvoorden et al. 2020).

Multiple vulnerability is also present in chronically ill people. Increasing multimorbidity, especially cardiometabolic multimorbidity, and polypharmacy, is associated with a higher risk of developing COVID-19 (McQueenie, Foster et al. 2020). Those with multimorbidity and additional factors, such as non-white ethnicity, are at heightened risk of COVID-19. Hewitt and colleagues (2020) conducted an observational cohort study at ten hospitals in the UK and one in Italy and found that disease outcomes were better predicted by frailty, using the clinical frailty scale (Rockwood, Song et al. 2005), than by either age or comorbidity (Hewitt, Carter et al. 2020). Hence, there is a chance that it is not the diseases themselves, but the impact of diseases on the functional status of the individual that could be the most important indicator of COVID-19 severity.

People who are at risk due to a compromised immune system from a medical condition or treatment (e.g. chemotherapy). People with weakened immune systems are at higher risk of getting severely sick from COVID-19. It is not confirmed yet, but they may also remain infectious for a longer period of time than others with COVID-19 (CDC 2020). For these patients, it is especially important that they maintain access to care and medicines, and that they be encouraged to continue their regular treatment plans, without stopping any medications or treatments.

People with rare diseases. People living with a rare disease have seen their regular access to medical advice restricted and their continuity of care disrupted. This includes routine treatment administration, appointments for screening tests, certain medical and surgical interventions, etc. As rare diseases can be highly debilitating and life threatening, waiting for medical intervention can result in a severe deterioration of symptoms. This may add future strains on healthcare systems due to possible complications. People living with a rare disease are facing issues in exercising their right to cross-border health care provided under relevant EU legislation due to travel restrictions, or because hospitals abroad are cancelling non-COVID-19-related interventions. When ill with COVID-19 themselves, people living with a rare disease may face barriers in receiving health care in the hospital setting as there are no protocols set in place for their care. This is due, in part, to the limited knowledge and scattered expertise on rare diseases (EURODIS 2020).

(b) Socially marginalized, such as those residing or working in certain physical settings prone to high density and reduced ability to physical distance

Several social contexts likely have an impact on vulnerability to COVID-19 and warrant appropriate health policy consideration.

Homeless or under-housed people are exhibiting anxiety, stress and fear about COVID-19, which may be exacerbated by the presence of other health issues. People experiencing homelessness are uniquely vulnerable to contracting SARS-CoV-2, and to experiencing harsher effects of the virus once infected. In the context of COVID-19 spread and transmission, the risks associated with sleeping outdoors or in an encampment setting are different than from staying indoors in a congregate setting such as an emergency shelter or other congregate living facility; the balance of risks should be considered for each individual experiencing unsheltered homelessness. Some people who are experiencing unsheltered homelessness may be at increased risk of severe illness from COVID-19 due to older age or certain underlying medical conditions, such as chronic lung disease or serious heart conditions. Lack of housing contributes to poor physical and mental health outcomes, and permanent housing assistance or provision should continue to be a priority. Furthermore, homeless people who are positive for COVID-19 need to have access to and a safe place to stay, separated from others who are not infected (CDC 2020).

Migrants and refugees. Third-country nationals across the EU have been disproportionately affected by COVID-19 and the European Web Site On Integration tracks the impact of migrant communities on a number of key integration areas (European Commission 2020). The WHO emphasizes that “*protecting the health of refugees and migrants through informed policies and interventions is critically important for public health protections for all citizens*”. To that purpose, in collaboration with the UN System, a consortium of research centres led by Ghent University and University of Copenhagen is implementing a global study to assess the public health social impact of the COVID-19 pandemic on refugees and migrants. As a recent IOM report suggests (IOM 2020), although some migrants may be healthier than their receiving communities, others have health vulnerabilities which can be due to:

- socioeconomic status;
- being in crowded or otherwise suboptimal environments;
- restricted eligibility to or access to services, including health services, for instance due to migration status; or
- cultural-linguistic barriers or health literacy, or general access to health information.

Migrant workers can also be considered as a vulnerable workforce. Foreign born workers, and extra-EU migrants in particular, are more likely to be in temporary employment, earn lower wages, and have jobs that are less amenable to teleworking (European Commission 2020). These factors place them in multiple vulnerability categories.

Identifying possible areas of policy intervention to address these vulnerabilities is warranted.

Residents in long-term care facilities (LTCF) are a vulnerable group. COVID-19-related deaths in LTCF residents represent a significant proportion of all COVID-19 deaths in many European countries (ECDC 2020). There is a need for healthcare policies with a focus on local and national testing, infection prevention and control, and monitoring programmes for COVID-19 in these settings. The aims of such policies include of early identification of clusters, decreasing the spread within and between facilities, and reducing the size and severity of outbreaks (Danis, Fonteneau et al. 2020).

Indigenous populations and geographically isolated people. Indigenous peoples' traditional lifestyles are a source of their resiliency, but large gatherings or living in multi-generational housing with elderly family members may lead to greater risks of spreading infection. Indigenous people also suffer from a relatively high degree of socio-economic marginalization that makes them more vulnerable. Their vulnerability may be enhanced by difficulties accessing medical care or health advice, lack of access to essential services, sanitation, and other key preventive measures, such as clean water, soap, disinfectant, etc. Data on the rate of infection in indigenous peoples are either not yet available (even where reporting and testing are available), or not recorded by ethnicity. There are concerns that indigenous COVID-19 cases are being undercounted (United Nations 2020).

Furthermore, indigenous and geographically isolated people lack access to effective monitoring and early-warning systems, and to adequate health and social services. Food insecurity could become an even greater challenge for indigenous people. Some of them already face food insecurity as a result of the loss of their traditional lands and territories. As the need for mobility restrictions to restrict the spread of infection continues, access to food could become even more difficult. As a result of the loss of their traditional, often land-based, livelihoods, many indigenous people who work in traditional occupations and subsistence economies or in the informal sector will be adversely affected. The situation of indigenous women, who are often the main providers of food and nutrition to their families, is even more dire (United Nations 2020).

Prison population. The WHO indicates that people deprived of their liberty, such as people in prisons and other places of detention, are more vulnerable to COVID-19 outbreaks (WHO Regional Office for Europe 2020). People in prison live in settings in close proximity and thus may act as a source of infection, amplifying the spread of infectious diseases within and beyond prisons. Furthermore, this vulnerable group often experience multiple vulnerability and simultaneously belong to other vulnerable groups.

Sex workers. Sex workers must not be forgotten in the COVID-19 response (Platt, Elmes et al. 2020). Sex workers are among the most marginalised groups since direct sex work has largely ceased as a result of physical distancing and lockdown measures. This group presents also high rates of poverty, unemployment, food insecurity and homelessness, while a high prevalence of sexual-transmitted diseases enhances their vulnerability.

LGTBI people. *Lesbian, gay, transgender and bisexual* (LGTBI) people is a group of people that are commonly left out when we are addressing vulnerability for COVID-19. They may simultaneously belong to other vulnerable groups. Transgender women with HIV may be particularly vulnerable to pandemic harms (Poteat, Reisner et al. 2020). LGTBI-led organisations' response to this crisis serve as an important model for effective community-led interventions.

People with substance use disorders. There is an active discussion about the vulnerability of people with substance use disorders, specifically because of the effects of certain drug use on respiratory and pulmonary health (Volkow 2020). Individuals with opioid use disorder (OUD) and methamphetamine use disorder may experience increased vulnerability, and may simultaneously belong to other vulnerable groups such as the homeless or incarcerated individuals. Smoking tobacco is associated with chronic diseases and, in general, with multiple vulnerability, and thus may be a determinant of severe COVID-19. Vaping and the use of marijuana may also increase vulnerability to severe COVID-19.

Children in low-income families. Children living in temporary accommodation or homeless are susceptible to viral infection because of pre-existing conditions (e.g., diabetes, asthma, epilepsy, anxiety, depression) (Story 2013), and rarely have the ability to self-isolate and adhere to physical distancing, with previous extreme inequalities and inequities in accessing health care exacerbated (Rosenthal, Ucci et al. 2020). School closures could affect poor children through food insecurity and worse educational outcomes in particular. While learning might continue unimpeded for children from higher-income households, children from lower-income households are likely to struggle to complete homework and online courses because of their precarious housing situations (Van Lancker and Parolin 2020). The current health crisis could become a social crisis that will have long-lasting consequences for children in low-income families. Moreover, child protection is at stake. With the disruption imposed on communities and families, children already at risk of violence and abuse will find themselves even more vulnerable (The Lancet 2020).

(c) Mentally/psychologically vulnerable

The mentally/psychologically vulnerable is an important group since it includes people with pre-existing mental health disorders and those who are more vulnerable because of the psychosocial effects of this syndemic. The mentally ill group includes those with psychosocial and intellectual disabilities who live in care homes, psychiatric hospitals and other forms of residential institution (WHO, 2020). The WHO Mental health, human rights and standards of care report describes adults with psychosocial and intellectual disabilities living in institutions in the WHO European Region as “*a highly marginalized, vulnerable group whose quality of life, human rights and re-inclusion in society are compromised by outdated, often inhumane institutional practices*” (WHO Regional Office for Europe 2018). Furthermore, the psychologically vulnerable include “*people who contract the disease, those at heightened risk for it (including the elderly, people with compromised immune function, and those living or receiving care in congregate settings), and people with pre-existing medical, psychiatric, or substance use problems are at increased risk for adverse psychosocial outcomes*” (Pfefferbaum and North 2020).

