

MARKUS RIES

TOWARDS BETTER PREPAREDNESS FOR FUTURE CATASTROPHES

Lessons Learned from Civil-Military
Pandemic Response



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**Lessons Learned from Civil-Military
Pandemic Response**

MARKUS RIES



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Photo: Marsilius-Kolleg Heidelberg University, Tobias Schwerdt

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Gratefully dedicated to
Sophie, Maxime, Noah, and Elias.

In respectful memory of more than 100,000 health care workers who made the ultimate sacrifice during the Great Pandemic in service to their people.

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Inventory of abbreviations

BBK	Bundesamt für Bevölkerungsschutz und Katastrophenhilfe (Federal Office of Civil Protection and Disaster Assistance)
CIMIC	Civil-military cooperation
CBRN	Chemical, biologic, radiological, and nuclear
COVID-19	Coronavirus disease 2019
DLRG	Deutsche Lebensrettungsgesellschaft (German Live Saving Association)
HeiGIT	Heidelberg Institute for Geoinformation Technology
ICU	Intensive care unit
IQR	Interquartile range
IT	Information technology
n.a.	Not addressed
N	Number (for quantity)
No.	Number (for sequential order)
NGO	Non-governmental organization
PCR	Polymerase chain reaction
PPE	Personal protective equipment
SARS-CoV-2	Severe acute respiratory syndrome coronavirus 2
THW	Technisches Hilfswerk (Federal Technical Relief Agency)
UN	United Nations
UN OCHA	United Nations Office for the Coordination of Humanitarian Affairs
VUCA	Volatile, uncertain, complex, ambiguous
WASH	Water, sanitation, hygiene
WHO	World Health Organization

 Heidelberg

**Gemeinsam
gegen Corona.**
Herzlichen Dank
für Ihren Einsatz!

Ihr


Eckart Würzner



Figure 1. Recognition of service by the Mayor of Heidelberg: "Together against corona. Thank you for your service" (top) and the Baden-Württemberg State Command of the Federal Armed Forces (bottom)

Image source: Markus Ries

Executive summary

The extent and intensity of the COVID-19 crisis was significant worldwide. The corona disaster relief support was the largest subsidiary mission of the German Federal Armed Forces in their history. The shared challenges to the disaster management community were considerable worldwide as well as in the region of Heidelberg/Rhine-Neckar, Germany, due to the dynamics and complexity of situational developments. A structured scientific analysis of the operational experiences of the COVID-19 disaster relief in Heidelberg/Rhine-Neckar between 2020 and 2022, especially from a civil-military perspective, has not been done so far. This study aims to fill this gap.

The research question of the study was **“what lessons have been learned from the civil-military cooperation in Heidelberg/Rhine during the COVID-19 pandemic and what needs to be done to be better prepared for future disasters?”**

This overarching research question was iteratively approached in three steps:

Focus question 1: What was done in Heidelberg/Rhine-Neckar? The extent and nature of the civil-military disaster relief support to Heidelberg/Rhine-Neckar during the COVID-19 crisis was assessed by an autoethnographic qualitative, empirical-observational analysis.

Focus questions 2: What impact did the Heidelberg/Rhine-Neckar disaster relief mission have?

Focus questions 3: How well are we prepared for future catastrophes after lessons learned from corona and what must be done to close this gap?

The civil-military mission impact (focus questions 2) and the pathway from lessons learned towards better future disaster preparedness (focus questions 3) were analyzed by semi-structured interviews with key stakeholders of the local disaster relief community that were recorded, transcribed, coded for significant statement and then horizontalized into clusters of meaning.

Core elements of community resilience defined by Patel in 2017 provided a methodological analysis framework. Themes of the local disaster

Executive summary

relief mission were juxtaposed to findings from a scoping review of the scientific literature on civil-military cooperation during the COVID-19 pandemic. This study was approved by the Medical Faculty of the University of Heidelberg, Germany (reference S-534/2022) and registered in the Clinical-Trials.gov study registry (registration number NCT05552989).

Focus question 1: What was done in Heidelberg/Rhine-Neckar?

Seven core issues with civil-military relevance arose in Heidelberg/Rhine-Neckar during the pandemic: (1) Hospitals lacked PPE which exposed staff to infections. (2) There was risk of SARS-CoV-2 outbreak in a major regional refugee center. (3) Ongoing surges of COVID-19 patients overwhelmed ICU units. (4) The risk of uncontrolled spread of infections endangered the population. (5) SARS-CoV-2 infections spread into vulnerable populations in nursing homes leading to casualties. (6) SARS-CoV-2 infections spread into vulnerable populations in nursing homes leading to surges of symptomatic infections among staff. (7) The swift roll-out of the ambitious vaccine campaign in a short time was endangered by lack of staff. To strengthen perseverance in pandemic management, the military mainly provided workforce and, to a minor degree, equipment, overall, with good outcomes for the afflicted population. The embedded proximity of local medical staff officers within liaison commands on both sides—the military medical service as well as the civilian health care system—was very useful for eight community resilience elements out of nine, i.e., local knowledge, community networks and relationships, communication, health, governance and leadership, resources, preparedness, and mental outlook. The liaison role provided little influence on economic investment.

Focus question 2: What impact did the Heidelberg disaster relief mission have?

The pattern of answers provided by participants suggested that subsidiary civil-military support in Heidelberg during the pandemic overwhelmingly strengthened local resilience. Specifically, increased local resilience was reported in the domains (1) community networks and relationships, (2) health, (3) governance and leadership, (4) resources, (5) preparedness, and (6) mental outlook (Table 16). The overall positive impact was, however, limited in sub-segments, mainly due to the limited availability of medical military personnel (health), the fact that the availability of subsidiary support by the military impeded recruiting efforts and self-sufficiency in specific sectors on the civilian side (economic investment), and, finally, the appropriate use of skills was addressed as an issue (mental outlook).

Focus question 3: How well are we prepared for future catastrophes after lessons learned from the corona pandemic and what must be done to close this gap?

This work provides a deep insight into both strengths and weaknesses of the current local disaster management system. Moreover, lessons learned from participants' own areas of responsibilities are being identified, as well as experiences with civil-military cooperation, across a broad spectrum of community resilience core elements. This includes a reflection on what should be done in the future—either the same way or differently. Likewise, the present work identified as a main result 37 action items to be addressed in order to enhance community resilience for future catastrophes. These action items lie within the areas of (1) local knowledge, (2) community networks and relationships, (3) communication, (4) health, (5) governance and leadership, (6) resources, (7) economic investment, (8) preparedness, and (9) mental outlook. **Their 16 main themes included the necessity for local alignment, continuous open-minded community networking, transparent communication internally and externally aligned, coordinated approach towards healthcare complexity, creation of personnel reserves including the acceptance of free resources in routine times, timely switching into disaster mode, reduction of bureaucracy, clear understanding of leadership, roles, and responsibilities, inclusion of volunteers, funding of novel ideas, prioritized planning and acquisition of material adapted to likely risk scenarios, improved disaster education including at schools, inclusion of practitioners, conducting frequent all-hands exercises, functioning as an anticipatory and learning organization, and promoting self-sufficiency within the population.**

Corroborating and expanding the local experience in Heidelberg/Rhine-Neckar, worldwide themes of civil-military interaction during the pandemic published in the scientific literature covered a broad spectrum of pandemic disaster management subjects such as capacity and surge capacity building, medical and pharmaceutical logistics, patient care under austere circumstances, SARS-CoV-2 testing support, intelligent and innovative information management, vaccination support, disaster communication, and the military as a role model for crisis management. As such, significant local actors in Heidelberg/Rhine-Neckar showed exceptional strengths in terms of 1) leadership, 2) diplomacy, 3) communication, they contributed as 4) enablers, demonstrated 5) agility, and 6) showed a particularly positive and constructive mindset.

In the future, cutting red tape, breaking the “panic-the-forget” cycle through sustainable preparedness, achieving timely operational readiness, and overcoming the next “infodemic” in a world of social media will be important. In general, civil-military cooperation during the COVID-19 pandemic led to valuable contributions to societal resilience—probably at

Executive summary

a high cost—world-wide and in Heidelberg/Rhine-Neckar. The mitigation potential for any agent may be limited if the health-care system is already overstretched in routine operations. To prevent abuse, the awareness of military's potential of threat and intimidation is important. Better holistic, sustainable prevention for future disasters is imperative to break the "panic-then-forget" cycle. Future research could focus on better inclusion of vulnerable populations including children.

Introduction

Space: Description and geography of Heidelberg and Rhine-Neckar district

Heidelberg is a southwestern German university city with ~ 160,000 inhabitants. It is an affluent economic area surrounded by the Rhine-Neckar district with a population of ~ 550,000. Further to the East lies the more rural Neckar-Odenwald district where ~ 140,000 inhabitants live (Figure 2).

Heidelberg had three vulnerable spots in its critical infrastructure that were susceptible to COVID-19. These included hospitals (Figure 3) such as the University Hospital which is one of the biggest and most important in Germany with 80,000 treated inpatients and more than 1 million out-

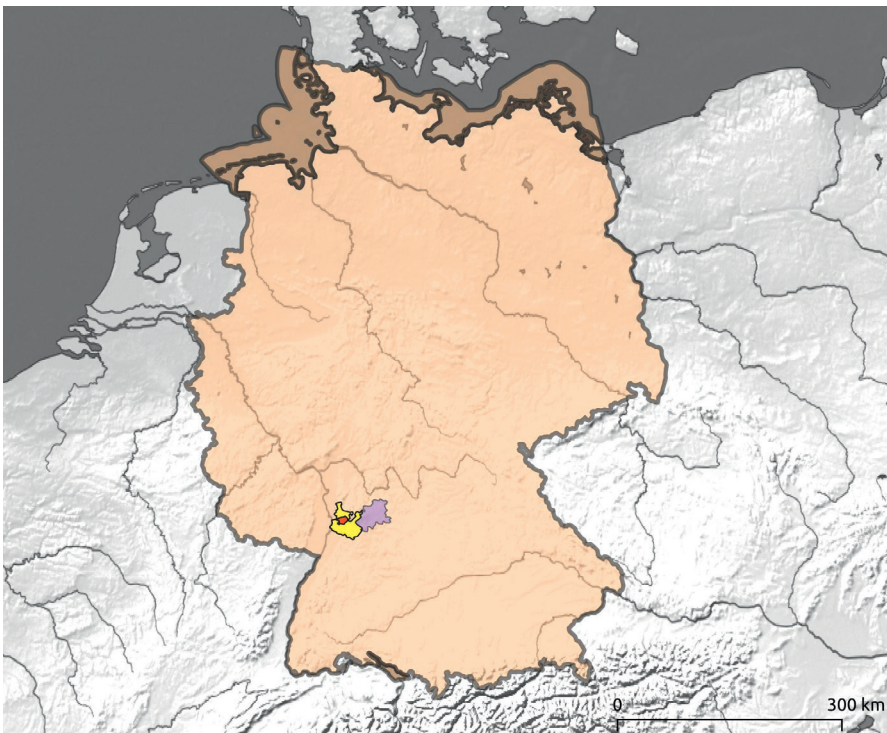


Figure 2. Geographic situation of Heidelberg (in red) and the Rhine-Neckar district (in yellow) within Germany. The neighboring Neckar-Odenwald district is shown in purple

Image credit: This map was created with QGIS [76] using Natural Earth data [63].

Introduction

patients per year [104]. There were several smaller hospitals in town (N = 9) and the surrounding districts Rhine-Neckar, and (N = 5) Neckar-Odenwald (N = 4) [92]. The nursing homes for the frail and elderly were at elevated risk of lethal disease courses of COVID-19. Heidelberg hosted a refugee center with a capacity of up to 2000 people which served as an institution of first and urgent admissions for incoming refugees and migrants [4].

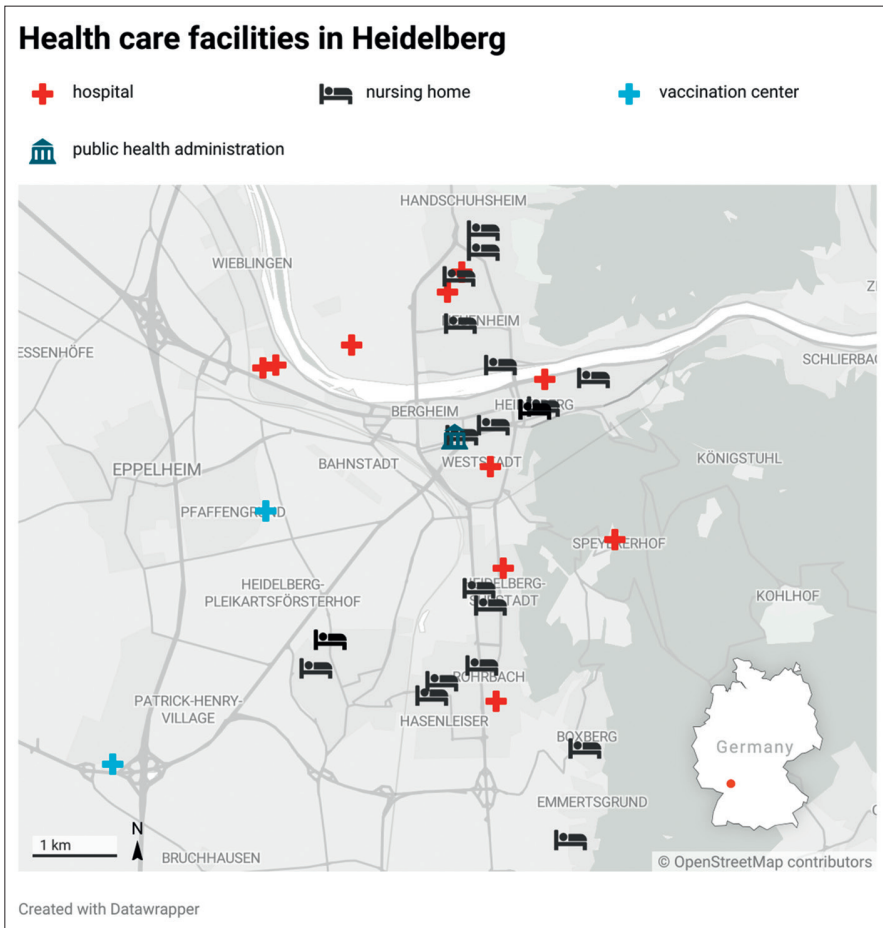


Figure 3. Health care facilities in Heidelberg

Image credit: Datawrapper [25] and OpenStreetMap [68]

Time: The great COVID-19 pandemic

COVID-19 (coronavirus disease 2019) is a respiratory disease with multisystemic manifestations due to an infection from the novel coronavirus which is also known as SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2). By 10 March 2023 (the day Johns Hopkins University has stopped collecting data), 676,609,955 cases and 6,881,955 deaths were reported globally [50]. A global overview over the timeline of major events in Heidelberg, Germany, during the COVID-19 pandemic is shown in Figure 4. First cases of COVID 19 in Heidelberg, Germany were reported on 27 February



Figure 4. Timeline of important events during COVID-19 in Heidelberg

Image credit: This figure was created with Free Timeline Maker [1]

Introduction

2020 [14]. On 13 March 2020, mass gatherings events were prohibited by the German Federal government, on 16 March 2020, schools closed and on 17 March 2020, shops closed, and public life went into a lockdown that ended with reopening in May 2020 [14]. The first death of a patient with COVID-19 in Heidelberg occurred on 01 April 2020 [14]. Due to an increase in new cases after the summer and fall 2020, a nightly curfew was imposed by the state government of Baden-Württemberg on 12 December 2020, and a second nation-wide lockdown started in Germany on 16 December 2020 [14]. First vaccinations against SARS-CoV-2 in Heidelberg were administered on 27 December 2020 at the central vaccination center under the direction of Christoph Schulze, MD. This important milestone started the vaccination campaign which was subsequently expanded [14, 90]. The nightly curfew in Heidelberg ended on 11 February 2021 [14]. Due to rising incidences, above 100 cases/100,000 inhabitants, contact restrictions were intensified on 23 April 2021 and gradually released after 01 May 2021 [15]. Increasing surges of patients with COVID-19 on intensive care units in the state resulted in further step-wise aggravations of contact restrictions beginning with the 'warning level' (defined by the decree of the state government) on 03 November 2021, the 'alarm level' on 17 November 2021, and the 'alarm-level II' on 04 December 2021 [16–18]. On 23 February 2022, the state government of Baden-Württemberg adjusted the corona rules which allowed a step-wise opening of public life again [19].

The spectrum of predominant SARS-CoV-2 infections within the population shifted over time from virus wildtype over alpha, delta, and omicron virus variants with a changing pattern of contagiousness, disease severity, and immune escape from available vaccines [83].

The epidemiological course of COVID-19 (new infections and deaths) in Heidelberg and Rhine-Neckar districts are summarized in Figures 5–8.

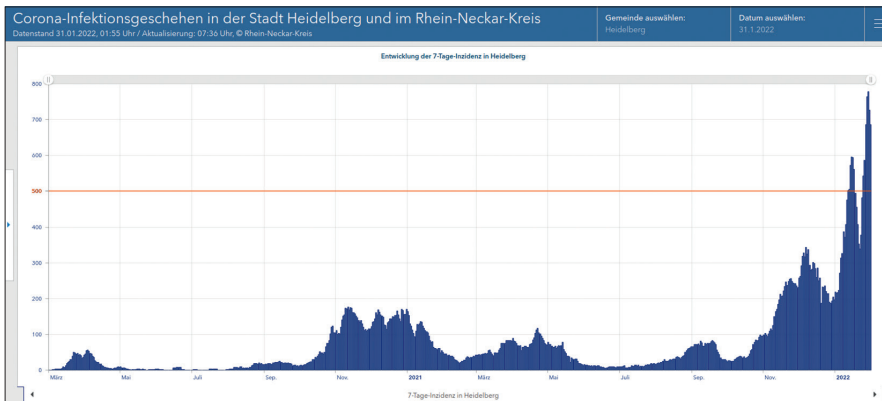


Figure 5. COVID-19 in **Heidelberg: 7-day incidences** (new cases)

Image credit: Corona dashboard Public Health Service Heidelberg/Rhine-Neckar [75]

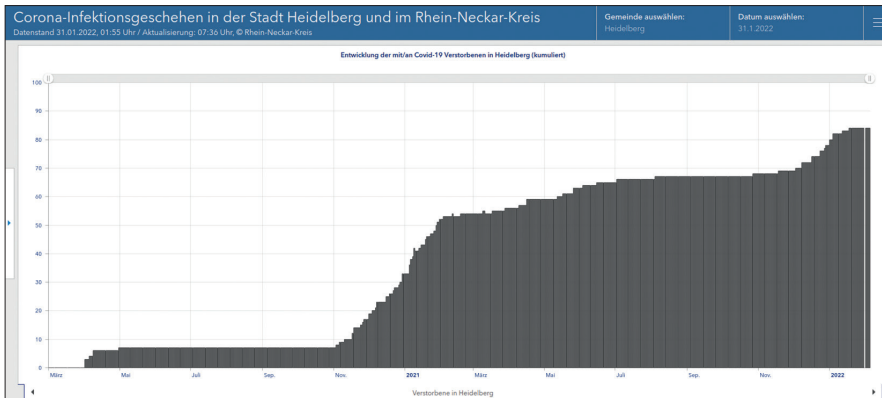


Figure 6. COVID-19 in **Heidelberg: number of deaths** (cumulative)

Image credit: Corona dashboard Public Health Service Heidelberg/Rhine-Neckar [75]

Introduction

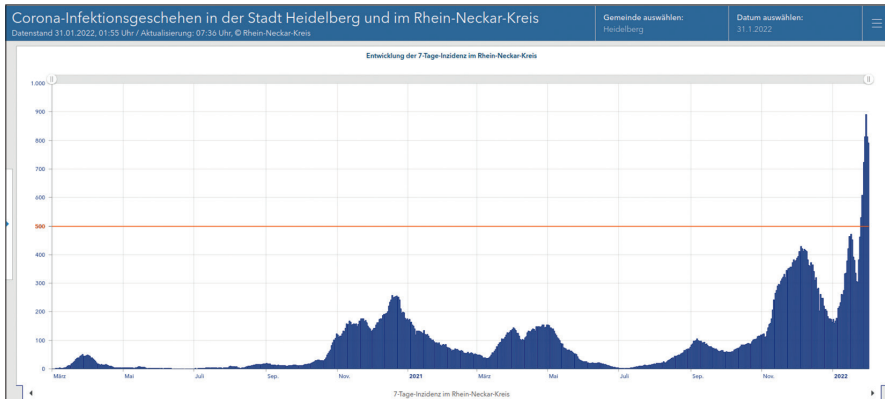


Figure 7. COVID-19 in **Rhine-Neckar district: 7-day incidences** (new cases)

Image credit: Corona dashboard Public Health Service Heidelberg/Rhine-Neckar [75]

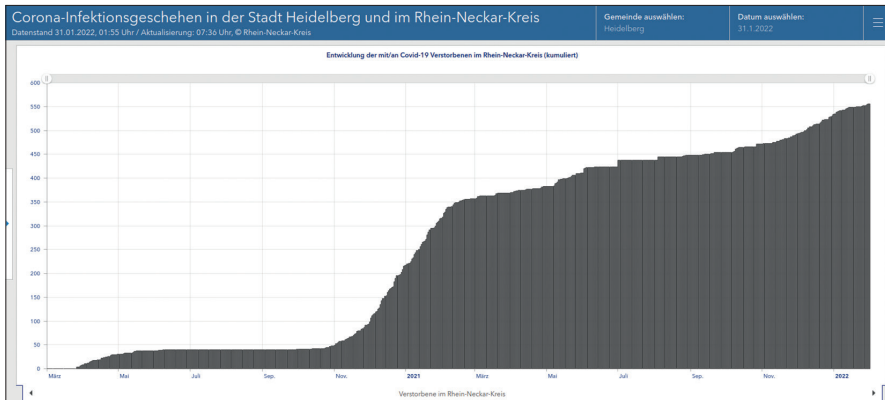


Figure 8. COVID-19 in **Rhine-Neckar district: number of deaths** (cumulative)

Image credit: Corona dashboard Public Health Service Heidelberg/Rhine-Neckar [75]

Knowns & Unknowns: Federal pandemic risk analysis of 2012

In 2012, the Federal Government of Germany conducted an insightful but nevertheless not very widely known risk analysis on a potential SARS virus pandemic which was published in 2013 [39, 96]. The likelihood of occurrence of a SARS pandemic was estimated as “conditionally probable— an event that statistically usually occurs once in a period of 100 to 1,000 years” [39, 96]. Considerable adverse consequences of such a pandemic were estimated with substantial impact on humans, the economy, as well as the immaterial sector which includes public safety, politics, and the psycho-social area [39, 96]. Of interest, the report recommended anticipatory medical preparedness by stating that “to date, there are no guidelines on how to deal with a mass influx of infected people during a pandemic. This problem requires complex medical, but also ethical considerations, and should preferably not be addressed only once a particular crisis occurs.” [39 page 65]. In addition, the authors had anticipated substantial communication issues that later became indeed known as the COVID-19 “infodemic” [78].

The report recommended that administrative crisis staff teams would take over leadership and coordination of pandemic management, and that anticipatory assessment of the situation and consecutive planning would be aligned among players involved, although without providing detailed operational instructions [39]. Therefore, affected teams on the ground would probably act in a primarily self-organizational manner, at least in the beginning of the disaster response. In order to help prioritizing and structuring organizational and institutional functioning under pandemic conditions, the German Federal Office of Civil Protection and Disaster Relief had made a pandemic planning manual available, the first edition being published in 2008. This planning manual included links to other international, federal, and state level pandemic plans [42].

Circumstances: A mission in a VUCA setting

The COVID-19 pandemic in which this CIMIC mission took place, was a challenging situation characterized by volatility, uncertainty, complexity, and ambiguity, the phenomena of the so-called VUCA-world which are common in certain contexts of medicine or disaster situations [2, 33, 58, 65, 67, 90, 93, 97, 98, 109]. VUCA environments are extremely dynamic, yet turbulent, and can lead to inaction and paralysis if leaders are overwhelmed (Figure 9). In order to master VUCA challenges successfully,

Introduction



Figure 9. Highly energized paralysis and focused ambiguity has not been unknown to human psychology in history: “The state of this epoch”, Southern Germany, 17th century [94]

“leaders need to ‘see around corners’—to see something significant about the future that others don’t see”, and step up and take appropriate action [13]. The VUCA concept was influential in military thinking after the Cold War responding to the difficulty of outlining future environmental conditions [5, 13]. Each VUCA factor describes a particular aspect of the turbulence. As such, “volatility” implies frequent and unpredictable changes, “uncertainty” relates to the absence of knowledge as to whether an event will result in a meaningful change, “complexity” defines the presence of an interconnected and convoluted network of information and procedures, and “ambiguity” stands for the inability to understand cause and effect [7].

We have previously addressed and analyzed VUCA phenomena during COVID-19 in Heidelberg, Germany, in the context of the vaccination roll out campaign [90].

Framework: CIMIC in disasters worldwide and in Germany

The cookie, the truck, and the bridge—types of military assistance

In humanitarian actions or disaster relief situations, the United Nations distinguishes three types of military assistance: 1) direct assistance, 2) indirect assistance, or 3) infrastructure support [79]. Table 1 provides an overview of these three concepts and further elaborations on details and examples.

Table 1. Types of military assistance according to the United Nations Civil-Military-Coordination Field Handbook [79, 103]



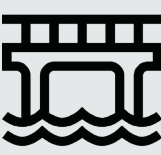
Symbol	Type of assistance	Definition [103]
"The cookie" 	Direct assistance	"Face-to-face distribution of goods and services"
"The truck" 	Indirect assistance	"At least one step removed from the population — transporting relief goods, building camps and shelters, providing water sources, clearing mines and ordnance, etc."
"The bridge" 	Infrastructure support	"General services that facilitate relief, but are not necessarily visible to, or solely for, the benefit of the affected population — repairing infrastructure, operating airfields, providing weather info, ensuring access to communications networks, etc."

Image credit: this table was designed using freely available resources from Flaticon [31]

Main sectors of humanitarian action and disaster relief operations—the UN cluster approach

When thinking about disaster management, it is of utmost importance to have a fundamental understanding about the basic needs of the potentially afflicted population including the vulnerable [10, 79, 82]. The UN-cluster approach provides a helpful overview and orientation about main sectors of humanitarian action and disaster relief. The following functional areas are considered: camp management, early recovery, children and education, emergency telecommunications, food security, health, logistics, nutrition, protection, shelter, WASH (water, sanitation, hygiene) [79, 101].

Respecting the humanitarian mindset is a foundation for successful cooperation with civilian partners

The UN recognizes that the military's specific capabilities and capacities are a valuable asset in humanitarian actions which includes disaster management [102]. When wanting to work successfully together with a non-governmental or humanitarian organization in a disaster relief mission, it is of utmost importance to both medical and non-medical military CIMIC officers to take into account the humanitarian principles—Humanity, Neutrality, Impartiality, and Operational Independence—that guide these organizations, because they provide the fundamental principles for their members' cultural and social mindsets [102, 103]. From a UN perspective, the framework for CIMIC-relationships between the military and civilian humanitarian organizations is determined by two key considerations: is the situation 1) a natural, technological, or environmental emergency in times of peace assuming a stable government and the state providing for security, or b) is the emergency situation complex, i.e., military and other armed actors are or are perceived as party to the conflict and thus humanitarian actors would avoid any association with military actors and minimize their interaction? [103] In peacetime, humanitarian actors would seek a *cooperative* approach to civil-military interaction, while in complex emergency situations with direct involvement of the military in the conflict, they would rather choose a *co-existent*, i.e., a more distant and indirect, less visible relationship with military actors in disaster relief [103]. As the COVID-19 crisis in management Germany occurred in a peace time setting, direct civilian-military information exchange and even direct military assistance to the population—within the constitutional framework under civilian leadership—would not pose any issue to NGO's and humanitarian organizations [79]. A dialogue between military and humanitarian actors is considered essential and key elements of humanitarian civil-military

interaction includes information sharing, task division and joint planning [79, 102].

The constitutional basis for domestic CIMIC in Germany in disaster relief situations

Exposures to heat and cold, storms, trauma, chemicals, water, and infectious agents were mechanisms of injury in disasters that struck Germany in the past [10, 82]. The legal framework for domestic subsidiary CIMIC in disaster management in Germany is set by the Constitution, also known as “Basic Law”. Specifically, article 35 defines mutual legal and administrative assistance between federal and state (“Land”) authorities, the military being a federal authority. In addition, the legal framework of assistance during disasters—which includes assistance by the Federal Armed Forces “in order to respond to a grave accident or a natural disaster”—is defined in article 35 [41].

Operationalization of subsidiary domestic CIMIC support in disaster management

Unless there is an immediate emergency threatening lives, health, the environment, or property requiring urgent intervention, the domestic military support in disaster relief in Germany is subsidiary [40, 43, 95]. Usually, a civil partner would approach a CIMIC liaison command requesting a specific capability intended to achieve a specific disaster relieving effect [37]. A conceptually excellent didactic example for capabilities relevant to disaster relief is the inventory of deployment options of the civilian German Federal Agency for Technical Relief [36]. Military CIMIC liaison teams have both general military and medical expertise embedded in a comprehensive civilian network, and are available on the local, district, or Federal state level, mirroring their administrative civilian counterparts within the Federal structure of Germany. This domestic territorial network was led by the Command for Territorial Tasks in Potsdam, Germany, the medical side reported separately into the Operational Medical Support Command in Weißenfels, Germany [11, 38].

Rationale and goals for this research project

The extent and intensity of the COVID-19 crisis was significant worldwide. The corona disaster relief support was the largest subsidiary mission of the German Federal Armed Forces in their history. The shared challenges to the disaster management community were considerable worldwide as well as in the region of Heidelberg, Germany, due to the dynamics and complexity of situational developments [90].

Within the constitutional and legal framework, the civilian disaster relief in Heidelberg/Rhine-Neckar was supported by the German Federal Armed Forces. This cooperation with the various civil protection organizations was remarkably close, so that there were excellent opportunities for mutual learning, especially in the aftermath, in the sense of a “learning organization”. The topic of crisis management is of foremost importance, strengthening the overall societal resilience to cope with crises and disasters (e.g., pandemics, refugee movements, disruption of energy supply, extreme weather, etc.), and will play an increasingly vital role in the future [10, 82].

A structured scientific analysis of the operational experiences of the COVID-19 disaster relief in Heidelberg/Rhine-Neckar, especially from a civil-military perspective, has not been done so far. This gap is now to be closed by the present study.

Research question

The research question of the study was **“what lessons have been learned from the civil-military cooperation in Heidelberg/Rhine-Neckar during the COVID-19 pandemic and what needs to be done to be better prepared for future disasters?”** This overarching research question was iteratively approached in three steps as explained further below.

We expected the results of this research to provide a deep expert insight into COVID-19 disaster preparedness at the local level. Flanked by comparison with published experiences at the global level [79], we hope that these lessons learned would contribute to sustainable strengthening local crisis resilience in the future.

Content and structure: Three modules of this work and their objectives

This work is divided into three modules representing a local and personal stakeholder level, as shown and further explained in Table 2.

Table 2. Modular levels of this project, representing a local and personal stakeholder analysis ascertained through a mixed-message approach, focusing on (1) mission goals and means, (2) mission impact, and (3) lessons learned for better preparedness and better future disaster resilience

Modular level	Focus questions	Methods
(1) Civil-military disaster relief support to Heidelberg during the COVID-19 crisis (mission goals and means)	What was done in Heidelberg/Rhine-Neckar?	Autoethnographic qualitative, empiric-observational analysis
(2) From civilian capability gaps towards societal resilience (mission impact)	What impact did the Heidelberg/Rhine-Neckar disaster relief mission have?	Structured interview with key stakeholders of the local disaster relief community
(3) From lessons learned towards better future disaster preparedness (resilience)	How well are we prepared for future catastrophes after lessons learned from corona and what must be done to close this gap?	Structured interview with key stakeholders of the local disaster relief community

Methods

Study type and study design

Design, execution, analysis, and publication of this study was conducted in compliance with the international quality criteria “STrengthening the Reporting of OBservational studies in Epidemiology (STROBE)” [29] and “Standards for Reporting Qualitative Research (SRQR)” [66].

This was a monocentric, qualitative, mixed-methods, non-interventional, non-randomized research project.

Module 1 is designed retrospectively, modules 2 and 3 are cross-sectional.

Data sources

Data sources for module 1 were administrative data related to the COVID-19 crisis (notes, diaries, protocols, correspondence, like [90]) as well as personal mission experiences of the principal investigator of this study. Module 1 did not need any study subject recruitment. The first CIMIC mission of the Heidelberg CIMC liaison team started on 16 March 2020 with a crisis team meeting at the mayor’s office in Heidelberg. Close of database for the mission analysis was 11 May 2022. At this date, CIMIC support had already ended.

Data sources for modules 2 and 3 were semi-structured interviews with key actors in disaster management as specified further below. Interview partners recruited for Modules 2 and 3 were subject to convenience sampling and were contacted personally and directly by the principal investigator. Subjects were recruited from adult non-vulnerable disaster response actors related to the management of the COVID-19 crisis. The rationale, purpose, goals, benefits, and risks of the study were explained in detail to the interview partners, and any questions were answered by the principal investigator. A study information sheet, an explanation on data protection, and an informed consent form was provided. If the subjects wished to take part in the study, the principal investigator and interview partners both signed the informed consent form. The semi-structured individual interview then started; all interviews were conducted by the principal investigator. The time needed was approximately 2 hours. The answers were recorded by the principal investigator. The subjects had the right to

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terminate the interview at any time without any disadvantages. The study started after receipt of the positive ethical vote and prospective study registration on ClinicalTrials.gov (study start with first subject enrolled 23 September 2022). The last subject was enrolled 17 November 2022.

Ethics

This study was submitted to the ethics committee of the Medical Faculty of the University of Heidelberg, Germany, and approved on 31 August 2022 (reference S-534/2022) before the recruitment of study subjects.

Study Registration

This study was prospectively registered on ClinicalTrials.gov on 21 September 2022 before study start and before enrollment (23 September 2022) of the first study subject (registration number NCT05552989 [80]). ClinicalTrials.gov is “a database of privately and publicly funded clinical studies conducted around the world” hosted by the U.S. National Library of Medicine [105].

Module 1: CIMIC mission in Heidelberg and Rhine-Neckar

The analysis of the local CIMIC mission in Heidelberg and Rhine-Neckar district was conducted through a qualitative, narrative, auto-ethnographic empiric approach according to the principles outlined by Creswell [22]. Here, the goal was to focus on three key issues:

(1) Understanding the thinking

The overarching guiding principle for CIMIC general and medical information exchange was a COVID-19 patient’s journey through settings and institutions, this was described and analyzed in detail, because it illustrated the interconnected flow of information, their significance, and derived consequences for action.

(2) Understanding the players

Key players, stakeholders, and their relationships with each other were described and analyzed by two actors' diagrams. The first actors' diagram focused on the civilian administrative crisis management team and civilian disaster relief which represented the overall disaster relief perspective. The second actor's diagram focused on the medical aspects of COVID-19 disaster management and depicted the regional interclinical medical task force.

(3) Understanding the mission

Understanding rationale, motifs, goals, and forces deployed allows the reader to judge the impact of the present CIMIC actions for disaster relief. Therefore, the CIMIC support provided to the local population of Heidelberg and Rhine-Neckar was described and analyzed as described in detail below.

Medical information exchange analysis

Medical information exchange was qualitative and quantitatively ascertained by the principal investigator's networking, researching, and participating in crisis team meetings orthodromically guided by the SARS-CoV-2 patient's journey in a systems based-approach. Patients' journeys visualize the pathway of a patient across the healthcare system throughout the disease [6].

Mission analysis

Variables analyzed were goal of support mission, times of deployment (in month and year), and numbers and type of forces deployed. Results were graphically summarized by a bubble chart.

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Modules 2 and 3: Impact of the Heidelberg/Rhine-Neckar CIMIC mission and lessons learned to be better prepared for future catastrophes

Modules 2 and 3 were based on semi-structured interviews with key players of the COVID-19 disaster response in Heidelberg/Rhine-Neckar, Germany.

Inclusion and exclusion criteria are presented in the following section.

Inclusion criteria

1. Age over 18 years
2. Direct or indirect involvement in civil-military collaboration during the COVID-19 crisis
3. Ability to provide consent
4. Providing written informed consent to participate in the study

Exclusion criteria

1. Failure to provide written informed consent to participate in the study

Interviewees

Interviewees were recruited upon invitation by the principal investigator [80]. A priori, a sample size of $N = 10$ was considered sufficient as a compromise of project feasibility, diversity of perspectives, and depth of insights. Seventeen potential study participants were contacted by the principal investigator, four invitees were not able to participate due to competing priorities, one invitee did not respond. Twelve participants were included after giving written informed consent, no interviewee discontinued the interview or withdrew consent.

Table 3 provides an overview of key stakeholders from the Heidelberg/Rhine-Neckar district disaster management community who were interviewed for this study.

Table 3. Interviewees by local disaster management function

Number	Interviewee disaster management function	Interview date [month/year]
Public health service		
1	Public health service physician	September 2022
2	Public health service physician	October 2022
3	Public health service physician, vaccination program	October 2022
Public service disaster managers and NGO's		
4	Public health and disaster management coordinator	November 2022
5	Director fire and disaster management agency	October 2022
6	Director fire and disaster management agency	October 2022
7	Red Cross operational manager	October 2022
Hospital and health care leadership		
8	Head, interclinical crisis management team and hospital alliance coordinator	November 2022
9	ICU cluster manager	November 2022
10	Nursing home director	October 2022
11	Nursing home care manager	November 2022
Civil-military cooperation		
12	Military CIMIC coordinator	September 2022

Semi-structured interview guide

Interviews were conducted in German language with the semi-structured guideline that is shown in Table 4. Interviews started after explanation of the study by the principal investigator and provision of written informed consent by the interviewee. The interviews started with an introductory sentence saying, "I have questions to you relating to 10 topics." At each step, the purpose of the questions was explained and then questions in the sections were asked iteratively (Table 4). Pauses were offered to participants during the interview.

Table 4. Semi-structured interview guideline

Number	Purpose of the question	Questions
1	Understanding of general perspectives and the context of the response	<ul style="list-style-type: none"> • Demographics (age, gender, marital status, citizenship, migration background, highest education, occupation, length of work experience, length of service in COVID-relevant field?)
2	Understanding of the specific professional context and perspectives of COVID disaster management	<ul style="list-style-type: none"> • What was your usual official professional role prior to COVID-19? • What was your official role in the pandemic (in terms of job title)? • What was your actual task in the pandemic (in terms of goals)?
3	Analysis of the perception of longitudinal pandemic development	<ul style="list-style-type: none"> • What phases would you divide your experiences or perceptions from the pandemic into?
4	Identification of the most important players	<ul style="list-style-type: none"> • Who were the five most important people (job title) to you in the pandemic response and why?
5	Analysis of task-specific challenges, results and lessons learned	<ul style="list-style-type: none"> • Which area exactly were you responsible for? • What were the three biggest challenges in your area? • What were the three biggest difficulties? • Which three things went best? • Which three things went worst? • What did you learn from this, what would you do the same, what would you do differently (how) and why?
6	Analysis of specific civil-military experiences, topics, outcomes, and lessons learned	<ul style="list-style-type: none"> • Did you have an insight into the work of the Bundeswehr? — if yes, where, and how? • In which areas were you supported by the Bundeswehr?



