# Visualizing the Psychosocial Situation in Crises and Disasters: Conceptualizing a Multi-Functional Crisis Information Platform (*CIP-PS*)

**Sebastian Sterl**
Technische Universitaet Braunschweig
sebastian.sterl@tu-berlin.de

**Andreas Billig**
Fraunhofer Institute for Open Communication Systems
andreas.billig@fokus.fraunhofer.de

**Franck William Taffo**
Fraunhofer Institute for Open Communication Systems
franck.william.taffo@fokus.fraunhofer.de

**Lars Gerhold**
Technische Universitaet Braunschweig
lars.gerhold@tu-braunschweig.de

## ABSTRACT

Crises and disasters are becoming more frequent, long-lasting, complex, and interdependent. This can lead to negative psychosocial consequences in vulnerable population groups, increasing the need to (1) monitor psychosocial indicators and (2) make information on psychosocial topics available to decision-makers, the scientific community, and the public. In this WiP paper, we present a way to systematically visualize, research, and document different types of psychosocial data in crises and disasters by developing a "Multi-Functional Crisis Information Platform for Psychosocial Situations", called *CIP-PS*. The *CIP-PS* has three components, i.e., an information dashboard (*CIP-DAB*), a research platform (*CIP-REP*), and a documentation (*CIP-DOC*) component which together help visualize, research and document psychosocial topics, such as the psychosocial situation picture in Germany. The platform is a valuable tool for presenting relevant psychosocial information in the context of disaster public health. Its strength lies in an extensive connection between the three components related to healthcare informatics.

### Keywords

Crisis information platform, psychosocial situation picture, data integration and visualization, dashboard, vulnerable communities

## INTRODUCTION

Crises and disasters are becoming more frequent, long-lasting (e.g., Covid-19 pandemic), more complex (e.g., climate crisis and extreme weather events) and interdependent (e.g., geopolitical and energy crisis, inflation) (Federal Ministry of the Interior and Community [BMI], 2022). Although these events have different causes and impacts, all of them can lead to negative psychosocial consequences, such as anxiety, depression or post-traumatic stress disorder (PTSD) in vulnerable population groups (Bonanno et al., 2010). Compared to spatially or temporally confined events like accidents or terror attacks, the complexity and interdependency of these kinds of crises and disasters makes vulnerable population groups difficult to identify. As a result, these groups and their psychosocial consequences are not always identified, and they lack support to deal with ongoing negative psychosocial consequences. This could be addressed, first, by monitoring the psychosocial situation over a suitable period to identify vulnerable groups and visualize psychosocial indicators of the population. Second, it is crucial to systematically collect and document information on other psychosocial topics, such as help-seeking behavior or field protocols of psychosocial emergency care. Doing so will make this information easy to find and

accessible and will enable evidence-based conclusions that address psychosocial needs in crises and disasters.

All these different types of psychosocial data must be integrated into an overall information platform that helps visualize, research and document (1) data on the psychosocial situation of the population, (2) help-seeking behavior, and (3) psychosocial emergency care in crises and disasters. Subsequently, the results should be made available to decision-makers, the scientific community, and the public at large. This raises the first question:

*How should an information platform be structured to integrate these different types of data for visualization, research, and documentation purposes?*

Furthermore, several visualization tools have been developed during crises and disasters like Covid-19, the climate crisis, or the Ukraine crisis. For instance, dashboards created during Covid-19 show the virus spread or vaccination rate (e.g., Covid-19 Dashboard from Johns Hopkins University [JHU] (2023)). Various visualization tools, based on process-produced, statistical data, show indicators of sustainable development for climate change (Statistische Ämter der Länder, 2023b) or energy crises (Statistische Ämter der Länder, 2023a; Federal Statistical Office of Germany, 2023). But there are fewer visualization tools that use population survey data (see few examples, e.g., COSMO Explorer Covid-19; University of Erfurt, 2022 or data on the general health situation; Robert Koch Institute [RKI], 2023). This raises the second question:

*How can survey data drawn from individuals be integrated and aggregated into a tool that visualizes differences in specific vulnerable groups?*

To address both questions, we present the state of the art and related work and then introduce the concept of a "Crisis Information Platform for Psychosocial Situations" (*CIP-PS*). First, we discuss the general concept of the *CIP-PS*, including its structure and types of data. Then, we illustrate the dashboard component, whose structure we demonstrate with the example of a psychosocial indicator, the "respondents' perceived safety", using real population survey data we collected. The next section focuses on some practical implications for the use of these psychosocial data in psychosocial emergency care. The final chapters address challenges, limitations, and future steps.

## STATE OF THE ART AND RELATED WORK

Crises and disasters have led to the development of several visualization tools. *Table 1* gives an overview of tools differentiated by type of crisis and data. For the Covid-19 pandemic, ongoing since 2019/2020, there are several dashboards that visualize infection or vaccination data with statistical process-produced or simulation data to predict virus spread and justify various non-pharmaceutical interventions (NPI), such as lockdowns or restricted mobility.[1] *Table 1* gives only one example for those types of data, but there are many dashboards at the international, national and community level (German Red Cross [GRC], 2023). However, visualizations of survey data are rare. Some visualization tools integrate survey data, such as the COSMO Explorer (University of Erfurt, 2022), which measures risk perception, behavior, and attitudes related to Covid-19 in Germany, or the "Wider Impacts of COVID-19 on Health (WICH) monitoring tool" developed by Public Health England (2023). Yet to the best of our knowledge, the concept of following a human-centered approach in crises and disasters, as elaborated in Schopp et al. (2022), is rather rare.