Healthcare providers may become psychologically vulnerable as a result of emotional distress caused by potential exposure to the virus, shortages of personal protective equipment, their intensive work that requires longer work hours, and the need to make decisions involving emotional and ethical dilemmas (Pfefferbaum and North 2020). Older adults, especially those in isolation and those with cognitive decline/dementia, may also become more psychologically vulnerable, e.g., anxious, angry, stressed, agitated and withdrawn during the outbreak or while in quarantine.

(d) Professions which entail closer proximity to confirmed or suspected COVID-19 cases

Essential workers. Many low wage earners have also been classified as essential workers, particularly in retail, food and transport. Their continuing work has contributed to wider social good, but, at times, they were given inadequate protection. As well as increasing their risk of exposure by working outside the home, and, for some, needing to travel on public transport systems, low wage earners may return home to cramped housing conditions, putting their household members at greater risk (Bibby, Everest et al. 2020).

Healthcare and social care workers. Following the outbreak of COVID-19, there is evidence that healthcare workers may suffer from various conditions related to their frontline involvement, such as significant levels of anxiety, depression or insomnia (Pappa, Ntella et al. 2020). The imperative of caring for patients is contradicted by the immediate presence of a virus with human-human transmission and no specific lifesaving treatment (Santarone, McKenney et al. 2020). Being forced to handle life-threatening

conditions while simultaneously putting one's own life at risk provokes a palpable sense of danger. Other workplace stressors for physicians and nurses during COVID-19 resulted from extended shifts with increased volume and severity of patients. Hence, it must be a priority to monitor the physical and mental health issues of the frontline workforce to safeguard their wellbeing and ability to perform under stressful conditions, beyond the provision of protective equipment and sufficient testing.

The vulnerability of nursing home workers is especially extreme. In the UK, when adjusted for age and sex, social care workers have twice the rate of death due to COVID-19 compared to the general population (Health Foundation 2020). Social care workers are often poorly paid and have short-term contracts. The sector is also largely fragmented, with thousands of organisations providing care, and concerns being raised about adequate provision of personal and protective equipment for staff in care homes. Social care workers often need to have very close physical contact with those they care for, and in care homes many people live in the same building or facility. This makes transmission of the virus among staff and residents more likely.

(e) Economically vulnerable

This category includes individuals with low incomes who may or may not belong to other vulnerable groups. The relationship between poverty and COVID-19 contagion has received considerable attention. Evidence from US indicates that *"...early in the pandemic counties with higher rates of poverty, and deep poverty, as well as those with less social mobility, lower life expectancy, a higher percent of low birth weight babies, and more urban counties had greater numbers of confirmed COVID-19 cases, but this trend shifted by April 1, 2020 in much the same manner as for the overall poverty index..."*(Finch and Hernández Finch 2020). Although several factors, including the possibility of treatment and availability of health care, could be considered as potential confounders, these individuals whose economic vulnerability may be exacerbated by income loss as a result of restrictions to contain the virus, deserve the attention of policy makers and the healthcare systems. Some of these individuals will become even more vulnerable in the aftermath as a result of losing jobs, being forced to accept less than adequate working conditions, experiencing reduction of income, and/or having greater needs for health care (impact on mental health, impact of deterred care, etc.) (Santarone, McKenney et al. 2020).

A key question is **how we can measure vulnerability** and to what extent there are prognostic tools. The answer to this question is of high importance, given that it could serve to inform health policy and management of the syndemic. A number of clinical risk prediction scores are currently available for use in the community. In April 2020, a report from the Centre for Evidence-based Medicine in Oxford described several such tools.

Although some of them had been validated, there is limited empirical evidence to support many of them. Thus, it is still unknown why some people experience severe COVID-19 illness, especially regarding the interactions of multiple vulnerabilities. Similarly, the extent to which the known and widely discussed risk factors are exclusively accountable for COVID-19 severity, or what other factors may increase a person's risk, is poorly understood. In US, the CDC is currently working to identify risk factors for severe COVID-19 illness through a variety of investigations, including the following:

- Investigation of people with COVID-19 who have symptoms vs. people with COVID-19 who do not have symptoms.
- Investigation of people hospitalized with COVID-19 vs. other groups.
- Investigation of people with COVID-19 requiring Intensive Care Unit (ICU) admission vs. other groups.

A final question is the extent to which people with known vulnerability/vulnerabilities will experience serious consequences if infected by SARS-CoV-2. What factors may be considered to be protective? More research and evidence to grade vulnerability is needed, and then translational methods are required that permit the use of this information in a timely manner to assess the risk of severe disease in the population. Lastly, high-level synthesis of these actions must lead to appropriate health policy changes and healthcare system responses that adequately address the needs of society's most vulnerable groups.

1.3.4. Exploring the impact of virus transmission control measures on vulnerability

The impact on human rights and health equity and further vulnerability

The Executive Committee of the International Human Rights Network argued that *"COVID-19 poses a threat to all members of the global community, but particularly to society's most marginalized and vulnerable members...We call upon governments and others working to confront the pandemic to make human rights protection a central part of their efforts"* (International Human Rights Network 2020).

As an example applied to a specific vulnerable group, in June 2020, the ECDC approved guidance on infection prevention and control of COVID-19 in migrants and refugees' reception and detention centres in the EU/EAA and in the UK (ECDC 2020). The guidelines included *"Providing free and equitable prevention, testing, treatment and care to migrants and refugees in settings of reception and detention is critical at all times, but particularly in the context of COVID-19"* and *"Migrant and refugee reception and detention centres should be given priority for testing, due to the risk of rapid spread of SARS-CoV-2 in these settings"*. Regarding measures to restrict virus transmission, the guidelines emphasize that *"there is no evidence that quarantining whole camps*

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effectively limits transmission of SARS-CoV-2 in settings of reception and detention, or provides any additional protective effects for the general population, outside those that could be achieved by conventional containment and protection measures". A recent outbreak following a fire in a refugee camp in Lesbos, Greece highlights how important this guidance is (BBC 202).

As described previously, measures that have been undertaken to protect the spread of infection could negatively impact several vulnerable groups, and an extreme example is that of the lockdown. Mezzina and colleagues (2020) highlight that *"There is a risk of greater self-isolation for those who are unable to comply or cope with emergency conditions and their vulnerabilities may be exacerbated during prolonged social isolation that 'lockdown' entails. Some individuals with serious mental health problems have also disappeared from services, holed up in houses, hospitals, supported accommodation and prisons"*. Vulnerable groups may be experiencing heightened distress for many reasons - they are physically distanced from loved ones and peers, they are facing economic turmoil having lost or being at risk of losing their income and livelihoods, and/or they are upset by frequent misinformation and disinformation about the virus. Thus, the cycle of distress is sustained, resulting in increased possibility of mental health problems requiring more immediate attention.

Domestic violence has increased. In the first weeks of the lockdown, emergency numbers for domestic violence recorded an 18% increase in calls in Spain and a 30% increase in France. The public health response to COVID-19 must safeguard people in the community (The Lancet 2020). Online home working has proved to be much more challenging for women when they have to take care of children in the house and meet their children's education needs, or take care of other dependents (Staniscuaski, Reichert et al. 2020). Moreover, low skilled workers are predominantly female; 70% of health workers around the world are female, as are many food-shops workers, cleaners, social care workers, and nursing-home staff (Instituto de la Mujer, 2020).

The impact on healthcare services and receipt of health care

Shortages of hospital beds and lack of availability of healthcare workforce were among the consequences of the pandemic. Diagnosis and treatment of many diseases was postponed. The COVID-19 outbreak had a profound impact on cancer care and care for cardiovascular and chronic neurodegenerative diseases, among others. Cancer screening was suspended, routine diagnostic work deferred, and only urgent cases were accepted for diagnostic interventions (Maringe, Spicer et al. 2020). Moreover, restricting in-hospital visits delayed not only diagnoses but also complex therapies such as surgery, radiotherapy, and chemotherapy/immunotherapy (Hanna, Evans et al. 2020). All this has led to substantial increases in the number of avoidable cancer deaths.

These issues are not limited to oncological patients and not necessarily due to restrictions in healthcare delivery. Receipt of health care for non-COVID-related issues decreased in general. Many countries have reported a substantial drop in the number of patients attending the hospitals due to fears of becoming infected, among other reasons. Specifically, there has been a dramatic reduction in the number of hospitalizations of cardiovascular patients needing acute interventions e.g., for myocardial infarction (Lantelme, Couray Targe et al. 2020, Mafham, Spata et al. 2020). As a result, there have been increases in out-of-hospital deaths and increases in the frequency of long-term complications because of missed opportunities to provide preventive treatment for cardiovascular patients.

The impact on professional development and training

The responses to COVID-19 may represent an opportunity for innovation and transformation of medical school curricula to promote the advancement of telehealth, adaptive research protocols, and clinical trials with the aim to protect vulnerable groups and reduce severe COVID-19 illness among them (Rose 2020). There is a need for the development of curricula oriented at team-based work with a focus on health promotion and disease prevention, as well as facilitating health behaviour adoption to reduce or counteract vulnerability (Expert Panel on effective ways of investing in Health 2019). The Association of European Self-Care Industries (AESGP) stresses that health literacy has a decisive role in healthy lifestyles and behaviours, while *"it empowers people to decide when to practice self-care to manage common symptoms and when professional care should be sought"* (AESGP 2020). Educational curricula should train health and social care students in communication and motivation skills. A high priority should be placed on ways to enhance people's health literacy. In addition, medical curricula must be more focused on the management of multimorbidity, since increasing multimorbidity, especially cardiometabolic multimorbidity, and polypharmacy are associated with a higher risk of developing COVID-19 (McQueenie, Foster et al. 2020).

