CARING FOR RESILIENCE:

A knowledge agenda for health systems resilience research in the Netherlands

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Pandemic and Disaster Preparedness Center
PDPC

Preface

On the 21st of May 2021, the directors of the Erasmus Medical Center, Erasmus University Rotterdam, and the Delft University of Technology officially opened the Pandemic and Disaster Preparedness Center (PDPC). The PDPC is a collaborative network that seeks to prepare Dutch society for future pandemic and disasters, amongst others by initiating and facilitating innovative research into related and relevant topics. Specifically, the PDPC focusses on four key themes, including their crossovers: i) pandemic preparedness, ii) disaster preparedness, iii) societal preparedness, and iv) health systems resilience. An earlier study has identified the key questions for the first three themes. In this current report we zoom in on the fourth theme and identify the most pressing research gaps and remaining knowledge questions about health systems resilience in relation to the Dutch health system. We would like to thank our interviewees for participating in our study and are thankful for the financial support of the PDPC which enabled this project.

Finally, we extend our gratitude to Linda Jansen, Jeannette de Boer, Valérie Eijrond, and Eline Boezelman for helping us in organising the working conference on health systems resilience in Utrecht.

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List of abbreviations

COVID-19	Coronavirus disease 2019
DPG	*Directeur Publieke Gezondheid* [Director of Public Health]
GGD	*Gemeentelijke Gezondheidsdienst* [Municipal Health Service]
GHOR	*Geneeskundige Hulpverleningsorganisatie in de Regio* [Regional Medical Emergency Preparedness and Planning Units]
GR	*Gezondheidsraad* [Health Council of the Netherlands]
ICU	Intensive Care Unit
IGJ	*Inspectie Gezondheidszorg en Jeugd* [Health and Youth Care Inspectorate]
KNAW	*Koninklijke Nederlandse Akademie van Wetenschappen* [Royal Netherlands Academy of Arts and Sciences]
LCPS	*Landelijk Coördinatiecentrum Patiënten Spreiding* [National Coordinating Centre for Patient Logistics]
LNAZ	*Landelijk Netwerk Acute Zorg* [National Network Acute Care]
NHG	*Het Nederlands Huisartsen Genootschap* [Dutch College of General Practitioners]
NWO	*Nederlandse Organisatie voor Wetenschappelijk Onderzoek* [Dutch Research Council]
OVV	*Onderzoeksraad Voor Veiligheid* [Dutch Safety Board]
PDPC	Pandemic and Disaster Preparedness Center
RIVM	*Rijksinstituut voor Volksgezondheid en Milieu* [National Institute for Public Health and the Environment]
ROAZ	*Regionaal Overleg Acute Zorgketen* [Regional Council Acute Care]
ROB	*Raad voor het Openbaar Bestuur* [Council for Public Administration]
VGN	*Vereniging Gehandicaptenzorg Nederland* [Netherlands Disability Care Organisation]
VNG	*Vereniging van Nederlandse Gemeenten* [Association of Netherlands Municipalities]
WRR	*De Wetenschappelijke Raad voor het Regeringsbeleid* [The Netherlands Scientific Council for Government Policy]
ZonMw	*Zorg Onderzoek Nederland en Medische Wetenschappen* [Care Research Netherlands and the Medical Sciences]

Summary

The post-pandemic era highlights health systems' inability to swiftly recover from crises and disasters, prompting renewed appreciation for health systems resilience. In this project we identified the most pertinent research and policy questions on health systems resilience and composed a research agenda for future empirical research into this topic. We conducted a scoping search of the scientific literature on health systems resilience, assessed recent crisis evaluations on the COVID-19 pandemic and the flooding of Limburg in 2021, relevant policy documents, and conducted semi-structured interviews with key health system actors. We also organised a working conference to reflect on our analysis. The study and resulting agenda are focused on the Netherlands.

Our scoping search shows that health systems resilience remains a disputed notion. Despite disagreements over the exact meaning of the term health systems resilience, we also found common denominators across the various literatures which we have conceptualised as three partly overlapping and cross-linked generations of thinking *and* practising health systems resilience. Firstly, the *rational generation* which conceives resilience of health systems as a state that can be achieved by making sure that the appropriate structures are in place. Secondly, the *interactive generation* which understands health systems resilience as a feature more difficult to capture in plans, structures, and strategies, simply because resilience arises from how different systems, actors, and plans interact. Finally, we describe a third generation of research that perceives health systems resilience as *reflexive*, an ongoing and adaptive process which requires constant work, and that stretches over institutional and organisational layers. These scholars are most sensitive to the politics and spatio-temporal elements of resilience.

Based on our analysis we propose that a knowledge agenda for health systems resilience raises questions on two main themes: (1) the systemic elements that are involved in practising health systems resilience and (2) practical concerns in facilitating health systems resilience. The first theme takes up the most important call from the reflexive generation of research on healthcare resilience: to critically, and thoroughly, reflect on what actors do to 'be resilient' in practice. Within this first theme, we identify three sub-themes: representing actors and organisations, governing across institutional layers, and accounting for resilience. The second theme addresses the practical concerns of health systems resilience by emphasising how resilience can be facilitated. Here, we distinguish between four sub-themes that each relate to contemporary issues within the Dutch health system: the health workforce, collaborative networks, knowledge infrastructures, and societal resilience. We elaborate on specific research questions in the final chapter of the report.

Samenvatting

De periode na de COVID-19 pandemie heeft de nadruk gelegd op het onvermogen van gezondheidsstelsels om snel te herstellen van crises en rampen. Dit leidde tot een hernieuwde waardering voor de veerkracht van het gezondheidsstelsel. In dit project zijn de meest pertinente kennisvragen voor beleid en wetenschap op het thema veerkracht van de gezondheidszorg geïdentificeerd. Deze vragen zijn samengebracht in een onderzoeksagenda. Daarbij is een explorerend onderzoek uitgevoerd, bestaand uit een 'scoping search' van de wetenschappelijke literatuur over de veerkracht van gezondheidssystemen, het beoordelen van recente crisisevaluaties over de COVID-19-pandemie en de overstroming van Limburg in 2021, analyseren van relevante beleidsdocumenten, en het voeren van semigestructureerde interviews met relevante actoren in het gezondheidssysteem. Daarnaast organiseerden we een werkconferentie waarin de deelnemers reflecteerden op onze analyse. Het onderzoek en de daaruit voortvloeiende agenda zijn gericht op Nederland.

Onze 'scoping search' laat zien dat de veerkracht van gezondheidssystemen een omstreden begrip blijft. Ondanks verschillende ideeën over de exacte betekenis van de term 'veerkracht van gezondheidssystemen', vonden we ook gemeenschappelijke noemers in de verschillende literatuur. We nemen die samen als drie overlappende en onderling verbonden generaties van het denken over, en uitvoeren van, de veerkracht van gezondheidssystemen. Ten eerste de *rationele* generatie die veerkracht van gezondheidsstelsels opvat als een toestand die kan worden bereikt door ervoor te zorgen dat de juiste structuren aanwezig zijn. Ten tweede, de *interactieve* generatie die de veerkracht van gezondheidssystemen begrijpt als een eigenschap die moeilijker te vangen is in plannen, structuren en strategieën, simpelweg omdat veerkracht voortkomt uit de manier waarop verschillende systemen, actoren en plannen op elkaar inwerken. Ten slotte beschrijven we de derde generatie onderzoek die de veerkracht van het gezondheidssysteem zien als *reflexief*, een voortdurend en adaptief proces dat constant werk vereist en dat zich uitstrekt over institutionele en organisatorische lagen. Dit onderzoek is het meest gevoelig voor de politieke en spatio-temporele elementen van veerkracht.

Op basis van onze verkennende analyse stellen we een kennisagenda voor die is gericht op de veerkracht van gezondheidssystemen. Deze agenda behandelt twee hoofdthema's: (1) de systemische elementen die betrokken zijn bij het uitoefenen van veerkracht van gezondheidssystemen, en (2) praktische problemen bij het faciliteren van veerkracht van gezondheidssystemen. Het eerste thema komt tegemoet aan de belangrijkste oproep uit de reflexieve generatie van onderzoek naar veerkracht in de zorg: namelijk het kritisch en grondig reflecteren op wat actoren in de praktijk doen om veerkrachtig te zijn. Binnen dit eerste thema onderscheiden we drie subthema's: het vertegenwoordigen van actoren en organisaties, het besturen over institutionele lagen heen en het verantwoording afleggen over veerkracht. Het tweede thema gaat in op de praktische problemen van de veerkracht van het gezondheidssysteem door te benadrukken hoe veerkracht kan worden bevorderd. We onderscheiden hier vier subthema's die elk betrekking hebben op actuele vraagstukken binnen het Nederlandse zorgstelsel: medewerkers in de zorg, samenwerken in netwerken, kennisinfrastructuren en maatschappelijke veerkracht. In het laatste hoofdstuk van het rapport gaan we dieper in op de specifieke kennisvragen.

Introduction

The concept resilience, often mentioned alongside terms like preparedness and adaptability, is back in favour with health system scholars and practitioners. While originally coined in relation to ecological systems (Huizenga et al., 2023), the term resilience entered the health systems parlance following the West-African ebolavirus outbreaks in 2014 (Kieny et al., 2014; Lapão et al., 2015). The ebolavirus outbreaks augmented existing fragilities in the health systems of Guinea, Liberia, and Sierra Leone. While there had been numerous earlier efforts to improve the health workforces and infectious disease response systems in these countries, their health systems at large remained poorly organised, funded, and governed (Kieny & Dovlo, 2015; Kruk et al., 2015). The term resilience was thus mainly mobilised to describe initiatives dedicated at improving the overall capacity of health systems to withstand shocks, such as an infectious disease outbreak, whilst maintaining to function and being able to recover promptly (Abimbola & Topp, 2018).

Even for less initiated readers, the dynamics described in relation to the ebolavirus outbreaks in the previous paragraph might resemble those during more recent events. The COVID-19 pandemic made very explicit how crises can impact healthcare on a system-level, and how such systems – even when they prove resilient under extreme stress – are confronted with numerous organisational and governance issues. In the Netherlands, for instance, the response to the pandemic was, especially in the beginning, predominantly biomedically and epidemiologically focussed and numerous practitioners called for better (central) coordination (Wallenburg et al., 2022). Historically, the Netherlands, with its well-performing health system, held top positions in numerous health system rankings. But even the Dutch system, and others alike, struggled substantially and had to reinvent its crisis response systems in the course of the pandemic (Burau et al., 2022; Paschoalotto et al., 2023). Post-pandemic, this sentiment of 'having been insufficiently prepared' has led to a plethora of plans to instigate new pandemic preparedness organisations and policies.

At the same time, the recent pandemic shows clear limits to health systems' ability to 'bounce back' after crises (de Graaff et al., 2022). Health(care) organisations in numerous countries still skirmish with backlogs in service delivery and these countries' health systems as a whole are now confronted with budget deficits, overburdened health work forces, and understaffed health facilities. Similarly, drastic pandemic responses such as lockdowns amplified societal dissatisfaction, and diminished trust in governments. Arguably, some of these issues were pre-existing and not particularly related to the pandemic. This does, however, signify that resilience of health systems comprises more than just 'having the right structures in place' and that health systems are tightly coupled with other (inter)national systems, including political, social, and economic ones.