In other crises, measurements of the critical situation rely almost exclusively on statistical and process data: For the environment/climate crisis, tools have been built that visualize indicators of sustainable development goals[2] or environmental economic accounts[3]. For general crises, visualization platforms use data on economy, health, or energy[4] as well as crisis response plans[5], man-made disasters like violence[6], or other crisis-relevant information for the civil protection authorities[7]. Other projects collect survey data on the population's health in general with no crisis-relevant context[8].

[1] See tools for visualizing infection (e.g., COVID-19 Dashboard by Johns Hopkins University, 2023) or vaccination data (e.g., Vaccination Dashboard Germany; Federal Ministry of Health [BMG], 2023) with statistical process-produced or simulation data (e.g., Covid-19 Mobility Project; Schlosser, 2021).

[2] E.g., measures for environment protection such as $CO_2$ emission, see Dashboard of Indicators of the goals of sustainable development (Statistische Ämter der Länder, 2023b).

[3] E.g., area for settlement and transport, see Dashboard - Environmental economic accounts of the German States (Statistische Ämter der Länder, 2023a)

[4] E.g., Dashboard Germany - Visualization of topics such as Covid-19, Ukraine crisis, energy crisis, economy, etc. (Federal Statistical Office of Germany, 2023)

[5] E.g., Global Crisis Response Platform (International Organization for Migration [IOM], 2023)

[6] E.g., "Bringing clarity to crisis" dashboard on human-made crises (Armed Conflict Location & Event Data Project [ACLED], 2022)

[7] E.g., ELD-BS – Electronic Situation Dashboard for civil protection in Baden-Württemberg (German State) presented at ISCRAM 2022 (Fraunhofer Institute of Optronics, System Technologies and Image Exploitation IOSB, 2023)

[8] E.g., GEDA-Dashboard on the general health situation in Germany (RKI, 2023)

**Table 1. Examples of visualization tools by type of crisis**

| Type of crisis | Type of data | Example of visualization tool (Citation) | Link |
|---|---|---|---|
| Covid-19 crisis | Statistical/process data on infections | COVID-19 Dashboard of Johns Hopkins University (JHU, 2023) | https://gisanddata.maps.arcgis.com/apps/dashboards/bda7594740fd40299423467b48e9ecf6 |
| | Statistical/process data on vaccination | Vaccination Dashboard Germany (BMG, 2023) | https://impfdashboard.de/ |
| | Simulation data | Covid-19 Mobility Project (Schlosser, 2021) | https://www.covid-19-mobility.org/de/mobility-monitor/ |
| | Survey data | COVID-19 Snapshot Monitoring (COSMO)-Explorer (University of Erfurt, 2022) | https://projekte.uni-erfurt.de/cosmo2020/web/explorer/ |
| Environment/ climate crisis | Statistical/process data on development | Indicators of the sustainable development goals (Statistische Ämter der Länder, 2023b) | https://experience.arcgis.com/experience/9113a815db134c7ba1a6d796bfe9c7b5/ |
| | Statistical/process data on economy | Dashboard - Environmental economic accounts of the German States (Statistische Ämter der Länder, 2023a) | https://www.giscloud.nrw.de/ugrdl-dashboard.html |
| Crises in general | Statistical/process data on, e.g., economy, health, labor market, mobility | Dashboard Germany - Visualization of topics such as Covid-19, Ukraine crisis, energy crisis, economy etc. (Federal Statistical Office of Germany, 2023) | https://www.dashboard-deutschland.de/ |
| | Statistical/process data on crisis response plans | IOM - Global Crisis Response Platform (IOM, 2023) | https://crisisresponse.iom.int/dashboard |
| | Statistical/process data on crisis such as battles, violence against civilians, etc. | ACLED "Bringing clarity to crisis" dashboard on human-made crises (ACLED, 2022) | https://acleddata.com/dashboard/#/dashboard |
| | Statistical/process data on crisis-relevant information | ELD-BS - Electronic Situation Dashboard for civil protection in Baden-Württemberg (German State) (Fraunhofer IOSB, 2023) | https://www.iosb.fraunhofer.de/en/projects-and-products/electronic-situation-dashboard-civil-protection.html |
| Other relevant topics | Survey data | GEDA Dashboard on the general health situation in Germany (RKI, 2023) | https://www.rki.de/DE/Content/Gesundheitsmonitoring/Studien/GEDA_Dashboard/GEDA_Dashboard_node.html |

All in all, many visualization tools for crises and disasters have been developed. Most of them integrate statistical process-produced data, such as epidemiological data on infections, vaccinations, and health; data on economy, mobility, labor, or energy; or data on various man-made events, such as violence and war, as listed in *Table 1*. However, survey data has been used less frequently to envision the psychosocial situation in crises and disasters or monitor psychosocial categories, such as perception (risk perception), behavior and coping mechanisms (e.g., protective and help-seeking behavior), individual and social resources (e.g., resilience, social support), risk factors (e.g., sociodemographic and socioeconomic factors), or psychosocial consequences (e.g., safety, stress, depression) (Gerhold et al., 2022; Lüttschwager et al., 2022).

All these approaches provide an excellent means to explore the information spaces concerning statistical and survey data in our domain. Whereas they focus on special aspects or views of the underlying information space, our approach aims to integrate three different, nearly orthogonal views: a statistical interdependencies view, a research and exploration view, and a document library view. The first – a dashboard component – uses well-

known, state-of-the-art visualization techniques to present statistical data. The second view provides a research interface for the semantic retrieval of domain-relevant data, and the third allows for inspecting static, document-oriented artifacts corresponding to our domain.