Transformation of the existing training and professional development courses must occur within a framework of patients' rights and safety. The American Medical Association (AMA) *Code of Medical Ethics* calls *"on physicians and the profession to advocate for fair policies that "protect the most vulnerable patients and populations"* (Opinion 11.1.1). In Opinion 11.1.4., on Financial Barriers to Health Care Access, it calls *"on medicine and its practitioners to work to ensure that societal decisions about the distribution of health resources safeguard the interests of all patients and promote access to health services."* While in Opinion 8.11, on Health Promotion and Preventive Care, it invites physicians *"to promote health through a collaborative, patient-centred process that promotes trust"*. It

encourages the profession to “*advocate for community resources designed to promote health and provide access to preventive services*”.

1.3.5. Sustaining healthcare provision for vulnerable groups

It is well understood that COVID-19 could impact everyone in the society in a different way. However, society’s most vulnerable are at the greatest risk. There is a clear necessity for a national commitment to reduce social and economic inequalities to achieve greater health equity (Marmot and Allen 2020). There is concern regarding the extent to which social inequalities may be exacerbated. Thus, it is essential to identify and establish “*...the longer-term public health policy responses needed to ensure that the COVID-19 pandemic does not increase health inequalities for future generations*” (Bambra, Riordan et al. 2020). The work to prepare, treat, reduce transmission and innovate must occur under the health equity lens (Smith and Judd 2020).

This work, at a fundamental level, is grounded in rights and respect for the individual. In particular, in Table 2 below, Guterres (2020) describes how healthcare systems must respect the rights and dignity of older people, and his four key messages apply to individuals experiencing vulnerability of any type.

Table 2 Grounding healthcare system transformation in respecting the rights and dignity of older people, expanded to individuals experiencing any vulnerability

“First, no person, young or old, is expendable. Older people have the same rights to life and health as everyone else.

Difficult decisions around life-saving medical care must respect the human rights and dignity of all.

Second, while physical distancing is crucial, let’s not forget we are one community and we all belong to each other. We need improved social support and smarter efforts to reach older people through digital technology.

That is vital to older people who may face great suffering and isolation under lockdowns and other restrictions.

Third, all social, economic and humanitarian responses must take the needs of older people fully into account, from universal health coverage to social protection, decent work and pensions.

The majority of older people are women, who are more likely to enter this period of their lives in poverty and without access to health care. Policies must be targeted at meeting their needs.

And fourth, let’s not treat older people as invisible or powerless.

Many older people depend on an income and are fully engaged in work, in family life, in teaching and learning, and in looking after others. Their voices and leadership count.

To get through this pandemic together, we need a surge in global and national solidarity and the contributions of all members of society, including older people.

As we look to recover better, we will need ambition and vision to build more inclusive, sustainable and age-friendly societies that are fit for the future”.

Source: Antonio Guterres (2020)

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In a communication to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions entitled “*Short-term EU health preparedness for COVID-19 outbreaks*” (European Commission 2020), the European Commission proposes 4 actions areas to advance sustainable healthcare provision for vulnerable people:

- (a) Design and implement specific high density, low threshold testing strategies for vulnerable groups and settings;
- (b) Sharing best practices in supporting COVID-19 prevention, testing and care in socially marginalized groups and medically vulnerable groups and settings;
- (c) Sharing of best practices and provision of mental health and psychosocial support to vulnerable prone to COVID-19;
- (d) Provision of specific online trainings to frontline staff working with vulnerable groups.

To progress in these action areas, healthcare systems need the capacities described in Section 1.2. The following capacities are particularly relevant:

- (a) Capacity and ability to determine relevant knowledge and good practices as related to vulnerable groups by underlying all available local and regional resources and as well as appropriately adapting them into the available levels of health literacy and local culture.
- (b) Capacity and ability to manage interdependence and cooperation of different actors by making effective links between health, mental and social care. Two groups requiring such inter-sectoral cooperation include migrants and refugees, and as well as people who are living in nursing homes.
- (c) Capacity and ability to separate people and patients at risk and infected from other patients.
- (d) Capacity and ability to procure and distribute the necessary resources to the vulnerable groups either at the community level or at the level of institutional care.
- (e) Ability to retain, prepare and flexibly increase staff capacity who serve vulnerable groups, especially those delivering social and mental health care.
- (f) Capacity and ability to protect mental health of people in vulnerable groups and their caregivers.
- (g) Capacity and ability to spread the load across facilities by strengthening the integration between primary and inpatient health and social care.

All the efforts to develop these capacities must be sustained and certainly there is an important structural/systemic component in the concept of ‘vulnerability’. Effective resilient health and social care organisation to meet the needs of vulnerable groups must necessarily address issues of the wider health eco-system.

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Based on the relevant capacity blocks, healthcare systems should identify and agree on a number of indicators to assess performance in these areas at a national level. For instance, protection and support for vulnerable and neglected populations in the community was proposed by Fisher and colleagues (2020). Such indicators can be incorporated into a resilience test of the healthcare system, as will be described in the next section.

1.4. Resilience testing of healthcare systems

This section of the Opinion serves to operationalize the practicalities of developing and implementing a resilience test. It provides an operational definition of resilience, overviews the concept of resilience testing, suggests a toolkit of standardized materials that can be used, and proposes a roadmap for implementation of resilience testing of healthcare systems in Member States.

1.4.1. Operational definition of “resilience” for resilience tests

Resilience is defined in the mandate as “the ability and capacity of health systems to absorb, effectively respond and adapt to shocks and structural changes, while sustaining day-to-day operations”. This definition was expanded in prior sections to emphasize the role of the health system’s ability to transform. The transformative capacity is supported by conceptual frameworks in the literature (Thomas, Keegan et al. 2013, Blanchet, Nam et al. 2017). The Expert Group on Health Systems Performance Assessment uses the following working definition of resilience, one that specifies the aims of a resilient health system in the context of potential shocks and structural changes: *“Health system resilience describes the capacity of a health system to (a) proactively foresee, (b) absorb, and (c) adapt to shocks and structural changes in a way that allows it to (i) sustain required operations, (ii) resume optimal performance as quickly as possible, (iii) transform its structure and functions to strengthen the system, and (possibly) (iv) reduce its vulnerability to similar shocks and structural changes in the future”*.³ The crux of this definition is transformation to ensure optimal health system performance in the long term. This is quite fitting for a resilience test of a health system. Resilience is understood as an emergent property arising from the health system inputs/outputs/outcomes framework described in Figure 4 that depends on the system’s ability to absorb, adapt, and transform after a shock or structural change impacts inputs, outputs, and/or outcomes.

To further operationalize the definition of resilience for use in a resilience test that examines health system change over time, three key components can be identified: (1) the stressor, in the form of a shock or structural change; (2) the health system, which is both the recipient of the stressor and the actor who must lead the response to the stressor; and (3) the response, which includes adaptation and maintenance of function. Each of these components will be briefly described in order to provide a common

³ The HSPA report will be published at https://ec.europa.eu/health/systems_performance_assessment/priority_areas_en

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understanding of resilience over time and clarify the assumptions that underlie the proposed resilience test for health systems espoused in this section.

The stressor is a stimulus, or combination of stimuli, that threatens system function. The stimulus may be introduced into the system from an external source or be a consequence of changes within the system itself. There are many dimensions that could be used to classify stressors. The definition in the mandate contrasts two types of stressors - a shock vs. structural changes. A *shock* is an unpredictable acute stimulus requiring immediate response, whereas structural changes refer to chronic stressors threatening the system, such as lack of qualified professionals or an ageing population. With respect to resilience testing of health systems, the mandate is primarily directed at the response to a shock to the system, involving “unpredictable high-pressure scenarios” requiring immediate action. However, a resilience test of health systems could involve stressors of different types, including shocks, structural changes, and/or other stressors.

The health system is defined by the WHO, as “*all the activities whose primary purpose is to promote, restore, or maintain health*” (WHO 2020). It further refers to “*the people, institutions and resources, arranged together in accordance with established policies, to improve the health of the population they serve, while responding to people’s legitimate expectations and protecting them against the cost of ill-health through a variety of activities whose primary intent is to improve health*” (WHO 2000). The health system consists of the inputs/outputs/outcomes as described in Figure 4. These inputs/outputs/outcomes may play passive or active roles. It is the recipient of the stressor, as the system that experiences the consequences of the stressor and its downstream effects. It is also the actor, which must proactively lead the active response to adapt to the stressor, monitor the impact on inputs/outputs/outcomes, and eventually support system transformation. As the consequences of the stressor can have eco-bio-psycho-social dimensions, the health system and its actors are conceptualized within a larger ecosystem of interconnected stakeholders, including those in the social, political, and educational arenas. The eco-system extends beyond Member States and includes cross-border, pan-European, and global perspectives. This idea of the health system as one part of the whole emphasizes the context-dependent nature of its response. As a result, a resilience test of health systems must involve individualized assessment involving multiple stakeholders, within a framework that balances stability and flexibility to provide added-value for any Member State’s health system.

The response to a stressor involves both a passive component (impact) and an active component (action). A stressor will generate an immediate impact on the system, and the passive component of the response reflects these changes in system function with respect to inputs/outputs/outcomes. Some of these passive consequences will create

additional stressors on the system, which will in turn elicit other changes in system function. An understanding of these mechanisms points to critical levers that become key indicators for the resilience test in practice. The response also refers to an active component - the adaptive actions taken by the system to counteract the stressor and its downstream effects on inputs/outputs/outcomes. Therefore, a resilience test of health systems must simultaneously examine the impact of the stressor on the system over time, the mechanisms or levers via which the stressor acts, and the measures implemented to mitigate these effects. As described earlier in the Opinion, Figure 6 illustrates the impact of two shocks and one structural change on the inputs/outputs/outcomes framework.