Table 4. (continued)

Number	Purpose of the question	Questions
6 (continued)		<ul style="list-style-type: none"> • How would you rate the support of the Bundeswehr? <ul style="list-style-type: none"> — Which three things went best? — Which three things went the worst? — Which three things should you do differently next time (how) and why?
7	Comparison of civilian and military capabilities	<ul style="list-style-type: none"> • In which area of pandemic response was the civilian side better positioned and in which area was the Bundeswehr better positioned? • In which area of pandemic response was the civilian side worse positioned and in which area was the Bundeswehr worse positioned?
8	Analysis of the impact of civil-military support on local resilience	<ul style="list-style-type: none"> • Has the support of the Bundeswehr helped to strengthen resilience (resistance to crises)? <ul style="list-style-type: none"> — If yes, why? — If no, why not?
9	Analysis of mutual learning and synergies	<ul style="list-style-type: none"> • What can the civilian side learn from the Bundeswehr and what can the Bundeswehr learn from the civilian side?
10	Outlook for the future: Gap analysis and necessary preparations to strengthen resilience	<ul style="list-style-type: none"> • From the lessons learned perspective of the corona era: how well are we (the Heidelberg/Rhine-Neckar disaster management community) positioned for future disasters? <ul style="list-style-type: none"> — Where do you see strengths? — Where do you see weaknesses? — What do we need to do to be better prepared for future disasters? • In one sentence: what is your summary of the corona crisis? • Wish question: You have one wish that would come true—what would it be?

Methods

Qualitative data analysis: Coding of significant statements, horizontalization, grouping into clusters of meaning

The interviews were analyzed through a qualitative, mixed narrative-phenomenological approach as proposed by Creswell which was used in previous projects of similar scope published in the peer-reviewed literature [22, 23, 78, 79]. The interviews were audio-recorded and then transcribed anonymously in text format. The text was translated into English by the principal investigator and then examined for significant statements as a narrow unit of analysis. These significant statements were then horizontalized and grouped into clusters of meaning [22, 23]. The instruments did not change over time.

Techniques to enhance trustworthiness

Credibility was enhanced through prolonged engagement of the investigator with the subject matter (i.e., since the beginning of the pandemic). This included the ability of triangulation of the interview data analysis with independent observations of the investigator. The research context and the methods are being described in comprehensive detail in order to allow transferability into comparable settings and populations. Reflexivity as another factor of credibility is addressed in the section “Researcher characteristics and reflexivity”

Analytic framework: Appraisal of findings through a harmonized community resilience lens

Resilience is defined as “the capacity of a dynamic system to adapt successfully through multisystem processes to challenges that threaten the function, survival, or development of the system.” [59]. Concepts of resilience can vary substantially between publications and sometimes appear diffuse across the literature [79]. Therefore, Patel et al. conducted a systematic literature review of 80 published papers to define common concepts and identified nine core elements of community resilience (Figure 10), [71]. To systematically appraise and contextualize preparedness in a wider sense through a community resilience lens in this work, the clusters of meaning elaborated from the interviews in this study were then aligned post hoc into a nine-level framework of resilience elements as defined by the systematic literature review of Patel et al. [71].

The coding was conducted using the open-source qualitative data analysis software QualCoder 2.9-Ubuntu [24] run with Linux Mint 20 (LTS) Ulyana [56].

Results were presented in an aggregated form out of privacy considerations. Individual most significant statements that highlighted core ideas in a didactically valuable and highly illustrative manner were cited with potentially identifying information removed, again, for privacy reasons. Likewise, if considered necessary, contextual information was carefully added to the statement with a brief explanation to allow the reader better comprehensibility.

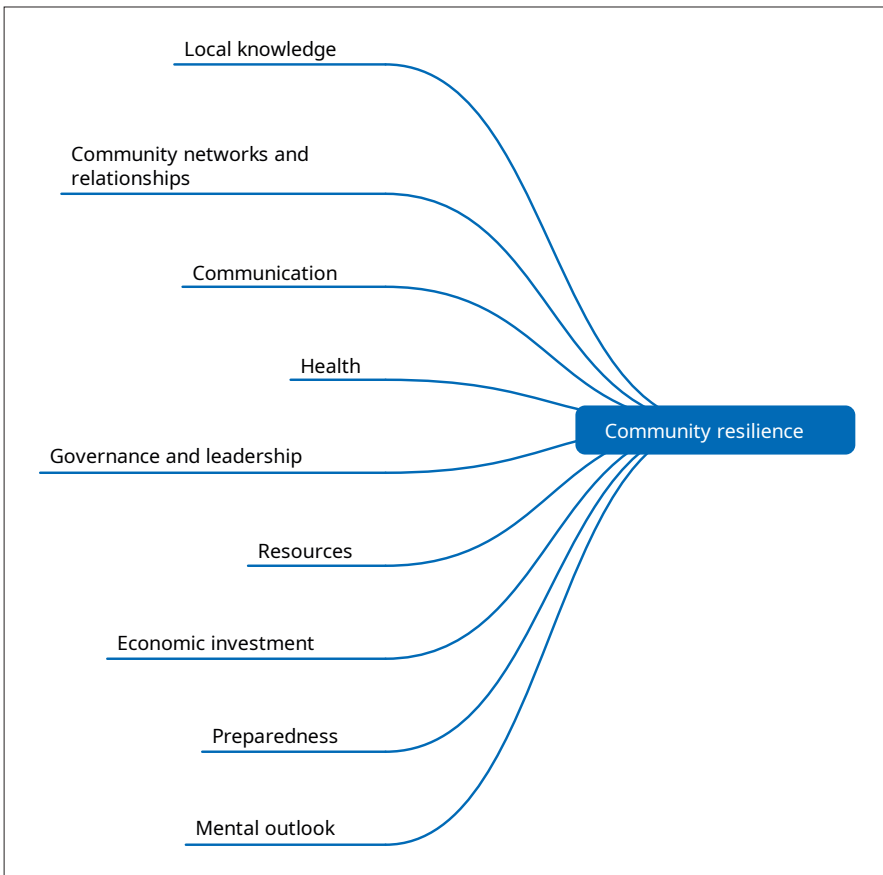


Figure 10. Nine core community resilience elements as defined by Patel et al., 2017 [71]

Variables and codes

Variables and codes analyzed are shown in Figure 11.

Methods

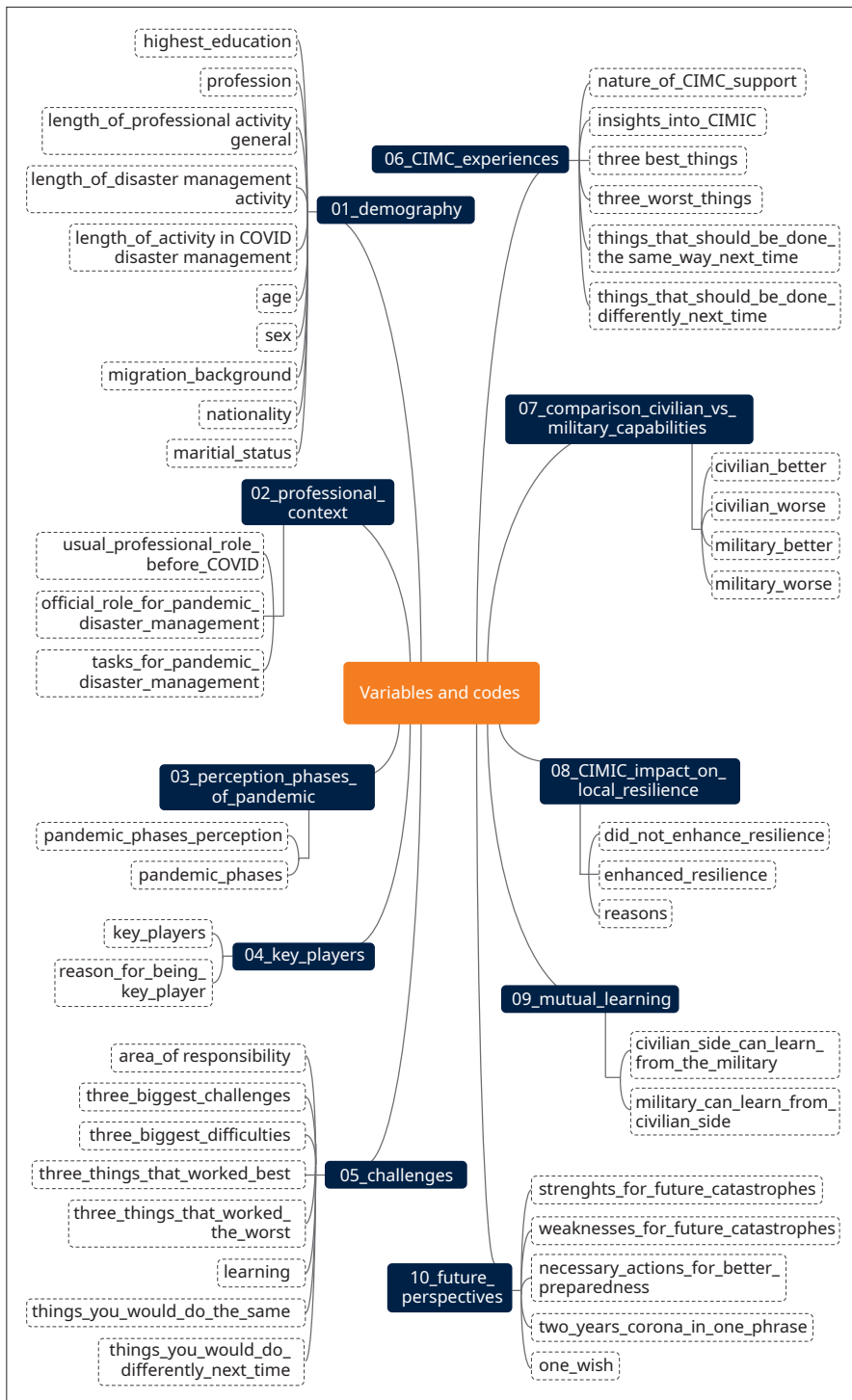


Figure 11. Variables and codes

Statistical analysis of quantitative variables

Continuous variables were analyzed through standard methods of descriptive statistics which included N, mean (if parametric), standard deviation (if parametric), median (if non-parametric) IQR (if non-parametric), minimum, maximum, missing values. Categorical variables were analyzed for frequency counts and percentages. Missing values were not imputed.

All calculations were conducted in RStudio “Tiger Daylily” (2389bc24, 2021-02-11) for Ubuntu Bionic using the packages “The R Base Package” (‘base’) version 4.1.3 and “Procedures for Psychological, Psychometric, and Personality Research” (‘psych’) version 2.2.3 [73, 77].

Epidemiological data: COVID-19 seven-day incidences and cumulative deaths for Heidelberg and Rhine-Neckar district

Data on the local COVID-19 seven-day incidences and deaths were obtained from the public health service Heidelberg/Rhine-Neckar district dashboard [75]. Data were reported for Heidelberg and the surrounding district separately because they are two distinctive administrative entities. The 7-day incidences give an indication about the spread of the infection in the population while numbers of deaths indicate the COVID-19 mortality.

Researcher characteristics and reflexivity

It is possible that qualitative data analysis and language translation can be influenced by the characteristics and the reflexivity of the individual conducting the research. The principal investigator of this work coordinated military-medical COVID-19 disaster management support for the city and healthcare system of Heidelberg, Germany, as well as for hospitals in the surrounding region since March 2020. He is a pediatric clinician-scientist practicing, researching, and teaching at the University Hospital Heidelberg, Germany, and the University of Heidelberg, Germany [79]. He has training or work experiences in Germany, the United States, France, Spain, the UK, Chile, and at the NATO (North Atlantic Treaty Organization) [79]. He currently serves as a reserve medical staff officer in the rank of a Lt.-Colonel (OF-4) of the German Armed Forces in the CIMIC liaison command Heidelberg, Germany [79].

Results

Module 1: Civil-military disaster relief support to Heidelberg and Rhine-Neckar district during the COVID-19 crisis. Autoethnographic qualitative, empiric—observational analysis

Systems-based guiding principle for CIMIC medical information exchange: A COVID-19 patient's journey

A typical, possible COVID-19 patient journey could look like this: a vulnerable person acquires the SARS-CoV-2 infection, spreads it unwillingly to other individuals, becomes symptomatic, undergoes testing (SARS-CoV-2 antigen or PCR), sees a physician as an outpatient, is admitted to the hospital due to aggravated disease which deteriorates further so that intensive care becomes necessary. In December 2021, vaccination became available and increasingly more individuals became eligible to be vaccinated (Figure 12).

Measurement points along the patient's journey helped ascertain whether the disaster relief system was still resilient. Proactive thinking ahead of the wave allowed recognizing deficiencies early and to start thinking about and preparing countermeasures. Table 5 provides an insight into seminal questions the CIMIC medical staff office should ask and the corresponding information and action matrix. These questions should be looked at from a lens which includes thinking about whether staff, stuff, spaces, and systems are still sufficient to provide an appropriate and timely disaster response [69].

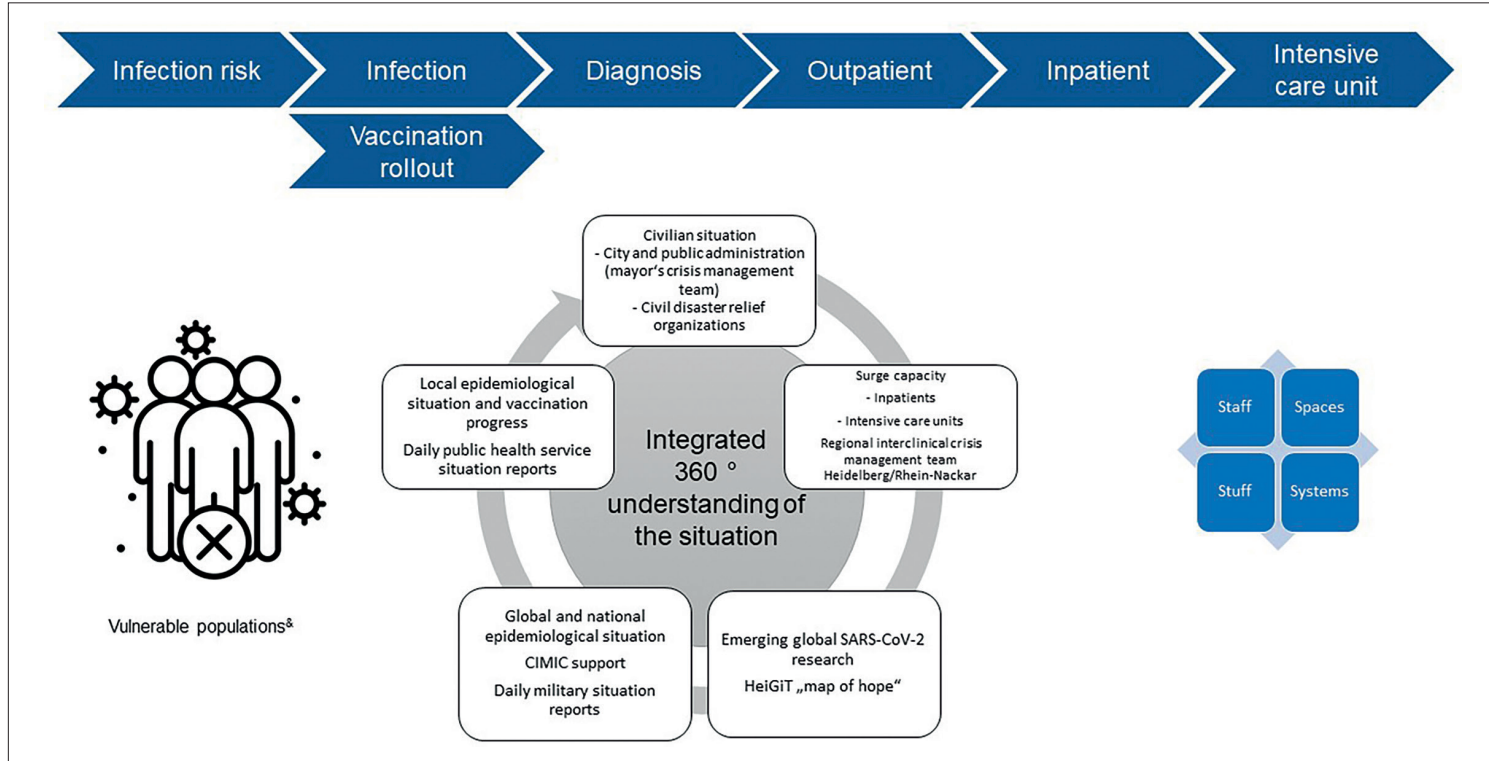


Figure 12. Agile, orthodromic CIMIC medical intelligence gathering along a COVID-19 patient's journey

Image credit: the freely available image depicting vulnerable populations was downloaded from Vecteezy [106]

Table 5. Seminal questions, information sources, network opportunities, and possible countermeasures from a CIMIC perspective

Seminal question to detect lack of resilience early	Information source (report)	Team to network with	Countermeasures with CIMIC relevance
What is the current rate of infection in the local population?	<ul style="list-style-type: none"> Public health service daily report Military daily situation report 	<ul style="list-style-type: none"> Mayor’s crisis management team Interclinical crisis management team 	
How can the spread of infection be impeded in the population?	<ul style="list-style-type: none"> Public health service daily report 	<ul style="list-style-type: none"> Mayor’s crisis management team Interclinical crisis management team 	<ul style="list-style-type: none"> Quarantine Tracking and tracing Communication Vaccination
Who are vulnerable populations at risk and where are they taken care of?	<ul style="list-style-type: none"> Public health service daily report 	<ul style="list-style-type: none"> Mayor’s crisis management team Interclinical crisis management team 	
How can you protect vulnerable populations?	<ul style="list-style-type: none"> Public health service daily report Military daily situation report 	<ul style="list-style-type: none"> Mayor’s crisis management team Interclinical crisis management team 	<ul style="list-style-type: none"> Testing Vaccination
What is needed to make a rapid diagnosis?	<ul style="list-style-type: none"> Public health service daily report 	<ul style="list-style-type: none"> Mayor’s crisis management team Interclinical crisis management team 	
Where are outpatients, inpatients, and ICU patients being taken care of, is there alignment in terms of staff, stuff, spaces, and systems and what is the surge capacity?		<ul style="list-style-type: none"> Interclinical crisis management team 	<ul style="list-style-type: none"> Personnel support



Results

Table 5. (continued)

Seminal question to detect lack of resilience early	Information source (report)	Team to network with	Countermeasures with CIMIC relevance
Is the civilian system still resilient?	<ul style="list-style-type: none"> Public health service daily report Military daily situation report 	<ul style="list-style-type: none"> Mayor's crisis management team Interclinical crisis management team Regular video-conferences with civilian disaster relief organizations 	<ul style="list-style-type: none"> Think ahead of the curve, anticipate issues early, prepare appropriate countermeasures as needed within possibilities and limitations of your organization and the overall situation in the country
Which scientific progress is being made in terms of disease knowledge, treatment, and vaccination developments?	<ul style="list-style-type: none"> HeiGIT "Map of Hope", a global mapping tool for ongoing clinical studies in COVID-19 [81] (Figure 13) 	<ul style="list-style-type: none"> Interclinical crisis management team (Figure 15) 	

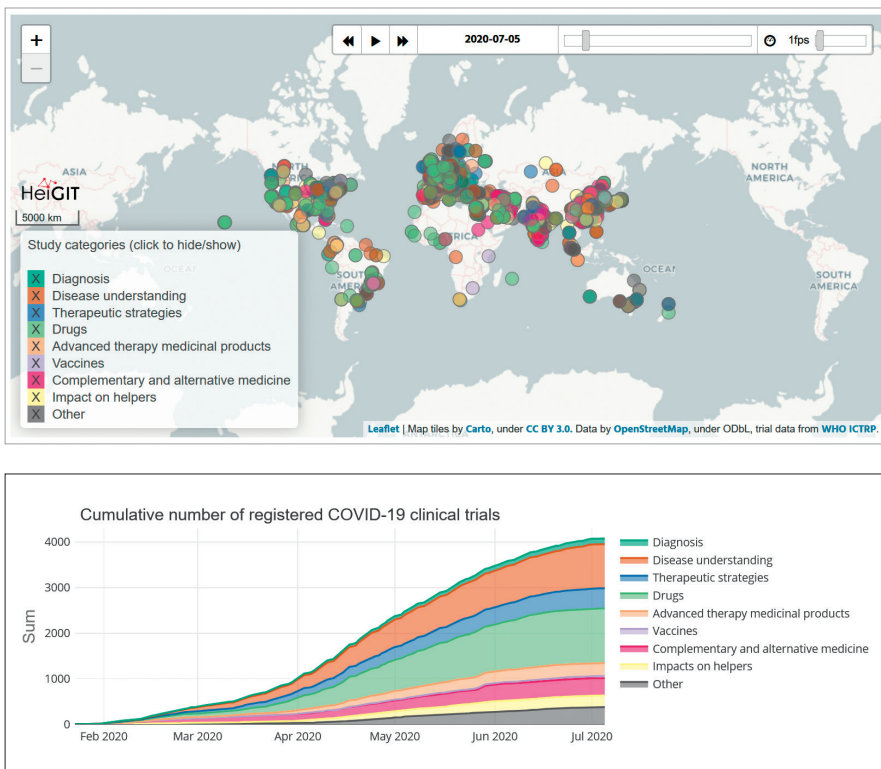


Figure 13. COVID-19 clinical trials map (“Map of Hope”) providing a temporal-spatial (top) and cumulative (bottom) overview of clinical research on SARS-CoV-2, developed by us in cooperation with the Heidelberg Institute for Geoinformation technology (HeiGiT) [81]

Actors’ diagram: Civilian administrative crisis management team and civilian disaster relief

On 16 March 2020, the mayor of Heidelberg, Germany, assembled an inter-institutional, civilian administrative crisis management team at the Heidelberg city hall because of the dynamization of the COVID-19 situation in Germany. On that day, a total of 9534 COVID-19 cases had been reported in Germany, compared with 167 cases on 01 March 2020 [84]. The civilian administrative crisis management team was headed by the mayor of Heidelberg, Germany. Members of the team include representatives from disaster-relevant critical line functions within the city’s own administration including schools and childcare (Figure 14, see left circle for further details on represented line functions). In addition, because the pandemic was a situation requiring substantial medical disaster management capacities, there was a strong and diverse medical presence in the administra-

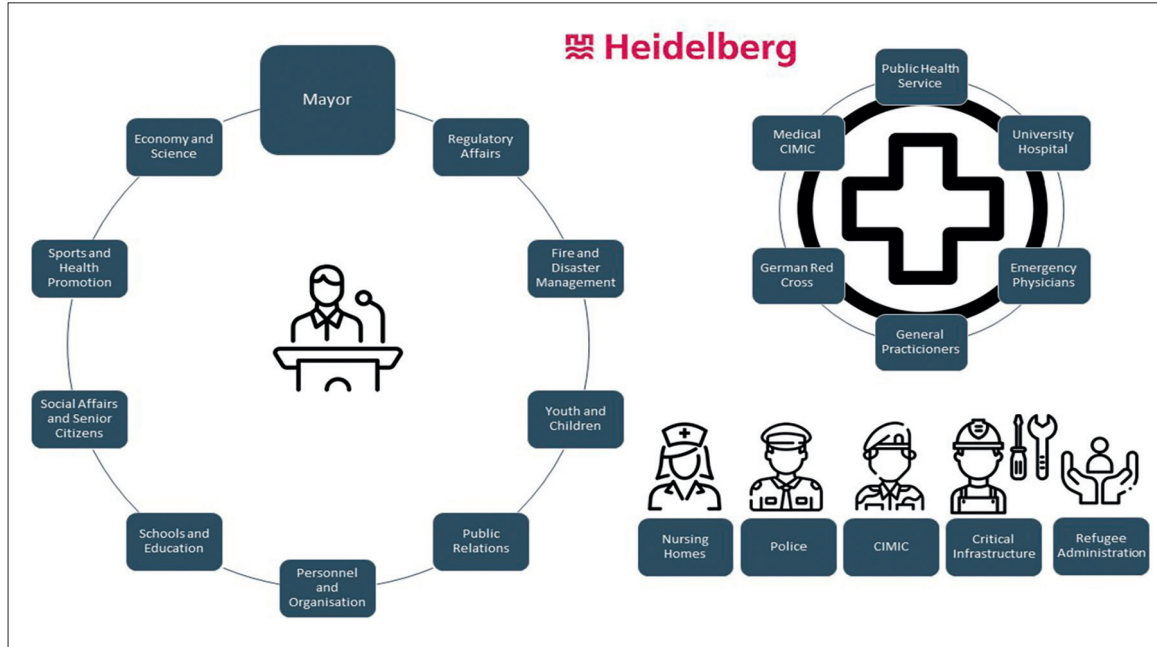


Figure 14. The city of Heidelberg mayor's crisis management team. The left circle represents representatives from the city's disaster critical internal line functions. The circle on the right lists external members from civilian and military medical organizations. Team members on the the bottom right represented vulnerable populations (elderly care and the refugee center), security, critical infrastructure and non-medical subsidiary CIMIC disaster management support by Germany's Federal Armed Forces

Image credit: This figure was designed using freely available resources from Flaticon [31]

tive crisis management team, which included the public health service, the University hospital, emergency physicians, general practitioners, the German Red Cross, and the local medical staff officer from the CIMIC liaison team (Figure 14, right circle). The main task of this team was a) counseling the mayor in terms of risk assessment and b) implementing appropriate, aligned mitigation and counter measures back in their line functions. There was a particular emphasis on 1) prudence (putting citizens' perspectives first, 2) transparency (early identification of ability gaps), and 3) determination (proactive mitigation and overcoming mindset borders of own responsibilities). This team was strengthened by external members representing responsibilities for vulnerable populations (nursing homes for the elderly, but also the neighboring refugee center with an intended capacity for up to 2000 incoming migrants [20]). Other external team members represented functions such as security (the police), critical infrastructure (e.g., but not limited to energy and water supply) and general military CIMIC for subsidiary support from the German Federal Armed Forces (Figure 14, right corner on the bottom). The team met as needed, initially once per week and later less often depending on the dynamics of the overall situation and the necessity to ascertain the possible impact of overarching strategic or political changes.

Actors' diagram: Regional interclinical medical task force

Upon the initiative of the public health service Heidelberg/Rhine-Neckar and the rescue coordination center (whose duty is, among others, to dispatch ambulances and firefighters), a regional interclinical medical task force was established on 27 March 2020 and later transitioned to and moderated by the University of Heidelberg Chair of Geriatrics. The main goal of this task force was to align staff, stuff, spaces, and systems in the regional COVID-19 disaster management. Participating actors were the University Hospital Heidelberg, regional hospitals who contributed beds of regular inpatient and intensive care units into a common pool. The numbers of beds need for the next days in were agreed upon in advance by consensus based on the epidemiological situation and a one-week prognosis provided by the Center of Infectious Diseases (virology) estimated on the basis of modeling and simulation techniques [54]. The allocation of COVID-19 beds was facilitated by the newly established COVID-19 coordination unit at the University Hospital Heidelberg which also served as a point of contact into the extended-regional, federal state-wide, and nationally aligned COVID-19 patient distribution management system. Within this system, if surge capacities happened to be depleted, patients would first be distributed within a regional cluster, then between clusters within a federal state, and finally within or across a so-called "cloverleaf" within a system

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consisting of one or more federal states. The overall German national territory was therefore grouped into five cloverleaves [46, 72]. The task force received regular situation updates from the nursing homes in the city and district because a substantial part of the vulnerable elderly population was hosted there. General practitioners brought an excellent insight into the outpatients' situation to the table. One important measure to avoid an overwhelming influx of patients into the hospitals which would rapidly exceed surge capacities, was to keep SARS-CoV-2 infected patients at home as long as possible, while at the same time being able to recognize the need of hospitalization in each patient in time and transporting him or her to the hospital. So-called "corona-taxis" were established that would drive an inter-professional team to patients' homes to monitor their medical situations [8, 9]. Medical CIMIC acted as a liaison into the military subsidiary disaster relief support (Figure 15). In a typical meeting, the task force would discuss the local and global epidemiological situation, the situation in nursing homes, local and regional patient allocation, the outpatient situation, testing issues, tracing and tracking, protocols for diagnosis and treatment, aligned hygienic measures and facility protection strategies, vaccination progress, and predictions for the next week. A critical item was aligned crisis communication and leveraging support through political opinion leaders.

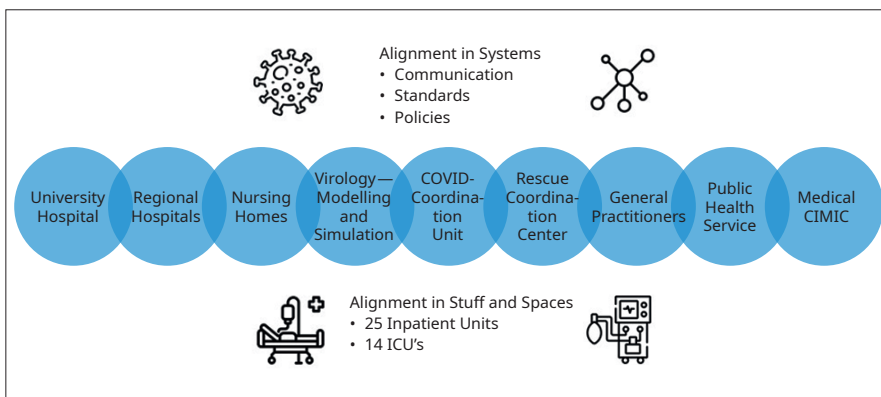


Figure 15. Regional interclinical medical task force Heidelberg/Rhine-Neckar district. The image shows actors involved and main collaborative tasks. The numbers of beds mentioned reflect the status on 04 February 2022

Image credit: This figure was designed using freely available resources from Flaticon [31]

CIMIC support provided to the population of Heidelberg and Rhine-Neckar

Table 6 summarizes the issues in civilian resilience encountered and the CIMIC support provided to the local population (Figure 16). The abilities required to mitigate these identified issues were negotiated with the appropriate civilian partners, ideally in a proactive, agile way ahead of the curve. The countermeasures taken were implemented under civilian overall responsibility and leadership in compliance with the German constitution. CIMIC support was provided to local civilian partners continuously during all the five COVID waves. These included counseling to institutions involved in disaster management by the CIMIC team and medical CIMIC team. PPE logistic support was provided. The three areas of main emphasis in military support included logistic quarantine support of the local refugee center, contract tracing support in the public health service, and vaccination support to the public health service by the military to civilian partners. Lessons learned during this SARS-CoV-2 vaccination roll-out in Heidelberg, Germany, were analyzed and reported by us, in detail, previously [90]. In addition, the military swiftly supported SARS-CoV-2-antigen testing in nursing homes during an infection surge in the second wave until civilian capacities were available. The goal was to protect vulnerable populations, i.e., the elderly, from COVID-19 which would overwhelm ICU capacities in the local hospital system (Figure 17). At a later stage, during the 5th wave, there was a sudden surge of symptomatic COVID-19 infections in a nursing home which was immediately supported by reservists who helped the remaining personnel taking care of the elderly by distributing food and taking over logistic support duties. Medical support by the military included medical assistance by health care professionals and a physician during the quarantine support in the local refugee center. In addition, the ICUs of the university hospital were supported twice during COVID-19 patients surges during the second and third wave.

Table 6. CIMIC support provided to the population of Heidelberg and Rhine-Neckar during the COVID-19 crisis. Overall, 788 soldiers (including 86 reservists) of 20 different military units were deployed between March 2019 and March 2022 (close of database 11 May 2022). See Figure 16 for time and deployment size of forces

No.	Infection wave	Issue	Civilian situation	Military support provided*	Outcome
1	1 st	Hospitals lack PPE which exposes staff to infections	Lack of capacities to bring decentrally 3D-printed PPE to University hospital	Staff: reservists volunteer to collect and transport PPE	Availability of PPE protects hospital staff
2	1 st	Risk of SARS-CoV-2 outbreak in a major regional refugee center	Lack of personnel and material for catering people in quarantine	Staff: personnel for logistic quarantine support, medical quarantine support, physician quarantine support Stuff: material support	Quarantine successful, no major outbreak
3	2 nd and 3 rd	Ongoing surge of COVID-19 patients overwhelm ICU units	ICU staff exhausted	Staff: medical personnel to support ICU nurses	Boost to morale ICU successfully mastered patient surge
4	1 st , 2 nd , 3 rd , 4 th , 5 th	Risk of uncontrolled spread of infection endangers population	Public health service unable to cope with necessary rapid personnel surge for contract tracking and tracing	Staff: personnel to support tracking and tracing, data entry, as well as COVID phone hotline answering FAQs from the public	Local public health service was able to maintain tracking and tracing duties which contributed to slowing down the infection curve



Table 6. (continued)

No.	Infection wave	Issue	Civilian situation	Military support provided*	Outcome
5	2 nd	SARS-CoV-2 infections spread into vulnerable populations in nursing homes leading to casualties	Fifteen nursing homes in lack of staff and personnel unable to conduct SARS-CoV-2 antigen testing	Staff: personnel for SARS-CoV-2 antigen point-of-care testing of nursing home visitors	Vulnerable populations at nursing homes protected (Figure 17)
6	5 th	SARS-CoV-2 infections spread into vulnerable populations in nursing homes leading to surge of symptomatic infections among staff	Lack of personnel due to COVID-19 infection of staff	Staff: reservists volunteer to support remaining nursing home personnel	Vulnerable populations at nursing homes protected
7	2 nd , 3 rd , 4 th , 5 th	Swift roll-out of ambitious vaccine campaign in a short time endangered by lack of staff [†]	Public health service unable to recruit personnel on the civilian market	Staff: personnel to support vaccination campaign	Vaccination campaign roll-out successful, resulting in an increased protection of the public, and bringing life closer to normal

*Under civilian leadership; PPE: personal protective equipment

[†]This mission was previously reported by us in detail [90].

Results

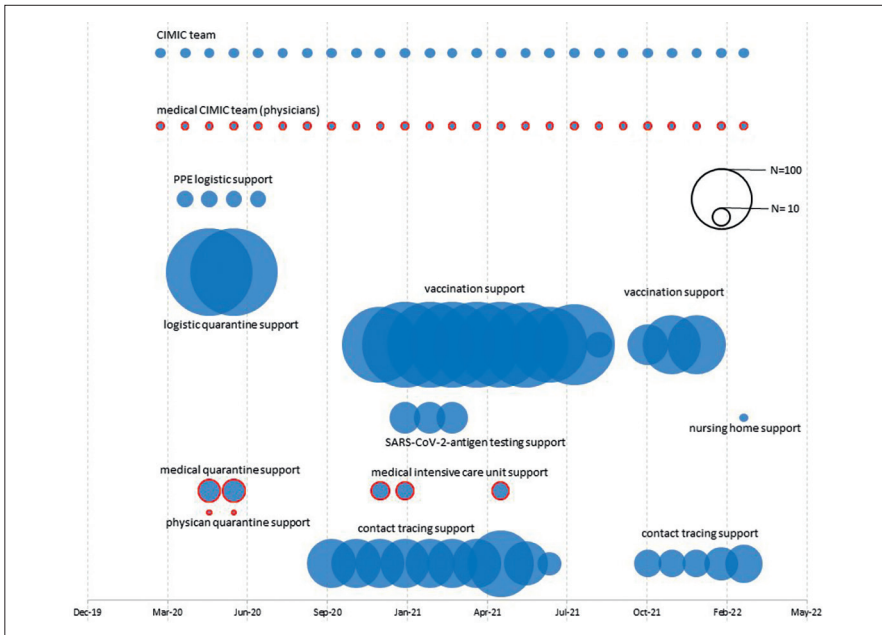


Figure 16. Time axis, nature, and strength of CIMIC support by the German Armed Forces to the population of Heidelberg and Rhine-Neckar during the great 2019–2022 SARS-CoV-2 pandemic. The size of the bubble indicates the number of forces deployed

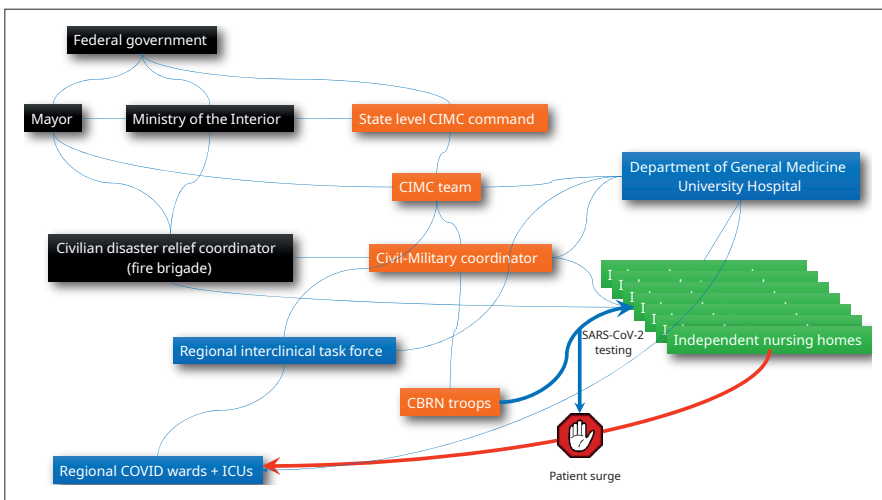


Figure 17. Actors' diagram for the CIMIC nursing home support mission in Heidelberg, Germany. The four groups of players are indicated by colors: black—public administration, orange—military, blue—the medical side, green—the independent nursing homes. The goal was to substantially decrease patient surges from nursing homes to hospitals (including intensive care units) by interruption of infection chains through SARS-CoV-2 testing of visitors by CBRN soldiers

Module 2: From civilian capability gaps towards societal resilience—impact of the Heidelberg/Rhine-Neckar CIMIC disaster relief mission. Semi-structured interviews with key stakeholders of the local disaster relief community

Demography of the study population

The demography of the participants of this study is provided in Table 7.

Table 7. Demography of the disaster management expert panel Heidelberg/Rhine-Neckar ($\Sigma = 12$) included in the present study

Demographic Indicator	Parameter	N ($\Sigma = 12$)	Percentage
Age	30–39 years	2	17%
	40–49 years	4	33%
	50–59 years	4	33%
	above 60 years	2	17%
Mean age	48.8 years Standard deviation: 8.68 years Range: 33–62 years	12	100%
Sex	Female	2	17%
	Male	10	83%
Migration background	Yes	2	17%
	No	10	83%
Nationality	German only	11	92%
	Dual incl. German	1	8%
Highest education	University	8	67%
	University of Applied Sciences	1	8%
	Professional education	3	25%
Marital status	Married	9	75%
	Not married	3	25%
Professional field*	Administration	1	8%
	Commerce	1	8%
	Economics and IT	1	8%
	Firefighting technical service	1	8%
	Geriatric nursing	2	17%
			▶▶

Results

Table 7. (continued)

Demographic Indicator	Parameter	N ($\Sigma = 12$)	Percentage
Professional field* (continued)	Law	1	8%
	Medicine	5	42%
	Theology	1	8%
Lengths of professional activity	0–9 years	2	17%
	10–19 years	2	17%
	20–29 years	3	25%
	30–40 years	5	42%
Length of activity in COVID-19 disaster management	From 1 st wave (up to May 2020) until date of interview (September—November 2022)	12	100%

*N_{total} is bigger than 12 because of individuals with dual degrees across two categories

Professional context

Participants' professional contexts provide an insight into the expertise of the local disaster management network. This section illustrates professional proficiencies, perspectives, and disaster management skill sets within the present study population. As such, participants' professional roles before and during the SARS-CoV-2 pandemic and their goals and tasks are shown in Table 8.