Thus, by combining different psychosocial data on crises and disasters and making it visible, researchable, and documentable, we want to address a gap in the research because there is – to the best of our knowledge – no such approach. Another, more technical advantage of our system is that it connects its three different components extensively in the backend and frontend design to enable target users to find the processed data they need and use it to support their decision-making in crises. In sum, our concept of the *CIP-PS* responds to the need for a platform that not only visualizes psychosocial data but also makes it possible to research and document information using the three components presented in the next chapter.

## CRISIS INFORMATION PLATFORM FOR PSYCHOSOCIAL SITUATIONS (*CIP-PS*)

### General Concept of the *CIP-PS*

*Figure 1* illustrates the general setup of the "Crisis Information Platform for Psychosocial Situations" (*CIP-PS*). The *CIP-PS* is structured in a matrix that includes three different psychosocial topics and three different information components. The user can click on the three buttons displayed at top left to go to the psychosocial topics of (1) Psychosocial Situation Monitoring in Germany, (2) Help-Seeking Behavior in Crises and Disasters, and (3) Psychosocial Emergency Care. Depending on what psychosocial topic the user wants to look at, three components – namely (1) the dashboard *CIP-DAB*, (2) the research platform (*CIP-REP*), and/or (3) the documentation *CIP-DOC* – appear together on another page.

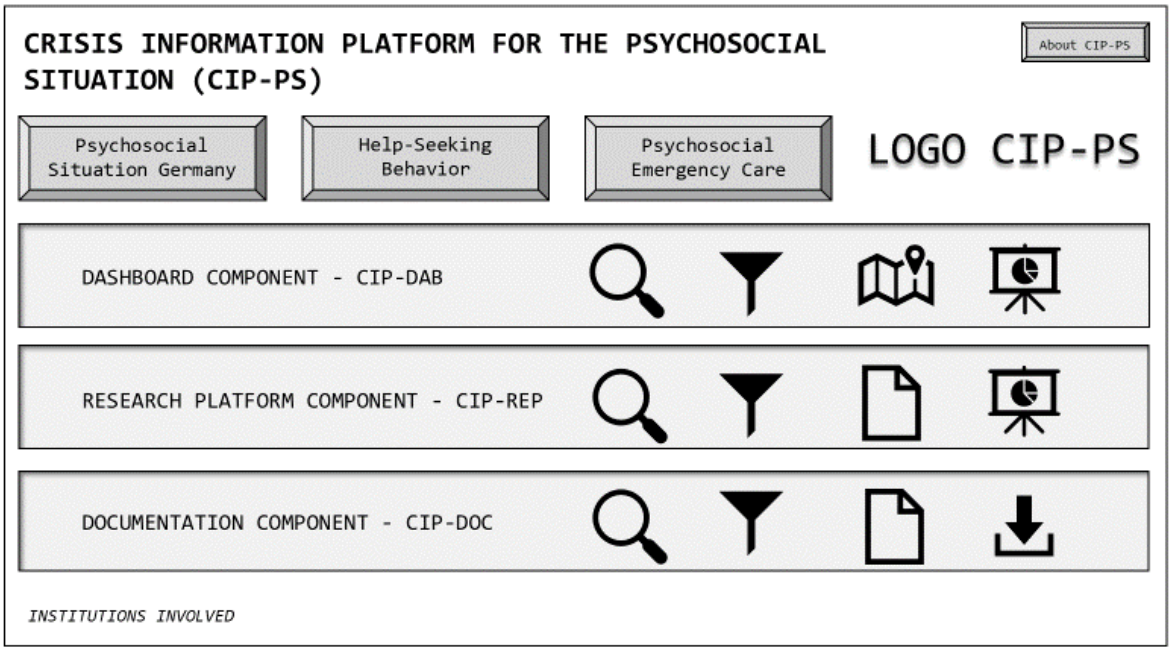


**Figure 1. Structure of the Crisis Information Platform (*CIP-PS*)**

Technologically, the *CIP-PS* platform is designed as a micro frontend. In this type of architecture, the application is composed of several independent micro frontends (dashboards, research platform, and documentation). These individual components are combined in an integration layer. This means that the entire frontend consists of several components that work together independently. The data of each component are pre-processed in a proxy server and mapped into a data structure that matches the specification of each micro frontend.

The *CIP-PS* platform is designed so that the dashboard, the research platform, and the documentation can be deployed separately and individually. The platform is responsive (tablet mode), and a preliminary study ensured that the User Interface (UI) and User Experience (UX) of each sub-component provides the user with their desired information.

The *CIP-PS* platform is conceptualized as a Progressive Web App (PWA). A PWA loads as much as possible of what it needs to work the first time it is called up or installed. As a result, the app can naturally start much more quickly with each subsequent use. In addition, the data that must be called up from the web is retrieved in the background. Thus, the user can continue to work problem-free while the app synchronizes the data. PWAs also work offline. This means that even if you do not have internet access, you can still work with the app, as the PWA is not run on a server like other web apps but directly on the device.

