Community-Based Smart City Digital Twin Platform for Optimised DRM operations and Enhanced Community

Disaster Resilience

D2.3

COMMUNITY VULNERABILITY AND CAPACITY ASSESSMENTS

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R = Document, report
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TASK ABSTRACT

Task 2.3: Community vulnerability and capacity assessments [M1-M**5**]
Lead: JOAFG, Participants: PRACTIN, ISPC, KEMEA, CMSA
Community vulnerability and capacity assessments (VCAs) will be carried out and as a participatory process, representatives of all community and stakeholder groups will be involved. Special attention will be given to vulnerable groups since Community-based DRM systems focus on the participation of the community including vulnerable groups and minorities such as women, children, elderly and disabled in order to raise the risk awareness of all individuals and increase the community's capacity as a whole. VC indicators will be developed for all social, economic, physical and environmental, political, cultural factors.

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DISCLAIMER

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LIST OF ABBREVIATIONS

Abbreviation	Definition
AMA	Alliance of Active Women
CBDRM	Community Based Disaster Risk Management
CBRNe	Chemical, Biological, Radiological, Nuclear, and explosives
CDP	Center for Disaster Preparedness
CVO	La centre de veille opérationnelle de la Ville de Paris
DICRIM	Document d'Information Communal sur les Risques Majeurs
DPP	Direction de la Prévention et de la Protection
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
EU	European Union
FWI	Forest Fire Weather Index
GDP	Gross Domestic Product
GDPR	General Data Protection Regulation
GIS	Geographic Information System
HAZMAT	Hazardous Material
INSARAG	International Search and Rescue Advisory Group
IT	Information Technology
MHIM	Multi-Hazard Impact Methodology
NGO	Non-Governmental Organisation
PPRN	Plan de Prévention des Risques Naturels
PPRT	Plan de Prévention des Risques Technologiques
RCSC	Réserve Communale de Sécurité Civile de la Ville
RUSLE	Revised Universal Soil Loss Equation
UK	United Kingdom
USA	United States of America
VC	Vulnerability and Capacity
VCA	Vulnerability and Capacity Assessment

EXECUTIVE SUMMARY

The objective of Task 2.3 "Community vulnerability and capacity assessments" is to assess the vulnerability and capacity against disasters in civilian areas of the two focus regions Paris (France) and Athens (Greece). The community vulnerability and capacity assessment (VCA) was carried out as a participatory process involving community and stakeholder representatives, especially of vulnerable groups such as women, children, elderly and disabled people. Based on the collected data, vulnerability and capacity (VC) indicators were developed for relevant factors (social, economic, physical, environmental, political, and cultural). The indicators were designed to provide ways of quantifying factors that make individuals and communities more vulnerable to disasters or more capable to cope with disasters. This Deliverable serves to present the results of the literature research, the data collection encompassing the VCA, and the derived VC indicators. The formulation of the report was led and compiled by JOAFG, with contributions from PRACTIN, CMSA, KEMEA, and ISPC, and support from the whole consortium.

The State-of-the-Art chapter describes general frameworks and models for VCAs, highlights the importance of community participation, and lists the most relevant hazards as identified in D2.2 as well as groups that are especially vulnerable to these hazard situations. Furthermore, it includes literature on vulnerability assessments conducted in Paris and Athens, as well as nearby regions in France and Greece.

The VCA was separated into a qualitative and a quantitative data collection part, consisting of interviews as well as an online questionnaire. Citizen- and community-stakeholders representing vulnerable groups as well as Disaster Risk Management (DRM) stakeholders from France and Greece with a focus on Paris and Athens were recruited as interview partners and survey participants. In total, seven interviews were carried out and 39 questionnaires were filled out. The results indicate that earthquakes, floods and wildfires are considered the most relevant hazards for the two regions. The most mentioned vulnerable groups were the elderly, people with mental or physical disorder/disability/illness, children, homeless people, and people with low income. Responses concerning inclusion of vulnerable groups in disaster management and disaster education were mixed, but revealed a general demand for more inclusion of these groups in order to increase their capacity and reduce their vulnerability.

Based on these results and further literature research, a set of VC indicators were derived. This led to 21 general vulnerability indicators, including factors that increase vulnerability in all listed hazard situations, such as old age or homelessness. In addition, 14 hazard-specific vulnerability indicators were identified which cover the relevant hazards identified in D2.2. These include indicators such as soil-liquefaction risk (earthquake) and levels of air pollution (heatwaves). The vulnerability indicators were divided into 7 categories: life-stage-related, health-related, social-connection-related, resource-related, exposure-and-protection-related, knowledge-and-awareness-related, and hazard-specific. Finally, 15 capacity-indicators were devised, encompassing capacity-building measures to address each of these seven vulnerability-categories.

1   INTRODUCTION

This part of Work Package 2 focuses on identifying the most relevant hazards that may affect Paris and Athens (T2.1 and T2.2) and identifying those who are most vulnerable to these hazards (T2.3). In D2.1 (Tsaloukidis et al., 2023), different crisis management and Disaster Risk Reduction (DRR) initiatives and policies regarding Attica and Île de France are presented. D2.2 includes a Regional Multi-Hazards-risk data assessment to assess the potential impacts of multiple hazards on a specific area. In distinction to the previous deliverables and literature research, D2.3 focuses on community vulnerability and capacity assessments, with a special focus on vulnerable groups. Relevant definitions, participatory methods, methods for capacity building and empowerment of vulnerable groups are discussed in the State-of-the-Art chapter. Qualitative (interviews) and quantitative (questionnaire) data were collected on Community- and DRM-stakeholders' assessments about local vulnerabilities and capacities. In addition, vulnerability and capacity indicators were also developed for the project's two focus regions.

Vulnerability is a multidimensional concept and for this reason its definition is very complex. Persons are vulnerable not only because of their personal characteristics, but the context and situation also determine whether a person or group is vulnerable. In general, a person or group can be vulnerable for physical, social or economic reasons. When we discuss vulnerability to disasters, we define vulnerable individuals or groups as those who, because of their characteristics - whether physical, social or economic - are more likely to suffer harm in the event of a disaster. In this sense, one of the objectives of D2.3 is to derive which people or groups can be considered especially vulnerable in the identified disaster situations.

Therefore, a first part of the deliverable aims to compare the different profiles of vulnerable people or groups with the most recurrent disaster situations identified in each study area (see D2.2). As expected, based on these outcomes, the hazards in France are not the same as those in Greece, so a risk analysis adapted to each pilot area was carried out in T2.2. For example, while floods are more frequent in France, the most frequent disasters in Greece are storms and sea level rise, although floods are also frequent. Similarly, not all individuals or groups are vulnerable to the same disasters. Certainly, some vulnerability factors increase the likelihood of suffering damage in the event of a disaster more than others, so special emphasis has been placed on analysing which sources of vulnerability are most affected in each case. Overall, it will be possible to take a much more integrated view of disasters and to respond to the needs of as many individuals as possible.

Another relevant point here is the concept of resilience. While there is a large body of literature on community resilience, there has been little attempt to measure or operationalise it (see chapter 2.1). This lack of agreement on how to translate the concept of resilience into a measurable framework creates problems at the implementation, academic and policy development levels. Therefore, one objective of PANTHEON and D2.3 is to develop indicators capable of measuring the resilience of communities in the two pilot regions, covering all relevant social, economic, physical, environmental, political and cultural factors.

Consequently, the second objective of this deliverable is to identify a vulnerability and capacity assessment methodology that should tell who is vulnerable, the degree and source of vulnerability, how households respond to disasters, and what gaps may exist between vulnerability and existing risk management mechanisms. In developing such a mechanism, the participation of affected communities is essential. Their contribution is vital not only because they have specific needs to be met, but also because they have knowledge and family and/or social networks that are extremely useful in coping with a disaster. The conducted study highlights the lack of consideration of vulnerable people/groups in disaster response planning, which is why our participatory approach will be crucial in bridging this gap.

The positive effects of the above are prominent. Overall, it should increase the confidence of vulnerable people/groups and consequently reduce their stress in the event of a disaster. It will also fill any identified gaps in disaster awareness and education for vulnerable populations. Both vulnerable communities and DRM managers will benefit from the work within PANTHEON, as it will encourage the creation of communication channels between both groups. Ultimately, it will reduce the risks, deaths and economic losses that can be caused by natural disasters, with clear benefits for society as a whole.

That said, Chapter 2 is dedicated to the state of the art in vulnerability and capacity assessments (VCAs). This section provides the main definitions, general frameworks and models related to VCA. It also focuses on participatory methods and vulnerability factors in disaster situations. Finally, capacity building is mentioned, with particular emphasis on empowering vulnerable groups, and the specific cases of Paris/France and Athens/Greece are examined. Chapter 3 deals with issues related to the research design, in particular the methodological approach, recruitment process, and analyses conducted during the study. Chapter 4 presents the empirical findings of the research. On the one hand, the qualitative findings from the interviews are described. On the other hand, the quantitative results collected through the questionnaires are also examined. The various indicators developed to measure vulnerability and capacity are summarised in Chapter 5. Chapter 6 presents the limitations encountered during the research and Chapter 7 contains the discussion and perspectives related to the study.

2 STATE OF THE ART OF COMMUNITY VULNERABILITY AND CAPACITY ASSESSMENT (VCA)

In D2.1 (Tsaloukidis et al., 2023), different crisis management and DRR initiatives and policies regarding the Attica and the Île de France region were presented. In the Attica region, this includes the "Development of the Attica Regional Emergency Plan", the "Implementation of the Flood Risk Management Plan", and "Urban Resilience". Urban resilience refers to the ability of a city to withstand and recover from various shocks and stresses, including natural disasters, economic crises, social unrest, and other challenges. Furthermore, some community engagement initiatives that have been implemented in the Attica region were described (e.g. "Seismic Awareness" program; "Civil protection volunteers' program; "Flood Awareness" campaign etc.). In France, the most significant plans and tools for the management of disasters and risks are The Natural Risk Prevention Plan (Plan de Prevention des Risques Naturels, PPRN), The Plan for the Prevention against Technological Risk (Plan de Prevention des Risques Technologiques, PPRT), and the DICRIM (Document d'Information Communal sur les Risques Majeurs). In Paris, civil protection is organised by the department for prevention and protection (Direction de la Prevention et de la Protection, DPP). The municipal civil security reserve of Paris (La reserve communale de securite civile de la Ville, RCSC) also participates in informing the population, and the city is constantly monitored for possible hazards by the operational monitoring centre (La centre de veille operationelle de la Ville de Paris, CVO). The most relevant hazards and the corresponding disaster management plans as well as community-based disaster risk management (CBDRM) platforms and early warning systems were described. Detailed information and links can be found in D2.1 (Tsaloukidis et al., 2023).

Following this, the Deliverable D2.2 (Triantafyllou & Apostolopoulou, 2023) on Regional Multi-Hazards-risk data assessment presents a Multi-Hazard Impact Methodology (MHIM) used to assess the potential impacts of multiple hazards, both natural and human-induced, on a specific area. Various risk and hazard maps were presented.

In distinction to the previous deliverables and literature research, D2.3 focuses on literature regarding community vulnerability and capacity frameworks and models, with special consideration to vulnerable groups. In this context, relevant definitions, participatory methods, methods for capacity building and empowerment of vulnerable groups are discussed. Emphasis was put on finding relevant literature regarding the research areas (and countries) Paris/France and Athens/Greece. To approach the area of community vulnerability and capacity assessment, it is important to clarify basic definitions, especially, the influencing factors and interactions. There is a broad spectrum of different understandings depending on the context and perspectives. The results of literature review to this field are summarised in the following chapter.

2.1 DEFINITIONS

"Vulnerability" is one of the key concepts in disaster research, but it is multidimensional and definitions vary. It can either be seen as a proneness to being hurt or harmed in certain events, or as a measure of or lack of capacity to deal with hazards and withstand damage (McEntire, 2012). The United Nations defines it as "*conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards*" (United Nations General Assembly, 2016, p. 24). One can broadly categorize into *physical vulnerability*, which includes the location of settlements, the construction of buildings, and the use of infrastructure such as dams, and *social vulnerability*, including politics and policy, demographic factors such as age, and economic conditions. These two concepts are interrelated because, for example, economic factors such as income often determine the condition of the buildings in which people live. Vulnerability can be assessed on the level of the individual or

on a group-level, but also on a community- or a national level (McEntire, 2012). In this chapter, we will focus on the social aspects that make individuals or groups of people vulnerable to disaster. In general, certain characteristics like advanced age increase vulnerability, which manifests itself by worse outcomes when disaster strikes, such as higher casualty numbers for people with these characteristics and a lower capacity to recover afterwards (see e.g., Tanida, 1996). However, vulnerability is dynamic, meaning it can be improved by certain measures such as ensuring equal access to risk and disaster communication (Hansson et al., 2020).

A closely related concept is that of "resilience" which refers to the ability to resist and adapt to and recover from the effects of a hazard while still maintaining its essential structures and functions (United Nations General Assembly, 2016). Elements of a resilient community are for instance robust essential services (e.g., health infrastructure) that continue to function in the case of a disaster, sound land-use planning, proper building codes and standards which are enforced, and awareness of its members of risks and risk mitigation. Resilience reduces the human and economic toll of disasters (The National Academies, 2012). The associated term "capacity" describes the "*combination of all the strengths, attributes and resources available within an organization, community or society to manage and reduce disaster risks and strengthen resilience*" (United Nations General Assembly, 2016, p. 12). Capacities can be identified via *capacity assessment* and increased by *capacity development*, which involves measures such as offering trainings, raising financial resources, and developing technological systems to prepare for hazards (United Nations General Assembly, 2016).

The Council of Europe published a document in 2012 (Prieur, 2012) outlining the ethical principles that should be applied in disaster risk reduction and concerning people's resilience. In this guideline, they mention the importance of reducing vulnerabilities linked to gender, social and environmental factors when building resilience. They point out that disasters often affect those in society the most who are already in vulnerable situations, such as homeless people or people with disabilities, and often even serve to increase their vulnerabilities, for instance by threatening their already fragile livelihoods. The Council of Europe therefore calls for special protection of these people in disaster situations as well as building resilience by reducing these underlying vulnerabilities and inequalities in society. This includes protecting the dignity and rights of all people affected by disasters, implementing disaster prevention measures tailored to their already existing vulnerabilities as well as special operational procedures for the evacuation of vulnerable persons, and giving priority first aid and emergency evacuations to the most vulnerable, such as pregnant or elderly people.

Based on this document and other definitions as well as literature research on vulnerability factors in disaster situations, a clear definition for "vulnerable groups" was decided on among the task partners of T2.3 for WP2. "Vulnerable groups" were defined for the PANTHEON project as people with characteristics that put them at higher risk of injury, death, financial or other ruin during or after a disaster situation. Following the identification of relevant hazards in T2.2 (see Chapters 2.4 and 3), which include natural (earthquakes, volcanic eruptions, etc.) as well as man-made (technical accidents, terrorist attacks etc.) hazards, these characteristics can be physical, such as the construction material of the houses that people live in, and social, such as financial means or physical or mental disability. More details on which people are considered vulnerable under this definition can be found in Chapters 2.4 and 3.

The VCA is a method to assess the risks (e.g., health risks, disaster risks), vulnerabilities to those risks, and capacities to cope with those risks in a certain location, the scope of which can reach from the household- to the nation-level. The goal is to collect data that can be analysed to enable planning for and preventing hazards, as well as reducing the identified risks and vulnerabilities and building capacities, so that when hazards strike, their effects are mitigated (IFRC, 1999, 2007).

2.2   GENERAL FRAMEWORKS AND MODELS REGARDING VCA

Vulnerability and capacity assessments (VCAs) should aim to ascertain the extent of vulnerability, to identify the vulnerable, the sources of vulnerability, how households respond to shocks, and the gaps between risks and risk management mechanisms (Hoddinott & Quisumbing, 2003). A VCA can be organised into the following five steps: (1) Scoping out the assignment, (2) facilitating assessment design, (3) conducting the field data collection, (4) conducting data analysis and sense making, and finally (5) reporting and dissemination. For each step, a variety of different tools is available. The necessary actions per step are outlined below (based on a guideline provided by Save the Children, 2018):

1. At first, key questions for the assessment should be determined. In doing so, it is important to identify the type of risks, target groups for VCA, and organisations that are active in the studied area. Furthermore, the envisioned team structure and skill requirements should be evaluated, as well as time and cost requirements.

2. Secondly, existing data and literature by relevant stakeholders on the focus area should be identified and reviewed to detect open questions, known issues, hazards, and risk factors. Data sources could e.g., be governmental surveys, disaster risk assessments, or city and Geographic Information System (GIS) maps. Based on this data, analysis questions should be formulated, which can be consolidated in an assessment matrix. Step 2 also contains the identification of stakeholders, including a plan on how to engage them in the VCA, and possibly an inception workshop.

3. The next step is to collect data in the field. This involves training the team and securing permissions, among other necessary preparation steps. The collected data should include a quantitative/ survey component (e.g., a questionnaire) as well as a qualitative component (e.g., interviews).

4. After the data is collected, it is analysed based on the research questions formulated in step 2. The analysis should reveal the relevant risks, the key challenges and constraints, and vulnerability and capacity overviews for key stakeholder groups. To discuss the findings and potential strategies for increasing resilience addressing vulnerabilities of the studied community, one or more stakeholder workshops can be conducted. The quality of the data should be assessed critically and any limitations of the VCA should be identified.

5. Finally, the main findings should be disseminated, e.g., as part of an assessment report.

The approach of PANTHEON T2.3 is based on these five steps, although only elements related to vulnerability and capacity are addressed in Task 2.3, while for instance hazards were identified in T2.2. The results from the present report will serve as a basis for T2.5 in which a participatory governance model will be developed with workshop partners.

A variety of organisations offer different toolsets for carrying out VCAs in various contexts. The International Federation of Red Cross and Red Crescent Societies (IFRC, 2007) for instance published a list of the following tools:

- review of secondary sources,
- community baseline data,
- semi-structured interview,
- focus group discussion,
- direct observation,

- mapping,
- transect walk,
- seasonal calendar (mostly useful in a rural setting),
- historical profile and visualisation,
- household/ neighbourhood vulnerability assessment,
- livelihood and coping strategies analysis,
- institutional and social network analysis,
- assessing capacity of people's organisations,
- and Venn diagram.

Oxfam (2012) adds assessing the demographic characteristics of the community, gender dynamics, groups within the community, available resources, and hazards in the analysis and depending on the target group, these methods can differ vastly. For example, the Center for Disaster Preparedness's (CDP) framework for including children in disaster assessments includes child-sensitive activities, such as drawing places that the children consider safe or dangerous, and moulding things using clay (Center for Disaster Preparedness, 2007).

VCAs are mainly used in a rural context. In urban settings, certain factors make the implementation of a VCA more difficult. Examples include decreased community cohesion, heightened environmental and societal complexity, less home- or land-ownership, and different priorities. Generally, an urban setting contains not only one community but also a number of sub-groups. In addition, people in cities tend to be less interested in or available for participation in a VCA. As VCAs are inherently community-based methodologies, these factors have to be taken into account and may warrant a less participatory "fast-tracked" approach when working in cities. This may include the use of local organisations such as NGOs as partners to the organisation carrying out the VCA (IFRC, 2011). Many tools such as the household vulnerability analysis and the livelihood analysis depend on data from individual households, which may be impractical to obtain and unrepresentative in an urban setting. The approach of PANTHEON T2.3 follows these models and steps while adapting them to a Western, urban setting with a focus on social vulnerabilities. For this, quantitative data in the form of questionnaires and qualitative data in the form of interviews were collected. More detailed information can be found in Chapter 3.

2.3 PARTICIPATORY METHODS IN VCA

Methods of VCA are participatory, meaning that the communities should be involved not only in the data collection, but also in the decision processes when it comes to implementing policies. The intention of a VCA is to assist people and communities in preparing for hazards while drawing on their own capacities. Therefore, the methodology follows a grassroots or bottom-up approach rather than a top-down approach. Usually, the studied communities benefit directly from a VCA by improving their own understanding of the risks they face and the capacities they possess to deal with these risks. One goal of this approach is identifying problems that the community considers important (e.g., road safety) rather than addressing problems that sound important on paper but may not affect people's lives as much (e.g., floods) (IFRC, 1999, 2007, 2011).

Community members should be involved as much as possible in a VCA. For instance, the community should be involved in gathering initial information through interviewing local social workers or community leaders, in the data analysis or by having them give feedback on written reports, enabling the team to identify and clarify issues while simultaneously empowering the community. Important tools to ensure community participation are focus groups, workshops, interviews, surveys and observations. Devising a seasonal calendar with the help of the community, where certain climatic phenomena as well as festivities can be charted, or coming up with a Venn diagram showing the links or relationships between different parts of a community, may be other participatory activities. The diversity of scopes, target groups, and focus areas

require different approaches. For instance, interviews could be conducted with individual persons or households, in a group, or with key informants such as doctors or teachers (IFRC, 2007). In this project, the latter approach was chosen due to the diversity and size of the two communities in focus – Athens and Paris. It was therefore deemed most appropriate to include the communities on a community representative/ stakeholder level rather than a household level.

Since men and women tend to view their environment differently and have different perspectives on the same topics, it is important to always keep the gender aspect in mind and ensure a balanced gender ratio in all participatory activities. Additionally, children, the elderly, or other people from vulnerable groups may offer unique insights as well (IFRC, 2007). The Hyogo framework for action stipulates that when planning for disaster risk reduction, vulnerable groups as well as gender should be taken into account (United Nations, 2007). Its successor, the Sendai framework for Disaster Risk Reduction, further emphasizes the importance of inclusion and active participation of vulnerable groups (women, children, people with disabilities etc.) in disaster risk reduction, to build their capacities, plan with their special needs in mind, and make use of their existing knowledge and skills (United Nations, 2015). In the past, the needs of vulnerable groups were often overlooked in disaster situations. This can for instance lead to people with limited local language skills or low income being stranded due to a lack of information or means of transportation (Flanagan et al., 2011).

The PANTHEON project therefore includes organisations/people working with vulnerable groups, to make their voices heard and create a technology for risk reduction that is inclusive and succeeds in using as well as increasing the capacities of all members of the community. More detailed information can be found in Chapter 3.

2.4   VULNERABILITY FACTORS IN DISASTER SITUATIONS

When the RMS Titanic sank in April 1912, only about 32% of its over 2,200 passengers and crew survived. The tragedy revealed major inequalities related to socio-economic status: while 62% of passengers travelling first class survived, only 25% of the third class made it safely to shore (Corona, 2015). More than 100 years later, disaster research reveals that poverty is still one of the main factors driving vulnerability to disasters, as well as other factors such as health and age (e.g. Fatemi et al., 2017).

In the literature, one can find different indices for measuring vulnerability. For instance, Jublee and Saikat Kumar (2016) identified eight variables describing socioeconomic and infrastructure related vulnerability in India using a principal component analysis, including the degree of houseless and marginalized population and the access to basic services. Similarly, Scheuer and colleagues (2011) talk about economic, social and ecological risk factors when describing vulnerability to floods in and around the German city of Leipzig. These include elements such as the number of children and elderly people, social and health care related infrastructure, and unemployment rate, in a particular area (Scheuer et al., 2011). Flanagan et al. (2011), focusing on the United States of America (USA), summarize the social vulnerability to any kind of disasters with four factors:

- socioeconomic status (including income, education, etc.),
- household composition/ disability (two-parent or single-parent household, people with disabilities, children and the elderly, etc.),
- minority status/ language (due to the social and economic marginalization of certain ethnic groups and the difficulties for disaster communications related to language skills),
- and housing/transportation (living in poorly constructed houses or mobile homes, overcrowding, no automobile ownership, etc.).

The Council of Europe (n.d.) lists people with disabilities, migrants, asylum seekers and refugees, and children as those most vulnerable to disasters. Throughout the literature, four groups are generally listed as socially vulnerable to disasters: Children, the elderly, people with disabilities, and women. However, while women are often more vulnerable to disaster, sometimes the roles are reversed (see e.g. European Commission, 2022; Sawai, n.d.). In addition, a lack of financial resources is also always understood as a vulnerability factor (e.g. Flanagan et al., 2011; Marshall et al., 2020; Stephens et al., 2007). These groups can be further divided and expanded.

To understand who is particularly at risk, it is important to first understand which kinds of hazards can occur in a focus area (McEntire, 2012). For the project PANTHEON with the focus areas Paris (France) and Athens (Greece), a number of relevant natural and man-made hazards were identified. The natural hazards include earthquakes, volcanoes, tsunamis, landslides, heatwaves, storms, blizzards, floods, droughts, wildfires, and epidemics/pandemics. The identified man-made hazards are technological accidents, cyber threats, CBRNe (chemical, biological, radiological, nuclear, and explosives) malicious acts, and terrorist attacks. These hazards are partly based on a working document by EUR-Lex (2014).

Concerning heat waves for example, the Global Heat Health Information Network (n.d.), the Centers for Disease Control and Prevention (2022) and the United Kingdom (UK) Government (2022) list particularly vulnerable groups (globally, in the USA, and in the UK, respectively). Besides the elderly and the very young, people with underlying health conditions such as cardiovascular disease as well as those taking medication that interferes with the body's regulatory mechanisms (also including some medications for mental illness) are mentioned. Further groups are outdoor workers and those working in civil protection, athletes training outside, health workers wearing protective equipment, pregnant people, people in long-term care facilities or prisons without adequate cooling, marginalized and isolated people, homeless people and people with low income, and people with an inability to adapt (e.g., because of Alzheimer's, being bed bound or otherwise dependant on others). The situation is similar for blizzards and very cold weather, with especially homeless and very poor people, refugees/ migrants as well as the elderly being at risk of dying from the cold (Dearden, 2017). New research shows that women (especially elderly women) are also at increased risk in a heatwave (Folkerts et al., 2022). Farmers are additionally put at risk due to droughts which threaten their livelihoods (Galindo, 2022).

For other natural disasters such as storms (Smith, 2020), tsunamis (Sawai, n.d.), epidemics/pandemics (Gray, 2021; Hutchins et al., 2009) and earthquakes, these groups are similar. In the 1999 earthquake in Taiwan scoring a 7.3 on the Richter scale, women, children under 15 and people over 36, but especially over 65, those with low income and farmers, those with non-mental as well as mental illnesses, physical disabilities, and hospitalisation shortly before the earthquake (being an indicator for individual health status) were at significantly increased risk of dying (Chou, 2004). The World Health Organization (2017) also lists similar groups among those most vulnerable to floods, such as elderly and pregnant people, additionally listing tourists and those with poor flood awareness or limited access to information, as well as people relying on homecare or important medication (which has to be taken into account in case of evacuation) and those with limited mobility. Wildfires and volcanic eruptions, and especially the resulting smoke, pose an additional threat to people with respiratory and cardiovascular diseases (Gudmundsson, 2011; Xu et al., 2020). Landslides on the other hand pose the most threat to unaware people and people not taking protective actions or living in poorly constructed houses, while age and gender are of less importance (Pollock & Wartman, 2020).

CBRNe malicious acts disproportionately affect the same vulnerable groups as natural disasters, such as the elderly, children and those with mental and physical disabilities, due to special needs in evacuation situations and in the aftermath of a disaster (Gouweloos et al., 2014). Concerning occupational technological accidents such as mining accidents, the most at risk tend to be people working in the affected facilities and those

working in disaster emergency service (Jafari et al., 2019). Road accidents are also technological accidents - they lead to approximately 40-50 deaths per million inhabitants per year in Europe. Among these fatalities are disproportionately many young people aged 18-24, men, and elderly people (European Commission, 2022). Concerning cyber threats, surprisingly, people between 20-29 years of age are the most vulnerable to internet fraud, although older adults tend to lose more money per individual (Federal Trade Commission, 2018). The European Commission (n.d.) states that people in public places are the most vulnerable to terrorist attacks.

In cases of evacuations from any disasters, it is particularly important to pay attention to people relying on medication or assistive devices, as they should never be evacuated without them (Pertiwi et al., 2019). It is furthermore crucial to keep diversity in mind when creating shelters, as some people belonging to marginalized groups may have special needs, e.g., when it comes to separation by gender (Gaillard et al., 2017). Lastly, vulnerability not only refers to the direct effects of a disaster, such as fatalities and injuries, but also to longer lasting effects, such as mental health issues. It should be kept in mind that some of those most affected directly (e.g., women, children, ethnic minorities, those with few financial resources, lack of social support, and prior mental health issues) are also at increased risk of suffering from long-term consequences such as mental health issues in the aftermath of a disaster (Mao & Agyapong, 2021).

2.5 CAPACITY BUILDING AND EMPOWERMENT OF VULNERABLE GROUPS

One of the most important steps in building capacities and empowering vulnerable groups is to ensure inclusion of members and representatives of these groups in disaster management. It is important to keep in mind that vulnerable groups are not only in need of special protection, but can also possess unique capacities, such as the gathered knowledge and wisdom of the elderly, or vast social networks in immigrant communities. The inclusion of these groups in disaster management (e.g., in VCAs) helps to ensure that their needs are considered when planning for disasters. At the same time the awareness and understanding of the members of these vulnerable communities about disaster situations will be raised and their own capacities will be utilized (Hilfinger Messias et al., 2012; IFRC, 2007; Pertiwi et al., 2019; Twigg, 2014; United Nations, 2015). Another very important aspect is communication and access to knowledge: to increase or activate one's capacity to prepare for or deal with disasters, information (such as warning messages or trainings for disaster preparedness) is crucial (Adams et al., 2019; Hansson et al., 2020). Enshassi et al. (2019) identified five important factors for successful community involvement in pre-disaster management in Palestine: understanding risk factors, building capacity (in human skills, technology, data, and methods for disaster management), education and knowledge, trust and networks, and awareness of disaster management.

Past research has highlighted the capability of vulnerable groups to participate in disaster management. When Hurricane Katrina hit the Gulf Coast region of the USA in 2005, people of Latin American origin made use of their social networks within the community, e.g., by sharing news with others of Latin American origin with limited English skills and convincing them to evacuate. It was also often within these networks that direct help, such as ways of transportation or places to stay, was found (Hilfinger Messias et al., 2012). Drolet et al. (2015) also researched hurricanes in the USA (Florida) and their impact on immigrant communities, but with a focus on women: They describe the spontaneous formation of a women's group called the Alianza de Mujeres Activas (AMA; Alliance of Active Women) in response to a lack of help by authorities, who distributed food and other resources and provided help to those from the migrant farm-worker community with limited English skills. The AMA continued to operate after the main recovery efforts were over by educating the limited English proficiency community on disaster preparedness. Additionally, they were involved in the creation of two other grassroots movements concerned with disaster response. The authors conclude that to ensure women's empowerment in disaster situations, it is imperative to include representatives of women's organisations in decision-making processes and to foster social networking among women. Another

example of empowering vulnerable groups is the involvement of children in disaster risk reduction: Children and teenagers are commonly creative, idealistic, passionate, and accustomed to working in groups. Schools and other institutions should offer disaster preparedness, response, and recovery activities to educate and empower young people (Pfefferbaum et al., 2018).

An impressive example of what people from vulnerable groups can achieve when given the right resources and information comes from Indonesia: Pertiwi et al. (2019) report on a project including three disabled people's organizations (DPOs). These had the opportunity to lead disaster preparedness programmes, funded by the Disability Rights Fund. Within one year, they managed to organize disaster preparedness trainings for people with disabilities and their families. They collected accurate data on people with disabilities and their living conditions in their respective regions. Furthermore, it was possible to influence policy through data-driven advocacy, include disability advocates in local disaster risk reduction programs, and hold workshops for stakeholders to raise awareness of the specific needs of people with disabilities. At the same time, they were able to break down barriers and reduce stigma in the respective communities. It was concluded that three elements were essential in ensuring the success of the projects: funding, the competence and confidence of organization members, and support from external experts.

2.6   FOCUS COUNTRY/AREA FRANCE/PARIS

The city of Paris lies in the region Île de France in the north-central part of France. The region is home to about 12 million inhabitants. Rough demographic numbers, such as unemployment rates, can be found in a report by the Mairie de Paris, 2018. Several risk assessments have been published recently on this area as well as other areas in France:

Boccard et al. (2018) report that the Île de France region has one of the highest scores of people affected by disasters per area in the country, which is not surprising given the population density of about 1,000 people/km^2. When looking at relative disaster intensity, which factors in population density, the rate of natural disaster declarations is still rather high in this region, but much higher in the southern and south-western part of the country, in the area between Bordeaux and Toulouse as well as around Nizza and Cannes and along the river Rhône. The most common hazard occurring throughout France is that of major flooding, followed by droughts and storms – however, storms generate greater losses. Especially in the Île de France region, a future flooding of the entire region by the river Seine is a serious threat. In his review, Baubion (2015) estimates that such a major flooding event could affect up to 5 million people (with a direct effect on 830,000 people living in the floodplain), causing billions of Euros in damage, as well as affecting the electric grid and sewage plants. In his study on flood vulnerability in Île de France, he reports that dependence on critical infrastructure situated near the river as well as an increased concentration of people in the area and institutional fragmentation have increased the vulnerability of the region since the last major flood in 1910. Existing protective banks and walls along the Seine offer protection against a major flood, but depending on the intensity of the flood, tens to hundreds of thousands of people would still be directly affected, disrupting individual lives as well as the economy. This would result in major job loss among other long-lasting issues, once again disproportionately affecting the most vulnerable in the population. Resilience should be increased by implementing structural measures, as well as building risk knowledge and awareness in the community and among decision-makers. For effective policy implementation, a common vision and appropriate linkages between different levels of flood prevention are needed.

An essay by Keller (2013) on the 2003 heatwave in France highlights the social trends of fatalities. During this time of extreme temperatures, more than a thousand people died in Paris because of the heat, 10% of which were extremely socially isolated people, including the elderly, people living in poverty, those suffering from addictions and those with mental disabilities. More than 80% of those who died were 75 years or older and

many lived in the big cities of France. Many of the deceased lived in so-called *chambres de bonne,* which are the former quarters of domestic servants, situated directly under the roof of a building. The heatwave further led to several other problems, including droughts, a rockslide caused by melting ice, and issues with the power grid. The situation was worsened by a lack of hospital staff and first responders, as many were on holiday during this time.

The Mairie de Paris (2018) reviewed the social, economic and spatial inequalities in Paris leading to challenges in resilience building. They report that housing accessibility, affordability and quality have declined over the last years, and the child poverty rate was at nearly 22% in 2018. Low-income neighbourhoods can mostly be found in the north and northeast of Paris. In 2015 and 2017, Paris was hit by two terror attacks that affected tourism and the economy, after which new security measures were introduced. Important measures to prevent future attacks include strengthening social ties, especially between ethnic groups, and mental health. Climate change and the resulting higher temperatures in the summer pose a threat to public health. Actions against social exclusion are part of the measures to prevent casualties. Furthermore, air pollution poses a threat to the health of the Parisian population, especially the most vulnerable, such as children, the elderly, and people with pre-existing conditions. They also point out that the Seine not only poses risks of flood, but also of droughts, which could affect individual livelihoods as well as agriculture, industry and river operations. This may be of special concern in the future, when climate change will cause such scenarios to be more frequent and more severe. The city of Paris plans to increase its resilience by preparing vulnerable populations. Amongst other measures, this includes setting up community emergency response teams, deploying first aid and risk management trainings, as well as psychological support, creating inclusive neighbourhoods, and involving local communities and stakeholders.