1.4.2. An overview of resilience tests for health systems

The approach to a resilience test that can assess a health system builds partially on the experience of stress tests in the banking sector, which are carried out regularly around the world. Their purpose is to identify risks and implement measures to address them. Some results are made public, with the transparency enabling public pressure to respond. Political pressure for improvement may also be generated.

In translating this concept of bank stress tests to resilience tests for health systems, it is important to highlight that a resilience test is not a performance assessment of the health system and does not serve to rank member states in terms of resilience. Instead, the resilience test addresses the perceived impact of adverse scenarios on the functioning of the health system and assesses the perceived extent to which the health system will be able to maintain its functions and objectives (e.g., inputs/outputs/outcomes). Thus, a resilience test implies a forward-looking exercise of coping with plausible and severe adverse events. It works as a “what-if” analysis. Furthermore, similar to a prudential stress test of banks, a resilience test on a health system implies that the interest is in system-wide effects, not on the impact on specific healthcare institutions and how they individually cope in adverse scenarios. In other words, it tests the health system as a whole, with its inter-connected parts, which is often more than the sum of the impacts on individual entities. Following from a health systems approach framework, a resilience test looks to capabilities of the population, for instance with respect to health literacy and social cohesion, to contribute a positive response should a stressor appear.

At the same time, the resilience test should produce actionable results. The modifiable risks identified need to be linked with strategies for improvement by those involved in carrying out the test. This corresponds to the transformative capacity of the health system. Policy levers and/or other change mechanisms become clearer via the resilience test to facilitate this improvement. Moreover, key stakeholders with the capacity for

creating change and implementing improvement are involved carrying out the resilience test. Finally, just as bank stress tests occur under external peer review, authorities and experts from other member states (or regions) can participate in the resilience test process. In this way, an international learning community is formed to support health system strengthening and responsiveness to shock(s) and structural change(s). A resilient test fosters strategic resilience. In other words, throughout the resilience test process, health systems identify their strengths and weaknesses and determine what they need to accomplish to better prepare for specific stressors, such as a future epidemic, for example.

In this Opinion, the Expert Panel aims to establish the approach and the necessary components that could be used in viable resilience tests. As emphasized earlier, such a test must involve both standardized and individualized assessment so that the results can be valuable to both the Member State being assessed and the other Member State health systems. Therefore, implementation requires (1) a toolkit of standardized materials, and (2) a detailed implementation plan describing the practicalities involved in using the toolkit and carrying out a resilience test in a similar fashion across Member States. In this section, a toolkit is outlined that provides (a) an example adverse scenario with supporting references for more detailed development, (b) a table of dimensions of shock characterization to assist the health authorities in selecting the adverse scenarios to use in the resilience test, and (c) a sample list of qualitative and quantitative indicators to be assessed. Then, an innovative roadmap for resilience test implementation in various phases is described.

A general overview of the resilience test process will help set the stage for understanding the descriptions of the toolkit to follow. Detailed descriptions of the resilience test implementation process will be elaborated after the toolkit is described.

The resilience test of a health system must involve more than an assessment of quantitative indicators. Therefore, the resilience test involves both qualitative and quantitative data collection by key informants. The resilient test must “belong” to the Member State. Therefore, the resilience test occurs via a collaborative process that is led by either Member State health authorities and/or an international support team established specifically for the purposes of providing oversight through the resilience test process. In a preparatory phase, the test owners in a given Member State (e.g. national or regional health authorities) adapt the adverse “what if” scenarios in the toolkit to their own context. They select which scenarios represent the most appropriate stressors for their health system. Then, different groups of key stakeholders meet in groups with a trained facilitator. In these groups, they discuss various indicators of system function. The indicators measure relevant aspects that contribute to resilience, not only from a

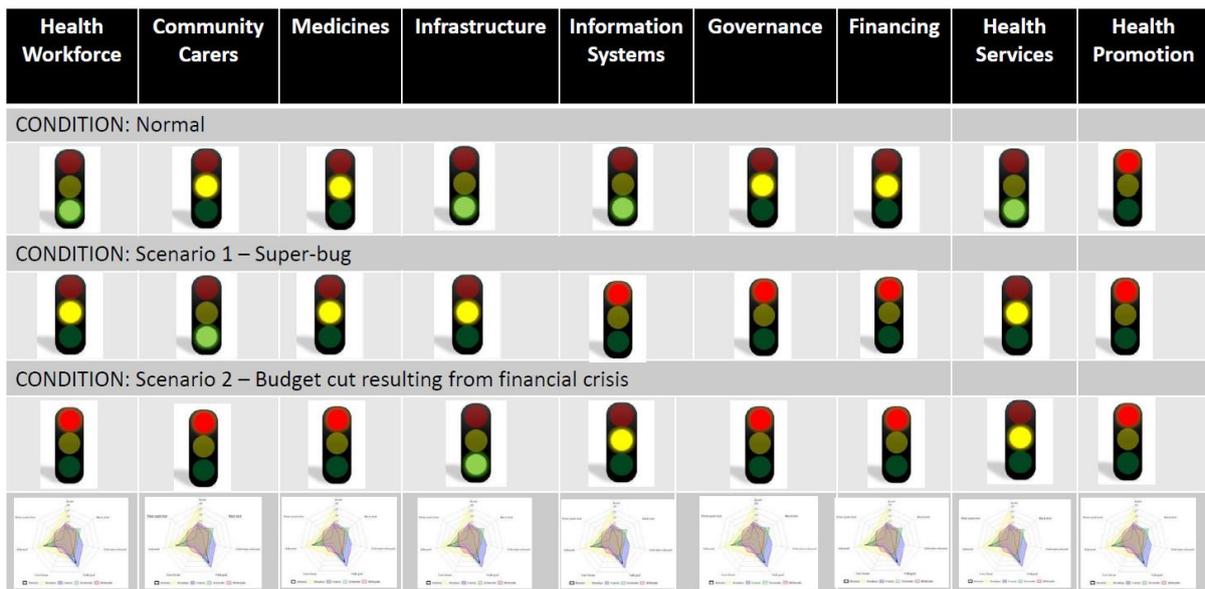
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theoretical perspective, but also a practical one (e.g., stocks of PPE, number of adequately skilled staff, mechanisms to enhance testing capacity in the short term, capacity to mobilize assistance from neighbouring countries). They assess the indicators under “normal” conditions, without the presence of any stressor, to offer a baseline reading. They then re-assess the indicators, and additional indicators, during the “what if” analysis of adverse stressor scenarios in order to determine the extent to which they perceive each would be impacted or activated. The qualitative data generated in the focus groups is the basis for quantification of the indicators, which is supplemented by available quantitative data. Both quantitative and qualitative data is gathered throughout the resilience test implementation process, and high value is placed on the process of qualitative data collection in the resilience test.

Indicators are scored and, using weights that are customized to each Member State health system, an assessment of hypothesized functioning of each input and output building block is produced under different scenarios. One of the products of the resilience test is a quantitative scorecard that visually displays resilience test results in the form of stoplights (red, yellow, and green) for each key area. The purpose of the scorecard is to offer a snapshot view of the health system building block functioning under stress. Green indicates that the building block is functioning well in the given condition and is likely to weather the stressor. Yellow suggests some deficiencies in that building block and caution is warranted. Red indicates that the building block is not functioning adequately and/or is not expected to weather the stressor. See Figure 10.

Figure 10 One outcome of the resilience test: A sample scorecard

Sample Scorecard for a Resilience Test of a Health System



The bottom row of the scorecard uses radar plots to show how specific lower-level indicators within a building block change across scenarios. The scorecard could be provided in the form of a dashboard. The scorecard is not the end product of the resilience test. It is one of the resilience test results that is shared with stakeholders who were and were not involved in the process. All stakeholders engage in critical reflection of the results and participate in action planning to strengthen those weaker areas of function under stress (e.g. the red or yellow lights). This is the transformative aspect of the resilience test that ensures long-term improvements in the health system and fosters strategic resilience.

1.4.3. Toolkit materials 1: Adverse scenarios

One of the essential components of a resilience test toolkit is the set of adverse “what if” scenarios. In order for the resilience test of health systems to be as accurate as possible, adverse, realistic “what if” scenarios must be fully developed. Those scenarios which contain stressors that Member States believe they will have to face in the future will be the most effective resilience test scenarios. Box 4. describes the basic elements of one possible adverse scenario – that of a “super-bug” outbreak. The example would need to be more fully developed following, for instance, tabletop exercise methodologies (see ECDC (2018)). The toolkit includes instructions for the test owner in the Member State to customize each example to his/her context, thus making the scenario relevant for that Member State’s health system.

Box 4 Example of basic elements of a resilience test adverse scenario: A “super-bug” outbreak

Example to developed in the preparatory Phase 0 of resilience test implementation and relationship with in later phases

“On any given day, about one in 31 hospital patients has at least one healthcare associated infection”, CDC.

The health system of country ‘x’ is characterized by [fill in specifics of the country]. The hospital sector has ‘y’ hospitals, which employ ‘L’ workers overall. Every year ‘n’ patients are admitted into hospitals for various treatments, totaling ‘w’ days of stay.

In a recent census of healthcare-associated infections in hospitals, it was found that 30% [or any other high number] of patients were affected by a particular species of multi-resistant bacteria. The reported mortality rate is 15%. The mode of transmission of infection of this infection is not yet fully understood, though contact with contaminated surfaces seems to be dominant.