In this phase after the pandemic, there is increased critique on the alleged misunderstanding of the resilience of health systems. Numerous scholars warn that our current understandings of resilience are mostly evaluative in nature: i.e. resilience is translated into a range of 'indicators' or 'building blocks' and if these are present in a health system, such a system is deemed resilient (Topp, 2023; World Health Organization, 2022). Yet, how health systems actually resile and prepare for the unknown unknowns of crises has thus far received scant attention (Ansell et al., 2016; Ansell & Boin, 2019; Boin & Lodge, 2016; Wildavsky, 1988). Instead of working with pre-existing definitions and frameworks of resilience, it becomes increasingly relevant to study what resilience actually means in practice (Topp,

2020, 2023). The aim of this project therefore is to explore academic and practical policy questions on the resilience of health systems and to compose a research agenda for empirical research into practices of health systems resilience. Our study, and the resulting research agenda, are focussed on the Netherlands. Yet some of our identified knowledge gaps and research questions may be more generic, for instance relating to the concept of health systems resilience and its translation into policy and practice.

Health systems or healthcare systems resilience

Within the Anglophone health policy and systems literature, both the term health system resilience and healthcare systems resilience are in use. Generally speaking, the latter term is more restrictive. The healthcare system comprises all healthcare organisations within a specific geographic entity (e.g. national level). For the Netherlands specifically, the healthcare system includes hospitals, elderly care homes, nursing homes, and youth care facilities. This term therefore commonly excludes public health and crisis organisations. The term health system resilience is more comprehensive and includes all organisations that are responsible for and/or take care of the health and well-being of citizens. In the English text of this report, we will therefore consistently speak of health system, or health systems, resilience.


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Methods

To establish a research agenda for health systems resilience, we conducted a mixed-methods analysis that consisted of two rounds of analysis. In the first round of our analysis, we performed a scoping search of the scientific literature on health systems resilience, assessed recent crisis evaluations and policy documents, and conducted semi-structured interviews with key health system actors. In doing so, we also built on our extensive analysis of the crisis organisation in the Netherlands during COVID-19 (de Graaff et al., 2022). In the second round of our analysis, we organised a working conference in which we presented the draft research agenda for further validation by key health system actors and researchers in the Netherlands. Additionally, we mapped options for public research funding. In the sections below, we will describe for each method separately how we collected and compiled the data.

Data collection

Scoping search of scientific literature

To arrive at an overview of literature on health systems resilience, we performed a scoping search. Scoping searches are a suitable method for rapidly constructing insight into a topic, especially when the literatures themselves are highly diverse and dispersed across different disciplinary scientific journals (Armstrong et al., 2011). A scoping search is a strongly converging inquiry that seeks to achieve maximum coverage on a specific set of questions. This aligned well with the objectives of our literature review, which were to identify:

1. The methods, theories, and perspectives that are commonly used in studies into health systems resilience.
2. The elements of health systems resilience that are described in the literature.
3. The questions for future research that the literature on health systems resilience articulates.

We entered the following structured searches into the PubMed, Google Scholar, and Web of Sciences search engines (last updated on 1 June 2023):

Web of Sciences (78 results):	(review "health system*" AND "resilience")
Google Scholar (25 results):	(allintitle: "health system*" AND "resilience" AND ("review" OR "synthesis"))
PubMed (29 results):	("health system*"[ti] AND "resilience"[ti] AND ("review" OR "synthesis")[tiab])

After deduplication, all titles and abstracts were screened. Articles that had a single-disease focus, only addressed military health systems, or were not directed at health systems level, were excluded from our full analysis. An additional four papers were added based on expert suggestions. After analysing the full papers, additional papers were excluded for not falling within the scope of our study. Figure 1 provides the flow diagram of this selection process.

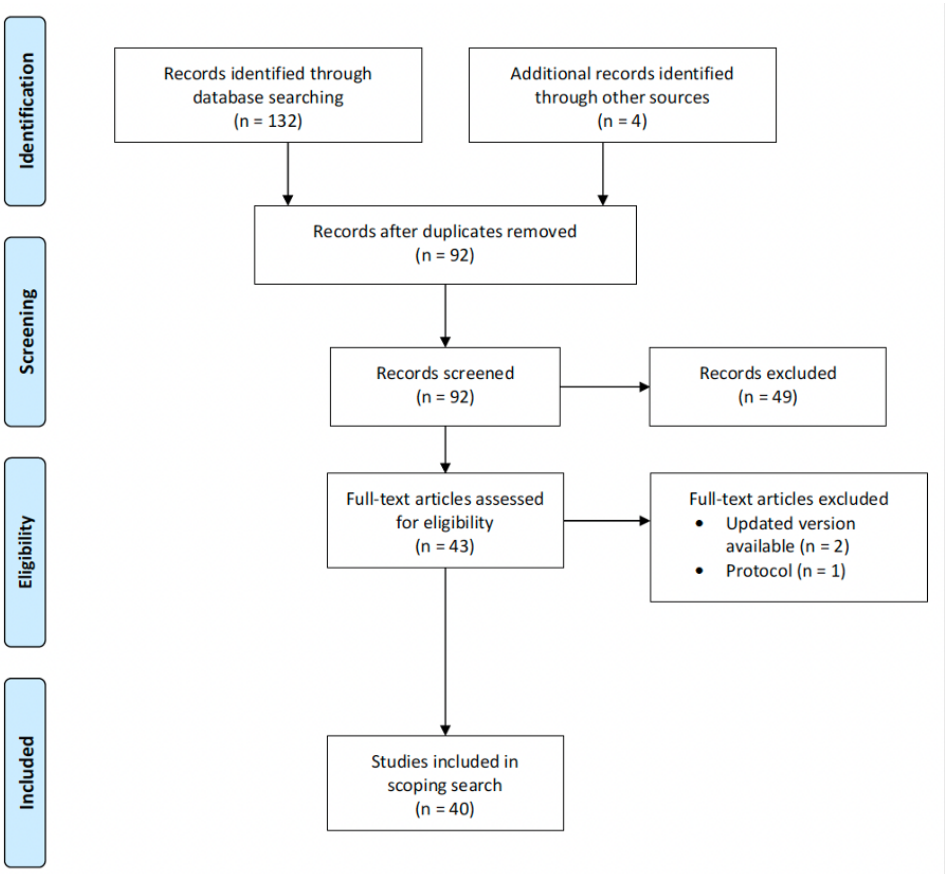

Figure 1. Flow chart diagram

Evaluations

In addition to the scoping search, we performed a critical study of evaluations into Dutch policymaking practices during the recent pandemic and the flooding events in the province of Limburg in July 2021 due to excessive rainfall. We chose to identify all national and regional policy evaluations that were published between January 2020 and March 2023. This selection yielded the following key evaluations:

- De Onderzoeksraad voor Veiligheid (OVV), 2022: Approach to COVID-19 crisis. Part 1: through to September 2020
- De Onderzoeksraad voor Veiligheid (OVV), 2022: Approach to COVID-19 crisis. Part 2: September 2020 - July 2021
- KPMG Nederland, 2021: Dit zijn de lessen van 1,5 jaar coronacrisis. Om zo de pandemic preparedness van Nederland te vergroten [These are the lessons of 1.5 year coronacrisis. In order to increase the pandemic preparedness of the Netherlands].
- The Netherlands Scientific Council for Government Policy (WRR) and the Royal Netherlands Academy of Arts and Sciences (KNAW), 2021: Navigeren en anticiperen in onzekere tijden [Navigating and anticipating in uncertain times].
- Wetenschappelijke Raad voor het Regeringsbeleid (WRR), de Gezondheidsraad (GR) en de Raad voor het Openbaar Bestuur (ROB), 2021: Verwerven, waarderen en wegen. De inzet van kennis bij beleidsadvisering in crisistijd [Obtaining, valuing, and weighing. The utilisation of knowledge in policy advisory during crises]

Policy documents

We also identified recent policy documents that are relevant for understanding how health systems resilience is understood, and what are considered to be key knowledge gaps for policy. We purposively sampled policy documents to make sure that we covered the different health domains in the Netherlands (primary care, nursing care, specialty care, public health). We also included evaluations and policy documents of the crisis management and water management domains when these were linked to the COVID-19 pandemic or the flooding events of Limburg in 2021, ranging from late 2020 until May 2023. A complete list of all policy documents included can be found in Annex 1.

Interviews

The scoping search and the reviews of the crisis evaluations and policy documents yielded a first overview of what could be considered as key themes for resilience. We translated these themes into different topics for empirical research. At this stage, we again aimed to include key actors from all domains of the Dutch health system. We first identified one key actor per domain, who could then serve as a 'gatekeeper' (Spradley, 1979) to other relevant actors within their network. For every interviewee, we constructed a tailor-made topic list. These topic lists included questions that we identified in the reviews of the literature, evaluations, and policy documents, but also topics that emerged in (potential) other interviews (cf. Hanney et al., 2003). The interviews were either conducted in-person, or digitally using a videoconferencing service. We conducted twelve interviews that all lasted between 45 and 90 minutes. All interviewees (n=20) provided written informed-consent for recording of the interview and use of the interview data in this analysis. Annex 2 shows a list of the organisational affiliations of the interviewees.

Working conference

On the 27th of June 2023, we organised a half-day working conference in Utrecht. Prior to the conference, a draft version of the research agenda was shared with the invitees. An overview of the invitees and their expertise can be found in Annex 3. During the working conference, we presented the draft agenda and subsequently asked the participants to reflect on the agenda in four rounds using a World Café format. During each round of discussion, participants were asked to reflect on four elements: 1) do they recognise the issues addressed in the research agenda, 2) what would they like to add, 3) which parts would they like to specify further, and 4) how would they prioritise the questions in the agenda? We collected detailed notes and audio-recordings of the conversations at the different tables – for which the participants provided verbal consent. In addition, we used flipcharts to gather input from the participants on the draft research agenda.

Research funding

As a final step in our data collection process, we mapped current and future calls by public research funders for studies into health systems resilience. Our mapping process focused both on European research funding (e.g. Horizon Europe) and Dutch research funding agencies (i.e. ZonMw, NWO). For our mapping process, we made use of ResearchConnect and a list of current and future calls maintained by Erasmus Research Services. The scope of our mapping exercise was limited to those calls that are open, or will open within the coming 12 months (October 2022 – October 2023). A complete list of funding possibilities is presented in Annex 4.

Data analysis

To build a comprehensive overview of how the concept health systems resilience is understood, and what the most pressing knowledge gaps are, we performed a combined analysis of all data (with exception of the mapping of research funding, and the input from the working conference – for which a separate procedure was used). We used an abductive technique to analyse our data (Timmermans & Tavory, 2012). Abductive analysis allows for a conceptually informed analysis of the data, whilst staying sensitive to empirical phenomena that cannot be explained using the existing concepts. In our case, we constantly switched between identifying knowledge gaps using the existing literature on health systems resilience, and using our interview data to re-analyse the literature, evaluations, and policy documents. The conclusions from the earlier performed ethnographic study into crisis governance practices during the pandemic (cf. de Graaff et al., 2022) provided the initial steppingstones of our analysis. In the abductive analysis, we coded relevant segments of our data, which we subsequently organised in a coherent framework. The data that were gathered during the working conference were used to revise the draft research agenda and to add, or highlight, specific themes. There were no themes that were deemed irrelevant and thus no parts of the draft research agenda were omitted in the final version.

Results

In this section, we present the results of our mixed-methods analysis into health systems resilience. The first part of results section engages with the scientific literature, and describes how that literature conceptualises health systems resilience. In the introduction of this report, we already presented our specific focus on health systems resilience. We have not, however, described how the concept of health systems resilience relates to other commonly used terms, such as prevention of crises and disaster preparedness. Besides, there are also vast differences between the various conceptualisations of health systems resilience in the literature, with different characteristics and imperatives being ascribed to it. Hence, we use this section to tease out the nuances between these terms, describe how they each require and work with different sorts of knowledges, and what consequences the different perspectives on health systems resilience have for health policy and practice.