2.7   FOCUS COUNTRY/AREA GREECE/ATHENS

Greece has recently suffered from a financial crisis and the enforced austerity measures, which have led to increased unemployment, poverty, tax evasion, and decreased funding of various institutions involved in disaster management. In addition, more and more people are living in older buildings, which may not be as stable in cases of earthquakes or other disasters. Consequently, social and physical vulnerability have increased throughout Greece (Mavridis, 2018; Papathoma-Köhle et al., 2021). This adds to the challenges posed by the humanitarian crisis, in which of hundreds of thousands of asylum seekers and refugees fleeing to and already residing in the country were and still are involved (International Rescue Committee, n.d.). In addition, climate change causes a substantial increase in the number of wildfires throughout the Mediterranean, a hazard which particularly threatens Athens and the surrounding region due to being one of the most fire-prone regions in Greece. Over the past few decades, numerous devastating wildfires occurred in the region: In the wildfire that hit the Attica region in 2018, more than a hundred people lost their lives (Efthimiou et al., 2020; Karali et al., 2023). Several recent publications have highlighted specific hazard risks and vulnerabilities in and around Athens, which lies in the Attica region in the south of the country at the Saronic Gulf:

Efthimiou et al. (2020) and Karali et al. (2023) provide recent assessments of the wildfire risk in Attica. Karali et al. (2023) tested the Canadian Forest Fire Weather Index (FWI) for estimating fire danger by applying it to the region of Attica: it uses meteorological inputs such as air temperature, relative humidity, and wind speed, in combination with other physical and environmental factors such as the moisture of the forest floor. The authors found that relative humidity and wind speed were good predictors for wildfire occurrence, and generally concluded that the FWI is a useful tool for predicting wildfires in Attica. Efthimiou et al. (2020) on the other hand used the Revised Universal Soil Loss Equation (RUSLE) to assess pre-wildfire vulnerabilities and post-wildfire effects (especially regarding soil erosion) in the Rafina catchment, where the devastating 2018 wildfire took place. The study identified poor spatial planning as well as a lack of firewalls as pre-disaster

vulnerabilities that exacerbated the effects of the fire, leading to the entrapment and death of numerous people. The destruction of buildings and subsequent abandonment of the population led to many people becoming homeless. In addition, many residents suffered long-term health- and financial impacts. Wildfires increase the rate of soil erosion, which can have devastating long-term-effects on the environment. High relief areas and basins (areas with long and steep slopes) as well as areas with sparse vegetation were identified as the areas most prone to soil erosion. Plans for protecting the region from wildfires in the future include the development of mixed forests (including refractory plants such as laurel and beech) and the construction of residential control zones (including the creation of firefighting zones). The authors of the study argue that soil management plans also have to be a crucial component of dealing with the after-effects of wildfires.

Tragaki et al. (2018) researched the coastal hazard vulnerability on the Peloponnese peninsula, which borders and even encompasses a small part of the Attica region. Their assessment focused on the coastal areas, which house a great number of municipal communities as well as ecologically important areas, and the related hazards – storms, sea-level-rises, and flooding. Six variables to measure physical vulnerability (coastal geomorphology, shoreline shifting rate, coastal slope, relative sea-level-rise rate, mean wave height, mean tidal range) as well as six social vulnerability variables (population density, percentage of women, of persons above 65 years of age, of children below 5 years of age, of foreign-born, and of low-educated in the population) were collected, resulting in an index for each vulnerability type. They found that the northern coastal sections were the most vulnerable in terms of geomorphology and coastal slope, but not very vulnerable in terms of wave height, while the areas in the west were the most vulnerable in terms of general physical vulnerability. Socially vulnerable groups are scattered along the coastline, especially in the north-west, the south-west, and the east. Overall, they identified seven municipal communities as the most vulnerable across both indices, which are mostly concentrated in the north-west (Vouprasia, Lechena, Vartholomio, Gastouni, Amaliada, Zacharo, and Elos).

From 2019, a VCA on flooding risk was carried out on the Kalloni Basin on Lesvos Island, using interviews, focus group discussions, problem-solution trees, and questionnaires as participatory tools. The participants were different stakeholders, such as farmers and schoolteachers. During those processes, the participants agreed that topography, land use, and management issues increase flood risks in the area, and a variety of solutions, including building dams and gabion walls and afforestation, were presented and discussed. The project culminated in the conception of the preferred measures, as well as a plan to finance them (Koutsovili et al., 2023).

A 2016 study (Karagiorgos et al., 2016) reported on flash flood risks in four communities (Nea Makri, Oropos, Rafini-Pikermi, and Marathonas) in East Attica, which borders Athens and has coastlines at the South Euboean and the Petalioi Gulf. This region is prone to flash floods due to its geographical setting as well as anthropogenic activities. The authors carried out physical (assessing the resistance of buildings based on available data) and social vulnerability (based on a door-to-door survey of previous flood victims) assessments and summed them up into one index. The tested social vulnerability factors included social networks, post-flood damages and psychological effects, security, and socio-economic and demographic characteristics such as income and age. They found that participants had relatively low motivation to participate in local association, and solidarity within the villages as well as flood preparedness was quite low. It was also found that the villagers rated the dangers of flash floods to their own health (injury, death) and property as rather low, but rated effects on psychological health and stress as more serious. Social vulnerability was moderate, but almost 25% of respondents were unemployed. Overall, the authors concluded that respondents showed high risk awareness and coping capacity, while the risks posed by the hazard itself as well as physical vulnerability were quite low, resulting in a low overall vulnerability score.

Only one year later in 2017, a devastating flash flood hit the town of Mandra in west Attica, costing 24 human lives. This disaster was retrospectively evaluated by the research team around M. Diakakis (2019, 2020), using an unmanned aerial vehicle in combination with ground observations. The flash flood occurred as a result of an intense storm with high amounts of rain falling in a short period of time – geological data showed that events of this magnitude are relatively rare in this region, but climate change might increase their frequency in the future. It was found that the disaster was partly caused by a blockage of culverts by debris that were meant to drain the water masses of the two contributing water channels. Moreover, the presence of buildings and other structures acted as obstructions to the water flow and caused higher water levels in several town areas. The flood caused significant damages to buildings as well as damaging and inundating transportation infrastructure – road surfaces, traffic lights, bridge foundations and other infrastructural elements were affected. This in turn affected the safety of people in vehicles as well as pedestrians and other road users. Human fatalities and injuries mostly occurred within a narrow valley road where victims were swept away within their vehicles. In other areas of the town, people who were indoors or outdoors traveling by foot were most affected. The industrial area of Mandra experienced significant pollution effects while vegetation was mostly affected upstream of the town.

Santamouris et al. (2015) reviewed the impact of heatwaves and the creation of urban heat islands on the historical centre of Athens. Due to the high thermal mass in the densely populated metropolitan areas, the surface temperature in the city is significantly higher than in the surrounding rural areas, especially at night. It was found that the highest discomfort exists during the afternoon hours of the summer months, and that during more than 10% of the warm period of the year, the population suffers from extreme heat stress. Extreme heat can cause a multitude of health problems, from respiratory to cardiovascular problems, which can be fatal – it was found that mortality, especially among the elderly, increases considerably above a threshold temperature of 32.7°C in Athens. Hospital admissions tend to spike one or two days after the most extreme temperature is measured. Urban heat islands mostly develop in the centre and the western parts of the city, and low-income households as well as badly insulated buildings are mostly situated in areas with the most intense heat islands. Possible mitigation measures include the use of cool roofs and pavements, an increase of urban greenery, and the use of special building materials such as reflective coatings.

3 RESEARCH DESIGN

The aim of Task 2.3 of the PANTHEON project was to conduct an assessment of vulnerability and capacity with particular reference to socially vulnerable groups, and to specific hazards. As the project focuses on conditions in the Paris and Athens region a lot of efforts were made to find suitable contacts for data collection in these areas. Due to difficulties in recruiting suitable stakeholders in the capital cities, it was decided to set a broader regional approach, namely France and Greece. To gain insight into this complex web, a cross-sectional mixed methods approach was chosen, in which both quantitative and qualitative data were collected.

The main goal of D2.3 is to identify vulnerable groups and their capacity in dealing with different types of hazards. To approach this, the following research questions should be addressed:

- Step 1: Which vulnerable groups can be identified in relation to the defined regions and hazards?
- Step 2: Which vulnerability and capacity indicators can be formulated regarding social, economic, physical, environmental, political and cultural dimensions?

Based on these research interests an appropriate methodological approach was designed. The following chapters describe relevant definitions, the methodological approach as well as the implementation of the study and the analysis of the data.

3.1 DEFINITIONS

In order to comply with the participatory approach of the project, not only the involvement of community and citizens- but also of DRM stakeholders was crucial for the research design to obtain their expertise and assessment of the situation. Therefore, a definition of these terms or actors is needed.
According to the Grant agreement, and consequently in the research design, these groups include the following actors:

DRM Stakeholders: Civil Protection Authorities, First Responders and emergency services, utilities and infrastructure providers, private companies, media, donors, governmental and policy making authorities

Community and citizen stakeholders: Local communities and citizens, NGOs/associations, charities, informal groups (European Research Executive Agency, 2022, S. 20)

Since this task focuses on community vulnerability and capacity assessment, much effort was put on recruiting community and citizen stakeholders working with vulnerable groups as interview partners and survey participants. These stakeholders can be, for example, school teachers, hospital staff, non-governmental organisation (NGO) and charity workers and, especially, those working at the intersection of vulnerability and disaster management, such as hospital employees responsible for emergency preparedness. Based on the literature research multiple vulnerable groups were identified.

However, whether a person is vulnerable depends strongly on the **hazard.** Therefore, as a starting point, it was crucial to define the main hazards in the two areas of interest (Athens/Greece and Paris/France). The following list was devised in T2.1 and T2.2, and detailed information can be found in D2.1 (Tsaloukidis et al., 2023) and D2.2 (Triantafyllou & Apostolopoulou, 2023):

- Earthquake
- Volcanic Eruption
- Tsunami

- Landslide
- Heatwave
- Storm
- Blizzard
- Flood
- Drought
- Wildfire
- Epidemics/Pandemics
- Technological accident (describes any accident caused by man-made technology, including train accidents, reactor malfunctions etc.)
- Cyber threat
- Terrorist attack
- CBRNe malicious act

As stated in Chapter 2.1, in T2.3 "Vulnerable groups" are defined as people with characteristics that put them at higher risk of injury, death, financial or other ruin in or after a disaster situation. In the first step, different vulnerable groups were identified regarding the narrowed down hazards and based on the literature. When defining the vulnerable groups, special attention was paid to consider the various social, economic, physical, environmental, political and cultural factors in order to reflect these dimensions in the defined groups. Table 1 shows the different vulnerable groups identified in Task 2.3 and the different dimensions they refer to.

Table 1: Vulnerable groups, vulnerability indicators and dimensions

Vulnerable groups	Vulnerability factor/Indicator	Dimensions
People with low income	Financial resources	economic
Children/minors	Age/ability to act, mobility problems	social and physical
Elderly people	Age/ability to act, mobility problems	social and physical
Pregnant people	Pregnancy/physical condition	social and physical
Single parent families with minor children	Parenthood/ role or responsibility and duty of care	social and economic
Homeless people	Financial resources and social involvement, living conditions	social, physical and economic
People with mental disorder/disability/illness	Mental health	social
People with physical disorder/disability/illness	Physical health, mobility problems	physical
Migrants, refugees, asylum seekers	Migration background, language issues	cultural and political

The above-mentioned groups were used in the online survey for single- and multiple-choice questions. As stated before, stakeholders working with these vulnerable groups as well as DRM stakeholders were contacted.

3.2   METHODOLOGICAL APPROACH

The interview guideline was compiled by JOAFG, with valuable input from KEMEA, ISPC, CMSA, THL, and PRACTIN. Questions were partly adapted from Jagnoor et al. (2019), who assessed vulnerability and disaster preparedness in a flood-prone region in Bangladesh. The questions relate to specific safety issues for vulnerable groups such as children and the elderly, the existence of trainings and warnings for the public, as

well as plans for disaster management and risk assessments. The interview guideline was extended by adding questions about the specific role of the interviewee and their organisation in disaster management, the inclusion of people from vulnerable groups in existing decision processes, and collaboration between different organisations involved in disaster management in the region. The focus was on the representation, inclusion and risks of vulnerable groups in the targeted areas. Separate questions were devised for DRM stakeholders, such as firefighters and police, and contacts working in organisations with community-based or vulnerable groups, such as disability rights advocates, doctors and nurses. The final interview guideline was translated into Greek and French via DeepL and then reviewed by native speakers from the consortium and a French partner of JOAFG. The interview guideline can be found in Appendix A.

To collect the quantitative data, a questionnaire was designed and implemented using the LimeSurvey online survey platform (Version 5.6.13+230327). The questions were partly adapted from a report by the Government of Canada (2002) on hazard risk reduction in rural Canada, and a publication by Fekete and Rufat (2023), who conducted a Europe-wide survey on social vulnerabilities to floods and pandemics. These two publications include a set of vulnerability indicators and hazards, some of which were adopted for the questionnaire after searching the literature for the most common hazards and the main socially vulnerable groups (see Chapter 2.4). The final hazards were defined in T2.2 and then provided to the project partners for use in the questionnaire in T2.3. The questionnaire was devised by JOAFG and KEMEA and valuable feedback was given by ISPC, CMSA, THL, and PRACTIN. Additional feedback was given by ENAC on the French translation.

As described before, the most relevant vulnerable groups were identified in T2.3 after several feedback rounds involving all project partners in T2.3. Since some fields of interest as well as the methodological approach overlapped in T2.1, T2.2 and T2.3, it was decided that the questionnaire should cover questions on all three task topics, resulting in a combined questionnaire. The process of designing the questionnaire across Tasks took time, but substantially improved the research instrument. The initial draft of the questionnaire was provided by the task leaders of T2.3 and expanded on by the task leaders of T2.1 and T2.2. It then passed through several feedback rounds among the project partners. The questionnaire was translated into Greek and French. To facilitate the distribution of the survey and to assure compliance with data protection requirements, JOAFG offered to implement the questionnaire as an online survey (in all three languages) using the online survey platform LimeSurvey. Translations were done via DeepL and then proofread by native speakers.

The questionnaire was designed to ask about the occurrence of and preparedness for these identified hazards, related to T2.1 and T2.2. Moreover, it intended to collect information about the dangers to and involvement of the identified vulnerable groups, related to T2.3, as well as to identify any other relevant hazards or vulnerable groups. In its final version, the questionnaire was structured into the following four main parts:

- Basic sociodemographic information and affiliation as well as role in disaster management or within the community,
- Relevant hazards, disaster management and preparedness in the respective region,
- Socially vulnerable groups, their vulnerability in different hazard situations as well as status of and potential for involvement in disaster management and education,
- Feedback on the questionnaire.

To enable conformity with General Data Protection Regulation (GDPR) requirements, the first page of the questionnaire contained a short description of the project as well as an informed consent form (see Appendix

B), which the participants had to agree to, and the last page contained a thank-you message and an email-address for contacting in case of questions (see also D10.2).

The questionnaire listed several hazards described before and possible vulnerable groups in the form of single- and multiple-choice questions derived from extensive literature research (see Chapter 2.4) and discussions among T2.3 contributors. Furthermore, it contained two mandatory filter questions to ensure the quality in data collection: If participants indicated that they were neither active in France nor Greece it was defined as drop out criteria and they received a screen-out message informing them that only participants from Greece and France were needed. Furthermore, the question "Does your organisation play a role in disaster management?" was used to distinguish between stakeholders working in disaster management and other participants. The two groups received slightly differently worded questions, and DRM stakeholders received two additional questions on disaster management. The online questionnaire mostly comprised single- and multiple-choice questions, with the option to add additional information or categories with "others", and it contained a "back" button. Participants could switch between English, Greek and French at any time during the survey and were given the option to pause the survey and resume later. Most questions could be skipped, only a small number were mandatory (e.g., the filter question and the question asking for the region). A printable version of the questionnaire in English can be found in Appendix C. It includes detailed information on dependencies between questions as well as preconditions for answering them which would not be visible in the online version.

The goal was to conduct 10 interviews and collect at least 30 participants for the survey, with roughly balanced numbers of participants from France and Greece, DRM stakeholders and Community and Citizens stakeholders, and men and women.

3.3   RECRUITING PROCESS AND CONDUCTION

Interview partners and survey partners were searched and data was collected from February to April 2023. All task partners as well as members of the consortium contributed to finding interview and survey partners.

To gather information from experts, for the survey and the interviews, organisations working with vulnerable groups, among others, were contacted (see Chapter 3). Contacts for interview and survey partners were shared among the consortium and searched pro-actively by looking for potential organisations online, starting at the end of February 2023. Contacts for potential interview partners were collected among the project partner organisations and shared in a list, on the online platform *box*. To protect anonymity, personal data and contact details were only listed when explicit permission was given by the participant.

For the interviews, convenience sampling was deemed the best approach, as it was believed that acquaintances or previous project partners would be more willing to agree to an interview. Potential interview partners were approached via email with the information that the interview would last approximately 40 minutes. Each project partner in T2.3 was tasked with conducting 2-3 interviews, most of them in oral form via online-conference tools or telephone, and some of them in written form by sending out the interview guideline via email. Oral interviews were preferred, but were often not possible due to time constraints. Before each oral interview, the informed consent form was sent out in their native language or, for DRM stakeholders with very good English skills, in English. People working with vulnerable groups received the informed consent in their native language due to the sensitivity of the groups. If requested by the interviewees, the interview guideline was also sent out (in their native language) before the interview took place so they could better prepare for the interviews. For written interviews, the informed consent as well as the interview questions in English and in their native language were sent out together, with the request to fill out the forms and return them via email.

There were considerable difficulties in finding interview partners from France/Paris as well as organisations/contacts working with the community or vulnerable groups, since none of the project partners in T2.3 were working in this region or in this field and therefore the involved organisations could only provide a small number of relevant contacts. This, in addition to a number of potential interview partners cancelling or not replying, was a major challenge. Half of all people who initially agreed to interviews ended up declining after seeing the questions or the informed consent, culminating in 7 interviews in total, of which half were done in written form. A possible explanation is that people believed that the questions did not fall into their area of expertise after seeing them. In respect to the research interest, the criteria for the sampling were set on a balanced number of participants in the targeted regions, fields of expertise area and gender. In total, the project partners in T2.3 sent out 14 invitations to oral and/or written interviews, which culminated in 4 oral and 3 written interviews. In addition, 140 invitations were sent out for the questionnaire, culminating in 27 fully filled out and an additional 12 partly filled out surveys (Table 2).

Table 2: Number of interview and questionnaire participants recruited for T2.3

	Invitations sent out	Oral interviews	Written interviews	Total
Interviews	14	4	3	7
	Invitations sent out	**Partly filled out**	**Fully filled out**	**Total**
Questionnaires	140	12	27	39

Similar problems were experienced with the questionnaire, with approximately half of those who opened the questionnaire not advancing past the first or second page. However, due to the combined efforts of the whole consortium, the responses to the questionnaire were overall much more numerous than for the interviews, which meant that the target number of 30 responses was reached (39 partly or fully filled out surveys).

Regarding the search for survey participants, each project partner searched online for relevant organisations in the focus areas Paris/Athens. However, it was decided to also contact stakeholders in all of France/Greece to ensure a higher response rate. To have an aligned process and to avoid multiple contacting of survey participants, each project partner was assigned a "field of expertise of organisations" within which they were tasked with finding possible participants. Additionally, all contacted persons were entered into an excel sheet which was accessible on *Box*, to further avoid overlap.

The fields of expertise were the following:

- First responders
- Civil protection organisations/ Governmental and policy making authorities
- Schools
- Disability associations (mental and physical)
- Hospitals
- Organizations supporting/working with women
- Charitable institutions
- Nursing homes
- Organizations working with migrant groups/refugees
- Public authorities/NGOs performing community work/educational work on disaster management (preparation)
- Technology, energy, network providers

Potential participants were contacted via e-mail using a short description of the project and information about the questionnaire (see Appendix D). This e-mail template was adapted according to the vulnerable groups the contacted persons were working with. Furthermore, potential survey partners were collected via

convenience sampling, asking for contacts within the project partners' organisations to reach the final participation of 39 respondents.

3.4   ANALYSIS AND DISTRIBUTION OF WORK

For analysing the interviews, templates were designed to enable comparability in-between different people working on it. The interviews were first analysed by the project partners who had conducted them. Shortened transcripts were created and uploaded to *Box*, and the main results for each answer were summarized into bullet points and entered into the combined excel sheet-template (also on *box*). For both the transcript and the excel sheet, the interview partners were anonymized via acronyms. In a second step, JOAFG interpreted the interview results using both sources.

The questionnaire data was downloaded and cleaned by deleting test runs and empty questionnaires as well as those where people broke off after entering their general data. Incomplete questionnaires were used if usable information about hazards or vulnerable groups was contained, to fully make use of the knowledge and the data that was collected. The data was analysed using descriptive statistics in IBM SPSS V 28.0.0.0 (190) and Microsoft Excel 2016. Results were presented with cross tables and bar charts, always showing the valid percentages. For D2.3, the first part of the questionnaire (general information), the third (related to T2.3) and the fourth part (feedback part) were used, whereas the second part of the questionnaire served as input for D2.2 (Triantafyllou & Apostolopoulou, 2023).

4 EMPIRICAL RESULTS

In this chapter, the qualitative and quantitative results for T2.3 are presented. It must be emphasized that due to the small sample size and the use of convenience sampling, these results are not representative of the population of stakeholders in France and Greece, but they can show a tendency. This chapter is structured into a qualitative part describing the results of the interviews, and a quantitative part containing the analysis of the questionnaires, including descriptive statistics and graphs.

4.1 QUALITATIVE RESULTS

4.1.1 DESCRIPTION OF INTERVIEW SAMPLE

In T2.3, seven interviews were conducted between March 24 and April 14 2023, of which four were done in oral and three in written form. Four of the interview partners were active in France (Nouvelle Aquitaine, South of France, Draguignan and surrounding district – all three regions being situated in the south of France, and Île de France) and three were active in Greece (Athens). Almost half of the interview partners were female, and the age ranged between 45 and 60 years. The interviewees stated that they had been active in their respective organization from 4 years to over 30 years. Most interviewees were from DRM stakeholder organisations in the broadest sense. The professional fields of activity and therefore expertise extend across an international fire brigade, earthquake planning and protection, an engineering school with expertise in disaster management, a risk expert, information technology (IT) administration in a psychiatric hospital, safety advisement in an NGO, and a schoolteacher in a Community and Citizens stakeholder organisation.

Regarding their main responsibilities before a disaster, respondents mentioned conducting trainings with and raising risk awareness of various target groups within and outside of their organisation, including designing tabletop exercises for practitioners and conducting trainings with vulnerable groups such as students and people with disabilities. Their responsibilities also include the conception of school emergency plans, coordination with international organisations, logistics and preparing equipment for first responder organisations, research on natural hazards, providing recommendations for disaster preparedness such as design rules for earthquake-safe buildings, and ensuring operational readiness of local authorities.

During a disaster, some interviewees mentioned their responsibilities as first responders (paramedics and firefighters, search and rescue and emergency medical teams), including coordination with other organisations and local authorities, while others stressed the importance of ensuring the continuing operation of the hospital by maintaining electronic devices and communications, and following school emergency plans.

After a disaster, the responsibilities of the respondents were related mainly to reporting (for first responders) and conducting field surveys and impact assessments, as well as logistics and giving technical assistance to affected people. By stating that their responsibilities included psychological assessments of team members and giving psychological assistance to affected people, interviewees also stressed the psychological impact of disasters.

4.1.2 MAIN HAZARDS AND MOST VULNERABLE GROUPS

When asked about the most relevant hazards in their region, respondents both from Greece and France mentioned earthquakes, floods, landslides and ground movements, cyber threats as well as fires, especially wildfires. Also listed were droughts (in the case of France), and tsunamis (in the case of Greece), as well as migration, an overload of the health system, pandemics, and nuclear risks. Additionally, a respondent who is active in search and rescue operations listed aftershocks, hazardous materials (HAZMAT), risk of collapses,

and extreme weather conditions among the relevant hazards, while another one emphasized the significance of maintaining the safety of information systems for critical infrastructure such as hospitals. It should be mentioned that although earthquake- or volcano-indicated high waves (tsunamis) happen regularly in and around Greece, they are usually of very small magnitude and cause few to no fatalities (WorldData, n.d.). Because of their impact, these events are better categorised as "floods" instead of "tsunamis".

In context of the questions about the most vulnerable groups, respondents highlighted students and children, the elderly and socio-economically disadvantaged, as well as people who are – for different reasons that were not further specified – not sufficiently informed about or trained for existing and newly emerging risks. Also mentioned were people working in search and rescue and people who are close to the rubble (e.g., because of the risk of aftershocks after an earthquake), people closest to the risk (e.g., because their houses are built in a flood area), homeless people, migrants, and refugees, as well as pregnant women, tourists, and people with underlying health conditions. This is largely consistent with findings in the research literature on disaster risk reduction and community resilience, which recommends that vulnerability should be defined as broadly as possible to include a wide range of vulnerable groups (Alexander & Sagramola, 2014; Andharia et al., 2023; Linnell, 2013).

In terms of vulnerability, respondents referred not only to the vulnerability of people, but also to that of infrastructure, by stating that the most vulnerable IT systems in the hospital, the systems that contained sensitive personal data, were those most vulnerable to cyber-attacks due to the value of the data.

When asked about the influence of gender on vulnerabilities and capacities, answers were inconclusive. One interviewee identified men as more vulnerable, because they tend to work in search and rescue, - apparently only considering search and rescue workers and not the direct victims of disasters when answering this question. Another respondent identified women as more vulnerable, arguing that mothers tend to sacrifice themselves for their children, while others replied that they could not see a gender difference regarding vulnerability or capacity to disasters.

Those interviewees working directly with affected communities tended to view the target group they were working with as most at risk and vulnerable; persons working in schools for instance answered that their students were primarily affected, while other respondents claimed that their whole community was affected since every community member had the obligation to apply relevant emergency plans. That some respondents limited their answers to their immediate work environment is most probably since that this is where they obviously have the most knowledge.

4.1.3   RISK ASSESSMENT AND MANAGEMENT OF DISASTERS

Concerning the question about the risk assessments that had already performed in the examined areas, all respondents knew of risk assessments that had been carried out or were currently being carried out. Respondents from France mentioned risk assessments that had been performed specifically for their search and rescue team i.e. for risks of building collapses and risks for the safety and security of their rescue team. More generally speaking, they also stated that regional risk analysis, contingency coverage plans, and "all kinds of assessments for all kinds of hazards" were available. Respondents from Greece (Athens) answered that flood risk maps exist for the area of Athens, that official seismic zonation mapping is available for all of Greece, and that the hospital in which one respondent worked had undergone a risk assessment.

Next, interviewees were asked how their organization is involved in the management of and protection against disasters. Participants from France were involved as firefighters, as educators and consultants which included performing awareness campaigns and trainings, and as researchers producing indicators and data as well as carrying out risk assessments. Respondents from Greece highlighted that they were primarily involved in producing plans and awareness actions in cases of emergency, impact assessments, monitoring

aftershock activity and post-seismic building-inspections after earthquakes, as well as following security policies, audits and disaster recovery plans in the case of the hospital.

In terms of the biggest challenges that interviewees or their organisations faced in disaster situations, the international firefighters from France mentioned a lack of coordination in the first few hours after a disaster hit (e.g., an earthquake). They specified that within the first 48 hours, the priority is to save lives, and that only after the arrival of more specialized personnel, such as International Search and Rescue Advisory Group (INSARAG) teams, sectorisation and coordination is beginning to improve. Another respondent stated that the biggest challenge faced by their region in the south of France were droughts. The risk expert specializing in the Paris/ Île de France region expressed the opinion that the main challenge was a lack of a risk culture – a generally low awareness of risks and consequences in combination with a high population density and the resulting complexity – which makes it difficult to analyse the region. An absence of anticipation and prevention of hazards as well as certain political decisions, i.e., making short-term instead of long-term plans, further worsen the situation. Similarly, one Greek school teacher stated that the biggest challenge at their school was the unpreparedness of both staff and students, and added that teachers should especially receive trainings for disaster situations, which they could then pass on to the students. From the perspective of a French safety advisor active in the region of Draguignan and the surrounding district, the biggest challenge is mobilizing personnel and equipment when disaster strikes, for which there is only very limited time. An expert working on earthquake planning and protection responded that they faced the biggest challenges after seismic events when supporting the affected communities. One respondent working at the hospital in Greece, who had already pointed out the vulnerability of infrastructure, maintained that the biggest challenge was ensuring the continued operation of the hospital without interruption of its services.

4.1.4 SENSITIZATION TO THE NEEDS OF VULNERABLE GROUPS

When asked whether emergency services were sensitised to the needs of vulnerable groups, one interviewee working in a hospital in France stated that they had conducted a study and found that hospitals in their region were adequately prepared for disasters, whereby the aspect of any special needs of vulnerable groups was not addressed in more detail. Other respondents from France emphasized that they did not think emergency services were giving special consideration to vulnerable groups, partly because the identification of certain groups as "vulnerable" is seen as difficult. Likewise, a respondent from Greece discovered that no special services were provided to vulnerable groups, while another one specified that information material was available for the public (only potentially including vulnerable target groups).

The question about special protocols in place to protect vulnerable groups in disaster/hazard situations was only posed to DRM stakeholders, and the interviews revealed that most of the organizations concerned do not make a special effort to address the needs of vulnerable groups. One interviewee from France specialized in search and rescue stated that according to the operation protocol, they did not distinguish between vulnerable and non-vulnerable groups, but that the team was noticeably more motivated when a living child was found under the rubble (e.g., after an earthquake). Another DRM stakeholder from France mentioned that there was a national framework for dealing with all kinds of disasters, which, to his knowledge, did not pay special attention to vulnerable groups. Some respondents answered that their organisations do have specific plans for the behaviour of the staff in cases of natural disasters and emergencies, but that these do not specifically consider any special needs of vulnerable groups. However, one expert in earthquake planning from Athens explained that their organisation provides special material on their website, aimed at prevention, preparedness, and relief for specific vulnerable groups, e.g., people with disabilities.

Concerning the inclusion and representation of vulnerable groups in disaster management, only a few respondents indicated that this aspect is considered in their organizations, for instance by including representatives of vulnerable groups such as people with disabilities in the creation of informative materials.

All the other interviewees either claimed that their organizations did not pay special attention to the inclusion and/or representation of vulnerable groups or that they were not aware of the issue at all.

In general, most respondents seemed to agree that more initiatives are required to address the needs of vulnerable groups. They suggested developing ERASMUS programs to prepare a special project for vulnerable people and claimed that the identification of vulnerable groups and their special needs (i.e., in the case of an earthquake) should be advanced to enhance general awareness on the topic.

4.1.5 PREPAREDNESS FOR HAZARDS AND IMPROVEMENT OF SAFETY

Interviewees were also asked about the hazard/risk-preparedness and level of information of people and especially of vulnerable groups. The search and rescue experts from France gave insights on preparedness in Turkey, as they had recently been active there. It was pointed out that it is important to train local people in first aid and search and rescue, because during the first hours after a disaster hits, it is mostly the locals who have to become active, as the rescue teams need time to arrive. This aspect is also supported by the literature on community responses to environmental crises, which states that is mainly the residents of the affected areas (including first responders) who were the first to react to the emergency events and quickly provide help and assistance (cf. Beldyga, 2022; Linnell, 2013). The respondent from France, who works at an engineering school listed a number of existing programs aimed at training vulnerable people and preparing them for different hazards. Furthermore, it was mentioned that there are mandatory programs for young people to prepare them for terrorist attacks and fires, as well as annual trainings for workers in potentially dangerous industries, such as nuclear power plants. One interviewee mentioned that the main problem regarding preparedness lies in access to information. It was suggested to improve the situation by using mobile phones, mentioned that certain risks such as transportation of dangerous goods would require better trainings, but summarized that overall, standards of education and assessment of training exercises are in place. The risk expert who is active in Île de France mentioned again that preparedness is difficult to achieve due to the lack of a risk culture in the region, and had no further knowledge of any preparedness programs for vulnerable groups. The safety advisor from Draguignan/France stated that there is accurate information at the district and regional level, a scalable risk culture but a lack of risk memory. Concerning vulnerable groups in particular, they mentioned that there are booklets, awareness campaigns, drill tests, and various recommendations available at the district level, but that there are no or too few programs in place to especially prepare vulnerable groups. The experts' suggestions to improve the situation included the creation of a risk culture, education about hazards and risks from a young age, making sure that disaster preparedness and awareness is promoted on a local level, and ensuring media support. A lack of risk culture was emphatically stressed as a problem regarding risk preparedness by interviewees from France, as was the access to accurate information as an important element in ensuring preparedness.

The responses of interviewees from Greece provided a similarly diverse and ambiguous picture of the situation of hazard preparedness across different organisations: The respondent working in earthquake planning and preparedness in Athens believed that people (including vulnerable groups) were prepared well for hazards, because their organisation made sure to also include representatives of these vulnerable groups when creating their informative material. On the contrary, the schoolteacher from Athens stated that the risk preparedness at their school was low, although exercises for fire and earthquakes are obligatory at their school. The IT administrator of the hospital in Athens stated that they were not prepared for hazards at all and mentioned a lack of state preparation programs, adding that actions must be taken on a political level to ensure a nationwide risk-preparedness plan.

When asked how the safety of vulnerable groups in disaster situations could be improved, interviewees suggested more training and sensitisation, as safety for vulnerable groups was low and thus needed improvement, i.e., by improving safety through European cooperation, by implementing territorial

vulnerability reduction policies or by improving knowledge of intervention zones for rescue services and establishing casualty counts with associated postal addresses. It was also suggested to examine and evaluate data on the topic and implement policies accordingly.

4.1.6   COPING STRATEGIES AND ASSISTANCE

When asked about coping strategies which they would recommend for (especially vulnerable) people, most respondents agreed that education, trainings, (simulation) exercises and preparedness actions were paramount. Education was considered important because it strengthens people's self-confidence and encourages them to take action when disasters strike. The cooperation of vulnerable people with civil protection authorities and emergency services was mentioned as a key parameter for enabling direct communication of concerns or special needs. One interviewee stated that vulnerable people should acquire protection equipment and assemble a survival kit, conduct maintenance as a prevision, and gain awareness of the risks and emergency services located in the surroundings. Sensitising, trainings, and clear update information were also mentioned as strategies that work well for coping with crises, while fear and lack of communication with emergency services do not work well.

In terms of the support needed to better help their community and vulnerable groups in disaster situations, it was emphasized that self-improvement of operational forces was needed by receiving trainings on how to approach, educate and interact with people with disabilities, as well as preparedness and prevention actions. As one respondent complained, social services often are completely overloaded with routine work, which is why more manpower, additional financing and more and better equipment was urgently needed. Also, it was suggested that the networks with local people should be strengthened and expanded to be able to better coordinate actions and to more effectively cooperate before, during and after a disaster.