Table 8. Local disaster management expertise: professional contexts, roles, tasks, and goals of study participants before and during the pandemic

No.	Professional role before the pandemic	Official role during the pandemic	Goals and tasks for pandemic disaster management
Public health service			
1	Unit head, health protection, public health service, which includes infection protection, drinking water hygiene. Deputy head, office for public health	Identical to the role before the pandemic. In addition: crisis staff team of city administration, operative staff team of the district, staff crisis team public health administration	<ul style="list-style-type: none"> • Evaluation of the situation • Coordination of reactions to challenges (built-up data management system, case management, built-up and maintaining testing units operational) • Support vaccination center built-up • Coordination of functional areas (phone hotline, contact tracing and tracking) • Acquisition of personnel and material
2	Physician public health service. Unit head, child and adolescent health service.	Head, contact tracing, office for public health, then deputy head, office for public health	<ul style="list-style-type: none"> • Establishment of contact tracing and tracking, SOP writing and area supervisions • Organizational management of functional subareas (nursing homes, hospitals, community housing, schools and childcare facilities, data management), personnel and organizational infrastructures
3	Medical student and volunteer member of a St. John Accident Assistance disaster protection unit	Physician for SARS-CoV-2 testing in nursing homes (surveillance of staff and testing of difficult cases), population testing center and testing of children (organization, establishment of operating procedures), establishment of vaccination center in close cooperation with other teams, operation procedures, management of personnel in vaccination centers, implementation of federal vaccination guidelines, and compliance with medical devices act, management of emergencies, staff safety, management of physicians in the vaccination center, point of contact for hierarchy in public health service, go-to-person in case of problems, dismantling and reestablishing vaccination centers, (re-)deployment	<ul style="list-style-type: none"> • Protection of vulnerable populations and civil protection by identification of infections in nursing homes and public testing facilities • Prevention of infections by protection through vaccinations



Table 8. (continued)

No.	Professional role before the pandemic	Official role during the pandemic	Goals and tasks for pandemic disaster management
3 (continued)		of vaccination teams after geographical move, management of vaccine supply, subject matter expert vaccination for children, supervising of appointment management for testing and vaccination	
Public service disaster managers and NGO's			
4	Department head, office for public health and order which includes the office for disaster protection. Supervision and strategic steering function in alignment with the district administrator	Identical to the role before the pandemic. Focusing on counseling and leadership for communities in the district	<ul style="list-style-type: none"> Initially: defining the issue, reaction, and necessary means Identifying and closing gaps (testing capacities, communication means, staff expansion) Smaller goals <i>"with the big headline we must somehow manage this pandemic in the best possible way for the residents of the Rhine-Neckar district, side by side also with the local authorities, because we were ultimately also dependent on them to a certain extent."</i>
5	District fire chief, supervision, counseling and planning of fire brigades in the district, participation in larger deployments of fire brigades and their operational management if necessary or tactical advice to the local operation manager, also responsible for disaster protection, participating in the regional mission control center, counseling member of the local board	District disaster manager supporting health protection through logistics, procurement, and distribution of personal protective equipment to communities and nursing homes, planning and setup of vaccination centers, personnel support for disaster management, personnel, and vehicles for vaccination teams	<ul style="list-style-type: none"> Fair, prioritized distribution of PPE to vulnerable groups or others in need Built up of vaccination center in suitable objects with functioning operational structures, emergency escape routes and fire protection
6	City disaster manager, planning and structuring staff work, administration of disaster management equipment	City disaster manager, information management (acquisition and distribution to city head and city administration), procurement and distribution of personal protective equipment (for administration, nursing home, facilities, physicians), planning, build-up, coordination and accompany of a vaccination center and mobile vaccination teams, maintenance of material, alignment conferences	<ul style="list-style-type: none"> PPE: distribution of state delivered material with the shortest delay possible to institutions, establishing a distribution center at the main fire station. Vaccinations: being ready-to-operate in time set by the state, vaccinate as much vaccine as possible but keep some reserves to be able to react to fluctuations; up-scaling vaccinations with availability of more vaccine which included building-up entirely new structures Remain up-to-date with knowledge to respond to future challenges by adapting structures in a rapidly changing environment Main task: run a vaccination center



Table 8. (continued)

No.	Professional role before the pandemic	Official role during the pandemic	Goals and tasks for pandemic disaster management
7	Full-time head of Red Cross Services, responsible for volunteers, training, fundraising. Volunteer as deputy head in the district preparedness management of the Red Cross.	Red cross operations manager, full-time assignment as operative head vaccination center, as a volunteer member of crisis staff team and operations staff team, responsible as S4** for material and procurement	<ul style="list-style-type: none"> • Build-up a vaccination center • Bring all players together to collaborate (physicians, city employees, military, as well as city administration, and private service providers) • Vaccinate the population
Hospital and health care leadership			
8	Medical director of a geriatric hospital	Interclinical alliance coordinator: communicative coordination of regional hospitals and other healthcare providers in the COVID-19 management, including communication to physicians in private practices, to nursing homes, to the public health service, to the military, and to municipal authorities	<ul style="list-style-type: none"> • <i>“Maintaining the ability to act—through agreements and through information and through balancing, i.e., representing different interests within a discussion process and deriving meaningful actions from the same and reducing and avoiding confrontational positions of the individual participants. So that the synergy was preserved in the pandemic, versus delimiting attitude”</i>
9	Specialist in anesthesiology and head of the emergency medicine section	COVID-19 intensive care cluster coordinator for the Heidelberg cluster* and representative of the regional COVID-19 hospitalization coordination unit, panels of the University Hospital	<ul style="list-style-type: none"> • Initially raising awareness of the crisis situation and clarification of implications to the institutions • Elaboration of the situation report in the department, the clinic, and the University Hospital • Direction of the COVID-19-coordination unit, initially conceived for secondary transportation of critically ill COVID-19 ICU patients between hospitals, quickly enlarged to manage primary hospitalizations for all hospitals in Heidelberg and the Rhine-Neckar district. • Contact person for the cluster* Heidelberg (which includes Heidelberg, Mannheim, Neckar-Odenwald district, Rhine-Neckar district)
10	Nursing home director for two institutions	Nursing home director, person in charge for nursing home residents, nursing staff, and the facility	<ul style="list-style-type: none"> • Primarily protection of the inhabitants • Protection of the staff <i>“so that we all get through it, get through this time well, as unharmed as possible”</i>
11	Nursing home care manager	Nursing home care manager plus organization of the vaccination campaign in three nursing homes, organization of services and visitors, hygiene management, directing staff	<ul style="list-style-type: none"> • Maintain the institution free of COVID-19 • Maintain residents in good spirit • Motivate staff to persistence
▶▶			

Table 8. (continued)

No.	Professional role before the pandemic	Official role during the pandemic	Goals and tasks for pandemic disaster management
Civil-military cooperation			
12	Deputy head, CIMIC liaison command Heidelberg	Deputy head, CIMIC liaison command Heidelberg	<ul style="list-style-type: none"> • Support of the civilian side in the management of the corona crisis together with other reservists and reserve officers • Coordination and cooperation with the soldiers deployed to Heidelberg and the Rhine-Neckar district

*Cluster = geographical subunit which is part of the resource sharing cloverleaf concept for COVID-19 patient transfers within Germany [46]

**S4 = position or person within the continental general staff system who is responsible for the logistics department

"Paragraphs in italics" denote citations from interviewees.

Perception of pandemic phases

Interviewees (N = 12) were asked how, and in which phases they had perceived the pandemic. One participant described two phases, three spoke about three phases, six reported four phases, and one participant, respectively, recounted five and nine phases each.

These perceptions included mixed elements of time sequences and mission aspects, intellectual processes and challenges, and emotions. Table 9 summarizes the findings.

Table 9. Phasic perception of the pandemic

Two phases (N = 1):			
No.	Phase		
	1	2	
1	Equipment phase (requests for material support)	Personnel and mission support phases for refugees, public health service, nursing homes, and vaccination program	
Three phases (N = 3):			
No.	Phase		
	1	2	3
2	Protection of nursing homes, supply with PPE, and building of test capacities. The surge required creating infrastructure for distribution of PPE and deployment of test teams	Vaccination program roll-out	Integration of situational developments of infection waves into routine structures and workflows. Managing pandemic fatigue among personnel
3	Uncertainty phase until standards in protection, diagnostics, and therapy had been reached	Vaccination phase (overlapping with significant pandemic wave and the availability of vaccination—the vaccination resulting in a substantial break for the pandemic response)	Ambiguity phase, whether pandemic is still relevant, inside hospitals and nursing homes as opposed to public life in the broader society. Understanding as a pandemic vs. endemic
4	Phase of fear (social distancing for oneself and team)	One episode of a severe infection outbreak (shortage of staff, necessity of crisis management, support by military reservists)	Relaxation phase (availability of PPE and staff)



Table 9. (continued)

Four phases (N = 6):				
No.	Phase			
	1	2	3	4
5	Chaos phase	Relaxation phases between the first and second wave	Fright phase in the beginning of the second wave and third wave (because of surprises by highly elevated infection numbers)	Consolidation phase around the third wave (team had working routine)
6	Huge curiosity and huge challenge, needed to create something without preexisting structures facing an event of great magnitude working under enormous pressure	Deceived hope that another wave would not occur anymore realizing that the second wave would even be bigger than the first wave	Cyclic repeats until vaccinations, hoping the pandemic would be over in 2–3 months	Realizing the pandemic is not over yet and necessity to transition from the crisis mode into some kind of normalcy mode
7	Comprehension and awareness phase (acquisition and distribution of information, creating new communication structures, establishing situation rooms)	Phase with surge of seriously ill patients on intensive care units, necessity of patient transfers	Phases of less aggressive virus variants leading to less severe disease, uncertainty about whether de-escalation would be appropriate, the intensive care units were busy but no longer overloaded	Endemic phase with the uncertainty of another surge in the winter, depending on virus variants, but better immunity of the population through previous infections and vaccination
8	Chaos and uncertainty phase (lack of medical information and experience, pandemic plans were not comprehensive)	Relaxation phase (better supply chains for PPE, perspective of vaccine development)	Chaos and uncertainty phase with new variants of unknown significance (made it difficult to deduct necessary behavioral consequences. Information from the state came in relatively late)	Relaxation phase (start of vaccination program, appearance of less pathogenic variants, established supply chains for PPE, people had learned how to adapt behaviors in their day-to-day life) interrupted from intermittent, short phases of brief chaos due to unknowns associated with new waves
9	Phase of uncertainty and fear (many deaths among risk groups in surrounding institutions)	Phase of vaccination (including many vaccines related questions from staff)	Phase of relaxation (feeling of being protected)	Phase of cautious return towards normalization (no more observation of severe disease or hospitalizations, positive staff with minor signs and symptoms)
10	Foundation or orientation phase (what do you have, where do you go?)	Saturation phase (operations in place, covering peaks)	Continuation phase (careful adjustments, integration of changing players)	Adaptation phase (lockdowns & opening, on and offs of operations, twice)



Table 9. (continued)

Five phases (N = 1):										
No.	Phase									
	1	2	3	4	5					
11	Shock-rigidity with lockdown and isolation which was unknown and not imaginable, even after having seen the first reports from China	Helplessness and uncertainty about further development of the situation	Enthusiasm about being able to help with distribution of PPE	Enthusiasm about starting-up the vaccination center	Frustration about stop and go, starting-up further vaccination points followed by satisfaction that this module worked out well and was well accepted by the population					
Nine phases (N = 1):										
No.	Phase									
	1	2	3	4	5	6	7	8	9	
12	Phase of uncertainty (<i>"this is like SARS1, it will go away after a while"</i>)	Phase of fear (work in lockdown)	Phase of abnormal normalcy (working in the pandemic)	Phase of calmness (between two waves)	Start-up phase (tests for children)	Stress phase (roll-out of vaccination centers)	Phase of relaxation (between two waves)	Stress phase (re-initiation of vaccination program and mobile) vaccination teams)	Normalization phase	

PPE = personal protective equipment

N refers to the size of the subgroup of participants

No. refers to the random sequential orders of interviews in this data table

Significant actors

Figure 18 provides an overview of individuals or institutions that participants considered most significant in the pandemic disaster response in Heidelberg Rhine-Neckar. These actors represented the medical side (academic and smaller hospitals as well private practice physicians), the public health service, SARS-CoV-2-vaccination teams, elderly care facilities, a private personnel staffing agency, the military, and the public administration (city, district, government district, fire and disaster management) as well as the political leadership on the local and state level.

Reasons for being considered a significant actor

The reasons why participants considered above named players (Figure 18) as significant actors could be categorized into six categories. Significant actors showed exceptional strengths in terms of (1) leadership, (2) diplomacy, (3) communication, they contributed as (4) enablers, demonstrated (5) agility, and (6) showed a particularly positive and constructive mindset. An overview of these six key elements and their features that illustrate and explain these elements in more detail is shown in Table 10.

Results

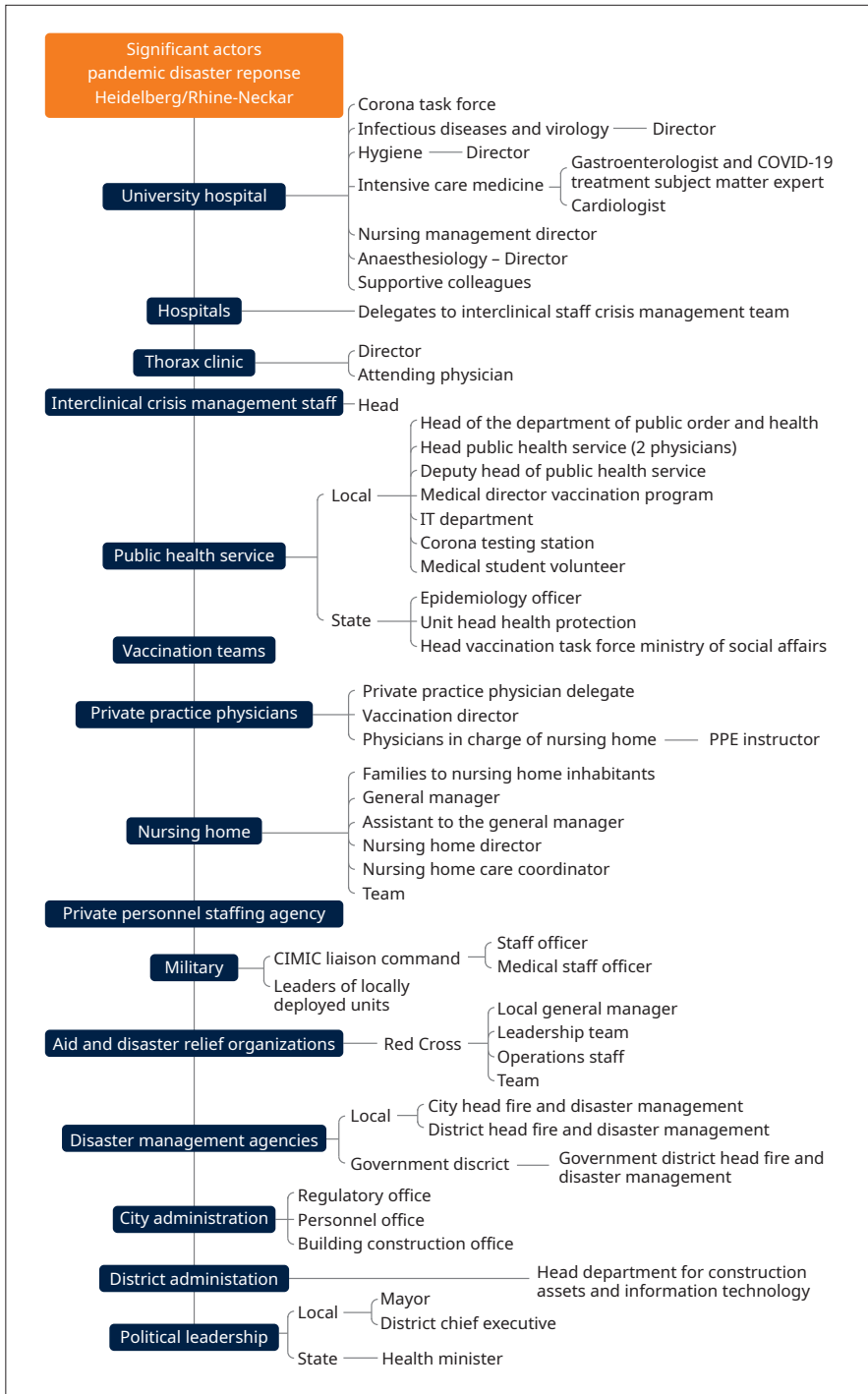


Figure 18. Significant actors during the pandemic disaster response in Heidelberg/Rhine-Neckar mentioned by participants

Table 10. Reasons for being considered a significant actor: six defining key elements and their characterizing features that were mentioned by participants

Key element	Characterizing features	
Leadership	<ul style="list-style-type: none"> • Political leadership • Making decisions • Organizing • Providing guidance • Leading a team • Operational leadership • Operational input • Providing alignment • Strategic input • Creating appropriate structures • Providing support for alignment 	<ul style="list-style-type: none"> • Being visible • Being present • Being supportive • Providing trust • Being helpful • Sharing critical knowledge • Providing moral support • Sharing positive energy • Providing guidance on priorities • Keeping the team together
Diplomacy	<ul style="list-style-type: none"> • Creating strong alliances with powerful players • De-escalating moods of decision makers 	<ul style="list-style-type: none"> • Building political and institutional bridges (public health and clinical care) • Being a mediator • De-escalating emotions in the team
Communicator	<ul style="list-style-type: none"> • Providing important background information • Disseminating valuable information • Communicator to the public 	<ul style="list-style-type: none"> • Providing transparency and vital information from a higher hierarchical level • Exchanging information
Enabler	<ul style="list-style-type: none"> • Political enabler • Providing finances & means • Providing resources • Providing freedom of movement to the team • Liaison to supportive institution • Multipliers convincing significant others • Creating communication structures and information management systems 	<ul style="list-style-type: none"> • Creating collaborative structures • Organizing support with personnel in critical areas • Providing volunteer personnel in times of uncertainty • Providing personnel • Recruiting personnel • Building and enabling structures • Being supportive in a complex administrative environment • Making things happen
Agility	<ul style="list-style-type: none"> • Creating momentum • Anticipatory thinking and planning • Mastering the crisis • Overcoming barriers of responsibilities 	<ul style="list-style-type: none"> • Being innovative • Re-prioritizing efforts for disaster management • Re-prioritizing private and professional life



Results

Table 10. (continued)

Key element	Characterizing features	
Agility (continued)	<ul style="list-style-type: none"> • Showing commitment • Planning ahead • Overcoming resistance • Being an enabler 	<ul style="list-style-type: none"> • Adopting personal professional plans to help responding to the pandemic • Being flexible • Quick learning
Mindset	<ul style="list-style-type: none"> • Providing moral support (<i>"believing there is really a crisis, and something has to be done"</i>) • Multitasking in critical areas • Being structured and organized • Being reliable • Avoiding unnecessary discussions • Excellent work ethic 	<ul style="list-style-type: none"> • Being motivated • Being constructive • Being flexible and supportive • Recognizing a higher common goal • Being collaborative • Being a formidable and constructive person • Being committed • Self-organizing

Own area: Responsibilities

The following section covers an analysis of participants' areas of responsibilities during the COVID-19 pandemic disaster management in Heidelberg/Rhine-Neckar. Table 11 summarizes these areas and explains functions as provided by the interviewees.

Table 11. Participants' areas of responsibility within the COVID-19 pandemic disaster management in Heidelberg/Rhine-Neckar

Area	Specification of function	N*
Health protection	<ul style="list-style-type: none"> • Overall oversight • Responsibility for structures • Responsibility for COVID-19 phone hotline to the public • Responsibility for tracing and tracking of cases • Responsibility for hospital hygiene 	4
Healthcare coordination	<ul style="list-style-type: none"> • Responsibility for COVID-19 coordination center for patient allocation and distribution in the local hospital network • Responsibility for interclinical staff crisis management team 	2
Elderly care	<ul style="list-style-type: none"> • Overall responsibility for two nursing homes • Responsibility for administration • Facilitator between family members, inhabitants, physicians, staff, also took over other necessary work such as disinfecting 	2
Civil-military interaction	<ul style="list-style-type: none"> • Coordination of subsidiary military support missions with civil partners • Reception of troops • Troop instruction and briefing • Coordination of accommodation and catering 	1
Disaster management	<ul style="list-style-type: none"> • Overall oversight • Responsibility for logistics • Responsibility for procurement of PPE and distribution to selected recipients • Accommodation of refugees after start of the Ukraine conflict 	3
SARS-CoV-2 vaccinations	<ul style="list-style-type: none"> • Medical direction of SARS-CoV-2 vaccinations • Operational direction together with medical director • Identifying building, planning, construction coordination, set-up, planning of processes, operations, and logistics of vaccination center • Planning and coordination of human resources with local physician and private temporary employment agency • Converting new structures into routine operations after personnel had been acquired • Planning of vaccination appointments in alignment with vaccine supply as blueprint for personnel coordination • Coordinating mobile vaccination teams 	4

* Some participants had responsibilities in more than one area.

Results

Own area analysis: Synopsis of findings

The following section qualitatively analyzes the aggregated results of interviews with key stakeholders (N = 12) from the Heidelberg/Rhine-Neckar disaster management community with the objective to juxtapose collective experiences across participants' own areas of responsibilities. This includes challenges, difficulties, best and worst experiences, lessons learned, and aspects participants would either do the same way or differently in the future. These findings are summarized in Table 12. Then a more detailed description of each category follows, illustrated by significant statements of participants. Results were systematically structured along the nine core elements of community resilience by Patel et al. [71].

Table 12. Own area analysis with challenges, difficulties, best and worst experiences, lessons learned, and aspects participants would do the same way or differently in the future

Resilience element	Own area analysis						
	Challenges	Difficulties	Best	Worst	Learning	Do the same way next time	Do differently next time
Local knowledge	<ul style="list-style-type: none"> Accommodation and catering of incoming troops 	<ul style="list-style-type: none"> Initial on-boarding of incoming troops 	n.a.	n.a.	n.a.	n.a.	<ul style="list-style-type: none"> Use a motorcycle downtown to overcome difficult parking situation
Community networks and relationships	n.a.	<ul style="list-style-type: none"> Pandemic education of the public Collaboration with the press 	<ul style="list-style-type: none"> Excellent network along players Excellent inter-institutional collaboration Uncomplicated mutual support 	<ul style="list-style-type: none"> Shortcomings in alignment, transparency, and cooperation with other organizations on a leadership level 	<ul style="list-style-type: none"> Early, inclusive, regular networking is important Use collective intelligence to solve complex problems Interclinical staff crisis management network system was helpful Good teams and all members of the team are important 	<ul style="list-style-type: none"> Re-initiate inter-clinical staff crisis management team Network and involve all relevant players Set expectations and roles with other players the same way as it had worked well during the pandemic Continue collaborations 	<ul style="list-style-type: none"> Involve other actors much earlier to recognize their resources and abilities Maintain networking
Communication	<ul style="list-style-type: none"> Communicate and explain rapid changes to the public Convert incoming information into aligned actionable items 	<ul style="list-style-type: none"> Taking people along who are far from the actual events Missing information 	<ul style="list-style-type: none"> Newsletter Early dialogues Once established, communication pathways worked increasingly well 	<ul style="list-style-type: none"> Top-down communication from state and federal level Infodemic phenomena Misaligned communication between local vaccination 	<ul style="list-style-type: none"> Use newly established communication structures There can be rare opportunities to be heard in the wider community 	<ul style="list-style-type: none"> Continue to assure internal alignment through frequent but short virtual briefings in a crisis 	<ul style="list-style-type: none"> Communicate more openly and frankly, formulate some statements more drastically to receive more attention and achieve better comprehensibility by



Table 12. (continued)

Resilience element	Own area analysis						
	Challenges	Difficulties	Best	Worst	Learning	Do the same way next time	Do differently next time
Communication (continued)				center and centralized vaccination hotline	<ul style="list-style-type: none"> Scientific work provided visibility 		the population for the true nature of the emergency <ul style="list-style-type: none"> Make better use of new communication tools Communicate earlier Speak up to the hierarchy instead of letting things happen
Health	<ul style="list-style-type: none"> Health data acquisition and usability Acquisition of medical knowledge Maintaining control over quality of medical care Staff attrition and pandemic fatigue 	<ul style="list-style-type: none"> Overcoming scarcity of healthcare resources Elderly care under austere circumstances Staff vaccination 	<ul style="list-style-type: none"> Cooperation with public health service and local physicians Virus changed pathogenicity over time and Vaccinations appeared to have worked well Progress in diagnostics and vaccine development 	<ul style="list-style-type: none"> Unbalanced representation of outlier positions and opinions concerning health and SARS-CoV-2 	<ul style="list-style-type: none"> Accept that humankind and individuals are vulnerable COVID-19 can be a serious disease with rapid progression 	n.a.	n.a.
Governance and leadership	<ul style="list-style-type: none"> Switching from routine operations into crisis mode Building vaccination centers and testing facilities without prior experience 	<ul style="list-style-type: none"> Dynamics and unpredictability Managing incongruent legal regulations Flow of information across hierarchy 	<ul style="list-style-type: none"> Barriers between departments disappeared Switch from line management into crisis mode was helpful 	<ul style="list-style-type: none"> Conflicting opinions between the Federal Ministry of Health and Standing Committee on Vaccination at the Robert Koch 	<ul style="list-style-type: none"> Use of established structures and political contacts for new situations Ask monitoring questions and think about adaptation 	<ul style="list-style-type: none"> Switch from line management to staff structure in a crisis Build alliances and common structures with people who 	<ul style="list-style-type: none"> Distribute the crisis workload broader Avoid quick overload of good performers in the beginning which may lead to dropouts



Table 12. (continued)

Resilience element	Own area analysis						
	Challenges	Difficulties	Best	Worst	Learning	Do the same way next time	Do differently next time
Governance and leadership (continued)	<ul style="list-style-type: none"> • Obtaining common mandate for novel patient allocation process • Lack of time • Defining roles and limits for partners 	<ul style="list-style-type: none"> • Complex processes • Set-up of vaccine centers: the lack of clarity, uncertain public announcements, missing specifications, and the late recruitment of personnel due to undefined processes. • Fluidity in vaccine supply • Integrating volunteers • Personnel fluctuations 	<ul style="list-style-type: none"> • Aligned patient allocation • Empowerment of players • Political decisiveness in the beginning of the pandemic 	<ul style="list-style-type: none"> • Institute, interpreted by the population as a deficiency of knowledge or even as malice • Lack of uniform pandemic policy on the national level and the absence of transparency in decision making created the impression of arbitrariness • Too much differentiation, led to paralysis • Lack of incentives to excellent performers in public service limited possibilities of personnel management • Slow initial disaster response • Inadequate commitment and rivalries • Overboarding bureaucracy • Attempts to implement complex or ambiguous decisions missing the perspective on the ground 	<ul style="list-style-type: none"> • Critically reflect which basis functions should continue during a crisis • You must recognize a crisis to fight a crisis, then speed, decisiveness, and generous mobilization of resources is of essence • Problem-solving disaster medicine is in the focus • Short pathways are needed for crisis management across several levels • A central situational overview across the overall disaster impact and management efforts for everybody is important 	<ul style="list-style-type: none"> • have the same mindset • Reach out for help in time, distribute tasks clearly, have regular briefings, ensure that responsibilities are clear • Manage hierarchies to create transparency towards the higher echelon and to receive support 	<ul style="list-style-type: none"> • Consolidate the necessities of the new situation earlier • Better document key details of critical issues to prevent post-hoc workload • Simplify rules and protocols and be more directive • Set expectations on roles and responsibilities earlier • Have a clear understanding about the “rules of engagement”



Table 12. (continued)

Resilience element	Own area analysis						
	Challenges	Difficulties	Best	Worst	Learning	Do the same way next time	Do differently next time
Resources	<ul style="list-style-type: none"> • Finding suitable personnel and quick on-boarding • Logistic workload • Planning around changing priorities • Finding space for vaccination center • Shifting and planning of personnel • Protecting patients and staff • Deficiency management • Vaccine logistics 	<ul style="list-style-type: none"> • Staff retention on short-term contracts • Deficiency or suitable resources and complex procurement processes • Compensation for loss of key personnel • Identification of suitable personnel • Mobilization of staff 	<ul style="list-style-type: none"> • Progress in infection protection and digitization • Development of an IT system for regional patient allocation in a public-private partnership • Internal and external support and allocation of resources • Support by 788 soldiers from 20 units • Cooperation with the Red Cross in the vaccination center • Workflow in the vaccination center 	<ul style="list-style-type: none"> • Vulnerable supply chains • Personnel drop-outs • Building disposition of the vaccination center needed modifications 	<ul style="list-style-type: none"> • Risk- and need adjusted anticipatory stockpiling is important • Need to catch up to close significant resource gaps that were neglected in the past • Smaller structures are easier to influence allowing to reflect with more clarity what the decision means on the operational or care providing level 	<ul style="list-style-type: none"> • Involve volunteers • Mobilize staff • Be flexible and consider performing necessary work beyond core competences • Support and take care of staff with genuine interest, express gratitude 	<ul style="list-style-type: none"> • Anticipate and train future crisis leader early
Economic investment	<ul style="list-style-type: none"> • Reimbursement processes 	<ul style="list-style-type: none"> • Ongoing deficits in hospital funding were aggravated 	n.a.	n.a.	n.a.	n.a.	n.a.
Preparedness	<ul style="list-style-type: none"> • Communication technology not on the level of technological possibilities • Lack of preparedness for future 	<ul style="list-style-type: none"> • Difficult and expensive procurement • Lack of suitable infrastructure • Ambitiously announced timelines for vaccination 	n.a.	<ul style="list-style-type: none"> • Non-reactivity and bad preparation • Switching into crisis mode • Timing of national vaccine procurement 	<ul style="list-style-type: none"> • Early preparedness together with other players on specific situations is key • Many aspects cannot be pre-planned, but raw 	n.a.	<ul style="list-style-type: none"> • Training staff is still equally important



Table 12. (continued)

Resilience element	Own area analysis						
	Challenges	Difficulties	Best	Worst	Learning	Do the same way next time	Do differently next time
Preparedness (continued)	waves during re-covery periods	program necessitat- ing complex logistic start-up		<ul style="list-style-type: none"> Insufficient prep- aration through inadequate pro- curement 	<ul style="list-style-type: none"> structures have to be clear Focus and priorities should be explained in an orienting manner in advance 		
Mental outlook	<ul style="list-style-type: none"> Uncertainty Frequent changes Pressures: time, public, prioritization, politics Managing conflicts and motivation Overcoming fear Human factors 	<ul style="list-style-type: none"> Lack of time Obstruction of work by antivaxxer movement 	<ul style="list-style-type: none"> Team more powerful than previously thought Well-rehearsed col- leagues Close cooperation, also on a per- sonal and human level resulted in innovative brain- storming and the fast implementation of novel ideas Motivation cre- ated and sense of purpose boosted morale and created energy 	<ul style="list-style-type: none"> Overwhelming workload in unfamil- iar areas Issues with com- munication and appreciation Doubts 	<ul style="list-style-type: none"> The will and feeling of purpose can be decisive Decisive action is necessary People are a priority Simple presence and motivation of soldiers had a positive impact Crisis provided professional growth opportunities Better awareness about possibilities and strengths, but also about the limitations of 	<ul style="list-style-type: none"> Be open, avoid thinking think too narrow, bring in many players with broad perspectives Volunteer for the same job 	<ul style="list-style-type: none"> Be more mindful Be less emotional in conflicts Ensure that work- load is distributed evenly to avoid overload and reduce tensions Know your limita- tions



Table 12. (continued)

Resilience element	Own area analysis						
	Challenges	Difficulties	Best	Worst	Learning	Do the same way next time	Do differently next time
Mental outlook (continued)			<ul style="list-style-type: none"> • Decisive mindset in the crisis, taking calculated risks resulting in speedy preventive actions accepting mistakes • Reliability of the soldiers • Culinary support important for well-being and morale 		<p>the own organization</p> <ul style="list-style-type: none"> • Need to become a learning organization across a variety of different disaster situations • Excellent experience with partners is a good basis for future collaborations 		

n.a. = not addressed

Own area: Biggest challenges

Local knowledge

It became increasingly clear that improved coordination of accommodation and catering of incoming troops in close cooperation with the civil side was required to avoid friction and to enable a smooth implementation of the mission. Here, the CIMIC liaison team was instrumental because of local knowledge and the existing local network.

Communication

Rapidly changing specifications due to novel scientific knowledge but sometimes for political motives lacking transparency required internal adaptation and needed to be communicated and explained to the public. A challenge was to convert all incoming information into actionable items for the own area of responsibility, adopt these into their own structures, and achieve internal alignment with help of crisis staff work, so that in the end everybody knew what to do.

Health

Data acquisition was a challenge: it became necessary to develop an on-time, easy to use web-tool—a “*virtual hospital*”—that made available patient care capabilities (ICU, intermediate care, regular wards) transparent between different hospitals to achieve a balanced workload and to ensure appropriate patient care in the region. Data needed to be presented in a way that made them usable in a swift and intuitive way (i.e., with graphs or dashboards) for coordinating or dispatching functions.

The participant explained:

“When a scheduler in the coordination center is faced with the question: ‘where can my next patient with COVID-19, who requires ventilation, go?’, this means that you have to have some kind of analyses and dashboards in order to be able to display it, and it was then possible with [Name of the software company] (redacted for privacy reasons) that you could build different display types apart from the now well-enabled, pure data acquisition. So, if the scheduler said, ‘where is the next free bed now?’ based on the requirement that this hospital should be burdened as little as possible, then he can have a display with the number of patients and the number of beds. And if you see that there is a lot of space, then I’d rather put him in there, so that you don’t occupy the last bed in one place, but maybe one of five free beds in another.”

Acquiring medical knowledge was one challenge with a non-medical professional background, e.g., learning the language around vaccines, and vaccines drug products.

Results

Providing excellent medical care for COVID-19 patients while maintaining a high protection standard for the personnel, to prevent burn-out of staff, was another challenge. Finding a balance between reducing elective care and creating surge capacity for patients with COVID-19 was a challenge, too.

The participant explained:

“Of course, they tried with funding opportunities to release the hospitals so that they were able to treat COVID patients. Sometimes I wished that this would have been even stronger, that the financial support should have been even more pervasive. There should have been more opportunities to move away from routine working mode, i.e., away from elective measures towards disaster medicine, at least pandemic medicine.”

Another challenge was maintaining the quality of medical care for patients considering a sudden, exponential loss of staff up to more than 30% on the one hand and fearing potential litigation for hygiene shortcomings or medical under-treatment on the other.

On the long run, the future of smaller hospitals, and the future conditions of health care delivery including the issue of staff attrition, as well as pandemic fatigue was considered as challenge respectively an area of substantial concern.

A participant explained:

“On the long-term: how can we keep the hospital functioning, with the aftermath of the pandemic, with other patient streams, with partial losses of patients who have died? How can you practically maintain the attractiveness and the quality of the hospital under the post-pandemic changes, which we are now seeing very strongly in politics? In the end, the pandemic has forced the restructuring process of the hospitals, which the first people already suspected during the first wave. I was on a panel with the [name] (redacted for privacy reasons) foundation and the [name] (redacted for privacy reasons) foundation, and the health insurance companies said very early that this would happen. I said they had no respect at all for saying that we need fewer hospitals, and we are still in the first wave! So that was tough stuff when it became clear where the journey was going, that they were saying that the system would be restructured, that we didn't need these small hospitals because the pandemic would be fought in the large hospitals, in the intensive care units, and I said that wasn't true at all. Such a large proportion does not even come to the intensive care unit, and they have to be cared for, they are not all in the intensive care unit. They are lying somewhere in some hospital in the black forest. So that's not true at all. They are all needed in the system. When you have a pandemic like this, you don't just need an intensive care unit, most of them are somewhere

*else, and it was also very frustrating that you could see very early on what the consequences would probably be. Staff frustration, I think, is difficult, so the exhaustion also of one's own performance and staff performance by the length of the pandemic, that's what I would say as a fourth thing. A kind of churning process, I would say, that still leaves its mark on the system, and I don't know how many nurses have to fill in gaps again and again in this long period of substitution, because there is no security at the weekend that they won't be disturbed because someone is always sick. And the next winter is just around the corner. And that someone says, 'I cannot stand this sh*t anymore, I am going to look for another job, because my Saturday is my Saturday and not the Saturday where—again—someone calls me.' Unfortunately, outside of our areas, perhaps within the fire department and the police, nobody is interested in this anymore and this outrages me. So, I think that is also difficult, because that can be the main mechanism why we get less and less nurses, because simply the others talk about work-life balance, and those who work in the hospital are simply continuously burned out and the others talk about work-life balance. The nurses and the doctors get called when the others are sick and then they are showing up, it's getting harder and harder over time. And I can see, it's probably going to start up again in December, if that goes off again, the weather gets worse again, I'm curious how we're going to get through the next winter, if they're going to keep this up endlessly. We've got staff attrition."*

Governance and leadership

A participant described challenging iterative steps necessary for the operationalization of crisis management once the crisis had been identified, namely converting routine structures into crisis management structures, creating personnel resources and system capabilities, identifying the focus of disaster vulnerability and then to derive protective countermeasures.

The participant explained:

"So, the biggest challenge was certainly getting to grips, initially, with a phenomenon that is theoretically quite familiar, a pandemic, but then the operational implementation on the ground with what was initially a standard structure. And of course, this in turn has consequences, for example, with regard to the question of 'how do I build up personnel? That was certainly one of the most important issues that concerned us at the beginning, Where do I actually get personnel who can support me adequately, who do I actually need? What do the staff actually have to be able to do, what do I expect from them? That was certainly one of the biggest challenges. Then, of course, it was possible to work out relatively quickly who it was really all about, namely the elderly and the sick. And the clear task of how to achieve as much protection as possible for the elderly and the sick,

Results

i.e., in particular for inpatient care facilities, starting with testing services, through protective equipment, to consulting and the function of home supervision, that was and has always been a guiding principle for these inpatient care facilities.”

Building vaccination centers and testing facilities was a challenge because the organization did not have any comprehensive prior experience in this field.

Another challenge was obtaining a common mandate to distribute patients across hospitals which was novel, because in routine times, physicians or paramedics in ambulances would choose the hospital the patient is driven to.

The participant explained:

“If the coordinating body has now recognized, the closest hospital is no longer the appropriate hospital, but another hospital is more appropriate in terms of the overall pandemic response, not in terms of for that individual patient—for that individual patient, maybe two hospitals will be eligible—but for the overall situation, it’s better if the ambulance drives by the closest one, and then this would be done. So the next big challenge was to obtain a strong mandate from all the stakeholders that we should not only be allowed to collect data, but also to allocate patients. That was achieved through the interclinical staff, where everyone sat in. This mandate could be obtained at the level of the decision-makers, i.e., the managing director and medical director together with the municipality and the Rhine-Neckar district, and the mandate was given to the university hospital and the coordination office there.”

The lack of time was a challenge, a participant had the feeling that actions were in part behind the curve, subject matter experts on the ground had a good feeling for the direction but were bound to central procedures. The own margin of discretion was small only. In particular, the standing vaccine commission at the Robert-Koch-Institute performed evaluations very carefully and therefore they were published with a certain delay.

Defining roles and limits of these roles, for the individual organizations that worked together was a challenge in the beginning, in addition to communicating these roles and limits clearly to the individuals.

A participant said:

“Then, of course, the overall challenge is to make it work altogether, because if one gear doesn’t mesh, the other one will blow up in your face as well.”

Resources

Finding suitable personnel was a challenge. Initially, medical students could step in. Later—with the reopening of public life and the lowering of pandemic restrictions—other staff had to be found, because the previous personnel had moved into different sectors. Likewise, the motivation of staff had to be managed, there was a lot of motivation in the beginning which decreased over time with the change of staff.

In addition to finding personnel, setting priorities out of routine work-stream was a main topic, defining what needs to be done, what can wait, on-boarding volunteers, keeping up motivation in times of ongoing high workload (7 days a week). Volunteers then had problems at their actual workplace due to their absences for disaster management.