Closure of affected areas to control the outbreak through extensive cleaning is deemed necessary by experts. This means a shutdown of an estimated 35% of hospital capacity for a period of 10 to 14 days. The cleaning process entails considerable additional costs, with a 50% chance of a second cleaning procedure being required depending on results following the first cleaning procedure.

Closure of hospital facilities will prevent admission and outpatient visits by new patients to affected facilities.

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Health authorities have to decide how to best control the “superbug”. The main question is how to achieve such control and resume normal activity levels of healthcare providers with the lowest cost to the population.

In the **preparatory Phase 0 of resilience test implementation**, the adverse scenario is populated with data and information specific to the Member State health system. The test owner, in collaboration with the external staff supporting the resilience test implementation process, discuss which particular issues are important to address in the response to the superbug. The toolkit will suggest initial areas of concern, which may or may not have indicators attached, and allow for inclusion of new elements as required after discussion.

In **Phase 1**, qualitative data is collected to explore potential responses to this adverse scenario depending on the perspective of the key stakeholders. Groups of separate key stakeholders would meet with a trained facilitator who would guide them to the most relevant aspects of the adverse scenario, depending on their role. In other words, hospital managers, senior clinicians in hospital care, primary care physicians, allied health professionals, social care providers, would meet separately to discuss their decisions and the impact of the scenario from their perspective.

Potentially relevant questions for **hospital managers and senior clinicians** include: Is it possible, given funding and capacity constraints, to interrupt activity for cleaning? What are the consequences for different key stakeholder groups in the various scenarios? Is there flexibility in finding alternative treatment settings, including use of ambulatory settings or primary care? Is it necessary to implement new training for health workers or new processes, or do existing processes, such as cleaning, just need to be enforced? What issues need to be considered regarding presentation of the situation to the public need?

Potentially relevant aspects for **patient groups, managers, clinicians, political decision makers**, etc. include a discussion centered on vulnerable groups: The closure of hospitals is likely to affect some groups more than others. What mitigating measures are needed?

Potentially relevant aspects at the **governmental level** for political decision makers, hospital managers, and clinicians include a discussion on governance and communication: Public opinion and polls ahead of a general election in 9 months has increased pressure on the Minister of Health to act decisively. In the cabinet of the Minister, a decision has to be made regarding centralizing decisions made concerning hospitals, as well as the communication strategy, or taking a decentralized approach, leaving decisions to individual hospitals. A task force has to advise on this issue. On the communication front, should each hospital develop its own communication plan or should decisions be centralized in some way? Who leads or coordinates efforts in this respect? What information should be released to the public?

Available quantitative data on key indicators can be incorporated into the qualitative discussions as appropriate by those stakeholder participants with relevant knowledge.

In **Phase 2**, test owners search out additional quantitative data. If necessary, the results from each group (which were convened separately and simultaneously) would be shared in a second discussion group of key stakeholders. The group can revise their previous views. A joint meeting with all stakeholder participating in the discussion groups can be considered to achieve consensus on the most likely reaction of the health system and the likely outcomes associated with that reaction.

In **Phase 3** of the resilience test implementation process, test owners and external support staff synthesize all available data from the individual groups. They assign weights to the indicators based on the data from the discussions, score the indicators, and determine a summary score in each input/output area for the scorecard.

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Phase 4 is the transformation phase, in which results are presented to stakeholders who were and were not involved in the resilience test implementation process. A debriefing exercise is conducted by the trained facilitator who asks small groups of participants in various roles about the evolution of their views and to identify possible and desirable actions by all actors in the field. An action planning owner is identified who leads a collaborative process to act recommendations from key stakeholders to strengthen health system resilience to similar adverse scenarios in the future.

The adverse scenario and discussions would need to be customized to each Member State as part of the phases of resilience test implementation and aligned with the inputs/outputs/outcomes framework and building blocks. For instance, as part of the preparatory Phase 0 of resilience test implementation, the “super-bug” scenario might be customized by adding tables of data indicating how different hospitals in the country are being affected. A fictitious letter or report from the administration at an important hospital in the country and addressed to health authorities could specify their experience and request closure. Regarding the cleaning procedures, the scenario could include descriptions of three possible technologies that could be used, along with costs and timeline for procurement. A report describing the human resource capacities required for the clean-up could be added. Each scenario would be accompanied by a list of concrete questions so that country-specific characteristics// are fully incorporated (see Box 4.). The purpose of the scenario specifications is to specify the “right questions” that guide the test owner to examine the necessary aspects of system functioning, which occurs in the preparatory phase of implementation.

Each resilience test involves at least two adverse scenarios, so the toolkit should contain at least five to choose from. Other examples of possible adverse scenarios to be developed could include shocks such as an earthquake, or water poisoning by unknown biological agent that affects multiple organs and leads to death over time (slow burn of two months) or permanent mental health problems. Additional scenarios might address “structural changes”, such as a sudden budget cut in healthcare as a result of financial crisis because of the economic impact of coping with COVID-19, steadily increasing privatisation of a health system that impacts accessibility, or a decrease in quality due to corruption. Figure 6 (from the beginning of the Opinion) illustrates the differential impact of an outbreak shock vs. a shortage of workers as a structural change on inputs/outputs/outcomes. These options could be considered for further development as adverse scenarios to ensure strategic resilience under diverse conditions.

1.4.4. Toolkit materials 2: Identification and classification of shocks

The development of adverse scenarios for the toolkit could be guided by a classification system of shocks. Table 3 offers a heuristic to begin to consider the many types of

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shocks and how they might vary on different dimensions. Four dimensions – time, expansion, origin, and impact – have been initially proposed, but further work might verify and expand this table. As shown in Figure 6, different shocks differentially impact inputs/outputs/outcomes. Additional work might link the shock dimensions to their area of impact. With further development, adverse scenarios may be able to be mapped to shock dimensions, impacts, and mechanisms. Test owners in Member State health systems could then use this type of advanced resilience testing framework to help them to select the appropriate adverse scenarios for their health system.

Table 3 A heuristic: Four dimensions of classification of shocks to a health system

Dimension 1	Time	Dimension 2	Expansion	Dimension 3	Origin	Dimension 4	Impact
Onset	Rapid Slow	Human being	Systematically Locally	Creature	Human Plant Animal Microbe / Virus	People	Individual Population Patients Staff
Occurrence	Complete Gradual	Geographical	Local Regional National Continental Global	Particle	Non-synthetic Synthetic	Non-human life	Animal/Species Plant
Continuity	Acute Chronic	Elemental	Air Water Terra Ice Vapor	Nature	Air Water Terra Ice Vapor	Infrastructure	Technical Logistical Medical Non-Medical Pharmaceutical
						Systems	Society Political Health

1.4.5. Toolkit materials 3: Key indicators for each building block and corresponding discussion questions

Another essential component of a resilience test toolkit is the set of key indicators for each building block and the corresponding discussion questions. As emphasized previously, the resilience testing process depends heavily on the collection of qualitative data via focus groups with key stakeholders. The information collected is then quantified according to the key indicators and used for score card generation. The indicators must emphasize the essential functions of a health system and the critical functions of a system under stress. They include input and output areas specified in the inputs/outputs/outcomes framework in Figure 4. Sample indicators can be found in Appendix 1. Once data collection for the resilience test has concluded, the test owners in collaboration with an external support team engaged in the resilience testing processes across Member States will rate each indicator on a 4-point Likert scale under normal conditions (in the absence of a stressor) and in each adverse scenario. A Likert-scale is more advantageous than a dichotomous yes/no response because it allows for the variability in opinions that is likely to result from the qualitative-quantitative data collection process carried out in the resilience test. A 4-point Likert scale is considered to be more advantageous than a 5-point scale because it eliminates the option to remain

neutral. In other words, for each indicator, a forced choice as to adequacy vs. inadequacy must be made.

These indicators, once scored, will be summed to provide an overall view into functioning for each building block, represented as a light on the scorecard stoplights. However, the influence of context on functioning suggests that not all indicators are equally important to all Member State health systems. Therefore, the weights for appropriate scoring will vary depending on the Member State. Early on in the resilience test process, the key stakeholders themselves, under the guidance of a trained facilitator, will assess the relative value of each indicator in the context of their own health system. In this way, the results of the resilience test will be more meaningful and actionable.

Numerous publications detail potential quantitative indicators of health system performance, monitoring, and/or strengthening. A non-exhaustive list includes those published by the World Health Organization, the Organisation for Economic Co-operation and Development [e.g., the forthcoming EC-OECD report examining how resilient European health systems have been to the COVID-19 crisis], reports by Eurostat, the European Observatory on Health Systems and Policies (Thomas, Sagan et al. 2020), and compilations in prior opinions by this panel (Expert Panel on Effective Ways of Investing in Health 2016). For the purposes of this Opinion, Appendix 1 provides potential sample of indicators that align with the building blocks in the inputs/outputs/outcomes health systems framework in Figure 4. Future work can expand these indicators, after a more extensive literature review and depending on the adverse scenarios designed.

A discussion guide script for each building block must be drafted so that the focus group facilitator is able to guide the discussion appropriately. In the development of the discussion guide, consideration can be given, for instance, to the possible existence of a one-to-one relationship between indicators of functioning in normal conditions and under stress, the comprehensiveness of the measures for each building block, and the need for additional indicators.