4.1.7   COOPERATION AND EXCHANGE WITH GOVERNMENTAL CRISIS MANAGEMENT AND OTHER SOCIAL SERVICES

Only few respondents indicated that their organisations were in regular exchange with governmental institutions, local authorities or unions of people with disabilities by means of face-to-face trainings, via social media channels or joint meetings. Most respondents, however, reported that there were no exchanges between their own and other governmental and non-governmental organizations and there was also no mention of more exchanges being planned in the future.

To better approach citizens for more effective community disaster management, it was recommended that the government and other agencies should improve their communication channels. One respondent stated that "[…] the channels to target and to reach vulnerable people [are] complex. It is a set of tools, a set of means, a set of actions", and emphasized that the mayor should be included in the communication with vulnerable groups, since „vulnerable groups are generally confident with the mayor at local level […], people trust in their mayors." Another one emphasized the role of schools for disaster preparedness trainings and explained that citizens should be trained from a young age for situations of disasters, so that they become more experienced in reacting to and handling these situations.

4.2   QUANTITATIVE RESULTS

4.2.1   SURVEY SAMPLE

The questionnaire was fully completed by 27 participants and partly completed by 12. Table 3 shows general socio-demographic results for the survey sample, separated by country. A good gender balance was achieved, with nearly 50% of respondents being women. However, there were twice as many respondents from Greece

as from France, with 26 respondents being active in Greece and 13 in France. Participants from France were younger on average and there were more male compared to female participants from France than from Greece. Most participants were active in the regions of Athens/Attica or Paris/ Île de France. Others were active in Draguignan, Orléans, Loire Atlantique (France), Thessaloniki (Greece), and "all of Greece".

Table 3: Socio-demographic questions in % per country (n = 39).

	All (*n* = 39)	**France (*n* = 13)**	**Greece (*n* = 26)**
Gender			
Female	48.6%	33.3%	53.8%
Male	51.4%	66.7%	46.2%
Diverse	0.0%	0.0%	0.0%
No answer (n)	4	4	0
Age in years			
Mean (SD)	44.2 (12.9)	37.3 (12.0)	47.0 (12.4)
Missing (n)	4	3	1
Country			
France	33.3%	100.0%	0.0%
Greece	66.7%	0.0%	100.0%
Missing (n)	0	0	0
City/region			
Athens/Attica	59.0%	0.0%	88.5%
Paris/Île de France	25.6%	76.9%	0.0%
Other	15.4%	23.1%	11.5%
Missing (n)	0	0	0

Results regarding the organisations the participants were working for can be found in Table 4. Results are quite balanced between France and Greece. For both countries, approximately 30% of participants worked for an NGO or other social organisations, and approximately 23% worked for a first response organisation. The average duration of employment for the current organisation is 12.6 years for both countries. Over 60% of participants from both countries stated that their organisation played a role in disaster management, mostly as first responders (in France predominantly as firefighters and in Greece predominantly as paramedics) and in overall management. Of those who stated that their organisation did not play a role in disaster management, none of the participants from France but more than half of the participants from Greece stated that they had professional experience in disaster management. Most respondents from both countries were working as researchers (predominant for respondents from France) or in management (predominant for respondents from Greece) within their organisation.

4.2.2   RESULTS FROM D2.2 - HAZARDS

As stated in Chapter 3.4, the second part of the questionnaire, which covered the hazards in the two regions, was analysed by KEMEA for D2.2 (Triantafyllou & Apostolopoulou, 2023). Most of the respondents in both Greece and France considered earthquakes to be the top risk. This result is consistent with the very high seismicity in Greece. On the other hand, it is surprising since France is a country of relatively low seismicity in Europe. A possible explanation is that due to the devastating earthquake in Turkey and Syria, which happened in February 2023, this kind of disaster was still in the back of everyone's mind.

About half of respondents replied that in their organization, an up-to-date disaster management plan/strategy either exists or is under development. However, the existing plans are not updated very often. For minimising future disaster impact and losses, the organizations focus mainly on training actions for both the public and the emergency services personnel. However, less than 40% of the respondents believe that their organization integrates international or European Union (EU) standards in its operational procedures.

Table 4: Questions regarding the organisation in % per country (n = 39)

	All (*n = 39*)	France (*n = 13*)	Greece (*n = 26*)
Organisation			
NGO or other social organisation	28.2%	30.8%	26.9%
First response	23.1%	23.1%	23.1%
Academia and research	17.9%	23.1%	15.4%
Industry/technology provider	12.8%	15.4%	11.5%
Other[3]	18.0%	7.6%	23.1%
Missing (n)	0	0	0
Years active in organisation			
Mean (SD)	12.6 (10.4)	12.0 (10.6)	12.9 (10.5)
Missing (n)	2	2	0
Does your organisation play a role in disaster management?			
Yes (multiple answers permitted):	61.5%	69.2%	57.7%
First responders – paramedics (% within „Yes")	33.3%	25.0%	36.8%
First responders - fire fighters (% within „Yes")	11.1%	37.5%	0.0%
Municipal services/ providing food, shelter… (% within „Yes")	11.1%	0.0%	15.8%
Overall management (% within „Yes")	22.2%	25.0%	21.1%
Other[4] (% within „Yes")	22.2%	12.5%	26.3%
Missing (n)	1	1	0
No:	38.5%	30.8%	42.3%
Professional experience in disaster management (% within „No")	40.0%	0.0%	54.5%
No professional experience in disaster management (% within „No")	60.0%	100.0%	45.5%
Position in the organisation			
Researcher	31.6%	50.0%	23.1%
Management	21.0%	8.3%	26.9%
First responder	18.4%	8.3%	23.1%
Social worker	2.6%	8.3%	0.0%
Other[5]	26.4%	25.1%	26.9%
Missing (n)	1	1	0

Important findings were received regarding the extent at which the four disaster management phases are addressed by national policies and initiatives. About half of the respondents declared that the prevention phase is addressed only at a "Limited" degree. On the other hand, only one third of the respondents declared that the preparedness phase is addressed at a satisfactory degree by national policies and initiatives. As regards the response phase, more than half of the respondents replied positively to this issue. However, the results about the recovery phase are not encouraging, since a percentage of 37% of the respondents remained "Neutral". In addition, the degree "Great" is missing from the replies received, while about one third of them replied that this issue is addressed only to a "Limited" degree.

The replies received in the question on the main gaps in disaster management preparation and mitigation are quite fragmented, as there is no predominant answer and the responses are spread across 13 different options, with percentages ranging from 3% to 14%. The respondents expressed the opinion that the main gaps in disaster management preparation and mitigation are present in "Training of the public", in "Early

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[3] Other: public authorities = center for security studies, directorate of civil protection (5.1%), other critical infrastructure (2.6%), other (10.3%): directorate of secondary education, Greek red cross, provider of technologies for disaster management

[4] Other: research activities, vulnerability assessments, earthquake and tsunami alerts, local authorities, volunteers in search and rescue, search and rescue

[5] Other: volunteers in charge of international service, director, environmental education coordinator, IT administrator, education

warning systems", as well as in "Prevention of the hazards". About half of the respondents replied that Early Warning System(s) are available in their region. This is consistent with the response of about half of the respondents that their organisations receive notifications for upcoming events through early warning mechanisms, mainly via the emergency number 112 but also from other means of communication including regular cell phone, fax, email, television and radio.

4.2.3 VULNERABLE GROUPS BY HAZARDS

Two questions in the questionnaire were designed to evaluate the most vulnerable groups in different hazard situations. Question 1 was an open question, relating to the top 5 hazards listed in the second part of the questionnaire by the participants, asking them to allocate particularly vulnerable groups to these top 5 hazard situations and give reasons why they considered them to be vulnerable. Question 2 was posed as a matrix (with potential vulnerable groups as rows and hazard situations as columns), where people could select or not select each cell, indicating whether they believed this group to be particularly vulnerable in this hazard situation.

4.2.3.1 Vulnerable groups by top 5 hazards – whole sample

Results for the open question asking participants to list the most vulnerable groups in their top 5 disaster situations can be found in Table 5. It shows the percentages within the listed hazards, with colour-coded cells, following the scheme of *the darker the cell, the higher the percentage of responses*. Since many people answered the ranking questions about the hazards and then did not list any relevant vulnerable groups, and the second question was an open question with several possible mentions, the total number of mentions of hazards does not correspond to the total number of mentions of groups per hazard. Open answers were clustered into categories, with answers making up less than 1% being combined into "Other". As was already found in D2.2 (Triantafyllou & Apostolopoulou, 2023), earthquakes were listed the most often among the top 5 ranked hazards by the combined sample of respondents from France and Greece, with 30 listings in total. This is followed by floods and wildfires, with 26 listings each, and heatwaves (n = 19), epidemics/pandemics (n = 17), storms (n = 15), and technological accidents (n = 10). It should be mentioned that just prior to the collection of the survey data, a devastating earthquake happened in Turkey and Syria, the COVID-19-pandemic was still ongoing, and a tragic train accident took place in Greece, which might have influenced the participants' perception of hazards in Europe. The relatively low listing of heatwaves is surprising, as some of the disasters in the 21st century with the highest death tolls were heatwaves in Europe (statista, 2022). The 2022 heatwave caused many wildfires and heat-related deaths and broke multiple temperature records, especially in France (Livingston, 2022). On the other hand, the low placement of tsunamis confirms that although tsunamis are not rare, they do not pose a significant threat to the two focus regions. Overall, the most vulnerable groups over all these hazards, when counting all mentions, were the elderly with 39 mentions, people with mental or physical disorder/disability/illness (n = 34), and children (n = 21), meaning these are the groups that the respondents consider the most vulnerable in the most relevant hazard situations in their areas. For the three most listed hazards (i.e., earthquakes, wildfires and floods), these three main groups are the same, although people with low income were also mentioned very frequently (9 mentions for these three hazards). "Other" mentions made up a total of 20 mentions and are made up of: active people, animals, companies/industries/institutions, "depends on the kind of epidemic/pandemic", the digitally illiterate, households with many children, households without a private car, lack of cooling, lack of physical endurance, lack of risk awareness or situational awareness, lack of urban planning, middle and upper class, overweight people, people living in basements or ground floors, socially isolated people, tourists, and women, with 1-2 mentions each.

Table 5: Table related to question 1, results shown for the whole sample: "Which people do you think are especially vulnerable in the top 5 hazard situations you identified?", in % per hazard

		Blizzard	CBRNe malicious act	Cyber threat	Drought	Earthquake	Epidemics/Pandemics	Flood	Heatwave	Landslide	Storm	Technological Accident	Terrorist attack	Tsunami	Wildfire	Total namings of the group
Total times the hazard was listed among the top 5		3	4	5	7	30	17	26	19	5	15	10	7	2	26	
Vulnerable groups	People with reduced mobility	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	6.1% (n = 3)	0.0% (n = 0)	2.5% (n = 1)	0.0% (n = 0)	20.0% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	5.9% (n = 2)	3.2% (n = 7)
	Children	0.0% (n = 0)	50.0% (n = 1)	0.0% (n = 0)	100.0% (n = 1)	10.2% (n = 5)	4.3% (n = 1)	10.0% (n = 4)	10.0% (n = 3)	0.0% (n = 0)	10.5% (n = 2)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	11.8% (n = 4)	9.5% (n = 21)
	Elderly	0.0% (n = 0)	50.0% (n = 1)	12.5% (n = 1)	0.0% (n = 0)	16.3% (n = 8)	21.7% (n = 5)	17.5% (n = 7)	23.3% (n = 7)	0.0% (n = 0)	15.8% (n = 3)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	20.6% (n = 7)	17.7% (n = 39)
	Elderly living alone	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	2.0% (n = 1)	0.0% (n = 0)	2.5% (n = 1)	3.3% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	2.9% (n = 1)	1.8% (n = 4)
	General population	0.0% (n = 0)	0.0% (n = 0)	12.5% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	5.3% (n = 1)	25.0% (n = 1)	100.0% (n = 1)	0.0% (n = 0)	2.9% (n = 1)	2.3% (n = 5)
	Homeless people	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	6.1% (n = 3)	4.3% (n = 1)	7.5% (n = 3)	13.3% (n = 4)	20.0% (n = 1)	21.1% (n = 4)	0.0% (n = 0)	0.0% (n = 0)	33.3% (n = 1)	5.9% (n = 2)	8.6% (n = 19)
	Linguistically isolated individuals or communities	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	2.0% (n = 1)	4.3% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	2.9% (n = 1)	1.4% (n = 3)
	People with mental or physical disorder/disability/illness	0.0% (n = 0)	0.0% (n = 0)	12.5% (n = 1)	0.0% (n = 0)	18.4% (n = 9)	17.4% (n = 4)	15.0% (n = 6)	16.7% (n = 5)	20.0% (n = 1)	21.1% (n = 4)	25.0% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	8.8% (n = 3)	15.5% (n = 34)
	Migrants/refugees	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	6.1% (n = 3)	4.3% (n = 1)	5.0% (n = 2)	0.0% (n = 0)	20.0% (n = 1)	5.3% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	33.3% (n = 1)	5.9% (n = 2)	5.0% (n = 11)

People with increased exposure	0.0% (n = 0)	0.0% (n = 0)	12.5% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	3.3% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	2.9% (n = 1)	1.4% (n = 3)
People with low income	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	6.1% (n = 3)	4.3% (n = 1)	7.5% (n = 3)	6.7% (n = 2)	20.0% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	33.3% (n = 1)	8.8% (n = 3)	6.4% (n = 14)
Poor housing quality/ old or insufficient regulations	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	6.1% (n = 3)	0.0% (n = 0)	5.0% (n = 2)	3.3% (n = 1)	0.0% (n = 0)	5.3% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	2.9% (n = 1)	3.6% (n = 8)
Pregnant people	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	6.1% (n = 3)	4.3% (n = 1)	5.0% (n = 2)	6.7% (n = 2)	0.0% (n = 0)	5.3% (n = 1)	25.0% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	2.9% (n = 1)	5.0% (n = 11)
Students	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	2.0% (n = 1)	4.3% (n = 1)	2.5% (n = 1)	3.3% (n = 1)	0.0% (n = 0)	5.3% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	2.3% (n = 5)
Those in special accommodations (hospitals, care homes, prisons…)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	4.1% (n = 2)	4.3% (n = 1)	2.5% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	1.8% (n = 4)
Untrained/ Uneducated (in disasters)	0.0% (n = 0)	0.0% (n = 0)	12.5% (n = 1)	0.0% (n = 0)	4.1% (n = 2)	4.3% (n = 1)	2.5% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	2.9% (n = 1)	2.7% (n = 6)
Workers	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	2.0% (n = 1)	8.7% (n = 2)	2.5% (n = 1)	3.3% (n = 1)	0.0% (n = 0)	5.3% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	2.7% (n = 6)
Other	100.0% (n = 1)	0.0% (n = 0)	37.5% (n = 3)	0.0% (n = 0)	2.0% (n = 1)	13.0% (n = 3)	12.5% (n = 5)	6.7% (n = 2)	0.0% (n = 0)	0.0% (n = 0)	25.0% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	11.8% (n = 4)	9.1% (n = 20)
Total mentions of groups for this hazard	100.0% (n = 1)	100.0% (n = 2)	100.0% (n = 8)	100.0% (n = 1)	100.0% (n = 49)	100.0% (n = 23)	100.0% (n = 40)	100.0% (n = 30)	100.0% (n = 5)	100.0% (n = 19)	100.0% (n = 4)	100.0% (n = 1)	100.0% (n = 3)	100.0% (n = 34)	100.0% (n = 220)

Most respondents only listed vulnerable groups but did not answer the second part of the question asking them for reasons why they considered them vulnerable. Those who did answer this sub-question listed as reasons for increased vulnerability: a lack of knowledge for those uneducated about disasters, and physical vulnerability for the elderly, people with mobility problems, sick people, children, and pregnant people. It was mentioned that earthquake and flood vulnerability is associated with vulnerable living conditions (poor quality housing), difficulties in emergency evacuation (e.g., because of disabilities), and a lack of earthquake/disaster awareness. Low income was stated to cause increased vulnerability to floods, since poor people often lack the resources to prepare for and recover from floods. Wildfire was stated to relate to difficulties in evacuation, lack of risk awareness, and poor situational awareness. Moreover, some mentioned that e.g., a lack of resilient infrastructure and urban planning would mean that the whole population in the area would be vulnerable. Patients in hospitals were listed because they are unable to do many things by themselves and are therefore reliant on others for help. Reduced mobility, mental and physical health problems, and pregnancy were stated to cause possible evacuation problems. Vision and hearing problems were mentioned as part of the reason why people with illnesses or disabilities face heightened risks. One participant mentioned that pregnant people are particularly vulnerable during technological accidents because of potentially toxic substances they could be exposed to. These could be teratogenic, meaning they could cause malformations in the foetus/embryo. Concerning epidemics/pandemics, it was mentioned that people with some diseases (such as cancer) may take medication which compromises their immune system, making them more vulnerable to pathogens. Moreover, people with past diseases were stated to have heightened vulnerability, and hospital staff was deemed vulnerable due to increased pathogen exposure. Immigrants were deemed vulnerable due to their frequent inability to speak the local language. It was mentioned that people with insufficient language skills may struggle to access or understand crucial public health information during an epidemic or pandemic, increasing infection rates among these groups. For cyber-attacks it was mentioned that the digitally illiterate, including older adults who may not have grown up with technology, are particularly vulnerable. This population may be more easily targeted by phishing scams, malware, or other cyber-attacks due to a lack of awareness or understanding of online security practices. People of medium and upper classes were listed as vulnerable to cyber threats due to their increased exposure to various kinds of hardware and software.

The listed categories overlap quite well with the before identified most relevant vulnerable groups, which were based on literature research (see Chapter 2.1) One category which was mentioned relatively frequently (3.2% of all mentions) but was not part of the list are people with reduced mobility, although they are mostly covered by the elderly and people with physical disorders/disabilities/illnesses. Another frequently mentioned factor (3.6% of all mentions) was poor housing quality/ old or insufficient building regulations, which was deemed particularly relevant in earthquake situations. Other notable new mentions include people who are linguistically isolated, the elderly living alone, people with increased exposure to the hazard, students, those in special accommodations such as prisons, those untrained or uneducated in disasters, and workers such as hospital staff (e.g., in pandemic situations), although none of these made up more than 3% of all mentions. Meanwhile, single parent families with minor children, which was a category used in our list, were never mentioned, although households with many children were mentioned once.

4.2.3.2   Vulnerable groups by top 5 hazards – France

In Table 6 the results for France for the open-ended question that asked participants to list the most vulnerable groups of people in their top 5 disaster situations can be found in percentages. Within the respondents' answers from France, the most listed hazards among the top 5 were floods with 9 and drought with 6 listings in total. In Paris, the Seine is an important factor for both of these potential hazards, as it is an important source of water while also regularly causing floods. Certain vulnerable groups who depend on agriculture for their livelihoods are more affected by these two hazards than others. Drought can also have

an impact on the elderly and those with underlying health conditions who may be more susceptible to dehydration and other heat-related illnesses. Furthermore, drought can exacerbate existing socioeconomic disparities by affecting the availability and affordability of food and water resources. Landslides, storms, technical accidents and cyber threats were mentioned with a total of 5 listings per each hazard. Mentioning technical accidents in the top 5 hazards in France may be in heavy correlation with significant impacts on public safety. Vulnerable groups such as people with low income, living near industrial or transportation infrastructure, and individuals with pre-existing health conditions, such as physical disorders/disability/illness, may be particularly at risk. The categories of cyber threat (n=4) and wildfire (n=4) were mentioned slightly less frequently. In sum, among all the responses, the two vulnerable groups of homeless people and migrants/refugees were named the most often (n=7), followed by people with mental or physical disorders/disabilities/illness, mentioned 6 times. This was followed by people with low income (n=5). I.e., these are the groups that respondents believe are most vulnerable in the most relevant hazard scenarios in France. The general population was mentioned (n=3) for hazards such as storm, cyber threat and terrorist attack. The lesser mentions made up a total of four vulnerable groups, such as people with reduced mobility, children, the elderly, poor housing quality/ old or insufficient regulations, with 1-2 mentions for each one.

Table 6: Table related to question 1, results shown for France: "Which people do you think are especially vulnerable in the top 5 hazard situations you identified?", in % per hazard

		Blizzard	CBRNe malicious act	Cyber threat	Drought	Earthquake	Epidemics/Pandemics	Flood	Heatwave	Landslide	Storm	Technological Accident	Terrorist attack	Tsunami	Wildfire	Total namings of the group
Total times the hazard was listed among the top 5		2	3	4	6	4	3	9	4	5	5	5	5	2	4	
Vulnerable groups	People with reduced mobility	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	20.0% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	2.7% (n = 1)
	Children	0.0% (n = 0)	50.0% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	2.7% (n = 1)
	Elderly	0.0% (n = 0)	50.0% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	16.7% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	5.4% (n = 2)
	Elderly living alone	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)
	General population	0.0% (n = 0)	0.0% (n = 0)	33.3% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	20.0% (n = 1)	0.0% (n = 0)	100.0% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	8.1% (n = 3)
	Homeless people	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	33.3% (n = 1)	0.0% (n = 0)	16.7% (n = 1)	0.0% (n = 0)	20.0% (n = 1)	20.0% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	33.3% (n = 1)	33.3% (n = 2)	18.9% (n = 7)
	Linguistically isolated individuals or communities	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)
	Mental or physical disorder/disability/illness	0.0% (n = 0)	0.0% (n = 0)	33.3% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	33.3% (n = 2)	0.0% (n = 0)	20.0% (n = 1)	20.0% (n = 1)	33.3% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	16.2% (n = 6)
	Migrants/refugees	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	33.3% (n = 1)	0.0% (n = 0)	16.7% (n = 1)	0.0% (n = 0)	20.0% (n = 1)	20.0% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	33.3% (n = 1)	33.3% (n = 2)	18.9% (n = 7)
	People with increased exposure	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)
	People with low income	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	33.3% (n = 1)	0.0% (n = 0)	16.7% (n = 1)	0.0% (n = 0)	20.0% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	33.3% (n = 1)	16.7% (n = 1)	13.5% (n = 5)

Poor housing quality/ old or insufficient regulations	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	20.0% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	16.7% (n = 1)	5.4% (n = 2)
Pregnant people	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	33.3% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	2.7% (n = 1)
Students	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)
Those in special accommodations (hospitals, care homes, prisons…)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)
Untrained/ Uneducated (in disasters)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)
Workers	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)
Other	0.0% (n = 0)	0.0% (n = 0)	33.3% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	33.3% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	5.4% (n = 2)
Total namings of groups for this hazard	100.0% (n = 0)	100.0% (n = 2)	100.0% (n = 3)	100.0% (n = 0)	100.0% (n = 3)	100.0% (n = 0)	100.0% (n = 6)	100.0% (n = 0)	100.0% (n = 5)	100.0% (n = 5)	100.0% (n = 3)	100.0% (n = 1)	100.0% (n = 3)	100.0% (n = 6)	100.0% (n = 37)

4.2.3.3   Vulnerable groups by top 5 hazards - Greece

Results for this question regarding respondents from Greece can be found in Table 7. Earthquakes were listed the most among the top five hazards for Greece, with 26 mentions. It is possible that the devastating earthquake in Turkey and Syria, which happened just shortly before the data collection, influenced the participants' perception of this hazard. Wildfires were also listed often with 22 mentions, followed by floods, heatwaves, and epidemics/pandemics. On the other hand, tsunamis and landslides were never listed among the top 5, indicating that the participants did not consider these hazards to be very relevant for Greece/Athens. The vulnerable groups with the most mentions were again the elderly, people with mental or physical disabilities/disorders/illnesses, and children, a trend which can also be seen in the whole sample. Homeless people and pregnant people also received 10 or more mentions each.

In the hazard situation that was deemed the most relevant by the participants - earthquakes - the most mentioned vulnerable groups were also the elderly, people with mental or physical disabilities/disorders/illnesses, and children, while people with reduced mobility, those living in homes with poor housing quality or old or insufficient regulations, and pregnant people were also mentioned quite often. For wildfires, the trend looks similar. This indicates that in Athens and Greece, special precautions should be taken for earthquakes and wildfires, and special attention should be given to the elderly, people with mental or physical disabilities/disorders/illnesses, children, people with reduced mobility, those living in houses with poor housing quality or old or insufficient regulations, and pregnant people. Tsunamis on the other hand did not receive a single mention in the top five hazards, supporting the notion that this kind of hazard is not a priority in the region.

Since floods, heatwaves, and epidemics/pandemics were also deemed quite relevant by respondents from Greece, it is important to take a closer look at the here-mentioned vulnerable groups as well. For floods and heatwaves, homeless people, people with low income, and pregnant people were mentioned quite frequently (2 mentions per hazard), in addition to the usual groups. For epidemic/pandemic situations, workers (i.e. healthcare workers) were identified as an additional vulnerable group, with two mentions. This suggests that particular attention should be given to those groups, in addition to elderly, people with mental or physical disabilities/disorders/illnesses, and children, during heatwaves, floods, and epidemics or pandemics. It should be mentioned that homeless people also fall under other categories mentioned here, as they may sleep in homeless shelters ("those in special accommodations") or old, dilapidated buildings ("poor housing quality/ old or insufficient regulations") and can therefore be considered vulnerable for multiple reasons.

Table 7: Table related to question 1, results shown for Greece: "Which people do you think are especially vulnerable in the top 5 hazard situations you identified?", in % per hazard

		Blizzard	CBRNe malicious act	Cyber threat	Drought	Earthquake	Epidemics/Pandemics	Flood	Heatwave	Landslide	Storm	Technological Accident	Terrorist attack	Tsunami	Wildfire	Total namings of the group
	Total times the hazard was listed among the top 5	1	1	1	1	26	14	17	15	0	10	5	2	0	22	
Vulnerable groups	**People with reduced mobility**	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	6.5% (n = 3)	0.0% (n = 0)	2.9% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	7.1% (n = 2)	3.3% (n = 6)
	Children	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	100.0% (n = 1)	10.9% (n = 5)	4.3% (n = 1)	11.8% (n = 4)	10.0% (n = 3)	0.0% (n = 0)	14.3% (n = 2)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	14.3% (n = 4)	10.9% (n = 20)
	Elderly	0.0% (n = 0)	0.0% (n = 0)	20.0% (n = 1)	0.0% (n = 0)	17.4% (n = 8)	21.7% (n = 5)	17.6% (n = 6)	23.3% (n = 7)	0.0% (n = 0)	21.4% (n = 3)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	25.0% (n = 7)	20.2% (n = 37)
	Elderly living alone	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	2.2% (n = 1)	0.0% (n = 0)	2.9% (n = 1)	3.3% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	3.6% (n = 1)	2.2% (n = 4)
	General population	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	100.0% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	3.6% (n = 1)	1.1% (n = 2)
	Homeless people	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	4.3% (n = 2)	4.3% (n = 1)	5.9% (n = 2)	13.3% (n = 4)	0.0% (n = 0)	21.4% (n = 3)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	6.6% (n = 12)
	Linguistically isolated individuals or communities	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	2.2% (n = 1)	4.3% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	3.6% (n = 1)	1.6% (n = 3)
	Mental or physical disorder/disability/illness	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	19.6% (n = 9)	17.4% (n = 4)	11.8% (n = 4)	16.7% (n = 5)	0.0% (n = 0)	21.4% (n = 3)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	10.7% (n = 3)	15.3% (n = 28)
	Migrants/refugees	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	4.3% (n = 2)	4.3% (n = 1)	2.9% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	2.2% (n = 4)
	People with increased exposure	0.0% (n = 0)	0.0% (n = 0)	20.0% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	3.3% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	3.6% (n = 1)	1.6% (n = 3)
	People with low income	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	4.3% (n = 2)	4.3% (n = 1)	5.9% (n = 2)	6.7% (n = 2)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	7.1% (n = 2)	4.9% (n = 9)

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15
Poor housing quality/ old or insufficient regulations	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	6.5% (n = 3)	0.0% (n = 0)	5.9% (n = 2)	3.3% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	3.3% (n = 6)
Pregnant people	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	6.5% (n = 3)	4.3% (n = 1)	5.9% (n = 2)	6.7% (n = 2)	0.0% (n = 0)	7.1% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	3.6% (n = 1)	5.5% (n = 10)
Students	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	2.2% (n = 1)	4.3% (n = 1)	2.9% (n = 1)	3.3% (n = 1)	0.0% (n = 0)	7.1% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	2.7% (n = 5)
Those in special accommodations (hospitals, care homes, prisons…)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	4.3% (n = 2)	4.3% (n = 1)	2.9% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	2.2% (n = 4)
Untrained/Uneducated (in disasters)	0.0% (n = 0)	0.0% (n = 0)	20.0% (n = 1)	0.0% (n = 0)	4.3% (n = 2)	4.3% (n = 1)	2.9% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	3.6% (n = 1)	3.3% (n = 6)
Workers	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	2.2% (n = 1)	8.7% (n = 2)	2.9% (n = 1)	3.3% (n = 1)	0.0% (n = 0)	7.1% (n = 1)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	3.3% (n = 6)
Other	100.0% (n = 1)	0.0% (n = 0)	40.0% (n = 2)	0.0% (n = 0)	2.2% (n = 1)	13.0% (n = 3)	14.7% (n = 5)	6.7% (n = 2)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	14.3% (n = 4)	9.8% (n = 18)
Total namings of groups for this hazard	100.0% (n = 1)	100% (n = 0)	100.0% (n = 5)	100.0% (n = 1)	100.0% (n = 46)	100.0% (n = 23)	100.0% (n = 34)	100.0% (n = 30)	100% (n = 0)	100.0% (n = 14)	100.0% (n = 1)	100% (n = 0)	100% (n = 0)	100.0% (n = 28)	100.0% (n = 183)

4.2.3.4 *Vulnerable groups by hazards and vice versa (Matrix question) – whole sample*

The following subchapters describe the results for the matrix question "Which of the following groups, in your experience, are especially vulnerable in these disaster situations? Please tick in case you think it applies." for the whole sample. This question was asked as a multiple-choice question, and participants were able to select any boxes where they thought it applied. Per line and per column they were also able to choose the answer "I don't know". A total of 28 participants answered this question, with 8 being active in France and 21 being active in Greece. Both tables contain the same numbers, but the first table respectively presents the results as hazards by vulnerable groups, and the second table respectively presents them as vulnerable groups by hazards. For each column, the three highest percentages are marked in orange, and the lowest percentage is marked in grey. In addition, "I don't know" answers are presented in the first table for each country for space reasons. Since the matrix was split into two questions for the questionnaire, the "I don't know" answers per vulnerable group can have two values, one for the first question and one for the second question – both numbers are presented in the tables.

Below are the results for the whole sample:

A. Per Vulnerable group (Table 8)

1. People with low income

Based on the data provided, people with low income are considered particularly vulnerable to earthquakes, heatwaves, storms, floods, and droughts, with percentages of participants choosing this cell ranging from 60% to 79%. For volcanic eruptions, tsunamis, and landslides, the percentage is lower, ranging from 28% to 34.8%. Responses were generally lower for the man-made disasters, with percentages ranging from 14.3-36.4%.

2. Children/minors

Looking at the data, we can see that children/minors are considered particularly vulnerable to several types of disasters by the respondents of the questionnaire. For earthquake scenarios, 81.8% of participants selected children/minors as particularly vulnerable. Similarly, for volcanic eruptions, 55.0% selected children/minors, and for tsunamis, 61.9%. For floods and blizzards, children/minors also have a high percentage of selection, with 75.0% and 54.2% respectively. On the other hand, droughts and cyber threats have the lowest selection rate, with only 40.9% and 23.8% respectively. Overall, the data suggests that children/minors are considered a particularly vulnerable group during disasters by participants from France and Greece, and disaster response efforts should take this into consideration to provide adequate support and assistance to this group.

3. Elderly people

The highest percentages of elderly people selected were for earthquakes (83.3%), heatwaves (85.2%), and droughts (70.8%). The lowest percentages were for cyber threats (21.7%), CBRNe malicious acts (30.4%), and terrorism attacks (37.5%). It is important to note that elderly people are often more vulnerable to disasters due to physical limitations, chronic health conditions, and social isolation. This data highlights the need for disaster preparedness and response plans that consider the unique needs and vulnerabilities of elderly populations.

4. Pregnant people

For pregnant people, the highest percentage of selection is for heatwaves (80.0%), followed by earthquakes (81.8%), drought (68.2%), and wildfires (65.2%). Tsunamis, volcanic eruptions, and terrorism attacks have a relatively lower percentage of selections for pregnant people. It is important to note that pregnant people are a vulnerable group in natural disasters and other emergency situations, and they may require special care

and attention to ensure their safety and the safety of their unborn child. Emergency preparedness plans should take this into consideration.

5. **Single parent families with minor children**

Earthquakes are a significant concern for single-parent families with minor children, with 83.3% of the respondents reporting that this group is disproportionately affected by them. Volcanic eruptions, tsunamis, and landslides were also selected by over 50% of the respondents. Epidemics/pandemics are also reported by 70% of the respondents as a concern, and technological accidents, cyber threats, and CBRNe malicious acts are all reported by at least 10% of the respondents. Terrorism attacks are reported as a concern by 35% of the respondents.

Overall, the data suggests that the survey participants from France and Greece believe that single-parent families with minor children are significantly affected by a wide range of crises, both natural and man-made. The high percentages reported for earthquakes and volcanic eruptions suggest that geographical location may play a role in the types of crises that these families are most vulnerable to. The high percentages reported for heatwaves, storms, floods, and wildfires suggest that climate change may also be a factor in the types of crises that these families face. Finally, the percentages reported for epidemics/pandemics, technological accidents, cyber threats, CBRNe malicious acts, and terrorism attacks suggest that these families may be particularly vulnerable to the effects of man-made crises as well.

6. **Homeless people**

Homeless people are considered to be disproportionately affected by almost all types of disasters, with the highest selection rates being for heatwaves, storms, blizzards, floods, and droughts. Homeless people were selected less frequently for the hazards of earthquakes, volcanic eruptions, and tsunamis, but still received over 40% for these disasters. Homeless people were also frequently selected to be particularly vulnerable to epidemics/pandemics, wildfires, and terrorism attacks, with more than 60% responses in each of these categories. The responses for technological accidents, cyber threats, and CBRNe malicious acts were relatively low, with less than 25% impact in each category. Overall, the data suggests that homeless people are considered among the most vulnerable populations during disasters and emergencies, and there is a need for special attention and support to address their unique challenges and needs.

7. **People with mental disorder/disability/illness**

For people with mental disorder/disability/illness, the data shows a relatively high percentage for almost all of the listed hazards. Earthquakes have the highest percentage at 85%, followed by wildfires and epidemics/pandemics at 77.3% and 73.9% respectively. The hazards with the lowest percentage of selection are cyber threats and CBRNe malicious acts at 18.2% and 28.6% respectively. It is important to note that this population may face unique challenges in preparing for and responding to emergencies, such as difficulty accessing information or physical barriers to evacuation. Emergency planners should consider these factors and work to ensure that emergency plans and response strategies are inclusive and accessible for all individuals, including those with mental disorders, disabilities, or illnesses.