Quick on-boarding of staff with variable experiences and backgrounds required the development of new highly efficacious training concepts and needed additional workspace.

Another challenge was handling the enormous logistic workload, i.e., provision, storage, and movement of PPE (personal protective equipment), and material for the construction of vaccine centers, this included the requirement of storage rental.

Adopting resource plannings around changing priorities in the vaccination roll-out was challenging.

A participant explained:

“And then the biggest challenge was definitely this balancing act of offering as many vaccinations as possible on the one hand, not stockpiling any surplus vaccine, but also having a certain reliability with regard to the vaccination dates and also planning the staff sensibly, which was then also made more difficult again and again, because, for example, vaccines from [company] (redacted for privacy reasons) were not allowed to be vaccinated at times, then it was only allowed for older people, then for younger people, and this back and forth. And sudden vaccine reductions—in terms of quantity—that threw off the whole planning. That was definitely one of the biggest challenges.”

Finding right space for the vaccination centers was a challenge in the beginning.

Aligning the needs of the civilian side with the military reality was challenging. Supplying the requested material in the beginning was not possible because there were general shortcomings of material in general, providing personnel later was easier. In addition, the shortage of military personnel with medical training and the necessity to balance local support with the increased and more urgent need in other parts of the country was challenging, as this was not a locally limited, but a general area situation.

Results

Another challenge was to transfer personnel from one unit of a hospital that suddenly had less workload due to COVID-19 restriction to other units with higher needs.

It was challenging to staff duty rosters, “*shift for shift*”, in nursing homes so that inhabitants could be taken care of in at least an acceptable way, setting priorities, and instructing staff what needed to be done immediately and what could wait.

Protection of the elderly inhabitants and protection of the staff was a challenge, which included finding a balance between proceeding as normally as possible and as safely as possible.

Deficiency management was challenging. Initially, the shortage of vaccine in contrast to the high interest of the public receiving a vaccination was an issue, then the lack of staff. When sufficient staff had been secured, the public lost interest in vaccinations.

Finding personnel was also a challenge for another participant, but the organization had established a structure that included the on-boarding of volunteers.

Logistics of vaccine was a challenge, managing the complexity of vaccination eligibility, and finding a good balance between overload of capacities and downtime were a challenge.

Economic investment

One challenge was managing the reimbursement process for the military missions. This process needed to be elaborated and amended over time, and the documentation occurred retrospectively which was cumbersome.

Preparedness

Communication technology was not on the level of technological possibilities, relied on faxes in the beginning, which quickly reached its limits. Likewise, excel lists and phone calls for documentation and data acquisition had to be replaced by more suitable solutions due to the demands of exponential growth of the pandemic.

The lack of preparedness for future waves during the time of transitional recovery between two waves coupled with a lack of time was challenging.

A participant explained:

“Because no matter how quickly you implemented something, it was abolished again in the same instant, i.e., all the specifications that existed were sometimes valid for two days and then there were new ones, and at the end of the day you were always the loser. So from disaster control, there’s the chaos phase and the normalization phase and the normalization phases you actually always had when the infection event was not there, so in the

summer, we had normal phases, but whenever the next waves came, we were always running behind the situation again.”

Mental outlook

Initial uncertainty was a challenge. The organization did not receive sufficient input from their super-ordinate body to answer the flood of incoming questions, this needed some degree of improvisation and advancing at risk (i.e., not precisely knowing legal and financial implications)

Frequent changes in procedures, the necessity to continuously train new incoming staff, pressure from the public, the necessity not to do the usual work led to pandemic fatigue and made it challenging to maintain the motivation of the core team. In addition, political considerations sometimes had a higher priority than subject matter expertise which created frustration.

Likewise, managing sometimes reemerging conflicts within the staff and keeping motivation was a challenge.

Overcoming fear was reported as a challenge.

The participant explained:

“Yes, overcoming one’s own fear at first, and that of the employees at the very beginning. Well, it was terrible, and when you saw the images from New York and Bergamo, and at the same time you had no idea how things were going in your own institution. And you were afraid every day that you might be infected because you knew so little. That was a challenge to keep one’s nerve, to lead people without degenerating in one’s personal, yes, communication style, human warmth, I found that was not easy at the beginning, and the fear that was already there, that one would suddenly change sides, I found that difficult, that was a challenge.”

The human factor was a challenge. Specifically, the rationing and prioritization of vaccine created frustration and incomprehension among citizens in the beginning. Then, in contrast, later in the summer 2021, the interest in vaccinations had declined. While the overwhelming majority of staff was loyal and cooperative, there were very few, exceptional cases of antivaxers in the vaccination teams.

Own area: Biggest difficulties

Local knowledge

Initially, the local on-boarding of soldiers was difficult because they came from remote areas. This was quickly improved by better local planning and facilitation.

A participant explained:

Results

"I then drew up plans. If you just let them come and say that they have to do it themselves, that usually doesn't work, then they are completely lost."

Community networks and relationships

The public had to be educated with pandemic knowledge (e.g., about the virus and the meaning of its variants, isolation, quarantine, etc.) to achieve a better understanding of the situation. In the beginning, the press was not acting as a didactic multiplier, but was perceived as an investigator searching for errors. This led—in the beginning—to a defensive attitude which compromised the educational effect, but improved later, after proactive conversations.

Communication

Taking people along who were far away from actual events was one of the greatest difficulties for one interviewee.

The participant explained:

"We know what the numbers are, we also know what the hospital occupancy rate is, we also know what's going on in the intensive care units. Especially now I say in the last two waves that it is not always rosy, because there are also staff shortages, because then simply the capacities are no longer there. But citizens on the street don't notice that at all. That's actually one of the biggest difficulties for me now, it was from the beginning, because no one understood that the chicken truck is not allowed to open, although I just go there and pick up my chicken and eat it at home. There were also these difficulties in the legal context that we had, there were simply incomprehensible regulations that the population had difficulty understanding and I think it is still the most difficult thing to actually create understanding. This has changed again and again, in which context understanding is lacking, in the conclusions."

Another difficulty was that a lot of information was missing.

Health

Overcoming, or trying to manage the scarcity of healthcare resources in a balanced way was a difficulty.

A participant explained:

"We had a huge problem, that is, the [name] (redacted for privacy reasons) hospital, with the fact that our elective patients, that is, what is often referred to here as elective patients, are actually not really elective at all, because we have to deal with an extremely high percentage, well over 50%, of tumor patients. And for a tumor patient, the resection of the tumor is not an elective procedure, even if from a medical point of view it may be a

plannable procedure, because it doesn't matter whether I operate on the patient this morning or in two weeks, but I can't postpone it indefinitely until the virtual end of a pandemic, and I think we had a huge problem here at the [name] (redacted for privacy reasons) hospital, because on the one hand we couldn't free up the resources we wanted, but at the same time we were supposed to be responsible for the severely affected cases in the COVID area. That's why the severely affected COVID patients were somehow competing for the same beds with the severely ill tumor patients all the time; those were really tough discussions. Who gets taken off the OR program during the day to keep an intensive care bed free for the next COVID patient? That's sort of what was actually going on under this discussion of triages, and that was in fact a bit of that."

Taking care of elderly inhabitants was made difficult due to the austere circumstances.

A participant explained:

"Then the challenge with residents with dementia who could not express themselves, 'are you okay or are you not okay'? Are they in pain or not in pain? Weighing it up, do I give them something for the pain on suspicion or better not—fever, of course that can be measured—pain not at all. That was also something that kept us very busy, is he missing something, does he have something, does he lie well, or does he not lie well? And all that in a hurry, we all didn't like these conditions, but it was an exceptional situation. To do fair treatment to the residents, that was a difficulty in the first place, actually."

One participant reported that vaccination of staff was difficult in their institution.

Governance and leadership

Dynamics and the absolute unpredictability were difficulties.

Incongruent legal regulations that arose from the dynamics were difficult to manage, especially making them comprehensible and acceptable to the public.

The flow of information across hierarchies was slow and therefore difficult. A participant spoke about instances where changes went public in the press before the information had reached them through the official communication channel.

The process of reimbursement for military missions was lengthy and complex.

There were initial difficulties in the set-up of vaccine centers: the lack of clarity, uncertain public announcements, missing specifications, and the late recruitment of personnel due to undefined processes.

Results

The permanent fluidity in vaccine supply was difficult to align with anticipatory scheduling of vaccination appointments for the public.

Working with volunteers slowed processes because longer explanations were needed, in addition, the work contract situation was unclear for volunteers. Personnel fluctuations from different players brought in new people with divergent backgrounds, this sometimes needed adjustment in processes to keep the overall system functioning. In terms of leadership power, a coordination position had less influence than someone in a directly reporting relationship or crisis staff.

Resources

The possibility of only providing short-term work contracts made it difficult to retain personnel, leading either to reorientation or demotivation of staff who felt they were not really wanted. Difficult in this aspect was the fluctuation of the pandemic situation itself, with waves coming and going, and the resulting ups and downs of financial means. This led to the necessity of several novel recruitment endeavors. Resource management would have been easier had the pandemic situation been more uniform without rapid peaks and troughs, here one could have built capacities only once and then maintain them over time. Having to balance economic necessities compromised the ability of perseverance.

Another participant equally considered short term contracts difficult because it led to the attrition of exceptionally good people.

Initial deficiency of suitable resources posed difficulties.

A participant explained—

“In the beginning, we had the problem of a lack of equipment, so that the protection goal could not be reconciled with the possibilities at all. You want to equip everyone with a mask. You want to equip everyone with disinfectant. But there is no material at all. Managing this deficiency in such a way that those who really need it get it and at the same time there is still enough in case the situation escalates any further. So, it was quite a challenge at the beginning and this shortage continued. It started with the masks. That went on with the disinfectants. And it continued with the test kits. So, then one had some laboratory equipment. But unfortunately, there was nothing that could have been used to make the measurements. In some cases, the reagents were not available at all. And if you had the laboratory equipment and the reagents, then there was a shortage again because you might not have had enough test sites and you might not have been able to take enough tests. This constant shortage management was a real problem in the beginning”

Procurement processes were initially complex and lengthy (e.g., for IT or other equipment), but they were quickly adjusted and made more flexible.

Having to compensate for individual key personnel losses was difficult. Finding suitable personnel was a difficulty (vaccination, public health support), therefore the armed forces were asked for subsidiary support.

Procurement of material was difficult in the beginning.

One participant said:

“In the beginning, the material procurement was catastrophic. That was a tight squeeze; it could have gone completely to pot. That was certainly difficult.”

Attrition of personnel, i.e., *“infection-related personnel shortages, the danger of being overburdened”* was another difficulty.

Mobilizing staff in compliance with complex quarantine regulations was complex and lengthy, it was therefore difficult to bridge gaps until approvals had been issued.

Another participant reported that recruitment of staff and maintaining business operations was difficult during a COVID surge.

The lack of resources was a problem. Therefore, the military was asked for subsidiary support because there was nobody else available who could do the job.

Economic investment

Ongoing deficits in hospital funding had already been a difficulty, this was probably aggravated and accelerated during the pandemic:

A participant explained:

“It is the dubious economy. In our case, for example, the rehabilitation has not been covered financially for four months. So definitely, financial consequences in the pandemic. Difficult—there is, there is simply no development in the hospitals, because simply no more financial resources exist. This has not been revealed 1 to 1, after all. There are so many reports that the hospitals have received so much money, but nothing has remained, it's gone. [...] So the financial trauma is not to be underestimated.”

Preparedness

Necessary equipment was difficult to procure and very expensive. The issue of missing or vulnerable supply chains has probably still not been addressed yet.

The lack of a suitable infrastructure was a difficulty, including furniture and IT systems.

Ambitiously announced timelines of the vaccination program while at the same time, necessitating a complex logistic startup (e.g., required freezers for the vaccine, electricity supply, transportation, space) was mentioned as a difficulty by a participant.

Results

Mental outlook

Dynamics of the situation and the lack of time was a difficulty. A participant said

“Again, the time factor was a big part of it. After all, we had to act and react relatively quickly, or mostly react.”

Antivaxxer activities (billboards or crowding) obstructed working, this was considered an important difficulty by a participant.

Own area: Elements that worked *best* in the local pandemic disaster management

This section summarizes which aspects of disaster management participants reported as having worked best.

Community networks and relationships

Participants reported that there was an excellent collaboration among players and networking with them was considered personally helpful. Significant examples mentioned were the interclinical staff crisis management forum, but also regular networking with nursing homes. There was an excellent cooperation with the local university hospital and its university hospital pharmacy which was considered extremely helpful for the SARS-CoV-2 vaccination program. Setting up the vaccination program, and handling of vaccine would not have been possible otherwise, said one participant. Other positive networking examples mentioned included the good cooperation at the working level—after having clarified goals and directions—with a broad spectrum of actors such as the military, and the federal technical relief agency (THW). Uncomplicated mutual support and assistance was a positive learning experience—*“one phone call or a short meeting was enough to make things work”* reliably with all actors involved. Due to positive common experiences during the pandemic, the cooperation, exchange, and networking between the civilian and military sides was considered more active than ever.

Communication

A positive example for transparency was an early newsletter generated by one participant to provide an information platform for stakeholders. Early dialogues with each other, communication within the core team internally, and support from communications office for aligned external messaging were mentioned as having worked well in the pandemic communication management.

One participant noted that it took a while until top-down communication structures were established in the administration which created a feeling of isolation. The participant speculated that the initial period of silence was due to an overwhelming number of questions from all sides to the level above. Once these communication pathways had been set up, they worked increasingly well, became more robust, and the information flow became faster.

Health

One participant said that their best experience was the cooperation within the public health service. In addition, the physicians who took care of inhabitants of nursing homes were praised.

Another participant was happy that virus variants changed towards milder pathogenicity in course of the pandemic. In addition, vaccinations appeared to have worked quite well, because less severe courses of disease were observed at the time of the interview, although the participant mentioned, it was not certainly known whether the positive effects were due to lower pathogenicity of the virus or better immunity in the population but considered the overall outcome in any case as positive.

Impressive progress in diagnostics and vaccine development were mentioned as positive examples, in particular, the development of specific PCR-tests and early PCR test capacities in Germany, as well as the fast development and broad availability of the vaccine and its good tolerability.

Governance and leadership

One participant reported that significant barriers, that had existed between departments before the pandemic, disappeared. Also immensely helpful was a leadership culture with clear messages, where the political leader was an enabler, which resulted in sustainable collaborations. Another participant found the switch from line organization to crisis staff work beneficial and reported that this switch had accelerated decisions significantly (*“from 3 weeks to 3 hours”*). A participant was incredibly happy with the disaster management in their own areas and considered it to have worked well.

The patient allocation across local hospitals worked very well, because all hospitals trusted the central patient distribution and allocation unit. This was a surprisingly good experience, because there was an initial concern being negatively branded as a “COVID hospital” that the population would avoid out of fear of being infected with SARS-CoV-2. Local hospitals had accepted the fact that taking care of COVID-19 patients was a necessity, and the overall coordination through a single point of contact was meaningful and functioned well.

Empowerment worked well: the attribution of competences and decision power upon players, and slightly modifying existing structures helped

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accelerating and better implementing actions in the crisis compared with the usual lengthier administrative pathway during routine business.

One participant considered the political decisiveness in the beginning of the pandemic as a formidable example of leadership in a crisis, this included united action, a can-do attitude, problem solving, and working together:

"I think that in the beginning, the decisive action of politics was also an example of how to deal with a crisis. I found that in Germany—and that was our glorious time—a unified attitude was reached in the government, and this unified attitude was also carried through to the executive bodies, right down to the hospitals and the outpatient teams. That was a highlight in those two and a half years. [...]. But what went well was certainly in the run-up to the pandemic, this unified action, a clear leadership—also in politics—and that was a blueprint that people jumped on, themselves. You say "Problem?" "Problem will be solved!". We act together, that was an absolute highlight."

Resources

The fight against the pandemic resulted in internal progress in infection protection and digitization. As such, a participant mentioned a well-functioning, own IT system that was conceived and developed in their organization to manage high COVID-19 caseloads.

In another case, the cooperation with a local software company led very quickly to a functional IT system that could easily be used by various players, because it could be operated through a standard internet browser.

A participant praised the support received from inside and outside the organization, which included necessary spaces, and priority in procurement; their team was the focus of the attention, which was supported by all players. Other participant positively mentioned the resources attributed to their team for mission-critical tasks, that sometimes were received surprisingly fast:

"Within two days, five volunteer fire departments came and set up and dismantled everything. That is great".

Seven-hundred-eighty-eight soldiers from 20 units provided subsidiary support to the city and district, the gratitude received from civilian side was an incredibly positive experience.

The cooperation with the Red Cross in the vaccination center was praised by a participant, in particular, the work-sharing was a great relief, and helped to focus on other important priorities.

The technical work in the vaccination center was mentioned as excellent once a fast routine was developed. Another participant positively mentioned safety, security, logistics with the vaccination center.

Mental outlook

Participants reported that people around them and the team proved to be very efficient, more powerful than previously thought, and that people surpassed themselves. One participant mentioned that their team was already a well-rehearsed team in advance—as four colleagues had worked together for very long in earlier crisis situations—which was immensely helpful, and the resulting flat hierarchies out of this relationship proved to be greatly beneficial.

Another participant spoke about the value of close cooperation, also on a personal and human level, which resulted in innovative brainstorming and the fast implementation of novel ideas within days. Cooperation with a particular colleague was mentioned positively, and the fact that the team moved closer together. This was exemplified by the experience in one organization where staff volunteered to step in and to fill critical gaps in an urgent emergency.

Motivation and the sense of purpose was key, a participant explained, *“we had a goal in front of our eyes, wanted to reach it and therefore reached it faster.”* This led to positively surprising results: the IT team in another organization provided programming solutions in a way that was beyond expectations and the usual way of doing business. Another participant described the positive mood and the gratitude within population as very motivating:

“What I basically found to be very good was just this feeling that you got from it as well, where you realized people are infinitely grateful to you for the work you’ve done. And they are happy that they are now protected. So, this positive mood that actually prevailed most of the time.”

Calculated risk-taking was seen as an asset by another participant, because preventive action needed speed, otherwise the negative consequences would have an immediate impact. Therefore, making mistakes was unavoidable, and the decisive mindset was praised.

The reliability of the soldiers during their missions was praised, and perception of the military has improved significantly within the population.

Finally, the availability of a kitchen and cooking was important for the well-being and the motivation of the staff.

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Own area: Elements that worked *worst* in the local pandemic disaster management

In this section lists the aspects of disaster management that participant reported as having worked worst.

Community networks and relationships

A participant mentioned shortcomings in alignment, transparency, and cooperation with other organizations on a leadership level as issues, in contrast to the operational level, where no relationship problems or dys-functionalities existed.

Communication

A participant considered the top-down communication from the federal level and the state level as an issue.

“Infodemic” communication phenomena occurred. A participant explained:

“The worst thing was that with the increasing duration of the pandemic, media communication was a single disaster. So this uncertainty, which was permanently carried on because of the usual marketing of opinions or even entertainment, which was mixed with sensationalism. The real knowledge was catastrophic and the worst thing about it was that masses of colleagues took part in this thunderstorm that permanently passed over our heads and that led to the fact that we hardly heard anything anymore, which I consider to be one of the worst experiences of my life, that practically everything was relativized.”

As such, confrontational and sensational media were problematic, but this improved over time in the perception of a participant. The unbalanced representation of controversial pandemic minority positions received equal screen time as the majority consensus. Even physicians contributed to the chaos—supposedly due to vanity reasons. While it is important—so the participant—to listen to minorities in situations like elections, this is not helpful in a crisis.

Another communication issue was that centralized phone hotlines on the one side and vaccination center operations on the other were fragmented from each other as they were run and by led by different organizations. Phone hotlines then, at one time, communicated unclear messages to the public about SARS-CoV-2 vaccination eligibility. A participant speculated whether this could have been due to shortcomings in training. As a result, many people showed up personally to ask for vaccination appointments which were denied to them by the vaccination center because they

were not yet eligible within the hierarchy of vaccine prioritization, which consequently led to anger and frustration.

Health

As mentioned above, there was an unbalanced representation of outlier positions and opinions concerning health and SARS-CoV-2 (the “infodemic” in the pandemic) in the media. Creating doubts through few individuals that were overemphasized and over-represented in the media lead to slowing of the vaccination campaign roll-out. With regard to the overall perception of the pandemic in the population, according to one participant, it was surprising that so many denied facts or followed conspiracy theories which led to significant friction and attrition of resources in many places such as the health care system or the police, which could have been used otherwise in a more meaningful way. Recognizing that plurality is important in democratic societies, and that more directive management is probably easier in autocratic societies, the participant was wondering whether it is really necessary to accept every single opinion in times of a crisis.

Governance and leadership

Participants mentioned issues in governance and leadership that they perceived negatively.

A participant reported missing alignment and communication issues. As such, conflicting opinions between the Federal Ministry of Health and Standing Committee on Vaccination at the Robert Koch Institute became publicly evident which was not well received in the population who interpreted this incongruence as a deficiency of knowledge or even as malice.

The lack of uniform pandemic policy on the national level and the absence of transparency in decision making created the impression of arbitrariness. In addition, a participant criticized, there was *“a lack of a visible communicator with high expertise like in other countries”*. There were deficiencies in broad advice to the government which could have included a stakeholder council standing for a broad spectrum of institutions, including the military, specialists affected by the pandemic (e.g., pediatricians, psychiatrists, nursing care homes), that assessed what consequence a federal decision would have on the care providing level. The participant considered the top-down approach without consensus and listening to feedback as problematic. In addition, the expert identification process was perceived as unstructured on the federal level. *“The build-up and protection of a visible and impact leader like Fauci was not politically desired”*. Science and politics decoupled, with politics acting on their own, in isolation from science and reality.

The lack of abstraction and decisiveness, but too much differentiation, led to paralysis.

Results

The absence of being able to provide incentives to excellent performers in public service limited the possibility of personnel management.

The initiation of disaster response was slow in the beginning due to an insufficiency of preparedness at several levels (including the federation, the state, and communities. There were vague pandemic plans, but no functioning overall disaster preparation for that scenario. There was no working basis, because protection of the population was not in the focus of interest during the last 30 years.

A participant disliked controversial and doubtful discussions without an overall direction. Leadership lacked focus and priority in an overwhelming situation and was not adhering to public promises.

A participant reported that an inter-institutional lack of transparency, the deficiency of documentation, and conflicting priorities lead to organizational chaos that consumed a lot of resources post-hoc.

Inadequate commitment in one part of the organization required compensatory input from another part in addition to their own workload.

Rivalries within two sub-units of an organization resulted in friction.

Overboarding bureaucracy was very time consuming, this time that could have been dedicated to more important priorities in the pandemic disaster relief. While the situation was catastrophic at a given moment in a given area, bureaucracy demands still needed attention and resources.

There were issues with decisions that could not be implemented because they did not reflect the reality on the ground, or they were overly complex and ambiguous. This led to a feeling of *"inert reactivity"*. In addition, this created tension within the team and aggressive behavior in the population.

Complexity in administrative procedures was an issue. This included the finding that the appointment system for vaccinations was too convoluted.

Resources

Resource issues became evident. As such, supply chains were vulnerable, and staggering support of vaccines led to resentment and needed adaptation of plans, although disaster managers are in general used to changing situations and readjustments.

As personnel dropped out, fresh staff had to be searched urgently and had to be asked to fill in the empty positions.

The building disposition for one vaccination center was not optimal and required modifications and enlargement.

Preparedness

There were issues with non-reactivity and bad preparation. Some players did not know their position in the beginning of the pandemic and were then overwhelmed; fragile structures in these areas had already existed

before the crisis. Their roles and responsibilities should have been known after having conducted exercises before the pandemic but were then either found during the course of the pandemic or later assigned.

Switching into crisis mode on the medical level had room for improvement. This was due to inadequate preparation despite existing—although vague—plans for a SARS pandemic. This resulted in a deficit of in a shortcoming of structures for capturing data and group formation to organize the flow of information, which then resulted in deficiencies of information flow.

A participant commented:

“So when you think—when we actually expect—there are plans for something like this and the state reaches into the drawer and pulls out the plan—but de facto it’s the case that the people who see the problem come up with a plan, go through ten iterations of it, until they’ve improved it, and then at some point a plan comes in from the top that is partly worse than what was partly quasi established through the iterations from the bottom, from the makers, from those who are engaged. That’s frightening. And it’s not good.”

Earlier procurement of vaccines might have accelerated the vaccination campaign considering that the manufacturer was a domestic company. In contrast, later there was too much vaccine that could not be used anymore. The lack of vaccine led to prioritization issues that could have been avoided if enough vaccine had been secured. Therefore, a better prognosis of vaccine requirements would be of advantage.

Insufficient preparation through inadequate procurement of critical items resulted in lack of supplies, not only vaccines but also masks. A more transparent communication to the population about the nature of these deficits, their distribution structures, and necessary priorities was missing.

Mental outlook

An overwhelming workload in unfamiliar areas required a substantial need for stressful improvisation. Another participant commented about issues with communication and appreciation. One participant reported thoughts about doubts whether they had done everything right.

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Own area: Learning

This section reports the participants' learning from the pandemic addressed during the interviews.

Community networks and relationships

One learning in terms of relationships was that early networking is crucial, therefore nobody should be forgotten because this person is not considered important.

The public health service in Heidelberg/Rhine-Neckar is one of the largest in the state. The military will therefore always network with this institution in case of a crisis, not only because of the large size of the population, but also because of the university hospital with supra-regional significance, because of the local migration center as initial reception facility for migrants/refugees entering the state, because the region is a large industry and science hub, and because new threat situations beyond SARS-CoV-2 can always emerge.

Another learning was that it is important to know the right people, meet them regularly, and use collective intelligence to solve problems. One participant explained:

"It is extremely important to know the right people and to meet with them regularly. That may be totally exhausting, because you run from one meeting to the next, but in the end it simply sticks that if there is a problem, you know with whom you have to discuss it. And the momentum of these groups, which then form, ensures that many problems that you think you have to solve yourself somehow, you then no longer have to solve, because there are suddenly others in the group who say: hey, I do it like this, we do it like this. Then you don't have to deal with it at all. Yes, so I've also learned that sometimes it can be enough to solve a problem if you form a group together, give the problem to the group and let the group work on it, instead of filleting the problem beforehand and then trying to give the right morsel to the right person individually. Those are the things that I've learned for myself personally."

An additional successful example of the benefit of networking was the establishment of the interclinical staff crisis management team: one participant first networked with a colleague who recognized the danger as well, furthermore, impressive modeling projections suggested a potentially massive impact of SARS-CoV-2 in the region. Therefore, they recognized the necessity to organize as a larger group in order to be more resilient—immensely helpful was the already established contact with many local players in the medical field. The subsequently institutionalized interclinical staff shared knowledge, and brought in further experts (e.g., on

reliability of SARS-CoV-2 testing systems), i.e., they first acted as knowledge multipliers. Interclinical staff work continued, as the participant explained, addressing mutual needs of the ongoing situational development:

“And then it went into the steering situation, and one tried to structure compensatory movements, that is, to improve this overload through communication, through regulations, and at the same time to maintain the cooperation, even if they sometimes shouted at each other. So, one has always tried to maintain the cooperation circle through these personal contacts and mostly one has found solutions. And if the solution did not work, then an alternative was sought, but always in the cooperation, and there were no permanent injuries. So it could have happened that one would have separated oneself. And that was only the case at a late stage, but when it also made pandemic sense to say that everyone should mind their own business, that’s the mode now: whoever gets sick at my place ends up at my place, and in the first phase this was centralized and that was then adapted. And also to stay in communication: where do we find ourselves with the public health department? What are the perspectives? What precautions do we have to create? Then it was so, that we had enormous bottlenecks in the materials. This has also been communicated together, that they tried to catch political actors. We wrote numerous letters to the minister. We wrote a dramatic letter when it went into winter and they left the stores open, and we said, this is not working, the projection is catastrophic. So with political influence on Stuttgart [the seat of the government] (added for contextual clarity) that was one thing. The second was exerting influence on the district, i.e., on the district administrator and the mayor, that was the next stage. And the other thing was the cooperation between doctors in private practice, the health authorities, the armed forces, the ambulance dispatch center, and the hospitals. And to achieve this distribution movement so that there was no overload. That actually always worked well, I have to say, but surely the main task was always to remain in conversation without anyone becoming the enemy of the next. Or indifference, which is just as fatal.”

A participant explained why a good team is important and why every member of the team was important:

“I have learned, but I always knew that, but now from this time: that here in our area retirement and nursing home, that in the cooperation between the organizational areas everything belongs together: we cannot do without pastors, we cannot do without home managers, nursing service managers, doctors, cleaning staff. So, that we all need each other. We all have to work together to be there for the residents, to take good care of the resi-

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dents and of course for our needs as well. The kitchen has played a very big role."

Communication

Using established communication structures from the pandemic disaster management—which includes virtual meetings—for new situations was another new learning.

Communication in the 'infodemic' noise can be problematic, but there can be rare opportunities to be heard. A participant reflected on positive experiences in the interaction with government entities after being asked to provide further insights into an important published analysis which raised attention:

"But I have learned that you are being heard very little, so you need very favorable circumstances to be heard. The responsibility of the media would also be to ensure that the important voices are heard, i.e., not to allow everything if it is not absolutely necessary, but also to select who is to be heard, because it is simply not possible for everyone to shout out. So that is certainly a very important experience, because in the end the person who actually has the best opinion is no longer perceptible, because he is drowned out. And you are still very much at the mercy of the process. You can only set accents in a few light moments in order to be heard."

and on opportunities respectively conditions that allow working well together with the media:

"Or when we were in [place] (redacted for privacy reasons) and discussed vaccination, 'should we get vaccinated now or not?', or 'should we introduce compulsory vaccination?' And then a newspaper like [name of the newspaper] (redacted for privacy reasons) creates a podium that is valuable. So you can't reproach them much, they've done a good job. Then there are moments when you think, 'now it's going there again, and you have to be in the media', then you don't have a chance, you can't determine the moment yourself, but you need such a favorable moment where everything comes together: media interest, your own full insights, which are then also heard, but you can't necessarily act yourself. In this public relations work, a lot must come together favorably."

In addition, scientific work provided the opportunity to become visible within the community.

Health

One learning in terms of health was the insight that humankind is indeed vulnerable. The pandemic could have ended badly—it was not completely

over yet [at the time of the interview]—the probability of a bad ending appeared small at the moment. If the vaccines had not come, if the delta virus variant would have continued to circulate, this would have been a real catastrophe—although 100,000 casualties was indeed a catastrophe—the outcome could have been much worse.

One participant found it astonishing to observe how fast the course of a corona infection could develop in an individual.

Governance and leadership

One leadership learning was to use established structures and political contacts for new situations.

At the same time, it was important to critically rethink current structures under given circumstances, and repeatedly ask monitoring questions: Should we continue like this? Should we modify structures? As collateral damages of pandemic management were probably not all being recognized yet, it is important to critically reflect which basis functions should continue during a crisis.

Another learning was, that you have to recognize a crisis in order to fight a crisis, then speed, decisiveness, and generous mobilization of resources is of essence:

*“First you have to recognize a crisis, when you recognize a crisis, you have to be extremely fast and step on the gas a lot to fight it. It makes no sense at all, when I see a problem, to tackle it drop by drop, only to have to escalate more and more afterwards. I had to remind myself several times in the crisis that someone explained to me: when you drive your car towards the wall, you step on the brake as hard as you can, and then when there is a lot of space to the wall, you can let go of the brake again; it makes no sense at all to step on the brake slowly and lightly and then realize that it is not enough. So—hit the brakes hard and then de-escalate. I had to remind myself of this quite often, because it was always like this: well, we’re doing a little bit of this and a little bit of that, and then we realized: cr*p, if we had said right from the start that this would be full steam ahead, get into this job, form a larger team, form a powerful team, and then you can always—if you notice that the team has finished the job in one day and I have three people too many—then I’ll just take them out again. So building a team, building the right sizes for the team, hitting hard and early, those are the things that I kind of learned as headings.”*

Another learning included that there was now a focus on problem-solving disaster medicine, which included better communication techniques such as video-conferences, and the acceptance of emails instead of faxes; there has been some progress although the participant considered the current status as “not really good yet”.

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A further take-out from the pandemic was that short pathways are needed for crisis management, e.g., having a central point at the federal level, then a central point at the state level, and then pathways down to the actors in order to enable quick and strong abilities for action. These structures need to be created technically. A central situational overview across the overall disaster impact and management efforts for everybody is important, although *“there may be disaster situations that do not differ substantially between Hamburg and Heidelberg”*. Knowing, however, what happens across the spectrum—what happens with the neighbors, districts, states, etc.—provides disaster managers with a helpful holistic overview and transparency. Valuable derivations could then be made about further situational developments resulting in more appropriate decisions and better actions. The participant emphasized the need to build such a system now.

Resources

One learning included that stockpiling with anticipation is important. It is crucial to anticipate needs—or potential initial needs—early and to be aware of global dependencies which may include vulnerable supply chains in times of a crisis. By avoiding initial supply issues, it is possible to buy some time in the first phase of the disaster response because some critical material is already available.

One participant concluded that the SARS-CoV-2 pandemic, the flash flood in the Ahrtal, and the energy crisis in the winter 2022 has taught us that we are not well positioned in some areas of disaster management, due to the fact that there was little investment in disaster management during the last 20–30 years. Therefore, personnel is needed now to work out priorities, plan and implement changes considering all the new learning during the last 3–4 years.

Of interest, one learning included that the need of personnel can also be overestimated—if processes are suddenly simplified after adjustment to new learning, or if the situation changes and decreases the level of needs in the disaster response (e.g., less interest in vaccinations).

One participant reported that he learned to lead a geriatric hospital through the SARS-CoV-2 pandemic together with his staff, by creating safety for the patients who were at high risk of fatal outcomes, by developing standards, and by creating a task force. Advantages of a smaller hospital compared to a bigger hospital included less administrative hurdles, less complexity because of more uniform structures, both allowing to reflect with more clarity what the decision actually meant on the operational or care providing level. Disadvantages included more personal workload because there were fewer possibilities to delegate.

Preparedness

Early preparedness together with other players in specific situations is key, although this is sometimes not possible, knowing that there may be an imperative act. As such, there was an actual focus on the Ukraine crisis, and possible shortage of gas at the time of the interview.

One learning included that many aspects cannot be pre-planned. As such, the next infectious agent may impose different challenges on the community. The raw structures, however, have to be clear. Focus and priorities should be explained in an orienting manner in advance so that staff is prepared and continues to feel appreciated if their usual task is temporarily being reorganized due to competing disaster management priorities:

“Many things, I say, cannot be definitively planned in advance. The next pathogen may bring different challenges. But you have to pre-plan the rough structures. Because it should already clear for the staff in advance: Where will I be when the following happens or what is my task there? Why am I not allowed to continue my actual work? For example, many employees felt that being pulled out of their core areas was a disrespect to the value of their work. As an example: the school enrollment examination was completely abandoned. However, this was not a disregard for the enrollment examination, but simply a necessity, because we needed experienced personnel who already knew the health department. And in that case we said: the enrollment examination is actually not worth less, but it is less of a priority. But we didn’t communicate that so well in the beginning. And you have to communicate that before the crisis. That it is clear to people: there are things that have to continue. Drinking water testing—we can’t put that on hold for two years. And there are things that would be great if they continued. But when it comes to the oath, those things have to fall. And communicating that cleanly, I think, is something that absolutely has to be done.”

Finally, soldiers on subsidiary disaster relief missions have to be prepared for their mission, also with practical items which should include local call lists and maps.

Mental outlook

One learning included that a fast disaster response is possible:

“So, actually, I learned from that that we can create a lot even in a very short time.”

The will and feeling of purpose can be decisive: a participant noted that an organization can work together very easily and perfectly if it wants to. “For

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something so big—despite all rivalries in daily routine business, all could stand together, pull one string, this was, so the participant, very unproblematic. One can deal with something unexpected and big very well if one manages to build a good and robust surrounding network. In the case of the start-up phase of vaccination center this included a local physician, the Red Cross, and the armed forces, and this worked well because everybody fulfilled their part, and all pulled on one string.

A participant commented:

“And I have learned, that has become clear, how quickly a person can change in such an emergency situation, what forces you can get out of yourself in the emergency situation. Or when one is needed in such a way, when one demands from us or when we demand from ourselves, what one can achieve there, that is unbelievable, one does not think at all that a human being can endure so much. We often worked through many days.”

Sometimes decisive action was necessary and although the rules were the rules, people were a priority. Previous technical professional skills and willingness to step in to improvise in an emergency situation can serve to enhance credibility of the leader and cohesion in the team.

Assistance of soldiers was helpful, and although they did not have medical skills, their simple presence and motivation had a positive impact.

The crisis provided professional opportunities to be early involved in aspects that one would usually encounter later at an advanced career stage. Furthermore, receiving trust was motivating.

A participant reported that learning more about personal limits helped becoming more mindful for the future.

Another participant learned more about the possibilities and strengths, but also about the limitations of the own organization, which helped to better manage expectations with partner organizations. The own organization was stable and functioned well, with their professional and volunteer members. Now there is the need to become a learning organization across a variety of different disaster situations. Being a learning organization includes setting priorities within the organization itself and allocating resources to the main focus, where the issues are. The excellent experience in cooperation with certain partners in disaster management was a good basis for future collaborations.

Own area: Elements that participants would do *the same* next time

Community networks and relationships

Participants would re-initiate the interclinical staff crisis management team, because this forum was a good basis to come together, to get to know each other, and provided a respectful environment.

A participant would also network again internally (which would include coordination centers, press office, and IT teams) in order to enable internal but also external operations.

Maintaining contacts with the players in disaster management without exaggerating (e.g., by too many phone calls) was considered important to have an exchange.

Involving all relevant players again in the future was seen as extremely valuable.

The participant explained:

"I think those are the essential things, that you just bring together the people that are involved and we would do that the same way."

Another participant would set expectations and definitions of roles with other players the same way as it had worked well during the pandemic and continue collaborations; the support for Ukraine refugees was a successful example for disaster relief after the pandemic.

Communication

A participant would continue to ensure internal alignment through frequent but short virtual briefings in a crisis, e.g., by use of 10 minutes of video-conferences daily.

Governance and leadership

Switching from line management to staff structure was considered a meaningful measure in a disaster. Another participant supported the switch into crisis mode in due time in case of a danger, would again build alliances and structures with people who have the same mindset.

The participant explained:

"I saw myself confirmed in the fact that we said from the beginning, there is a serious problem, and we have to switch from everyday mode into crisis mode, I would definitely do it that way again."

and

"I would do the same thing again: I would form a group again with people

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who also believe it is a problem, and I would look at things like a situation center, coordinating bodies, task forces, groups, I would definitely do that again."

and

"I think letting go of the daily grind and moving on to 'we have to do something else now, and that is fighting a pandemic'. I think that's the crucial thing. I would take that with me again."

A participant would once more identify potential leaders and pull them out of their routine work for a new leadership role within the crisis.

The participant explained:

"In the same way, I would withdraw employees from their actual work whom I consider suitable to lead larger units, because the problem is: at the beginning, you need personnel who already knows the structures. So they know how it was and at the same time they are able to create new structures—independently—and also to lead units, i.e., to lead people. That's not so common, you have to retain these people and to anticipate together with them what they might expect might in their new role. Well, some people were pretty overwhelmed when they got the task"

Another participant would once more reach out for help in time, distribute tasks clearly within the team, have regular team briefings to make sure everybody is on the same page, and to ensure that responsibilities are clear. That worked well in the pandemic.

Preparing soldiers well for the mission with appropriate briefing and background material (e.g., mails, sketches, or meetings) was considered a valuable practice to be repeated.

Because pandemic management, clinical care, the vaccination centers, mobile vaccination teams, and novel IT tools worked well, participants would go that route again.