After having discussed our scoping search of the literature, we move on to deliberate on the empirical part of our analysis. This is where we critically reflect on the various connotations that actors assign to health systems resilience and we describe which elements they think play a pertinent role in practices of health systems resilience. We are particularly sensitive to what these actors see as the most important knowledge gaps and questions for further research. We have subdivided this part of our analysis into two overarching themes: practising resilience and facilitating resilience. The former describes the resilience work that health systems actors *do*: i.e. how do they absorb shocks, what sort of flexibility is inscribed in decisions that they make, and to what extent they (can) use there discretionary capacities. The latter (i.e. facilitating resilience) denotes that there are ways to enable health systems actors to be resilient. It is important to note here that we thus do not see resilience as a characteristic of a system per se, but we do want to emphasise that there are ways of structuring and organising systems so that the actors in which these systems are embedded may work in more resilient ways. These two overarching themes, and the interaction between them, recurred throughout our analysis and were identified across the different data sources that we used. We will first describe them in detail here, to subsequentially present the specific knowledge questions in the final section of this report.

How does the literature conceptualise health systems resilience?

The scholars that work on the topic of health systems resilience represent a wide range of literatures and disciplines. Most contributions, however, originate from the fields of health policy and systems research, health services research, public health, and global health (Turenne et al., 2019). It is especially after 2010 that scholars in these fields show an increasing interest in the term health systems resilience, with a surge in papers on health systems resilience after the numerous Ebola virus disease outbreaks in Western-Africa (2013 – 2016). Recently, the term has obtained renewed interest following the outbreak of the coronavirus pandemic. Resulting from the unprecedented pressures on health systems during the pandemic, international organisations such as the World Health Organization increasingly call for more resilient, and thus 'stronger', health systems (World Health Organization, 2022).

Our analysis of the literature also shows that health systems resilience remains a disputed notion. The literature maintains countless definitions and frameworks on health systems resilience, most of which are concerned with prescribing how resilience of a health system can be achieved and measured (Kruk

et al., 2015, 2017; Turenne et al., 2019). Crucially, as described by both Turenne et al. (2019) and Topp (2020), there is little agreement over what health systems resilience specifically means, or how it can be achieved. Most descriptions of health systems resilience focus on the capacity of health systems to recover, or 'bounce back', following on external shocks (Fridell et al., 2019). Another connotation that is often ascribed to health systems resilience is the extent to which health systems sustain, or maintain their 'core' functions during an external shock or crisis (Biddle et al., 2020; Kruk et al., 2015). Finally, some scholars use the term resilience to refer to the adaptations and transformations that health systems undergo during and after an external shock (Haldane et al., 2021; Naimoli & Saxena, 2018). This perspective is more normative in nature by attaching a positive connotation to such transformations; resilience is then about using a shock or crisis as windows of opportunity for health system improvement (Rodin, 2014).

Despite disagreements over the exact meaning of the term health systems resilience, there are also common denominators across the various literatures. For analytical purposes, we have summarised these commonalities into three 'generations' here. These generations are not strictly sequential or completely distinct, with there often being significant overlap and cross-fertilisation. However, by postulating them as generations, we also indicate that we observe an element of progression within the literatures. We argue that this progression is mostly concerned with the extent to which the different generations engage with the political and normative aspects of resilience (e.g. who benefits from resilience?, who is responsible?, etc). To be concrete, we propose to speak of rational, interactive, and reflexive generations of thinking *and* practising health systems resilience. With this latter aspect we emphasise that these generations are not merely conceptual constellations that are detached from how health systems are (re)constructed in practice. Instead, the practices of health systems resilience are in a continuous dialogue with the literatures on this topic – constantly and mutually reconstituting themselves. We will tease out the characteristics of these three generations, and in particular what aspects of resilience they highlight, in the paragraphs below.

Rational generation

The first generation that we can identify in the literatures is what we propose to call the 'rational' generation. As the name already suggests, contributions in this generation are mostly concerned with careful reasoning about elements that make that health systems are resilient. In this understanding, resilience of health systems is a state that can be achieved by making sure that the appropriate structures are in place – for instance patient surge capacities, diagnostic equipment, monitoring systems, crisis management plans, and appropriate laws in support of such structures (Blanchet et al., 2017). More specifically, authors in this generation conceive of resilience as the structural capacity of health systems to withstand crises and shocks, or as a range of protective mechanisms that make health systems less vulnerable to such shocks (Hess et al., 2012; Munir & Worm, 2016). This generation therefore also commonly deploys terms like 'readiness', or 'preparedness', of which an example can be found in the definition of health systems resilience that Meyer et al. (2020, p. 1) postulate: *"(…) to enhance the readiness of health system actors to respond to crises, while also maintaining core functions."* Definitions like this emphasise that resilience is a characteristic of a health system that needs to be in place *before* a crisis or disaster for it to keep functioning during such an event.

It is vital that health systems are structurally resilient, but merely emphasising the 'preparedness' of such structures neglects several important aspects. Foremost, the rational generation implies that health systems and health system actors can anticipate what crises and disasters they ought to prepare for. More specifically, in this understanding the effects that specific crises and disasters will have on the health system and its actors are assumed to be known up front (Kennedy et al., 2013). This includes an a priori clarification of the different roles that health system actors will play during such events (Kruk et al., 2015). Yet there are also literatures that show that even 'known', or familiar, crises and disasters always produce new, unknown, dynamics and actors may shift roles or change positions (Smaggus et al., 2022). Besides, preparedness of health systems is generally based on lessons learned during and after previous events – thereby being prone to an inherent 'old wars, new structures' bias; a reference to the idea that new crises and disasters are likely to differ from previous ones, but will (initially) be approached with similar responses (Leistikow & Bal, 2021; Saulnier et al., 2022).

Interactive generation

Over time, the literature on health systems resilience gradually progressed towards a more interactive understanding of resilience. In this understanding, health systems resilience is more difficult to capture in plans, structures, and strategies, simply because resilience arises from how different systems, actors, and plans interact (Fridell et al., 2019; Madrigano et al., 2017). Turenne et al. (2019, p. 173) for example note that the *"[h]ealth system is only a subsection of a wider system (…) and the natural question to ask is whether analysing the resilience of any of [such systems] in isolation (like the health system) may actually be relevant."* Similarly, Nuzzo et al. (2019) argue for considering resilience as a relational notion. As an example of this relationality, they show for instance that the efficacy of a national biomedical laboratory (considered a crucial aspect of health systems resilience), depends on whether there are healthcare professionals, with sufficient materials, who are able to collect and transport the appropriate samples. This example shows the importance of considering the interactions not merely *within* the health system, but also *between* the health system and other systems – such as those of transport and workforce.

The timing of this shift from understanding resilience as bound to a single system towards seeing resilience as a relational construct is not entirely coincidental. During, but especially after, the Ebola virus disease outbreaks in West-Africa in 2014, the health systems research community reflected on their approaches and the extent to which the severely affected countries (i.e. Guinea, Liberia, and Sierra Leone) were prepared for an infectious disease outbreak of this magnitude (Kieny et al., 2014; Kieny & Dovlo, 2015). Several scholars concluded that most efforts directed at making these countries' health systems more resilient had fragmentedly focussed on a narrowly defined system and specific set of communicable diseases, with little eye for improvement of the overall health systems *in their contexts* (Kieny et al., 2014; Lapão et al., 2015; Ravi et al., 2019). In acknowledgement of these system complexities, several authors started pleading for overall health systems improvement – including the evaluation and measurement of the resilience of systems using indexes and indicators (Khan et al., 2019; Kruk et al., 2017). In sum, while some elements of health systems resilience can (and need to be) planned, scholars in the interactive generation would argue for a more holistic approach that emphasises overall health system improvement. Notably, this involves seeing resilience as a relational notion that extends beyond a single system only.

Although the interactive generation is more comprehensive in its understanding of health systems resilience, it does not account for the inherent contingencies that come with crises and disasters. While this literature, for example, emphasises the importance of system-level interactions, it does not acknowledge that *how* such systems interact is not necessarily known in advance. Besides, and as stated earlier on, it is not unlikely that new types of crises and disasters will produce unanticipated system dynamics that can change over time – thereby constantly requiring different responses and continuously reshaping the meaning of resilience. This is what, for example, also became clear in how the recent pandemic suddenly required the national coordination of ICU-beds in hospitals in the Netherlands; which no policies, structures, or plans necessarily foresaw (de Graaff et al., 2021). Such unpredictability creates situations where resilience of health systems is not so much about preparing for known risks, but about finding ways to provide discretionary space within health systems to navigate 'unknown unknowns'.

Reflexive generation

In response to earlier literatures, there is now a growing scholarship that pleas for more reflexive understandings of resilience. These reflexive understandings of resilience differ from the earlier generations in several ways. First, they move away from the idea that resilience is a characteristic of health systems that can be planned, measured, and ranked. Instead, resilience is seen as an ongoing and adaptive process, that stretches over institutional and organisational layers, and which requires constant work (Paschoalotto et al., 2023). Second, a more reflexive view on resilience is also sensitive to its politics – for instance in terms of unravelling for whom and for what purpose resilience is promoted (cf. Wiig et al., 2020). Third, this generation is more attentive to spatiotemporal elements of resilience. While resilience is commonly understood as the capacity of a health system to bounce back after one event, there are scholars who argue that this neglects the *longue durée* of crises and disasters – that is: crises might not be clearcut and demarcated events, and even if they are, they might affect vaster times and spaces than foreseen (Chabrol & David, 2023; Chopra & Kasper, 2021; Saulnier et al., 2022). These three aspects each come with consequences for policy and practice, which is why we will discuss these aspects in more detail below.

In the wake of the recent pandemic renewed scholarly interest arose in the resilience of health systems. This contemporary scholarship on health systems resilience is increasingly critical about the extent to which we actually understand what resilience means and how it can be achieved (Ewert et al., 2022; Topp, 2023). Some scholars, for instance, speak of failed responses to the coronavirus pandemic – which they relate to inadequate understandings of health systems resilience (Arsenault et al., 2022). Anecdotally, Paschoalotto et al. (2023) show for instance that the countries that used to rank highest on international resilience and security indices, were those that performed poorest during the pandemic. In short, the more reflexive generation of health systems resilience scholars calls for a critical re-evaluation of what resilience of health systems constitutes.

As described before, one of developments within the more critical and reflexive health systems resilience literature is to question and reconsider the nature of resilience. Topp (2020), for instance, argues for a distinction between conceiving resilience either as an outcome, or as an ability. The former, she argues, is what the literature usually does – which has resulted in an overall emphasis on performance measurement and corresponding structures. The latter, which she puts forth as a more

appropriate alternative, is to understand resilience as process consisting of a range of activities. Such an understanding means seeing resilience as the *"dynamic nature of adaptation [of health systems], without needing to make statements about the ends to which that adaptation occurs"* (ibid., p. 1). Besides, the notion of adaptation leaves room to consider more than just substantial 'shocks'. Other authors propose that resilience (as an ability) is not something that can be achieved (in the sense that it is a stable state), rather they argue that resilience is a broad denomination of a range of continuous and rather mundane practices that take place at different and interacting (institutional) layers (Ewert et al., 2022). De Graaff et al. (2022) show, for example, that health systems resilience during the pandemic resided – to a large extent – in the creation and maintenance of trustful and long-lasting relationships between actors in different parts and levels of the health system. At the same time, they note that such relationships cannot be seen as independent from the wider contexts and systems in which they take place. This duality of resilience as ability, or practice, thus remains an important consideration.