To illustrate what development is needed in this component of the toolkit, we return to the “super-bug” scenario example described in Box 4. After the resilience test owner fully elaborates the example, the test owner and external support staff would use it, in combination with the inputs/outputs/outcomes framework to determine which input/output/outcome areas are affected and the specific building blocks impacted. This assessment guides the selection of preliminary indicators and discussion questions to be used for this scenario in the focus groups. The super-bug has an immediate impact on population health outcomes and healthcare services outputs. Multiple building blocks (inputs) are affected downstream. The particular building blocks affected may vary across Member States, but are likely to include health workforce, information systems,

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and infrastructure. Governance become especially critical in times of stress. Therefore, it would be critical to discuss those building blocks and related indicators in each focus group. The indicators would need to be assessed both in normal conditions (without the stressor) and under stress, as well as the extent to which appropriate financial resources can be mobilized to address the need. Drawn from the example potential indicators in Appendix 1, the discussion group questions concerning the health workforce building block would centre on the extent to which the health system adequately:

- Trains qualified professionals
- Integrates different specialties and disciplines
- Addresses mental health of professionals
- Re-assigns health professionals
- Engages in task shifting
- Expands responsibilities of health professionals

In addition, quantitative data at baseline would be collected on:

- # different types of professionals per population
- # patients per type of health professional

The participants would then anticipate how these numbers might change as a result of the given stressor.

Questions on how the Health Services building block is affected by the “super-bug” scenario might include (as referenced in Appendix 1): the extent to which the health system maintains access in line with health needs, including mental health care, and ensures access to care for vulnerable groups, as well as supports primary care services. In addition, the participants can discuss how certain quantitative indicators, such as waiting times for services, satisfaction ratings, and percent of the population without coverage might change over time as the system responds and adapts to the stressor.

Each of the other relevant building blocks affected (e.g., information systems, infrastructure, governance, etc.) would be discussed in a similar manner by referring to the indicators and corresponding discussion questions that have been fully developed for each building block as the third component of the toolkit.

1.4.6. Resilience test methodology roadmap – An innovative qualitative approach to data collection

National health authorities are the individuals held accountable for carrying out the resilience test, but they do not work in isolation. The implementation methodology requires political, scientific and operational capacity. It involves collecting relevant

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quantitative data available and qualitative data provided by key informers and stakeholders within the health system and its eco-system. These target groups extend beyond the research community to anyone involved in healthcare system performance. Involvement of individuals who design health systems and/or have strategic decision making capacity in the health system helps to ensure that the resilience test results lead to action planning for improvement. Inter-sectoral collaboration is required, e.g., by professionals from other sectors that influence population health, such as education and housing. Although the assessment of resilience goes beyond the health system, the health system is responsible for its assessment. Emphasis in the implementation methodology is placed on inclusive, participatory strategies based on “proportionate universalism” targeting the general public that seek to reach vulnerable or at-risk groups (Marmot and Bell 2012). Guidance from authorities and experts from other Member States is expected throughout the resilience test process. Collaborative involvement of all stakeholders can be expected to result in a comprehensive assessment of health system response to the adverse scenarios alongside related strengths and weaknesses.

The core of the resilience test is the assessment of system function and evolution under various scenarios. The process of resilience testing is conceptualized as occurring in a total of five phases. Phase 0 is a preparatory phase, in which the test owner must adapt and develop the adverse scenarios in the toolkit with respect to his/her health system. This individual, or group of individuals, is also responsible for determining which adverse scenarios are the most appropriate ones to introduce in the resilience test. This involves an initial review of baseline quantitative indicators to gain additional insight and provide realistic data to support the tailoring of the adverse scenarios. Appropriate indicators and corresponding discussion questions are identified. In this phase, test owners should consider who are the key individuals who need to be involved in the process of resilience testing for the results to be meaningful. Effort should be made at the beginning of the process to contact and integrate these individuals.

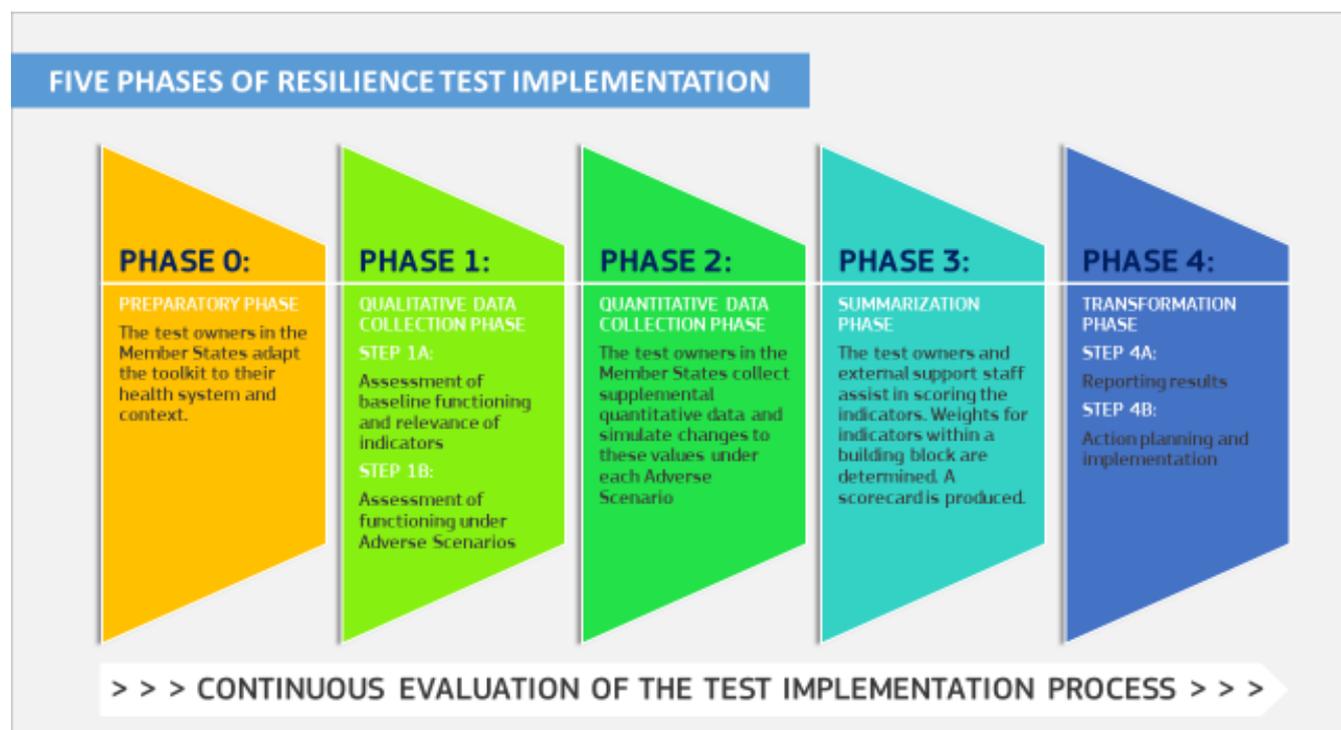
Phase 1 involves qualitative data collection, in which a trained facilitator leads groups of approximately 10 key informants through a series of tabletop exercises. Key informants would be grouped by function, e.g., clinician, nurse, allied health professional, manager, health authority, health system user, informal carer, intersectoral collaborator, etc. Phase 2 is collection supplemental quantitative data by Member State health authorities. The new data required is driven by the adverse scenarios and the discussion and questions raised in Phase 1. Additional discussion groups are carried out as needed. The Summary phase, Phase 3, is completed primarily by the individuals guiding and providing oversight through the resilience test process (e.g., test support staff). Together these facilitators, consultants, and external peer reviewers synthesize the data collected in prior phases into a written report. They determine appropriate weights for the indicators within a

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building block, score the indicators, and create the resulting scorecard. Phase 4 is the Transformative phase, in which results are reported back to stakeholders who were and were not involved in the resilience test process. The resilience test does not end with reporting of results in Step 4A. Instead, the resilience test process culminates in Step 4B. This is crucial for the development of strategic resilience. It allows for the planning of follow-on actions to counteract potential stressors that will enhance health system resiliency in the future. This phase is critical to achieve long-term change and prepare for potential stressors in the future. An owner of the process of action planning and implementation process is designated, and he/she may not be the owner of the test. He/she should be a stakeholder with high interest and endurance, able to overcome obstacles, motivate others, and sufficient drive to follow-through on goals. This individual should have a certain level of power and a reasonable level of capacity to be able to transform the structures and functions in the healthcare ecosystem. The collaborative process that this individual will lead requires participatory leadership methods and expertise in consensus building. He/she will have to balance the potential impacts of various changes, as well as competing timeframes, feasibility, interests and power of the stakeholders involved, all while maintaining trust.

A visual representation of the resilience test process and key actors is provided in Figure 11. A more detailed description of each phase can be found in Box 5.

Figure 11 Five phases of resilience test implementation



Box 5 Overview of resilience testing of a health system

Phase 0: Preparatory phase

The test owners in the Member States adapt the toolkit materials to their health system and context. Quantitative data to support the realistic development of the adverse scenarios is gathered. Appropriate building blocks, associated indicators and discussion questions are selected from a menu of options.

Phase 1: Qualitative data collection

Step 1A – Assessment of baseline functioning and relevance of indicators: The facilitator uses the discussion questions from the toolkit and leads the focus groups of key informants to examine the normal and natural evolution of health system functioning in the absence of any particular stressor (under “normal” conditions). The informants (1) discuss meaningful indicators of each building block and (2) describe the extent to which each indicator is aligned with health system values and context.

Step 1B – Assessment of functioning under adverse scenarios: The facilitator presents the “what if” adverse scenario to the group from the toolkit. Each scenario describes a stressor(s) that is relevant and plausible for that health system to experience in the future. The adverse scenario simulates a severe shock to the health system with supporting information that is as realistic as possible. The facilitator then elicits responses from the group as to the impact on the health system and how the group members themselves would react or respond. The group discusses the changes in the relevant indicators that the health system would experience relative to baseline capacities and any second round effects. This sequence is repeated for each scenario. At least two adverse scenarios should be presented and assessed separately to show varying responses.