A participant would once more manage hierarchies in order to create transparency towards the higher echelon and to receive leadership support in case of any shortcomings.

Another participant would continue the leadership style the same way. That style had developed as a result of former missions. This statement was seconded by a different participant who would again lead people the same way.

In particular, this participant described:

"There are certainly some differences of opinion on how to treat employees. Now I'm a little more careful in how I express myself. So for me personally,

I set a structure for how I dealt with the employees I was given to be responsible for and I would do it that way every time. So always friendly to the point where there's no other way, but that point has always been relatively high up for me. The way I dealt with the employees, that's what I would do again".

Resources

Involving volunteers anew in disaster management was considered valuable.

In case of another outbreak, a participant would once more strengthen personnel resources and mobilize staff, including former staff, retired staff, then distribute the work in the team, ask people to be flexible and to consider performing necessary work beyond their core competences, because disaster management requires some degree of improvisation and the need for a generalist working style to fill gaps. Supporting and taking care of staff, motivating staff by sharing knowledge, and demonstrating genuine interest in the individual person, as well as expressing gratitude to the staff by organizing a party at the end would be measures the participant would apply again.

Mental outlook

A participant would again be open, avoid thinking think too narrow, and bring in many players with broad perspectives, because there were other institutions that were usually not involved in disaster relief, who brought in clever ideas how to better structure tasks during the pandemic. Involving many for meaningful planning was considered valuable.

A participant would do most the same way and another would once more volunteer for the same job, if asked again, after having worked for an inspiring supervisor.

Own area: Elements that participants would do *differently* next time

Local knowledge

Because driving a car, necessary for disaster management related business, proved to be too difficult in downtown Heidelberg due to the parking situation, a participant would use a motorcycle in the future.

Community networks and relationships

For new situations and new challenges, a participant would involve other actors in disaster management much earlier. The goal is to better recognize their resources and abilities, so that all have the same information, and on-boarding can occur on time. In addition, maintaining the network-

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ing within the disaster management community after the SARS-CoV-2 pandemic was considered important.

The participant said:

“What we have also learned from this, especially in this context, is to exchange ideas more regularly with others, to simply see what is happening with them, what resources do they have that we can use? It is also very important to get to know the people. It’s always said that ‘knowing people in crises’ is a good thing. Simply to have this contact with the others, which in some cases was not the case before. Especially when I see it now with the topic [redacted for privacy reasons], I think we never had any contact before. And I have to say that this has shown us that it is very important in such situations to bring everyone to the table at an early stage, so that everyone has the same information, everyone knows the strengths and possibilities of the others, and so that we can continue to cultivate this in order to meet new situations, new challenges that are now coming. That is such an essential story for me”

Communication

A participant would communicate more openly and frankly and probably formulate statements more drastically to receive more attention and achieve better comprehensibility by the population for the true nature of the emergency. Looking back, statements published were probably too cautious in order to avoid panic in the public, but it was probably not clear to all how tense the situation really was.

The participant said—

“Yes, perhaps it would be formulated a bit more drastically in different forms and colors in order to draw a bit more attention to how bad the situation actually was. But that’s also very difficult from an ex-ante point of view, because we wanted to avoid somehow stirring up panic. Of course, we had a shortage of beds in the intensive care units, but I’m relatively sure that that was never said anywhere so clearly. Perhaps we would do things a little differently now, in retrospect, by saying okay, we could actually have expected a little more of the citizens in the sense of we are not panicking, but we are perhaps a little more open about what the situation actually looks like. Perhaps also to be able to generate a bit of comprehensibility or a bit more understanding or a bit more sensitivity at the end. But perhaps we could have been a little clearer.”

Making even better use of the new communication opportunities that worked well in the pandemic, such as video-conferences, may result in improved transparency and stronger alignment within the team.

As the flow of information from the state was staggering in the beginning of the pandemic, local managers should communicate earlier with their subordinate units to allow them to better adjust and to be prepared in time.

One participant found it important to speak up to the hierarchy in a constructive way in the future instead of remaining silent and letting things happen, which had led to conflicts.

The participant said:

“In the future, I think I would do it in such a way that I say ‘yes, but—we can do it this way, but this and this are my concerns’. I didn’t do that at the beginning either, because I simply wasn’t experienced enough to be able to say ‘but that will have such and such an effect’. I don’t think I would do that again today.”

Governance and leadership

One participant emphasized the future importance of distributing the crisis workload broader and assigning personnel differently in order to avoid individual overload. Likewise, another participant reminded us to be mindful about the use of personnel to avoid an overload of the good performers in the beginning which may lead to long personnel drop-outs. The participant cautioned not to not assume that a few individuals would keep the overall situation under control by extremely high personal workload, especially not in a long-term disaster management situation.

The participant explained:

“I would plan less with a sprint in the beginning. In the beginning, we relied very heavily on a few people keeping the overall situation under control through a high workload. This leads to the fact that there are people who have built up over 1000 hours of overtime and are still dragging it along. Which also means that they have not been in recovery for the 1000 hours. And they built them up especially in the first phase. That sort of grew exponentially for some. I would do that differently. Because you can’t estimate how long a situation will last. If I burn out the good personnel right at the beginning, then in case of doubt they will drop out. Thank God, we’ve had relatively few of those. So I haven’t had any longer absences. I know this from other [institutions] (redacted for privacy reasons). There are really people who have been absent for three months. You can’t really afford that.”

Another participant recommended to explore possibilities to consolidate the necessities of the new situation much earlier, because the participant noted that after two years of the pandemic, there were still processes run-

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ning in disaster mode, which imposed extra work and which was hard to explain to the staff assigned.

In order to prevent significant post-hoc workload, better structures and better documentation of key details of critical issues would be advisable, because they are eventually difficult to trace back afterwards.

Pandemic rules and standard operation procedures were too complex and changed too frequently. A participant therefore recommended making it simpler, and—in the interest of a structured management of the pandemic—to be more directive next time. This could be done by avoiding addressing too many individual issues, because they resulted in too many technically detailed discussions which led to arcane protocol ramifications, that consumed a lot of energy in the team.

Another participant considered it important to set expectations on roles and responsibilities earlier in the future. This referred to the situation internally, but also with partner organizations, and would also include aspects relating to contracts and finances, reimbursement of expenses—especially to volunteers, defining processes, setting a political mandate, and have a clear understanding about the “rules of engagement” in the disaster relief mission.

Resources

A participant recommended to better anticipate who in the team could become a future leader in a crisis, because that person needs to be prepared for this new role in time to avoid that the individual feels overwhelmed if a sudden change of role with more responsibility is required in the crisis.

Preparedness

A participant emphasized that training staff remains equally important for the future.

Mental outlook

A participant “*would work a bit less*” in the future. Likewise, another participant would spend less time with the disaster, at the same time recognize that although might be difficult—when reflecting back upon the pandemic—due to intensity of the situation.

Another participant would be less emotional in resource and structure related professional conflicts and would separate the factual situation from emotional situation to assess what the result from both of them would be.

The participant explained the reasoning:

“Why? Because it is exhausting. It does not lead to a better result if you are emotionally involved. It only leads to the fact that it costs you more energy. So, if it were different, if it were relevant, if the better result arose from this emotionality and the difference, because one has more motivation from

it—‘I am emotional now, therefore I am totally motivated and therefore I occupy myself longer and more intensively with it and the result becomes better’—then okay, so far, then these grains are worth it. But if you notice that the result doesn’t really change, just because you get emotional, then it’s of no use, then you can also leave it and say ‘well, we have to try to do this emotionless’”.

Ensuring that the work-load is distributed evenly among peers was a crucial point to consider in the future for another participant. This would avoid individual overload and reduce tensions.

A participant stated that it is especially important to know personal limitations. Going up to these limits—just these limits—in the future would be acceptable, but personal mindfulness is of equal importance.

The participant explained:

“And that’s another point that I wouldn’t do the same way again. I would not give up everything for it. I would give a lot for the situation and do a lot for the situation, but I wouldn’t give everything for it, because everything means forgetting myself in the end, and I don’t think I would do that anymore. Because that didn’t do me any good in some phases. I think that’s one of the biggest points, because in the end it’s done a lot for the general public, but if you ruin yourself, then it doesn’t do you any good. So, I would pay more attention to myself.”

Nature of subsidiary civil-military support towards the present study population

The complete civil-military support mission to Heidelberg and the Rhine-Neckar district is described in Module 1, summarized in Table 6 and mapped in Figure 16.

To better understand the perspectives represented in this chapter, the nature of subsidiary civil-military support within this study sample is specified in this section. Specifically, this analysis of civil-military support including lessons learned in modules 2 and 3 refers to the study population of key actors (N = 12) who gave interviews for this study, and their corresponding organizations in the Heidelberg/Rhine-Neckar disaster management community. Organizations represented in this study population received civil-military subsidiary support by the Federal Armed Forces in the areas (1) public health service, (2) nursing homes, (3) hospital health-care, and (4) disaster management. An overview including more details of soldiers’ tasks in the respective areas is provided in Table 13.

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Table 13. Areas of subsidiary civil-military support represented in the present study population of interviewees (N = 12)

Area of support	Military support personnel tasks
Public health service	<ul style="list-style-type: none">• Infection tracking and tracing• Public health phone hotline• Vaccination centers and mobile vaccination teams
Nursing homes	<ul style="list-style-type: none">• SARS-CoV-2 testing for visitors• Elderly care support
Hospital healthcare	<ul style="list-style-type: none">• COVID-19 intensive care unit support
Disaster management	<ul style="list-style-type: none">• Coordination of civil-military subsidiary support

Analysis of specific civil-military experiences, topics, outcomes, and lessons learned

The following section analyses civil-military experiences during the COVID-19 pandemic in Heidelberg/Rhine-Neckar. Specifically, best and worst experiences, as well as things participants would do the same way on the one hand or do differently on the other hand will be juxtaposed, categorized by community resilience elements [71]. Table 14 provides a summary for orientation followed by more detailed descriptions that are illustrated with significant statements by participants in the four sections thereafter.

Table 14. Best and worst civil-military experiences, as well as things participants would do the same way or do differently next time, categorized by community resilience elements

Resilience element	Civil-military cooperation			
	Best	Worst	Do the same way next time	Do Differently next time
Local knowledge	n.a.	n.a.	<ul style="list-style-type: none"> Local exploration of situation with small teams prior to the arrival of larger units Regular audits and civil-military exchanges with anticipatory mindset 	<ul style="list-style-type: none"> Incoming units need more support by local liaison teams
Community networks and relationships	<ul style="list-style-type: none"> Excellent cooperation between different professions and between the civilian and military sides 	<ul style="list-style-type: none"> Single cases of complaints (food, cooperation issues) 	<ul style="list-style-type: none"> Encourage civil-military support because it created value in the overall network Joint disaster management approach between the separate units of city and district Networking and close exchange between the aid organizations and the local district CIMIC liaison command Local availability of military expert Availability of the armed forces contributed to the diversity of actors, which would again be helpful in the future because this creates a redundancy of critical items and avoids dependency on one single player. Continue civil-military exchange 	<ul style="list-style-type: none"> Analyze the perception of military uniforms among citizens during subsidiary support of the military
Communication	<ul style="list-style-type: none"> Clear communication structures Transparent flow of information Realistic management of expectations 	<ul style="list-style-type: none"> Technical language issues led to friction Roles and expectation during supervisory visits were unclear Late communication of significant changes Rigid rules, difficult to understand because no context provided 	<ul style="list-style-type: none"> Involve the local CIMIC district liaison command 	<ul style="list-style-type: none"> Some more oversight or better training would result in more appropriate behavior of individuals towards the public in the future More explicit communication of pre-conditions for locally deployed missions (e.g., hygiene specifications)



Table 14. (continued)

Resilience element	Civil-military cooperation			
	Best	Worst	Do the same way next time	Do Differently next time
Communication (continued)				<ul style="list-style-type: none"> • Clear communication around changes or the definite end date of subsidiary support with a little lead time allowing adjustments • Early communication about possibilities and limitations of subsidiary civil-military support • Earlier alignment within disaster management organizations whether subsidiary military support is necessary or not
Health	<ul style="list-style-type: none"> • Military medical personnel supported intensive care units • Military medical personnel is a key component of civil-military cooperation and can act as an ice-breaker 	<ul style="list-style-type: none"> • Military involvement in federal level crisis management could have been communicated more proactively • Single case of a soldier who brought a dog to work in a vaccination center 	<ul style="list-style-type: none"> • Deployment with the goal of providing aid to patients and to support personnel should be considered again. 	<ul style="list-style-type: none"> • Wider participation of the medical corps including nurses and physicians of the federal armed forces in health protection tasks • Appropriate lengths of working shifts
Governance and leadership	<ul style="list-style-type: none"> • Structured working style of the military with clear points of contact • Dropped out personnel was replaced instantaneously • Fast integration of the military personnel in the ongoing processes • Military support came as requested • Constructive and solution-oriented teams • Smooth transition between teams • Reliability 	<ul style="list-style-type: none"> • Clear end of subsidiary support was not defined well in advance • Motivational issues due to inactivity in the beginning of the mission • Delayed decisions and long, complex administrative process for subsidiary support • Initial central procurement process for PPE perceived as ineffective • Long military working hours not ideal • Rigid military working structures: process changes required wider alignment • Rotation of personnel required adjustment due to different perspectives 	<ul style="list-style-type: none"> • Ask the military again for subsidiary support, because the workforce and the military structures were a reliable asset in the disaster management • Create transparency and motivation through state command level visits to the deployed units • Adjust processes for improvement in the spirit of mutual alignment • The leadership structure of the military in the local subsidiary mission should be the same way • The mission-type tactics of the military, i.e., defining the goal, <i>“but not exactly the how and where”</i> was an asset 	<ul style="list-style-type: none"> • Simplify requirements and processes • Better define limitations



Table 14. (continued)

Resilience element	Civil-military cooperation			
	Best	Worst	Do the same way next time	Do Differently next time
Resources	<ul style="list-style-type: none"> • Military support came fast once an agreement had been reached • Military was able to deliver 	n.a.	<ul style="list-style-type: none"> • Involve the armed forces again in subsidiary disaster support together with the other actors, because the military was instrumental in mastering personnel surge capacity as well as long endurance. • Availability of relatively rapidly deployable units 	<ul style="list-style-type: none"> • Longer rotation phases allow better continuity • Civilian players might require longer subsidiary support • Civilian personnel recruitment efforts should be intensified in future situations • Transparency of the availability of military means in terms of numbers and deployment times should be available faster • Faster turn-around and decision times on military support
Economic investment	n.a.	n.a.	n.a.	n.a.
Preparedness	n.a.	n.a.	<ul style="list-style-type: none"> • Anticipatory dialogue in terms of preparedness, considering possibilities and limitations of subsidiary support 	<ul style="list-style-type: none"> • Some individuals require more technical training
Mental outlook	<ul style="list-style-type: none"> • Mutual trust • Reliable and motivated personnel • Orientation towards the mission • Flexibility in terms of time and space 	<ul style="list-style-type: none"> • Single cases of motivational issues and leadership style issues 	n.a.	n.a.

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Civil military cooperation: What worked *best*

Community networks and relationships

The collaboration with different professions was excellent. Many good moments arose out of the daily work. In general, there was exceptionally good cooperation between the civilian and military side.

Communication

The communication structures were noticeably clear.

The flow of information towards and from the CIMIC liaison team went well, and was considered useful, early signals of what would work and what would not work were immensely helpful to adjust expectations. Knowing from early on what would not work saved participants a lot of work.

Communication with the soldiers was direct, and without reservations, and led to concrete agreements.

Health

Personnel came to support the intensive care units, which was considered helpful.

Medical personnel is a key component of civil-military missions, because they are then perceived more positively. As such, the presence of medical military personnel was especially important in the quarantine support of the refugee center, because refugees felt well taken care of. This was an ice-breaker.

Governance and leadership

The military had a structured working style, it was always clear who the point of contact was. They organized themselves. The number of personnel remained constant, if soldiers dropped out, they were replaced instantaneously.

Military teams integrated themselves fast into the ongoing processes.

Support came as requested, it was well coordinated by the CIMIC liaison team with short pathways and alignment, this worked very well, the participant would hope that it would continue to work well in such situations.

The cooperation with the military coordination teams was excellent, they were perceived as constructive and willing to find solutions in the planning phase. The collaboration was pleasant. The participant never had the feeling that the military had a different agenda than the civilian side.

Replacement forces familiarized themselves with the new tasks and made the handover independently. They introduced themselves, so one would know there is a change, and the processes and knowledge transfers would be handed over smoothly from the departing unit to the incoming unit without the need of supervision.

A participant explained:

"I would say that the big jackpot was the two subgroups from this company, which were super and almost all of which functioned perfectly. The leaders on the ground worked so well that they saw for themselves where structural difficulties arose and then had consultations and changed them on their own, i.e., they first asked whether they could change them and then did so. And then they trained their own men and women to the extent that they were able to implement everything, and that was top-notch, it worked really well."

Individual soldiers stood out in leadership performance.

Soldiers worked independently and organized themselves independently, they did not require micro-management.

One basis of the military's image gain was the fact that the soldiers were punctual, reliable, and that military leadership and coordination worked well.

Resources

Once the support initiation process was clear, an agreement and a precise definition of the task was in place, the military support arrived fast and without problems. Soldiers integrated themselves fast and were fast learners. They played an important part in the work that had to be done.

A participant said:

"I can say right at the beginning: without the armed forces, we would never have been able to manage the processes to the extent we did. We simply had far too few personnel resources, and it wouldn't have worked without the armed forces."

The military perceived a great amount of gratitude for their presence, their help, their reliability, and their performance. The perception was that the military could deliver, even if the initially requested number of soldiers had to be reduced for the mission.

Mental outlook

Soldiers were perceived as exceptionally reliable. The motivation of the soldiers was, in general, excellent, there were no complaints. The best was that the performance of tasks occurred without arguing. Soldiers were also perceived as friendly. Volunteer reservists to support nursing home stepped in quickly and were motivated, they could help where they were needed. Their thinking along, being alert, being there for the mission, changing things toward the positive was considered a valuable experi-

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ence. The overall professionalism was excellent and remained constant. Soldiers were very flexible in terms of working times and working conditions. Situational improvisations were considered helpful.

Civil military cooperation: What worked *worst*

Community networks and relationships

A participant knew of one case (out of 788), where a soldier was not happy with the food, in another case the integration of one soldier into the civilian team required some readjustments. Likewise, another participant reported that two soldiers in their area were not happy with the food. One soldier was exchanged because of cooperation issues. The cooperation with the replacement went well.

Communication

“Translation of need” into a language that is understood by the military was an issue and could have worked better. The roles and expectations at military supervisors’ inspection visits were non-transparent which led to uncertainty about consequences. The military’s COVID-19 related hygiene specifications were communicated late in the planning process which rendered workplace disposition plannings of incoming soldiers difficult. Information on personnel changes was communicated with short anticipatory notice. Likewise, while subsidiary support had been repetitively authorized for limited periods and had frequently been extended afterwards, the true end date of support was communicated suddenly and unexpectedly. Earlier availability of the information would have been helpful to adjust plannings timely, in both cases. Selected workplace rules of the military were rigid and difficult to understand, because no explanation could be provided. Specifically, soldiers had fix working places that could not be used by someone else if the soldier was off duty. Alignment of communication was an issue to another participant.

Health

A soldier brought his dog into the vaccination center.

The communication about the work of the military in the crisis team on the level of the federal government could have been more proactive in the perception of one participant.

Governance and leadership

Defining a clear end to the subsidiary support well in advance was an issue. There was an initial delay with the immediate integration of soldiers into civilian working schedules which lead to motivation issues because the soldiers could not start their support immediately after having arrived at the

site. Information on possible subsidiary support was not available immediately but followed a specific process. Likewise, decisions whether support was authorized or not were not immediate but came in after having gone through a lengthy administrative process. There was the perception that the central PPE procurement process by the military in the beginning of the pandemic was not appropriate and slow. Long working hours of the soldiers were not ideal, because this might lead to accuracy issues. Military working structures were predefined, and changes required wider alignment before they could be implemented. Exchange of military personnel at the end of rotation sometimes required minor adjustments of processes due to altered perspectives.

Mental outlook

There were single cases of motivational issues. The leadership style of one military leader did not fit into the overall project culture according to the perception of one participant.

Civil military cooperation: What should be done the same way next time?

Local knowledge

Local exploration by a command of a few soldiers before arrival of the military units should be conducted again, as well as audits from time to time and exchanges between the military and the civilian parts, with an anticipatory mindset.

Community networks and relationships

A participant would encourage civil-military support because it created value in the overall network.

The participant said:

“That’s exactly how the possibility of support in this crisis, for a defined area, should be done. That was simply infinitely valuable, and I think it was also very well perceived, overall, that everyone worked together: public agencies, the German Armed Forces, hospitals and rescue services. Simply the possibility to fall back on this support and it went well overall, i.e., the possibility to get motivated people who can be trained quickly and also approach the task with enthusiasm.”

The fact that both sides, i.e., the city of Heidelberg and the Rhine-Neckar district which are two separate territorial entities, jointly aligned their needs for civil-military support is an approach that one participant would choose again.

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Networking and close exchange between the aid organizations and the local district CIMIC liaison command was an approach that a participant would choose again, because this gave a better picture of the situation, a better understanding of current issues in the organizations, problem-solving directions taken, and helped facilitating the process obtaining subsidiary support.

Because the military support had worked well, a participant would again contact the military in case of a crisis. The local availability of a military expert was helpful.

The availability of the armed forces contributed to the diversity of actors which would again be helpful in the future because this creates a redundancy of critical items and avoids dependency on one single player. In a huge crisis no single actor can manage everything on their own.

Civil-military networking, cooperations, *“involvement with civil society”* and exchange should continue.

Communication

A participant would involve the local CIMIC district liaison command, because of the possibility for a short reach out and the alignment.

Health

Deployment with the goal of providing aid to patients and to support personnel should be considered again.

The participant explained:

“What one would do in exactly the same way: I think that this recruitment for these patients or personnel performance was very, very good and that one should also do it again in exactly the same way. So, that you had this proximity of the Bundeswehr to the civilian services, that that was possible, that was great, that should also be done again in this way. Because it was not a military function, it was an auxiliary function and that was certainly very, very well chosen, I had the impression.”

Governance and leadership

A participant would ask the military again for subsidiary support, because the workforce and the military structures were a reliable asset in the disaster management.

The participant said:

“Because it was simply honestly for us also a continuance size. If I knew, okay, I now have the request for assistance, it is limited until, I don’t know, xyz, but the Bundeswehr provides me with so and so many people, then I also knew that I can rely on the fact that I don’t always have the same people, but I at least have the head count that I can also rely on.”

and

“I had a responsible contact person on site, which meant that I didn’t have to talk to every single one of them, but I knew that if I talked to the contact person, he would pass that on to the troops, which of course relieved the pressure on us, because we didn’t have to talk to everyone individually. So that was a very reliable, dependable support unit for us, exactly in that sense.”

Visits by the military state command to the sites of subsidiary support created transparency how the demanded aid had been implemented and that it was needed, that it worked, and it motivated soldiers because visibility from the top of hierarchy existed.

A participant would again have regular meetings with leaders from different organizations on the operations level in order to have an exchange how the project is running, where issues are, why things are working well or probably why not, with the goal to adjust processes for improvement in the spirit of mutual alignment.

The leadership structure of the military in the local subsidiary mission should be the same way. It was very helpful that there was one leader who was responsible for the soldiers so that the civilian director did not need to supervise each soldier individually. Besides the supervisory function, the military leader was even personally fully integrated in the work-stream. The military unit was a self-regulatory body and acted *“as a single person”* which was incredibly positive and saved civilian leadership resources.

The mission-type tactics of the military, i.e., defining the goal, *“but not exactly the how and where”* was an asset in the civilian setting for a participant.

The interviewee explained:

“This area, cover that, that’s the group assignment, but how you cover it is your job. Allow some leeway in how you handle the task. Personally, I would do the same for myself, i.e., not to make any concrete specifications, as you might have to do with one or the other employee for whom you are the direct superior, but just to give the framework assignment and then rely on it being implemented in that way, the mission-type tactics with which the Bundeswehr works, with which it can also manage.”

Resources

A participant would involve the armed forces again in subsidiary disaster support together with the other actors, because the military was instrumental in mastering personnel surge capacity as well as long endurance.

As there are uncertainties about the nature of the next disaster, the availability of relatively rapidly deployable units was positive.

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A participant elaborated further on this subject:

"You never know whether you have a regional disaster or a national one. So you simply put together this availability, you say that I can get people on their feet within 48 hours. So, that you just say, I have a contingent—can I expand that, can I optimize that? Can I shift it to crisis areas, Ahr Valley, or it's national and who else can I recruit? Do I still have a reserve option, that perhaps this can be expanded, that the various time corrections—I hope that this is all there anyway—that is, in the first phase I need so and so much in the second phase so and so much, that you simply optimize the availability of people. Let's assume that we do have another pandemic. The pathogen would be just as bad or worse, then you would have to act very, very, very quickly, otherwise the people in the homes would die, because simply no one would be there and maybe it would be too late anyway, but that you at least have such scenarios where you can deploy very quickly and very many people for any emergencies, but that does exist, you would just have to check whether everything was as good as it was now. "

According to one participant, resources of the military have their role in future disaster management:

"And in general, in this situation, I would also say that what you should do again is to deploy the Bundeswehr. So, there was this thing at the beginning: can you use the Bundeswehr for this in the domestic sphere? Military assistance to provide aid: yes, or no? Yes, that is indeed what we should do again. In a situation like that, you should use the resources that you have, and the Bundeswehr is an important one and good one."

Preparedness

A participant would turn again towards the armed forces in a crisis situation and reflected about a more anticipatory dialogue in terms of preparedness, considering possibilities and limitations of subsidiary support.

Specifically, the participant explained:

"I mean what one must do in any case again in a crisis, is to ask the Bundeswehr for help, that is clear in any case. Ideally, this help should have been sketched out a bit beforehand, i.e., it would have been ideal if, at that time, when these evaluations were made all around or when this prognosis was made that there would be a SARS virus at some point, that there would be a pandemic, if something like that had been taken as a reason to ask, okay, in such a case, we would have the need, point by point, for the hospital, and at which of these points the Bundeswehr could help. So there were different ideas, from security and order of a hospital over medical person-

nel over medical material over the services, material transport, delivering something from A to B, these are such items which were conceivable. And I think it would have been clever to have said in advance, roughly, this is an option, this is not an option at all. Simply in such a way that we had thought about it at the moment we were confronted with the crisis, what actually makes sense to inquire now—perhaps if we had already clarified it a bit roughly beforehand. And the Bundeswehr then says, no, security and order, we cannot, we must not do. If not, we don't need to worry about such things. Or if the Bundeswehr says, in such a crisis situation, then there will be no medical personnel under any circumstances, because we use that as the very first thing for our Bundeswehr hospitals, then that is also a statement. Or the Bundeswehr says, we can always imagine to help in such a crisis situation but in the transport sector, because we have the vehicles and the drivers for that and in a medical crisis we won't have much of our own need there, I don't know, but you could spin something like that together and then I would say then it would make so total sense to say, yes, plan out, we turn to the Bundeswehr for help. But of course, I'm also aware that all these plans are always just a 'good plan till first contact with the enemy'"

Civil military cooperation: What should be done *differently* next time?

Local knowledge

Incoming units require more support by local liaison teams.

Community networks and relationships

One participant suggested it would be interesting to analyze the perception of military uniforms among citizens during subsidiary support of the military. Specifically, some people may feel intimidated or threatened, on the other hand this may lead to the result that *"things run in a calmer, more orderly fashion"*.

Communication

Some personnel should not have been assigned with the number of privileges for external communication with citizens, there some more oversight or better training would result in more appropriate behavior in the future.

The communication around preconditions such as hygiene specifications for deployed soldiers was perceived as ambiguous and should be more explicit.

A clear communication around the definite end date of subsidiary support with a little lead time would have been helpful, as it would take at

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least two weeks to recruit and onboard new personnel. In addition, clearer communication about expectations, roles, and responsibilities of supervision visits were mentioned.

It would be helpful if changes to deployed units and information about replacement were communicated well in advance.

For the future, it would be helpful to know from early on which support from the military would be possible and which support would not.

A participant explained:

“For a relatively long time, the whole thing was a bit in the fog, do we get medical personnel from the Bundeswehr under certain circumstances or not? I would say that this could perhaps be done more quickly or this information could be shortened so that it is said right from the start that we can do this, but nothing beyond that. That would not be bad.”

Early communication about possibilities and limitations of subsidiary civil-military support by the armed forces would be helpful in the future, was a suggestion made by another participant.

The interviewee explained:

“Communication about what is possible at a very early stage, so that you don’t generate expectations that you can’t fulfill. That you know very early on—you can optimize this again—I have such and such challenges and I can now do such and such. That you get your pipe dreams out of the way very early on and simply say on day two that you can and can’t do it. I think it was unclear at times how much the Bundeswehr can really do, and then there was simply no clear presentation in the media, there were a few misunderstandings, I think. If you can show that clearly, I think the pandemic would then have to be different, to perhaps update the portfolio of options again through different scenarios and then also to go very quickly into the communication, we have these options, we do it differently, but we can do this and we can’t do that.”

Earlier alignment within disaster management organizations whether subsidiary military support of necessary or not would be helpful in the future in order to avoid gaps.

Alignment on communication structure and means between the civilian and military sides are helpful, this also includes the smooth management of transition processes.

Health

The participation of the medical corps including nurses and physicians of the federal armed forces in health protection tasks such as refugee protection and COVID-19 crisis management was crucial. Their capacities should

therefore be extended and supported with appropriate resources in the future.

Appropriate lengths of working shifts should be considered because working long hours or many weekdays interfere with motivation and quality of results. Accommodation and food are especially important points, too, in this context.

Governance and leadership

Some specific requirements for accommodation, transportation, and parking were difficult to understand for civilian counterparts, and could probably be simplified in the future.

The change from local reimbursement to federal reimbursement of the costs of the subsidiary civil-military support mission created some friction on various sides. These complex reimbursement processes should be clearer from the beginning so that roles and responsibilities can be attributed accordingly.

A more precise definition of what the military is allowed to do and what not helps prevent misunderstanding.

Resources

One participant thought they should have involved the armed forces earlier, although recognizing the subsidiary nature of military support which mandates that the armed forces cannot be called in the first place once personnel shortages are being noted in the surge of a pandemic. Civilian disaster management resources have to be brought into play in the beginning.

Rotation phases of the soldiers should be longer in order to guarantee continuity.

The format, process, and roles of complex civil-military procedures such as reimbursement should be optimized in the future.

Civilian players might require longer subsidiary support by the military in the future and might request more influence on the decision about the duration of this support. In particular military nurses and physicians might be in high demand.

Civilian personnel recruitment efforts should be intensified in future situations.

One participant asked that transparency of the availability of military means in terms of numbers and deployment times should be available faster.

The participant said:

"I don't know, but maybe at some point there will be a communication or knowledge system that will make it possible for an individual sitting in a meeting to call up even more information on an ad hoc basis, so to speak,

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and then to be able to give an answer immediately. So, of course, that would already increase the effectiveness of these meetings extremely, because everything that can be clarified in the meeting does not have to be postponed to the next one. But this is not a point that concerns the Bundeswehr alone; it concerns all those involved in these crisis teams—they make sure that their own level of information is extremely high so that they can answer as many questions as possible on an ad hoc basis.”

Another participant commented that faster turn-around and decision times on military support would better inform overall planning.

Preparedness

Some individuals require more training as they might not be familiar with certain tools, e.g., IT.

Comparison of civilian and military capabilities during the pandemic disaster management: Overview

The following section analyzes aggregated results of interviews with key stakeholders (N = 12) from the Heidelberg/Rhine-Neckar disaster management community with the objective to qualitatively juxtapose in which parts of pandemic disaster management either the civilian side or the military were positioned *better* or *worse*. The points addressed were based on the mutual collective experience during the COVID-19 mission. An overall synopsis of findings is provided, for better orientation, in Table 15. Thereafter, a more detailed description of each category follows which is illustrated by significant statements of participants. Results were systematically structured along the nine core elements of community resilience by Patel et al. [71].

Table 15. Juxtaposed key points: better or worse positioning of a) the civilian side and b) the military during the local pandemic disaster management, identified in the interviews, and mapped to core community resilience elements [71]

Resilience element	Comparison of capabilities during the local COVID-19 disaster management			
	Better positioned		Worse positioned	
	Civilian side	Military	Civilian side	Military
Local knowledge	n.a.	n.a.	n.a.	n.a.
Community networks and relationships	n.a.	n.a.	n.a.	n.a.
Communication	n.a.	n.a.	<ul style="list-style-type: none"> • Problematic crisis communication on the upper political level 	<ul style="list-style-type: none"> • Difficulties finding a common language with civil partners
Health	n.a.	n.a.	<ul style="list-style-type: none"> • Variable compliance with hygiene rules 	n.a.
Governance and leadership	<ul style="list-style-type: none"> • More flexibility for task and working hours modifications • Had overall leadership with their knowledge and personnel • Carried the main burden 	<ul style="list-style-type: none"> • Solution oriented • Experts in logistics • Clear structures and thinking • Reservist status less interfering with employment 	<ul style="list-style-type: none"> • Redundant and ambiguous leadership structures • Heterogeneous leadership cultures 	<ul style="list-style-type: none"> • Inability to take over sovereign tasks • National procurement structures unable to handle sharp increase in supply requirements
Resources	<ul style="list-style-type: none"> • Personnel had appropriate professional background and experience • Personnel reserves including volunteers • Structures were appropriate to fight the pandemic • Delivery of equipment • Physicians and assistant personnel 	<ul style="list-style-type: none"> • Reliable ability to provide workforce in time agreed upon • Strong personnel surge capacity • Long perseverance • Robust performance in standardized tasks 	<ul style="list-style-type: none"> • Slow or insufficient personnel recruitment due to lack of reserves • Lack of specific, specialized equipment • Issues in supply with personal protective equipment and vaccine • Heterogeneous skills, competences, and training among helpers 	<ul style="list-style-type: none"> • Shortage of medical personnel • Longer mobilization time than for civilian volunteers • Limited subsidiary resources due to the global nature of the pandemic



Table 15. (continued)

Resilience element	Comparison of capabilities during the local COVID-19 disaster management			
	<i>Better positioned</i>		<i>Worse positioned</i>	
	Civilian side	Military	Civilian side	Military
Economic investment	n.a.	n.a.	n.a.	n.a.
Preparedness	n.a.	n.a.	<ul style="list-style-type: none"> • Lack of reserves for personnel and equipment 	<ul style="list-style-type: none"> • Lack of preparedness for material supply
Mental outlook	<ul style="list-style-type: none"> • Adapting to situations, organizing and implementing change • Motivating encouragement • Creative 	<ul style="list-style-type: none"> • Reliable working culture 	<ul style="list-style-type: none"> • Less flexible in terms of longer working hours • Workplace sense of entitlement • Availability limited due to other obligations or motivational issues • Friction due to needs for discussion 	<ul style="list-style-type: none"> • Difficulties in handling more nuanced tasks • Less creativity and proactiveness

n.a. = not addressed

Comparison of civilian and military capabilities during the pandemic disaster management: Strengths of the civilian side

Governance and leadership

There was more flexibility for modifications of tasks or working hours on the civilian side, because the administrative process for authorization of modifications for military subsidiary support was complex and required alignment of various supervisory bodies, both civilian and military.

The civilian side led the coordinated overall disaster management with their knowledge and personnel and carried the main burden; the military support was—as mandated by the constitution—subsidiary.

Resources

Civilian personnel who were trained for specific task worked better than the military (deployed in the vast majority as “helping hands”), because they had the appropriate professional background and experience, related to knowledge, procedures but also—at least in some cases—with regard to external representation.

Civilian personnel was specifically trained for the task and could therefore guide and train the incoming soldiers.

The availability of civilian reserves helped to resist and compensate, which avoided having to ask the military to step in for subsidiary support.

The civilian structures, although not ideally positioned, were the appropriate ones to fight the pandemic, because overall and in the core aspects, this was not a military situation.

The participant explained:

“I also believe that the civilian structures were the right ones to deal with the problem. In the primary sense, it has not been a military situation. It was a civilian situation in which the civilian structures were not ideally positioned, but were not completely naked either, because at least the medical structures are already relatively efficient in routine care, and it was really a matter of managing this switch. It was a matter of remaining capable of acting even in the face of material and personnel shortages, which we also had initially.”

Civilian disaster management structures based on volunteers who demonstrate solidarity can mobilize many people relatively fast, although there are availability restrictions due to family or work requirements. Switching from volunteer personnel over to professionals over time became important for the ability to sustain on the long-term.

Another participant explained this as follows:

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“I think where the civilian side is better positioned in the short term is simply the great mass of volunteerism. So quite ad hoc, just as an example in the central vaccination center: when it was a matter of erecting the exhibition walls to separate the offices, consultation and doctors’ booths: we pressed the button, and the fire department was standing there and built it up. That was ad hoc. That’s not possible with the Bundeswehr, because an application has to be prepared, it has to be approved, the people have to come. That simply takes longer.”

The delivery of equipment including SARS-CoV2 test kits through civilian disaster management structures worked well.

The availability of civilian physicians and assistant personnel was critical for tasks that require medical privileges.

Mental outlook

The civilian side was strong in adapting to situations, organizing and implementing change, probably due to the less strict chain of command, although the participant also saw change and adaptation to new situations on the military side. The common goal of both sides was acceleration, process improvement, and minimizing errors.

A lot of encouragement and positive feedback came from the wider civilian side which motivated teams.

A particular strength of the civilian side was finding creative solutions.

Comparison of civilian and military capabilities during the pandemic disaster management: *Strengths of the military*

Governance and leadership

Soldiers were experts in logistics, thought and acted in a very structured way, within networks, looking for solutions.

A participant explained:

“But what the Bundeswehr can do much better, of course—or I would say better across the mass of personnel—is this logistical and very structured thinking and approach. So, it has become very clear in the [institution] (redacted for privacy purposes), we also had this logistics area in the second phase in the [institution] (redacted for privacy purposes), that they simply think in a much more networked, structured and clearer way and with a view to ‘what is the goal at all’ and ‘how can I best achieve this goal’? I think that the civilian employee who is not a specialist is often overwhelmed and simply lacks this networked, goal-oriented, solution-oriented thinking. I think you can do that much better with this background in the Bundeswehr, so to speak.”

Working structures, roles, and responsibilities were clear in the military. This was often not the case on the civilian side and led to competence issues.

A participant explained:

“Of course, the Bundeswehr always has the advantage of the hierarchical structure in crisis mode. I think it’s undisputed, and it’s also undisputed in civilian rescue, that the more I get to a special situation or an emergency situation, the more the system benefits from having predefined structures, hierarchical structures. It simply doesn’t make sense to have long discussions in the time crunch, but it is good if someone has already made a plan beforehand and you simply carry it out. And that is certainly something that was somewhat difficult for the civilian side. You needed democratic mandates and several discussions, which you might not need with the Bundeswehr, because you already have the hierarchies right from the start. But on the other hand, there are hierarchies here at the [institution] redacted for privacy purposes) as well, so the civilian side is not completely blank in the hierarchy either.”

Another participant said:

“And ultimately, I think this command structure, this hierarchy, this linearity—we do this now, and that’s our job, and then it’s done without discussion. The volunteers are more open to discussions. Which, of course, made it more difficult, because then everyone wants to push through their ideas.”

A participant illustrated:

“There were these tight channels that existed. In the end, if you called or talked about 50 people coming, then it was clear that I would get the 50 people on Monday morning once the request for assistance had been approved. Which of course would be much more difficult on the civilian side, because these are voluntary people on whom you can fall back, and then, of course, there is definitely one or the other uncertainty factor involved: will everyone actually show up now? Of course, this access to personnel resources works better with the Bundeswehr or with such institutions. Here I can say, I have 50, you can have them or not.”