**Table 2. Data integrated into *CIP-PS* by *CIP-PS* component**

| | **Crisis Information Platform for Psychosocial Situations *CIP-PS*** | | | | | |
|---|---|---|---|---|---|---|
| | **Dashboard *CIP-DAB*** | | **Research Platform *CIP-REP*** | | **Documentation *CIP-DOC*** | |
| **Use of content** | Interactive | | Interactive | | Static | |
| **Data upload / data base** | Manual / expandable | | Manual / expandable | | Manual / expandable | |
| **Psychosocial topic** | 1 | Psychosocial situation in Germany | 1 | Psychosocial situation in Germany | 1 | Psychosocial situation in Germany |
| | 2 | Psychosocial emergency care | 2 | Psychosocial emergency care | 2 | Psychosocial emergency care |
| | | | 3 | Help-seeking behavior | | |
| **Data basis, differentiated by psychosocial topic** | 1 | Longitudinal survey data on psychosocial categories | 1 | Questionnaires and codebooks of surveys | 1 | Questionnaires and codebooks of surveys and short reports per survey wave |
| | 2 | Simulated data on psychosocial emergency operation / field protocols and information on German Red Cross psychosocial emergency units in Germany communities | 2 | Documents on psychosocial emergency care (e.g., field protocols, literature) | 2 | Documents on psychosocial emergency care (e.g., field protocols, literature) |
| | | | 3 | Studies in help-seeking behavior in crises and disasters | | |

*Table 2* contains information on the data sources integrated into the three *CIP-PS* components described below.

The *CIP-DAB* is a dynamic, interactive component. It includes information about the psychosocial situation in Germany by implementing longitudinal survey data on psychosocial categories, we collect in several waves of representative population surveys on different crises and disasters. Furthermore, it contains information on psychosocial emergency care field protocols by simulating data on different fictional crises and disasters as well as on psychosocial emergency care units operated by the German Red Cross in German communities (see *Table 2*).

Technologically, this component works with several libraries, such as the Angular chart and leaflet map. *CIP-DAB* can work with a large amount of data. The incident and critical values are highlighted.

The *CIP-REP* is also a powerful, interactive tool that allows users to search the psychosocial data based on ontology and various filters. The data stems from codebooks and questionnaires about psychosocial situation monitoring in Germany to help the user research and find certain variables, question labels, etc. while psychosocial emergency care data contains, for instance, related literature or field protocols. All scientific studies regularly collected and coded as systematic reviews on help-seeking behaviors are implemented in *CIP-REP* to help the user find study results filtered by, e.g., vulnerable group, publication year, or research method.

From the technological viewpoint, the multi-modal conceptual base of *CIP-REP* described above requires a highly integrative component design. We define a unified conceptual model for the different data sources specified in *Table 2* – i.e., questionnaires and codebooks of surveys, documents on psychosocial emergency care, and studies in help-seeking behavior – to avoid redundant information structures and maximize the re-use of common patterns.

The ontology-based search and exploration of the underlying data is an essential feature of *CIP-REP*. Depending on the data source, there are different domain ontologies that represent the specific (controlled) vocabulary of the respective field. The design of representation and matching components for each adapt mature partition techniques from Decker et al. (2005) and ontology matching approaches from Billig et al. (2007). The genericity of this multi-ontology search approach makes it possible to exchange domain ontologies transparently, even for different domains, such as the medical domain (Billig & Krebs, 2014).

Finally, the *CIP-DOC* is a static component that includes data on both psychosocial situation monitoring in Germany and psychosocial emergency care. It serves as an area to download relevant materials, like questionnaires and codebooks as well as short wave reports on psychosocial situation monitoring and standardized psychosocial emergency care protocols for psychosocial emergency care. This component facilitates the rapid download of documents, tables, etc., offering the user a quick overview on certain psychosocial information.

From a technological perspective, *CIP-DOC* must represent and manage all static data relevant to the different aspects listed in the third column of *Table 2*. Arbitrary multimedia artifacts are storable and accessible for download or inspection. Furthermore, the artifacts of *CIP-DOC* play a key role for the ontology concept space utilized within the *CIP-REP* component. Concepts from textual artifacts are extracted to augment the domain ontologies to improve the search and exploration of the underlying data.

In all three components, a designated author has to upload data manually when expanding the data base with further survey waves for the *CIP-DAB*, studies for *CIP-REP* and/or documentation material for *CIP-DOC*.

### Visualizing Psychosocial Indicators Using the *CIP-DAB* Component

To offer a concrete example that illustrates the dashboard component *CIP-DAB*, we show the visualization of the psychosocial indicator "respondents' perceived safety". We surveyed this variable in several representative population surveys in 2020, 2021, and 2022 to monitor its development over time and in different crisis contexts (i.e., Covid-19 and the Ukraine crisis). Then, we computed the aggregated data with a statistical program before implementing it in the *CIP-DAB* using a data-centered approach. Persons cannot be identified, since the data is aggregated and cannot be traced back to individuals.

*Figure 2* shows the concept of the *CIP-DAB* for the psychosocial topic "Psychosocial Situation Germany" at the top left. The *CIP-DAB* has a tripartite structure: the input section on the left, the map section in the center, and the output viewer on the right.

First, users click on the psychosocial topic that interests them (here: "Psychosocial Situation Germany"). Using the input section integrated into the *CIP-DAB*, the user can interactively select the psychosocial indicator of interest (here: "perceived safety") differentiated by wave and risk factors, such as sociodemographic or socioeconomic factors (here: "sex"). Moreover, the last entry shows the statistics the user would like to see in the output section on the right (here: "time series" and "frequencies"). In the center, users can click on a map of the population area of Germany and see the psychosocial indicator for the German states that interest them. We plan to integrate several layers into the map, such as a heat map showing the extent of the psychosocial indicator per state as well as crisis or disaster events occurring in certain German regions (e.g., extreme weather event, flood, heat).