Phase 2: Quantitative data collection - Health authorities identify and obtain available supplemental quantitative data on the indicators under “normal” conditions and are asked to simulate changes to these values in response to each adverse scenario. This phase is guided by the results of Phase 1 and may involve carrying out additional focus groups.

Phase 3: Summarizing - The facilitator, consultants, and external peer reviewers synthesize the qualitative and quantitative data. They quantify the qualitative and quantitative data from prior phases by rating each indicator on a 4-point Likert scale. They determine the appropriate weights per Step 1A and the scorecard is generated.

Phase 4: Reporting and action planning for transformative change

Step 4A – Reporting: Results are shared with key informants and other stakeholders who did not participate in the process. All collaborators engage in critical reflection on the results, identify key areas where improvements are needed, and offer recommendations in the form of summative as well as formative evaluation.

Step 4B – Action planning and implementation: The owner of the test identifies, based on the results, an owner of the process of action planning and implementation. Based on the scorecard and recommendations, a collaborative process is led by the owner of this phase to act on core building blocks, identifying relevant facilitators and barriers to implementation. Qualitative assessments are reviewed for potential solutions.

Throughout all phases: Continuous evaluation of the resilience test implementation process

The qualitative data collection occurs in focus groups to allow for engagement with diverse stakeholders and maximizing discussion. Adverse scenarios are presented through a series of tabletop exercises as illustrated by the example “super-bug” scenario elaborated in Box 4 (Dausey, Buehler et al. 2007, Frégeau, Cournoyer et al. 2020). Tabletop exercises are discussion based collaborative workshops, led by a facilitator, that aim to achieve a deeper understanding of systems and their responses to particular scenarios. Methods for these exercises include participatory leadership, Design Thinking,

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LEGO Serious Play etc. to facilitate in-depth analysis by the participants and to generate new knowledge. The facilitator may also use other methods depending on his/her training. Questions should be designed for a personalized response, e.g., "How would you react?" instead of "How would they react?" and permit in-depth analysis by the group of professionals as to their own behaviours in the adverse scenarios. Both short-term and longer-term impact and responses are considered. For instance, as the scenario evolves over time, stakeholders examine the system response to actions taken, known as second-round effects. Discussion questions would align with the indicators in Appendix 1 and general questions may include:

- What is the impact of the adverse scenario? Where does it impact in the health system?
- What tools and resources are available to be exploited (e.g., databases, protocols, human resources)?
- How will the adverse scenario be managed from an organisational perspective (e.g., organisational models, capacities of staff, organisational change)?
- What aspects of the eco-system (e.g., mental health, psycho-social impact, equity, human rights, social cohesion) will be monitored and how?
- How will decisions be made and implemented?
- How will different levels of care communicate and integrate?

The intermediate outcome of the resilience test is a scorecard that provides feedback to the health system stakeholders on the results. Through the implementation process, data is collected that leads to scoring of indicators under various conditions – baseline, adverse scenario 1, and adverse scenario 2. The scorecard (Figure 10) is an important outcome that must be meaningful to the health system stakeholders. Therefore, scorecards must take into account that there may be various effective ways that a given health system may be able to absorb the stressor and that effectiveness is context dependent. Ultimately, the outcome of the resilience test determines if the system has enough green lights on (a) enough indicators, or (b) enough critical indicators, or (c) the right combination of indicators, to effectively respond to the stressor. A Member State health system that achieves green lights for all building blocks under all scenarios may want to assess alternate scenarios to ensure resiliency under different types of stressors. Green lights across all building blocks and scenarios might also suggest that this Member State is ready to further the integration of existing capacities and move towards becoming an integrated resilient health system. The ability of the resilience test process to generate relevant data will be assessed throughout all phases of the resilience test as part of the continuous evaluation of resilience test implementation which is led by the

test owners and external support team. The process of obtaining these scorecard results is seen to be as valuable as the scorecard itself.

Ideally, weighting of critical indicators would be evidence-based, using scientific literature to describe the relationship between similar shocks experienced in the past with their inputs/outputs/outcomes impacts and responses within a given health system. However, the healthcare system and its eco-system is a complex system, and shocks can be expected to cause context-dependent impacts and context-specific responses. Thus, there are a number of significant challenges with an evidence-based approach to scoring, including the different characteristics of a healthcare system influencing the impact of the shock and the system's response to the shock, the existence of multiple shocks in any given prior actual adverse scenario whose impacts cannot be teased apart, the role of timing and order of multiple shocks on impacts and health system responses, and the multiplicative (not solely additive) impacts and responses to these multiple shocks.

To address these challenges, the resilience test methodology allows the key informants to determine the important indicators and how they need to be weighted to appropriately roll-up into key area assessments. This occurs in the Phase 1 baseline assessment (Step 1A) and is re-visited throughout the resilience test process. This type of approach can be based on realist evaluation, which is being used increasingly in health services research and examines 'What works for whom, in what circumstances and why?' (Pawson 2013). A realist approach encouraging stakeholders to hypothesize context-mechanism-outcome (CMO) configurations under adverse scenarios ensure that the test results are relevant and actionable for the health system (Tilley and Pawson 1997, Jagosh 2019). Multi-criteria decision making, from the field of operations research, offers another approach to determining the appropriate health system specific weights to apply to the scorecard.

Special consideration must be given to the appropriate dissemination of the results of the resilience test. It would be valuable to classify the different pieces of information gathered in the test as restricted, confidential, internal, or public. Additional care must be taken to communicate this information appropriately. For instance, certain results should be released to the public, with the aims of enhancing transparency and building trust. However, when exposing any limitations, it is important to focus on the actions being taken to improve with a set timeline. This offers the benefit of public accountability and can help to ease health system user anxieties about the quality of care they are receiving.

Other results may be shared with the participants of the resilience test process and other Member States in the context of the learning communities (e.g. internal classification). Some results might receive a confidential classification, indicating that the information will remain with the executives in the Member State to act accordingly. The collaborative

nature of the resilience test, from the preparatory phase to the transformation phase and beyond, in the learning communities formed with other Member States is central to this process. Therefore, it is not expected that resilience test results would need to receive a restricted classification. Additional work during pilot studies can further specify the types of information generated by the resilience test and recommended classification levels. A guide to effective communication of results with different audiences should also be developed.

1.4.7. Potential strengths and weaknesses of resilience testing of a health system using this approach

The strengths of this approach to resilience testing of Member States can also be considered weaknesses if the processes are not adequately carried out. For instance, the methodology is built on an inclusive approach that values input from all key stakeholders, including patients, citizens, and representatives beyond the health system. It is not sufficient to ensure that the appropriate stakeholders are engaged in the process. The test owners must demonstrate a willingness to listen and to give these stakeholders a voice.

Furthermore, the “right” people must be involved in the resilience test implementation in order for the results to be meaningful. Care must be taken in the preparatory phase to identify, reach out, and achieve buy-in from these individuals.

Similarly, the methodology leverages existing strengths in eco-system response and encourages the stakeholders themselves to develop and implement the action plans to further develop these capacities. Again, the test owners must foster trust and collaboration among stakeholders for such plans to be successful.

Another strength of the approach is that it allows for identification and prioritization of opportunities for improvement by the stakeholders themselves – they themselves create the action plan. Thus, test owners must be open to empowering the stakeholders the freedom to create change in the health system and its larger eco-system. In summary, the resilience test process is designed to result in the establishment of concrete steps, with monitoring mechanisms, for continuous improvement of the health system in the context of the larger eco-system. The test owners and governance must want this feedback.

The proposed approach to resilience testing offers an innovative collaborate approach to assessment. Further value will result from the creation of learning communities both within and across Member State healthcare systems. With the involvement of and input from external advisors from other Member States, there is ample potential to use the resilience test implementation process as means to enhance collaborations across

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borders or regions. Twinning partnerships may be possible in which one Member State health system that is strong in one building block can be paired with another who is weak in that same area. In this way, the role of context and its impact on resilience can be further explored for the benefit of all partners. Ultimately, resilience testing carried out via the proposed approach would strengthen macro-European dimension efforts, including solidarity between regions and Member State collaborations at the European level. This would, in turn, potentiate Member States' responses to various adverse scenarios and lead to the development of more resilient health systems in the future.

1.5. Recommendations

In this Opinion, we described how the challenges of COVID-19 for health and social care have been addressed in EU and what could be learned from these first responses to organise more resilient health and social care in the future. Moreover, we explored how the resilience of health systems confronted with shocks or structural changes can be assessed in order to enable strengthening and health system transformation.

We are very much aware that, at the moment of writing (October 2020), we are still in the midst of the pandemic with a lot of uncertainties. Hence, in this context, it is with humility and with deep respect for the efforts that are made every day by citizens, health care providers, health system managers, scientists and politicians that we formulate some recommendations, knowing that there is still a lot to learn.

Before starting the recommendations, it is important to provide appropriate context for them. President Ursula von der Leyen's State of the Union Address (September 16, 2020) describes the impact of COVID-19 and the need for a sense of urgency in this way:

"A virus a thousand times smaller than a grain of sand exposed how delicate life can be. It laid bare the strains on our health systems and the limits of a model that values wealth above wellbeing. It brought into sharper focus the planetary fragility that we see every day through melting glaciers, burning forests and now through global pandemics. It changed the very way we behave and communicate – keeping our arms at length, our faces behind masks. It showed us just how fragile our community of values really is – and how quickly it can be called into question around the world and even here in our Union.