Another participant described:

“I could have imagined, if it had become even worse, that other structures would have had to be introduced, command structures and, in the end, that nothing more would be discussed, that action would simply be taken, so with us it went quite well, but I can imagine that sometimes there was

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even more discussion before action was taken and at some point it no longer works. If this had become an even worse crisis, I would have imagined that perhaps an organization that is militarily organized would have had advantages. So an even bigger disaster—then the civilian [structures] (added for clarity) might be difficult. Because then I think only actions [count] (added for clarity), whether they are a 100% right, I don't know, but you just can't discuss anymore, you have to follow through. And we narrowly missed it, relatively narrowly in some phases, I think."

One participant thought that military reservists would be exempted by their civilian employer more easily than civilian volunteers. In addition, reservists receive financial compensation for the lost salary which is not everywhere the case for civilian volunteers. In addition, reservists might be absent from work less often than civilian volunteers because they might be called to service less frequently than e.g., the fire department or the Red Cross. Fewer work absences would then lead to fewer professional career disadvantages for reservists.

Resources

The military was better in delivering a defined number of personnel to a defined place at a defined point in time. Civil recruitment at that time was perceived as either administratively complex or went through informal networking.

The military had a longer ability to persevere, because civil personnel volunteering in disaster management would, at a certain point in time, be called back to work, or their employer might lack understanding for the situation.

A participant said:

"As long as it's still burning, it's all good. Of course, the fire has to be put out, you can't leave in the middle of it. But when it comes to building something up, setting it up, after a certain time the employer lacks understanding."

The military is efficient in responding to sudden needs of personnel surge capacity.

A participant explained:

"And I think another advantage is, of course, the number of helpers that the Bundeswehr can provide, depending on the area of responsibility. The support that we got with the nursing staff, that was clear, that was of course limited. Because the Bundeswehr, I assume, doesn't have too many medical personnel. That's quite clear, but I think in terms of potential, let's say the 'ordinary helper', there, of course, I have a much larger amount of

personnel. And I think you can definitely supplement for a certain amount of time in terms of personnel. Maybe because that is a limitation on the civilian side again. Because within certain organizations, I would say, that there are experts in their field. And that is just a small group of people and they are then used up. And I can't put the citizen at the pump of the fire engine, he can't operate it, the Bundeswehr can't either, that's not possible, because it's too special. So to get people from the civilian side, from the pure citizenry, who reliably perform their tasks, come on time and do it over a longer period of time, is also difficult."

The military functioned well in disaster management areas requiring a significant workforce for standardized tasks. In addition, this workforce needed was made available relatively fast in this public health emergency and could be implemented quickly.

Mental outlook

The military leadership structure and working culture was perceived as reliable and useful for the overall mission. Soldiers complied with the rules.

A participant explained:

"The soldiers were really reliable, they were happy to do their job, they didn't criticize or they didn't want to do it anymore after two days. So, it was completely different and they were always there when they were supposed to be. They left when it was agreed that they should leave."

Comparison of civilian and military capabilities during the pandemic disaster management: Weaknesses of the civilian side

Communication

Crisis communication was mentioned as a weakness of the civilian side, especially on the political level.

The participant explained:

"This reconciliation of science, clinical expertise and political decision-making was bad for the political side, it was not well arranged. It was also not possible to understand why politicians chose some advisors, and it was not always possible to understand what drove them, and at some point, they did not understand that they simply could no longer talk to some people, which meant that the reasonable ones were actually disavowed. One has always made an effort for those who thought differently, but has made less effort for the majority. This is perhaps also a systemic problem in our country, and it has increasingly enhanced the value of these troublemakers and

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lateral thinkers. So I think that's also a political failure. I understand that you want to do it this way, but you only do it once. You see that at some point you don't get through and you actually weaken the majority positions. I know that this is very difficult, but I personally have the impression that sometimes I would have preferred a little more authority in a crisis rather than an overly permissive attitude. But that's a purely personal life lesson that may not be one, I found that to be a weakness of our state."

Health

Compliance with hygiene rules varied in different civilian organizations. The spectrum was broad, ranging from excellent ones to a few *"who did not perform so well"*, which might have been a leadership or resource issue in the sense of lacking personnel.

Governance and leadership

Civilian leadership structures were often redundant and not unambiguous, in addition, leadership cultures in the civilian sector were subject to heterogeneity that may result in alignment issues.

A participant illustrated this:

"Particularly with the police, for example, and this is also apparent in day-to-day operations where we meet together: we as the fire department practically lead from the front, the police from behind, i.e., the police operations manager sits in the command and situation center; our operations manager is at the front at the scene of the operation, so to speak. These are simply different leadership and organizational developments and other structures that do not make the whole thing any easier. And that, I have to say, is of course clear in the case of the Bundeswehr. And what makes it easier to lead and pass on decisions is that I always say that sometimes we first form a circle of chairs. In other organizations, such as in the German Armed Forces, the decision comes from one place and then it is passed down completely, so to speak. That makes it a little easier, I think, in such situations."

Resources

Personnel recruitment was an issue for the civilian side.

A participant explained:

"In my opinion, the civilian side was in a worse position when it came to recruiting personnel, and that sounds stupid now. But the Bundeswehr can release forces more quickly from its personnel pool—or at least that's the impression it gave. As an example, we were told that these are units that should have been preparing for foreign missions or that were in a phase where they were still in a resting phase, i.e., after a foreign mission,

or that could be recruited on an ad hoc basis. On the civilian side, there are no such areas, there are no rotation schemes or there are no redundancies anymore. We no longer have anyone. [...] All right, we have a massive shortage of personnel in the public sector. Even in times of peace, so to speak, not all positions are properly filled. If I then want to pull out personnel, then I have nothing left in times of crisis."

The civilian side might be outfitted less well with special technical equipment for certain disaster situations such as the Ahrtal flooding.

The supply of personal protective equipment was an issue on the civilian side. In addition, the political handling of supply with vaccine had room for improvement.

The skills, competences, training, and experience among civil helpers was more heterogeneous which made it more difficult to identify the right person for the right job.

A participant explained:

"So, the disadvantage of the civil society is—I have in these situations almost always a lack of specialized personnel, which I need. And I wonder whether they are good or not, which person can do what if they are allowed to, who has which training, and competencies, and so on. With the Bundeswehr, I know that the skills are there if they are allowed to do it. I don't need to look again specifically, can they do it, but I know that the standard is then also given."

Preparedness

The civilian side was less prepared in terms of availability of personnel reserves.

A participant explained:

"The civilian side was definitely in a worse position when it came to human resources. So there's nothing that you can access that can support in the event of a disaster, there's no disaster reserve or anything. In that respect, the Bundeswehr was definitely better positioned than the civilian side was."

In addition, the lack of preparedness in terms of material was an issue.

One participant explained:

"So, where the civilian side was poorly positioned, that's relatively easy for me to answer because I have deep insight into that. And the initial main problem was that we generally stockpile medical material on a line of sight basis, that we stockpile a lot of material in such a way that we can get by with it for 3–4 weeks, but no longer. There is no structure that safeguards Germany against not being able to import masks for half a year, or pro-

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tective gowns, or ventilation hoses, or anything like that. Germany was well positioned as far as equipment manufacturing is concerned, because there are some equipment manufacturers based in Germany. But they also need foreign countries to be able to deliver the devices. But at least a part of the production is in Germany and therefore also a part of the stock or the material, with which one can produce then somehow also, ad hoc, ventilators. But the fact that we are completely blank in the consumables area is, of course, a huge problem for the civilian sector."

The civilian side was less prepared to deal with a global situation, mainly due to the lack of quickly available personnel resources. In large area disaster situations, there would be competition for the small number of available civilian experts.

Mental outlook

The civilian side was less flexible when working longer hours became necessary because of unforeseen circumstances. That led to more discussions.

There was a higher sense of entitlement with regard to workplace location on the civilian side.

The availability of civilian auxiliary personnel was compromised by other obligations or motivational issues.

The participant said:

"What happens on the civilian side is that there is one person who still has to attend the first aid course, who still has to attend university lectures. Of course, the civilian side was not quite as well positioned with its auxiliary staff, let's say, which was supposed to provide support, because they were then much more volatile, and were then sick, and dropped out, and lacked the motivation—and quit after two days."

Operational necessities led to more discussions on the civilian side which resulted in friction.

A participant explained:

"OK, I have to do something now and I want to have it now. Civilians are often not so good at this, and you could see that there. So when I told someone—there were also many artists who worked with us—when I told them it needed to be done now, they said, 'why?'. That cost time and wasted energy. And if I told the Bundeswehr, it has got to be now, then he didn't ask 'why?' but said 'done' after 5 minutes. That is certainly a big problem from the civilian side, so, that was bad with the civilian side."

Comparison of civilian and military capabilities during the pandemic disaster management: *Weaknesses of the military*

Communication

Finding a common language between the civilian and military side was in some instances somewhat difficult, depending on the training and experiences of the people involved.

Governance and leadership

Soldiers were not able to take over sovereign tasks because they were not trained to and also not authorized to.

The military procurement structures were probably not prepared to handle a sharp increase in supply requirements.

A participant explained:

“The procurement logistics were probably not adequately set up, perhaps simply not prepared for it. And this was, I think, obviously really an over-taxing of a structure that was not designed to act at all, in the speed and the scope of what was required. I think that the procurement logistics were simply not sufficient, the procurement office of the Bundeswehr in the first wave.”

Resources

The military needs more medical personnel in order to provide more domestic support.

Another participant seconded:

“That you have people there who perhaps have nursing training or even medical training. That might be desirable.”

Mobilizing military resources for subsidiary support takes longer than mobilizing civilian volunteer personnel which can be available within an hour. This is a disadvantage for acute situations.

Military subsidiary resources were limited because of the global nature of the pandemic.

Preparedness

The lack of pandemic preparedness in terms of material supply also became clear on the military side.

A participant explained:

“Because it was to some extent to be expected that there would not be tons of ventilators standing around in barracks, being maintained and kept in stock so that they could be used when ours were not working, so perhaps

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both structures actually have a huge problem with that. But the overriding thing is that we don't have any supplies or production in our own country."

Mental outlook

The military mindset proved weaknesses in certain tasks that needed more nuanced thinking.

A participant illustrated:

"In the fight against the pandemic—partly in the training for it—in the sense of there is a lack of technical background and that was also partly difficult to teach. Not because people didn't understand it, but because the way of thinking is different in some cases, which is difficult to capture. When we investigate, we start with different principles. In the Bundeswehr, when I ask a question, I expect the other person to answer clearly. That is not the case in an investigation with the civilian population, and then to teach them to pay attention to the nuances, so to speak, or to ask questions or not to take certain information for granted, but to question it. This plausibility check, I would say, is something that the Bundeswehr is not prepared for, because there are many soldiers who assume that if he says so, then it's true, which is okay, because only in this way can you work well together, but that is, well, in the investigation, it is not cooperation with the civilian population, I would put it that way. There was simply a lack of this technical know-how, how do I conduct an investigation? But the problem is, of course, to train them. Again, the question is, what do I need it for most of the time? So, I think, since the founding of the Bundeswehr, it would have needed it only once, that is, now, and then there is also the question of maintaining the capabilities. Also, the question arises, do I need it again? Or shouldn't I perhaps strengthen the civilian side so that it can do it without the Bundeswehr, because at the end of the day it has to be said that the civilian side has to be able to solve this on its own. The fact that the Bundeswehr came into this happened out of necessity. And that's, I'll put it this way, to help with a dike breach or a flood disaster or something like that, that's much closer to the core tasks of the Bundeswehr, logistics, loading, et cetera, than to conduct an investigation. I don't think it makes sense to free up resources permanently and say that they now have to learn this, too. Otherwise, you would have to say the other way around, civilians would now have to learn how to handle a weapon or something similar, so that's simply, that's a division of labor. So, we cannot be capable of doing everything anymore. Therefore, it was good that they were there, but as I said, you noticed a weakness clearly. But that is pre-programmed."

The military side was less creative or less proactive with suggestions to reorganize structures or workflows.

Impact of the subsidiary CIMIC mission on the local community resilience

The impact of the civil-military subsidiary support during the COVID-19 pandemic on local community resilience in Heidelberg/Rhine-Neckar is addressed in this chapter. Table 16 summarizes the findings. Community resilience elements that were strengthened were juxtaposed to those that did not improve. Then follows a more detailed description and significant statements of participants corroborating and illustrating the findings.

Table 16. Impact of the CIMIC mission in Heidelberg/Rhine-Neckar on the local community resilience

Resilience element	Impact of the CIMIC-mission	
	Increased local resilience	Did not increase local resilience
Local knowledge	n.a.	n.a.
Community networks and relationships	<ul style="list-style-type: none"> • Military as a reliable and available partner • Contributions of the military were of value • Military hierarchy was approachable 	n.a.
Communication	n.a.	n.a.
Health	<ul style="list-style-type: none"> • A small amount of support provided to the hospital sector • Support in the nursing homes and for the vaccination campaign saved lives 	<ul style="list-style-type: none"> • Limited availability of medical personnel
Governance and leadership	<ul style="list-style-type: none"> • Personal learning experience from military structures for civilian employees • Enhanced understanding how civilian and military structures work 	n.a.
Resources	<ul style="list-style-type: none"> • Handling the SARS-CoV-2-outbreak situation in the refugee center would have been more difficult • Important civilian services could be maintained • Public health strengthened with resources • Positive impact on the elderly care, although the overall burden was carried by the civilian nursing staff and the time of military support was short • The civilian side would not have been able to complete all tasks on their own • The subsidiary support system of the military became more widely known to the public, might have strengthened the disaster response to the Ahrtal flooding in the year 2021 	n.a.
Economic investment	n.a.	<ul style="list-style-type: none"> • Subsidiary support relieved the civilian sector but impeded further efforts to



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Table 16. (continued)

Resilience element	Impact of the CIMIC-mission	
	Increased local resilience	Did not increase local resilience
Economic investment (continued)		increase personnel headcount in the public sector <ul style="list-style-type: none"> • Surges were buffered with the military. The civilian side should become more self-sufficient in order to avoid dependencies upon subsidiary military support
Preparedness	<ul style="list-style-type: none"> • Possibility of an early outreach to military partners 	n.a.
Mental outlook	<ul style="list-style-type: none"> • Strengthening public institutions resulted in maintaining trust • Sense of reassurance among citizens increased • Pride about mutual achievements in the pandemic disaster management 	<ul style="list-style-type: none"> • Some soldiers deployed for administrative support felt that their skills were not used appropriately

n.a. = not addressed

Elements of community resilience that *increased* as a result of the subsidiary civil-military mission in Heidelberg/Rhine-Neckar

Community networks and relationships

Contacts with the military as a reliable and available partner were seen as positive.

The contributions of the military proved to be of value.

A participant explained:

“And that is then, so to speak, with a view to the future, also something that pays into resilience for me, because I know that, okay, I have tried this out before and it has proved to be good and it has proven itself and that is why I am also prepared, so to speak, to access this actor again. Yes, it’s definitely proven to work, and it’s definitely made a great contribution in my opinion.”

Another participant recounted:

“On the one hand, because we have now grown together better, I’ll just say that, because we now know all the players better [...]. The population has seen that there—and this was also in the media every day—that the Bundeswehr was present, especially in the vaccination center and so on. So, according to the motto, they also help with—I’ll just say—humanitarian

things or civilian problems, let's put it that way [...]. I think that this has already brought about a change, I don't want to say a rethinking, but a different assessment of the population for the Bundeswehr, I think so. And I think that this has strengthened the overall situation here in [place] (redacted for confidentiality reasons), and that the Bundeswehr has gained a different perspective and a different status. I see it that way."

Another participant said:

"To know that when it comes to a crisis: it works, that I can request support, that I also get support. That there's a better understanding of what's going on. On both sides, I think, too."

A participant explained:

"And I think it also triggered a lot of rethinking in the long term, that there is another actor that was not considered by many sides before. The BBK [Federal Office of Civil Protection and Disaster Assistance] (explanation added for clarity) certainly knew that it was possible. But the fact that the local head of the disaster management team then said, I can submit an application for assistance, I'm pretty sure no one would have done that before corona."

One participant was surprised by the approachability of the military hierarchy

"What else comes to mind, or what surprised me very much: for example, Mr. [name] is a lieutenant colonel, but that you can talk to him like that or that he distributes the coffee to us, I would never have dreamed that he just does normal work and that you can just meet him at eye level like that. This hierarchical level was actually gone at that moment. That surprised me in a very positive way."

The military's position as a player in the community has been strengthened:

"It suited them well [the Bundeswehr] (added for clarity) to accept such a civilian assignment too."

Health

A small amount of support was available for the hospitals.

Especially the support in the nursing homes and for the vaccination campaign saved lives which enhanced resilience.

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Governance and leadership

Some civilian employees had personal learning experiences from military structures.

Enhanced understanding of how civilian and military structures work contributed to an enhanced overall resilience in the community.

Resources

Handling the situation in the refugee center during a SARS-CoV-2 outbreak would have been more difficult without the military.

Other important civilian services could be maintained because of the subsidiary support by the armed forces.

A participant explained:

“Yes, definitely, the Bundeswehr supported us in situations where we reached our limits, where I don’t know whether we would have managed so well without the support of the Bundeswehr. Or whether a lot would have fallen by the wayside that we would have had to rework at some point. And I think that in any case this alone has strengthened our resilience.”

Military support strengthened the public health sector by providing resources, e.g., for SARS-CoV-2 contact tracing.

The support (e.g., SARS-CoV-2 testing in nursing homes) also had a positive impact for the elderly care, although the overall burden was carried by the civilian nursing staff and the time of military support was short.

A participant said:

“Secondly, there were already these sometimes very difficult situations in nursing home care, where there were no alternatives at all. The homes could hardly help each other. They helped each other a little bit. But they all had no staff, and people had to come in from outside. The job market was empty. Some were also unwilling to work there, clearly because of the close contact, etc., so these were two areas where one had the feeling that the workforce of the Bundeswehr strengthened resilience.”

The civilian side would not have been able to complete all tasks on their own. This resulted in short-term strengthening of resilience. On the long-term, resilience was strengthened because the subsidiary system of the military became only widely known to the public after positive experiences with military support missions during the COVID-19 pandemic. A participant hypothesized that this led to a broader request for military support during the subsequent Ahrtal flooding in the year 2021.

Preparedness

The possibility of an early outreach to the military strengthens resilience for the future.

A participant said:

“When a crisis is imminent, it is important to enter into a mutual exchange at an early stage, so that the other side knows why the need might arise now and what we can actually do or contribute, and what is currently being done.”

Mental outlook

The subsidiary support of the armed forces strengthened public institutions which was important to maintain trust in the eyes of the public.

A participant explained:

“I think this has definitely strengthened resilience simply by ensuring that citizens can get in touch with questions and competent information, which has also strengthened trust in the local authorities, and I think that is very important for a region’s ability to withstand crises, so that citizens have the impression that the authorities still have things under control and don’t perceive that the authorities have already pulled up stakes and can’t keep up with the situation anyway. And that’s where the support of the Bundeswehr was very important.”

The presence of the military strengthened the sense of reassurance within the population in the perception of one participant.

A participant said:

“I think that has ensured that the population sees that the Bundeswehr’s deployment is working out well, and that people are coming. They do wear uniforms, but the fire department also wears uniforms during an operation. And they don’t do anything bad to me, on the contrary, they help me, and I think that has simply created a lot of understanding among the population. And it also gave them a certain feeling of reassurance. People are working together to deal with the crisis.”

Another participant explained:

“Has strengthened, yes. It has done us good; it has done the staff good, and it has also done the residents good. As I said, it has also changed the image of the Bundeswehr very much for the better, what you get from the people who are around you every day. They all confirmed that. It’s probably a question of how we can make it even more effective, the cooperation, in case such a situation comes up again.”

Results

One participant expressed a sense of pride about mutual civil-military achievements in the pandemic disaster management:

"I have indeed realized what we have accomplished, on both sides"

Elements of community resilience that *did not increase* as a result of the subsidiary civil-military mission in Heidelberg/Rhine-Neckar

Health

The availability of medical personnel was limited.

Governance and leadership

One participant mentioned an especially important general governance issue ("barriers by complexity of rules in 'peace time'") that renders disaster preparation difficult:

"What always strikes me—I am now also in the task force energy and operational safety. There is a routine mode in which all the rules have to be observed. In Germany, there is an extremely large number of them. And then there is the mode of catastrophe, war, something bad, where what is necessary is done. The break between the two is this switching, that is what is sometimes somehow difficult. What I just notice now is that when I improve something, when I want to improve resilience in routine operations, sometimes it means that I have to kind of buy something, establish something. Then there is no money for this purchase and implementation, or there are regulations that actually prohibit it, because the safety standard in routine operations is high. The safety standard in the event of a disaster is actually 'as long as it doesn't explode, it can be done'. It is low and it is not possible to say in routine operation that we will now build something in advance so that we can use it better in disaster control operations and do not have to fall to this whole low level. In concrete terms: give me my tank farm, which contains millions of liters of gasoline or some other diesel fuel, which I can't fill up in our tankers during routine operations, because the tank facility is protected as a going concern. For that, if it's changed, it has to be re-approved, this costs several millions. When I'm in disaster mode, the only thing that matters is if you get it out of there without the thing burning down, everything's okay. Now it doesn't work to go here and say: let's change the things we need already now—to take it out a bit safer afterwards: bigger pumps, different hose systems, what do I know, make a right of way different so that I can drive my big truck there. None of this is possible because I have to comply with all the regulations in the current column, and if I change the tank system now, it will cost 10 million euros to

change all the specifications. That means you have to wait until someone presses the button and says, it doesn't matter now, we'll drive over the field and somehow fill it up. And I think it's kind of stupid that it's not possible to improve resilience now, so to speak, because the rules are too high."

Economic investment

Whereas subsidiary support by the military relieved the civilian sector, it impeded at the same time further efforts to increase in personnel head-count in the public sector. Instead, surges were buffered with the military. The civilian side should become more self-sufficient in order to avoid dependencies upon subsidiary military support.

A participant illustrated:

"No, I would say, because that is precisely the point I was making earlier. That we actually have to make sure that perhaps the civilian sector can do it itself. But if I rely on the Bundeswehr and say: yes, yes, they'll certainly come, then I'm not strengthening resilience, but rather I'm ensuring that, in principle, we continue to provide support in this way—as we did in the developing world in the past, i.e., someone put out the food parcels and didn't show them how they could help themselves. And it is this what I think: in the area of organization and leadership, the Bundeswehr has provided development aid. In the area of building up strength and personnel, I think the opposite has happened. Because the peak phases, where you could have built up even more civilian personnel, so to speak, were mitigated by the Bundeswehr."

Mental outlook

Some soldiers, deployed for administrative support, felt that their skills were not used appropriately.

Possible mutual learning between the military and the civilian side

The intense and close cooperation of military forces and the civilian institutions during the COVID-19 pandemic provided mutual insights into the structures and cultures of both sectors. Table 17 juxtaposes opportunities for mutual learning identified by the study participants, i.e., areas where the civilian side can learn from the military and vice versa, again categorized by core elements of community resilience [71].

Results

Table 17. Opportunities for mutual learning identified after close civil-military co-operation during the COVID-19 pandemic, stratified by community resilience elements

Resilience element	Possible mutual learning	
	For civilian from military side	For military from civilian side
Local knowledge	n.a.	n.a.
Community networks and relationships	n.a.	n.a.
Communication	<ul style="list-style-type: none"> • Clear specifications 	<ul style="list-style-type: none"> • <i>"Vibrancy of the collegiate communicative togetherness which is a superior communication structure outside of an ultimate crisis"</i>
Health	n.a.	<ul style="list-style-type: none"> • Soldiers learned nuances in diagnostic procedures SARS-CoV-2 testing
Governance and leadership	<ul style="list-style-type: none"> • Structured iterative working style • Goal orientation • Clear leadership structures for situations that necessitate common, aligned action • Individuals with clear accountability, organization and briefings • Unified appearance in public • Being present as an institution in case of a crisis 	<ul style="list-style-type: none"> • Focus on content instead of hierarchies and formalities • Possibility to re-utilize newly acquired competences from soldiers' deployments into civilian sector • Leave individuals more room for improvement suggestions • Opportunity of strategic and tactical learning from aid organizations • Boost motivation by leaving individuals more room for personal development accepting their ideas, strengths, and weaknesses • More flexibility and concessions • Learning from novel leadership developments in the civilian sector
Resources	n.a.	n.a.
Economic investment	n.a.	n.a.
Preparedness	<ul style="list-style-type: none"> • Having crisis reserves available, e.g., personnel representing diverse specialties from different functional areas that can be locally deployed and act as a group 	n.a.
Mental outlook	<ul style="list-style-type: none"> • Commitment to the mission • Respect • Solution oriented thinking • Cohesion • Flexibility and additional performance for the mission • Standing together in situations that require overcoming a problem • Focus on action • Being a calm, altruistic player as opposed to necessity of wider visibility or concentration on personal agendas • Notion of service to the people • Avoidance of unnecessary discussion • Acceptance of a role and performance within 	<ul style="list-style-type: none"> • More open mindedness and integration of diverse perspectives • Mutual respect • Polite collegiate attitude • Human courtesy and apology for transgressions in order to maintain overall functionality • Individual thinking • Openness for suggestions from the team

n.a. = not addressed

Module 3: From lessons learned towards better future disaster preparedness—How well are we prepared for future catastrophes after lessons learned from the corona pandemic and what must be done to close this gap? Semi-structured interview with key stakeholders of the local disaster relief community

The following section qualitatively analyzes the aggregated results of interviews with key stakeholders (N = 12) from the Heidelberg/Rhine-Neckar disaster management community with the objective to lay out (1) strengths, (2) weaknesses, and (3) necessary actions for better preparedness for future catastrophes. The findings for all three analysis categories are summarized in Table 18. Then a more detailed description of each category follows, illustrated by significant statements of participants. Results were systematically structured along the nine core elements of community resilience by Patel et al. [71]. This is followed by participants' one-sentence summaries of the corona crisis.

Table 18. Key points for strengths, weaknesses, and necessary actions for better preparedness for future catastrophes identified in the interviews mapped to core community resilience elements [71]

Resilience element	Analysis category		
	Strengths	Weaknesses	Necessary actions for better preparedness
Local knowledge	<ul style="list-style-type: none"> Well-known local structures manageable population size 	n.a.	<ul style="list-style-type: none"> Develop sustainable concepts out of an aligned network on all levels that all identify with
Community networks and relationships	<ul style="list-style-type: none"> Established intra- and inter-institutional networks Educated and motivated population of an affluent region 	<ul style="list-style-type: none"> Challenging geography Loss of networks System amnesia and institutional memory loss 	<ul style="list-style-type: none"> Continue building and maintaining disaster management network, including on a global level Stay in touch with important players also in times without crisis in order to be ready when the crisis occurs Be open, look beyond the borders of your own organization
Communication	<ul style="list-style-type: none"> Ability for dialogue between players 	<ul style="list-style-type: none"> Communication issues 	<ul style="list-style-type: none"> Establish and exercise functional communication channels using a variety of media Be aware that communication between different actors is particularly important in to get an overview and to ascertain alignment Align messages directed to the population to create and maintain transparency and trust
Health	<ul style="list-style-type: none"> Robust healthcare system Proven joint ability for coordination and patient allocation 	<ul style="list-style-type: none"> Fragmented hospital landscape Healthcare complexity 	<ul style="list-style-type: none"> Coordinate complex patient pathways early during routine times to create required capacities earlier in time of crisis
Governance and leadership	<ul style="list-style-type: none"> Strong political leadership recognizing the importance of disaster management Good cooperation with political and administrative players Well trained leadership in organizations Visibility of go-to-persons 	<ul style="list-style-type: none"> Non-redundant personnel with specialist knowledge Misaligned structures Leadership issues Rigid structures Fluid guidelines and concepts Inappropriate definition of goals 	<ul style="list-style-type: none"> Consider establishment of flexibly deployable disaster response modules within the administration More directive leadership style on the appropriate level avoids complicated discussions Timely switching into disaster response mode increases momentum of response Have the right person in the right leadership position Reduce bureaucracy, be decisive in a crisis, show courage Eliminate contradictory and redundant leadership structures because they can lead to paralysis



Table 18. (continued)

Resilience element	Analysis category		
	Strengths	Weaknesses	Necessary actions for better preparedness
Governance and leadership (continued)			<ul style="list-style-type: none"> Establish clear mandates and aligned understanding of roles and responsibilities, this requires inter-institutional agreements in advance Think beyond silo structures, ask for outside feedback in order to avoid the bias of “group-think”
Resources	<ul style="list-style-type: none"> Strong disaster relief organizations Community and district support acquisition of material for disaster preparation (e.g., generators, food, gas) 	<ul style="list-style-type: none"> Material procurement issues Lack of personnel 	<ul style="list-style-type: none"> Retain your personnel because the labor market is empty Accept that there should be free resources in routine times, otherwise you cannot react appropriately to an emergency situation Redundancy of critical items allows switching into disaster relief mode earlier Align availability of material with anticipated disaster scenarios Hire more personnel for disaster management in “peace time” in order to be better prepared once the crisis occurs Be prepared and develop processes to better include volunteer personnel Cooperate better with headhunters and local labor bureau to improve personnel supply
Economic investment	n.a.	<ul style="list-style-type: none"> Funding issues Catch up necessary to close the “complacency gap” 	<ul style="list-style-type: none"> Fund novel ideas and create incentives to improve disaster management Be able to spend fast and flexible in a crisis without long and complicated administrative processes Recognize that implementation of improvement will take time, even if required funding were available instantaneously
Preparedness	<ul style="list-style-type: none"> Good operational level after the pandemic Strong regional infrastructure Improving disaster awareness Well prepared for specific scenarios 	<ul style="list-style-type: none"> Preparation gaps Insufficient training 	<ul style="list-style-type: none"> Improve disaster education (e.g., in schools) Revise and extent your disaster plans for further scenarios Develop a priority list of threat mitigation for highly likely events, recognizing that not everything can be covered Include practitioners and mission experienced helpers for more realistic planning Conduct broader and more frequent all-hands disaster training exercises in order to improve readiness
Mental outlook	<ul style="list-style-type: none"> Cooperative and open mindset with can-do-attitudes Trust across organizations 	<ul style="list-style-type: none"> Insufficient disaster awareness Too narrow view and too narrow perspectives 	<ul style="list-style-type: none"> Be aware that disasters occur, and that vulnerability is real Have an anticipatory mindset Function as a learning organization Leave your confort zone Consider needs and capabilities of the affected population Promote self-sufficiency within the population

n.a. = not addressed

Results

Strengths

Local knowledge

The manageable population size of the region was considered a strength, because it is not too large which would result in anonymity. As a result, players in disaster management knew each other, and the structures, including logistics, roads, or railway connections very well. Early reach-out towards local disaster management partners increased mutual understanding about individual needs, this was considered a good and important basis. Due to their individual strengths, reliability, and willingness to cooperate and to network, diverse and specialized local organizations were considered strong altogether.

One participant stated:

“You knew whom to ask—this has moved us ahead”

Community networks and relationships

Established intra- and inter-institutional networks were considered a strength for regional disaster preparedness. Disaster management players had known each other before and got to know each other even better during the pandemic, which included knowledge about strengths and limitations of respective institutions. They worked together within and across organizations and local geographies. Especially on the working level, good relationships were reported. Informal pathways for alignment and decision making were used which was considered helpful. Successful networking included knowing each other and led to excellent cooperation across organizations. As an example, vaccination teams included personnel from diverse organization such as the German Life Savings Association (DLRG), the Federal Technical Relief Agency (THW), the Red Cross, the military, and others. This cooperation was unprecedented to this extent and moved the whole disaster relief community ahead. Progress was also made in terms of awareness of networking benefits: this became not only evident across organizations, but also inside the organization of one interviewee. Besides the Federal Technical Relief Agency, the military, and disaster relief units, new actors came into play.

Another asset of the relatively affluent region was the fact that the population was in general highly educated, relatively young due to the strong presence of educational institutions such as universities, and was, in general, motivated for voluntary service.

One participant stated:

“It is often related to individuals who network with each other, who know each other well, who can work well together”

Another one emphasized the importance of networking:

“These are the strengths; but of course, they are also eroding, it has to be said clearly, if you don’t maintain it, at some point you no longer know each other anymore”

Communication

During the COVID-19 pandemic there was a cultural shift towards improved communication characterized by higher transparency within and across organizations. A particular strength of disaster management players included the ability for dialogues.

Two participants said:

“And we are perhaps fortunate that we also have many people who have a certain human maturity and who communicate with a certain composure and do not act so excitedly, but have a sense of composure, human experience—a certain maturity and a certain ability to communicate.”

and

“Even if we sometimes had different positions because we had a different interest than, for example, [another institution] (redacted for privacy reasons), it never got to the point where communication reached a level that caused irreparable damage. Instead, at all times it was possible to continue the cooperation with sufficient appreciation.”

Health

The robust healthcare local system which included the city and its surroundings, its strong infrastructure with two maximum care providing university hospitals in the immediate vicinity (i.e., Heidelberg and Mannheim), a network of smaller hospitals and private practices was considered a particular strength (one participant stated: *“a lot of medical care per person”*). This included a regionally integrated emergency dispatch center which avoids fragmentation in the response to emergency calls.

De novo established patient care coordination and patient allocation during COVID-19 proved to be successful and was considered an actual regional strength. This system—operated by the COVID ICU coordination unit—included aligned data acquisition, communication, bed and patient distribution within the regional interclinical alliance network. Only a few COVID-19 patients had to be allocated outside of the regional area of responsibility; Heidelberg/Rhine-Neckar was indeed a netto acceptor of COVID-19 patients during the pandemic.

Results

One participant commented on the strength of the regional healthcare system by saying:

“Overall, our position is not too bad”

Governance and leadership

One strength was that political leadership was exhibiting disaster awareness. The public health service and disaster managers were considered strong institutions and functions, because they had provided leadership and expertise during the pandemic. Other participants reported a good cooperation with political and administrative players which included mayors and, again, disaster managers. A participant experienced that help was offered quickly during the pandemic within and outside of their own organization which was accompanied by strong leadership support. Another strength was the availability of trained leadership with knowledge, in addition to supply with material, and aligned communication within the organization. Another participant reported strong governance structures in the sense that their institution was integrated in their own organization's wider network, and the community network. The participant found it helpful that their mayor cared, that potential needs of their organization were being considered by the community, recognizing their own awareness of necessary initial self-sufficiency until help from outside might be available. Another participant found it helpful that their organizations were sending delegates with a strong mandate to meetings in order to reach agreements without delay. Go-to-persons became visible across organizations which moved the disaster response community ahead.

One participant said:

“We have a certain strength in that we have seven [facilities within our own organization] (redacted for privacy reasons) and that we support and help each other and advise each other, one does this and the other does that, that is such a strength.”

Resources

Strong resources of the region included disaster relief organizations, such as fire fighters, the Federal Technical Relief Agency (THW), ambulance services, the German Live Saving Association (DLRG), the Red Cross, and the military, that were knowing each other and, as one participant put it, *“like each other better and better, more and more”*. These resources included rapidly deployable units such as the Red Cross medical task force. Overall, the Heidelberg/Rhine-Necker region as seen as a strong, populous region with significant workforce, such as firefighters, disaster managers, and other important players including specialized disaster response units (e.g., chemical industry providing resources to deal with chemical or environ-

mental accidents). Increased economic investment was being positively noted: the community and district supported the acquisition of material for actual disaster preparation in case of a lack of electricity or gas during the winter 2022/2023, specifically, the procurement of power generators, gas for storage, and food.

One participant stated optimistically:

"If that day X were to come, which I hope it won't, we will certainly think or say: oh, dear me, we are not prepared at all. Once that happens, you realize what you have and what you've been missing out on, but when that day X happens, I think we have a lot of things."

Another one said:

"A lot has already happened within a short time frame. It is clear that one cannot change everything from today until tomorrow, but overall, we are on a good way."

Preparedness

A good operational level after three pandemic years pandemic was identified as a strength, at least for another pandemic situation or a similar incident. The remarkably close cooperation during that time was interpreted as a significant training effect that enhanced disaster resilience. Traditionally, disaster management in the region was well prepared for specific scenarios including mass casualty events, and key players had accepted this role and responsibility. The region's preparedness for shortage situations including energy loss, migration, and, in particular future pandemics similar to SARS-CoV-2 was considered as strong within the strong regional infrastructure.

An increasing shift of thinking in the population towards greater awareness for disasters and disaster preparation was regarded as another strength. This was paralleled by a perceived shift of thinking among politicians emphasizing better preparedness for disaster resilience. A greater political willingness to improve recognized deficits now was seen as a strong asset, although there were still financial constraints in some respects. Trying to manage the unknown with a focus on likely scenarios for disaster preparation was considered important.

Two participants commented:

"The field of infectious situations is pretty well covered now."

and

"I think we are well prepared for disasters. For those that we know."

Results

Mental outlook

The value of a resilient mental culture was emphasized as a strong asset in the regional disaster management community. This culture was illustrated as a can-do-attitude, but also the striving for realistic goal settings in order to maintain credibility. During the pandemic interaction, psychological safety increased—there was less fear of contact reported—which resulted in better cooperation beyond the challenges imposed by SARS-CoV-2. As an example, the Federal Technical Relief Agency and the fire department developed a much closer cooperation for firefighting missions. Strong teams within organizations who help out each other were another mental strength mentioned.

Likewise, trust between disaster management players, more harmonious interaction and more information exchange was positively mentioned. The perceived culture of mutual appreciation between players during the pandemic was seen as a good basis for future cooperation.

Two participants said:

“We are on a relatively good way, of course, we can always improve.”

and

“We are in a better and better position—if you look at the development.”

Weaknesses

Community networks and relationships

The geographical size of the region Heidelberg/Rhine-Neckar was mentioned as a weakness. The Rhine-Neckar district ranges among the largest districts in Germany which requires long transportation pathways for patients and makes logistics complex.

One participant said:

“Well, it’s already a huge county. The logistics of the area are complex. The transport routes are long. If you look into the accounts with the transport routes, then you are in checkmate.”

Progressive loss of networks, system amnesia and institutional memory loss were reported as further weaknesses. As such, common experiences of the pandemic might be forgotten, after “panic and forget” the system would try to get back to the “old normal”. Ongoing networking capability could be vulnerable because it would be contingent upon the availability of few non-redundant individuals and personal interest.

Two participants stated:

“Where we are not as well positioned as we could be is, now that the transition to endemics is here, that one would actually prefer to forget how great the burden was and what the neuralgic points were: digitization, staffing and so on. And in fact, at least that is the perception here for us, that it is not said how can we expand what we had as a team now, so that we perhaps have a certain reserve for the future. Instead, we are looking for how we can save the costs that have arisen and how we can ensure that we can complete as many routine tasks as possible with as few people as possible, so that we no longer have any capacities for possible additional tasks. That’s where I would have simply learned: something so big can just come along very quickly.”

and

“No matter how good the basis is, there is always a piece of truth, a danger or a risk: what actually happens when two, three, four, five, six people are simply no longer there, or when simply, when individuals drop out, this networking is simply no longer there, because successors may not be so involved.”

Communication

It was mentioned as a weakness that there were still gaps in communication structures across organizations.

One participant explained:

“But [the] Ahrtal [flood catastrophe] (explanation added) has also shown that this is one of the things you have to work on: what are the communication structures among each other—not in the own organization—but among each other, so that communication does work, because only then speed is guaranteed.”