8. **People with physical disorder/disability/illness**

The highest percentage of selections for this group is in the range of 52.4% to 90.5%. The disasters that were selected the most for this population are earthquakes, landslides, floods, and blizzards.

In contrast, cyber threats and CBRNe malicious acts received the lowest percentage for this population at 27.3% and 28.6% respectively. Terrorism attacks also received a relatively low percentage at 47.8%.

9. Migrants, refugees, asylum seekers

For the group of migrants, refugees, and asylum seekers, the highest percentage of respondents allocate vulnerability to heatwaves (69.6%) followed by storms (72.7%). Respondents also indicated the vulnerability of this group to floods (59.1%), landslides (59.1%), earthquakes (60.0%), and tsunamis (50.0%). For droughts and wildfires, the selection rate for this group is moderate with 66.7% and 65.2% respectively. For epidemics/pandemics, the percentage is relatively low with 39.1%. Regarding human-made disasters, this group is considered to have a relatively low vulnerability to technological accidents, cyber threats, CBRNe malicious acts, and terrorism attacks, with percentages ranging from 18.2% to 43.5%.

B. Per hazard (Table 9)

1. Earthquakes

The results presented show the percentage of mentions of various demographic groups who are considered to be particularly vulnerable to earthquakes, with percentages of participants indicating this ranging from 54.5% to 90.5%. People with physical disorders, disabilities, or illnesses have the highest percentage at 90.5%, indicating that they are considered the most vulnerable group to the impacts of earthquakes. This could be due to the challenges they face in evacuating or finding shelter during an earthquake, as well as the increased risk of injury or harm during seismic activity. Elderly people, pregnant people, children/minors, and single-parent families with minor children were mentioned by a high percentage of respondents of 83.3% or higher. These groups are likely to have specific needs or vulnerabilities that need to be addressed during and after an earthquake, such as access to medical care or child care. People with mental disorders, disabilities, or illnesses were mentioned by 85.0% of respondents. This group may also have specific needs, such as access to medication or counselling services that may be disrupted or interrupted by an earthquake. People with low income and migrants, refugees, and asylum seekers have selection percentages of 79.2% and 60.0%, respectively. These groups may be disproportionately impacted by earthquakes due to underlying socioeconomic factors, such as lack of access to resources or inadequate housing. Homeless people have the lowest percentage at 54.5%. This could be due to their lack of permanent housing or possessions, which may make them less susceptible to certain impacts of earthquakes. However, it is important to note that they are still vulnerable to harm or injury during seismic activity, and may face additional challenges in accessing resources and shelter after an earthquake. Overall, these results suggest that all of the listed demographic groups are considered vulnerable to the impacts of earthquakes by the experts participating in this survey, and that addressing the specific needs of these groups is important in earthquake preparedness and response efforts.

2. Volcanic Eruption

These results show the percentage of various demographic groups who are impacted by volcanic eruptions, with percentages ranging from 33.3% to 61.9%. Elderly people have the highest percentage at 61.9%, indicating that they are considered particularly vulnerable to the impacts of volcanic eruptions. This could be due to factors such as mobility limitations, underlying health conditions, and lack of access to resources or evacuation options. Children/minors and pregnant people have percentages of 55.0%, which may reflect their vulnerability due to developing immune systems and physical limitations. Single-parent families with minor children have a percentage of 52.9%, indicating that they are also vulnerable and may face additional challenges in evacuation and recovery efforts.

People with physical disorders, disabilities, or illnesses were mentioned by 57.9% of the respondents. This group may be particularly vulnerable due to challenges in mobility, access to medical care and medications, and other factors related to their conditions. People with mental disorders, disabilities, or illnesses were mentioned by 52.6%, indicating that they too are vulnerable and may require specific accommodations and

support in evacuation and recovery efforts. People with low income and migrants, refugees, and asylum seekers have percentages of 33.3% and 36.8%, respectively. These groups may be particularly vulnerable due to lack of access to resources and information, and inadequate housing or evacuation options. Homeless people have a percentage of 42.1%, indicating that they are also vulnerable to the impacts of volcanic eruptions. They may face additional challenges in accessing resources and shelter during and after an eruption.

Overall, these results suggest that certain demographic groups are considered more vulnerable to the impacts of volcanic eruptions than others, and that addressing the specific needs of these groups is important in preparedness and response efforts. The results also suggest that there may be some similarities between the demographics impacted by earthquakes and those impacted by volcanic eruptions, but the assessments of vulnerability for these groups are generally lower for volcanic eruptions. A possible explanation is the relative rarity of volcanic eruptions in Greece and France, and therefore a certain lack of knowledge among the respondents.

3. Tsunami

Children/minors and elderly people were both selected in a majority of cases, with 61.9% and 60.9% respectively. People with physical disorder/disability/illness had the highest percentage of any group selected for tsunami, with 60% of respondents indicating that this group is particularly vulnerable. Pregnant people and migrants, refugees, asylum seekers had the lowest percentages of any group at 54.5% and 50% respectively. People with low income and homeless people had relatively low percentages compared to other groups, with 34.8% and 47.6% of respondents.

Overall, the percentages suggest that certain vulnerable groups are considered more likely to be affected by a tsunami, particularly children, elderly people, and those with physical disabilities or illnesses. However, the impact on other groups, such as pregnant people and migrants, may be lower. It should be mentioned that tsunamis, although identified by the participants as affecting some of these groups in particular, might not be a relevant hazard for the regions of Paris and Athens. Several catastrophic tsunami events have been reported in the Mediterranean sea surrounding Greece in the last millenia (Karkani et al., 2021; Papadopoulos et al., 2014), however altogether, Greece is affected by relatively few tsunamis and these are mostly small events with few or zero casualties (WorldData, n.d.). These data may therefore be seen as out of scope or be combined with the data on floods, which are a much more frequent hazard (see e.g. Karagiorgos et al., 2013).

4. Landslide

The Landslide results regarding the vulnerability of the various groups show that: People with physical disorder/disability/illness are the most selected group with 72.7%. Elderly people and people with mental disorder/disability/illness also have a relatively high percentage, with 60.0% and 63.6% respectively. Pregnant people also have a relatively high percentage at 58.3%. Children/minors and single parent families with minor children are also considered vulnerable with 52.2% and 55.0% respectively. People with low income and homeless people have a relatively lower percentage of selection at 28.0% and 43.5% respectively. Migrants, refugees, and asylum seekers have a moderate percentage at 59.1%.

Overall, landslides were indicated to have a significant impact on people with physical and mental disabilities/disorders, the elderly, pregnant women, and families with children. It is also worth noting that people with low income and homeless people were not selected as often compared to other disaster types, such as earthquakes and tsunamis.

5. Heatwave

Based on the percentages, the elderly population was indicated as the most vulnerable group during a heatwave, with 85.2%. Pregnant people and people with low income were also selected often, with 80% and 66.7% respectively. Homeless people, people with mental disorder/disability/illness, and migrants, refugees, asylum seekers also have high selection percentages, with 72.0%, 69.6%, and 69.6% respectively. Children/minors and single parent families with minor children have relatively lower percentages, with 52.0% and 57.1% respectively. People with physical disorder/disability/illness have a moderate percentage with 62.5%. Overall, the results indicate that heatwaves can disproportionately impact vulnerable groups.

6. Storm

According to the results, storms are considered to have a significant impact on homeless people, with 83.3% of respondents selecting this cell. Migrants, refugees, and asylum seekers also have a high percentage of selections, at 72.7%. Elderly people also have a relatively high percentage, with 65.4%.Single parent families with minor children are also considered to be vulnerable, with 65.0% of respondents indicating that they are. People with physical disabilities/disorders and people with mental disabilities/disorders also have a moderate to high percentage, with 69.6% and 63.6% respectively. People with low income have a moderate percentage at 53.8%, while pregnant people have a relatively lower percentage at 54.2%. Children and minors also have a moderate percentage at 50.0%.

Overall, storms were indicated to have a significant impact on homeless people, migrants and refugees, elderly people, and single parent families with minor children. People with physical and mental disabilities/disorders are also considered vulnerable to the effects of storms.

7. Blizzard

Based on the results, we can see that the groups of people most indicated to be affected by blizzards are homeless people with a percentage of 66.7%, followed by migrants, refugees, and asylum seekers with 63.6%. Other groups that are considered to be significantly impacted by blizzards are children/minors (54.2%), elderly people (53.8%), and people with physical disorder/disability/illness (60.9%). It is worth noting that people with low income (30.8%) and pregnant people (45.8%) were also selected, although to a lesser extent. Single parent families with minor children (47.6%) and people with mental disorder/disability/illness (59.1%) are also- considered to be impacted, but again participants indicated this to a lesser extent than the groups mentioned above.

8. Floods

During a flood, people with low income, children/minors, and elderly people are considered particularly vulnerable. Over 60% of participants answered that people with low income and elderly people are particularly vulnerable during floods. Similarly, 75% of participants answered that children/minors and homeless people, and 65% answered that single parent families with minor children are affected disproportionately by floods. Pregnant people and migrants, refugees, and asylum seekers are also considered to be affected, with 58% and 59% respectively. Additionally, over two-thirds of participants indicated that people with mental and physical disabilities/disorders/illnesses are disproportionally affected by floods.

9. Drought

In terms of income, 60% indicated that people with low income are affected by drought. This suggests that drought can have an economic impact on those who may already be struggling financially. Interestingly, only 40.9% of participants selected children/minors as affected by drought, which is the lowest percentage compared to the other disasters we analysed. This may be due to the fact that children may not be as affected by drought in the short term, but the long-term consequences, such as malnutrition, can still have an impact

on their health and development. Elderly people and homeless people are both highly considered to be affected by drought, with 52.2% and 68.2% respectively. This suggests that access to water and other basic necessities may be a challenge for these groups during times of drought.

For pregnant people, single parent families with minor children, people with mental or physical disorders/disabilities/illness, and migrants/refugees/asylum seekers, roughly half of the participants indicated that they are affected by drought. This suggests that drought can impact a wide range of vulnerable groups and highlights the need for disaster relief efforts to be inclusive and address the unique challenges faced by each group.

10. Wildfire

The analysis shows that certain vulnerable populations are m considered to be disproportionately affected by wildfires. The data reveals high percentages for elderly people (70.8%), pregnant people (68.2%), single parent families with minor children (63.2%), homeless people (65.2%), and migrants/refugees/asylum seekers (72.7%). Furthermore, people with mental and physical disabilities or illnesses were also selected by many participants (77.3%). While the percentage of people indicating those with low income and children/minors to be affected by wildfires is not as high as some of the other groups, it is still significant and cannot be ignored (47.6% and 63.6%, respectively). These findings suggest that disaster relief efforts for wildfires should prioritize these vulnerable populations to ensure they receive the necessary assistance and resources during and after a wildfire.

11. Epidemics/ Pandemics

The analysis indicates that a high percentage of participants consider single parent families with minor children, people with mental disorders/disabilities/illnesses, and pregnant people as disproportionately impacted by epidemics and pandemics, with 70.0%, 73.9%, and 65.2% respectively. Elderly people and people with low income were also selected often, with 64.0% and 50.0% respectively. The percentage for homeless people, children/minors, and migrants/refugees/asylum seekers is not as high as some of the other groups, but it is still significant, with 62.5%, 54.2%, and 65.2% respectively. These findings suggest that public health policies and interventions during epidemics and pandemics should prioritize these vulnerable populations to ensure they receive the necessary resources and assistance to protect their health and wellbeing.

12. Technological accident

The analysis shows that some groups were selected more than others. Among those, elderly people and people with physical disabilities or illnesses were selected at a higher percentage (44.0% and 43.5% respectively). Pregnant people, people with low income, and migrants/refugees/asylum seekers are also considered to be impacted by technological accidents at a significant rate, with percentages ranging from 36.4% to 39.1%. Homeless people and people with mental disabilities or illnesses have the lowest percentage, at 25.0% and 30.4% respectively. While the impact of technological accidents to these groups may not be considered as significant as that of other disasters, these findings suggest that disaster relief efforts should still prioritize vulnerable populations to ensure they receive the assistance and resources they need during and after a technological accident.

13. Cyber threats

Cyber threats were indicated to affect vulnerable populations at relatively lower rates compared to other types of disasters. The analysis shows that the percentage of respondents considering people with low income, homeless people, single parent families with minor children, and pregnant people to be particularly vulnerable to cyber threats is relatively low. However, children/minors, elderly people, people with mental or physical disabilities or illnesses, and migrants/refugees/asylum seekers were still selected at notable rates, ranging from 18.2% to 27.3%. These findings suggest that while cyber threats may not disproportionately

affect vulnerable populations, there are still segments of these populations that need to be protected and provided with resources to prevent or mitigate the impact of cyber threats.

14. CBRNe malicious act

The analysis suggest that vulnerable populations are considered to be significantly impacted by CBRNe (Chemical, Biological, Radiological, Nuclear, and explosive) malicious acts. Pregnant people, children/minors, and elderly people are among the most selected, with over 30% of participants indicating that they are particularly vulnerable. People with mental and physical disabilities or illnesses, as well as low-income individuals, are also considered to be disproportionately affected, with percentages around 20-30%. Single-parent families with minor children and homeless people were indicated at lower rates, but still significantly, with around 20-23% of participants selecting them for this hazard. Migrants, refugees, and asylum seekers were selected at a similar rate as children and pregnant people, with 33.3%. These findings suggest that disaster relief efforts for CBRNe malicious acts should prioritize these vulnerable populations to ensure they receive the assistance and resources they need during and after such an event.

15. Terrorism attack

From this analysis, we can see that terrorism attacks are considered to affect a relatively high percentage of vulnerable populations across all categories. The highest percentages are seen among children/minors (45.5%), people with mental disorder/disability/illness (47.8%), and people with physical disorder/disability/illness (47.8%). Other vulnerable populations such as people with low income (36.4%), pregnant people (36.4%), elderly people (37.5%), single parent families with minor children (35.0%), homeless people (37.5%), and migrants, refugees, asylum seekers (43.5%) were also indicated to experience a significant impact from terrorism attacks, albeit to a somewhat lesser extent.

Overall Analysis of Table

Looking at the table, we can see the percentage of participants indicating whether each population group is disproportionately affected by different types of disasters. The table provides information on 15 types of disasters, including earthquakes, volcanic eruptions, tsunamis, landslides, heatwaves, storms, blizzards, floods, droughts, wildfires, epidemics/pandemics, technological accidents, cyber threats, CBRNe (chemical, biological, radiological, nuclear, and explosive) malicious acts, and terrorism attacks. The data in the table suggest that people with low income, homeless people, and people with mental disorders/disabilities/illnesses are the most vulnerable to different types of disasters. These groups have the highest percentage of participants indicating that they are affected by most of the disasters listed in the table.

Main conclusions

- People with low income are considered more vulnerable to a wide range of disasters, including earthquakes, heatwaves, storms, floods, and wildfires.
- Certain demographic groups, such as children, elderly people, pregnant people, single-parent families with minor children, homeless people, and people with mental or physical disabilities, are considered more vulnerable to various types of disasters.
- Man-made disasters, such as epidemics and pandemics, technological accidents, cyber threats, CBRNe malicious acts, and terrorism attacks, can affect anyone and require preparedness and prevention measures.
- Preparedness, such as having an emergency plan and kit, and prevention measures, such as reducing greenhouse gas emissions and implementing disaster-resistant infrastructure, can reduce the impact of disasters on individuals and communities.

- There is a need for increased awareness and education on disaster risks and preparedness, particularly among vulnerable groups, to reduce the impact of disasters.
- Collaboration between individuals, communities, organizations, and policymakers is crucial in addressing the complex challenges related to disaster risk reduction and promoting resilience.

Table 8: Matrix showing which groups were considered vulnerable in which hazard situations by participants in the whole sample (hazards by vulnerable groups). Percentages indicate how many (valid) percent of respondents selected this cell, parentheses show the number of people who selected it/valid responses for this cell. "I don't know" answers are presented for each hazard and each vulnerable group.

	People with low income	Children/minors	Elderly people	Pregnant people	Single parent families with minor children	Homeless people	People with mental disorder/disability/illness	People with physical disorder/disability/illness	Migrants, refugees, asylum seekers	I don't know (n)
Earthquakes	79.2% (19/24)	81.8% (18/22)	83.3% (20/24)	81.8% (18/22)	83.3% (15/18)	54.5% (12/22)	85.0% (17/20)	90.5% (19/21)	60.0% (12/20)	4
Volcanic Eruption	33.3% (7/21)	55.0% (11/20)	61.9% (13/21)	55.0% (11/20)	52.9% (9/17)	42.1% (8/19)	52.6% (10/19)	57.9% (11/19)	36.8% (7/19)	7
Tsunami	34.8% (8/23)	61.9% (13/21)	60.9% (14/23)	54.5% (12/22)	50.0% (9/18)	47.6% (10/21)	55.0% (11/20)	60.0% (12/20)	50.0% (10/20)	5
Landslide	28.0% (7/25)	52.2% (12/23)	60.0% (15/25)	58.3% (14/24)	55.0% (11/20)	43.5% (10/23)	63.6% (14/22)	72.7% (16/22)	59.1% (13/22)	3
Heatwave	66.7% (18/27)	52.0% (13/25)	85.2% (23/27)	80.0% (20/25)	57.1% (12/21)	72.0% (18/25)	69.6% (16/23)	62.5% (15/24)	69.6% (16/23)	1
Storm	53.8% (14/26)	50.0% (12/24)	65.4% (17/26)	54.2% (13/24)	65.0% (13/20)	83.3% (20/24)	63.6% (14/22)	69.6% (16/23)	72.7% (16/22)	3
Blizzard	30.8% (8/26)	54.2% (13/24)	53.8% (14/26)	45.8% (11/24)	47.6% (10/21)	66.7% (16/24)	59.1% (13/22)	60.9% (14/23)	63.6% (14/22)	2
Flood	61.5% (16/26)	75.0% (18/24)	69.2% (18/26)	58.3% (14/24	65.0% (13/20)	75.0% (18/24)	68.2% (15/22)	78.3% (18/23)	59.1% (13/22)	2
Drought	60.0% (12/20)	40.9% (9/22)	52.2% (12/23)	47.6% (10/21)	36.8% (7/19)	68.2% (15/22)	52.4% (11/21)	52.4% (11/21)	66.7% (14/21)	3
Wildfire	47.6% (10/21)	63.6% (14/22)	70.8% (17/24)	68.2% (15/22)	63.2% (12/19)	65.2% (15/23)	77.3% (17/22)	77.3% (17/22)	72.7% (16/22)	2
Epidemics/ Pandemics	50.0% (11/22)	54.2% (13/24)	64.0% (16/25)	65.2% (15/23)	70.0% (14/20)	62.5% (15/24)	73.9% (17/23)	60.9% (14/23)	65.2% (15/23)	1
Technological accident	36.4% (8/22)	34.8% (8/23)	44.0% (11/25)	39.1% (9/23)	35.0% (7/20)	25.0% (6/24)	30.4% (7/23)	43.5% (10/23)	39.1% (9/23)	1
Cyber threat	14.3% (3/21)	23.8% (5/21)	21.7% (5/23)	19.0% (4/21)	10.5% (2/19)	8.7% (2/23)	18.2% (4/22)	27.3% (6/22)	18.2% (4/22)	3
CBRNe malicious act	19.0% (4/21)	33.3% (7/21)	30.4% (7/23)	38.1% (8/21)	21.1% (4/19)	22.7% (5/22)	28.6% (6/21)	28.6% (6/21)	33.3% (7/21)	3
Terrorism attack	36.4% (8/22)	45.5% (10/22)	37.5% (9/24)	36.4% (8/22)	35.0% (7/20)	37.5% (9/24)	47.8% (11/23)	47.8% (11/23)	43.5% (10/23)	2
I don't know (n)	2-6	4-5	2-3	4-5	8	4	5-6	5	5-6	

Table 9: Matrix showing which groups were considered vulnerable in which hazard situations by participants in the whole sample (vulnerable groups by hazards). Percentages indicate how many (valid) percent of respondents selected this cell; parentheses show the number of people who selected it/valid responses for this cell

	Earthquakes	Volcanic Eruption	Tsunami	Landslide	Heatwave	Storm	Blizzard	Flood	Drought	Wildfire	Epidemics/ Pandemics	Technological accident	Cyber threat	CBRNe malicious act	Terrorism attack
People with low income	79.2% (19/24)	33.3% (7/21)	34.8% (8/23)	28.0% (7/25)	66.7% (18/27)	53.8% (14/26)	30.8% (8/26)	61.5% (16/26)	60.0% (12/20)	47.6% (10/21)	50.0% (11/22)	36.4% (8/22)	14.3% (3/21)	19.0% (4/21)	36.4% (8/22)
Children/minors	81.8% (18/22)	55.0% (11/20)	61.9% (13/21)	52.2% (12/23)	52.0% (13/25)	50.0% (12/24)	54.2% (13/24)	75.0% (18/24)	40.9% (9/22)	63.6% (14/22)	54.2% (13/24)	34.8% (8/23)	23.8% (5/21)	33.3% (7/21)	45.5% (10/22)
Elderly people	83.3% (20/24)	61.9% (13/21)	60.9% (14/23)	60.0% (15/25)	85.2% (23/27)	65.4% (17/26)	53.8% (14/26)	69.2% (18/26)	52.2% (12/23)	70.8% (17/24)	64.0% (16/25)	44.0% (11/25)	21.7% (5/23)	30.4% (7/23)	37.5% (9/24)
Pregnant people	81.8% (18/22)	55.0% (11/20)	54.5% (12/22)	58.3% (14/24)	80.0% (20/25)	54.2% (13/24)	45.8% (11/24)	58.3% (14/24)	47.6% (10/21)	68.2% (15/22)	65.2% (15/23)	39.1% (9/23)	19.0% (4/21)	38.1% (8/21)	36.4% (8/22)
Single parent families with minor children	83.3% (15/18)	52.9% (9/17)	50.0% (9/18)	55.0% (11/20)	57.1% (12/21)	65.0% (13/20)	47.6% (10/21)	65.0% (13/20)	36.8% (7/19)	63.2% (12/19)	70.0% (14/20)	35.0% (7/20)	10.5% (2/19)	21.1% (4/19)	35.0% (7/20)
Homeless people	54.5% (12/22)	42.1% (8/19)	47.6% (10/21)	43.5% (10/23)	72.0% (18/25)	83.3% (20/24)	66.7% (16/24)	75.0% (18/24)	68.2% (15/22)	65.2% (15/23)	62.5% (15/24)	25.0% (6/24)	8.7% (2/23)	22.7% (5/22)	37.5% (9/24)
People with mental disorder/disability/illness	85.0% (17/20)	52.6% (10/19)	55.0% (11/20)	63.6% (14/22)	69.6% (16/23)	63.6% (14/22)	59.1% (13/22)	68.2% (15/22)	52.4% (11/21)	77.3% (17/22)	73.9% (17/23)	30.4% (7/23)	18.2% (4/22)	28.6% (6/21)	47.8% (11/23)
People with physical disorder/disability/illness	90.5% (19/21)	57.9% (11/19)	60.0% (12/20)	72.7% (16/22)	62.5% (15/24)	69.6% (16/23)	60.9% (14/23)	78.3% (18/23)	52.4% (11/21)	77.3% (17/22)	60.9% (14/23)	43.5% (10/23)	27.3% (6/22)	28.6% (6/21)	47.8% (11/23)
Migrants, refugees, asylum seekers	60.0% (12/20)	36.8% (7/19)	50.0% (10/20)	59.1% (13/22)	69.6% (16/23)	72.7% (16/22)	63.6% (14/22)	59.1% (13/22)	66.7% (14/21)	72.7% (16/22)	65.2% (15/23)	39.1% (9/23)	18.2% (4/22)	33.3% (7/21)	43.5% (10/23)

4.2.3.5 Vulnerable groups by hazards and vice versa (Matrix question) – France

A. Per vulnerable group (Table 10)

1. People with low income

In sum, 6 respondents answered the question whether they consider "people with low income" particularly vulnerable to "earthquakes". 83.3% (5 respondents out of 6) of them indicated that the group is especially vulnerable regarding earthquakes. The same result is recorded for this group`s vulnerability for "heatwaves" (83.3% from 6 respondents). 66.7% out of a total of 6 respondents indicated, that "People with low income" are also especially vulnerable regarding two additional hazards: "storm" and "flood", while this group is not considered vulnerable to Cyber threats and CBRNe malicious acts.

2. Children/Minors

In total, 6 respondents answered whether they think "Children/minors" are vulnerable for the hazard "flood". 66.7% of them indicated, that the group is especially vulnerable regarding a few hazards: the "earthquakes", "volcanic eruption", "tsunami" and "landslide". 4 respondents from a total of 6 believe similarly. "Children/minors" are not considered vulnerable to "cyber threat", which is a bit surprising since children with access to technology may become the victims of scams or online predators.

3. Elderly people

This question was answered by 6 people. 83.3% of them indicated, that "elderly people" are especially vulnerable to two hazards: "heatwave" and "flood", while 66.7% of 6 respondents found, that this group of people are quite vulnerable to "earthquake". "volcanic eruption", "tsunami" and "landslide". They were not indicated to be particularly vulnerable for "CBRNe malicious acts", terrorism attacks or cyber threats, which is again surprising as the elderly often lack digital literacy and may therefore fall victim to scams.

4. Pregnant people

In sum, 6 people answered which hazards "pregnant people" are vulnerable to. 83.3% of those 6 respondents highlighted, that 'pregnant people" are particularly vulnerable to "flood", while 66.7%, which is 4 out of total 6 respondents, think, that this group is vulnerable to "earthquake", "tsunami", "landslide" and "heatwave". "Cyber threat", "CBRNe malicious act" and "Terrorism attack" were not considered considerable hazards to "pregnant people".

5. Single parent families with minor children

In total 3 people answered the question about the vulnerability of "single parent families with minor children" to different hazards. 66.7% of them found, that this vulnerable group is especially impacted by hazards "storm" and "flood", while no vulnerability (0%) was identified for the hazard "CBRNe malicious act" or "cyber threat". Many participants selected "I don't know" for this particular group, indicating that many were not aware of specific vulnerabilities related to this combination of factors.

6. Homeless people

A total of 6 respondents responded to the query about "homeless people". 83.3% (5 respondents out of 6) highlighted, that "homeless people" are very vulnerable to "storm" and "flood". In contrast, 0% identified them as vulnerable for "CBRNe malicious act" and "cyber threat". This group of people also has been indicated to be minimally vulnerable to "landslide".

7. People with mental disorder/disability/illness

In sum, 5 respondents gave an opinion if they consider "people with mental disorder/disability/illness" a vulnerable group. 4 of 5 respondents considered this group of people especially vulnerable for the hazards "earthquake" and "flood", while 20% of respondents indicated "people with mental disorder/disability/illness" vulnerable for "technological accident" and "CBRNe malicious act".

8. People with physical disorder/disability/illness

In total, 5 respondents provided their opinion on the question for which hazards they think "people with physical disorder/disability/illness" are a vulnerable category. All of the respondents answered, that this group of people is highly vulnerable to "flood" and 80% of them believed, that high risks of vulnerability exist for "earthquake" and "landslide". "People with physical disorder/disability/illness" are not considered vulnerable for "cyber threat" (1 response out of 5).

9. Migrants, refugees, asylum seekers

Overall, 5 respondents mentioned a vulnerability of "migrants, refugees, asylum seekers" to "storm" and "wildfire". 80% agreed with this statement, while very few (20%) mentioned the vulnerability of "migrants, refugees, asylum seekers" to "cyber threat".

It should be noted that for some hazards, such as flood, storm and earthquake, very high percentages (60-100%) are shown for multiple groups. It is worth mentioning, that almost all chosen groups, except "migrants, refugees, asylum seekers" have been highlighted as very vulnerable to the hazard "flood". Additionally, it can be said that most of the listed groups were not considered particularly vulnerable to technological accidents, cyber threat, or CBRNe malicious acts by respondents in France, mirroring a trend also visible in the whole sample.

B. **Per hazard (Table 11)**
1. **Earthquakes**

5 respondents out of 6 with 83.3% indicated, that "people with low income" are very vulnerable to earthquakes. 80% of respondents (4 respondents out of 5) also indicated "people with mental disorder/disability/illness" as highly vulnerable to earthquakes. "People with physical disorder/disability/illness" with 80% of answers (4 respondents out of 5) similarly are indicated as highly vulnerable to mentioned hazard. The least selected group was "single parent families with minor children" with 33% (1 respondent out of total 3).

2. **Volcanic Eruptions**

"Children/minors" and "elderly people" with 66.7% (4 responders out of 6) were considered as particularly vulnerable to volcanic eruption. "People with mental and physical disorders/disabilities/illness" with 60% (3 respondents out of 5) were indicated as vulnerable to this hazard. The least selected group for volcanic eruption is "homeless people" with 16.7% (1 responder of 6).

3. **Tsunami**

66.7 % of respondents each (4 individuals out of total 6) indicated, that three vulnerable groups, such as "children/minors", "elderly people" and "pregnant People" groups are highly vulnerable to tsunamis. Meanwhile, 33.3% of respondents out of total 3 indicated, that "single parent families with minor children" are vulnerable when tsunamis hit.

4. Landslide

In sum 6 respondents indicated their consideration about landslide's impact on different groups of vulnerable people. There were 4 groups indicated as most vulnerable to landslides "people with physical disorder/disability/illness" with 80% (4 respondents out of a total 6). The next three groups with 66.7% each (4 respondents out of 6 in each group) are "children/minors" and "elderly people" and "pregnant people". Regarding the hazard landslide, "homeless people" were not considered vulnerable (16.7%).

5. Heatwave

In sum 6 respondents gave answer to the question whether they consider "people with low income" vulnerable to heatwave and 83.3% of them answered, that there is an increased vulnerability. The same percentage of respondents noted, that there is existing vulnerability in "elderly people" group also.66.7% of answers indicated, that "pregnant people" are vulnerable to heatwave. "Single parent families with minor children" (1 respondent out of total 3 with 33.3%) and "homeless people" (2 respondent out of total 6) are considered less vulnerable to heatwaves. This is surprising, since homeless people often lack adequate shelter or cooling which can protect them from the heat. They are therefore considered especially vulnerable to extreme temperatures in the literature.

6. Storm

In sum, 83.3 percent of respondents (total 8 people) found "homeless people" very vulnerable to storms.80% out of a total of 5 respondents consider "migrants, refugees, asylum seekers" highly vulnerable for the hazard storm. The third position is given to the following categories of vulnerable people with 66.7% (total 5 respondents): "people with low income" and "elderly people", which are also vulnerable to mentioned hazard. "Children/minors" and "single parent families with minor children" (equalling 50% of a total of 6 responses for both) were considered as not vulnerable to storms.

7. Blizzard

In sum 75% of respondents selected that "migrants, refugees, asylum seekers" are vulnerable to blizzard. Three more groups of vulnerable people ("children/minors", "elderly people", "pregnant people") with 60% of responses out of a total of 5 indicating them as vulnerable. According to 33.3% responses "single parent families with minor children" are not a vulnerable group for blizzard.

8. Flood

In total, 6 respondents replied whether they think "people with physical disorder/disability/illness are vulnerable to the hazard flood. 100% of them highlighted an existing vulnerability in this group. 83.3% of respondents selected, that "children/minors", "elderly people", "pregnant people" and "homeless people" are also highly vulnerable to floods. According to responses, "migrants, refugees, asylum seekers" are less vulnerable to the above-mentioned hazard.

9. Drought

In sum 60% of respondents consider "people with physical disorder/disability/illness" as well as "migrants, refugees and asylum seekers" highly vulnerable for drought. Another 50% of responses constitute, that there is a vulnerability in the following groups for drought: "people with low income", "elderly people", and "pregnant people". The overall low selection rates may reflect the fact that droughts in Western Europe are mostly an economic and environmental problem, as access to drinking water is always ensured to the population. Actual health problems are usually a result of high temperatures in terms of heatwaves and not a lack of water in terms of droughts.

10. Wildfire

80% out of a total of 5 respondents considered "migrants, refugees, asylum seekers" highlighted as vulnerable for the hazard wildfire. 60% (with 3 responses out of total 5) for each of the following groups believe that "homeless people", as well as "people with mental and physical disorder/disability/illness" are especially vulnerable to wildfire. "Children/minors" and "single parent families with minor children" are not identified as vulnerable to the mentioned hazard, with 33.3% each.

11. Epidemics/pandemics

5 respondents in sum answered the question whether they think "people with mental disorder/disability/illness" are vulnerable to epidemics/pandemics, and 60% of them think that this group is quite vulnerable in case of epidemics/pandemics. Additionally, the groups of "people with low income" and "elderly people" were highlighted by 50% of respondents as vulnerable. As less vulnerable to epidemics/pandemics, with 33.3% each, were noted "children/minors", "pregnant people" and "single parent families with minor children".

12. Technological Accident

Overall, 6 respondents expressed their opinion on the question of vulnerability of "elderly people" for technological accidents. 66.7% found them highly vulnerable. Another 50% out of in total 6 respondents considered "people with low income" and "pregnant people" as vulnerable to technological accidents. One person out of a total of 5 participating in the survey noted "homeless people" as vulnerable for this kind of accident.

13. Cyber Threat

Less than half of respondents (40% out of total 5) think, that "children/minors", "elderly people" and "pregnant people" are particularly vulnerable for cyber threats. Cyber threat is the hazard with the lowest selection rate for most groups, indicating that respondents do not consider the listed groups as particularly vulnerable to cyber threats. This may indicate that cyber threats can be considered more of a danger towards critical infrastructure and organisations than individual people, or that cyber threats are considered to affect everyone rather equally without "discriminating". Additionally, it is possible that respondents did not consider this particular hazard as very threatening when compared to the other listed hazards such as earthquakes, which may cost hundreds of thousands of lives when they happen.

14. CBRNe malicious act

- In sum, 5 people responded. 40% of them indicated three groups of vulnerable people for CBRNe malicious act hazard. Those are "children/minors", "elderly people" and "pregnant people". According to the responses, most of the groups were found to be very little or not vulnerable at all for this hazard. The reason may be similar as for cyber threats.

15. Terrorism Attack

There were 5 people in sum who answered about terrorism attacks' impact on different vulnerable groups, 60% of which indicated "children/minors" and "people with physical disorder/disability/illness" as highly vulnerable for it. 50% out of total 4 respondents considered "people with low income" particularly vulnerable for terrorism attack. 20% of 5 respondents gave an answer, that "homeless people" are vulnerable to that kind of attack.