The second premise of the reflexive generation is that health systems resilience is not an apolitical notion. A substantial part of the literature mobilises discourses that either present resilience as a serene panacea ('as long as systems are resilient, we will be prepared') or as a heroic prospect ('strong systems are able to bounce back from all hardship'). What such understandings of resilience neglect, however, is that discussions about health systems resilience include numerous political and normative aspects – including decisions about what resilience means in practice, what is expected from the people that make use of a resilient health system, and most saliently: where resilience of a health system ends and vulnerability and rigidity begin (Smaggus et al., 2022; Topp, 2020; Wiig et al., 2020). Besides, resilience may sometimes be used as an excuse for poor governance of health systems – thereby circumventing more fundamental issues (Grimm et al., 2021).

By bringing in the political and normative aspects of resilience, it becomes clear that health systems resilience is actually composed of numerous micro-resilience practices, uncertain decisions, and controversial choices. Topp (2020) for instance suggests that decisions about resilience at system level automatically demand specific capacities, roles, and responsibilities of actors and networks within such systems. This clearly came to light during the coronavirus pandemic. Healthcare professionals were stretched far beyond their usual deployment to retain some level of quality and accessibility of healthcare. While we, in retrospect, could argue that was a clear example of resilience, we now also know and see widespread fatigue, Post COVID-19 Conditions, and dropout among healthcare staff (Ballering et al., 2022; Varkevisser et al., 2023). Besides, this 'resilience' of healthcare staff depended directly on decisions about who would and would not be eligible for an ICU-stay (de Graaff et al., 2021). Similarly, contemporary decisions concerning the water preparedness of the Dutch health system are likely to include choices about the acceptability of strategic inundations of (potentially) inhabited areas (Deltares, 2022).

The third element that a reflexive generation on health systems resilience problematises is that of temporality. Most earlier studies on resilience work with trigger-like understandings of resilience. That is: resilience is a response to a sudden shock or major event (Dutch: *flitsramp*) that happens unexpectedly, and generally only once (Fridell et al., 2019; Sagan et al., 2020). More recent work on resilience, especially after the pandemic, hints at forms of resilience that are not as clearly demarcated and which can stretch out substantially, both over time and space. This resilience in response to the

longue durée, or long tail, of crises and disasters has become a key topic of discussion (Fridell et al., 2019; Toner et al., 2017). One of arguments in those discussions is that we need to consider resilience more in relation to smaller disturbances, or the accumulation and interaction of crises (Fridell et al., 2019; Topp, 2020). In addition, there are increasing calls to critically question whether resilience is an appropriate solution to more chronic and everyday problems within the health system. This holds true, for instance, in times of substantial workforce shortages – which is currently the case in the Netherlands and elsewhere (Wallenburg et al., 2023). In such cases, the health system is likely to be stretched far beyond its capacity to 'bounce back' and more drastic overhauling might be required. A slightly different angle is presented by Gilson et al. (2017), who argue that we must reconsider resilience as a routinised, everyday, and adaptive practice (cf. Horlick-Jones, 2005). The difference with other understandings of resilience is that this everyday resilience resides in relatively small actions in the health system, rather than large scale interventions. A consequence of such an understanding may be that governance actors need to be more observant of 'soft signals' (cf. Kok et al., 2020) from all layers within a health system, including patients, citizens, and frontline health workers.

To conclude, we observe in the literature that there are different meanings attached to health systems resilience. We have divided these different understandings of health systems resilience into three generations: a rational, interactive, and reflexive generation. For the purpose of establishing a knowledge agenda on health systems resilience, we deem it most useful to work with more reflexive understandings of health systems resilience. In short, we aim to understand health systems resilience foremost as a range of *practices* within the health system, instead of evaluating resilience as a static, a-political capacity of a system that can be rationally constructed (cf. Ansell & Boin, 2019; Greenhalgh & Engebretsen, 2022).

What are the health systems resilience knowledge gaps in practice?

Throughout our interviews and analysis of policy documents and evaluations, the notion of health systems resilience was often mobilised in answer to uncertainty. Such uncertainties were, for instance, related to the nature and mechanisms of crises (such as was the case with COVID-19 in early 2020), or to the governance and policy structures that were seen as appropriate for effective crisis management. In such cases, resilience was often ascribed a connotation as metaphorical 'plan B': in times of uncertainty – when we do not fully know in advance what crises or disasters to prepare for – the least we can do is make sure that the health system is somehow equipped to withstand crises in general. That is: health systems ought to be resilient. It is precisely this normative connotation that recurred both in our study of policy documents and evaluations, and in the interviews with key actors. At the same time, the exact meaning of the term remained opaque. Rather saliently, most interviewees for instance often returned our questions when we asked them what resilience meant to them. Instead of offering an all-encompassing definition, and in spirit of the empirical dissonance, we will different aspects of health systems resilience *in practice* in the sections below.

Part 1: practising health systems resilience

In our interviews with Dutch health system actors, actors generally referred to their activities and the dynamics of decision-making during the pandemic. What stood out is that the actors often describe rather dissimilar practices of health systems resilience. Actors from healthcare, nursing homes, and care homes for people living with a disability kept emphasising the importance of cooperation (instead

of competition) as a way of being resilient. Others, including policymakers at the Ministry of Health and decision makers from a Safety Region spoke of 'caring' for the continuity of the health system. We noticed that there were generally three themes that played a role in such discussions. The first theme addresses the importance of representation in relation to health systems resilience. One of the recurring questions was, for instance, who speaks on behalf of the health system during a crisis and what role the public health and acute care system then play. The second theme pertains more fundamentally to governance arrangements in the Dutch health system. In particular, discussions under this theme focussed on the balance between central and more decentral governance relations and how they each enable or constrain specific practices. The final theme had to do with practices of accountability during a crisis or disaster and how health system actors can be resilient amidst existing accountability structures. This theme included, for instance, deliberations about how health system actors can work with leeway in legislation, or what role preparation plays in the capacity to be resilient. We will discuss these three themes in the same sequence as they are summarised here, starting with discussions about representation.

Representing actors and organisations

> *"When there is a problem bigger than an institution, or region, who takes care of it?"* (LCPS employee)

An important topic in discussions about health systems resilience is representation. In our review of policy documents and evaluations, representation was mainly discussed in relation to 'who speaks' for a crisis or disaster that affects the health system. To be concrete, most evaluations for instance note that the pandemic was clearly framed as a crisis in healthcare (i.e. hospital-based care), whereas it equally – or sometimes even predominantly – affected care homes and organisations for people living with disabilities. Representation has thus been discussed in terms of who sits 'at the table'[2] and gets to act as spokesperson for a particular group of health system actors during a crisis or disaster. Representing, in this sense, was mentioned in relation to two purposes. First, it is about making sure that the needs and interests of a particular group are served during crisis management – much like the actor in the quote above asks "*who takes care*" of a problem that spans different boundaries. Second, representation works as a means of communicating between the different governance layers of a crisis. It therefore clearly relates to discussions about crisis command structures.

One of the tables that was regularly mentioned in evaluations and interviews is the regional council for acute care, or ROAZ (after its Dutch name: *regionaal overleg acute zorg*).[3] Historically, the different ROAZ served as network organisations for acute care within, and between, different regions. Considering that the pandemic was initially mainly treated as an acute care crisis, the different ROAZ started and maintained in key positions during the pandemic response in the Netherlands. Their key

[2] The notion of 'table' was frequently mentioned during our interviews. While often metaphorically referring to a piece of furniture, it also commonly referred to administrative tables (i.e. committees, networks, or crisis meetings with a fixed or rotating membership).

[3] The Netherlands is divided into eleven ROAZ structures, which correspond to the adherent areas of the eleven Ministerially appointed trauma centres. Each ROAZ 'table' consists of directors from the hospitals, ambulance services, midwifery care facilities, mental health care organisations, municipality health services, and medical emergency preparedness and planning units (GHOR) that are active in that specific region.

positions during the pandemic led to renewed impetus for the ROAZ. As such, they have now been asked to make an extended inventory of all acute care needs and providers of acute care, including acute neighbourhood nursing and referrals to nursing homes in relation to acute care.[4] However, our analysis highlights that there is also increasing dissonance about the governance roles that ROAZ might have during future crises and disasters. One of these issues that was often mentioned during interviews is the boundary between what constitutes a public health(care) crisis or acute care crisis, and which entities should be in the lead of the responses. The difference was often addressed in relation to these entities doing 'pager duty' or not, as can be read in the quotes below.

> *"The ROAZ is an administrative council, the ROAZ is not equipped, and does not – in my view – have the instruments for a la minute decision making. It is not a pager-based service. We are not an organisation with pager duty, that is not how we are arranged. (…) Our analysis is that in circumstances where the continuity of care is threatened over a prolonged period, which can be a pandemic or any other threat that puts prolonged strain on healthcare, the ROAZ is in the lead and the [director of public health: DPG] joins in. (…) In situations of acute water nuisance, or an airplane crash, in all such circumstances, the DPG has, and maintains, the core responsibility." (ROAZ representative)*

> *"I hold the opinion that if it makes sense to do something… if you have a well-substantiated reason to instate a pager-based service somewhere, then you need to hire people to do pager duties. Merely stating that you do not have a pager-based service is not enough. If you do not have it, you must create it." (policy advisor)*

> *"It is quite simple really: just buy some damned pagers." (public health manager)*

This tension between the public health(care) system and the acute care system in the Netherlands stood out in several of the interviews that we had. Similarly, there were different evaluations and policy reports that provided similar pictures. At the same time, however, there were substantial differences between regions, with public health and acute actors collaborating on more harmonious terms in some regions. What would be interesting to further explore is what made some regional collaborations more productive than others and what lessons can be drawn from them. These include applied questions about who should chair a ROAZ, which actors should be present at these 'tables', and what makes the difference between a public health and acute care crisis. These applied questions touch upon issues which can be further explored through scientific research, including the position and governance of informal and home care during crises and disasters, and hybrid and collaborative governance modes.

Governing across institutional layers

Different crises call for different modes of governance. Some health system shocks might benefit from (temporary) top-down guidance and control, whereas others might require significant leeway at regional and local administrative level. The Netherlands Scientific Council for Government Policy (WRR), Health Council of the Netherlands (GR), and Council for Public Administration (WRR et al., 2021) describe for instance that crises can be acute, chronic, or predicted. They suggest that the boundaries

[4] A comprehensive list of all actors in the extended format can be found here: https://zoek.officielebekendmakingen.nl/stb-2021-291.html.

between these crisis categories are not clear-cut and static. Crises may change over time and place, and crises such as pandemics may affect regions differently, even within countries. Our analysis shows the importance of investing more in studies that empirically explore this layered and dynamic nature of crisis governance in healthcare. This is particularly salient given that, in the wake of the COVID-19 pandemic, there is renewed interest in more central modes of governance whereas the Dutch health system is, and has been for decades, strongly decentralised.

Heterogeneity in crises necessitates diverse modes of governance. Some interviewees addressed this diversity by comparing the 2021 flooding events in South-Limburg to the long tailed COVID-19 pandemic. The former, they argued, was a clear 'flash disaster'[5], whereas the latter changed faces over more than two years' time – thereby not being a singular crisis, but rather an 'umbrella' that binds together numerous crises at once. The diversity of this crisis constellation requires a mix of national, (supra)regional, and local governance networks, including an appropriate 'command and communication structure'.