Health

A fragmented hospital landscape in the region was mentioned as a weakness. The hospital structures were not ideal, in the sense that there were too many small hospitals in too many places, in part remote, which may result in difficulties of logistical alignment in case of a disaster situation. Another weakness was the difficulty to quickly switch into crisis management mode due to competing resources in complex healthcare structures: when a hospital has a high proportion of oncology patients, they would compete for ICU beds with the surge of patients related to the disaster situation (e.g., COVID-19)

One participant explained:

Results

“That leaves 100 usable intensive care beds. And of these 100 usable beds, however, all the severe strokes, the polytrauma and the type A dissection, the surgery that is not performed at any other hospital, they will also be there. And if I then calculate further, you can see that with 50 COVID patients, I am in the displacement position, I am in a triage situation, because I then displace the first type A dissection, which we can no longer admit, because we no longer have a bed for this patient.”

Another weakness was that smaller hospitals were not prepared in routine times to take over complex ICU patients early in their therapeutic management. If this were possible, it would have the potential to generate larger ICU capacities in due time. As an example, if patients usually required 14 days of ICU time, but could be transferred to a smaller hospital much earlier, i.e., after 2 days—which would of course be more complex and more difficult to handle for smaller hospitals—one would save 12 ICU days per patient in the maximum care providing hospital. The smaller hospitals did not acquire this complex patient management knowledge fast in a disaster situation. It was, however, recognized that smaller hospitals might have different missions and priorities.

Governance and leadership

One weakness was the observation that disaster management was often contingent upon a spectrum of activities of single individuals or non-redundant personnel with specialist knowledge.

Disarrayed structures with either misaligned or overlapping roles and responsibilities were mentioned as further weaknesses. There were leadership issues such as rivalries in certain areas, e.g., people, departments, or organizations working against each other, which was often perceived as more an issue on the leadership level with good cooperation on the operational level despite of the issues. Rigid structures, e.g., administrative structures which were not organized in functional modules and did therefore not allow flexible interventions, were mentioned as a weakness. Another reported weakness was the run-up period required to respond to a disaster situation.

A participant said:

“The weaknesses I undeniably see are due to a certain ‘competence rivalry’.”

Fluid guidelines and concepts were regarded as weaknesses, resulting from the experience that these were complex, intrinsically inconsistent, and frequently changing during the pandemic. As an example, the complex guidelines for facial masks were in part contradictory or perceived to be elaborated in isolation without consideration of the wider contexts of daily living activities. Guidelines appeared in part arbitrary and therefore,

as one participant explained, *“it would be difficult to expect that people will follow them enthusiastically”*.

Inappropriate definition of goals was seen as a weakness. Blind actionism tended to occur. If strategic goals were not aligned with feasibility on the planning and operational level, their implementation would be difficult.

One participant explained:

“Sometimes I have the feeling that there is a bit of blind actionism, that our conscience has been somewhat soothed, that we have done something. But whether it can actually be implemented, whether it is sustainable—with all these things, there is sometimes a bit of doubt behind it. These are things where I would like to see us better positioned, even more closely networked and more sustainable concepts developed at all levels, which can then ultimately be supported by everyone and also implemented. That’s what I would like to see.”

Resources

Material procurement issues were reported as a weakness, especially when the purchase of highly demanded material become difficult when not ordered in advance, such as power generators for preparation for an electricity blackout in the winter 2022/2033. At the time of the interview, shortage was perceived as a supply problem, not as a financial issue. While they considered it crucial to build alliances, stay engaged and follow-up on procurement, participants admitted that for their institution, at some point, help from outside would become necessary,

Two participants explained:

“The procurement of material—it’s difficult to get hold of it at the moment and to order it at all. That’s not so much due to payment as to supply.”

and

“For the other things like electricity or gas—yes, we have heating—we would need help from outside, we can’t handle that.”

Lack of personal was a weakness, because careful disaster management and public health protection requires sufficient workforce to fulfill the mission appropriately. As one participant put it, *“if a small [office] (redacted for privacy reasons) has 10 employees, this is not a huge resource to do proper disaster preparation.”*

It was noted that there was no personnel available on the labor market in certain activity sectors. This led to recruitment issues and would result in substantial difficulties in case of sudden staff shortages.

Results

One participant stated:

“And another weakness, as we have already mentioned a few times, is personnel. What happens when staff is absent? The market for [profession] (redacted for privacy reasons) staff is empty.”

and another one said:

“[The organization] (redacted for privacy reasons) must strengthen its personnel in the area of disaster management, even now, when there is no disaster yet, so that we can then act better and faster.”

Economic investment

Funding issues were considered a weakness, one participant reported lengthy discussions for obvious solutions requiring relatively little financial input. The participant perceived this situational friction as a wrong signal in contradiction to the assumption that protection of the population was becoming a priority now. Due to the “complacency gap” with little investment in disaster preparation in Germany, a catch-up spending would be become necessary in general.

Preparedness

Preparation gaps were cited as weaknesses, with a lot of potential for improvement. The local disaster response community was considered not being well prepared for some specific disaster scenarios (e.g., electricity blackout) and not being well prepared for disasters that had not occurred yet. It was criticized that disaster plans were not comprehensive and not tested in exercises. Structures were not yet sufficient to manage all situations that the community may face, e.g., electricity blackout or drinking water shortage. One interviewee rated the local overall preparedness level at 3–4 out of 6 (1 being the best and 6 being the worst rating possible) because of neglect in proceeding years.

In addition, insufficient training was considered as a weakness. As such, well trained forces may have to work together with forces who do not often or not at all conduct exercises. This may cause friction, which was a lesson learned in a previous combined disaster exercise in a technically complex emergency situation other than COVID-19 (a radiation emergency response exercise).

A participant stated:

“Of course, we are still very specialized in the system, so two and a half years of corona means that we can still do a third year of corona without any problems, and a fourth and a fifth year without any problems, in the

sense that the structures will still stand. What I'm just wondering is, will they still be standing when something else comes along?"

Mental outlook

Insufficient disaster awareness in segments of the population and on the political level was considered a weakness.

One participant illustrated this by saying:

"There is another weakness: that it must be made clear to the population that civil protection has great limits in terms of equipment, what cannot be comprehensively maintained, in terms of personnel—that is also a limited group of people that is available, and also that everyone is responsible for themselves somewhere, that is a huge systemic weakness here in Germany."

Another weakness was a too narrow view or too narrow perspectives. Structures were currently still focused on COVID-19, and it was not clear if these structures are sufficient to address a situation different from a pandemic. Some individuals would still think in silos within their own organizations. Exercises were not comprehensive, because many variables were not considered. Most importantly, oftentimes the big picture in disaster preparation was not considered.

Necessary actions for better preparedness for future catastrophes

Local knowledge

To improve preparedness for future catastrophes, one recommended action item was to develop sustainable concepts out of an aligned network on all levels that all identify with.

One participant said:

"I think that's very important, if possible, to simply coordinate with contacts or with players in advance. You can't be prepared for everything, there's no question about that, but for the things you can see coming, it's good to have a plan in the drawer beforehand."

Community networks and relationships

Ongoing networking was considered an important task. This includes continuing to build and maintain a disaster management network, to stay in touch with important players also in times without crisis with the goal to be ready when a catastrophe approaches. A good knowledge of possibilities and limitations of your partners across organizations is instrumental.

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Being open, uniting forces and staying engaged was another recommendation mentioned. Younger colleagues should be encouraged to network. Looking beyond the borders of the own organization can widen horizons, this could even include networking with a global perspective to learn from each other.

As such, one participant suggested:

“We should network much more globally, and all learn from each other, then we would be better prepared, I think. Brazil has experience with black-outs. If we were to practice with them, I think, we would also be prepared.”

Communication

Lessons learned from the corona pandemic included the observation that transparent and timely communication between different actors was very important, in order to establish and maintain an overview on the development of the situation. Within that context it should be taken into account that those other actors may have different problems than you have, therefore, ascertaining alignment was very important. In particular, in this context, the interclinical staff meeting (see chapter “Actors’ diagram: Regional interclinical medical task force”, Figure 15) was considered an unbelievably valuable communication and alignment tool. A participant recommended to be more transparent with a broad audience of relevant actors on plans. In addition, more thorough communication pathways between decision making and execution levels should be practiced in order to make sure that the sense of reality is being met. Functional communication channels are important, a variety of media—ranging from online media to radio to loudspeakers—should be used considering that one single medium does reach the whole target group. For the choice of communication means it has to be taken into account that technology might be vulnerable to adverse conditions such as electricity loss or destruction of cellphone broadcasting masts which require appropriate backup solutions. Message directed to the population must be aligned, *“speaking with one single voice”* is crucial in order to *“take the population with you”*, i.e., to build and maintain transparency and trust.

One participant stated:

“What needs to improve is the openness to think the impossible beforehand and to communicate that widely, even if it’s unpleasant, but maybe people have learned that now.”

Health

A recommendation for the healthcare sector was to coordinate complex inter-institutional patient pathways already early during routine times, so that in times of a significant crisis smaller hospitals would be better pre-

pared and could takeover patients from ICUs much earlier which would generate more ICU capacities for maximum care providing institutions.

Governance and leadership

A participant recommended to consider the establishment of flexible disaster management modules and equipment including in areas where the organization detected structural weaknesses. A blueprint for these modules would be available in the structures of the Federal Technical Relief Agency. To illustrate this, crisis management by modules would start asking the following questions *“which is the task required?”*, *“which abilities are needed (e.g., pumping, locating, recovery)?”*, *“what workforce and equipment do these modules need in general and in particular in case of a deployment?”*, *“can I accept a mission because the personnel is available?”* These flexible modules would be particularly desirable for organizations that are organized in rigid line functions with daily routine tasks such as the public administration. As such, flexibly deployable modules could be useful for a variety of operational settings (i.e., crisis communications to citizens). Here, one would need a flexible head who can rapidly dive into a new disaster management situation (e.g., shifting from “corona” into “contaminated water”). In addition, one would need people who answer phone calls with necessary FAQ lists and have the right equipment. Depending on the situation, they could either stay at their usual workplaces or move to more suitable places if necessary. In this case, intelligent phone switching needs to be anticipated. The personnel of such modules would require access to pertinent information and means, and it must be clearly defined what is needed for the mission tasks, e.g., working with the press). It is especially important to anticipate rapid module scale-up necessities, (e.g., availability of software licenses—*“if you have only five, but need 15, then 10 persons cannot work”*). One has to be aware that there are crises *“with an announcement”*, although their true impact may not be assessable yet (cf. the course of COVID-19 in China, Italy, Bavaria—it was known that something would be coming but the true local effect was still unknown), but there are also unexpected crises with immediate need for action (e.g., contaminated drinking water). These sudden situations require the ability for a rapid and robust response. Therefore, it is necessary that modules be constantly prepared and thus be ready for deployment. As such, newly established communication structures within such a module require regular exercises. At this point there are no comparable modular structures in the public administration in Germany, each new crisis tended to be addressed through de-novo improvisation to the newly acute, individual situation. Furthermore, shifting personnel from other areas to fulfill functions in a disaster management module that itself has less workforce in time without crisis could be an additional asset.

One participant said:

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"It has to be said quite clearly that there are crises that come completely without warning, e.g. [past event] (redacted for privacy reasons). That was on one day, from 9 a.m. all hell broke loose. But I still have to be able to react. And these modules must be kept operational. That just doesn't exist. With every crisis, we've sort of put together new structures in each case."

It was recommended that the leadership style be more directive on the appropriate level to avoid complicated discussions, e.g., on roles and responsibilities of hospitals, such as 'distributional justice' of burden. Being open and transparent, thinking in networks, within and across subunits and organizations can help to establish trust and ease cooperation. Positively mentioned was the observation that *"the members of interclinical staff team proved human qualities among each other, all behaved and endured together, this should also be possible in different contexts, which then requires the same dedication, emotionality and energy."*

In case of a crisis or a disaster, prompt switching into disaster response mode is important. The right leadership attitude should include keeping a cool head, showing common sense, being able to lead, showing trust and earning trust.

A participant explained:

"Both, common sense, and also that we in the management function just keep a cool head in any situation, like [name] as [position and function] or [name] (redacted for privacy reasons)."

The necessity of having the right person in the right leadership position was emphasized. In a disaster, there should be less emphasis on bureaucracy, leaders should be decisive and show, as a participant said:

"Simply—sometimes courage, civic courage!"

Eliminating contradictory and redundant leadership structures can prevent paralysis. Therefore, a clear mandate and clearly aligned understanding of roles and responsibilities is crucial. This requires inter-institutional agreements well in advance of a disaster situation. Reflecting beyond silo structures and asking for outside feedback can help avoid the danger of "groupthink".

A participant illustrated:

"Maybe also to get a glimpse from you, a short phone call or feedback, these are impressions that I personally can continue to work with, or that we as an association can continue to work with. These are also points of content that are interesting from your point of view, that are surprising,

that we then say: yes, ok, where are we perhaps too caught up in our own way of thinking, then I also have a contact person who opens up my horizons a bit—that is always the danger when you are only stuck in your own role.”

Resources

In terms of personnel resources, it was recommended to work hard to retain your current staff if the labor market is empty. Furthermore, it is especially important to be better prepared for staff attrition in disasters, as the experience with COVID-19 has proven. One countermeasure could be to mobilize and reactivate qualified forces in case of a disaster, e.g., nurses who had previously left clinical work into administrative jobs fields. An interviewee mentioned that it would be desirable if the military had more medical personnel available for disaster relief. There must be reserves to buffer for surges to respond appropriately in case of a disaster. As such, ninety-five percent utilization of ICU or trauma room capacities in routine mode is not an option for crisis management, because polytraumas and myocardial infarcts will continue to occur in addition to the surge capacities needed. It has to be accepted—which is currently not the case—that there should be free resources in routine times, otherwise it is not possible to react appropriately to an emergency situation. Taking unprepared personnel out of a routine task for emergency response can be chaotic and takes time depending on the situation. Wherever there are free resources, this would be faster. As such, more personnel for disaster management in “peace time” allows an institution to be better prepared once the crisis is there.

A participant said:

“Where it comes to emergency medicine or responding to sudden events, you must accept that there are free resources in routine mode. That’s the simplest rule, if I make sure there are no resources free in routine mode, then I won’t be able to respond to an emergency incident.”

Furthermore, redundancy of critical items allows switching into disaster relief mode earlier, because there is no need to regroup personnel or material, this saves valuable time for further planning and actions, and compensates for personnel attrition (e.g., in time of a pandemic where staff will become sick). A participant emphasized that it is crucial to align availability of material (e.g., drinking water purification, vehicles, etc.) with disaster scenarios, to anticipate needs, and to network with other players including the military.

Spontaneous helpers who are not organized in a disaster relief organization can be a valuable asset. Participants recommended to be prepared to better include volunteer personnel, because there is substantial solidar-

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ity in times of crisis which may generate a significant potential of workforce. This, however, requires careful coordination in order to avoid chaos, as the experience in the disaster response to the 2021 Ahrstal flash flood has shown. On-boarding spontaneous helpers requires a structured approach including the assessment of capabilities, functioning, organizing groups, and matching with required needs.

A participant illustrated:

“How can I integrate this great resource of volunteers a bit better, use it better in different situations? If they all suddenly run there, no one is helped because it is completely uncoordinated and completely out of control. We have to look at how we can channel these people in such situations, get them organized, so that maybe we can organize and bundle the power behind it, no matter in which area—whether it’s taking care of people or helping to sort clothes, as in the severe Ahrstal flooding. So that it can really be used effectively.”

A better future cooperation with public and private staffing agencies to recruit professionals with particular abilities and competences for disaster management in times of crisis (e.g., from the corona disaster management: staff for testing, helping hands for nursing homes, etc.) would allow withdrawing the military out of subsidiary missions earlier. This should be part of the civil-military exit strategy on the way to the recovery phase.

A participant explained:

“What I would also like to see, is simply that—when you need personnel—there is much closer cooperation with the job agency, with private staffing agencies that exist in Heidelberg, so that the soldiers can really be pulled out more easily. There simply must to be much more cooperation.”

Economic investment

In general, funding novel ideas for disaster management was mentioned as a key step looking forward. One issue in the pandemic disaster response phase was that hospitals feared being stigmatized as a “COVID-hospital” with financial or reputation damages. Therefore, it would be important to either provide financial incentives to hospitals for engaging in certain aspects disaster relief or, alternately, direct local governments to oblige hospitals to do so. Being able to spend money fast and flexibly in a crisis without long and complicated administrative processes would create a timelier disaster response and increase flexibility. As such, one participant recommended the establishment of a so-called “hand cash box” for institutions that usually have complex financial spending and procurement processes. Participants recognized that implementation of improvement (e.g., more material, more training exercises) will take time, even if

required funding were available instantaneously, because there is a large catch-up gap to overcome.

Preparedness

Disaster education within the population was considered an especially important topic for better preparedness. This would start at childcare facilities, kindergarten, or schools, because children are a vulnerable population and usually, they are separated from their parents during workdays. As such, parental disaster readiness would include aligned emergency planning facilitated by schools that include answers to pertinent questions such as what should happen to children in case of a disaster? Where do they stay? Where can parents pick them up? Schools should carefully prepare students to become disaster resilient (e.g., like it is already being practiced for first aid education for school children) and discuss preparation and plans with their students who would carry knowledge and skills as multipliers into their families who—as a core unit—would then need to address these themes for themselves to have a family disaster readiness plan.

Transparency towards citizens was mentioned as another core item of preparedness. It is important for proper expectation management to convey the message to the population that self-sufficiency is crucial for societal resilience, that provision of emergency aid is not all-encompassing, but rather covers basic needs if circumstances allow, and that disaster management has limitations in terms of equipment that cannot be held in stock exhaustively. A participant explained that citizens need to understand that comprehensive aid may not be available to everybody depending on the size of the situation: a tornado moving across a single city would be manageable because external support will become available. The city could subsequently be rebuilt. On the other hand, a tornado affecting the surrounding region would be more difficult to manage, but a storm affecting the whole state minimizes the possibility of immediate disaster assistance to the individual person. The situation would be similar in case of an electricity blackout: the bigger it is and the longer it lasts, the less aid can be provided to the individual, therefore the population needs to be prepared and self-sufficient.

One participant said

“And we also have to educate the population and make it clear that people cannot be helped comprehensively in all situations. This all has its limits, the larger the situation becomes the less I can help on the individual level.”

A participant recommended developing a priority list of threat mitigation for highly likely events, recognizing that not everything can be covered. Larger groups should be involved in this process to cover a broader per-

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spective and achieve alignment. A participant emphasized the necessity to include practitioners and mission experienced people into the planning process to broaden perspectives, achieve realistic and inclusive planning, and have important aspects covered, including time management, staff supply, shelter, WASH, as well as training and exercises.

Another participant recognized that preparing for shortages on gas, electricity, and water technical improvements or installations in some institutions may be necessary to have options and alternatives available once the shortage occurs. Further strengthening financial and personnel means to develop viable disaster management concepts was considered crucial for better disaster preparation.

Reflecting upon necessary staff training is paramount, in terms of frequency, audience, and content. There is a need for regular practice and catch-up with exercises in general because disaster preparation efforts in the last years were limited due to a predominant focus on financial economy which limited opportunities for spending. These new training and exercise initiatives need to be worked out carefully and be accompanied, which may require financial input and workforce, strengthened through external vendors. Participants advocated for more, and more regular exercises, once a year or every two years. The target groups for exercises should be broadened, and not only be limited to leadership planners, but particularly be extended to the personnel who operationalize disaster management, so all-hands exercises should be considered. A participant recommended making the exercises granular and broad. Likewise, exercises should be more realistic. This could be achieved by conducting exercises unannounced in the context of an “alarm day” for disaster management which half of all units may attend for a period of two days. At this point, mass casualty situations are being exercised frequently. This scenario should be extended to other more complex situations where units have less training, such as shelter, protection, food supply, and population support after a storm, which is difficult to exercise. Here, joint exercises would be needed because the training effect is more effective than separated exercises of single organizations in isolation (e.g., medical units on one side and technical units on the other such as fire brigades, water rescue, technical relief).

Mental outlook

Appropriate disaster awareness is a key mental outlook factor for resilience. To be prepared, it is important to recognize that disasters can happen, although this may be uncomfortable. A participant emphasized the necessity to understand that life is not 100% safe and that there are risks, therefore, the participant recommended to be open to future events and to anticipate. One lesson of the pandemic included “*think the unthinkable*” and communicate this broadly, although it is indeed uncomfortable.

Leaving the comfort zone is valuable, as *“everything outside of the day-to-day work is perceived as a burden”*. An anticipatory mindset would include to *“think crisis’ in your daily work”*, to reflect whether strategic decisions are potentially crisis resilient on the long term, and to develop various disaster management scenario options for possible crises (e.g., but not limited to African swine fever outbreaks, migration waves). An anticipatory mindset includes early synergistic alignment with players. Balance is key: although you cannot prepare for everything, it is helpful to have plans available in the drawer. Factors to anticipate include needs, necessary structures, and equipment. This should be worked out with an anticipatory mindset well in advance. Appropriate and timely contract management is of importance: it may be difficult to get computer screens if there is a widespread surge of need in scale-up situations, this is an issue that is important for the whole disaster management community as one participant emphasized. Anticipation includes revising and extending disaster plans for further scenarios; this was a lesson learned of a recent shooter scenario. It is important to recognize that structured planning beneath the surface may require substantial input, and this would also require personnel resources. One anticipatory approach could include developing a priority list of threat mitigation for highly likely events, recognizing—as stated above—that not everything can be covered; this should be addressed by involving larger groups of players for consensus. A participant cautioned not to feel overwhelmed by disaster planning; instead, items should be worked through step by step on a small scale first, and then bigger and bigger (e.g., anticipating having to address a 2-hour blackout first and then moving forward, step-wise, to larger events). Considering lessons learned from each previous event is key to reach the goal of becoming a learning organization.

An anticipatory mindset includes considering the needs as well as the capabilities of the population affected by a disaster. Resilience could be strengthened in the population by training and education on self-sufficiency, and—as laid out above—by reaching people when they are young (kindergarten, schools). As disaster support to the population is contingent upon the population’s ability to care for themselves, neighborhoods and the communities should be encouraged to network and support each other mutually in the sense of a community-based disaster preparation and response approach. This goal should be supported with training offers and facilitating structures that could include a phone hotline for “match-making” between community needs and community offers. The advantage is that this approach builds on established and functioning structures that are already available within the community.

The population should be more involved in disaster planning, their needs and expectations should be monitored, asking for feedback would avoid misalignment early. One participant reflected that—from the point of view of a learning organization—it would be interesting to inquire on

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the following questions: how did the population feel taken care of during the pandemic by the various actors and institutions? Were the efforts of the institutions noticed by the population and did they meet the expectations? Is it also possible that people did not want this at all? Last, it should be taken into account that people's mental outlooks may be challenged and change during the burden of an ongoing disaster because individuals experience a significant amount of stress—as observed during the pandemic—this may turn into aggression against helpers which requires anticipatory measures.

Résumé

In order to intellectually reduce a complex global crisis to the most essential personal element, participants were asked to express their résumés of the COVID-19 pandemic in a single phrase. Two of the 12 interviewees answered with two phrases that conveyed different ideas, these answers were considered as well, therefore there were 14 statements overall. These résumé statements were categorized post-hoc (1) first order into two groups of temporal directions—either looking back or looking forward—and then (2) juxtaposed post-hoc second order to the nine elements of community resilience by Patel et al [71]. Table 19 provides an overview.

Table 19. Participants’ (N = 12) personal one-phrase résumé statements of the corona crisis, categorized by temporal direction and juxtaposed to community resilience elements by Patel et al. [71] Two individuals conveyed two statements each

Résumé direction	Community resilience element	Individual statements
Looking back	Local knowledge	<ul style="list-style-type: none"> • <i>“In our region, through our approach, we made it quite good so far through the pandemic.”</i>
	Community networks and relationships	<ul style="list-style-type: none"> • <i>“On the local level we did a great job, but only on the local level.”</i>
	Resources	<ul style="list-style-type: none"> • <i>“From the bad times, or the scary times we had, this is the summary: that I have two really great, strong teams, really great employees. If we stick together, we can overcome any crisis. Really, I’m getting sentimental now, because I think it was really a positive experience from the bad times, as far as the staff is concerned. We have really great employees, yes.”</i> • <i>“Thank God we had very few deceased cases. I think that this was due to the protective measures which were well done and implemented with persistence. But it sometimes takes your breath away, because it was a huge specter of horror.”</i>
	Mental outlook	<ul style="list-style-type: none"> • <i>“We can do more than I ever thought—but it is very exhausting.”</i> • <i>“Many have suffered in the corona crisis. I think that the mission of the Federal Armed Forces was an image gain, a big boost, the armed forces are being perceived very positively.”</i>
Looking forward	Governance and leadership	<ul style="list-style-type: none"> • <i>“We have to rethink administrative structures, and the cooperation with other structures—agencies as well as other institutions—once again.”</i> • <i>“Humankind cannot be safe, and we need strong characters to lead.”</i>
	Preparedness	<ul style="list-style-type: none"> • <i>“The résumé is that humanity has learned to deal with global challenges that may well change. Personal responsibility and global learning become my résumé if I may look a little bit at everyone. We as an organization are in a pioneering role. The crisis is being realized by us as helpers differently than the population. Having a</i>



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Table 19. (continued)

Résumé direction	Community resilience element	Individual statements
Looking forward (continued)	Preparedness (continued)	<p><i>connection to the population, asking what they need, what reaches them, not just looking at it from the perspective of the green table but really on the ground—this was personally very important to me.</i></p> <ul style="list-style-type: none"> • <i>“We have learned a lot. We know in part now where our weaknesses are. I hope we have learned to manage these situations better in the future.”</i>
	Mental outlook	<ul style="list-style-type: none"> • <i>“It is not over yet.”</i> • <i>“The world changes faster as one thought it would change. Nothing is really safe. And it happens fast. The loss of security, also thought into the future. Life bears dangers, I cannot eliminate them 100%. This can only have been the beginning of problems that society will face in the next 10, 20, 30 years. Perhaps the pandemic was the starting shot for a chain of conditions that challenge society. As has been said, the pandemic as reality of the unthinkable that must be thinkable in the future.”</i> • <i>“That you do what you can do, but sometimes not so hesitantly, not so fearful. We should be more courageous in these times, and reflect what must be done, and think it through, but then approach it with courage.”</i> • <i>“We can achieve anything if we work together and stick together, then we get everything done, and I personally think, whatever this may be.”</i>

Discussion

This work defines individual and collective lessons learned during a two-year subsidiary civil-military pandemic disaster relief mission in Heidelberg/Rhine-Neckar involving 788 soldiers from 20 different military units between March 2020 and March 2022 guided by (1) a systems-based medical leadership and management process along the patient's journey, (2) analyzed with the openness-approach of semi-structured interviews engaging key actors, and (3) regarded through the holistically comprehensive focus of a community resilience lens. We identified 37 action items to enhance community resilience for future catastrophes in the nine areas of (1) local knowledge, (2) community networks and relationships, (3) communication, (4) health, (5) governance and leadership, (6) resources, (7) economic investment, (8) preparedness, and (9) mental outlook.

The methodological core elements proved to be extremely useful for the mission analysis. The first useful element was the **systems-based medical leadership and management process along the patient's journey** to inform and facilitate the medical coordination activities of the subsidiary mission in Heidelberg/Rhine-Neckar within the pandemic. Specifically, this perspective included the consideration of patients' experiences along their health journey throughout time with regard to SARS-CoV-2 related risks, care, and prevention within and across elements of local health-care settings (Table 5, Figure 12). In general, including patients' perspectives is considered a key factor in improving patient safety within an overall aligned multi-domain system which integrates real-life experiences and skills of people [6]. In a concept analysis and systematic review, Gartner et al. proposed a seven-point framework for fluid and effective pathways which included (1) the centrality of patients and caregivers, (2) the positioning of professional actors involved in the care pathway, (3) the operation management through the care delivery process, (4) the particularities of coordination structures, (5) the structural context of the system and organizations, (6) the role of the information system and data management and (7) the advent of the learning system [34]. Seminal systems-based steward questions (Table 5) that arose during the subsidiary mission did cover and address this seven-point framework.

The second useful element was **qualitative semi-structured interviews which did prove to be greatly beneficial though their openness to novel ideas** raised by the participants within the interviews. Specifically, it provided valuable thematic insights, because it captured comprehensive descriptions by the interviewees and allowed diving deeper into sponta-

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neously addressed phenomena through the possibilities of asking questions and engaging in a dialogue. This would not have been possible with a questionnaire-based study.

The third useful element of this work was the **analysis structure around the community resilience framework** elaborated by Patel et al. [71]. This framework proved to be very beneficial in the sense of a holistic comprehensiveness around the ideas expressed in this work, because it overcame the heterogeneous resilience framework concepts that were previously reported in civil-military COVID-19 disaster relief missions around the globe, while, at the same time, these individual non-aligned concepts are being represented as a whole within in Patel's framework construct [71, 79].

Focus question 1: What was done in Heidelberg/Rhine-Neckar?

Seven core issues with civil-military relevance arose in Heidelberg/Rhine-Neckar during the pandemic: (1) hospitals lacked PPE which exposed staff to infections. (2) There was risk of SARS-CoV-2 outbreak in a major regional refugee center. (3) Ongoing surges of COVID-19 patients overwhelmed ICU units. (4) The risk of uncontrolled spread of infections endangered the population (5). SARS-CoV-2 infections spread into vulnerable populations in nursing homes leading to casualties. (6) SARS-CoV-2 infections spread into vulnerable populations in nursing homes leading to surges of symptomatic infections among staff. (7) The swift roll-out of ambitious vaccine campaign in a short time was endangered by lack of staff. To strengthen perseverance in pandemic management, the military mainly provided workforce and, to a minor degree, equipment, overall, with good outcomes for the afflicted population (Table 6). The embedded proximity of local medical staff officers within liaison commands on both sides—the military medical service as well as the civilian health care system—was especially useful for eight community resilience elements out of nine, i.e., local knowledge, community networks and relationships, communication, health, governance and leadership, resources, preparedness; and mental outlook (Table 5, Table 6, Figure 14, Figure 15, and Figure 18). The liaison role provided little influence on economic investment.

The nature and extent of civil-military cooperation in Heidelberg, Germany, during the COVID-19 pandemic was essentially in line of what has been reported worldwide in the scientific literature [79]. In preparation for this study, we had previously analyzed 45 publications by means of a scoping review. This structured, mixed-methods scoping review analysis of the

Focus question 1

scientific literature extracted from three databases (PubMed, Web of Science, and Cochrane Library) included the work of authors from 22 countries and covered five continents (Figures 19 and 20) [79].

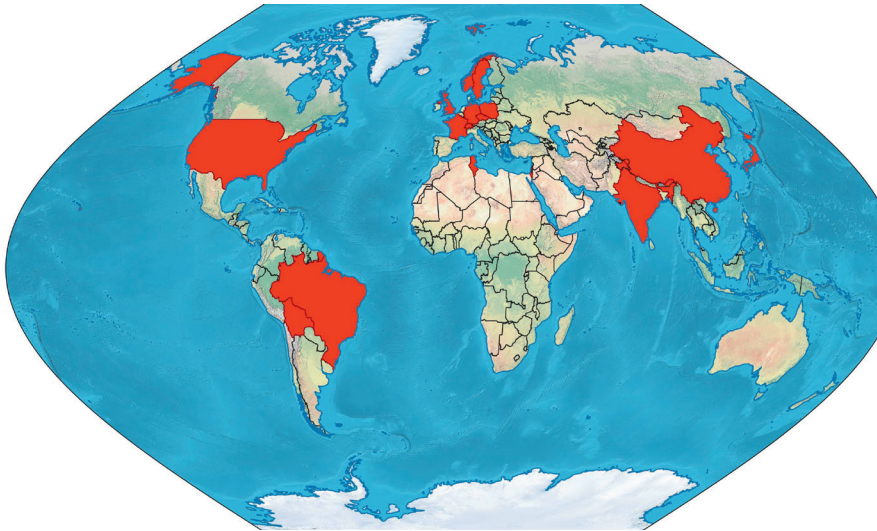


Figure 19. Countries of military (co-)authors' affiliations in medico-scientific civil-military publications during the COVID-19 pandemic (in red) [79]

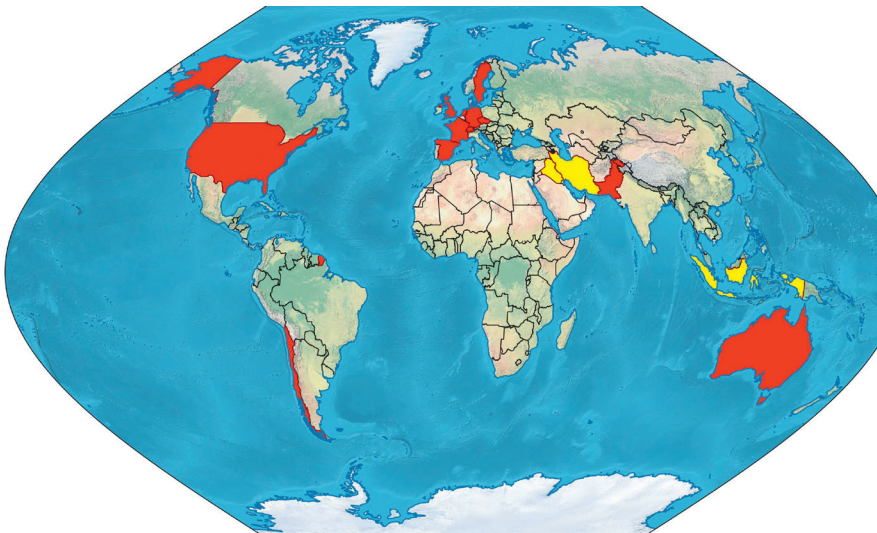


Figure 20. CIMIC field experiences and analyses during the COVID-19 pandemic. Red: first authors' countries of affiliation. Yellow: Countries in which CIMIC activities were analyzed by authors from other countries [79]

Discussion

In general, civil-military cooperation worldwide was heterogeneous and could differ from country to country (for details, see [79]). In the scoping review analysis of the literature reports, we could, however, identify three thematic clusters which are described in the following sections in more detail as expanded contextual perspectives.

Expanded contextual perspective: Worldwide medico-scientific contributions with the participation of military medical personnel or institutions

Members of the military acted as subject matter experts, clinical and experimental (co-)investigators as well as co-founders for enabling COVID-19 relevant research [79] (Figure 21). Areas covered were relevant to the COVID-19 patient's clinical journey from prevention, exposure, diagnostics, and treatment and included pertinent fields such as digital health and telemedicine, global and public health, critical care, emergency and disaster medicine, radiology, neurology, as well as other medical specialties, i.e., respiratory care, pulmonology, burn medicine, and transfusion medicine, in addition to environmental and occupational sciences as well as materials science [79].

Expanded contextual perspective: Worldwide CIMIC field experiences or analyses

CIMIC field experiences or analyses reported in the literature included areas such as political framework, strategy, structure, nature of civil-military interaction and concrete mission reports in selected countries [79] (Figure 22). Although, in general, findings in scoping reviews tend to be more abstract and conceptual compared with individual studies like the present one, the themes identified in our scoping review nevertheless corroborated and expanded the local civil-military experience in Heidelberg/Rhine-Neckar during the COVID-19 pandemic by covering a broad spectrum of pandemic disaster management subjects such as capacity and surge capacity building, medical and pharmaceutical logistics, patient care under austere circumstances, SARS-CoV-2 testing support, intelligent and innovative information management, vaccination support, and disaster communication [79].

Some country reports were of specific relevance to the present study, because they dealt either with common motifs of the mission or they addressed issues raised by the participants in the present study [79]. These examples will be addressed in more detail in the next paragraphs.

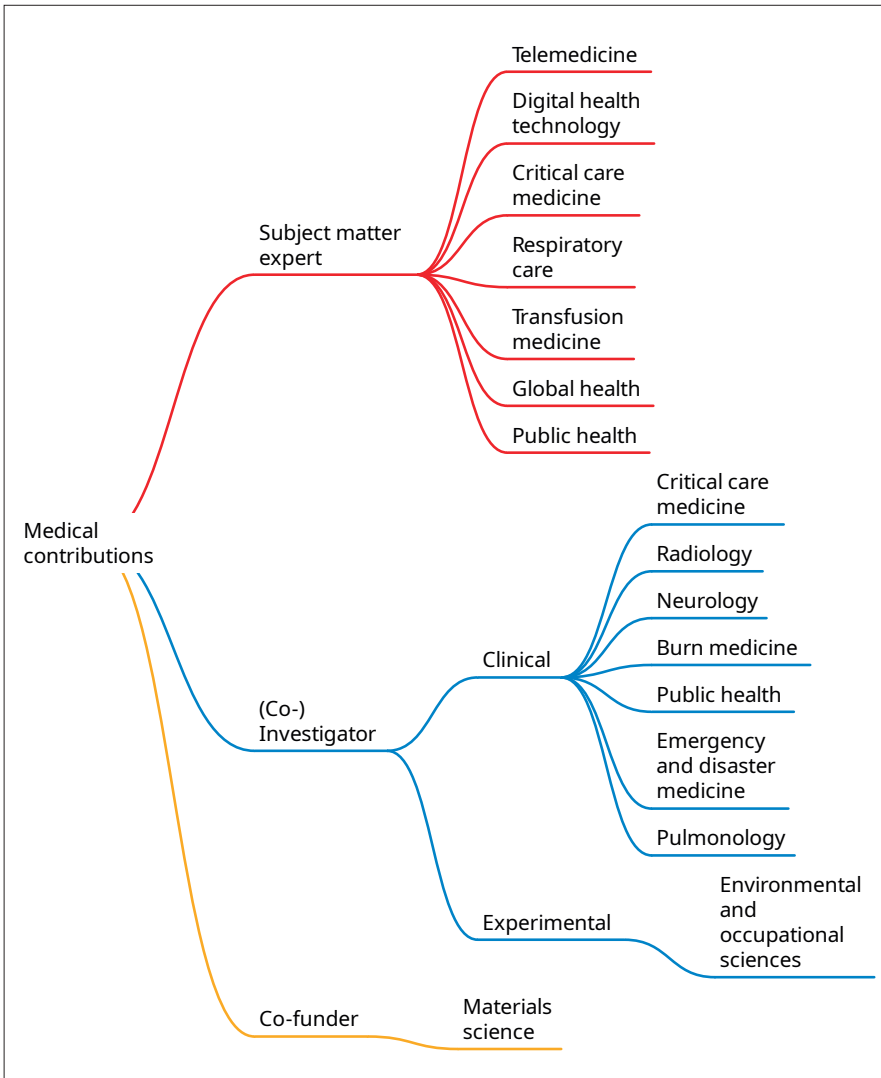


Figure 21. Worldwide medical contributions of the military during the COVID-19 pandemic [79]

Discussion

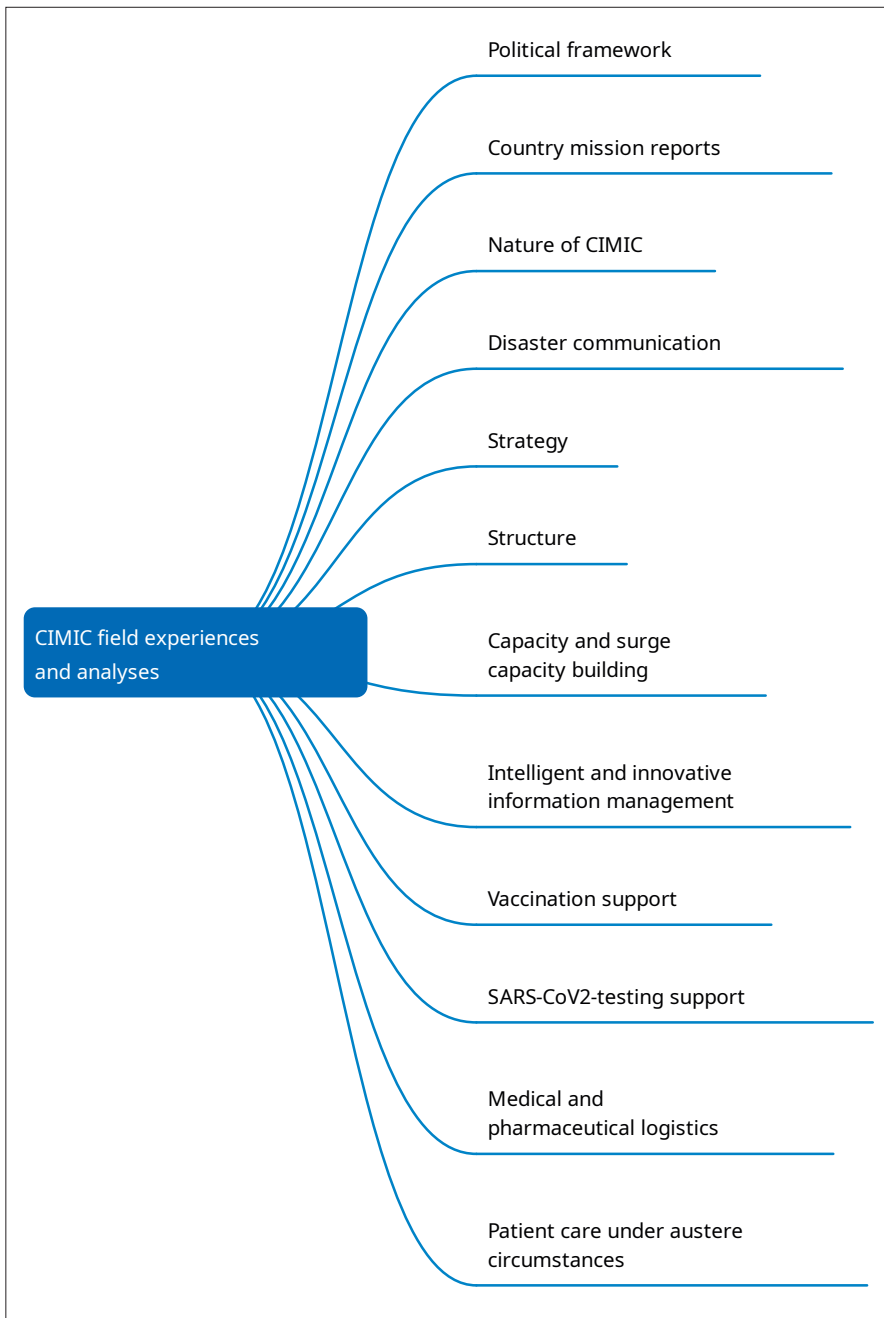


Figure 22. Themes of worldwide CIMIC field experiences during the COVID-19 pandemic [79]

Jabbar and Makki analyzed civil-military cooperation during the COVID-19 pandemic from a leadership perspective in Pakistan [48, 79]. They focused on four themes, i.e., (1) the significance of CIMIC in disaster management, (2) challenges associated with CIMIC during the COVID-19 pandemic, (3) the role of a common civil-military command operation center, and (4) government policies and practices related to disaster management [48, 79]. Of interest, most funding is spent on measures responding to a disaster rather than on prevention [48, 79]. This is not an isolated phenomenon, but a frequent global shortcoming, which is being addressed by the Sendai Framework for Disaster Risk Reduction 2015–2030 [74, 79]. Tasks of the Pakistani army included support in SARS-CoV-2-testing, logistics (i.e., distribution of medical equipment including testing kits, ventilators, personal protective equipment and drugs), disaster response coordination, and information management [48, 79]. In Pakistan, overcoming a communication gap and fostering collaboration between civilian actors was important during the COVID-19 crisis [48, 79]. In the absence of international guidelines for CIMIC, a definition of the overall framework and guidelines are considered helpful [48, 79]. Joint training of civilian and military stakeholders improved functioning and mutual understanding, and increased trust, while previous military training of civilian actors proved to be beneficial in this regard [48, 79]. Of interest, the administrative structure of civil-military cooperation in Pakistan is similar to the one in Germany, where military entities mirror their civilian counterparts on the local, regional, and state levels [48, 89].