After the user selects all necessary factors in the input section, the viewer (output) window on the right contains the results of these statistics / factors. As time series and frequencies are chosen in *Figure 2*, the first row includes relative frequencies (in percent) of all five values of the "perceived safety" variable, differentiated by the "sex" factor and visualized for waves 1 and 2 (the figure shows only two waves here since four would make it too detailed). The second graph contains a time series of mean values, differentiated by the "sex" factor for all four waves, to illustrate differences in means of perceived safety by sex factor over time. In the future, further statistics will be integrated into the dashboard as controls, such as univariate summary statistics (e.g., mean, median, min, max, standard deviation [SD]), test statistics and bivariate correlations between psychosocial indicators and risk factors dependent on the measurement level (e.g., Pearson and Spearman correlations, Chi-Square test), and confidence interval (CI) plots to observe statistical differences in variables over time, etc. However, to reduce complexity and provide a quick overview for users from aid organizations, authorities, or political decision-makers, the plan is to integrate between five and ten different visual controls to avoid overloading the *CIP-DAB* component. Moreover, we intend to make the data available for secondary use and research according to the highest data protection and anonymization standards. Overall, the dashboard, research, and document view help improve the outcome by linking the data with one another. For example, *CIP-DAB* visualizes survey data that is linked to codebooks and questionnaires in the *CIP-DOC* in case the user wants to access the original survey items we collected from the sample. *CIP-REP* is linked to *CIP-DAB* as well, so that scholars who want to use our data for further research can search and document all survey items including meta data (e.g., question wording, values,

synonyms).

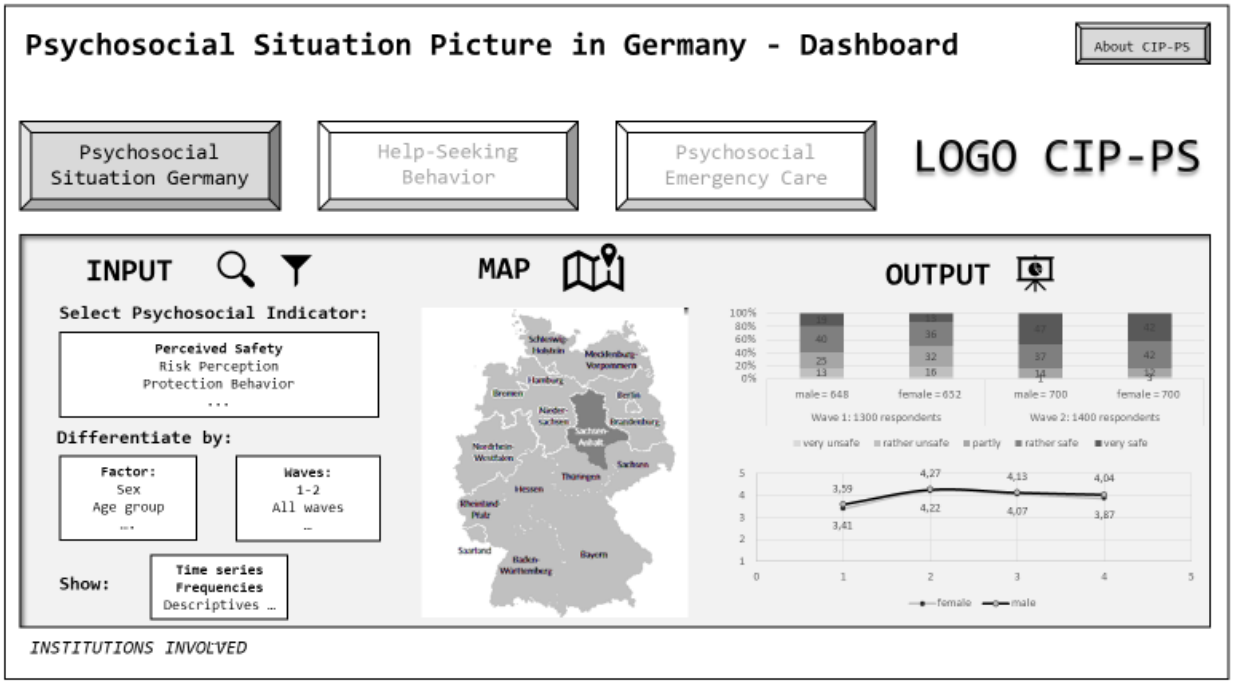


**Figure 2. Visualizing perceived safety using the dashboard component (*CIP-DAB*)**

## USE CASES

As the *CIP-PS* and its components are developed further, its design will be tailored to target user groups, such as decision-makers from aid organizations (e.g., our project partner, the German Red Cross), authorities (e.g., public health institutes like the RKI), and political decision-makers from all levels of government whose work addresses psychosocial situations in crises and disasters. While everyone – including citizens, scholars, and the media – would have access to the platform, it will be tailored to the needs of users whose work directly involves psychosocial situations in crises and disasters**.** The following use cases relate to the dashboard component *CIP-DAB* as presented above. We will discuss two examples in detail to illustrate the use of the *CIP-PS* for disaster management in public healthcare and communication strategies in general as well as for psychosocial emergency care and its evaluation in particular.

Generally, the *CIP-DAB* can help identify vulnerabilities[9] in certain population groups during crisis or disaster events using longitudinal (panel) data collected before, during, and after an event. It can also support public communication strategies. Monitoring survey information on psychosocial indicators of mental health using, e.g., psychologically validated scales can differentiate between these values by typical risk factors like age, sex, or socioeconomic status. Thus, this component serves to inform and support political decision-makers, authorities, or emergency organizations by deriving or improving effective risk or crisis communication strategies for certain population groups. For instance, Gerhold (2020) found that at the beginning of the pandemic, older people rated their likelihood of being affected by Covid-19 as lower – although that population is at higher risk of suffering from serious Covid-19-related health issues (Karagiannidis et al., 2020). As such findings show, monitoring the population can justify evidence-based risk communication strategies that address these population groups to increase Covid-19-related protective behavior, which, in turn, is linked to risk perception (Savadori & Lauriola, 2020).