But people want to move out of this corona world, out of this fragility, out of uncertainty. They are ready for change and they are ready to move on. And this is the moment for Europe. The moment for Europe to lead the way from this fragility towards a new vitality."

Prior to this mandate, before starting the writing of this Opinion, the individual members of the Expert Panel took the initiative to publish a blog in BMJ Global Health (March 27, 2020) entitled "Saving lives by European solidarity and cooperation in response to COVID-19". We wrote:

"These are truly exceptional times. A united response underpinned by the solidarity and human values that are at the heart of the European project will build a stronger European identity, one that could inspire and help other regions across the world. Local initiatives by citizens, the heroic efforts of healthcare staff, and the commitment of volunteers illustrate the centrality of solidarity in the European project.

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By demonstrating solidarity in the ways that Member States cope with infectious disease outbreaks, Europe will provide an enduring example and a precedent for addressing future pandemics. However, solidarity must extend to vulnerable regions outside the European Union – particularly, but not necessarily limited to, low and middle income countries, and especially the most vulnerable within them.

Pathogens do not respect national borders. COVID-19 will not be the last pandemic. The Member States of the European Union (EU) must act to protect populations and to save the democratic and humanitarian values the Union stands for.”

In order to act appropriately, Member States’ health systems need to be resilient. They must prepare to be prepared for the next unexpected event. Resilience has received a great deal of attention from many sources as of late. Of particular relevance is the EC’s First Strategic Foresight Report to inform major policy initiatives, which introduces resilience as a new compass for EU policy making to chart the course for a more resilient Europe (European Commission 2020). The Joint Research Centre proposed prototype resilience dashboards as an example of a way of monitoring resilience in four critical areas, including the social and economic dimension of resilience which include health indicators (European Commission 2020).

The recommendations in this Opinion to enhance capacity building for resilient health and social care organisation and to develop a resilience test for healthcare systems complement this guidance. These recommendations, once enacted, can be expected to contribute to a more resilient healthcare eco-system in Member States and beyond, leading to a more resilient Europe.

Towards the organisation of resilient health and social care following the COVID-19 pandemic, **the Panel formulates the following recommendations:**

- Adaptive surge capacity is important in preparing for and dealing with unexpected events in an effective and sustainable manner taking into account solidarity mechanisms within and across borders. Preventative overcapacity should be avoided. **All countries will need to invest in the training and resilience of their local health workforce.**
- Research and development, such as for innovative medicines (e.g. vaccines), and stock keeping for existing therapies and personal protective equipment should be more grounded in strategic preparedness for new challenges, including pandemics, in order to increase resilience. This requires new systems for R&D, on one hand, and production and sales, on the other.
- **Monitoring disinformation is key, as is identifying and applying strategies to reduce disinformation surrounding unexpected events.**

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- Health resilience is a multi-system and multi-sector challenge requiring inter-sectoral and inter-system collaboration for health. **Linkability of databases across systems and sectors (not limited to epidemiological data, and including relevant quantitative and qualitative data from the public and patients) is necessary for effective measurement, monitoring and decision-making based on an integrated whole-of-society approach.** This requires a consolidated measurement system from primary care and public health, to secondary care and long-term care based on person-centred electronic records in conformity with the GDPR, where the patient and all providers have access. International efforts are needed to facilitate standardized information, for instance through standardized methods of registration and classification (e.g., building on the Family of International Classifications of WHO).
- **Strong primary care and mental health systems form the foundation of any emergency and/or preparedness response.** All Member States should re-assess their investments in primary care and mental health and strengthen the integration of these systems with public health at population level. Aggregated levels of psychological distress should be recognised as a public health priority that requires a rapid adoption of clear behavioural strategies to reduce the burden of disease and the mental health consequences of an unexpected event. Moreover, it is important to promote measures to optimise therapy delivery in the framework of hospital care and improve critical care capacity during public health emergencies and beyond.
- Reducing social and ethnic disparities in health is a major strategy to address inequity in health, wellbeing and related domains, especially relevant in the context of pandemics. **To ensure equity-driven decision-making, it is essential that data can meaningfully be disaggregated, for instance by sex, age, ethnicity, race, socioeconomic status (SES), comorbidities and long-term care facility residence.** We recommend that Member States improve their capabilities to allow for such data disaggregation. The Expert Panel recommends that a debate be initiated on ways in which health data on ethnicity and SES can be collected in all Member States, recognising the complex issues involved.
- The COVID-19 pandemic disproportionately affects the vulnerable groups such as the old and frail, the poor, and members of minority ethnic groups. **In order to reduce vulnerability, primary care services should be supported and healthcare professionals, community health workers and informal care givers should be motivated to focus more on health promotion, lifestyle programs and inter-sectoral collaborative actions to increase health equity and resilience in the community.** The exploitation of existing European health promotion projects could enhance this effort. Moreover, as COVID-19 complications might have long-term impacts

on the prevalence of some chronic diseases as a collateral damage of the crisis, investment in improving care for optimal management chronic conditions is needed (ECDA 2020).

- **Specific (inter-professional) training courses that aim at appropriately dealing with and reducing the vulnerability of socially deprived and minority groups should be standard in the undergraduate curricula of institutions for health professional education.** Provision of specific online trainings (CPD) to frontline staff working in both health and social care settings with vulnerable groups should be encouraged.

The Panel recommends investment in the development and implementation of comprehensive resilience testing of health systems, with all its components.

A. Regarding resilience testing, there is a need for financing mechanisms to fully develop and pilot the resilience test toolkit and implementation methodology.

- The EC should allocate funds and create calls for tenders or Research and Innovative Actions in which teams of inter-sectoral partners from various Member State can comprehensively document resilience testing methodologies. A manual for resilience testing of health systems is warranted.
- The EC should allocate funds and devise mechanisms through which evidence on the effectiveness of these innovative and participatory resilience tests can be collected. Piloting schemes that allow data on the real-life implementation of resilience tests are warranted.

B. Regarding creation of learning communities, an international mechanism is required to build a European scientific community to bring together, synthesize and share evidence to support harmonization and solidarity in international approaches when dealing with unexpected events.

- The EC should invest money and human resources to develop a team, including representatives from Member States and specialized staff, to support sustainable resilience testing across Member States.
- The EC should sponsor a network of learning communities regarding lessons learnt from responses COVID-19 and subsequent actions to facilitate more resilient health and social care organisation.

C. Phase 4 of the resilience test requires Member States to translate the results of the resilience testing process into a strategic action plan. These transformative actions would be monitored and adapted as needed with the support of

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the resilience testing team. In this way, Member States will be better able to transform their health and social care systems and to be better prepared for future challenges affecting population health and wellbeing.

Finally, the Panel welcomes the strategy “A European Health Union” (11.11.2020) tackling health crises together, and hopes that this Opinion may contribute to greater EU solidarity and cooperation leading to the creation of robust structures that support greater preparedness and increased resilience of health systems in Member States and regions (European Union 2020).

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**ANNEX - EXAMPLE POTENTIAL INDICATORS ALIGNED WITH
INPUTS/OUTPUTS/OUTCOMES FRAMEWORK**

Inputs/Outputs Building Blocks	Functions (Capacities)		
	Example Potential Indicators of Essential Functions - <i>Use of Existing and Consistent Development of New Knowledge and Resources</i>	Example Potential Indicators of Critical Functions Under Stress – <i>Effective, Timely Use of Available Knowledge and Resources; Rapid Development of New Knowledge and Resources</i>	Example Quantitative Measures
Health workforce	Trains qualified professionals Integrates different specialties and disciplines Addresses mental health of professionals	Re-assigns health professionals Engages in task shifting Expands responsibilities of health professionals	# different types of professionals per population # patients per medical professional
Community Carers	Trains qualified professionals Retains qualified professionals	Coordinates community carers Communicates with community carers	# community carers per population
Medicines	Availability of needed medicines Accesses needed medicines	Has flexibility in purchasing Scales up to population level	# medications stockpiled
Infrastructure	Has spare capacity of physical resources Has ability to adapt existing infrastructure Has telehealth infrastructure	Re-deploys physical resources Adapts physical resources	# hospital beds/population # ICU beds/population
Information systems	Utilizes an integrated inter-professional EMR Tracks population health via standardized data, i.e., EMRs, surveys Designs alert systems Identifies quality improvement needs	Leverages existing data for routine surveillance Identifies at-risk populations quickly	Real-time data lag estimate # data fields populated with useful aggregate data to inform public health
Governance	Engages in participatory leadership Coordinates decision making across hierarchies Incorporates effective models of governance Informs public in a transparent way Encourages accountability Fosters environment for collaboration and learning Real-time response and decision making Responsive to feedback	Adapts leadership and governance structure in an agile manner Allocates clearly decision-making power under stress Potentiates public health messaging Takes advantage of strengths of collaborators Timely response and decision making	<u>n.a.</u>
Financing	Balances funding mechanisms Has a revenue structure	Mobilizes financial resources	% increase in funds

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	Has a set of rules for financing		
Health services	<p>Potentiates primary care services</p> <p>Provides sufficient coverage of health needs</p> <p>Provides sufficient mental health care coverage</p> <p>Integrates mental health care into other services</p>	<p>Supports primary care services</p> <p>Maintains access in line with health needs</p> <p>Ensures access to care for vulnerable groups</p> <p>Maintains access to mental health care</p>	<p>Waiting times for services</p> <p>Satisfaction ratings</p> <p>% of population without coverage</p>
Health promotion	<p>Engages in prevention activities</p> <p>Encourages inter-sectoral collaboration</p>	<p>Maintains health promotion activities</p> <p>Strengthens inter-sectoral collaborations</p>	<p># collaborating organisations</p>

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