The importance of a clear command and communication structure, and especially the dynamic nature thereof, was a topic that recurred throughout our interviews and analysis of crisis evaluations. Several interviewees and crisis evaluations described that at the onset of the pandemic, several health systems actors expected the Ministry to take a leading 'steering' role. Especially interviewees from the care and public health domains describe that in order to be resilient, they expected more guidance from the Ministry. One interviewee recalled that they eventually started *"a process of weaving"* (representative from care home organisation) the crisis organisation into their regular organisations – mainly in an attempt to maintain their regular duties whilst also responding to the crisis. That moment coincided, however, with Ministry of Health's decision to opt for a more 'central' role in the crisis. This shows the difficulty of navigating between central and decentral modes of governance at the appropriate time in responding to a crisis. Some interviewees therefore also spoke of constructing a 'middle ground', of finding commonalities between decentral and central, as a way of being resilient.

What stands out in this discussion about governance during the COVID-19 pandemic is a difference between the 'acute', or sharp edge of the crisis, and the *longue durée* of the crisis. Our analysis suggests that it was especially in the first, acute, moment of the crisis that there was a clear role for more centralised modes of governance, which dissipated when the crisis endured. At the same time, the long tail of the pandemic brought new uncertainties that spanned regional and sectoral boundaries and which maintain up until today – including questions about how to cope with shortages in health workforce, or how to provide regulatory leeway during crises and disasters. This interplay between central and decentral modes of governance is a topic that deserves further investigation; especially in light of how central steering and command (Dutch: *regie en sturing*) mechanisms might overrule regional agreements and networks. This dynamic between the central and decentral (regional or local) response to crises then also necessitates further research into how communication platforms can be organised in such a way that centralised steering is made possible, but that knowledge and experience from local and regional actors is taken into account.

[5] Analogous to the 'flash' in flash flood, to connote the rapid onset and culmination of a disaster. In Dutch described as *flitsramp*. Note however that even the Limburg flooding has a 'long tail', for example in mental health and housing problems of citizens.

Accounting for resilience

An important element that remains underexplored in the literature on health systems resilience is that of accountability. Similarly, we noted throughout the interviews and our analysis of policy documents that most discussions about resilience 'worked around' questions of accountability. This is not entirely surprising given that the Dutch health system is traditionally fragmented, with numerous interacting accountability networks and structures. Articulating accountability criteria and structures for health systems resilience therefore touches upon a wide and complex institutional patchwork. Some interviewees thus note that it often remains unclear in practice how they can account for the extent to which they are prepared for shocks, or the ways in which they are resilient during crises and disasters. Similarly, several interviewees questioned how preparedness and resilience can be governed and regulated. One interviewee noted, for instance, that the ambiguous nature of the term preparedness itself complicates discussions about health system governance.

> *"If you look at the theme pandemic preparedness, can we account for how we are doing in healthcare? We have had different consultancy firms who studied this. Producing beautiful reports. But is that the truth? Does a 'green traffic light' mean that you are 'well' prepared? Or 'very good' prepared? Or 'could not be better' prepared? What does 'preparedness' even mean? Prepared for what?"* (policy advisor)

Making sense of concepts like resilience and preparedness is important for translating such terms into more coherent accountability structures. Healthcare regulators, for instance, are now required to develop regulatory standards and norms appropriate for preparedness, but struggle with the operationalisation of these terms. Public health entities and healthcare professionals, on the other hand, argued in our interviews that they know relatively well how to *be* resilient, but do not always know how to account for such practices in a way that it abides to the relevant norms and criteria that were produced through a more rational perspective. This also shows that resilience means different things for different actors, at different layers of the health system, and that being more reflexive within a rationally organised system becomes increasingly difficult. One interviewee described that this is a conundrum that they regularly experience:

> *"What we might need to consider more is how to weigh the interest of the individual [organisation] against the public interest. That is an issue where we, well not struggle with, but of which we increasingly consider questions like: what is right, for whom, and what does that entail in practice? Particularly over time."* (healthcare regulator)

As a solution to such concerns, the Dutch Safety Board (De Onderzoeksraad voor Veiligheid, 2022a), proposes in their first evaluation to work with scenarios of different crises as a way to establish norms about the appropriate level(s) of preparedness. Such scenarios, however, tend to (and necessarily so) reduce the normative complexities that are crucial when considering system-level responses to disasters and crises. For instance, a scenario where the entire Dutch crisis governance was informed by and based on ICU-capacities of hospitals was difficult to conceive before the pandemic – for instance because of the lack of relevant data – yet this focus made that in practice other types of care were initially paid scant attention. For most of our interviewees, this inability to foresee and account

for all consequences in advance constitutes the boundary between a governing mode based on preparedness versus one informed by resilience: while preparedness emphasises certainty and rationality, resilience focusses on considered vulnerabilities, reflexivity, and experimentation. Several interviewees therefore proposed to further explore the relation between regulation and resilience. The interviewee below, for instance, speaks of 'space' as a way to practice resilient regulation, but also notes that this introduces numerous legal questions.

> *"As regulator, we can provide space where it is needed. But it is an entirely different thing for private law implications or liability claims. Where are we in that regard? As you can imagine, a director may call us with a question like: am I allowed to deviate from this and that rule? We might then say: you know what, considering the circumstances, yes – there is no other way. A private citizen, however, could argue: 'these deviations harmed me, so I am stepping to a judge'. There is a clear field of friction there where a director might say 'the [regulator] approved this' whilst it does not cover all legal grounds."* (healthcare regulator)

As exhibited in the quote above, accountability structures tend to be based on how we expect crises to evolve, rather than being able to move along with what actually happens in practice. Besides, a common theme throughout our data was that the consequences of resilience are often considered in a siloed approach, i.e. studying what resilience means in a single domain or field, rather than looking at how such events evolve in a network of systems, rules, and potentially conflicting logics. The quote also highlights that accountability structures could benefit from a certain flexibility, for instance by allowing health system actors to deviate from guidelines, or to temporary postpone formal regulation systems – which might then clash with other accountability structures, such as private law or European legislation. Another example of this was how, during the 2021 flooding events in Limburg, decision makers decided to deviate from formal crisis structures to arrive at a more locally appropriate solution. An evaluation of the events thus notes the following, without necessarily adding a value judgement to it:

> *"Respondents agreed that the structure does not have to be leading, but that it is important to express explicitly to each other how the structure will be filled in if it deviates from the normal structure and what this means in terms of roles and responsibilities. Now, some commanding officers were trying to stick to the normal structure while others wanted to let go of it."* (COT Instituut voor Veiligheids- en Crisismanagement, 2022c, p. 29)

In correspondence with above quote, our data also suggest that resilience at the level of a (health) system, partly resides in how frontline actors interpret and make decisions about the role and use of norms and guidelines. Similarly, interviewees regularly spoke of being sensitive to the interactions between individual and system, or between plan and situated action, as an important part of health systems resilience in practice. According to them, this also means being able to account for the difference that might arise in such potential contradictions (e.g. system versus individual). Most interviewees described that resilience involves working flexibly with(in) existing structures and plans, and deviating from such structures where necessary – as long as you describe why such deviations were generative. This resonates with the conclusions of an evaluation of the 2021 flooding events in Limburg:

> *"In deviating and special situations such as these [i.e. floods], it is essential to be able to let go of the prepared structure. When deviating from the standard structures, make explicit and clearly indicate what changes are made to the responsibilities and mandates of the various entities. (…) So that in accounting for these deviations, it can be indicated more clearly why the [crisis structure] and the agreed mandates have been deviated from."* (COT Instituut voor Veiligheids- en Crisismanagement, 2022c, p. 30)

To conclude, our analysis shows that more research is needed into accountability structures and networks, with particular emphasis on their role in relation to health systems resilience. We have shown in the paragraphs above that this includes, according to our interviewees and the grey literature, research into at least three specific topics. First, the normative aspects of preparedness deserve more attention. What does preparedness of a health system for instance imply in terms of accessibility, quality, and continuity of care? Second, the roles and responsibilities of healthcare regulators during crises, both from the perspective of the regulators and regulatory system and from the *regulatees* (e.g. health workers), requires more consideration in scientific research. Finally, our analysis points at different complexities in the interaction between accountability and the ability to work more flexibly during a crisis. This is an area that remains underacknowledged in the health policy and systems research and health services research literatures.

Part 2: facilitating health systems resilience

We have described in the previous section that health systems resilience, at least in the eyes of our interviewees, relies to a large extent on the decisions and activities of the different interacting health system actors. At the same time, it was often suggested that there are ways of structuring and organising the health system so as to facilitate such practices of resilience. In this section, we will therefore zoom in different elements that our analysis shows might be necessary to facilitate resilience. Through our documentary analysis and interviews we identified four important 'facilitators' for resilience at the health system level. These facilitators include: human resources for health, collaborative networks, knowledge infrastructures, and societal resilience. For health care organisations these facilitators are often interlinked and might even conflict with more institutionalised elements like labour laws and market competition. In the sections below, we will therefore describe these facilitators of health systems resilience through an institutional lens, which means that we are sensitive to the *"more or less coordinated set of rules and procedures that governs the interactions and behaviors of actors and organizations"* (Lascoumes & Le Gales, 2007).

Health care workforce

The health care workforce, serving as the backbone of the health system, faced unprecedented challenges during the COVID-19 pandemic, with a profound impact on the workload. Throughout this period, resilience became a defining trait of individuals. Both in the media and the wider public discourse, the remarkable flexibility of health professionals, manifested in long working hours and creativity with resources, was widely applauded and praised (Kuijper et al., 2022). Concurrently,

healthcare organisations demonstrated flexibility and creativity in increasing the capacity of the health system whilst dealing with significant staff shortages. However, these flexibilities produced substantial budget deficits, postponement of elective surgeries, and the adjournment of other 'non-urgent' care created lingering backlogs. Nonetheless, the aftermath of the pandemic in terms of backlog of care and the impact on the health care workforce is not yet fully known and could become more apparent in the years to come. Furthermore, back-office employees that were diverted from their regular duties during the pandemic, returned to their desks to discover an overwhelming build-up of overdue tasks.

The different confrontations with 'postponed tasks' made that after the COVID-19 pandemic, concerns arose regarding the long-term repercussions of demanding flexibility from an already strained health workforce (De Onderzoeksraad voor Veiligheid, 2022a). This was a regularly mentioned topic in our interviews. One of the interviewees, for example, described the paucity of reflexivity into such indirect effects that significantly affect the health workforce. During the more recent monkeypox (Mpox) outbreak, they observed a recurrence of patterns that they had already witnessed during the COVID-19 pandemic – as can be read in the quote below.