PANTHEON

Table 10: Matrix showing which groups were considered vulnerable in which hazard situations by participants in France (vulnerable groups by hazards). Percentages indicate how many (valid) percent of respondents selected this cell; parentheses show the number of people who selected it/valid responses for this cell

	People with low income	Children/minors	Elderly people	Pregnant people	Single parent families with minor children	Homeless people	People with mental disorder/ disability/illness	People with physical disorder/ disability/illness	Migrants, refugees, asylum seekers	I don't know (n)
Earthquakes	83.3 % (5/6)	66.7% (4/6)	66.7% (4/6)	66.7% (4/6)	33.3% (1/3)	50.0% (3/6)	80.0% (4/5)	80.0% (4/5)	60.0% (3/5)	1
Volcanic Eruption	33.3% (2/6)	66.7% (4/6)	66.7% (4/6)	50.0% (3/6)	33.3% (1/3)	16.7% (1/6)	60.0% (3/5)	60.0% (3/5)	20.0% (1/5)	1
Tsunami	50.0% (3/6)	66.7% (4/6)	66.7% (4/6)	66.7% (4/6)	33.3% (1/3)	50.0% (3/6)	60.0% (3/5)	60.0% (3/5)	40.0% (2/5)	1
Landslide	33.3% (2/6)	66.7% (4/6)	66.7% (4/6)	66.7% (4/6)	33.3% (1/3)	16.7% (1/6)	60.0% (3/5)	80.0% (4/5)	60.0% (3/5)	1
Heatwave	83.3 % (5/6)	50.0% (3/6)	83.3 % (5/6)	66.7% (4/6)	33.3% (1/3)	33.3% (2/6)	40.0% (2/5)	40.0% (2/5)	60.0% (3/5)	1
Storm	66.7% (4/6)	50.0% (3/6)	66.7% (4/6)	50.0% (3/6)	66.7% (2/3)	83.3 % (5/6)	60.0% (3/5)	60.0% (3/5)	80.0% (4/5)	2
Blizzard	40.0% (2/5)	60.0% (3/5)	60.0% (3/5)	60.0% (3/5)	33.3% (1/3)	60.0% (3/5)	50.0% (2/4)	50.0% (2/4)	75.0% (3/4)	2
Flood	66.7% (4/6)	83.3 % (5/6)	83.3 % (5/6)	83.3 % (5/6)	66.7% (2/3)	83.3 % (5/6)	80.0% (4/5)	100.0% (5/5)	60.0% (3/5)	1
Drought	50.0% (2/4)	33.3% (2/6)	50.0% (3/6)	50.0% (3/6)	33.3% (1/3)	40.0% (2/5)	40.0% (2/5)	60.0% (3/5)	60.0% (3/5)	0
Wildfire	50.0% (2/4)	33.3% (2/6)	50.0% (3/6)	50.0% (3/6)	33.3% (1/3)	60.0% (3/5)	60.0% (3/5)	60.0% (3/5)	80.0% (4/5)	0
Epidemics/ Pandemics	50.0% (2/4)	33.3% (2/6)	50.0% (3/6)	33.3% (2/6)	33.3% (1/3)	40.0% (2/5)	60.0% (3/5)	40.0% (2/5)	60.0% (3/5)	0
Technological accident	50.0% (2/4)	33.3% (2/6)	66.7% (4/6)	50.0% (3/6)	33.3% (1/3)	20.0% (1/5)	0.0% (0/5)	40.0% (2/5)	40.0% (2/5)	0
Cyber threat	0.0% (0/4)	40.0% (2/5)	40.0% (2/5)	40.0% (2/5)	0.0% (0/3)	0.0% (0/5)	20.0% (1/5)	20.0% (1/5)	20.0% (1/5)	1
CBRNe malicious act	0.0% (0/4)	20.0% (1/5)	40.0% (2/5)	40.0% (2/5)	0.0% (0/3)	0.0% (0/4)	0.0% (0/4)	25.0% (1/4)	25.0% (1/4)	1
Terrorism attack	50.0% (2/4)	60.0% (3/5)	40.0% (2/5)	40.0% (2/5)	33.3% (1/3)	20.0% (1/5)	40.0% (2/5)	60.0% (3/5)	40.0% (2/5)	1
I don't know (n)	2-4	2	2	2	5	2-3	3	3	3	

Table 11: Matrix showing which groups were considered vulnerable in which hazard situations by participants in France (vulnerable groups by hazards). Percentages indicate how many (valid) percent of respondents selected this cell; parentheses show the number of people who selected it/valid responses for this cell

	Earthquakes	Volcanic Eruption	Tsunami	Landslide	Heatwave	Storm	Blizzard	Flood	Drought	Wildfire	Epidemics/ Pandemics	Technological accident	Cyber threat	CBRNe malicious act	Terrorism attack
People with low income	83.3 % (5/6)	33.3% (2/6)	50.0% (3/6)	33.3% (2/6)	83.3 % (5/6)	66.7% (4/6)	40.0% (2/5)	66.7% (4/6)	50.0% (2/4)	50.0% (2/4)	50.0% (2/4)	50.0% (2/4)	0.0% (0/4)	0.0% (0/4)	50.0% (2/4)
Children/minors	66.7% (4/6)	66.7% (4/6)	66.7% (4/6)	66.7% (4/6)	50.0% (3/6)	50.0% (3/6)	60.0% (3/5)	83.3 % (5/6)	33.3% (2/6)	33.3% (2/6)	33.3% (2/6)	33.3% (2/6)	40.0% (2/5)	20.0% (1/5)	60.0% (3/5)
Elderly people	66.7% (4/6)	66.7% (4/6)	66.7% (4/6)	66.7% (4/6)	83.3 % (5/6)	66.7% (4/6)	60.0% (3/5)	83.3 % (5/6)	50.0% (3/6)	50.0% (3/6)	50.0% (3/6)	66.7% (4/6)	40.0% (2/5)	40.0% (2/5)	40.0% (2/5)
Pregnant people	66.7% (4/6)	50.0% (3/6)	66.7% (4/6)	66.7% (4/6)	66.7% (4/6)	50.0% (3/6)	60.0% (3/5)	83.3 % (5/6)	50.0% (3/6)	50.0% (3/6)	33.3% (2/6)	50.0% (3/6)	40.0% (2/5)	40.0% (2/5)	40.0% (2/5)
Single parent families with minor children	33.3% (1/3)	33.3% (1/3)	33.3% (1/3)	33.3% (1/3)	33.3% (1/3)	66.7% (2/3)	33.3% (1/3)	66.7% (2/3)	33.3% (1/3)	33.3% (1/3)	33.3% (1/3)	33.3% (1/3)	0.0% (0/3)	0.0% (0/3)	33.3% (1/3)
Homeless people	50.0% (3/6)	16.7% (1/6)	50.0% (3/6)	16.7% (1/6)	33.3% (2/6)	83.3 % (5/6)	60.0% (3/5)	83.3 % (5/6)	40.0% (2/5)	60.0% (3/5)	40.0% (2/5)	20.0% (1/5)	0.0% (0/5)	0.0% (0/4)	20.0% (1/5)
People with mental disorder/ disability/ illness	80.0% (4/5)	60.0% (3/5)	60.0% (3/5)	60.0% (3/5)	40.0% (2/5)	60.0% (3/5)	50.0% (2/4)	80.0% (4/5)	40.0% (2/5)	60.0% (3/5)	60.0% (3/5)	0.0% (0/5)	20.0% (1/5)	0.0% (0/4)	40.0% (2/5)
People with physical disorder/ disability/ illness	80.0% (4/5)	60.0% (3/5)	60.0% (3/5)	80.0% (4/5)	40.0% (2/5)	60.0% (3/5)	50.0% (2/4)	100.0% (5/5)	60.0% (3/5)	60.0% (3/5)	40.0% (2/5)	40.0% (2/5)	20.0% (1/5)	25.0% (1/4)	60.0% (3/5)
Migrants, refugees, asylum seekers	60.0% (3/5)	20.0% (1/5)	40.0% (2/5)	60.0% (3/5)	60.0% (3/5)	80.0% (4/5)	75.0% (3/4)	60.0% (3/5)	60.0% (3/5)	80.0% (4/5)	60.0% (3/5)	40.0% (2/5)	20.0% (1/5)	25.0% (1/4)	40.0% (2/5)

4.2.3.6 Vulnerable groups by hazards and vice versa (Matrix question) – Greece

A. Per Vulnerable group (Table 12)

1. People with low income:

For Greece it seems that the top three risks for people with low income are earthquakes (77.8%), heatwaves (61.9%), and floods (60.0%). This may be due to the fact that low-income individuals may live in areas that are more prone to natural disasters, or they may have limited access to resources that could help them prepare for or recover from these events.

Other risks that were noted as significant for people with low income include droughts (62.5%), wildfires (47.1%), and epidemics/pandemics (50.0%). These risks may disproportionately affect low-income individuals because they may have less access to healthcare or be more likely to work in industries where exposure to disease is higher.

It is interesting to note that cyber threats (17.6%) and CBRNe malicious acts (23.5%) were considered relatively low risks for people with low income. This may be because these risks are seen as more abstract or unlikely to affect this population directly. Overall, it is clear that people with low income face a variety of risks, both natural and man-made.

2. Children/minors:

The data shows that children/minors are highly vulnerable to earthquakes, with 87.5% of the respondents indicating this as a significant threat. Floods (72.2%) and wildfires (75.0%) also appear to be significant threats to children. Additionally, epidemics/pandemics (61.1%) and terrorism attacks (41.2%) are also perceived as significant threats to children. On the other hand, technological accidents and cyber threats are perceived as less of a threat to children, with only 35.3% and 18.8% of respondents, respectively, indicating concern about these events.

Overall, it is clear that children are vulnerable to a wide range of natural disasters and human-made threats, and protective measures should be taken to ensure their safety and well-being during and after such events.

3. Elderly People:

For the category of Elderly People, the highest perceived risk is related to earthquakes, with 88.9% of the respondents considering it as a risk. Heatwaves are also perceived as a high risk with 85.7% of the respondents perceiving it as a risk. Storms, floods, wildfires, epidemics/pandemics, and volcanic eruptions are also considered high risks, with more than 50% of the respondents perceiving them as risks. Cyber threats and CBRNe malicious acts are perceived as low risks by the majority of the respondents, with less than 30% perceiving them as risks.

4. Pregnant people:

For pregnant people, we can see that the perceived risk of earthquakes is high at 87.5%, with similar high percentages for heatwaves and epidemics/pandemics at 84.2% and 76.5%, respectively. The perceived risk for volcanic eruptions, tsunamis, storms, landslides, and wildfires ranges from 50% to 75%. However, the perceived risk for droughts, blizzards, cyber threats, CBRNe malicious acts, and terrorism attacks is relatively low, ranging from 12.5% to 46.7%. It is worth noting that pregnant people may have different risks due to their unique vulnerabilities and health concerns.

5. Single parent families with minor children:

For single parent families with minor children, the top three hazards perceived as a major threat are earthquakes with a percentage of 93.3%, followed by epidemics/pandemics with 76.5%, and storm with 64.7%. The perceived threat for volcanic eruption, tsunami, and wildfire are above 50%, while drought, cyber threat, and CBRNe malicious act are perceived as a major threat for this group by less than 40% of respondents. It is interesting to note that the percentages for most hazards are relatively consistent with the overall trends observed across all groups.

6. Homeless people:

From this analysis, we can see that homeless people are considered to be most impacted by heatwaves, storms, floods, and droughts, with percentages of selections ranging from 68.4% to 84.2%. In contrast, homeless people are considered to be least impacted by cyber threats and technological accidents, with probabilities of only 11.1% and 26.3%, respectively. The percentage for other disasters, such as earthquakes, volcanic eruptions, tsunamis, landslides, wildfires, epidemics/pandemics, CBRNe malicious acts, and terrorism attacks, falls in between these two extremes, with probabilities ranging from 46.7% to 66.7%.

7. People with mental disorder/disability/illness:

Based on the analysis of the data, it is clear that people with mental disorders, disabilities, or illnesses are considered particularly vulnerable during natural disasters and other threats. The risks associated with earthquakes, heatwaves, wildfires, and epidemics/pandemics are especially high for this population, with over 75% of participants indicating that these risks affect this group in particular. This indicates the need for targeted measures to protect and support this population during such events.

It's also important to note that while some risks, such as cyber threats and technological accidents, have lower percentages affecting this population, it's still crucial to take their vulnerabilities into account in planning and response efforts. The findings emphasize the need for inclusive emergency management practices that consider the diverse needs of all populations, including those with mental disorders, disabilities, or illnesses.

8. People with physical disorder/disability/illness:

Based on the data provided, people with physical disorders, disabilities, or illnesses are particularly vulnerable to the risks associated with natural disasters and other threats. Earthquakes, wildfires, and storms have the highest percentage of perceived risks affecting this population, with more than 80% of participants indicating that this risk affects this group. Other risks, such as volcanic eruptions, tsunamis, landslides, floods, and heatwaves, also pose a significant risk to this population, with more than half of participants indicating this. It is important to consider the specific vulnerabilities of this population when developing emergency preparedness plans and response strategies for these types of events. Additionally, while the percentage associated with technological accidents, cyber threats, CBRNe malicious acts, and terrorism attacks regarding this population are relatively low, it's still important to consider their vulnerabilities during such events.

9. Migrants, refugees, asylum seekers:

The analysis of the data shows that migrants, refugees, and asylum seekers are vulnerable to various types of disasters and threats. Heatwaves, storms, wildfires, and epidemics/pandemics were indicated to affect this group more severely, with a percentage of 72.2% or above. Drought, landslide, flood, and tsunami also appear to pose a considerable risk, with a percentage ranging from 53.3% to 68.8%. In contrast, migrants, refugees, and asylum seekers are considered to be less affected by technological accidents, cyber threats,

and CBRNe malicious acts, with a percentage ranging from 35.3% to 38.9%. This may be due to the fact that these types of disasters are less common than natural disasters. Terrorism attacks are considered to be a moderate threat, with a percentage of 44.4%. This finding suggests that this group may face a higher risk of terrorism compared to the general population. In conclusion, the data indicates that migrants, refugees, and asylum seekers are vulnerable to a range of disasters and threats.

B. Per hazard (Table 13)

1. Earthquakes

The analysis of the table suggests that people with low income, children/minors, elderly people, pregnant people, single-parent families with minor children, people with mental disorder/disability/illness, people with physical disorder/disability/illness, and migrants, refugees, asylum seekers are all considered particularly vulnerable to earthquakes. The percentage varies among different groups, with the highest response rate observed for single-parent families with minor children (93.3%), people with physical disorder/disability/illness (93.8%), and elderly people (88.9%). Homeless people are considered less vulnerable to earthquakes (56.3%) compared to other groups.

2. Volcanic eruptions

Looking at the table, we can see that the identified vulnerability to volcanic eruptions is relatively high among all the groups mentioned. Elderly people are considered the most vulnerable group with 60% of respondents identifying them as vulnerable to volcanic eruptions, followed by pregnant people with 57.1%. Children/minors and single-parent families with minor children also have a high percentage, with 50% and 57.1% respectively. People with low income and people with mental disorder/disability/illness have the lowest percentage of selections, with 33.3% and 50% respectively.

3. Tsunami

Looking at the data, children/minors and elderly people are considered particularly vulnerable to tsunamis, with 60.0% and 58.8% respectively being identified as vulnerable. Pregnant people and single parent families with minor children also had a high percentage of selection at 50.0% and 53.3%, respectively. People with low income and homeless people had lower percentages at 29.4% and 46.7%, respectively. Meanwhile, people with mental disorders, disabilities, or illnesses, people with physical disorders, disabilities, or illnesses, and migrants, refugees, and asylum seekers had moderate to high percentages ranging from 53.3% to 60.0%.

4. Landslide

The table shows the percentage of perceived vulnerability to landslides for different groups of people. People with low income, children/minors, and homeless people have relatively high indicated vulnerability to landslides, with 26.3%, 47.1%, and 52.9% respectively. Elderly people, pregnant people, and single-parent families with minor children also have a relatively high percentage of selection, ranging from 55.6% to 58.8%. People with mental and physical disorders, disabilities, or illnesses and migrants, refugees, and asylum seekers have the highest indicated vulnerability to landslides, with percentages ranging from 64.7% to 70.6%. It is important to note that landslides can occur in areas with steep slopes, heavy rainfall, and loose soil, which are often found in impoverished communities. Additionally, landslides can occur after earthquakes, which can cause significant damage to infrastructure and increase the risk of landslides. Therefore, it is crucial to implement measures to prevent and mitigate landslides and ensure that vulnerable populations are protected.

5. Heatwaves

In the context of a heatwave, the data suggests that elderly people, pregnant people, and people with physical or mental disorders/disabilities/illnesses are more vulnerable compared to other groups. More specifically, the percentages of participants indicating elderly people, pregnant people, and people with physical or mental disorders/disabilities/illnesses as vulnerable to the effects of a heatwave are 85.7%, 84.2%, 77.8%, and 68.4%, respectively. Children/minors, single-parent families with minor children, and migrants/refugees/asylum seekers have a lower identified vulnerability to the effects of heatwaves, with percentages ranging from 52.6% to 72.2%. However, it is important to note that a significant proportion of participants also indicated people with low income (61.9%) as vulnerable to the effects of heatwaves.

6. Storm

The data shows that storms were considered to have varying degrees of impact on different vulnerable groups. Elderly people were the most selected group with 65% (13/20), followed by homeless people with 83.3% (15/18). Pregnant people had a moderate response rate with 55.6% (10/18). Single parent families with minor children and people with physical disorder/disability/illness were also indicated to be affected significantly with 64.7% (11/17) and 72.2% (13/18) respectively. People with low income, children/minors, people with mental disorder/disability/illness, and migrants, refugees, asylum seekers had a relatively lower selection rate compared to other groups with 50.0% (10/20), 50.0% (9/18), 64.7% (11/17), and 70.6% (12/17) respectively. Overall, the data highlights the need to pay attention to vulnerable groups during natural disasters like storms to ensure their safety and well-being.

7. Blizzard

A low number of participants (28.6% (6/21)) indicated that people with low income were disproportionately affected by blizzards. For children/minors, the percentage was 52.6% (10/19), and for elderly people, 52.4% (11/21). For pregnant people, the percentage was 42.1% (8/19). Single parent families with minor children were indicated to be affected at a rate of 50.0% (9/18). For homeless people, the percentage was 68.4% (13/19). For those with mental disorder/disability/illness, the rate was 61.1% (11/18), while for those with physical disorder/disability/illness it was 63.2% (12/19). For migrants, refugees, asylum seekers, the percentage was 61.1% (11/18).

It can be seen that the indicated impact of blizzards is similar to the impact of storms for some vulnerable groups (such as homeless people), but different for others (such as pregnant people and those with low income). These differences may be due to factors such as the severity of the weather, the location of the affected population, and the availability of resources and support systems. Further analysis and contextual information would be needed to fully understand the implications of these differences.

8. Flood

The data indicates that vulnerable groups are considered to be disproportionately affected by floods. Low-income individuals, children/minors, elderly people, pregnant people, single-parent families with minor children, homeless people, people with mental and physical disorders/disabilities/illnesses, and migrants/refugees/asylum seekers were all identified as significantly impacted by floods.

The results show that among all the vulnerable groups, children/minors were the group most selected for floods, with a rate of 72.2%. Homeless people and those with physical disorders/disabilities/illnesses also had high rates of selection at 72.2%.

9. Drought

A high number of participants (62.5% (10/16)) indicated that people with low income were disproportionately affected by droughts. For children/minors, the percentage was 43.8% (7/16), and for elderly people, 52.9% (9/17). For pregnant people, the percentage was 46.7% (7/15). Single parent families with minor children were identified as affected at a rate of 37.5% (6/16). For homeless people, the percentage was 76.5% (13/17). For those with mental disorder/disability/illness, the rate was 56.3% (9/16), while for those with physical disorder/disability/illness it was 50.0% (8/16). For migrants, refugees, asylum seekers, the percentage was 68.8% (11/16).

Overall, the data suggests that vulnerable populations are considered to be disproportionately affected by droughts, with homeless people being the most selected group, followed by migrants, refugees, and asylum seekers. These findings highlight the need for targeted interventions to mitigate the impacts of droughts on vulnerable populations, particularly those who are homeless or displaced and those with pre-existing health conditions. Additionally, there is a need to address the underlying socioeconomic factors that contribute to vulnerability, such as poverty and limited access to healthcare.

10. Wildfire

For those with low income, 47.1% (8/17) of participants selected this cell. For children/minors, the percentage was 75.0% (12/16). Among elderly people, 77.8% (14/18) were selected. For pregnant people, the percentage was 75.0% (12/16). Single parent families with minor children were selected at a rate of 68.8% (11/16). For homeless people, the percentage was 66.7% (12/18). For those with mental disorder/disability/illness, the rate was 82.4% (14/17), while for those with physical disorder/disability/illness it was also 82.4% (14/17). For migrants, refugees, asylum seekers, the percentage was 70.6% (12/17).

Based on this data, it is clear that vulnerable groups are significantly affected by wildfires. The elderly, pregnant people, and those with mental and physical disabilities/disorders/illnesses are among the groups that were indicated to be affected at particularly high rates. The data also highlights the impact on children/minors, single parent families, and homeless individuals.

11. Epidemics/ Pandemics

This table presents the percentage and number of individuals belonging to different vulnerable groups affected by epidemics/pandemics.

For people with low income, 50.0% (9/18) of respondents answered that they are affected by epidemics/pandemics. For children/minors, the percentage was 61.1% (11/18). Among elderly people, 68.4% (13/19) were selected. For pregnant people, the percentage was 76.5% (13/17). Single parent families with minor children were selected at a rate of 76.5% (13/17). For homeless people, the percentage was 68.4% (13/19). For those with mental disorder/disability/illness, the rate was 77.8% (14/18), while for those with physical disorder/disability/illness it was 66.7% (12/18). For migrants, refugees, asylum seekers, the percentage was 66.7% (12/18).

Overall, the data suggests that vulnerable groups are disproportionately affected by epidemics/pandemics. Elderly people, pregnant people, single-parent families with minor children, and people with mental or physical disabilities or illnesses are considered particularly vulnerable to the impacts of epidemics/pandemics. It is important to consider the specific needs of these vulnerable groups in planning and responding to epidemics/pandemics to ensure equitable access to healthcare, resources, and support.

12. Technological accident

For people those with low income, 33.3% (6/18) of respondents answered that they are particularly affected. For children/minors, the percentage was 35.3% (6/17). For elderly people, 36.8% (7/19) were selected. For pregnant people, the percentage was 35.3% (6/17). Single parent families with minor children were selected at a rate of 35.3% (6/17). For homeless people, the percentage was 26.3% (5/19). For those with mental disorder/disability/illness, the rate was 38.9% (7/18), while for those with physical disorder/disability/illness it was 44.4% (8/18). Among migrants, refugees, asylum seekers, the percentage was 38.9% (7/18).

From this data, we can see that vulnerable groups are affected by technological accidents, with people with physical disabilities/illnesses being the most selected group. However, it is important to note that the sample size is relatively small for each group, and further research is needed to confirm these findings. In conclusion, technological accidents have the potential to disproportionately affect vulnerable groups, and it is important to take into account their specific needs and circumstances when planning for and responding to such events.

13. Cyber threat

According to the table, the selection rate of cyber threats is relatively low on most of the vulnerable groups. Only 11.1% to 29.4% of participants selected this threat as relevant for the listed vulnerable groups. However, it is important to note that the data might be biased, as the impact of cyber threats is not always easy to identify, and some people might not even be aware that certain groups of people might be more vulnerable towards them it. Overall, the low percentage of people selecting cyber threats suggests that it is not a major concern for most vulnerable groups compared to other types of disasters. However, it is still important to raise awareness and take measures to prevent and respond to cyber threats, especially for those who are more vulnerable and might have less access to resources and information.

14. CBRNe malicious act

For the category of CBRNe malicious act, the highest percentage of selections are single parent families with minor children (37.5%) and people with mental disorders/disabilities/illness (35.3%). The lowest percentage is for pregnant people, with only 37.5% of participants indicating that these groups are particularly vulnerable. It is important to note that the percentages for all vulnerable populations are lower compared to the other types of disasters listed in the table. This could be due to the fact that CBRNe malicious acts are less common compared to natural disasters such as floods, wildfires, and droughts, and therefore affect a smaller number of people overall. In conclusion, the analysis of this table shows that single parent families with minor children and people with mental disorders/disabilities/illness are considered more vulnerable to the effects of CBRNe malicious acts compared to other vulnerable populations. However, it is important to consider that the overall perceived impact of CBRNe malicious acts is relatively low compared to other types of disasters listed in the table.

15. Terrorism attack

The data shows that elderly people, single-parent families with minor children, homeless people, people with mental disorders/disabilities/illnesses, and people with physical disorders/disabilities/illnesses are considered among the most vulnerable groups to terrorism attacks, with percentages ranging from 36.8% to 50%. Children/minors and pregnant people also have relatively high response rates, with percentages ranging from 35.3% to 41.2%. People with low income and migrants, refugees, and asylum seekers have the lowest percentages of selection, with percentages ranging from 33.3% to 44.4%. It is important to note that terrorism attacks have the potential to cause significant harm and can result in physical injuries, psychological trauma, and economic and social disruption, among other consequences.

Conclusion for Greek results

The analysis shows that earthquakes affect the majority of vulnerable groups in Greece, with over 77.8% to 93.8% of each group selected to be particularly vulnerable. Heatwaves, floods, and wildfires also affect a high percentage of vulnerable groups, ranging from 58.8% to 85.7%. Epidemics/pandemics are also considered to disproportionately affect the listed groups, with 50% to 76.5% of participants choosing these cells. On the other hand, volcanic eruptions and cyber threats are considered to affect a relatively smaller percentage of vulnerable groups. For example, volcanic eruptions were selected for between 33.3% to 60% of vulnerable groups, while cyber threats were only selected for 17.6% to 29.4% of cells.

Overall results for Greece:

•   Earthquakes are considered to pose a high risk to all vulnerable groups, especially to pregnant people, single-parent families with minor children, and people with physical disorders/disabilities/illnesses.

•   Heatwaves are considered particularly dangerous for elderly people and pregnant people, who are at high risk of heatstroke and other heat-related illnesses.

•   Floods are also believed to pose a significant risk to vulnerable groups, with low-income people and children/minors being particularly at risk.

•   Wildfires are believed to have a high impact on children/minors, homeless people, and people with mental disorders/disabilities/illnesses.

•   Epidemics/pandemics are believed to pose a high risk to pregnant people, single-parent families with minor children, elderly people, and people with physical disorders/disabilities/illnesses.

•   Landslides   were   selected   to   have   a   high   impact   on   people   with   physical disorders/disabilities/illnesses and migrants, refugees, asylum seekers.

•   Tsunamis have a selection rate for homeless people and migrants, refugees, asylum seekers.

•   Storms have a high percentage for homeless people and migrants, refugees, asylum seekers.

•   Blizzards are believed to pose a significant risk to elderly people and homeless people.

•   Technological accidents are thought to have a high impact on homeless people and migrants, refugees, asylum seekers.

•   Cyberattacks   are   considered   to   have   a   high   impact   on   people   with   mental disorders/disabilities/illnesses.

Table 12: Matrix showing which groups were considered vulnerable in which hazard situations by participants in Greece (hazards by vulnerable groups).
Percentages indicate how many (valid) percent of respondents selected this cell; parentheses show the number of people who selected it/valid responses for this cell

	People with low income	Children/minors	Elderly people	Pregnant people	Single parent families with minor children	Homeless people	People with mental disorder/disability/illness	People with physical disorder/disability/illness	Migrants, refugees, asylum seekers	I don't know (n)
Earthquakes	77.8% (14/18)	87.5% (14/16)	88.9% (16/18)	87.5% (14/16)	93.3% (14/15)	56.3% (9/16)	86.7% (13/15)	93.8% (15/16)	60.0% (9/15)	3
Volcanic Eruption	33.3% (5/15)	50.0% (7/14)	60.0% (9/15)	57.1% (8/14)	57.1% (8/14)	53.8% (7/13)	50.0% (7/14)	57.1% (8/14)	42.9% (6/14)	6
Tsunami	29.4% (5/17)	60.0% (9/15)	58.8% (10/17)	50.0% (8/16)	53.3% (8/15)	46.7% (7/15)	53.3% (8/15)	60.0% (9/15)	53.3% (8/15)	4
Landslide	26.3% (5/19)	47.1% (8/17)	57.9% (11/19)	55.6% (10/18)	58.8% (10/17)	52.9% (9/17)	64.7% (11/17)	70.6% (12/17)	58.8% (10/17)	2
Heatwave	61.9% (13/21)	52.6% (10/19)	85.7% (18/21)	84.2% (16/19)	61.1% (11/18)	84.2% (16/19)	77.8% (14/18)	68.4% (13/19)	72.2% (13/18)	0
Storm	50.0% (10/20)	50.0% (9/18)	65.0% (13/20)	55.6% (10/18)	64.7% (11/17)	83.3% (15/18)	64.7% (11/17)	72.2% (13/18)	70.6% (12/17)	1
Blizzard	28.6% (6/21)	52.6% (10/19)	52.4% (11/21)	42.1% (8/19)	50.0% (9/18)	68.4% (13/19)	61.1% (11/18)	63.2% (12/19)	61.1% (11/18)	0
Flood	60.0% (12/20)	72.2% (13/18)	65.0% (13/20)	50.0% (9/18)	64.7% (11/17)	72.2% (13/18)	64.7% (11/17)	72.2% (13/18)	58.8% (10/17)	1
Drought	62.5% (10/16)	43.8% (7/16)	52.9% (9/17)	46.7% (7/15)	37.5% (6/16)	76.5% (13/17)	56.3% (9/16)	50.0% (8/16)	68.8% (11/16)	3
Wildfire	47.1% (8/17)	75.0% (12/16)	77.8% (14/18)	75.0% (12/16)	68.8% (11/16)	66.7% (12/18)	82.4% (14/17)	82.4% (14/17)	70.6% (12/17)	2
Epidemics/ Pandemics	50.0% (9/18)	61.1% (11/18)	68.4% (13/19)	76.5% (13/17)	76.5% (13/17)	68.4% (13/19)	77.8% (14/18)	66.7% (12/18)	66.7% (12/18)	1
Technological accident	33.3% (6/18)	35.3% (6/17)	36.8% (7/19)	35.3% (6/17)	35.3% (6/17)	26.3% (5/19)	38.9% (7/18)	44.4% (8/18)	38.9% (7/18)	1
Cyber threat	17.6% (3/17)	18.8% (3/16)	16.7% (3/18)	12.5% (2/16)	12.5% (2/16)	11.1% (2/18)	17.6% (3/17)	29.4% (5/17)	17.6% (3/17)	2
CBRNe malicious act	23.5% (4/17)	37.5% (6/16)	27.8% (5/18)	37.5% (6/16)	25.0% (4/16)	27.8% (5/18)	35.3% (6/17)	29.4% (5/17)	35.3% (6/17)	2
Terrorism attack	33.3% (6/18)	41.2% (7/17)	36.8% (7/19)	35.3% (6/17)	35.3% (6/17)	42.1% (8/19)	50.0% (9/18)	44.4% (8/18)	44.4% (8/18)	1
I don't know (n)	0-2	2-3	0-1	2-3	3	1-2	2-3	2	2-3	

Table 13: Matrix showing which groups were considered vulnerable in which hazard situations by participants in Greece (vulnerable groups by hazards). Percentages indicate how many (valid) percent of respondents selected this cell; parentheses show the number of people who selected it/valid responses for this cell

	Earthquakes	Volcanic Eruption	Tsunami	Landslide	Heatwave	Storm	Blizzard	Flood	Drought	Wildfire	Epidemics/ Pandemics	Technological accident *	Cyber threat	CBRNe malicious act	Terrorism attack
People with low income	77.8% (14/18)	33.3% (5/15)	29.4% (5/17)	26.3% (5/19)	61.9% (13/21)	50.0% (10/20)	28.6% (6/21)	60.0% (12/20)	62.5% (10/16)	47.1% (8/17)	50.0% (9/18)	33.3% (6/18)	17.6% (3/17)	23.5% (4/17)	33.3% (6/18)
Children/minors	87.5% (14/16)	50.0% (7/14)	60.0% (9/15)	47.1% (8/17)	52.6% (10/19)	50.0% (9/18)	52.6% (10/19)	72.2% (13/18)	43.8% (7/16)	75.0% (12/16)	61.1% (11/18)	35.3% (6/17)	18.8% (3/16)	37.5% (6/16)	41.2% (7/17)
Elderly people	88.9% (16/18)	60.0% (9/15)	58.8% (10/17)	57.9% (11/19)	85.7% (18/21)	65.0% (13/20)	52.4% (11/21)	65.0% (13/20)	52.9% (9/17)	77.8% (14/18)	68.4% (13/19)	36.8% (7/19)	16.7% (3/18)	27.8% (5/18)	36.8% (7/19)
Pregnant people	87.5% (14/16)	57.1% (8/14)	50.0% (8/16)	55.6% (10/18)	84.2% (16/19)	55.6% (10/18)	42.1% (8/19)	50.0% (9/18)	46.7% (7/15)	75.0% (12/16)	76.5% (13/17)	35.3% (6/17)	12.5% (2/16)	37.5% (6/16)	35.3% (6/17)
Single parent families with minor children	93.3% (14/15)	57.1% (8/14)	53.3% (8/15)	58.8% (10/17)	61.1% (11/18)	64.7% (11/17)	50.0% (9/18)	64.7% (11/17)	37.5% (6/16)	68.8% (11/16)	76.5% (13/17)	35.3% (6/17)	12.5% (2/16)	25.0% (4/16)	35.3% (6/17)
Homeless people	56.3% (9/16)	53.8% (7/13)	46.7% (7/15)	52.9% (9/17)	84.2% (16/19)	83.3% (15/18)	68.4% (13/19)	72.2% (13/18)	76.5% (13/17)	66.7% (12/18)	68.4% (13/19)	26.3% (5/19)	11.1% (2/18)	27.8% (5/18)	42.1% (8/19)
People with mental disorder/disability/illness	86.7% (13/15)	50.0% (7/14)	53.3% (8/15)	64.7% (11/17)	77.8% (14/18)	64.7% (11/17)	61.1% (11/18)	64.7% (11/17)	56.3% (9/16)	82.4% (14/17)	77.8% (14/18)	38.9% (7/18)	17.6% (3/17)	35.3% (6/17)	50.0% (9/18)
People with physical disorder/disability/illness	93.8% (15/16)	57.1% (8/14)	60.0% (9/15)	70.6% (12/17)	68.4% (13/19)	72.2% (13/18)	63.2% (12/19)	72.2% (13/18)	50.0% (8/16)	82.4% (14/17)	66.7% (12/18)	44.4% (8/18)	29.4% (5/17)	29.4% (5/17)	44.4% (8/18)
Migrants, refugees, asylum seekers	60.0% (9/15)	42.9% (6/14)	53.3% (8/15)	58.8% (10/17)	72.2% (13/18)	70.6% (12/17)	61.1% (11/18)	58.8% (10/17)	68.8% (11/16)	70.6% (12/17)	66.7% (12/18)	38.9% (7/18)	17.6% (3/17)	35.3% (6/17)	44.4% (8/18)

4.2.4 WORKING WITH VULNERABLE GROUPS AND RESILIENCE

4.2.4.1 Working with vulnerable groups

Throughout the whole sample, approximately half of the participants indicated that they or their organization was working with vulnerable groups, with relatively balanced numbers for France and Greece (see Table 14). Twelve participants prematurely ended the questionnaire in the second part (hazards) or the third part of the questionnaire and therefore did not answer many questions in the third and fourth part. Seven people from France and 20 from Greece answered the question. The responses were divided into three categories: "Yes", "No", and "Not aware".