Helping individuals during or after a crisis or disaster requires psychosocial emergency care, defined as "short-, medium-, and long-term support, counseling, and therapy related to emergency events (e.g., natural disasters,

[9] "*Vulnerability* in general means the susceptibility to injuries and impairments. *Vulnerable* therefore means […] in need of help (German Red Cross (GRC), 2017, p. 7); English translation). Within the context of crises, large-scale emergencies, and disasters, groups of people are considered vulnerable when they are, for various reasons, dependent upon other people on a regular basis and long-term for vital assistance and do not have access to resources for dealing with events (GRC, 2018, p. 9)."

accidents, acts of terrorism, domestic death, sudden infant death)" (Beerlage, 2022; English translation). With the *CIP-DAB*, the user can zoom into certain survey areas (so-called model regions) where aid organizations offer psychosocial emergency care. During the Covid-19 crisis, for instance, single parents and mothers represented a psychosocially vulnerable population group because they faced increased burdens (Zinn & Bayer, 2021). It is possible to identify these groups based on survey data including sex, marital/relationship status, and number of children. Knowing whether these groups have received psychosocial emergency care and surveying relevant psychological indicators in longitudinal data then enables users to analyze differences in psychological values between those who received such care and those who did not. This allows researchers to evaluate the use and effectiveness of psychosocial emergency care over time and to adapt certain strategies to the risk groups' needs.

In sum, the *CIP-PS*, and particularly the *CIP-DAB*, can be used in certain scenarios to monitor the psychosocial situation of the population before, during, and after crises or disasters. However, this paper only focuses on the two examples above to illustrate the use of this platform for specific scenarios.

## CHALLENGES AND LIMITATIONS

The *CIP-PS* offers a way to systematically visualize, research, and document psychosocial information. However, it faces certain challenges and has some limitations, which will be presented in the next sections.

### Challenges

A challenge for the technological development of the system components, especially for *CIP-REP*, is the identification of common patterns within the overall information structure. The results of identification can serve in reusable information substructures. For instance, common concept spaces of the different ontologies need to be identified to use them for the semantic search of the underlying data. The question of how to efficiently and effectively combine several components that work together independently also represents a challenge for the *CIP-PS* as a whole and for its single components, such as the *CIP-DAB*.

Another possible challenge concerns the design and arrangement of the *CIP-PS* elements, which should be tailored to users' needs. The *CIP-PS* and the individual parts of the dashboard component *CIP-DAB*, such as the UI and UX, should be user-friendly, easy to understand, and practical so that users, e.g., decision-makers and crises managers, can get an overview of psychosocial information in crises and disasters and draw evidence-based conclusions. Hence, the structure of the platform and its single components should be as simple as possible and as complex as necessary (Ockham's razor, principle of parsimony), including help texts where required to explain displayed information.

As *Table 2* above shows, different data types are integrated into the single components of the *CIP-PS*. One challenge is to process the data before introducing it into the platform. For instance, the survey data must be prepared before they are sent to the *CIP-DAB* using a data-centered approach, while data on help-seeking and psychosocial emergency care must be summarized in tables including different filters and ontology topics. A second challenge concerns data security and protection. Survey data, for instance, need to be processed and aggregated carefully to guarantee that every respondent is fully anonymous and untraceable. If the survey data is published for secondary use, sensitive information, for example on the respondents' location (e.g., postal code) has to be completely anonymized.

### Limitations

The following limitations are divided into those concerning the psychosocial data used for the *CIP-PS* and general technical limitations of the system and its components.

First, the *CIP-DAB* is a tool which integrates psychosocial data from a limited space and time. For instance, the survey data is online-representative by federal state, age, and sex. While we plan to integrate data from three so-called "model regions" in Germany, including the function of "zooming into" different regions, we cannot differentiate between all small-scale regions and communities in the event of certain disasters, such as a flood (like that of 2021). For the topic of psychosocial emergency care, we will only integrate simulated data on field protocols into the *CIP-DAB*. Due to issues of data security and protection, it is impossible, after crises or disasters, to process real data from people who are addressed in psychosocial emergency care. However, once we have built the intersection for fictional data, we could use real data in a future project if data security and protection is fully assured.

Another limitation is that the dashboard component can only be used for the German context, although crises and disasters and their psychosocial impact on society occur everywhere in the world. To address this issue, a future project should involve an international consortium and data for different countries.

The technical development is currently limited by the fact that the underlying data cannot be "authored" dynamically at system runtime. This concerns the underlying data of the *CIP-REP* component as well as the static data of the *CIP-DOC* component. Artifacts like studies, codebooks, etc. must be added offline. Moreover, if changes within the domain ontologies occur, new versions cannot be imported at runtime.

## CONCLUSION AND OUTLOOK

In this WiP paper, we presented the concept of the "Crisis Information Platform for Psychosocial Situations" (*CIP-PS*). First, we addressed the increasing complexity of crises and disasters and their psychosocial impact, which requires psychosocial information on the population, including the identification of vulnerabilities distributed unequally in society. After presenting the state-of-the-art visualization tools for crisis and disaster contexts, we concluded that a human-centered approach in crisis management requires integrating psychosocial data (i.e., survey data, help-seeking studies, and psychosocial emergency care information) into a public health platform to systematically visualize, research, and document psychosocial information in crises and disasters using a multi-functional information platform: the *CIP-PS*.