> *"Actually, it [Mpox outbreak] was like a mini-version of Corona, but fortunately not as bad. We saw a lot of the same pitfalls happening again, with professionals being pulled away from the work they had to do, which led to a huge increase in workload. So you want to have some kind of accordion that can extend and retract, but your system needs to be able to handle that. I'm very interested about how you would organize that with your staff and everything."* (public health policy maker)

In the beginning of this quote, resilience of the health workforce is referred to as a practice: i.e. the process of adapting in times of adversity. This capacity to *"extend and retract"*, to scale up and scale down, to go beyond normalcy and return to a status quo, however, is clearly problematised as a systemic element. To assure effective use of existing capacity and flexibility of the workforce, the Dutch national government released a series of interventions in June 2022, which are mainly aimed at being able to increase the number of available health care staff during crises that cause a large increase in healthcare demand. These interventions included the implementation of flexibility in the Individual Healthcare Professions Act. It was, for instance, made possible for former healthcare professionals and non-registered healthcare staff to step in during a crisis. Moreover, this intervention aimed to decrease the administrative burden of health care professionals. However, questions regarding the ways to fund and integrate 'scaled-up care' (NL: *opgeschaalde zorg*) into regular contracting by health insurers remains unresolved (Kuipers et al., 2022). What further stands out during the interviews is the focus on individual resilience of the workforce as an important factor of system resilience. This interplay between individual resilience-work and systemic elements deservers further investigation, especially given that deferring the responsibility to resile to individual health workers or organisations might put unfeasible strain on them. Besides, not all actors might have this capacity to be resilient, leading to further inequalities and tensions.

Collaborative networks

> *"I would just wish for healthcare to be able to think more about content and collaboration and what can be achieved through that, so that any disruptions can be taken in. To me, that's resilience, being able to handle anything that's different from what you're used to and find a solution, and move on to the next thing. Of course, some disruptions are much bigger than others, so it won't always work out, but I do think that you can't win the war alone, you need others." (health care policy maker)*

Our data suggests that an important facilitator for a resilient health system is the presence of well-functioning collaborative networks. We noted throughout the interviews and evaluation of policy analysis that collaboration prior to actual crises, for instance through building networks and shared emergency practices and policies, was a fertile ground for effective collaboration during a crisis. The interviewee below describes collaboration prior to crisis as a facilitator for resilience during crisis.

> *"The grounds for conversations between the [acute care networks] and [directors of public health] in our acute care region are fruitful, simply because there is one acute care region with two [municipality health services]. That simplifies the arrangements. At the same time, the importance of personal relations remains. That is what I also experienced during COVID. Look, if it is during the COVID period that you must still get to know the directors of health care organisations, well, you have missed a chance, and that does not work well. So, it is in such networks, besides general conditions, also very important to invest in personal relations, getting to know each other, and that we in tranquil times also talk about each other's roles."* (public health manager)

The interviewee in the quote above implies that the resilience of healthcare organisations partly resides in their ability to build collaborations. That is: working together is essential for making sense of uncertainties. This importance of multisectoral collaboration was also emphasised in evaluations of the 2021 flooding events in Limburg by the Safety Regions and water board (COT Instituut voor Veiligheids- en Crisismanagement, 2022c, 2022a, 2022b). During the high water in the Muse, and subsequent floodings surrounding the upstream rivers, the events created a 'bond of urgency' (fieldnotes) that facilitated collaboration. Nevertheless, the dynamics of the flood, its geographically dispersed nature, and the wide range and diversity of effects of the water on different crisis sites, made it difficult to create effective forms of collaboration (COT Instituut voor Veiligheids- en Crisismanagement, 2022c). However, with more lingering types of crises, such as the COVID-19 pandemic, it were mechanisms like regulated market competition that often stood in the way of effective collaboration between health system actors; thus limiting what could be achieved through the bonds forged by shared sense-making of urgency. One of the interviewees describes this conflict in relation to the sharing of information about hospital bed capacities during the COVID-19 pandemic. Hospitals in the Netherlands were asked to deliver daily reports on bed capacity to a central entity for patient distribution, however hospitals were sometimes hesitant to share this data, thereby showing the effect of an ingrained logic of regulated competition on collaboration during a crisis.

> *"I think that within the current scarcity, we can still compete in certain areas. But in emergency care, when everything is focused on keeping it running, who are you actually competing with? I mean, when there's an overload of patients, how much do you really want to compete with others? I don't really get it. We could understand it better if everyone dared to share their data, and if the ACM [Authority for Consumers and Market] could support that, because it serves a greater purpose. What's happening in emergency care? How can we keep it running? Why do we have more patients than care spaces? Well, then I think the whole idea of competition is no longer important." (policy maker)*

Questions about the role and functioning of internal logics of the Dutch health system during crises, such as regulated competition, recurred throughout our analysis. This prompts the need to reconsider the position of the competitive approach to (acute) care provision, leading to a reluctance to share data. Firstly, it shows the importance of considering how the act of facilitating resilience aligns with more institutionalised logics within the health system, particularly regulated market competition. Secondly, more research into the strategies that can be implemented to foster cooperation and promote the sharing of data among healthcare organisations, despite the competitive dynamics of the market, might be warranted. Lastly, it raises questions about the potential mechanisms that can facilitate collaboration and data exchange before and during a crisis, especially considering the competitive landscape in which health system actors operate.

Especially actors working in public health noted that collaboration networks and shared emergency practices are of critical value for developing a common understanding of practices, roles, and language among organizations involved in crisis management. One of the respondents describes the importance of acknowledging the roles of all partners involved in the communication between central and decentral layers of the health system.

> *"So basically, what the [Ministry of Health] needs to understand is that, even though they may not have a direct leadership role over the [municipality health services: GGDs], but when they are preparing to declare a [state of emergency], it's important to have conversations with the GGDs, even if it's not legally required and even if the [National Institute for Public Health and the Environment: RIVM] is responsible for the task. It's just good to keep people in the loop, because ultimately it will be helpful. During the COVID-19 pandemic, for example, I heard stories about how people found out only during the press conference what they had to do the next day."* (public health employee)

This quote exhibits the importance of communication between the decision-making and operational actors during a crisis, even though this level of communication is not legally required or formalised. The analysis of the interviews and documents showed that scenario building can enhance the understanding of what other actors require to effectively address the crisis based on their expertise. The evaluation from the perspective of a Safety Region regarding the flooding in South Limburg, describes, for instance, that improving communication and gaining a better understanding of each other's practices, roles, responsibilities, and information needs is crucial for preparing for future crises (COT Instituut voor Veiligheids- en Crisismanagement, 2022c). Based on the interviews this is

especially important during the 'cold phase' that leads up to a crisis, where scenario exercises can help participants become familiar with each other's roles and create informal communication channels. However, such scenarios always include decisions about normative complexities, as selecting relevant participants for scenario-building events inevitably excludes certain groups, determining which organisations are better prepared to be resilient and which ones are not. Additionally, scenario-building exercises are necessarily reductive. They may, for example, restrict the number of possible futures that can be imagined. Some interviewees therefore argued that preparedness policies based on scenarios are always incomplete, and they may exclude specific groups or organisations, thereby leaving those potentially (more) vulnerable in the end. Decision-making practices amidst the uncertainty and normative complexity that usually comes with crises and disasters thereby remain an important subject for further research.

Knowledge infrastructures

As described before, the sharing of data and knowledge was generally seen as important for health systems resilience. Knowledge infrastructures play an important facilitating role in this. The beforementioned evaluations by the OVV and Safety Regions show that during the COVID-19 pandemic and flooding of South Limburg, data were often not available, not properly shared in the existing knowledge infrastructures, or used in models different to the situation at hand – thereby providing an incomplete basis for decision-making (COT Instituut voor Veiligheids- en Crisismanagement, 2022b, 2022c, 2022a; De Onderzoeksraad voor Veiligheid, 2022a). These issues reiterate the importance of further research into the mediating role of (socio)technical solutions in effective crisis responses. From a governance perspective, we deem it relevant to draw attention to the facilitating role of knowledge infrastructures in practices of decision-making during crises and disasters.

In the early stages of a crisis, policymakers often prioritise the reduction of uncertainties and rely on readily available 'stable' metrics to inform their decisions. Based on the evaluations of the high-water crisis in Limburg, it becomes apparent that receiving timely information is of utmost importance for crisis management and decision-making with regard to evacuations. That also implies that such information might necessarily include more uncertainty. The disputed nature of the provision of such 'raw' information during decision-making practices is clearly visible in the following quote.

> *"It's all about information provision. Were people informed in a timely manner and would things have gone differently if they had been? Of course, there's always a desire to know things as early as possible, but would that actually result in taking different actions? If people were informed earlier, perhaps there would have been more uncertainty and the response may have been to wait until things were clearer. Would people have been willing to take action earlier? These are important questions to consider."* (crisis advisor)

This quote points at the ongoing balancing work during crisis, between either having recent and real-time information or equivocal information with little uncertainty. While receiving information as early as possible might be preferred, this information may contain more uncertainty, which – according to the interviewee above – could actually lead to indecision, or postponement of decisions. It is crucial to find an appropriate balance between providing information in a timely manner, while pressing the

need for prudence in using this information for decision-making. For the governance of crises, it is important to get better insight into how decision-makers work with such uncertainties, and how to facilitate decision-making through knowledge infrastructures that enhance resilient practices.

As described above, during the COVID-19 pandemic as well as the flooding of Limburg, monitoring of quantifiable aspects related to the crises were used to enhance decision-making. The evaluation of the COVID-19 pandemic by the Research Council for Safety (Onderzoeksraad voor Veiligheid) sheds light on the limitations of relying solely on data-driven decision-making, by addressing the impact of the chosen metrics on policies made (De Onderzoeksraad voor Veiligheid, 2022a, p. 159). While quantitative data can provide relatively comprehensible metrics such as the number of deceased patients, hospital beds used, and vaccines administered, they fail to capture the more intangible or long-term aspects of a crisis (De Onderzoeksraad voor Veiligheid, 2022b, p. 13). These aspects, often referred to as 'soft signals' and 'early warning signs', may not be easily quantifiable, or – if they are – might take prolonged times to collect and analyse. They can, however, include important information about a crisis' effect on psychological wellbeing and the impact of governance decisions. In a response to the evaluation of the Research Council , the minister of Health, Welfare and Sports stresses the importance of knowledge infrastructures and the monitoring of impact of COVID-related policies on society (Kuipers et al., 2023). To set up effective monitoring before and during crises, policymakers must be sensitive to the political implications of the chosen indicators and prioritise sensitivity to the more subtle and nuanced aspects of a crisis. This requires a revaluation of the relationship between data, decision-making, and the broader social and political context in which crises occur.

Societal resilience

As described earlier on, health systems resilience is often perceived as panacea: systems that are resilient ought to withstand shocks, and even improve whilst 'bouncing back'. In practice, however, health systems are often precarious and balanced constellations of actors. Constellations that, not unlike rubber bands, are easily stretched and strained beyond repair, or even snap. An unjustified reliance on the resilience of systems thereby makes a substantial appeal to societal resilience, thus often disproportionately affecting those that are least resilient and most vulnerable. In this section, we will therefore zoom in on this intersection of system and societal resilience for health.

On 14 December 2021, when the Prime Minister of the Netherlands announced a third lockdown to relieve the pressure on the intensive care units, he stressed the importance of societal resilience as an important tool in 'the battle against the virus' whenever the health system was put on too much strain. This shows the important interplay between health systems resilience and societal resilience. To understand this intersection of health systems resilience and societal resilience, it is crucial to understand where (and if) health systems resilience ends and societal resilience begins. Investigating this interrelation can provide insights into the reciprocal influences and dependencies between these two forms of resilience. Moreover, it is important to explore whether the demarcation between these forms of resilience is consistent across all individuals or varies. Examining these dynamics can shed light on the nuanced interactions and potential disparities between health systems resilience and individual resilience in relation to vulnerability.