Table 14: Participants working with vulnerable groups in % per country (n = 39)

	All (n = 39)	France (n = 13)	Greece (n = 26)
Yes	44.4%	42.9%	45.0%
No	37.0%	57.1%	30.0%
Not aware	18.5%	0.0%	25.0%
Missing (n)	12	6	6
Total	100.0%	100.0%	100.0%

According to a study of the poll results, about 43% of respondents in France selected "Yes", suggesting that they or their organization assists or works with vulnerable groups. This indicates that a sizeable percentage of French respondents are aware of the vulnerable groups and actively interact with them. Additionally, 57% of French respondents who were asked if they worked with vulnerable groups gave a "No" response. This suggests that a sizeable portion of respondents may not be aware of the vulnerable groups or may lack the means or ability to assist them. Thus, the results show that there is a need to better understand and help vulnerable groups in France, although this is not dominant. In the French group, the question "If "yes", which vulnerable groups are you working with?" question got multiple answers. Elderly people, single parents, people with mental and physical disorders were the most indicated vulnerable groups, with 14.3% of respondents each saying they work with these groups (see Table 15).

In the analysis of participants from Greece, 45% of respondents answered "Yes," indicating that they or their organization works with vulnerable groups. This suggests that a significant portion of the respondents in Greece are aware of the vulnerable groups and actively engage with them. Additionally, 30% of the respondents in Greece answered "No," indicating that they do not work with vulnerable groups. This implies that a significant proportion of respondents may not be aware of the vulnerable groups or may not have the resources or capacity to work with them. Finally, 25% of the respondents in Greece answered "Not aware," indicating that they may not have enough information to answer the question or may not fully understand the definition of vulnerable groups. This highlights the need for greater education and awareness-raising around vulnerable groups and their needs.

Overall, the results suggest that there is a need for increased awareness and support for vulnerable groups in Greece. The question "If yes, which vulnerable groups are you working with? (Multiple answers permitted)" was asked to respondents who answered "Yes" to the previous question about whether they or their organization work with vulnerable groups. The most frequently mentioned vulnerable group was children/minors, with 24.1% of respondents indicating that they work with this population. Other frequently mentioned groups were people with mental disorder/disability/illness (13.8%) and migrants, refugees, and asylum seekers (13.8%). It is worth noting that the "Other" category had no responses, indicating that respondents did not mention any vulnerable groups that were not included in the list of options provided.

Further analysis of the results reveals several interesting patterns and implications.

- First, the fact that children/minors were the most frequently mentioned vulnerable group indicates that there is a significant focus on addressing the needs of this population in Greece. This could be related to the country's ageing population and the importance placed on supporting the next generation.

- Second, the fact that people with mental disorder/disability/illness and migrants, refugees, asylum seekers were also commonly mentioned highlights the importance of addressing the needs of these populations in Greece. This may be related to the country's recent history of economic and political instability, which has resulted in an influx of refugees and migrants and a strain on mental health services.

- Third, the relatively low percentages of respondents mentioning elderly people, pregnant people, single parent families with minor children, homeless people, and people with low income suggest that these groups may be overlooked or underserved in Greece. This may indicate a need for greater attention and resources to support these vulnerable populations.

- Finally, the fact that no respondents mentioned "Other" vulnerable groups indicates that the list of options provided was comprehensive enough to capture the most commonly recognized populations.

Overall, the results provide valuable insights into the vulnerable populations that organizations and individuals in Greece are working with and the gaps that may exist in current support and services.

Those participants who indicated that they were working with vulnerable groups were also asked in how far. Two participants from France indicated that they were primarily transporting them (railroad sector) and that they provide an early warning system.

Table 15: Answers for "If yes, which vulnerable groups are you working with?" (Multiple answers permitted), in % per country

	All (n = 43 answers)	France (n = 14 answers)	Greece (n = 29 answers)
Children/minors	18.6%	7.1%	24.1%
Elderly people	9.3%	14.3%	6.9%
Pregnant people	7.0%	7.1%	6.9%
Single parent families with minor children	9.3%	14.3%	6.9%
Homeless people	7.0%	7.1%	6.9%
People with mental disorder/disability/illness	14.0%	14.3%	13.8%
People with physical disorder/disability/illness	11.6%	14.3%	10.3%
Migrants, refugees, asylum seekers	11.6%	7.1%	13.8%
People with low income	11.6%	14.3%	10.3%
Other	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

The answers to the question "How are you working with these vulnerable groups?" in Greece suggest a range of approaches, including:

1. Providing guidance in a timely manner and safe avoidance of disasters to all vulnerable groups: This approach seems to focus on disaster preparedness and response, with an emphasis on ensuring that vulnerable groups are well-informed and able to protect themselves during disasters. This could include providing guidance on evacuation routes, emergency supplies, and other essential

information. It is a proactive approach that aims to prevent harm to vulnerable groups and reduce the negative impact of disasters on them.

2. Targeted information dissemination through the social media of the prefecture: This approach seems to focus on using social media to reach vulnerable groups with important information. Social media can be an effective tool for reaching large audiences quickly and efficiently, and can be particularly useful for reaching younger people or those who may not have access to traditional media. The use of targeted information dissemination suggests that this approach is designed to reach specific groups with information that is relevant to them.

3. Research and development projects: This approach involves conducting research and developing new solutions to address the needs of vulnerable groups. This could include developing new technologies, programs, or services that are tailored to the needs of specific vulnerable groups. Research and development projects can help to identify innovative solutions and improve outcomes for vulnerable groups.

4. Training on earthquake protection measures and familiarization with the phenomenon of earthquake: This approach focuses on educating vulnerable groups on how to protect themselves during earthquakes. This could include training on earthquake-resistant building design, evacuation procedures, and other protective measures. By providing education and training, vulnerable groups can better understand the risks associated with earthquakes and take appropriate action to protect themselves.

5. Primary health care and relief aid in food etc. for lonely elderly people, chronically ill, people with disabilities (physical, mental), low-income, single-parent families, children: This approach seems to focus on providing direct assistance to vulnerable groups, particularly those who may struggle to access essential services or resources. This could include providing primary health care, relief aid in the form of food or other supplies, and other forms of support. By providing direct assistance, this approach aims to improve the well-being and quality of life of vulnerable groups.

6. Street work for the homeless: This approach involves reaching out directly to homeless people and providing them with support and assistance. This could include providing access to shelter, food, health care, and other essential services. Street work can be an effective way to reach vulnerable groups who may not have access to traditional support services, and can help to build trust and relationships with these groups.

7. Primary health care for immigrants/refugees in Structures where they reside: This approach focuses on providing primary health care to immigrants and refugees who may face barriers to accessing traditional health care services. By providing care directly in the structures where these groups reside, this approach aims to improve access to care and address the unique needs of these vulnerable groups.

Overall, the answers suggest a proactive and diverse approach to working with vulnerable groups in Greece, with a focus on education, outreach, and direct support.

4.2.4.2 Bouncing back after a disaster

The next question was "What do you think helps people best to bounce back after a disaster?" This question was answered by a total of 29 participants and results can be seen in Figure 1. In the overall sample,

rebuilding infrastructure was chosen the most often (by 30.0% of participants) as being the most important step, followed by building strong social ties in the community (20.7%).
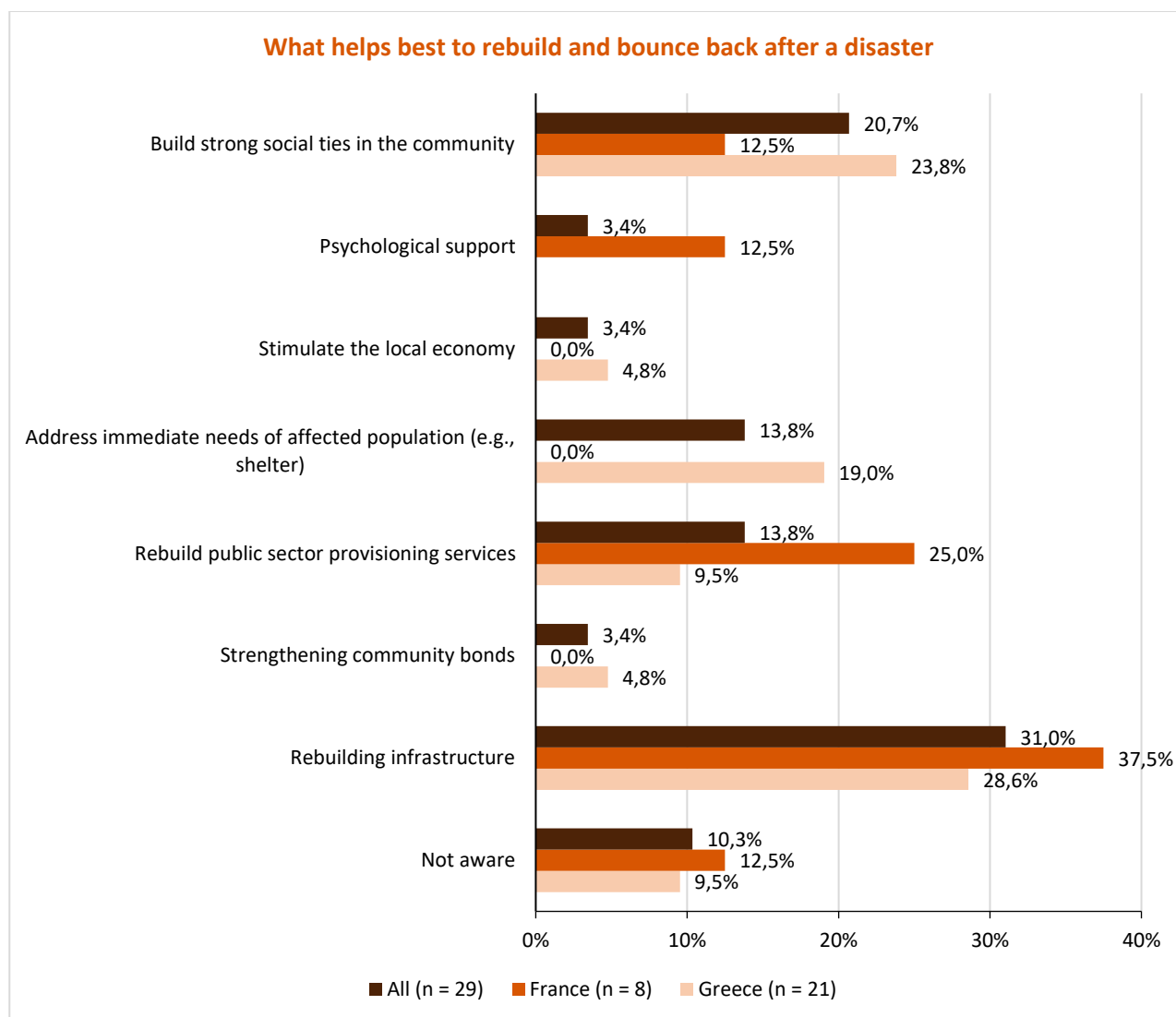
What helps best to rebuild and bounce back after a disaster

Category	All (n = 29)	France (n = 8)	Greece (n = 21)
Build strong social ties in the community	20,7%	12,5%	23,8%
Psychological support	3,4%	12,5%	
Stimulate the local economy	3,4%	0,0%	4,8%
Address immediate needs of affected population (e.g., shelter)	13,8%	0,0%	19,0%
Rebuild public sector provisioning services	13,8%	25,0%	9,5%
Strengthening community bonds	3,4%	0,0%	4,8%
Rebuilding infrastructure	31,0%	37,5%	28,6%
Not aware	10,3%	12,5%	9,5%

Figure 1: Bar chart showing the results of the single choice question on what helps best to build back after a disaster, shown in % within country

Only 8 of the respondents were from France. According to the responses from France, it appears that rebuilding infrastructure is the preferred strategy for recovering from a disaster, as indicated by 37.5% of respondents. Rebuilding infrastructure is essential for the community's operation. The next most popular strategy, chosen by 25% of respondents from France, is rebuilding public sector provisioning services, which involves the public-private partnership and capacity building. Only 12.5% of respondents indicated that it is crucial to build strong community ties in order to rebuild after a disaster.

Responses from Greece also indicate that the most popular approach to rebuilding and bouncing back after a disaster is rebuilding infrastructure, with 28.6% of respondents indicating this. This may include repairing damaged buildings, roads, bridges, and other infrastructure that is crucial for the community's functioning. Building strong social ties in the community was chosen by 23.8% of respondents, which suggests that social support and a sense of community are also important factors in helping people recover from disasters. Strengthening community bonds may involve promoting volunteerism, organizing community events, and facilitating communication among community members. The next most indicated approach is addressing the

immediate needs of the affected population, such as providing shelter and necessities like food and water, which was selected by 19.0% of respondents. Only a small percentage of respondents from Greece, 4.8%, indicated that stimulating the local economy was important for rebuilding after a disaster. This may be because the immediate needs of the affected population take priority over economic concerns in the aftermath of a disaster.

Overall, the results suggest that a multifaceted approach is necessary for effective disaster recovery, with a focus on addressing the immediate needs of the affected population, rebuilding infrastructure and public sector provisioning services, and building strong social ties in the community.

4.2.4.3 Vulnerabilities after a disaster

Another single choice question asked participants to identify the factor which makes people most vulnerable after disasters, according to their opinion. Results can be seen in Figure 2. This question was answered by 29 participants. In the overall sample, pre-existing vulnerabilities, lack of support from authorities, and economic loss or poverty were chosen most frequently by the respondents (17.2-24.1%). These percentages differ markedly between participants from France and from Greece:

According to the findings, most French respondents (37.5%) believe, that economic loss or poverty best characterizes a person's vulnerability following a disaster. This suggests that significant damage to infrastructure, homes, businesses, and livelihoods can result in economic losses, particularly for individuals and communities, who were already living in poverty before the disaster. Another interesting conclusion is that 25% of respondents think that vulnerability during a disaster is defined by the absence of support from authorities. This supports that French citizens are concerned about the efficiency of institutional and governmental responses to disasters. Furthermore, 12.5% of respondents think that psychological effects or trauma following a disaster characterizes vulnerability after them. Addressing the mental health needs of those affected by a disaster is crucial for promoting resilience and reducing the long-term impact of the disaster on individuals and communities.

Based on the results, most respondents in Greece (28.6%) believe that pre-existing vulnerabilities define best whether people are vulnerable after a disaster. This suggests that factors such as age, physical and mental health, socio-economic status, and access to resources prior to the disaster play a significant role in determining vulnerability. Another notable finding is that 19.0% of respondents believe that the lack of support from authorities defines vulnerability after a disaster. This indicates that the effectiveness of government and institutional responses to disasters is a concern for people in Greece, just as in France. Additionally, 9.5% of respondents identified economic loss or poverty as the defining factor of vulnerability after a disaster, while 9.5% cited injuries and deaths. These results highlight the importance of addressing not only the immediate physical needs of affected populations, but also the economic and social impacts of disasters. It is worth noting that 14.3% of Greek respondents were not aware of the factors that define vulnerability after a disaster, suggesting a need for increased public education and awareness on the topic. Overall, these results suggest a complex understanding of vulnerability after disasters, with multiple factors contributing to the experiences of affected populations.

4.2.5 REPRESENTATION AND INVOLVEMENT OF VULNERABLE GROUPS

4.2.5.1 Vulnerable groups and their inclusion in disaster management plans

The question whether representatives from vulnerable groups were involved in any disaster management plans (in the region or organization) was again answered by 29 participants in total. Results can be seen in Table 16. Most participants stated that they were not aware whether this was the case, followed by "no". Only 6.9% answered that this was the case, and all of them were from Greece, while "partly" was chosen by very few respondents, all of them from France, indicating a possible difference due to translations.
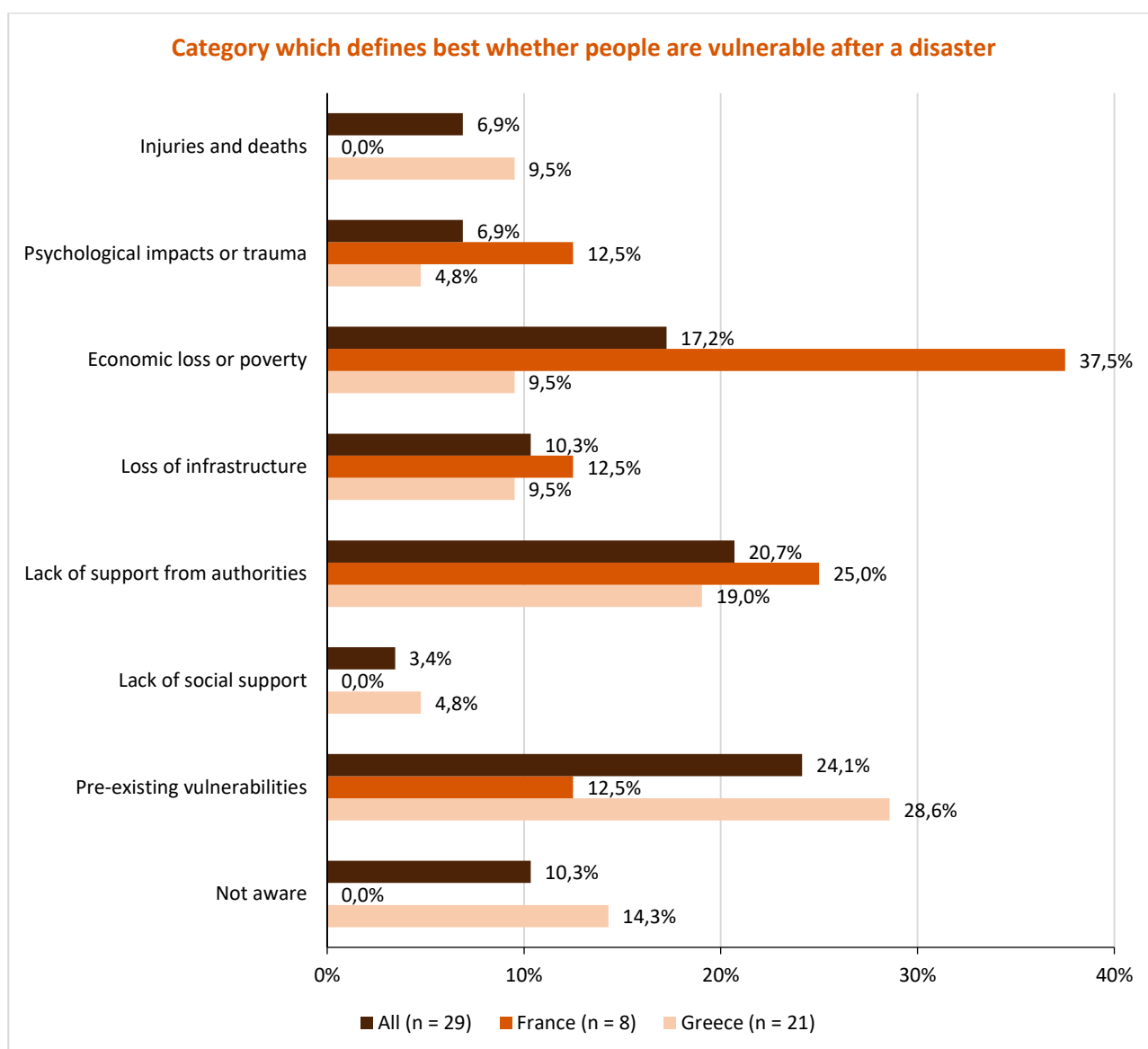
Category which defines best whether people are vulnerable after a disaster

Injuries and deaths
- 6,9%
- 0,0%
- 9,5%

Psychological impacts or trauma
- 6,9%
- 12,5%
- 4,8%

Economic loss or poverty
- 17,2%
- 37,5%
- 9,5%

Loss of infrastructure
- 10,3%
- 12,5%
- 9,5%

Lack of support from authorities
- 20,7%
- 25,0%
- 19,0%

Lack of social support
- 3,4%
- 0,0%
- 4,8%

Pre-existing vulnerabilities
- 24,1%
- 12,5%
- 28,6%

Not aware
- 10,3%
- 0,0%
- 14,3%

■ All (n = 29) ■ France (n = 8) ■ Greece (n = 21)

Figure 2: Bar chart showing the results of the single choice question on what makes people most vulnerable after a disaster, shown in % within country

Table 16: Vulnerable groups involved in disaster management plans in % per country (n = 39)

	All (n = 29)	France (n = 8)	Greece (n = 21)
Yes	6.9%	0.0%	9.5%
Partly	3.4%	12.5%	0.0%
No	31.0%	37.5%	28.6%
Not aware	58.6%	50.0%	61.9%
Missing (n)	10	5	5
Total	100.0%	100.0%	100.0%

According to answers in the French group, 50% of the 8 responders were not aware of whether representatives of the before-identified vulnerable groups were involved in any disaster management plans in their region/organization. This can imply that there is a lack of communication and transparency about the inclusion of vulnerable groups' representatives in disaster management strategy. There may be a need for greater inclusion and consideration of disadvantaged populations in disaster planning efforts, according to another 37.5% of respondents in France who stated that representatives of vulnerable groups were not included in any disaster management plans. The remaining 12.5% of respondents indicated that representatives of vulnerable groups were partially involved in disaster planning. This leads to the conclusion, that the engagement of vulnerable groups in disaster planning processes in France needs to be developed.

Based on the results from Greece (n=21), it appears that the majority of respondents (61.9%) were not aware of whether representatives of vulnerable groups were involved in any disaster management plans in their region/organization. This suggests a potential lack of transparency and communication around the involvement of vulnerable groups in disaster management planning. Furthermore, 28.6% of respondents reported that representatives of vulnerable groups were not involved in any disaster management plans, indicating that there may be a need for greater inclusivity and consideration of vulnerable populations in disaster planning efforts. The remaining 9.5% of Greek respondents reported that representatives of vulnerable groups were involved to some extent, indicating that there may be some efforts to include vulnerable populations in disaster planning, but perhaps not to a sufficient extent. Overall, these results suggest that there may be room for improvement in the involvement of vulnerable groups in disaster management planning in Greece.

Those who indicated that representatives of vulnerable groups were indeed involved in disaster management plans were asked how they were involved. Three participants answered this question – one from France and two from Greece. The French participant indicated that they were involved in crisis management exercises in schools. Based on the two responses provided from Greek participants, it is difficult to draw generalizable conclusions about how representatives of vulnerable groups are involved in disaster plans in Greece. The first response suggests that representatives of vulnerable groups may be involved in disaster plans through dissemination and simulation activities, which may involve training and educating individuals on disaster preparedness and response. The second response mentions the involvement of representatives of vulnerable groups during the Olympic Games in Greece, but the details are not clear.

4.2.5.2   Do current disaster management plans serve vulnerable groups?

Twenty-eight participants answered the question "How well do current disaster management plans serve vulnerable groups?" Half of these participants indicated that they believed it served them rather badly, suggesting an urgent need for improvement and, together with the previous question, a need for closer cooperation between DRM decision makers and institutions and representatives of vulnerable groups. However, it should be noted that no participant chose "not at all" as an answer. Answers are visualized in Figure 3.

According to the answers from France, an equal number of participants (28.6%) believe that existing disaster management plans serve vulnerable groups either rather badly or rather well. Only 14,3% percent of responders indicate that current disaster management plans serve the vulnerable groups very well. It may imply that disaster management plans do not cover all the types of vulnerable groups or definition of those vulnerable groups is not precise enough. There might be some aspects that are covered by disaster management plans and some might not.

For the respondents from Greece, it appears that a significant number (57.1%) feel that the current disaster management plans in their region serve the vulnerable groups rather poorly. This suggests that there may be

gaps or weaknesses in the disaster management plans in Greece/Athens when it comes to addressing the needs and vulnerabilities of certain groups. It is worth noting that a relatively high percentage of Greek respondents (19.0%) indicated that they did not know how well the disaster management plans served vulnerable groups, which may indicate a lack of awareness or understanding of the issue. On the other hand, a small percentage of respondents (4.8%) felt that the disaster management plans served vulnerable groups very well, while another 19.0% felt that they served them rather well.

This suggests that there may be some aspects of the disaster management plans that are effective in addressing the needs of vulnerable groups, but that more needs to be done to improve overall preparedness and response efforts, especially in Greece.
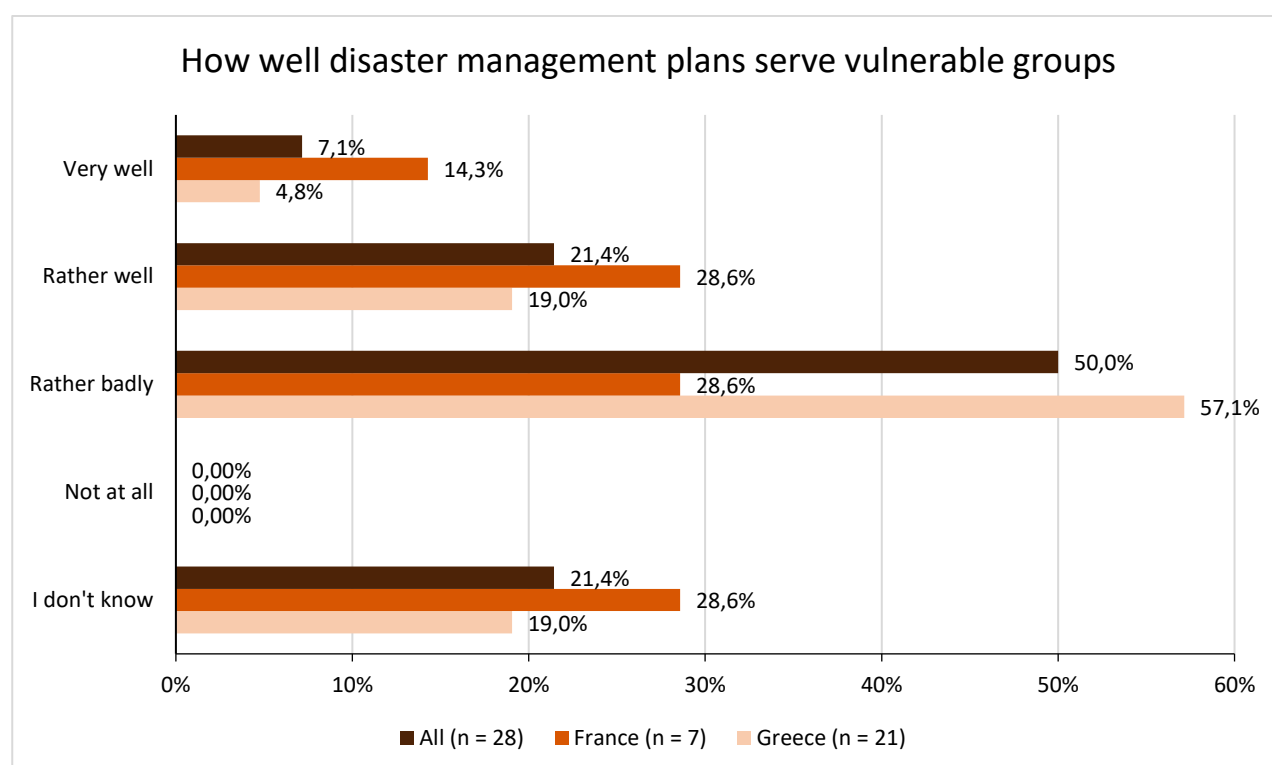
Figure 3: Assessments on how well the existing disaster management plans serve vulnerable groups, in % per country

4.2.5.3 Initiatives to reach vulnerable groups

Participants were also asked whether they knew of any initiatives in place to reach vulnerable groups in terms of disaster risk education. Results can be found in Table 17. Half of all participants indicated that they were not aware if such initiatives existed. The second most chosen answer was "partly", with 25.0%.

Table 17: Presence of initiatives to reach vulnerable groups in % per country (n = 39)

	All (n = 28)	France (n = 7)	Greece (n = 21)
Yes	3.6%	14.3%	0.0%
Partly	25.0%	28.6%	23.8%
No	21.4%	14.3%	23.8%
Not aware	50.0%	42.9%	52.4%
Missing (n)	11	6	5
Total	100.0%	100.0%	100.0%

According to 7 responses in France from a total of 28, 42.9% of the participants were unaware of any initiatives designed to educate vulnerable populations about disaster preparedness. Only 28.6 % of participants from France were aware of initiatives in place to reach vulnerable groups in particular in terms of disaster management education. This suggests that there is a lack of effective information sharing and communication on disaster management initiatives for vulnerable groups in France.

Based on the responses from Greece (n=21), it can be observed that more than half (52.4%) of the participants were not aware of any initiatives in place to reach vulnerable groups in terms of disaster management education. However, some participants reported that such initiatives were partly (23.8%) in place while an equal percentage reported that there were no (23.8%) initiatives in place.

It is concerning that half of the respondents were not aware of any initiatives to reach vulnerable groups in terms of disaster management education. This suggests a lack of effective communication and dissemination of information regarding disaster management initiatives for vulnerable groups in Greece as well as France. The results highlight the need for increased efforts to improve awareness and education for vulnerable groups in disaster-prone regions. This could involve targeted outreach programs, community-based initiatives, and partnerships with relevant organizations to ensure that vulnerable groups are well-informed and prepared for disasters.

Those who answered "yes" or "partly" to this question were asked, for which vulnerable groups these initiatives were in place. Results for this multiple-choice question can be found in Table 18. Overall, most initiatives targeted the elderly (19.2% of all answers), people with mental (15.4%) or physical (11.5%) disorders, disabilities or illnesses, children and minors (15.4%), homeless people (11.5%) and migrants, refugees, or asylum seekers (11.5%).

Table 18: If yes (or partly), for which vulnerable groups are these initiatives in place? In % per country

	All (n = 26 answers)	France (n = 9 answers)	Greece (n = 17 answers)
People with low income	7.7%	0.0%	11.8%
Children/minors	15.4%	11.1%	17.6%
Elderly people	19.2%	11.1%	23.5%
Pregnant people	3.8%	11.1%	0.0%
Single parent families with minor children	3.8%	11.1%	0.0%
Homeless people	11.5%	11.1%	11.8%
People with mental disorder/disability/illness	15.4%	11.1%	17.6%
People with physical disorder/disability/illness	11.5%	11.1%	11.8%
Migrants, refugees, asylum seekers	11.5%	22.2%	5.9%
Other	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

The responses from France demonstrate that although there are some initiatives in place to reach vulnerable groups in terms of disaster management education, not every respondent was aware of them. An equal percentage of answers (11.1%) followed, identifying that the vulnerable group was Children/minors, Elderly people, Pregnant people, Single parent families with minor children, Homeless people, People with mental disorder/disability/illness, and People with physical disorder/disability/illness. Nobody mentioned an initiative targeting people with low income.

Based on the responses from Greece, it appears that there are some initiatives in place to reach vulnerable groups in terms of disaster management education, but not all respondents were aware of them. Of the 17 answers received, the most commonly identified vulnerable groups were elderly people (23.5%), followed by children/minors (17.6%) and people with mental disorder/disability/illness (17.6%). Other groups identified

included people with low income (11.8%), homeless people (11.8%), and people with physical disorder/disability/illness (11.8%). It appears that elderly people were the most commonly cited group for which initiatives are in place, followed by children/minors and people with mental or physical disorders, illness or disabilities. Pregnant people and single parent families with minor children were not mentioned by any of the participants, while migrants, refugees, and asylum seekers were mentioned by only one participant.

Overall, more information is needed to fully understand the extent and effectiveness of disaster management education initiatives targeting vulnerable groups in Greece.

4.2.6   FEEDBACK ON THE QUESTIONNAIRE

Lastly, participants were asked for feedback on the questionnaire, the results of which can be seen in Table 19. Most participants found the questionnaire understandable, and the rest replied with "partly", although it seems to have been better understood by participants in Greece than in France.

Table 19: Was the questionnaire understandable? In % per country

	All (n = 27)	France (n = 7)	Greece (n = 20)
Yes	81.5%	57.1%	90.0%
Partly	18.5%	42.9%	10.0%
Total	100.0%	100.0%	100.0%

This indicates that the questionnaire was generally well-designed and clear for the majority of the respondents. However, it is worth noting that a small proportion of respondents found it only partly understandable, suggesting that there may be room for improvement in the questionnaire's clarity or structure. The higher number of respondents answering "partly" from France indicates that perhaps the French translation was not perfect.

The last question asked participants to indicate anything they would like to add concerning the topic or the questionnaire in general. One respondent from France indicated that the question number should be added. One respondent from Greece added that they believe that bouncing back after a disaster requires a comprehensive strategy that includes multiple measures, which is in line with the various approaches mentioned in the questionnaire. Additionally, the participant also emphasized the importance of addressing the characteristics of people that hinder their ability to bounce back after a disaster. This feedback highlights the need for disaster management plans to consider the complex interplay between various factors that contribute to vulnerability and the importance of taking a holistic approach to disaster management.

4.2.7   SUMMARY OF QUESTIONNAIRE RESULTS

Based on the results from the questionnaire in the overall sample, it appears as if the relevant vulnerable groups were chosen well in advance through the literature research. In general, the most relevant vulnerable groups that were identified via open questions and closed questions were the elderly, children/ minors, and people with mental or physical disorders/ disabilities/ illnesses, which fits well with the literature. People with low income were generally mentioned less but were mentioned more frequently in the hazard situations the participants regarded as the most relevant. Women on the other hand were hardly mentioned, supporting our decision not to include them among the most vulnerable groups. Single parent families with children were never mentioned in the open question but were indicated to be vulnerable for a number of hazards in the matrix question. Overall, the results for the matrix question show that the vulnerable groups were well chosen initially, as each of them was selected to be vulnerable for multiple hazards, while the open

question highlighted several additional groups that should also be considered, such as people living in poor quality housing with old or insufficient regulations.

The questionnaire further showed that there is a general awareness of the importance of disaster management and the need to include vulnerable groups in disaster planning. However, there also seem to be some gaps in terms of implementation and effectiveness of current disaster management plans, with most respondents indicating that the plans serve vulnerable groups rather badly. There also appears to be a lack of awareness and initiatives in place to reach vulnerable groups specifically in terms of disaster management education, with half of respondents not being aware of any such initiatives.

In terms of measures that can help people to rebuild and bounce back after a disaster, there seems to be some consensus among respondents, with the most mentioned measures being rebuilding infrastructure and building strong social ties in the community.

Overall, the questionnaire was generally well understood by respondents, with the vast majority indicating that they found it understandable. One respondent did offer feedback suggesting that a strategy comprising several different measures is necessary to support bouncing back after a disaster.

5 VC INDICATORS

In the following chapter, the indicators for vulnerability and capacity derived from the literature research and the surveys will be presented. The purpose of this chapter is to come up with indicators for vulnerabilities to the most relevant hazards identified for Paris/France and Athens/Greece, based on the literature research, the qualitative and the quantitative data collected in this Task. In accordance with the Grant Agreement, vulnerability and capacity (VC) indicators will be developed for social, economic, physical and environmental, political, and cultural factors

For a common understanding, it is important to specify what is meant by indicators in general and in context of the contemporary epistemological interest.