To answer the first question of how an information platform should be structured to integrate different types of psychosocial data, we presented the general structure of the *CIP-PS*, which includes three components: (1) the dashboard *CIP-DAB*, (2) the research platform *CIP-REP*, and (3) the documentation platform *CIP-DOC*. These components comprise information on psychosocial topics of (1) the situation picture in Germany, (2) help-seeking behavior in crises and disasters, and (3) psychosocial emergency care.

Then, we turned to the second question of how to integrate survey data and aggregate it into a visualization tool for crisis managers, demonstrating how the dynamic and interactive *CIP-DAB* dashboard visualizes a psychosocial indicator, here "respondent's' perceived safety", over time and for different crisis contexts. We then presented practical implications, discussing how the *CIP-DAB* can help users, such as decision-makers, to draw evidence-based conclusions from psychosocial data visualized in two different crisis scenarios presented on the dashboard.

Since the *CIP-PS* is at an early concept stage, the next steps include developing a first version of the entire platform and its three components as well as collecting and processing the data on the three psychosocial topics. For example, later this year, we will collect survey data to monitor the psychosocial situation in Germany by conducting population surveys in eight waves. We will also process questionnaires and codebooks for integration into the research and documentation platform. Furthermore, we will create potential use cases to focus on users' needs regarding the elements' design and arrangement in the *CIP-PS*.

With respect to technological development, the overall system can be enhanced in numerous ways. First, the interrelations between the data spaces of *CIP-REP* and *CIP-DOC* could be utilized. For instance, search results in *CIP-REP* could be linked to semantically similar artifacts in *CIP-DOC*. Another important feature is an authoring component for the data of all three *CIP* subsystems (*CIP-DAB*, *CIP-REP*, and *CIP-DOC*). While classic Content Management Systems could be used to author documents, the authoring or joint editing of studies, questionnaires, and ontologies requires special tools customized to their structural types. The next step for the *CIP-DAB* includes finding suitable efficient and user-friendly visual controls (packages).

This WiP paper has highlighted the state of the art, the overall concept of our *CIP-PS*, the example of the *CIP-DAB*, and use cases for the system. In future publications, we plan to discuss the theoretical and methodological bases of our concept.

In summary, the "Crisis Information Platform for Psychosocial Situations" (*CIP-PS*) addresses a gap in the research: It combines different psychosocial data on crises and disasters and helps to visualize, research, and document these topics. By creating an overview of the psychosocial situation, it serves as a valuable tool for presenting relevant psychosocial information in the context of disaster public health and healthcare informatics. It thus addresses a gap by combining different psychosocial data on crises and disasters. Another, more technical advantage is that the *CIP-PS* connects its three different components – the *CIP-DAB*, *CIP-REP* and *CIP-DOC* – extensively in the backend and frontend design to make it as easy as possible for target users to find the processed data they need and to use it as a decision-support system in crises and disasters.

## ACKNOWLEDGMENTS

We would like to thank our project partners Eva Steinberger and, Laura Assmann from the German Red Cross as well as our research intern Johanna Ulbricht from TU Braunschweig for their invaluable support in writing this article.

**REFERENCES**


Armed Conflict Location & Event Data Project. (2022). *ACLED Dashboard - ACLED*. https://acleddata.com/dashboard/#/dashboard

Beerlage, I. (2022). *Psychosoziale Notfallversorgung (PSNV)*. https://leitbegriffe.bzga.de/alphabetisches-verzeichnis/psychosoziale-notfallversorgung-psnv/

Billig, A., Blomqvist, E., & Lin, F. (2007). Semantic Matching Based on Enterprise Ontologies. In R. Meersman & Z. Tari (Eds.), *Lecture Notes in Computer Science. On the Move to Meaningful Internet Systems 2007: CoopIS, DOA, ODBASE, GADA, and IS* (Vol. 4803, pp. 1161–1168). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-540-76848-7_76

Billig, A., & Krebs, F. (2014). *Ein wissensbasierter Terminologie-Dienst zur Unterstützung von Konzept-getriebenen E-Health-Prozessen*. https://doi.org/10.24406/publica-fhg-386563

Bonanno, G. A., Brewin, C. R., Kaniasty, K., & La Greca, A. M. (2010). Weighing the Costs of Disaster: Consequences, Risks, and Resilience in Individuals, Families, and Communities. *Psychological Science in the Public Interest : A Journal of the American Psychological Society*, *11*(1), 1–49. https://doi.org/10.1177/1529100610387086

Decker, S., Sintek, M., Billig, A., Henze, N., Dolog, P., Nejdl, W., Harth, A., Leicher, A., Busse, S., Ambite, J. L., Weathers, M., Neumann, G., & Zdun, U. (2005). TRIPLE - an RDF Rule Language with Context and Use Cases. In W3C Technology and Society domain (Chair), *W3C Workshop on Rule Languages for Interoperability, 27-28 April 2005, Washington, DC, USA*. http://www.w3.org/2004/12/rules-ws/paper/98

Federal Ministry of Health. (2023, January 5). *Das offizielle Dashboard zur Impfkampagne der Bundesrepublik Deutschland*. https://impfdashboard.de/

Federal Ministry of the Interior and Community. (2022). *Deutsche Strategie zur Stärkung der Resilienz gegenüber Katastrophen*. https://www.bmi.bund.de/SharedDocs/downloads/DE/publikationen/themen/bevoelkerungsschutz/BMI22017-resilienz-katastrophen.pdf?__blob=publicationFile&v=2