The term vulnerability, usually as implicit antonym of resilience, was predominant during the COVID-19 pandemic – both in public and policy discourse. Protecting 'the vulnerable in society' was used as a driver for pandemic decision-making (De Onderzoeksraad voor Veiligheid, 2022b). In this sense, vulnerability referred to a medical perspective, wherein vulnerability is quantitatively defined by variables such as age or the severity of underlying conditions. Specific policies were implemented that targeted, or protected, these vulnerable groups, and neglected others that felt vulnerable to COVID-19 due to chronic illnesses, or were vulnerable to the longer term consequences of the policies implemented to prevent the spread of the virus, such as children unable to attend school for several months in a row (De Onderzoeksraad voor Veiligheid, 2022b). This also shows that who is deemed vulnerable varies – depending on the specific characteristics of a crisis and how that crisis evolves. For instance, when risks associated with a crisis are alleviated, such as through vaccination during a pandemic, or after mitigating high water levels during a flood, those who possess the fewest resources to recover are often the most vulnerable. Socio-economic status, health, social networks, and other factors play an important role in determining an individual's ability to 'bounce back'. As stated by the Association for Dutch Municipalities, the COVID-pandemic has widened the gap between *"can's"* and *"cannot's"*, the people who have the individual resilience and/or the social support system to bounce back from crises, and the ones who lack resilience or support (VNG, 2022, p. 8). Understanding how vulnerability is perceived and operationalised in decision-making in different stages of a crises, as well as its implications for learning from crises should be further investigated.

Our analysis provides a steppingstone for further research into understanding the complex interplay between health systems resilience, societal resilience, individual resilience, and vulnerability. Such explorations can contribute to the development of comprehensive strategies aimed at strengthening resilience across multiple levels, leading to more effective and equitable responses in health systems and society as a whole.

Knowledge agenda for health systems resilience

In this final chapter of our report, we bring together the main themes of the literature review, policy analysis, interviews, and working conference into a succinct knowledge agenda. Our perspective on health systems resilience is anchored in a more reflexive and pragmatist research tradition (cf. Ansell & Boin, 2019; Greenhalgh & Engebretsen, 2022). The consequence thereof is that we perceive health systems resilience not as a static, apolitical capacity which can be rationally created and evaluated. Instead, we see resilience in health systems as comprising of a range of dynamic activities on different layers (e.g. local, regional, and national) – some of them pertaining to individuals, and others clearly revolving around more structural and systematic elements. In short, health systems resilience is not one 'thing' that can be easily defined, demarcated, and implemented. In articulating our knowledge agenda for health systems research, we have restricted ourselves to specifying questions and knowledge gaps that explicitly relate to policy and governance dimensions of the health system. Moreover, we have tried to move beyond questions that relate to the (emergence of) the COVID-19 pandemic to enable a broader focus on future health systems resilience practices.

We propose that the knowledge agenda for health systems resilience consists of two main themes: practising health systems resilience and facilitating health systems resilience. The first theme takes up the most important call from the 'reflexive generation' on healthcare resilience: i.e. to critically, and thoroughly, reflect on what actors do to 'be resilient' in practice. Within this first theme, we identified three sub-themes: representing actors and organisations, governing across institutional layers, and accounting for resilience. These themes are not exhaustive, but covered most of our data. The second theme more explicitly addresses the practical concerns of health systems resilience by emphasising how resilience can be facilitated. Here, we distinguish between four sub-themes that each relate to contemporary issues within the Dutch health system: the health workforce, collaborative networks, knowledge infrastructures, and societal resilience. The list below provides an overview of the questions that we distilled from the scientific literature, policy documents, interviews with key health system actors in the Netherlands and which was validated during the working conference that we organised. The agenda is divided into two main sections which correspond with the key themes in our analysis (i.e. practising and facilitating resilience).

Practising health systems resilience

Representing actors and organisations

- What constitutes a crisis, how is a crisis represented and by whom?
- What role do representation and democratic decision-making play in health systems resilience?
- What is the distinction and relation between health systems resilience, vulnerability, and rigidity?
- How are informal care and home care positioned within health systems resilience? How can informal and home care be involved in governance processes during crises and disasters?

Governing across institutional layers

- Crises and disasters tend to produce new authorities and institutions: in what ways does layering of such entities affect the complexity of the health system?
    - To what extent are health system actors willing to 'outsource' responsibilities?

- What does it involve to create attention for the *longue durée* of crises?
- What is necessary for resilience to become a 'skill'?
    - Are such skills limitless, or bounded?
    - To what extent does investing in resilience-as-skill enhances asymmetries in society?
    - How can reflexive practices be organised in such a way that they allow for deviating from usual decision-making logics?
- How do practices of resilience interact with ingrained institutional logics of the health system (e.g. professional self-regulation, market, the state, civil society)?
- How do centralised and decentralised modes of governing crises and disasters interact and change?
- How does health systems resilience interact between health systems at large (cross-country, EU-level, Global South?)

Accounting for resilience

- What sorts of accountability logics support practices of resilience during crises and disasters?
    - Temporal: in the context of the 'longue durée' of crises?
    - Practical: in the context of improvising, experimenting on the one hand, and standardisation (guidelines) and regulation on the other?
- How can practices of pandemic preparedness and health systems resilience be regulated?
- What role does vulnerability play in practices of shared sense-making and accountability during crises?

Facilitating health systems resilience

Health care workforce

- How to support the resilience of 'front-line' workers prior, during, and after crises?
    - What makes that some occupations are constituted as frontline and others are not?
- What is the interplay between micro-level resilience-work and macro/systemic levels of resilience? E.g. what defines the boundaries of the extent to which health workers perform boundary work (e.g. formal/informal)?
- What role do (international) labour laws play in facilitating flexible human resources for health?
- How do 'scaled-up care' and regular care interact on health system level and what are appropriate ways of governing and financing these elements?
- What are the wider health system effects of postponement of care – e.g. due to workforce scarcity - during the pandemic?
- How does resilience relate to issues of sustainability, for instance in terms of workforce and the climate crisis?
- What are the ethical consequences of attracting foreign health workers during crises?
- How can 'restricted actions' be efficiently distributed across health workers in times of crises?
    - What does this mean for deploying lay health workers, or workers from other sectors, in the health system?
- How to organise a balance between being resilient and providing care of sufficient quality?

Collaborative networks

- How can resilient practices be institutionalised on different sectors and levels of the health system (acute care, long-term, public health, informal care, etc.)?
- How can latent networks (e.g. of practitioners) be activated in a timely way?
- How can different levels of the health system interact in more resilient ways? (central/decentral, formal/informal)?
- How does the institutional logic of regulated market competition relate and interact with the role and position of collaborative networks in organising resilient health care?
- What might be relevant interests for not sharing information?
- What sorts of collaborative networks allow for sharing (uncertain) information freely and timely?
- How to organise productive and trustful relations within both new and existing networks?
- What is the role of representation in mediating between collaborative networks on different layers (e.g. local, regional, global)?

Knowledge infrastructures

- How to learn well from and (especially also) *during* crisis for resilience practice? What does learning from a crisis actually involve?
- How to build resilient practices that 'learn to live with' deep uncertainties and aim to manage the 'unknown unknowns'?
- What is the role of soft signals and early warnings in health systems resilience?
- How can health care systems learn from previous crises and translate such insights into 'new' practices and structures?
- How do practices of sense-making (role of evidence, data-infrastructures) and meaning-making (framing, media-discourses, etc) relate in health systems resilience?
- How to facilitate the translation from frontline knowledge to decision-making practices?
- What role do different valuations of knowledge play in informing decision-making practices during crises?
- How to 'measure' resilience whilst acknowledging the complexity of a crisis or disaster?
    - What role could indicators play and what would they look like?

Societal resilience

- How does community-resilience relate to health systems resilience?
- What are the potential 'dark sides' of practices of health systems resilience? (e.g. where it pertains the displacement of health system failures to the individual domains).
- How do actors collectively decide on tipping points between responding to an emergency and abiding to the laws?
- Who has the power to bring a halt to specific laws and rules?
- What distinguishes societal resilience from societal preparedness, and self-sustainability?
- What, and who, does an emphasis on societal resilience exclude? Who is left behind?
- How do civilian initiatives for resilience entangle interact with government-led plans for societal resilience?
- How is the boundary between resilience as a public responsibility versus resilience as an individual capacity negotiated in practice?

Final remarks and synthesis

The COVID-19 pandemic and the 2021 flooding events in North-western Europe have, more than ever, underscored the limits of the resilience and preparedness of health systems. The results of our research project show the need to move beyond evaluative and indicator-thinking, to instead explore health systems resilience as an ongoing and dynamic practice. With the report, we want to contribute – albeit modestly – to furthering the study and practice of health systems resilience and pandemic preparedness. We like to reiterate our gratitude to our interviewees for their help in our study and analysis. We also kindly acknowledge the PDPC for their financial support.

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Annex 1. List of reviewed policy documents

Document	Year	Core focus	Organisations involved
COVID-19 Pandemic			
Aanpak Coronacrisis. Deel 1: tot September 2020	2022	This report on the first part of the COVID-19 pandemic, describes and analyzes the crisis approach of the governance organisations in the Netherlands	Onderzoeksraad voor Veiligheid (Dutch Safety Board)
Stand van zaken aanbevelingen eerste OvV-rapport 'Aanpak Coronacrisis'	2023	A response of the ministries involved regarding the OvV report part 1 on the COVID-19 pandemic	Ministry of Health, Welfare and Sport; Ministry of Justice and Security
Aanpak Coronacrisis. Deel 2: September 2020 tot juli 2021	2022	This report on the second part of the COVID-19 pandemic, describes and analyzes the crisis approach of the governance organisations in the Netherlands	Onderzoeksraad voor Veiligheid
De gezondheidsgevolgen van uitgestelde operaties tijdens de coronapandemie: Schattingen voor 2020 en 2021	2022	The health consequences of postponed surgeries during the COVID-19 pandemic.	Rijksinstituut voor Volksgezondheid en Milieu (RIVM)
Het Nederlandse Herstel-en Veerkrachtplan	2022	Report focusing on reforms and investments, including the recovery of the pandemic, and preparing for the challenges of tomorrow. Including a resilient, green, and digital Netherlands.	Ministerie van Financiën
Crisisnetwerken: effectief en veerkrachtig opereren tijdens crises	2021	Knowledge document on collaboration during crises within the crisismanagement domain	Instituut Fysieke Veiligheid
Nadere uitwerking lange termijn aanpak COVID-19	2022	Policy letter towards the house of representatives regarding the long term policies for COVID-19	Ministerie van Volksgezondheid, Welzijn en Sport (Ministry of Health, Welfare and Sport)