5.1 DEFINITION

Indicators are different functions that map observable variables (such as the presence of a certain lichen) to theoretical variables (such as air quality). Indicators can be very simple: Scalar indicators, or instance, map one variable onto another (like the example above). Composite indicators are more complex, as they map multiple observable variables onto one theoretical variable. The Human Development index is an example for a composite indicator, combining the measures *life expectancy, adult literacy, mean years of schooling,* and *income*, to describe the theoretical variable *human development*. Vector-valued indicators are even more complex, as they map a vector of observable variables onto a vector of theoretical ones. Generally, indicators are simple linear functions with monotonous increase or decrease. Vulnerability indicators can be used to identify particularly vulnerable people, regions or sectors at local scales. Developing vulnerability indicators should include two steps: defining what should be indicated, and selecting the indicating variables (summarized in Hinkel, 2011).

Examples for VC indicators can be found in articles by Tapia et al. (2017) and Nguyen et al. (2016). Tapia and colleagues (2017) developed 61 vulnerability indicators for 571 European cities (including Paris and Athens) concerning floods, draughts, and heatwaves, on the basis of literature research. To structure their indicators, the authors divided them into five broad categories: (i) human capital, (ii) socio-economic conditions; (iii) built environment; (iv) natural capital and ecosystem services, and; (v) governance and institutions, and 18 further sub-categories. In this article, the authors divided the indicators into sensitivity indicators and adaptive capacity indicators. Indicators that increased vulnerability as their value increased (e.g., the share of elderly people in the population) were defined as sensitivity indicators as equivalent for vulnerability, and those that decreased vulnerability (e.g., larger shares of green areas) were defined as adaptive capacity indicators. These included the proportion of households that are single pensioner households, the unemployment rate, the average disposable annual household income in euros and the number of Google hits for different climate and hazard related strings. Their analysis of the scores was based on data from the GISCO Urban Audit 2004 database (Eurostat, n.d.); and the data on socio-economic indicators was taken from the Urban Audit database (Eurostat, 2016). The data on city awareness and commitment was aggregated from multiple Big Data sources including Google. According to the scores, both Paris and Athens are highly vulnerable (> quantile 0.75) to floods, droughts and heatwaves.

In context of the analysis for the PANTHEON project, vulnerability indicators are defined as factors that put people or communities at higher risk of injury, death, financial or other ruin in or after a disaster situation. Capacity, on the other hand, refers to *the strengths, attributes and resources available within the community to manage and reduce disaster risks and strengthen resilience* (see Chapter 2.1). Therefore, the formulated capacity indicators will aim to indicate the extent of preparedness as well as measures to counter or mitigate vulnerabilities within the communities.

Nguyen et al. (2016) conducted a review on vulnerability indicators and indexes for coastal vulnerability to climate change. Their list is made up of mostly composite indicators, including an overall vulnerability indicator that combines environmental measures such as temperatures with vulnerability indicators (e.g., population density, percent slum population) and capacity indicators (such as corruption index ranking, willingness of city leadership to address climate change). Another notable index listed in this review is the Heat waves vulnerability index designed for European regions, which uses age, Gross Domestic Product (GDP), and education level as social indicators, and a warm spell duration index as well as the number of tropical nights as environmental variables. Also worth mentioning are the eight indicators of vulnerability to climate change which can be applied globally. Three of these relate to the environment (median & standard deviation of projected change in precipitation, median of the projected change in runoff), three to vulnerability in a narrower sense (current population weighted precipitation, renewable water resources per person, water use ratio) and two to capacity (households with improved water supply or with improved sanitation). The vulnerability indicators for river flooding vulnerability and for storm-surge driven flooding are especially relevant for Paris and Athens, as both constitute indices designed for European cities. The indicator for river flooding vulnerability is a composite function that includes measures of river discharge and river flooding, population density, GDP, education level, and money spent on flood protection. The indicator for storm-surge driven flooding vulnerability combines sea-level-rise projections with changes in the height of storm surges, the number of people flooded, population density, elevation and slope of the coast, sea defences, GDP, and education level. It should be noted that a high population density, apart from being an indicator that a large number of people may be affected, also causes difficulties in evacuation due to the high probability of traffic congestion (Lee et al., 2022).

5.2 GENERAL VC INDICATORS FOR THE PANTHEON PROJECT

Based on these examples, combined with the results of the literature review of Chapter 2.4, and empirical data from interviews and survey results, VC indicators specifically adapted to the pilot regions of Paris and Athens and the hazards that are most relevant in these areas were developed. Capacity indicators were partly based on the before-devised vulnerability indicators, proposing mitigation measures for these vulnerabilities.

The resulting VC indicators, including ways to quantify them for Paris and Athens regions or for sub-regions, can be found in Table 20 and Table 22. The overview includes 21 general vulnerability indicators and 15 capacity indicators. In addition, the affected vulnerable groups and vulnerability aspects that were identified as relevant through the research, as well as the dimensions of the indicators, are listed. Vulnerability indicators were further divided into seven categories:

- life-stage-related,
- health-related,
- social-connection-related,
- resource-related,
- exposure-and-protection-related,
- knowledge-and-awareness-related,
- and hazard-specific.

14 Hazard-specific vulnerability indicators are listed separately in Table 21. Of course, these categories are interrelated, e.g., homelessness fits into various categories. Capacity indicators list the categories addressed by each indicator. The operationalization for measurement is intended to provide guidance and does not preclude other approaches. Since those numbers are mostly estimates, also a number of unreported cases

must always be taken into account. Others, such as the familiarity with the environment/Local knowledge are more qualitative or "soft" indicators, which are difficult to be measured directly.

Since according to definitions indicators need to be unidirectional, the presence of critical infrastructure in the area was not included in the list. Critical infrastructure is crucial to be maintained during a disaster and therefore very vulnerable, while hospitals or other resources nearby also increase capacity, meaning this measure would simultaneously increase and decrease vulnerability. It is therefore very important to keep this factor in mind, as it influences the impact of indicators and plays a deciding role on a meta-level.

The order of listing is no indication of the severity or importance of the vulnerability. It also has to be stressed that this list is not exhaustive. Other factors, such as the above-mentioned critical infrastructure, play a role in determining a regions or a community's capacity and vulnerability when facing a disaster, but are difficult to quantify or predict. Gender on the other hand was not included, since both the literature research and the interview- and questionnaire-results paint an unclear picture: Depending on the situation, it may be men or women who are more vulnerable to hazards. According to many of the interviewed experts, there is no notable effect of gender in Greece or France.

Table 20: Vulnerability indicators devised for the focus regions Paris and Athens

Vulnerability Indicator	Reasons for vulnerability	Affected groups and covered factors	Dimensions	Potential measurement
Life stage-related				
Advanced age	Lack of capacity to respond to disasters, dependency on others, mobility problems	Elderly people, lack of physical endurance	social physical	% of people over 65 years of age in the population
Young age	Lack of capacity to respond to disasters, dependency on others, mobility problems	Children/minors, students, households with many children, lack of physical endurance	social physical	% of people under 15 years of age in the population
Family status	Care-giving responsibilities Financial resources	Single parent families with minor children, households with (many) children	social economic	% of single-parent families with minor children in the population
Health-related				
Mental health	Lack of capacity to respond to disasters, dependency on others, possible problems with medication	People with mental disorder/disability/illness	social	% of people with mental disorder/disability/illness in the population
Physical health	Lack of capacity to respond to disasters, dependency on others, mobility problems, possible problems with medication	People with physical disorder/disability/illness, lack of physical endurance	physical	% of people with physical disorder/disability/illness in the population
Mobility	Complications during evacuation or concerning self-protection	Elderly people, children/minors, pregnant people, people with physical disorder/disability/illness, lack of physical endurance, overweight people	Social physical	% of people in the population with known mobility problems
Pregnancy	Mobility problems, possible health complications, teratogens	Pregnant people, lack of physical endurance, women	social physical	% of known pregnant people in the population
Social connection-related				
Migration background	Language barriers, possible insufficient social integration and awareness of local disaster management plans, living conditions and financial resources	Migrants, refugees, asylum seekers	Cultural social political	% of first generation immigrant households, refugees and asylum seekers in the population

Language barriers	Problems with communication between emergency services/ official bodies and locals, vulnerability to misinformation	Migrants, refugees, asylum seekers, people with mental disorder/disability/illness, tourists	Cultural social political	% of people with insufficient skills in the local language in the population
Social isolation	Lack of social network, lack of possible aid in case of problems	The elderly living alone, the socially isolated, homeless people	Social cultural	% of single-person households in the area

Resource-related

Financial resources	Finances influence the capacity to respond to or recover from disasters, as individual resources are needed to prepare for disasters as well as recover and rebuild after they happen	People with low income	economic social	Median income of inhabitants
Potentially affected agricultural areas	Potential threat to livelihoods and food sources	Workers, animals	Physical environmental economic	% of the region being farmed land situated in the hazard zone
Vegetation/ecosystem	Certain kinds of vegetation recover easily while others are more vulnerable to wildfires, storms, floods or other hazards	General population, e.g., summer season in Greece, heat waves in Paris	environmental	Qualitative / Resilience of the ecosystem, particularly vulnerable areas (see hazard-specific vulnerabilities and D2.2 (Triantafyllou & Apostolopoulou, 2023))
Potential job losses	Potential threat to livelihoods as well as the economy and infrastructure	General population, esp. people with increased exposure, like workers, companies, industries, institutions	Social economic	Number of potential jobs lost per 1,000 inhabitants in the area

Exposure and protection-related

Population density	Higher population density means more people are at risk while also creating potential issues during evacuation	General population	Physical, social, cultural	Number of inhabitants per square kilometer
Increased exposure	Increased exposure of e.g., healthcare workers to pathogens or first responders to aftershocks puts them at risk	People with increased exposure, like workers, active people (people doing sports outside), animals, companies/industries/institutions, people living in basements or ground floors	Physical social environmental	% of people working and living in the potential hazard area out of total population (including people living in top-floor apartments for heatwaves, in basements and ground floors for floods, and people living next to forests for wildfires)

Homelessness	Financial resources and social isolation, living conditions and resulting exposure to environmental conditions	Homeless people, people with low income	social physical economic	% of unhoused people in the population
Poor housing quality	Increased risk of collapse or damage, e.g., during earthquakes or floods	People living in houses with poor housing quality/ old or insufficient regulations, people with low income, lack of cooling, lack of urban planning	Physical political economic	% of population living in houses with poor structural integrity and/ or insufficient regulations
Special accommodations	Dependency on others, possible problems with mobility and evacuation, possible problems with heating and cooling, dependence on working infrastructure, electricity	Students, the elderly, children/minors, pregnant people, workers, homeless people, migrants, refugees, asylum seekers, People with physical or mental disorder/disability/illness, lack of cooling, women	Physical social economic	% of people living or staying in special accommodations in the area (hospitals, prisons, care homes, homeless shelters and women's shelters…)
Knowledge and awareness-related				
Lack of disaster awareness or disaster education	Lack of knowledge on the best way to behave in a disaster situation puts people at risk, lack of awareness may also cause hazards, e.g in the case of man-made wildfires or other man-made hazards	People untrained/uneducated in disasters, digitally illiterate people, people with lack of risk awareness or situational awareness, tourists	Social cultural political	Qualitative / Number of disaster preparedness trainings/education programs available per 1,000 inhabitants
Lack of familiarity with the environment/Local knowledge	Tourists are vulnerable due to unfamiliarity with the terrain, the local safety measures, and the local language	Tourists, newcomers, students, children, elderly	Cultural social	Qualitative / % of people without familiarity with the environment in the area during a typical day

5.3 HAZARD-SPECIFIC VULNERABILITY INDICATORS

Hazard-specific indicators are mostly physical and environmental, as social, economic, cultural and political factors are already covered by the general indicators and apply to most hazards. Hazard-specific vulnerabilities do not cover the likelihood of occurrence of a disaster or hazard. This is covered by "risk", which is talked about in D2.1 (Tsaloukidis et al., 2023). The 2020 European Seismic Risk Model for instance incorporates the likelihood of earthquakes occurring in specific areas, soil conditions, as well as measures of soil conditions, building vulnerability, and exposure (e.g., the population density) (EFEHR, 2021). In Table 21, the soil-conditions-aspect of this risk model is used as an indicator for general earthquake-vulnerability, as the other aspects of the 2020 European Seismic Risk Model are already covered by other indicators or describe the likelihood of occurrence rather than vulnerability. The risk of soil liquefaction is an important predictor for an area's vulnerability to earthquakes, as it can lead to building collapses and numerous casualties. It depends on the physical properties of the soil (its relative compactness), groundwater level and water-permeability, and stress characteristics as intrinsic environmental factors (Zhang, 2019). Except for specific construction measures and the distance to the nearest volcano, which is already covered by the indicator "increased exposure", no specific vulnerabilities for volcanic eruptions were found. For tsunamis, this is similar, as the most important physical vulnerability factor appears to be distance from the ocean (Jelínek et al., 2009). However, since in this case the elevation is an area-specific trait and can be adjusted by construction measures, it was nonetheless counted as a vulnerability. The most important factors found for landslides were geology, proximity to streams and torrents, and land use/land cover (Rahman et al., 2022), but this is a measure of likelihood of occurrence rather than vulnerability.

Concerning heatwaves, the formation of urban heat islands is a particular danger due to the trapped heat in some urban areas, which can cause numerous health-problems and fatalities. People living in such areas are therefore particularly vulnerable. The risk of urban heat island formation depends on physical factors such as the amount of vegetation and construction materials (Santamouris et al., 2015). Additionally, air pollution can exacerbate the effects of a heatwave (Sera et al., 2019). For storms, one of the most important factors of vulnerability and capacity is the presence and proximity of shelters, which is covered by the capacity indicator "presence of protective shelters". Storms can cause floods, especially in proximity to coasts and rivers, and in areas of low elevation, making these areas vulnerable to storms (Hossain, 2015). Hossain also mentions proximity to roads as an important factor; however, this should not be relevant in the areas of Paris and Athens and surrounding regions. Blizzards, being severe winter storms, carry different vulnerability factors, especially extreme cold. Urbanized areas are especially vulnerable to extreme temperatures, hot or cold (López-Bueno et al., 2022; Sera et al., 2019). According to a Global expert survey results report by the European Commission, the most relevant indicator for droughts in Europe (not already in the list) is baseline water stress, measured by the ratio of withdrawals to renewable supply (Meza et al., 2019). Regarding wildfires, important vulnerability indicators are the available biomass and presence of forests, as well as the ease of access to the hazard area for firefighters (Rivière et al., 2023).

There are a number of vulnerability factors for epidemics and pandemics, many of which are already included in the general lists. These include the usual indicators of social vulnerability, such as low income and pre-existing illnesses. Depending on the kind of disease, additional factors increase vulnerability on an individual or a community level. For example, people who do not practice safe sex are more vulnerable to contract sexually transmissible infections, and smokers are more vulnerable to COVID-19 (Juárez-Ramírez et al., 2021). Technological accidents (as well as CBRNe malicious acts) are particularly threatening when they involve fires and explosions or the release of hazardous material such as toxic gases. For scenarios like these, meteorological conditions determine the scope of the spread and are therefore vulnerability indicators (Sanchez et al., 2018). Cyber-attacks are a special form of hazard, because in contrast to other hazards, they

do not necessarily cause any physical harm to the environment, buildings, or people, but rather threaten critical infrastructure and security. A whole separate field deals with cyber-vulnerabilities, which includes weaknesses in the system such as poorly configured firewalls (Dosal, 2020). However, cyber-attacks can also target nuclear power plants or other technological facilities, leading to technological hazard events or CBRNe events. In a similar way terrorist attacks can target individuals, but also for example critical infrastructure. In addition to armed attacks, terrorists can also use cyber-attacks or malicious CBRNe actions, so the term "terrorist attack" is very broad. In this context, the psychological impact is also a very important vulnerability factor for the general population, but was not used as an indicator because it is not region-specific but can be seen as a general aspect that is important to keep in mind. Political stability and level of terrorism are factors that determine the likelihood of a terrorist attack (Lambert, 2018), this is however not a vulnerability factor strictu sensu.

It should be noted that while many of the vulnerability indicators address the social, physical, environmental and economic aspects of vulnerability and capacity, many of the capacity indicators involve the political and cultural level. This means that political and cultural measures are necessary to address many of the underlying vulnerabilities within a community. It is also important to stress that some indicators need to be adjusted to specific hazards. For instance, the level of exposure depends highly on the hazard: during heatwaves, people living in top-floor apartments and homeless people are very exposed, while for cyber-attacks, it is mostly critical infrastructure and people spending a lot of time on computers that are especially vulnerable. Depending on the dimension and duration of the caused influence, companies who rely on digital devices and information are vulnerable here, e.g., in the care sector to enable the supply for their clients. Also, the psychological impact and therefore the cultural and social vulnerability has to be taken into account – in cases of wide-spread breakdowns of communication systems and technologies, people may feel distressed by the fact that they cannot reach loved ones or feel trapped. Some indicators might not be relevant to specific kinds of cyber-attacks, such as spam targeting individual people, however since cyber-attacks may also target critical infrastructure, causing technological accidents or supply-issues, they can generally be applied to this hazard too. Therefore, when using these indicators to measure vulnerability and capacity, it has to be known for which hazard(s) they should be applied. Certain capacity indicators, such as the presence of disaster risk management plans, are of course also hazard-dependent.

Attempting to measure the vulnerabilities and capacities also identifies needs for information and further analysis or mapping. To quantify the proposed indicators, certain measures are needed such as statistics of the population. Numerous organisations and institutions collect statistical data on inhabitants and the environment throughout the European Union, including academic institutions, meteorological institutes and statistics institutes. For instance in Greece, the Hellenic National Meteorological Service (*Hellenic National Meteorological Service*, 2023) might be able to provde data on meteorological conditions, and data from the PurpleAir network (*PurpleAir*, 2023) could be used to assess air quality. Furthermore, the number of existing initiatives for community initiatives of vulnerable groups and their interconnectedness - also with disaster management organisations – should be evaluated and if necessary increased for a better overall resilience.

Table 21: Vulnerability indicators devised for the focus regions Paris and Athens – hazard-specific indicators

Vulnerability Indicators	Reasons for vulnerability	Related hazards	Dimensions	Potential measurement
Soil liquefaction risk	Soil liquefaction can cause large-scale collapse in cases of earthquakes	Earthquake	Environmental physical	Risk of soil liquefaction
Shoreline elevation	Close proximity to the ocean and lack of protection by elevation puts areas at risk of tsunamis and storm-caused flooding	Tsunami Storm Flood	Environmental physical	Elevation (in m)
Risk of urban heat island formation	Urban heat islands constitute man-made areas with very high temperatures that can cause serious health problems	Heatwave	Environmental Physical cultural	Likelihood of occurrence of surface urban heat islands in the area
Air pollution	Air pollution can worsen the effects of a heatwave	Heatwave	Environmental cultural	Degree of air pollution ($PM_{2.5}$ and NO_2)
Proximity to coasts and rivers	Storms can cause flooding in areas with bodies of water	Storm	Environmental Physical	Proximity to larger bodies of water (in m)
Urbanity	Cities are especially vulnerable to extreme temperatures	Blizzard Heatwave	Environmental physical cultural	Degree of urbanisation
Coastline vulnerability	Certain physical traits make a coastline more physically vulnerable to flooding	Flood	Physical environmental	Physical vulnerability index by Tragiki et al. (2018)
River flooding vulnerability	Certain physical properties of rivers can make an area more vulnerable to flooding	Flood	Physical environmental	River flows and river floods
Baseline water stress	A baseline lack of water in a certain region makes it more vulnerable in times of water scarcity	Drought	Physical environmental	Ratio of withdrawals to renewable supply
Fuel load	Fires that can consume more biomass may become more severe	Wildfires	environmental	Biomass per hectare
Defendability and firefighting access	Fires are harder to fight if access is more difficult for firefighters	Wildfires	Physical Environmental Cultural political	Distance of hazard area to nearest road, to nearest waterpoints, and to nearest firefighting station
Pathogen-specific risk factors	Depending on the pathogen and the mode of transmission, different groups	Epidemics/Pandemics	Social Cultural environmental	% of people with these pathogen-specific risk factors in the population

	of people are at risk of infection and severe illness			
Meteorological conditions	Wind can carry hazardous material, contaminating a large area or a particularly vulnerable area such as a nature reserve	Technological accident CBRNe malicious act	Environmental	Typical wind strength and direction
Cyber-vulnerabilities	Cyber-threats are more effective and have a higher chance of being successful when there are vulnerabilities in the cyber security system. Depending on dimension and duration of the attack: Supply chains, Companies with supply responsibilities who rely on digital information, e.g., in care sector. Communication systems, traffic; psychological impact/burden on general population	Cyber threat Terrorist attack CBRNe malicious act	Cultural Political	Number of vulnerabilities in the cyber security systems of critical infrastructure in the region

Table 22: Capacity indicators devised for the focus regions Paris and Athens

Capacity Indicators	Description of capacity	Addressed vulnerability categories	Dimensions	Potential measurement
Inclusion of vulnerable groups	Inclusion and representation matter as they create awareness in DRM personnel of the special needs and capacities of vulnerable groups, and disaster education matters specially to people who are already vulnerable	Life-stage-related Health-related Social-connection-related Resource-related Exposure-and-protection-related Knowledge-and-awareness-related	Social Cultural Political	% of DRM processes involving vulnerable groups
Capacity building of vulnerable groups	Participative empowering activities for citizens in DRM enables DRM organisations as well as vulnerable groups to decrease their vulnerabilities	Life-stage-related Health-related Social-connection-related Economy-and-environment -related Exposure-and-protection-related Knowledge-and-awareness-related	Social Cultural	Qualitative / Number of initiatives to reach vulnerable groups concerning DRM education and empowerment per inhabitant

Representation of vulnerable groups	Inclusion and representation matter as they ensure that the special needs and capacities of vulnerable groups are met	Life-stage-related Health-related Social-connection-related Resource-related Exposure-and-protection-related	Political	% of representatives of vulnerable groups in DRM decision making processes
Confidence and initiatives taken by members of vulnerable groups	Enables self-empowerment and active participation and awareness-building within the community	Life-stage-related Health-related Social-connection-related Resource-related Exposure-and-protection-related Knowledge-and-awareness-related	Social Economic Cultural	Qualitative / number of established community initiatives for particular vulnerable groups, interconnectedness
Individual mobility	Enables local people to evacuate and to be self-reliant	Life-stage-related Health-related Social-connection-related Resource-related Exposure-and-protection-related Knowledge-and-awareness-related	Economic Social	Average number of cars owned per household
Degree of social connectedness in the area	Social networks are important for communication and aid within the community, increase resilience	Social-connection-related	Cultural Social	Qualitative / number of established institutions for community exchange, neighbourhood associations
Budget spent on hazard preparedness	Many DRM measures require funding to be implemented, research needs funding, disaster education programs require funding	Exposure-and-protection-related Knowledge-and-awareness-related Hazard-specific	Political environmental	Annual budget spent by city on hazard preparedness divided by number of people annually affected by said hazard
Resilience of critical infrastructure	Ensures the maintenance of emergency services, health services and evacuation routes, includes cybersecurity	Exposure-and-protection-related Health-related	Political	Qualitative / Area wide implemented measures for strengthening critical infrastructure, e.g., analogous backups; existing emergency plan
Implementation of protection measures for housing	Housing quality is an important factor in any physical hazard situation	Exposure-and-protection-related Hazard-specific	Economic Political	% of houses in the area using hazard protection measures (e.g., green roofs to mitigate heatwaves, earthquake-proof buildings etc.)
Implementation of protection measures for the area	Environmental and physical protection measures such as dams are key to protecting an area and its community against potential hazards	Exposure-and-protection-related Hazard-specific Resource-related	Political Environmental	Number of environmental and physical protection measures in place for a specific hazard divided by number of people annually affected by said hazard

Presence of protective shelters	During or after disasters, the population may need to seek shelter	Exposure-and-protection-related	Political Cultural	Number of shelters available per 1,000 inhabitants
Network of DRM and the community	Enables efficient disaster management in collaboration with the locals, e.g., multilingual information	Social-connection-related Exposure-and-protection-related Knowledge-and-awareness-related	Social Cultural Political Economic	Qualitative / Number of existing initiatives involving the community in DRM activities (per 1.000 inhabitants)
Disaster risk management plans	Ensures a fast and efficient disaster risk management	Exposure-and-protection-related Knowledge-and-awareness-related Hazard-specific	Political Cultural	Are disaster risk management plans in place for the specific hazard (yes/no)
Early Warning Systems	Ensures a fast and efficient disaster risk management and awareness of the public	Knowledge-and-awareness-related Hazard-specific	Political Cultural	Are early warning systems in place for the specific hazard (yes/no)
Enhancement of Risk awareness	Research and the distribution of the generated knowledge are crucial for assessing risks of different hazards and disasters	Knowledge-and-awareness-related Hazard-specific	Political Cultural	Qualitative / Number of risk assessments carried out plus number of trainings offered for the community per year for the specific hazard

6   EXPERIENCED RESEARCH LIMITATIONS

The Task Team of Task 2.3 had to face several challenges. The first obstacle was the absence of task partners from France, which serves as one of the pilot regions in the project and is therefore a mandatory focus. This difficulty led to considerable delays since several documents (questionnaire, interview guideline, informed consent form, introduction texts) had to be translated into Greek and French as well as proof-read by native speakers. The absence of native French speakers in the task forced the task leaders to ultimately ask French consortium partners for help. As they were not able to assist, task leaders contacted French speaking natives from the own network. However, delays were still inevitable, especially as there were some tasks done simultaneously with T2.3 but were needed for T2.3, e.g., regarding the informed consent form. The informed consent was still in progress when it was already needed as a prerequisite to conduct the interviews.

A further difficulty was the absence of project partners working with vulnerable groups within the project. The task was heavily reliant on community involvement and required the input of people working in disaster management and/or working with vulnerable groups in the pilot areas. Because this task focuses on vulnerability and vulnerable groups in disaster situations people were required who could cover both topics, e.g., people conducting emergency trainings for children, or those responsible for disaster preparedness in hospitals. The absence of project partners working in this field in combination with the absence of French task partners meant that there was no organisation involved in this task who could function as "gate keeper" and provide the corresponding contacts, especially in France/Paris region. Finding fitting participants for the research processes not only in the regions, but with targeted expertise was therefore difficult. Existing contacts with people fitting this niche were needed to conduct interviews and for the questionnaire, because sending such invitations to strangers is difficult and the response rate was expected to be low. For sending out invitations, the official project presentation was used, which also took time. With the support of the whole consortium in actively recruiting potential participants, it was possible to gather several suitable contacts via their vast networks. However, the additional required steps in collecting these contacts lead to further delays within the task. Lastly, co-dependencies and the cooperation with other tasks made it necessary to coordinate the development of research tools. To finalise the questionnaire in a first step the most relevant hazards had to be defined in T2.2, for then identifying the corresponding vulnerable groups.

Concerning the collected data, it must be pointed out that they can in no way be considered representative of the population of Paris and Athens, due to the small sample size and the nature of the respondents (mostly experts in DRM or people working with potentially vulnerable groups). One can however discern trends concerning vulnerabilities and capacities in these two regions. It should also be mentioned that there were very few survey participants from France, limiting the explanatory power of this subsample. Lastly, 37.5% of respondents from France and no respondents from Greece were working as firefighters, while 15.8% of respondents from Greece and no respondents from France were working for municipal services/providing food. These differing perspectives may have influenced their answers.

Regarding the indicators, these were devised via literature research and interview as well as survey results. Possible modes of quantifying the indicators are presented in D2.3, however these measurements were not tested in the field for applicability. The indicators can be used as a starting point but would generally need testing for overall applicability and relevance and for determining different weights for each indicator for a potential composite index. Some of the proposed variables (e.g., the % of unhoused people in the population) may be hard to measure and would have to be estimated instead. Other indicators such as the familiarity with the environment are qualitative indicators, which are difficult to be measured directly. A further difficulty might be the accessibility to these different data in the specific regions.

7 DISCUSSION AND OUTLOOK

The PANTHEON T2.3 approach to VCA is based on the following steps: (1) scoping out the assignment, (2) facilitating assessment design, (3) conducting the field data collection, (4) analysing and making sense of the data, (5) reporting and dissemination. These steps aim to ascertain the extent of vulnerability, the sources of vulnerability, and the gaps between risks and risk management mechanisms. Task 2.3 only considers elements related to social vulnerability and capacity, while for instance hazards were identified in T2.2. VCAs are mainly used in rural context. In urban settings, certain factors make the implementation of a VCA more difficult, such as the split of one community into several sub-groups. Urban VCAs may therefore include the use of local organizations such as NGOs as partners to the organization carrying out the VCA.

VCA intends to help people and communities to prepare for hazards while drawing on their own capacities. The methodology of VCA follows a grassroots-/ bottom-up rather than a top-down approach. One goal of this approach is identifying problems that the community itself considers important. Community members should be involved as much as possible in a VCA. Important tools to ensure community participation are focus groups, workshops, and interviews. The diversity of scopes, target groups, and focus areas require different approaches. In this project, due to the diversity and size of the communities in focus – Athens and Paris, it was deemed most appropriate to include the communities on a community representative/ stakeholder level rather than a household level. The Hyogo framework for action and the Sendai framework for Disaster Risk Reduction emphasize the importance of inclusion and active participation of vulnerable groups (women, children, people with disabilities etc.) in disaster risk reduction (United Nations, 2007, 2015). In the past, the needs of vulnerable groups were often overlooked in disaster situations. The PANTHEON project therefore includes organisations/people working with vulnerable groups and to aims to create a technology that is inclusive and increases the capacities of all members of the community.

One of the most important steps in building capacities and empowering vulnerable groups is to ensure inclusion of members and representatives of these groups in disaster management. The inclusion of these groups in disaster management (e.g., in VCAs) helps to ensure that their needs are considered when planning for disasters. At the same time, the awareness and knowledge of the members of these vulnerable communities about disaster situations can be raised and their own capacities utilized when they are included in DRM processes. In accordance with the Grant agreement and approach of the project, community and citizens- as well as DRM- stakeholders were included in the research design.

Since PANTHEON T2.3 focuses on community vulnerability and capacity assessment, significant effort was put into recruiting community and citizens stakeholders working with vulnerable groups as interview partners and survey participants. Based on the literature research, multiple vulnerable groups were identified. Vulnerability depends strongly on the particular hazard. Therefore, as a starting point, it was crucial to define the main hazards in the two areas of interest (Athens/Greece and Paris/France), which was done in T2.2. When defining the vulnerable groups, special attention was paid to consider the various social, economic, physical, environmental, political and cultural factors in order to reflect these dimensions in the defined groups (see Table 1). These groups were used in the interview guideline and in the online survey. Stakeholders working with these vulnerable groups as well as DRM stakeholders were contacted and asked for their participation as interviewees and survey (questionnaire) participants.

The interview guideline included questions related to specific safety issues for vulnerable groups. Additionally, it contained questions about the specific role of the interviewee and their organization in disaster management, the inclusion of people from vulnerable groups in existing decision processes, and collaboration between different organizations involved in disaster management in the region. Separate questions were devised for DRM stakeholders, such as firefighters and police, and contacts working in

organizations with community-based or vulnerable groups. The final interview guideline was translated into Greek and French via DeepL. To collect the quantitative data, a questionnaire was designed and implemented on the online survey platform LimeSurvey. The final hazards were defined in T2.2 and then provided for use in the questionnaire in T2.3. A combined questionnaire was used for T2.1, T2.2 and T2.3. The questionnaire was also translated into Greek and French via DeepL.

The goal was to conduct 10 interviews and collect at least 30 filled out surveys. For the interviews, convenience sampling was deemed the best approach. There were considerable difficulties in finding interview partners from France/Paris as well as organizations/contacts working with the community or vulnerable groups. For the survey, each project partner searched online for relevant organizations in the focus areas Paris and Athens and then sent out emails to potential survey partners asking them for participation. In total, 14 invitations to oral and/or written interviews were sent out, which culminated in 4 oral and 3 written interviews. In addition, 140 invitations were sent out for the questionnaire, culminating in 27 fully filled out and an additional 12 partly filled out surveys.

The interviewees listed earthquakes, floods, landslides and ground movements, cyber threats as well as fires, especially forest fires, as the most important hazards in their areas. Also listed were droughts (in the case of France), and tsunamis (in the case of Greece), as well as migration, an overload of the health system, pandemics, and nuclear risks. In context of the questions about the most vulnerable groups, respondents highlighted a wide range of vulnerable groups. By those participants who filled out the questionnaire, earthquakes were listed the most often among the top 5 ranked hazards, followed by floods, wildfires, heatwaves, epidemics/pandemics, storms, and technological accidents. The most relevant vulnerable groups via open questions and closed questions were identified as the elderly, children/ minors, and people with mental or physical disorders/ disabilities/ illnesses, which fits well with the literature. Women were hardly mentioned, supporting our decision not to include them among the most vulnerable groups. Overall, the results for the matrix question show that the vulnerable groups were well chosen initially, as each of them was selected to be vulnerable for multiple hazards.

Concerning the risk assessments in the aimed areas, all interviewees knew of risk assessments that had been carried out or were currently being carried out. Respondents from France mentioned risk assessments that had been performed specifically for their search and rescue teams. Respondents from Greece (Athens) answered that flood risk maps existed for the area of Athens, that official seismic zonation mapping was available for all of Greece (the region of Attica is partly covered by hazard zone). In terms of the biggest challenges that interviewees or their organisations faced in disaster situations they mentioned:

- a lack of coordination in the first few hours after a disaster hit (e.g., an earthquake),
- a lack of a risk culture – a generally low awareness of risks and consequences in combination with a high population density and the resulting complexity – which makes it difficult to analyse the region.
- an absence of anticipation and prevention of hazards as well as certain political decisions (i.e., making short-term instead of long-term plans).

Most interviewees agreed that more initiatives are required to address the needs of vulnerable groups and sensitize emergency services about them. They suggested to develop ERASMUS programs to prepare a special project for vulnerable people and claimed that the identification of vulnerable groups and their special needs should be advanced to enhance general awareness on the topic. A lack of risk culture was stressed as a problem regarding risk preparedness, as was the access to accurate information as an important element in ensuring preparedness for hazards and improvement of safety. It was pointed out that it is important to train local people in first aid and search and rescue, because during the first hours after a disaster hits, it is mostly the locals who must become active. The questionnaire data showed that there is a

general awareness of the importance of disaster management and the need to include vulnerable groups in disaster planning. However, there also seem to be some gaps in terms of implementation and effectiveness of current disaster management plans, with most respondents indicating that the plans serve vulnerable groups rather badly. There also appears to be a lack of awareness and initiatives in place to reach vulnerable groups specifically in terms of disaster management education, with half of respondents not being aware of any such initiatives.

Regarding coping strategies, it was mentioned by the interviewees that the cooperation of vulnerable people with civil protection authorities and emergency services are a key parameter for enabling direct communication of concerns or special needs. Sensitizing, trainings, and clear update information were also mentioned as strategies that work well for coping with crises. For more effective community disaster management, interviewees found it necessary for the government and other agencies to improve their communication channels. Most respondents reported that there were no exchanges between their own and other governmental and non-governmental organizations and there was also no mention of more exchange being planned in the future. Overall, the questionnaire and the interview guidelines received positive feedback from the participants.