Federal Statistical Office of Germany. (2023). *Dashboard Deutschland*. https://www.dashboard-deutschland.de/

Fraunhofer Institute of Optronics, System Technologies and Image Exploitation IOSB. (2023). *Electronic Situation Dashboard for Civil Protection (ELD-BS) - Fraunhofer IOSB*. https://www.iosb.fraunhofer.de/en/projects-and-products/electronic-situation-dashboard-civil-protection.html

Gerhold, L. (2020). *COVID-19: Risk perception and Coping strategies.* https://doi.org/10.31234/osf.io/xmpk4

Gerhold, L., Stelzmann, D., Sterl, S., & Lüttschwager, N. (2022). *Psychosoziales Lagebild der Bevölkerung während der Corona-Pandemie (LaBeCo) : Abschlussbericht zum BMBF-Forschungsprojekt : BMBF-Fördermaßnahme: "Zivile Sicherheit - Forschungsansätze zur Aufarbeitung der Corona-Pandemie" : Laufzeit des Vorhabens: 01.01.2021-31.12.2021*.

German Red Cross. (2017). *Stärkung von Resilienz durch den Betreuungsdienst: Teil 1:: Wissenschaftliche Erkenntnisse zu Bedingungen für einen zukunftsfähigen DRK-Betreuungsdienst* (Schriften der Forschung Nr. 4). Berlin. German Red Cross (GRC). https://www.drk.de/forschung/schriftenreihe/schriften-der-forschung-band-vi/broschueren-downloaden/

German Red Cross. (2018). *The Vulnerable Group "the Elderly and those Needing Care" during Crises, Large-scale Emergencies, and Disasters. Findings and Possible Solution: Moving toward a Socio-spatial Approach to Civil Protection*. Berlin. German Red Cross (GRC). https://www.drk.de/forschung/schriftenreihe/schriften-der-forschung-band-vi/download

German Red Cross. (2023). *COVID Lage - DRK-Rettungsdienst Rheinhessen-Nahe*. https://drkrheinnahe.maps.arcgis.com/apps/dashboards/2bee57d64d374a1481bfa59cd6ca8027

International Organization for Migration. (2023). *Dashboard | Global Crisis Response Platform*. https://crisisresponse.iom.int/dashboard

Johns Hopkins University. (2023). *COVID-19 Dashboard*. https://gisanddata.maps.arcgis.com/apps/dashboards/bda7594740fd40299423467b48e9ecf6

Karagiannidis, C., Mostert, C., Hentschker, C., Voshaar, T., Malzahn, J., Schillinger, G., Klauber, J., Janssens, U., Marx, G., Weber-Carstens, S., Kluge, S., Pfeifer, M., Grabenhenrich, L., Welte, T., & Busse, R. (2020). Case characteristics, resource use, and outcomes of 10 021 patients with COVID-19 admitted to 920 German hospitals: An observational study. *The Lancet. Respiratory Medicine*, *8*(9), 853–862. https://doi.org/10.1016/S2213-2600(20)30316-7

Lüttschwager, N., Stelzmann, D., Gerhold, L., & Sterl, S. (2022). How Did Corona Crisis Managers in Germany Make Sense of the Psychosocial Situation? *European Journal for Security Research.* Advance online publication. https://doi.org/10.1007/s41125-022-00086-8

Public Health England. (2023). *Wider Impacts of COVID-19*. https://analytics.phe.gov.uk/apps/covid-19-

indirect-effects/

Robert Koch Institute. (2023). *RKI - Dashboard „Gesundheit in Deutschland aktuell“*. https://www.rki.de/DE/Content/Gesundheitsmonitoring/Studien/GEDA_Dashboard/GEDA_Dashboard_node.html

Savadori, L., & Lauriola, M. (2020). Risk Perception and Protective Behaviors During the Rise of the COVID-19 Outbreak in Italy. *Frontiers in Psychology*, *11*, 577331. https://doi.org/10.3389/fpsyg.2020.577331

Schlosser, F. (2021). *Monitor | Covid-19 Mobility Project*. https://www.covid-19-mobility.org/de/mobility-monitor/

Schopp, N., Schüler, C., Tondorf, V., & Schüller, L. (2022). Lagebild Bevölkerungsverhalten für ein effektives Krisenmanagement [Situational Awareness of Public Response for effective crisis management]. *Bundesgesundheitsblatt, Gesundheitsforschung, Gesundheitsschutz*, *65*(10), 1067–1072. https://doi.org/10.1007/s00103-022-03583-2

Statistische Ämter der Länder. (2023a). *Dashboard Umweltökonomische Gesamtrechnungen der Länder*. Arbeitskreis Umweltökonomische Gesamtrechnungen der Länder im Auftrag der Statistischen Ämter der Länder. https://www.giscloud.nrw.de/ugrdl-dashboard.html

Statistische Ämter der Länder. (2023b). *Indikatoren zu den Zielen für eine nachhaltige Entwicklung*. https://experience.arcgis.com/experience/9113a815db134c7ba1a6d796bfe9c7b5/

University of Erfurt. (2022, December 2). *Explorer | COSMO*. https://projekte.uni-erfurt.de/cosmo2020/web/explorer/

Zinn, S., & Bayer, M. (2021). Subjektive Belastung der Eltern durch die Beschulung ihrer Kinder zu Hause zu Zeiten des Corona-bedingten Lockdowns im Frühjahr 2020 [Parents' subjective burden of home schooling their children at times of the Corona-related lockdown in spring 2020]. *Zeitschrift fur Erziehungswissenschaft : ZfE*, *24*(2), 339–365. https://doi.org/10.1007/s11618-021-01012-9