Beleidsagenda Toekomstbestendige Acute Zorg	2022	Policy letter towards the house of representatives regarding the long term policies for acute care	Ministerie van Volksgezondheid, Welzijn en Sport (Ministry of Health, Welfare and Sport)
Coronascenario's doordacht. Handreiking voor noodzakelijke keuzes	2022	Elaboration of various scenarios in which the challenges for different societal sectors have been taken into account.	Wetenschappelijke Raad voor het Regeringsbeleid (WRR), Gezondheidsraad, Raad van State, Raad voor het Openbaar Bestuur en Raad voor Volksgezondheid & Samenleving
MIT advies Fit voor het Najaar	2022	Advice from the MIT (Societal Impact Team) regarding the long term approach towards COVID-19	MIT
Kabinetsreactie op het rapport 'Coronascenario's doordacht Handreiking voor noodzakelijke keuzes', en het MIT-advies 'Fit voor het najaar'	2023	Policy response towards the house of representatives regarding the report on Coronascenario's and MIT advice.	Ministerie van Volksgezondheid, Welzijn en Sport (Ministry of Health, Welfare and Sport)
Stip op de Horizon COVID-19 in de langdurige zrog	2022	This document describes how COVID-19 will be addressed in healthcare organizations and other clustered residential settings for long-term care, including both elderly care and disability care.	ActiZ, Alzheimer Nederland, LOC Waardevolle zorg, Mantelzorg NL, NIP, NVAVG, NVO, Patiëntenfederatie Nederland, Verenso, VGN, V&VN, Zorgthuisnl
Stip op de horizon COVID-19 in de zorg thuis	2022	This document describes how COVID-19 will be addressed in home care organizations, including what will be needed from the governance domains.	ActiZ, Alzheimer Nederland, LOC Waardevolle zorg, Mantelzorg NL, NIP, NVAVG, NVO, Patiëntenfederatie Nederland, Verenso, VGN, V&VN, Zorgthuisnl
Memorie van antwoord op Wijziging van de Wet publieke gezondheid in verband met de bestrijding	2023	Response of the Minister of Health Welfare and Sports to questions from the Senate	Ministerie van Volksgezondheid, Welzijn en Sport (Ministry

van een epidemie van infectieziekten behorend tot groep A1, of een directe dreiging daarvan		regarding the law on Public Health	of Health, Welfare and Sport)
Dit zijn de lessen van 1,5 jaar Coronacrisis	2021	Reconstruction of the COVID-19 pandemic until June 2021, focusing on a pandemic preparedness agenda for the Netherlands	KPMG Health
Tijdelijk beleidskader toegankelijkheid zorg: msz	2023	Report on maximizing the accessibility of the medical specialistic care in the Netherlands.	Nederlandse Zorgautoriteit
Verwerven, waarderen en wegen. De inzet van kennis bij beleidsadvisering in crisistijd.	2021	Report on the value and role of knowledge and policy advice committees during crises.	Wetenschappelijke Raad voor het Regeringsbeleid (WRR), de Gezondheidsraad (GR) en de Raad voor het Openbaar Bestuur (ROB)
Voorbij de crisis in Coronatijd	2022	This report provides a long term perspective and strategy on COVID-19 from a local perspective	Vereniging Nederlandse gemeenten (VNG)
Met de kennis van straks: De wetenschap goed voorbereid op pandemieënadvies	2022	An analysis of the pandemic research preparedness of the Dutch scientific community, based on the experience gained since the start of the Covid-19 pandemic in 2020.	Koninklijke Nederlandse Akademie van Wetenschappen (KNAW)
Reactie GGD GHOR Nederland op rapport Evaluatiecommissie Wvr	2020	Response of the GGD GHOR on the report of the evaluation committee of the law on safety regions.	GGD-GHOR (GGD's: Regional Public Health Services and GHOR: Regional Medical Emergency Preparedness and Planning)
Beleidsagenda pandemische paraatheid	2022	Within this policy letter the minister of Health Welfare and Sport sketches the outline for pandemic preparedness of the health system.	Ministry of Health, Welfare and Sport; Ministry of Justice and Security
Flooding Limburg 2021			

Leerevaluatie Hoogwater veiligheidsregio Zuid-Limburg	2022	Evaluation of the crisismanagement organisation during the flooding of South-Limburg in 2021	Veiligheidsregio Zuid-Limburg
Leerevaluatie Hoogwater Maas en Roer	2022	Evaluation of the crisismanagement organisation of north Limburg, during the highwater crisis in 2021	Veiligheidsregio Limburg Noord
Hoogwater in Limburg: de aanpak van Rijkswaterstaat.	2022	An evaluation of the crisisorganisation of the waterboards focusing on learning from the flooding in 2021 in Limburg	Nederlands Instituut Publieke Veiligheid (NIPV) Netherlands institute for Public Safety
Een crisis van ongekende omvang: Leerevaluatie Watercrisis Juli 2021	2022	Evaluation of the waterboard (waterschap Limburg) on the high water crisis during the summer of 2021	Waterschap Limburg, COT
Een watersysteemanalyse - wat leren we van het hoogwater van juli 2021?	2023	Evaluation of the functioning of the watersystem in Mid- and South Limburg.	Deltares (in request from waterboard Limburg and the Province of Limburg)
Hoogwater 2021 Feiten en Duiding	2021	This fact finding study includes hydrological and civil engineering topics; attention is also given to the societal impacts of the floods, evacuation and response and the health impacts from the floods	Expertise netwerk waterveiligheid, TU Delft, Deltares, Wageningen University & Research, Erasmus MC, HKV, Universiteit Utrecht, Institute for Environmental Studies, VU, KNMI, University of Twente.
Een Waterschap voor het waterbeheer van de toekomst	2023	Strategic report of the waterboards Exploring the future role of the water board. This report provides insight in the consequences of unknown unknowns for decision-making by the waterboards.	Nederlandse School voor Openbaar Bestuur
Evacuatiegedrag van getroffenen tijdens de overstromingen in Limburg in juli 2021	2022	This report provides an insight in the behaviour of citizens prior to during and after evacuations due to the high water and floodings in	HKV

		Limburg. It provides timelines, risk factors and an insight into the information provision during the flooding of South Limburg.	
Rampbestrijdingsplan Hoogwater Limburg	2022	Disasterplan from the safetyregions in Limburg regarding high water levels in up and downstream rivers	Veiligheidsregio Limburg Noord, Veiligheidsregio Limburg Zuid

Annex 2. List of interviewee affiliations

ActiZ
Erasmus MC
GGD GHOR NL
GGD Hart voor Brabant
GGD Rotterdam-Rijnmond
GGD Zuid-Limburg
GHOR Brabant MWN
GHOR Zuid-Limburg
Het Nederlands Huisartsen Genootschap (NHG)
Inspectie voor Gezondheidszorg en Jeugd (IGJ)
Landelijk Coördinatiecentrum Patiënten Spreiding (LCPS)
Landelijk Netwerk Acute Zorg (LNAZ)
Ministerie van Volksgezondheid, Welzijn en Sport (MinVWS)
Pameijer
Philadelphia Zorg
Traumacentrum Zuid-West Nederland
Vereniging Gehandicaptenzorg Nederland (VGN)
Veiligheidsregio Rotterdam-Rijnmond (VRR)

Annex 3. Working conference participants

Name	Expertise
Anja Schreijer	publieke gezondheidszorg, infectieziektenbestrijding public health, infectious disease control
Annechien Alkemade	caribisch gebied, beleid, rampen en crises, beleid caribbean, policy, disasters and crises, policy
Bart Kooi	toezicht, gezondheidszorg, veterinair surveillance, healthcare, veterinary
Dennis Barten	(rampen)geneeskunde, spoedeisende hulp (disaster) medicine, emergency care
Eline van der Hoek	pandemische paraatheid, beleid pandemic preparedness, policy
Erik van der Linden	beleid, bestuur, rampen en crises, GHOR policy, governance, disasters and crises, GHOR
Franice l'Ortye	pandemische paraatheid, beleid, politiek pandemic preparedness, policy, politics
Hans van Oers	wetenschap, publieke gezondheidszorg, volksgezondheid science, public health, public health
Jos Bal	beleid, bestuur, rampen en crises, GHOR policy, governance, disasters and crises, GHOR
Marije Vonk-Noordegraaf	evalueren, epidemiologie, veterinair evaluation, epidemiology, veterinary
Marion Koopmans	wetenschap, virologie, pandemische paraatheid science, virology, pandemic preparedness
Marloes Verheul	veiligheid en zorg, evalueren safety and care, evaluate
Michel Duckers	wetenschap, crises, veiligheid, gezondheidszorg science, crises, security, healthcare
Michiel Bos	huisartsengeneeskunde, huisartsenzorg, eerstelijnszorg general medicine, family medicine, primary care
Moniek Peters	publieke gezondheidszorg, GHOR, beleid, bestuur public health, GHOR, policy, governance
Nadia Ait Hammou	beleid, verpleegkundige zorg policy, nursing care
Sjaak de Gouw	publieke gezondheidszorg, GHOR, beleid, bestuur public health, GHOR, policy, governance
Wiebe Bijker	wetenschap, techniek, onderwijs, onderzoeksfinanciering science, engineering, education, research funding

Annex 4. Current and future funding calls

National level

There are several organisations that fund scientific research whose mandate it is to strengthen health systems. In the list below, we merely include programmes from public research funders in the Netherlands (i.e. NWO, ZonMw, and KNAW). There appears to be an overall paucity of programmes directed at health systems strengthening and resilience in relation to the Netherlands.

ZonMw kennisprogramma Pandemische Paraatheid*
ZonMw deelprogramma Regulatoire Pandemische Paraatheid
ZonMw stimuleringsimpuls Pandemische Paraatheid

*The programme has currently received funding for a first phase of two years (i.e. 2022-2024) and focusses on the themes 1) prediction and detection and 2) society and behaviour. Both themes will be subdivided into rounds of one year and subsidies will be allocated by invitation (two existing consortia, one per theme).

European level

Most calls within the Horizon Europe programme close in November 2023. Most opportunities for funding into health systems resilience seem to be in work programme 2 (i.e. health) and 6 (i.e. civil security for society).

Work Programme 2: Health

Destination: Tackling diseases and reducing disease burden .
Call: Tackling Diseases 2023

Note: very little calls under this call that focus on system-level interventions. Mostly directed at infectious diseases/biomedical interventions. E.g.:
HORIZON-HLTH-2023-DISEASE-03-04: Pandemic preparedness and response: Broad spectrum anti-viral therapeutics for infectious diseases with epidemic potential

HORIZON-HLTH-2023-DISEASE-03-05: Pandemic preparedness and response: Sustaining established coordination mechanisms for European adaptive platform trials and for cohort networks

HORIZON-HLTH-2023-DISEASE-03-17: Pandemic preparedness and response: Understanding vaccine induced-immunity

HORIZON-HLTH-2023-DISEASE-03-18: Pandemic preparedness and response: Immunogenicity of viral proteins of viruses with epidemic and pandemic potential

Destination: Living and working in a health-promoting environment
Call: Environment and health
HORIZON-HLTH-2023-ENVHLTH-02-01: Planetary health: understanding the links between environmental degradation and health impacts

- 30 million (5 to 6 million per project, 5 projects funded)

Call: Ensuring access to innovative, sustainable and high-quality health care

HORIZON-HLTH-2023-CARE-04-01: Maintaining access to regular health and care services in case of cross-border emergencies

- 20 million (4 to 6 million per project, 4 projects funded)

HORIZON-HLTH-2023-CARE-04-02: Resilience and mental wellbeing of the health and care workforce

- 20 million (4 to 6 million per project, 4 projects funded)

HORIZON-HLTH-2023-CARE-04-03: Environmentally sustainable and climate neutral health and care systems

- 20 million (4 to 6 million per project, 4 projects funded)

Work Programme 6: Civil Security for Society

Destination: Resilient Infrastructures
Call: Resilient Infrastructures 2023
HORIZON-CL3-2023-INFRA-01-01: Resilient Plans and next generation tools for Risk Assessments and Incident Notification

- 15.04 million (3 million per project in first stage, 1 project funded)
- 23 November 2023 (first stage deadline)

Destination + call: Disaster-Resilient Society 2023
HORIZON-CL3-2023-DRS-01-02: Improving social and societal preparedness for disaster response and health emergencies

- 28.82 million (3 million per project, 1 project funded)
- 23 November 2023

HORIZON-CL3-2024-DRS-01-03: From Global to Local: how to strengthen Disaster Risk Reduction cooperation among global organizations and local first and second Responders

- 29 million (2 million per project, 1 project funded)
- 23 November 2023

Pandemic and Disaster Preparedness Center
PDPC

PDPC
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