In the UK, Gad et al. analyzed civil-military cooperation from open-source grey literature in six European countries, i.e., UK, France, Spain, Italy, Belgium and Sweden, in the early phase of the COVID-19 crisis [32, 79]. For this analysis, they identified seven main analytical themes, i.e., (1) recognition of health security threat from coronavirus spread in Wuhan, (2) detection and announcement of first cases as reported through military health functions, (3) invocation or announcement of national crisis, plans and/or military involvement, (4) how military support was incorporated into national crisis response, (5) how the military modified its activities, (6) dealing with rumors/allegations related to COVID-19, and (7) other—military and COVID-19, and divided these themes into 19 categories of civil-military cooperation [32, 79]. The armed forces and the military medical service were key components of early disaster response and strengthened resilience, while Italy and Spain had the most intense and Sweden the least intense level of CIMIC within this group of countries [32, 79]. Gibson-Fall identified three different trends of national military involvement during the COVID-19 crisis worldwide: (1) minimal technical military support, (2) blended civil-military responses, and (3) military-led responses [45, 79]. The blended civil-military response was characterized by civilian leadership and military support in organization and logistics which could

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include air repatriations, border controls, mobile testing, quarantine and lockdown enforcement, and emergency field hospitals [45, 79]. This trend model was practiced in countries such as Nigeria, Kenya, the US, France, the UK, China, Vietnam, South Africa, and Singapore [45, 79]. Subsidiary civil-military support in Germany during the COVID-19 pandemic followed this blended civil-military response trend model as well. A participant of the present study suggested considering the establishment of flexibly deployable disaster response modules within the administration to enhance resilience. In this context, an interesting example for enhancing crisis management capabilities in the public sector is the British stabilization unit, which facilitates cooperation between agencies, civilians and the military and could serve as a training and capacity building model [21, 79].

In Germany, Roßmann et al. focused on systems innovation, analyzing the dynamic challenges of the emerging COVID-19 pandemic through a Cynefin lens; remarkably similar crisis management problems were found in different areas of the public health service in Germany [79, 86]. They identified four key areas that necessitated systems innovation to strengthen disaster resilience, i.e., (1) information-management including crisis communication, (2) data- and information-visualization (dashboard), (3) training and education of supporting staff, and (4) a framework and evaluation concept (“scoring-matrix”), and developed novel tools to adapt, change, and innovate the public disaster management system [79, 86]. Similar challenges and difficulties were recognized and addressed in participant’s own areas of responsibility, too, within the community resilience elements communication, health, resources, and governance and leadership (Table 12). In particular, the proven joint ability for coordination and patient allocation was considered a particular strength of the region Heidelberg/Rhine-Neckar for future catastrophes.

We previously summarized lessons learned during the SARS-CoV-2 emergency vaccination roll-out campaign in Heidelberg in the year 2020 [79, 90]. The following five strategic elements were important for success: (1) robust mandate, (2) use of established networks, (3) fast on-boarding and securing of commitment of project partners, (4) informed planning of supply capacity, and (5) securing the availability of critical items [79, 90]. Planning tools included (1) analyses through a VUCA lens, (2) analyses of stakeholders and their management, (4) possible failures, and (5) management of main risks including mitigation strategies [79, 90]. Lessons learned identified ten tactical leadership priorities and ten major pitfalls. We proposed that methods which comprised considerations of VUCA factors combined with analyses of possible failures, and management of stakeholders and risks could be adjusted to any public health care emergency anywhere across the globe in the future [79, 90]. Participants in this study considered the vaccine campaign a success because it saved lives. Post-hoc, participants stated that main challenges for the vaccination pro-

gram was building the vaccination center without prior experience, lack of time, planning around changing priorities, finding personnel, and the vaccine logistics. Misaligned communication was a main issue., but prioritized resource allocation, work-flow, and collaboration with diverse partners, including the military, in the vaccine centers was excellent (Table 12).

Consistent with the report by Gad, Lopez-Garcia from Spain observed a high degree of visibility of the military and other security institutions in the crisis communication strategy of the Spanish government [32, 57, 79]. The four key axes of the crisis communication in Spain were (1) continuous communication, (2) seriousness of the crisis, (3) feeling of control, and (4) unity [57, 79]. This highly visible presence was a result of the high degree of trust that the military was enjoying in Spain compared with other public, political, private, and religious institutions. Thus, an association with the military during the COVID-19 crisis had a protective function for Spanish politicians against critics from the opposition [57, 79]. The involvement of the German military in the crisis communication was lower than in Spain. Soldiers wore uniforms during the subsidiary mission in Heidelberg/Rhine-Neckar and generally enjoyed a large amount of gratitude from the population for their service, although the presence of the military led to questions in individual cases. Awareness of difference in civilian and military communication cultures and styles is important for future CIMIC missions.

Preparedness is of utmost importance for future catastrophes. Bacchus and colleagues emphasized the necessity of thorough inter-agency preparedness for disasters in advance [3, 79]. They reported civil-military experience with the rapid deployment—initially a high readiness exercise in January 2020—of a military mobile biological field analysis laboratory and the development of a polymerase chain reaction (PCR) test in order to facilitate the diagnosis of SARS-CoV-2 infections [3, 79]. This project was a collaboration of the Swedish Armed Forces, the Public Health Agency, and a civilian hospital [3, 79]. Assessment of military preparedness for civil-military cooperation in a disaster situation can be challenging and complex. Therefore, Tušer and colleagues from the Czech Republic developed a capacity and capability assessment procedure based on questionnaires and a mathematical model which includes Saaty's method [79, 99]. The goal was to determine the degree of preparedness of the Czech army for cooperation with civilian partners in disaster management including the COVID-19 crisis. and to identify specific areas for improvement [79, 99]. The four assessment criteria included (1) human resources, (2) technical security of allocated forces, (3) command and control of allocated forces, and (4) planning; these criteria were further subdivided into two or three indicators each [79, 99]. As preconditions for better future preparedness, participants in the present study emphasized the value of inter-institutional alignment, networking, transparent communication,

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sufficient resources, realistic training, and an anticipatory, open mindset (Table 18).

In our area, there was some degree of *medical* military support, i.e., during quarantine support in the refugee center and on the intensive care units of the university hospital (Figure 16, Table 6). Despite the limited availability of medical military personnel in a large area situation for local circumscribed support, both missions had beneficial impact on morale and public health. There were two remarkable project reports on civil-military cooperation from the US. First, Dutta et al. described the deployment of 500 Navy Reserve medical professionals to New York City [28, 79]. Some of these reservists supported eleven local hospitals that were overburdened with the COVID-19 surge which led to the exhaustion of the civilian staff. This civil-military mission was an example of successful rapid deployment of medical forces and cohesive cooperation in a diverse professional setting across all specialties [28, 79]. Likewise, the Army medical service supported New York City as well. They rapidly activated and operationalized a COVID-19 inpatient care facility in a civilian congress center in New York City, successfully integrating uniformed services, governmental agencies, and private healthcare organizations [61, 79]. Participants in the present study stated a wider participation of the medical corps including nurses and physicians of the federal armed forces in health protection tasks would be beneficial for better future preparedness which implies that the medical sector within the Federal Armed Forces should be further strengthened for better public health protection (Table 14).

Focus question 2: What impact did the Heidelberg/Rhine-Neckar disaster relief mission have?

The pattern of answers provided by participants suggested that subsidiary civil-military support in Heidelberg during the pandemic overwhelmingly strengthened local resilience. Specifically, increased local resilience was reported in the domains (1) community networks and relationships, (2) health, (3) governance and leadership, (4) resources, (5) preparedness, and (6) mental outlook (Table 16). The overall positive impact was, however, limited in sub-segments, mainly due to the limited availability of medical military personnel (health), the fact that the availability of subsidiary support by the military impeded recruiting efforts and self-sufficiency in specific sectors on the civilian side (economic investment), and, finally, the appropriate use of skills was addressed as an issue (mental outlook) (Table 16). The method of the present study did not allow assessing quantitative effects on mortality. A recent study from the US established a quanti-

tative relationship between ICU surges and mortality. Specifically, each 1% increase in general ICU capacity was correlated with approximately 5 more weekly deaths from COVID-19 per 100,000 population [44]. Likewise, each percentage increase in the number of patients with COVID-19 admitted to the ICU resulted in approximately 10 more COVID-19 deaths per week per 100,000 population [44]. Therefore, limiting the spread of SARS-CoV-2 infections into the elderly (who had a higher risk for severe disease necessitating ICU care) by providing military personnel for SARS-CoV-2 antigen point-of-care testing of nursing home visitors highly likely contributed to lowering the overall mortality in the local population (Figure 17, Table 6).

Expanded contextual perspective: Role models for crisis management and mutual learning

Identified as the third thematic cluster in our scoping review of the worldwide literature, structure, function, and leadership culture in the military was previously discussed as a role model for crisis management [79]. Michael elaborated on the tradition of influence of military medicine to its civilian partners [62, 79]. Two examples in the COVID-19 pandemic corroborated this relationship and dialogue. As such, successful management of SARS-CoV-2 outbreaks on a ship and in a Marines boot camp delivered valuable insight into virus transmission, disease understanding, diagnosis, tracking and tracing as well as appropriate quarantine measures in the early phase of the pandemic that could be extrapolated into civilian community settings such as schools, dorms, or other shared living environments [62, 79]. Katz and colleagues considered items of military medicine such as preparedness, team-based care, echelons of care, augmenting the effort, effective triage, and servant leadership as important lessons learned for adaptation into cardiac critical care during the COVID-19 pandemic [51, 79]. In the present study advantages and limitations of either the military system or the civilian side within the local COVID-19 pandemic disaster management were addressed in a much more nuanced manner. Mutual learning opportunities for both sides were identified. In general, participants praised the military for its determination, reliability, clear language and structures as well as rapidly deployable resources for standardized tasks, whereas the civilian side was lauded for creativity, flexibility, and professional experience for specific tasks (Table 14). Of interest, some positive and negative characteristics were attributed for both sectors which could mean that certain features are probably just contingent upon the individual who is responsible for the deliverable, and whether this person is working within a civilian or a military environment would rather be a question of a secondary importance. One participant emphasized that leadership styles change over time on both sides. This phenomenon was also

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addressed in our scoping literature on civil-military key concepts during COVID-19 [79]. Hierarchical top-down, command-and control structures in healthcare may have worked well in the past in military operations, crisis management, and certain healthcare settings, they do not meet today's standards due to generational value change and complexity issues in the operational environment [79, 91]. There has been a slow shift in healthcare leadership culture toward the emphasis on emotional intelligence in order to (1) foster respect and civility to empower teams, (2) lead with transparency and open communication to promote psychological safety, and (3) lead with compassion when tackling severe problems. This change process may now experience push-backs and regression into the old-school system because of the pressure during the pandemic [79, 91]. In this context, features attributed to key actors in the local pandemic management by the study participants could be regarded as characteristics for role models in disaster management situations and in general. These were: (1) exhibiting leadership, being a (2) diplomat, (3) communicator, (4) enabler, (5) demonstrating agility and a (6) supportive, robust, anticipative, focused, determined and ethical mindset (Figure 18, Table 10).

Results of this research and the information pattern detected in our scoping review of the literature suggest that civil-military cooperation during the COVID-19 pandemic contributed substantially to societal resilience in crisis management, both in Heidelberg/Rhine-Neckar as well as on a global scale in general [79]. Locally and globally, a broad spectrum of core abilities was covered by military support—presumably at a high cost, because if the health care system in a particular country or region is already overstretched before a crisis occurs, the mitigation potential may be limited whoever the health agent would be [79]. Therefore, from a holistic perspective, decisive measures to prevent the next pandemic should receive considerable attention in the future [79, 100]. In order to maintain trust within the population, the awareness of the military's potential of threat and intimidation is crucial to prevent abuse [79].

Participants reflected on the framework for civil-military cooperation and their civil-military experiences during the pandemic in Heidelberg/Rhine-Neckar. As stated above, the type of subsidiary disaster response in Heidelberg/Rhine-Neckar followed—as all over Germany—the blended civil-military trend model characterized by civilian leadership and military logistic as well as operational support [45]. Civil-military cooperation was in general perceived as very positive in terms of (1) community networks and relationships (2) communication, (3) health, (4) governance and leadership, and (5) resources. Principal areas for improvement—besides a few individual outliers—included timing and semantics in the communication domain between both sides as well as differences in working structures. Study participants made a variety of valuable suggestions for future missions in terms of what they would do the same or probably do

differently next time (Table 14). For an improved understanding of cooperative dynamics in civil military cooperation during infectious disease outbreak situations, Janse et al. recently conducted a qualitative scoping review that identified five recurring themes covering challenges and opportunities in civil-military cooperation [49]. These themes were (1) managing relations, (2) framework conditions, (3) integrating collective activities, (4) governance, and (5) civil-military differences [49]. They concluded that successful civil-military cooperation requires (1) sustainable relations, (2) binding agreements, (3) transparency, (4) a clear operational perspective, and (5) acknowledgment of organizational cultural differences, as well as (6) early and continuous engagement in order to avoid distrust and tension among stakeholders [49]. Our findings in the present study—both positive and negative (Table 14)—are essentially in line with these useful themes and helpful recommendations by Janse et al.

The vast majority of published articles analyzed in our scoping review about the role of the military during the COVID-19 pandemic was—like the insights provided by interview participants in the present study—reported in a neutral or positive perspective [79]. Positive experiences found in the scoping review included (1) the military contribution to the advancement of medical and scientific knowledge, and (2) providing medical care in austere circumstances [79]. Furthermore, (3) the use particular, sometimes even unique capabilities of the military such as leadership, technical, logistical, and organizational skills, innovative thinking, as well as (4) the availability of rapidly deployable workforce and equipment for the purpose of serving the population and resulting in tangible disaster relief were positive, and well-received examples that should be followed in the future [79]. As expected, there were also disapproving voices in some countries. As such, the political frameworks of civil-military cooperation in particular in Indonesia and Chile were discussed critically by other authors [27, 30, 79]. Likewise, Medeiros Passos and Acácio analyzed the impact of military involvement in Latin American countries, in particular policing missions in the Dominican Republic, Ecuador, El Salvador, Guatemala, Bolivia, Honduras, Chile, as well as Peru, and addressed the critical issue of short term-human rights degradation and aggravation of police violence [70, 79]. Furthermore, they concluded that the attribution of disaster management positions to military personnel in Brazil, Chile, Bolivia, and Peru may have weakened the civilian control of the armed forces in the future [70, 79]. Participants in the present study also addressed the possible intimidating perception of military uniforms in disaster relief operations that civil-military coordinators should be aware of.

Focus question 3: How well are we prepared for future catastrophes after lessons learned from the corona pandemic and what must be done to close this gap?

This work provides a deep insight into both strengths and weaknesses of the current local disaster management system. Moreover, lessons learned from participants' own areas of responsibilities are being identified, as well as experiences with civil-military cooperation, across a broad spectrum of community resilience core elements. This includes a reflection on what should be done in the future—either the same way or differently (Table 12, Table 14).

Most importantly, the present work identified as a main result 37 action items to be addressed to enhance community resilience for future catastrophes. These action items lie within the areas of (1) local knowledge, (2) community networks and relationships, (3) communication, (4) health, (5) governance and leadership, (6) resources, (7) economic investment, (8) preparedness, and (9) mental outlook (Table 18). Their 16 main themes included the **necessity for local alignment, continuous open-minded community networking, transparent communication internally and externally aligned, coordinated approach towards healthcare complexity, creation of personnel reserves including the acceptance of free resources in routine times, timely switching into disaster mode, reduction of bureaucracy, clear understanding of leadership, roles, and responsibilities, inclusion of volunteers, funding of novel ideas, prioritized planning and acquisition of material adapted to likely risk scenarios, improved disaster education including at schools, inclusion of practitioners, conducting frequent all-hands exercises, functioning as an anticipatory and learning organization, and promoting self-sufficiency within the population.**

Useful tools for better disaster preparation in Germany include the knowledge of past disasters [82] as well as the available risk analysis of the Federal Government which include natural disaster scenarios such as (1) extreme melting floods from the mid-mountains, (2) pandemic due to a SARS-like virus, (3) winter storm, (4) storm flood, (5) drought, (6) earthquake, and technological disaster such as (7) release of radioactive substances from a nuclear power plant, (8) release of chemical substances, as well as (9) central recurrent findings [96]. Nevertheless, despite the (theoretical) availability of these rather high-level framework tools, self-organization within or between institutions played a key role in the local disaster response in Heidelberg/Rhine-Neckar out of operational necessities within the situational evolution. Two successful local examples were the establishment of the interclinical staff crisis team and the common patient allo-

cation system (Figure 15). Self-organization is considered a typical need for successful disaster response, because situations change quickly and actors need to improvise and adapt, often beyond the comfort zone of their usual role [52, 64].

Lee et al. conducted a scoping review of 36 papers on public health emergency preparedness focusing on infectious diseases [55]. Framework for their analysis was the 11 elements all-hazards resilience framework for public health emergency preparedness [53]. They found that collaborative networks, community engagement, risk analysis and communication played an important role, in addition to planning to mitigate inequities, research and evidence-informed decision making, building vaccination capacity, building laboratory and diagnostic system capacity, building infection prevention and control capacity, financial investment in infrastructure, health system capacity, climate and environmental health, public health legislation and phases of preparedness [55]. Our findings—although elaborated under a more generalist framework of community resilience and taking into account all hazards beyond the pandemic—largely align with the results of the scoping review of Lee et al.

Cutting of red tape

Excessive, unnecessary bureaucracy—also known as “red tape”—during the COVID-19 pandemic was often criticized in the interviews [12]. This is a true concern, because red tape in public administration has a negative impact on organizational and employee performance as recently demonstrated in a meta-analysis by George et al. [35]. The phenomenon of red tape was stable across sectors and administrative traditions internationally. Of interest, excessive bureaucracy established by the institution itself was more destructive than externally imposed red tape, but is a correctable issue because it can be addressed by the public manager themselves [35]. The necessity for improvement on this subject was recognized by the participants in the present study as a factor that could strengthen future resilience in case of catastrophes.

Breaking the “panic-then-forget” cycle through sustainable preparedness

The pandemic has taught us valuable lessons on challenges faced in complex and dynamic societies. Results of the present study emphasize the imperative to break the recurrent “panic-then forget” cycle after disasters from a local perspective. This was seconded on a global level by the WHO at the occasion of the 75th Session of the United Nations General Assembly,

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1 October 2020, advocating “for long-term, sustainable emergency preparedness through diplomacy, investments, capacity-building and health system strengthening”, and for “applying a whole-of-society approach in countries for sustainable emergency preparedness through effective multisectoral collaboration and community engagement” [108]. In order to be better prepared for future catastrophes in terms of physician personnel, the public health sector in Germany will be strengthened. Specifically, medical students will be able to do part of their clinical training in form of electives or final year rotations periods in public health departments [26]. In Heidelberg, this is a joint project between the Faculty of Medicine, University of Heidelberg, and the Public Health Service Heidelberg/Rhine-Neckar district, which has sustainably evolved out of the close, common pandemic disaster management between these institutions. Proper civil protection addressing the real needs of a changing population and society requires alignment and adaptation towards the realities of today’s society, such as migration, aging, and evolution of organizational structures of civil societies [60]. Participants of the present study mentioned the inclusion of spontaneous helpers—volunteers who are not organized in a disaster relief organization but nevertheless very motivated and willing to contribute—as an aspect of these evolving structures that provide opportunities for personnel resources, but need a structured conceptual approach for on-boarding. Another vital action point addressed in this societal context was the necessity of promoting self-sufficiency within the population and a realistic understanding within the public what limited services disaster management would be able to provide in a major, geographically extended scenario.

Achieving timely operational readiness

Timely switching from routine operations into crisis mode was recognized as an important item in our study. De Rooij et al. investigated this concept of achieving operational readiness—which is mainly defined “by the time dimension required to deploy the response to a specific threat”—in a qualitative study based on interviews with COVID-19 disaster responders from 11 European countries [85]. Critical factors for activation were time, overcoming information overload, and workforce [85]. Using the NATO Combat Readiness as a possible framework for readiness, the definition of time and stages of operational resource activation could address these challenges but further structural and sustainable investment in preparedness is necessary; these were items that our study participants addressed as well [85]. In our study, self-organization played a vital role.

Overcoming the next “infodemic” in a world of social media

Another important global issue with impact on the local situation as addressed by participants in the present study was the “infodemic” within the pandemic. The term “infodemic” was initially coined by Rothkopf in 2003 in a Washington Post article. This infodemic occurred in the wider context of a SARS outbreak and was defined by Rothkopf as “a few facts, mixed, with fear, speculation and rumor, amplified and relayed swiftly worldwide by modern information technologies [that] have affected national and international economies, politics and even security in ways that are utterly disproportionate with the root realities” [88]. The WHO definition of infodemic is “too much information including false or misleading information in digital and physical environments during a disease outbreak” [107]. The world-wide COVID-19 infodemic was indeed recognized as a multifaceted problem within the medical literature. It extended into global political spheres such as societal cohesion and security, the infodemic mechanisms involved specific factors related to the situation, sender, instrument, and recipient and had a substantial impact on human health, by causing stress, deception, violence, and harm [78]. Mixed-synergistic pre-impact, trans-impact, and post-impact countermeasures were recently summarized by us in a scoping review of reviews [78]. The most important infodemic countermeasure is building and maintaining trust; these two items were also addressed by interviewees in this study in the context of community resilience.

Limitations and directions for future research

This work is subjected to some especially important limitations that have to be considered for the appropriate interpretation and extent of generalizability of this study.

Modules 2 and 3 were methodologically based on a qualitative approach, based on semi-structured 1:1 interviews with local key players (N = 12), that were transcribed, coded and phenomenologically analyzed for significant statements. The limitation of this approach is the small sample size which requires caution regarding interviewer bias. On the other hand, the advantage of the present method lies in a high commitment though trusted settings in psychological safety, that were a priori expected to reveal deeper insights than for examples questionnaires in a wider audience with higher sample sizes, because the study population and the answers were a priori expected to be highly heterogeneous. A posteriori, the methodological approach of modules 2 and 3 with semi-struct-

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tured qualitative interviews qualitative did prove to be greatly beneficial through its openness to novel ideas raised within the interviews. Specifically, it provided valuable thematic insights, because it captured comprehensive descriptions by the interviewees and allowed diving deeper into spontaneously addressed phenomena through the possibilities of asking questions and engaging in a dialogue. This would not have been possible with a questionnaire-based study. Therefore, the present method was judged sufficient and appropriate to meet the research goal, mainly because of the composition of the study population. The resources required were a priori considered feasible which, from a post-hoc view, could be confirmed. Out of 17 participants invited, 12 were enrolled (= 71%), and exceeded the a priori defined enrolment goal of N = 10 by 20%. This response rate of 71% in the present study is substantially higher than the recruitment achieved in a cross-sectional study conducted by our team assessing parental experiences in children with a rare neurogenetic disorder, which was based on questionnaires that were mailed to potential participants with support of a patients' organization. In that study, we achieved a response rate of only 13,8% [47]. The categorization of clusters of meaning into elements of resilience may be arbitrary in single cases, because one cluster of meaning could be attributed to more than one precise element of resilience. A best-fit-approach without adjudication was chosen within the pre-planned single rater design of this study; therefore, a subjectivity bias cannot always be completely excluded, although the single rater was a subject matter expert. Nevertheless, structuring the analysis along the nine core elements of community resilience elaborated by Patel et al. [71] proved to be greatly beneficial in the sense of a holistically comprehensive framework around the ideas expressed in this work. As in any qualitative study, the qualitative analysis within the present work was contingent on the researcher's characteristics and reflexivity. Therefore, subjectivity bias cannot be completely excluded. The study was a priori designed as a single rater research because it was an individual master thesis project. A multi-rater approach might have provided a broader perspective and an opportunity for insightful discussions. Translation of the German source data into English might introduce linguistic and/or cultural inaccuracies. Nevertheless, reporting this study in English widens the potential of knowledge dissemination in the worldwide disaster management community and enhances global opportunities for exchange and mutual learning. Modules 2 and 3 are to be understood as a bird's eye view from a diverse local key player perspective. These modules comprise key concepts derived from lessons learned. They were not intended to be and should not be understood as a comprehensive detailed disaster risk-analysis for the area. While some insights of this report (e.g., geography and structures) have a very strong local component and cannot necessarily be generalized, other topics, in particular networking, leadership, resilience, and—most impor-

Limitations and directions for future research

tantly—disaster preparation are of universal nature, and may therefore be of interest to colleagues worldwide.

The part of this work containing the scoping review of world-wide key concepts of civil-military cooperation in the COVID-19 pandemic has several important limitations, too, as previously mentioned [79]. In order to avoid selection bias, a systematic and transparent literature search, screening, and inclusion was conducted. This approach probably underreported the spectrum and experiences of civil-military cooperation during the pandemic, because it is very likely that not all CIMIC experiences in the field were indeed published peer reviewed [79]. The inclusion of other databases or even gray literature may have provided further nuances [79]. Nevertheless, this report covered information from established, robust and credible medical and scientific databases which might result in higher specificity of findings [79]. Therefore, we consider the scoping review part informative because common global themes of the pandemic were identified, and we consider these data generalizable within the context of the above-described, important limitations [79]. To better address the needs and perspectives of children in disasters, future research should better capture pediatric data as previously suggested [82]. Future research should focus on the inclusion of vulnerable populations into disaster management or as suggested by one participant, on concepts for better preparedness of children, who could then act as multipliers for stronger resilience in their own families.

Conclusion

Civil-military cooperation led to valuable contributions to societal resilience—probably at a high cost—world-wide and in Heidelberg/Rhine-Neckar. The mitigation potential for any agent may be limited if the health-care system is already overstretched in routine operations. To prevent abuse, the awareness of military’s potential of threat and intimidation is important. Better holistic, sustainable prevention for future disasters is imperative to break the “panic-then-forget” cycle. We identified 16 themes within 37 action items to enhance community resilience for future catastrophes in the areas of local knowledge, community networks and relationships, communication, health, governance and leadership, resources, economic investment, preparedness, and mental outlook. Future research could focus on better inclusion of vulnerable populations including children.

Epilogue

To encourage creative thinking, explore values and beliefs, and stimulate a debate about priorities and motivations, participants were asked at the end of the interviews to imagine a hypothetical scenario that they had one wish that will be granted to them. Then they were asked what they would wish for. Table 20 lists individual statements and their corresponding concepts. These evolved around values and desires and included family, moving ahead stronger, solidarity, better resources, and less disasters. These concepts aligned with the 6-factors of individual resilience defined by Rossouw and Rossouw, which are (1) vision, (2) composure, (3) tenacity, (4) reasoning, (5) collaboration, and (6) health [87].

Table 20. “One-wish that would become true”: main concepts and individual statements

Concept*	Individual Statement
Family	<i>“That I get back the missed three years with my children.”</i>
Moving ahead stronger	<i>“That we do not forget the experiences we had and use them to better prepare for the next crisis.”</i>
	<i>“I would like to see that for all the things that we have been talking about all along, there is the possibility of implementing that.”</i>
	<i>“I do not want to forget anything from the experience I had here. I want to be able to take everything from it and I always want to be able to take everything from it for my future life, work and whatever situation and, as I said, not forget anything. [...] A world without disasters. [...]. If we would influence everything what we could, influence ourselves in such a way that we do not need [catastrophe plans] (added for clarity) now, then that would already be good so far.”</i>
Solidarity	<i>“That the job center and everyone pulls together to really find enough staff [...] and, that all the students and all the unemployed who were at home say, I will support in the vaccination center, or I will go to the nursing home.”</i>
	<i>“So, my wish would be that we really achieve again that people in society experience a sense of “we” that connects them, and that people become clear about what will be important to them together in the future. To reconnect as a society with common goals, and not about the Instagram post or about the new SUV, but that you say,</i>



Epilogue

Table 20. (continued)

Concept*	Individual Statement
Solidarity (continued)	<i>what do I have in shared values. And that's not my appearance, that's not my car, and that's not my great cabin. But what connects us as a society, in good times and in bad, and how can we recommend this togetherness as so valuable that we are better off through this togetherness than we are alone."</i>
	<i>"Peace and health for all. That one perhaps always looks a bit more into one's neighborhood and perhaps not so globally at the big everything. An open culture, an open society, a structure that thinks for itself. I believe that we should simply say that everyone has their own role and think a little bit about themselves and everyone else."</i>
Better resources	<i>"My greatest wish would actually be adequate staffing."</i>
	<i>"Then I would want redundancy, or more resources that I am not forced to tap into."</i>
	<i>"No more catastrophes. Many many nurses, that is, many many people who enjoy doing this."</i>
Less disasters	<i>"I think it would be nice for everyone to not be faced with an acute crisis again."</i>
	<i>"The dearest wish would be if the Ukraine war did not exist. That we wouldn't have had corona, because I think the damage to society was too great overall. Apart from all the deaths, it has set society and the economy back massively in many areas. That didn't have to be the case. But also the social division that existed and still exists and will continue to exist. The vaccination supporters and the vaccination opponents, vaccination deniers, this rift that has arisen and is unnecessary, and yet is very deep. Yes, the good news is that some things have been revisited. Working together, helping each other."</i>

*Within a participant's statement some concepts can overlap.

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Quality control instruments: Research checklists

Strengthening the Reporting of OBServational studies in Epidemiology (STROBE) Statement [29]

	Item No	Recommendation
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (page iii)
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found (pages 19–22)
Introduction		
Background/ rationale	2	Explain the scientific background and rationale for the investigation being reported (pages 23–35)
Objectives	3	State specific objectives, including any prespecified hypotheses (pages 34–35, table 2)
Methods		
Study design	4	Present key elements of study design early in the paper (page 37)
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection (page 37–43, tables 3 and 4)
Participants	6	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up <i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls (not applicable) <i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants (pages 37–40)



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	Item No	Recommendation
Participants (continued)		<p>(b) <i>Cohort study</i>—For matched studies, give matching criteria and number of exposed and unexposed (not applicable)</p> <p><i>Case-control study</i>—For matched studies, give matching criteria and the number of controls per case (not applicable)</p>
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable (figure 11)
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group (table 4)
Bias	9	Describe any efforts to address potential sources of bias (pages 44 and 47)
Study size	10	Explain how the study size was arrived at (page 40)
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why (page 47)
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (pages 45–47)
		(b) Describe any methods used to examine subgroups and interactions (not applicable)
		(c) Explain how missing data were addressed (page 47)
		(d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed <i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy (not applicable)
		(e) Describe any sensitivity analyses (not applicable)



Quality control instruments: Research checklists

	Item No	Recommendation
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (page 40, table 3)
		(b) Give reasons for non-participation at each stage (page 40)
		(c) Consider use of a flow diagram (table 3)
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (tables 3, 7, and 8)
		(b) Indicate number of participants with missing data for each variable of interest (table 7)
		(c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount) (not applicable)
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time (not applicable)
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure (not applicable)
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures (pages 49–174, tables 9–19)
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (pages 49–174, tables 9–19)
		(b) Report category boundaries when continuous variables were categorized (table 7)



Quality control instruments: Research checklists

	Item No	Recommendation
Main results (continued)		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period (not applicable)
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses (not applicable)
Discussion		
Key results	18	Summarise key results with reference to study objectives (pages 176, 184–185, 188)
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias (pages 191–193)
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence (pages 175–198)
Generalisability	21	Discuss the generalisability (external validity) of the study results (pages 191–193)
Other information		
Funding	21	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based (not applicable)

* Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

Standards for Reporting Qualitative Research (SRQR^a) [66]

	Page/line no(s).
Title and abstract	
Title —Concise description of the nature and topic of the study Identifying the study as qualitative or indicating the approach (e.g., ethnography, grounded theory) or data collection methods (e.g., interview, focus group) is recommended	Page iii
Abstract —Summary of key elements of the study using the abstract format of the intended publication; typically includes background, purpose, methods, results, and conclusions	Pages 19–22
Introduction	
Problem formulation —Description and significance of the problem/phenomenon studied; review of relevant theory and empirical work; problem statement	Pages 23–35
Purpose or research question —Purpose of the study and specific objectives or questions	Pages 34–35, table 2
Methods	
Qualitative approach and research paradigm —Qualitative approach (e.g., ethnography, grounded theory, case study, phenomenology, narrative research) and guiding theory if appropriate; identifying the research paradigm (e.g., post-positivist, constructivist/interpretivist) is also recommended; rationale ^b	Page 37, table 2, figure 10
Researcher characteristics and reflexivity —Researchers' characteristics that may influence the research, including personal attributes, qualifications/experience, relationship with participants, assumptions, and/or presuppositions; potential or actual interaction between researchers' characteristics and the research questions, approach, methods, results, and/or transferability	Page 47
Context —Setting/site and salient contextual factors; rationale ^b	Table 2
Sampling strategy —How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g., sampling saturation); rationale ^b	Pages 37–41, table 3
Ethical issues pertaining to human subjects —Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues	Page 38
▶▶	

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	Page/line no(s).
Methods (continued)	
Data collection methods —Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources/methods, and modification of procedures in response to evolving study findings; rationale ^b	Pages 40–43, tables 3 and 4
Data collection instruments and technologies —Description of instruments (e.g., interview guides, questionnaires) and devices (e.g., audio recorders) used for data collection; if/how the instrument(s) changed over the course of the study	Page 41, table 4
Units of study —Number and relevant characteristics of participants, documents, or events included in the study; level of participation (could be reported in results)	Tables 2,3,5,7, and 8
Data processing —Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymization/de-identification of excerpts	Page 44
Data analysis —Process by which inferences, themes, etc., were identified and developed, including the researchers involved in data analysis; usually references a specific paradigm or approach; rationale ^b	Pages 44–47, figure 11
Techniques to enhance trustworthiness —Techniques to enhance trustworthiness and credibility of data analysis (e.g., member checking, audit trail, triangulation); rationale ^b	Page 44
Results/findings	
Synthesis and interpretation —Main findings (e.g., interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory	Pages 49–174, tables 9–20
Links to empirical data —Evidence (e.g., quotes, field notes, text excerpts, photographs) to substantiate analytic findings	Pages 49–174, tables 9–20
Discussion	
Integration with prior work, implications, transferability, and contribution(s) to the field —Short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of earlier scholarship; discussion of scope of application/generalizability; identification of unique contribution(s) to scholarship in a discipline or field	Pages 175–198
Limitations —Trustworthiness and limitations of findings	Pages 191–193
▶▶	

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	Page/line no(s).
Other	
Conflicts of interest —Potential sources of influence or perceived influence on study conduct and conclusions; how these were managed	There were no conflicts of interest
Funding —Sources of funding and other support; role of funders in data collection, interpretation, and reporting	Not applicable

^aThe authors created the SRQR by searching the literature to identify guidelines, reporting standards, and critical appraisal criteria for qualitative research; reviewing the reference lists of retrieved sources; and contacting experts to gain feedback. The SRQR aims to improve the transparency of all aspects of qualitative research by providing clear standards for reporting qualitative research.

^bThe rationale should briefly discuss the justification for choosing that theory, approach, method, or technique rather than other options available, the assumptions and limitations implicit in those choices, and how those choices influence study conclusions and transferability. As appropriate, the rationale for several items might be discussed together.

<http://www.equator-network.org/reporting-guidelines/srqr/>

This work is a scientific analysis of the operational experience of COVID-19 disaster relief in Heidelberg, Germany, between 2020 and 2022. Civil-military cooperation during the pandemic has made valuable contributions to strengthening the resilience of society as a whole – probably at a high price. The mitigation potential can be limited for all stakeholders if a healthcare system is already overloaded in routine operations. In the future, it will be important to reduce bureaucracy, to break the ‘panic-then-forget’ cycle through sustainable, holistic disaster preparation, to establish timely operational readiness, and to master the “infodemic” in a world of social media.



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