Based on the interviews and the questionnaire data as well as the literature research, 50 VC indicators were devised. 21 describe the general vulnerability to the relevant hazards, 14 describe vulnerability factors specific to individual hazards, and 15 describe capacity measures that can either be intrinsic to the community or can be put in place to mitigate vulnerabilities. The vulnerability indicators were grouped into 7 categories:

- life-stage-related,
- health-related,
- social-connection-related,
- resource-related,
- exposure-and-protection-related,
- knowledge-and-awareness-related,
- and hazard-specific.

Capacity indicators were devised to address each of these six categories. Therefore, capacity indicators were not further grouped into specific categories. The VC indicators address the social, economic, physical and environmental, political, and cultural factors that contribute to the vulnerability and capacity of a community towards disasters. While many vulnerability indicators map social, economic and physical factors, many of the capacity indicators map cultural and political aspects. This highlights the need for cultural and political measures when building resilience and capacity towards disasters. Common themes for capacity building are awareness raising and disaster education, inclusion and representation of vulnerable groups and the community in DRM, and social connectedness and networks. Another important factor is preparedness on a political level, measured by the money spent on hazard preparedness and the existence of disaster risk management plans and early warning systems. These indicators are not exhaustive and require testing in the field before they can be used to accurately map vulnerability, especially regarding the quantification of measurements.

At carry out of Task 2.3, the Task Team had to face several challenges. The first obstacle was the absence of task partners from France, which serves as one of the pilot regions in the project and is therefore a mandatory focus. This caused several delays since several documents (questionnaire, interview guideline, informed consent form, introduction texts) had to be translated into Greek and French. A further difficulty was the absence of project partners working with vulnerable groups within the project. The task was heavily reliant

on community involvement and required the input of people working in disaster management and/or working with vulnerable groups in the pilot areas. The absence of project partners working in this field in combination with the absence of French task partners meant that there was no organization involved in this task who could function as "gate keeper" and provide the corresponding contacts, especially in France/Paris region. Existing contacts with people fitting this niche were needed to conduct interviews and for the questionnaire. With the support of the whole consortium in actively recruiting potential participants, it was possible to gather several suitable contacts via their vast networks. Lastly, co-dependencies and the cooperation with other tasks made it necessary to coordinate the development of research tools. To finalise the questionnaire in a first step the most relevant hazards had to be defined in T2.2, for then identifying the corresponding vulnerable groups.

The collected data from interviews and surveys can in no way be considered representative of the population of Paris and Athens, due to the small sample size and due to the respondents being mostly experts in DRM or people working with potentially vulnerable groups. One can however discern trends concerning vulnerabilities and capacities in these two regions. It should also be mentioned that there were very few survey participants from France, limiting the explanatory power of this subsample. Lastly, 37.5% of respondents from France and no respondents from Greece were working as firefighters, while 15.8% of respondents from Greece and no respondents from France were working for municipal services. These differing perspectives may have influenced their answers.

The results from the present report will serve as a basis for T2.5 in which a participatory governance model will be developed with workshop partners.

8 CONCLUSION

The purpose of T2.3 was to carry out a community vulnerability and capacity assessment on the regions Paris/France and Athens/Greece. It was carried out as a participatory process involving representatives of community and stakeholder groups and especially of vulnerable groups such as women, children, elderly and disabled people. During the empirical research, expert interviews were conducted, online-questionnaire were distributed for completion, and VC indicators were devised from the resulting data in combination with comprehensive literature research.

The collected qualitative and quantitative data shows that the experts from Paris/France and Athens/Greece considered earthquakes, floods, and wildfires to be the most important hazards in their respective regions. In comparison, survey respondents from France considered floods and droughts to be more important, and respondents from Greece highlighted the danger of earthquakes and wildfires to their region. However, only rough tendencies are possible to discern on region-specific risks, vulnerabilities, and capacities, due to the low number of respondents from France. The most relevant vulnerable groups were identified as the elderly, children/ minors, and people with mental or physical disorders/ disabilities/ illnesses. Homeless people and people with low income were also mentioned quite frequently. Interviewees mentioned several risk assessments that had been carried out in the areas and highlighted several problems their organisations faced during disasters. These included a lack of a risk culture and high population density as well as the resulting societal complexity. Interview as well as survey participants mentioned several initiatives to include vulnerable groups and empower them in terms of disaster education and risk management. However, many pointed out that there is a need for greater involvement of the diverse people in the community, especially vulnerable groups, in these processes and a need for trainings for the large variety of people. This would serve to increase awareness and capacity building among those most vulnerable before, during, and after disasters.

The results of the interviews and questionnaire data were combined with further literature research to devise several VC indicators, which can be used to (qualitatively) assess the vulnerability and capacity of a certain region. They consist of 34 vulnerability indicators, which can be divided into 7 categories: life-stage-related, health-related, social-connection-related, resource-related, exposure-and-protection-related, knowledge-and-awareness-related, and hazard-specific. Furthermore, 15 capacity-indicators were devised, encompassing factors that increase preparedness and measures that address the identified vulnerabilities. While many of the vulnerabilities are of a social, environmental, physical, or economic nature, many of the capacity indicators cover political and cultural aspects. This shows that cultural and political initiatives are needed to counter the vulnerabilities that are inherent to an area or a community. For the PANTHEON project, this means that the inclusion of the community and these vulnerable groups is key to increasing the resilience of the whole community. The Smart City Digital Twin Technology can help to increase the capacity indicators "Money spent on hazard preparedness", "Network of DRM and the community", as well as "Representation of vulnerable groups" and "Inclusion of vulnerable groups". If the results of its analyses are available to the public and free to use for the community, it could further increase "Enhancement of Risk awareness" and "Capacity building of vulnerable groups".

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10 APPENDIX

APPENDIX A: INTERVIEW GUIDELINE

Interview Guideline Community Representative[6]/ *Stakeholder*[7]

Date and Time:	
Place:	
Interviewer (name and organisation):	
Name of interview partner and organisation:	

Interview instructions

Please make sure, that the informed consent was signed.

The guiding questions serve as orientation for the aspects to be asked and to structure the conversation to make it comparable. The words do not have to be reproduced exactly, but the wording should also be adapted to the dynamics of the interview. Depending on the course of the interview, some questions may already be addressed before the question is asked. In this case, please repeat what was said and ask the question, if there is sth. to add.

⇨ Questions marked with a star * concern only community representatives.
⇨ Questions marked in italics concern the stakeholders
⇨ Important keywords are marked in bold for a better orientation during the interview

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0. Start: **Introduction of interviewer and recording**: Thankfully, you have already signed the consent form. The interview will be recorded, and your data will of course be treated confidentially. The content will be summarised.
    a. May I ask you to introduce yourself?

Socio-demographic and general information	
Gender of participant:	☐ female ☐ male ☐ diverse ☐ no answer
Age of participant:	_____years
Organisation:	
Role in the organisation:	
Role in the community:*	
Years active in organisation:	_____ years
Country and region active:	

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[6] Questions for community representatives only are marked with a *
[7] Questions for stakeholders only are marked in *italics*

1. What are your and your **organisation's main responsibilities** within the community before/during/after a disaster?
   *What are your and your **organisation's main responsibilities** before/during/after a disaster?*

2. In your estimation, what are the **major hazards and risks in the area you are active**? Why do you think these are the biggest risks (frequency, severity, most people affected, least prepared…)?

3. What are generally the **most vulnerable groups** to these major hazards and risks? What do you think makes them vulnerable?

4. How does **gender** impact vulnerability and capacity?

5. How is your community affected (pre- and post-disaster)?*

6. Do you know, if a **risk assessment** has ever been performed for the area?
   a. If yes, what were the main results?

7. How is your organisation involved in the **management of and protection** against these disasters?

8. In your opinion, what are the **biggest challenges** for your organisation in such a crisis situation?

9. Are **emergency services sensitized** to the needs of these vulnerable groups?
   a. If yes, to what extent?
   b. How do you think this could be **improved**?

10. Does your community have any kind of **plan to deal with hazards/risks**? Are there trainings and warning systems in place to prepare the locals for a disaster? If yes, please describe. If no, what do you think is the reason?
    *Regarding your organisation, are there **special protocols** in place for search and rescue, awareness-raising or community rebuilding actions concerning people from these vulnerable groups?*

11. Is there **inclusion and representation of people from vulnerable groups** to ensure that their needs are met in disaster situations?

12. How well do you think are people prepared for and informed about hazards/risks?
    a. And how do you think are **vulnerable groups prepared** for and **informed** about hazards/risks?
    b. Are there any **special programs** to prepare them?
    c. How do you think this could be **improved**?

13. How can the safety of the vulnerable groups be improved during and in the aftermath of a disaster?

14. Coping strategies: What would you **recommend to people**, especially vulnerable ones, so they can **better cope with crises**, also regarding fear of occurrence of a disaster or crisis?
    a. Which strategies would you say work well, and which do not work very well?

15. What would you need to better help your community in a disaster situation?

What would you need to better help vulnerable groups in disaster situations?

16. Is there an **exchange with the governmental crisis management**? If not, is this planned?
    a. Is there **cooperation** with other organisations, such as **social services** or disability rights organisations?
    b. How much collaboration exists between different organisations handling crisis situations and those representing vulnerable groups?

*Is there an **exchange with community organisations** of the mentioned vulnerable groups? If not, is this planned?*

17. What do you think is the **best way to approach citizens** for a better community disaster management (e.g. which channels)?

18. Could you **recommend us any organisation** that we could contact (e.g. disability rights organisations, civil protection authorities, first responders, children's groups …)?

19. Is there anything else you would like to add concerning disasters and vulnerable groups in your area?

20. Overall, are you satisfied with the interview and the discussion? Is there any other comment you would like to make?

<div align="center">Thank you very much for your time!</div>

Follow up: Please do not ask this question directly in the interview, but instead ask your participants **after the interview in an email**, after potential candidates have been collected:

21. A User Advisory Board will be formed for PANTHEON-project to advise and evaluate the developments. This dialogue group consists of community representatives and experts, to involve these perspectives. This advisory board will meet online once a year to discuss the project's progress. If you are interested in supporting us in this way, we would like to add you to the list of potential board members and will come back to you once a decision has been made.

APPENDIX B: INFORMED CONSENT FORM USED IN THE QUESTIONNAIRE

Before we start with the study, we would like to inform you about the data processing and ask for your consent. You need not worry about privacy as we will not share the information we have gathered from this study other than statistical and non-identifiable personal information in the report.

- I am aware of the main aspects of the participation for the above PANTHEON project.
- I confirm that I have had the opportunity to ask questions.
- I understand that my participation is voluntary.
- I understand that my answers to any questionnaire will remain anonymous.
- I understand that if I don't wish to answer any particular questions, I am free to decline.
- I give permission for members of the research team to have access to my anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified of identifiable in the outputs that result from the research without my agreement.
- I agree to take part in the above mentioned activity.
- I give my consent to audio footage
- I understand, that I can revoke my consent at any time with effect for the future, whereby the lawfulness of the processing carried out on the basis of the consent until revocation is not affected. A revocation has the consequence that my data will no longer be processed for the above-mentioned purposes from that point on.
- I hereby confirm that I have read and understood this declaration of consent and that my questions were addressed properly.

Project information

The EU-funded project PANTHEON will design and develop a Community based Digital Ecosystem for Disaster Resilience. In more detail, the aim is to improve risk assessment, reduce vulnerability, and strengthen community disaster resilience. Part of this is the enhancement of operational capabilities of Community Based Disaster Resilient Management (CBDRM) teams. To this end, it will use Smart City Digital Twin (SCDT) technology and leverage new and emerging technologies and innovations. For the specific developments in the project, our research focuses on Greece (Athens) and France (Paris) as pilot regions. Input from other areas will also be welcome to broaden the scope.

In order to find out what can contribute to the improvement of community-based disaster resilience, the first step is to systematically elaborate the application-oriented approach. This includes:

- Analyzing existing legal and regulatory environment, i.e. **platforms and decision making systems** for community based DRM and Human, technical, material and financial resources
- **Mapping** of regional multi-hazard/risk assessments of all major hazards and risks
- Develop **indicators for community vulnerability and capacity** for all social, economic, physical and environmental, political, cultural factors

In order to include the needs of individuals, recommendations for outreach are also asked. It should also be noted here that information on individuals must be clarified with them in order to protect their rights as well.

Methods: Conduction of surveys (interview and questionnaire) with members of community organisations and stakeholders in the pilot areas of Greece/Athens and France/Paris to get insights into the status quo of

national hazards, risk assessment and disaster management tools used, potential approaches for improvements as well as recommendations for community outreach. The recorded interview will be transcribed and summarized using content analysis to address the research questions. The collected data in the questionnaire will be analysed statistically descriptively.

Project Partners:

1 TWI ELLAS ASTIKI MI KERDOSKOPIKI ETAIREIA (Greece)

2 AIRBUS DEFENCE AND SPACE SAS (France)

3 M3 SYSTEMS BELGIUM (Belgium)

4 SOFTWARE IMAGINATION & VISION SRL (Romania)

5 Mobility Ion Technologies SL (Spain)

6 FUTURE INTELLIGENCE EREVNA TILEPIKINONIAKON KE PLIROFORIAKON SYSTIMATON EPE (Greece)

7 ECOLE NATIONALE DE L AVIATION CIVILE (France)

8 UNIVERSITAT POLITECNICA DE CATALUNYA (Spain)

9 PRACTIN IKE (Greece)

10 ISEM-INSTITUT PRE MEDZINARODNU BEZPECNOST A KRIZOVE RIADENIE, NO (Slovakia)

11 INTEROPTICS S.A. (Greece)

12 JOHANNITER OSTERREICH AUSBILDUNG UND FORSCHUNG GEMEINNUTZIGE GMBH (Austria)

13 EPSILON MALTA LIMITED (Malta)

14 INSTITUT DE SEGURETAT PUBLICA DE CATALUNYA (Spain)

15 HELLENIC POLICE (Greece)

16 KENTRO MELETON ASFALEIAS (Greece)

17 Crisis Management State Academy (Armenia)

Information about generated data

Processing of data

All data collected in the course of the survey will be treated confidentially and will only be viewed or processed by the project-involved employees of the data processor (in the role of data processor according to GDPR) and the data controller (in the role of data controller according to GDPR). Information that could lead to an identification of the person will be changed (anonymisation / pseudonymisation) or removed. In

scientific publications, the data is post-processed accordingly, so that the resulting overall context of events cannot lead to an identification of the person by third parties. The results will be further processed in the form of a report and possibly further scientific publications.

Voluntary nature of participation

Participation in this survey is voluntary. Participants may withdraw at any time without giving reasons and without incurring any disadvantages.

Confidentiality and anonymity

Your information will be used solely by researchers for research purposes in the context of the above research project. Personal information will not be shared with anyone outside the research team of this project. The published research results (publications, research reports) have no personal reference and therefore do not allow any conclusions to be drawn about your identity.

Data protection

The data will be processed on the basis of your consent for the purpose of carrying out the above-mentioned research project (collection, evaluation, generation of results, publications). The legal basis for this is the EU General Data Protection Regulation (GDPR), namely in particular Art 6(1)(a) (consent) and Art 9(2)(j) (research purposes in the public interest) in conjunction with the Austrian Research Organization Act (FOG). Your personal data (name, contact, age, gender, duration in working area, role in disaster management, allocation of organisation and information about the disaster management plan) will be encrypted and stored for up to 10 years after the end of the project period (i.e. until 31.12.2032) and then deleted. The collected questionnaire ("raw data") will be kept for 10 years from the date of publication of the results of the project to demonstrate compliance with good scientific practice and then destroyed. Data required for the assertion, exercise and defence of legal claims will be stored for up to 30 years and subsequently deleted. You have the right to information, correction, deletion, restriction of processing, data portability, objection, and a right of appeal to the data protection authority at any time in accordance with legal provisions (in particular Art 15 to 22 DSGVO with the restrictions in § 2d paragraph 6 FOG).

Right of withdrawal

In order to be able to fulfil your right of withdrawal and to enable assignment of the correct record for this purpose, we urgently recommend to note the date and exact time of questionnaire completion with the following contact address, to be able to contact us: dpo@pantheon.eu. otherwise the data record can't be deleted.

APPENDIX C: PRINTABLE VERSION OF THE QUESTIONNAIRE AS IMPLEMENTED IN LIMESURVEY

PANTHEON T2.3 Vulnerability and capacity assessment with focus areas Paris and Athens

The EU-funded project PANTHEON will design and develop a Community-based Digital Ecosystem for Disaster Resilience. In more detail, the aim is to improve risk assessment, reduce vulnerability, and strengthen community disaster resilience. Part of this is the enhancement of operational capabilities of Community Based Disaster Resilient Management (CBDRM) teams. To this end, it will use Smart City Digital Twin (SCDT) technology and leverage new and emerging technologies and innovations.

For the specific developments in the project, our research focuses on Greece (Athens) and France (Paris) as pilot regions. In this questionnaire, you may find questions that help the PANTHEON researchers to gain important insights regarding hazards affecting your area, with the aim to perform a multi-hazard/risk mapping of the aforementioned countries and regions. Moreover, valuable information will be acquired concerning existing policies and plans that are implemented at national and/or regional level for a more effective management of these hazards/risks. In addition, through this questionnaire PANTHEON partners aim to gain feedback regarding vulnerable groups, how these groups are affected by crises and disasters and their role in disaster risk management strategies.

Your answers will be used to further develop the Smart City Digital Twin (SCDT) technology and to improve it. The data collection, handling and storage is compliant to the GDPR standards that you may find in the PANTHEON Informed Consent for participation. Please again indicate that you read the informed consent for participation and gave your consent to collect your data in the statement of informed consent. Thank you for taking the time to fill out the questionnaire for the PANTHEON Project.

There are 65 questions in this survey.

GENERAL QUESTIONS

Gender

Please choose **only one** of the following:

○ Female

○ Male

○ Diverse

○ No answer

Age (years)

❶ Only an integer value may be entered in this field.
Please write your answer here:

[   ]

Which country are you active in? *

❶ Choose one of the following answers
Please choose **only one** of the following:

○ France

○ Greece

○ Other

General questions 2

Which city/region are you active in? *

Please write your answer here:

[   ]

What organisation are you a part of?

❶ Choose one of the following answers
❶ If you choose 'Other (please explain):' please also specify your choice in the accompanying text field.
Please choose **only one** of the following:

○ First Response Organization (Police, Fire Brigade, First Aid, Military)

○ Public Authority (please explain):

○ NGO or other social organization (e.g. associations, charities, informal groups, second responders)

○ Academia & Research

○ Industry/ Technology Provider

○ Hospital or care facility

○ Other critical infrastructure (e.g. power supply system)

○ Other (please explain):

Public Authority (please explain):

Only answer this question if the following conditions are met:
Answer was 'Public Authority (please explain): ' at question ' [G01Q06]' (What organisation are you a part of?)

Please write your answer here:

Other (please explain):

Only answer this question if the following conditions are met:
Answer was 'Other (please explain): ' at question ' [G01Q06]' (What organisation are you a part of?)

Please write your answer here:

For how long have you been a part of this organisation? (years)

❶ Only numbers may be entered in this field.
Please write your answer here:

_____

Does your organisation play a role in disaster management? *

❶ Choose one of the following answers
Please choose **only one** of the following:

○ Yes
○ No

What role does your organization play in disaster management?

Only answer this question if the following conditions are met:
Answer was 'Yes' at question ' [G01Q08]' (Does your organisation play a role in disaster management?)

❶ Check all that apply
Please choose **all** that apply:

☐ First responder; paramedic
☐ First responder; firefighter
☐ Municipal services/ providing food, shelter....
☐ Overall management
☐ Other:

Other:

Only answer this question if the following conditions are met:
Answer was at question ' [G01Q09]' (What role does your organization play in disaster management?)

Please write your answer here:

What is your position in the organization?

Only answer this question if the following conditions are met:
Answer was 'No' at question ' [G01Q08]' (Does your organisation play a role in disaster management?)

❶ Choose one of the following answers
Please choose **only one** of the following:

◯ Social worker

◯ Counselor (e.g. for finances or mental health)

◯ Community and social service specialist

◯ Researcher (social sciences, humanities...)

◯ Researcher (natural sciences, technology, IT...)

◯ Engineer/ Technician/ Software Developer or similar

◯ Civil servant

◯ Management

◯ Other:

Other:

Only answer this question if the following conditions are met:
Answer was 'Other: ' at question ' [G01Q10]' (What is your position in the organization?)

Please write your answer here:

What is your position in the organization?

Only answer this question if the following conditions are met:
Answer was 'Yes' at question ' [G01Q08]' (Does your organisation play a role in disaster management?)

❶ Choose one of the following answers
Please choose **only one** of the following:

○ Researcher

○ Engineer/technical development

○ First responder

○ Second responder (e.g. shelter construction, cleanup)

○ Management

○ Other:

Other:

Only answer this question if the following conditions are met:
Answer was 'Other: ' at question ' [G01Q10sh]' (What is your position in the organization?)

Please write your answer here:

Do you have any professional experience with disasters/disaster management?

Only answer this question if the following conditions are met:
Answer was 'No' at question ' [G01Q08]' (Does your organisation play a role in disaster management?)

❶ Choose one of the following answers
Please choose **only one** of the following:

○ Yes

○ No

If yes, in how far?

Only answer this question if the following conditions are met:
Answer was 'Yes' at question ' [G01Q11]' (Do you have any professional experience with disasters/disaster management?)

Please write your answer here:

HAZARDS

What are the top 5 hazards/risks that affect or could affect your area? Please place the hazard with the highest relevance at the top, continue with the second most relevant etc.

❶ Please select from 1 to 5 answers.
Please number each box in order of preference from 1 to 17
Please choose at least 1 items.
Please choose no more than 5 items.

- [ ] Earthquake
- [ ] Volcanic eruption
- [ ] Tsunami
- [ ] Landslide
- [ ] Heatwave
- [ ] Storm
- [ ] Blizzard
- [ ] Flood
- [ ] Drought
- [ ] Wildfire
- [ ] Epidemics/Pandemics
- [ ] Technological Accident
- [ ] Cyber threat
- [ ] Terrorist attack
- [ ] CBRNe malicious act

- [ ] Other:
- [ ] I don't know

Other:

Only answer this question if the following conditions are met:
Answer was 'Other:' at question ' [G02Q01]' (What are the top 5 hazards/risks that affect or could affect your area? Please place the hazard with the highest relevance at the top, continue with the second most relevant etc. (RANK 1))

Please write your answer here:

Other:

Only answer this question if the following conditions are met:
Answer was 'Other:' at question ' [G02Q01]' (What are the top 5 hazards/risks that affect or could affect your area? Please place the hazard with the highest relevance at the top, continue with the second most relevant etc. (RANK 2))

Please write your answer here:

Other:

Only answer this question if the following conditions are met:
Answer was 'Other:' at question ' [G02Q01]' (What are the top 5 hazards/risks that affect or could affect your area? Please place the hazard with the highest relevance at the top, continue with the second most relevant etc. (RANK 3))

Please write your answer here:

Other:

Only answer this question if the following conditions are met:
Answer was 'Other:' at question ' [G02Q01]' (What are the top 5 hazards/risks that affect or could affect your area? Please place the hazard with the highest relevance at the top, continue with the second most relevant etc. (RANK 4))

Please write your answer here:

Other:

Only answer this question if the following conditions are met:
Answer was 'Other:' at question ' [G02Q01]' (What are the top 5 hazards/risks that affect or could affect your area? Please place the hazard with the highest relevance at the top, continue with the second most relevant etc. (RANK 5))

Please write your answer here:

Does your organization use risk assessment/hazard analysis tools?

Only answer this question if the following conditions are met:
Answer was 'Yes' at question ' [G01Q08]' (Does your organisation play a role in disaster management?)

❶ Choose one of the following answers
Please choose only one of the following:

○ Yes

○ No

○ Not aware

If yes, which tools?

Only answer this question if the following conditions are met:
Answer was 'Yes' at question ' [G02Q02]' (Does your organization use risk assessment/hazard analysis tools?)

❶ Check all that apply
Please choose all that apply:

☐ Qualitative risk assessment / hazard identification tools

☐ Quantitative risk assessment / Analyse and evaluate level of impact, severity of exposure

☐ Inventory of assets with information related to disaster risk

☐ Tools for security management / controls implementation for risk mitigation tools

☐ Other:

☐ Not aware

Other:

Only answer this question if the following conditions are met:
Answer was at question ' [G02Q02s1]' (If yes, which tools?)

Please write your answer here:

[   ]

Does your organization use risk information to fulfil its mandate?

Only answer this question if the following conditions are met:
Answer was 'Yes' at question ' [G01Q08]' (Does your organisation play a role in disaster management?)

❶ Choose one of the following answers
Please choose only one of the following:

○ Yes

○ No

○ Not aware

If yes, what kind?

Only answer this question if the following conditions are met:
Answer was 'Yes' at question ' [G02Q03]' (Does your organization use risk information to fulfil its mandate?)

ⓘ Check all that apply
Please choose all that apply:

☐ Hazard forecast

☐ Exposed assets

☐ Estimated Impact

☐ Other:

☐ Not aware

Other:

Only answer this question if the following conditions are met:
Answer was at question ' [G02Q03s1]' (If yes, what kind?)

Please write your answer here:

[   ]

Does your organization have an up-to-date disaster management plan/strategy?

ⓘ Choose one of the following answers
Please choose only one of the following:

◯ Yes

◯ No

◯ Under development

◯ Is being planned for the future

◯ Not aware

If yes, how often is the disaster management plan/strategy updated?

Only answer this question if the following conditions are met:
Answer was 'Yes' at question ' [G02Q04]' (Does your organization have an up-to-date disaster management plan/strategy?)

❶ Choose one of the following answers
Please choose **only one** of the following:

- ◯ Very often
- ◯ Often
- ◯ Not so often
- ◯ Rarely
- ◯ Never
- ◯ Not aware

If not, is a disaster management plan/strategy planned to be implemented in the future?

Only answer this question if the following conditions are met:
Answer was 'No' at question ' [G02Q04]' (Does your organization have an up-to-date disaster management plan/strategy?)

❶ Choose one of the following answers
Please choose **only one** of the following:

- ◯ Yes
- ◯ No
- ◯ Not aware

DISASTER MANAGEMENT

What are the main actions that your organisation has taken to minimize future disaster impact and losses?

❶ Check all that apply
Please choose all that apply:

☐ Training for the public

☐ Training of emergency services personnel to new technologies

☐ Training of emergency services personnel to operational plans and procedures

☐ Use of standards, which enable technical interoperability between different technological systems and tools

☐ Use of standards, which facilitate and enhance interoperability between different agencies

☐ Early warning systems

☐ Prevention of hazards

☐ Relocation of exposed people

☐ Insurance

☐ Mitigation measures (e.g. flood protection)

☐ Building resilient infrastructure

☐ Detailed evacuation and disaster management plans

☐ Adoption of new technology

☐ Other:

☐ None

Other:

Only answer this question if the following conditions are met:
Answer was at question ' [G02Q07]' (What are the main actions that your organisation has taken to minimize future disaster impact and losses?)

Please write your answer here:

[   ]

To what extent does your organization integrate international/EU standards in its operational procedures?

ⓘ Choose one of the following answers
Please choose only one of the following:

○ Great

○ Considerable

○ Neutral

○ Limited

○ Not at all

○ Not aware

To what extent are the four disaster management phases, in your opinion, addressed by national policies and initiatives?

Please choose the appropriate response for each item:

	Great	Considerable	Neutral	Limited	Not at all	I don't know
Prevention	○	○	○	○	○	○
Preparedness	○	○	○	○	○	○
Response	○	○	○	○	○	○
Recovery	○	○	○	○	○	○

What do you think are the main gaps in disaster management preparation and mitigation?

ⓘ Check all that apply
Please choose all that apply:

☐ Training for the public

☐ Early warning systems

☐ Training of emergency services personnel to new technologies

☐ Training of emergency services personnel to operational plans and procedures

☐ Use of standards, which facilitate and enhance interoperability between different agencies

☐ Use of standards, which enable technical interoperability between different technological systems and tools

☐ Prevention of hazards

☐ Relocation of exposed people

☐ Insurance

☐ Mitigation (e.g., flood protection)

☐ Building resilient infrastructure

☐ Explicit and clear disaster management plans

☐ Legal framework for land management, structural upgrade, etc.

☐ Other:

☐ Not aware

Other:

Only answer this question if the following conditions are met:
Answer was at question ' [G02Q10]' (What do you think are the main gaps in disaster management preparation and mitigation?)

Please write your answer here:

DISASTER MANAGEMENT 2

Is there any available Early Warning System in your region?

❶ Choose one of the following answers
Please choose **only one** of the following:

○ Yes

○ No

○ Not aware

If yes, for which risks?

Only answer this question if the following conditions are met:
Answer was 'Yes' at question ' [G02Q11]' (Is there any available Early Warning System in your region?)

Please choose **all** that apply:

☐ Earthquake

☐ Volcanic eruption

☐ Tsunami

☐ Landslide

☐ Heatwave

☐ Storm

☐ Blizzard

☐ Flood

☐ Drought

☐ Wildfire

☐ Epidemics/Pandemics

☐ Technological Accident

☐ Cyber threat

☐ Terrorist attack

☐ CBRNe malicious act

☐ Other:

☐ Not aware

Other:

Only answer this question if the following conditions are met:
Answer was at question ' [G02Q11s1]' (If yes, for which risks?)

Please write your answer here:

Does your organization receive notifications for upcoming events as result of early warning?

❶ Choose one of the following answers
Please choose **only one** of the following:

○ Yes

○ No

○ Not aware

If yes, which is the main dissemination system for the warning issued?

Only answer this question if the following conditions are met:
Answer was 'Yes' at question ' [G02Q12]' (Does your organization receive notifications for upcoming events as result of early warning?)

❶ Check all that apply
Please choose **all** that apply:

☐ operations centre/real-time info on screen

☐ telephone/fax/e-mail

☐ cell broadcasting (reverse 112)

☐ TV/radio

☐ on the ground alarm/sirens/megaphones

☐ Not aware

☐ Other:

Other:

Only answer this question if the following conditions are met:
Answer was at question ' [G02Q12s1]' (If yes, which is the main dissemination system for the warning issued?)

Please write your answer here:

Vulnerable groups

Which people do you think are especially vulnerable in the top 5 hazard situations you identified before (in terms of personal characteristics such as gender, living conditions like housing, lack of capacities such as language issues…)? Please also add a short explanation for why you think they are especially vulnerable.

Reminder: The possible options were:

Earthquake, Volcanic Eruption, Tsunami, Landslide, Heatwave, Storm, Blizzard, Flood, Drought,, Wildfire, Epidemics/Pandemics, Technological accident (describes any accident caused by man-made technology, including train accidents, reactor malfuntions etc.), Cyber threat, Terrorist attack, CBRNe malicious act (Chemical, Biological, Radiological, Nuclear, and high yield Explosives), Other

Which of the following groups, in your experience, are especially vulnerable in these disaster situations? Please tick in case you think it applies. *

	Earthquake	Volcanic Eruption	Tsunami	Landslide	Heatwave	Storm	Blizzard	Flood	I don't know
People with low income	☐	☐	☐	☐	☐	☐	☐	☐	☐
Children/minors	☐	☐	☐	☐	☐	☐	☐	☐	☐
Elderly people	☐	☐	☐	☐	☐	☐	☐	☐	☐
Pregnant people	☐	☐	☐	☐	☐	☐	☐	☐	☐
Single parent families with minor children	☐	☐	☐	☐	☐	☐	☐	☐	☐
Homeless people	☐	☐	☐	☐	☐	☐	☐	☐	☐
People with mental disorder/disability/illness	☐	☐	☐	☐	☐	☐	☐	☐	☐
People with physical disorder/disability/illness	☐	☐	☐	☐	☐	☐	☐	☐	☐
Migrants, refugees, asylum seekers	☐	☐	☐	☐	☐	☐	☐	☐	☐
I don't know	☐	☐	☐	☐	☐	☐	☐	☐	☐

Which of the following groups, in your experience, are especially vulnerable in these disaster situations? Please tick in case you think it applies. *

	Drought	Wildfire	Epidemics/ Pandemics	Technological Accident	Cyber threat	CBRNe malicious act	Terrorism attack	I don't know
People with low income	☐	☐	☐	☐	☐	☐	☐	☐
Children/minors	☐	☐	☐	☐	☐	☐	☐	☐
Elderly people	☐	☐	☐	☐	☐	☐	☐	☐
Pregnant people	☐	☐	☐	☐	☐	☐	☐	☐
Single parent families with minor children	☐	☐	☐	☐	☐	☐	☐	☐
Homeless people	☐	☐	☐	☐	☐	☐	☐	☐
People with mental disorder/disability/illness	☐	☐	☐	☐	☐	☐	☐	☐
People with physical disorder/disability/illness	☐	☐	☐	☐	☐	☐	☐	☐
Migrants, refugees, asylum seekers	☐	☐	☐	☐	☐	☐	☐	☐
I don't know	☐	☐	☐	☐	☐	☐	☐	☐

Are you or is your organisation working with people belonging to these vulnerable groups?

❶ Choose one of the following answers
Please choose **only one** of the following:

○ Yes

○ No

○ Not aware

If yes, which groups?

Only answer this question if the following conditions are met:
Answer was 'Yes' at question ' [G03Q03]' (Are you or is your organisation working with people belonging to these vulnerable groups?)

Please choose **all** that apply:

☐ People with low income

☐ Children/minors

☐ Elderly people

☐ Pregnant people

☐ Single parent families with minor children

☐ Homeless people

☐ People with mental disorder/disability/illness

☐ People with physical disorder/disability/illness

☐ Migrants, refugees, asylum seekers

☐ Other:

☐ Not aware

Other:

Only answer this question if the following conditions are met:
Answer was at question ' [G03Q03a]' (If yes, which groups?)

Please write your answer here:

How are you working with them?

Only answer this question if the following conditions are met:
Answer was 'Yes' at question ' [G03Q03]' (Are you or is your organisation working with people belonging to these vulnerable groups?)

Please write your answer here:

VULNERABLE GROUPS 2

Were representatives of the before identified vulnerable groups involved in disaster management plans of your organisation?

Only answer this question if the following conditions are met:
Answer was 'Yes' at question ' [G01Q08]' (Does your organisation play a role in disaster management?)

❶ Choose one of the following answers
Please choose **only one** of the following:

○ Yes

○ Partly

○ No

○ Not aware

If yes, how?

Only answer this question if the following conditions are met:
Answer was 'Yes' *or* 'Partly' at question ' [G03Q06sh]' (Were representatives of the before identified vulnerable groups involved in disaster management plans of your organisation?)

Please write your answer here:

Were representatives of the before identified vulnerable groups involved in any disaster management plans in your region?

Only answer this question if the following conditions are met:
Answer was 'No' at question ' [G01Q08]' (Does your organisation play a role in disaster management?)

❶ Choose one of the following answers
Please choose **only one** of the following:

○ Yes

○ Partly

○ No

○ Not aware

If yes, how?

Only answer this question if the following conditions are met:
Answer was 'Yes' or *Partly* at question ' [G03Q06cr]' (Were representatives of the before identified vulnerable groups involved in any disaster management plans in your region?)

Please write your answer here:

What do you think helps people best to rebuild and bounce back after a disaster?

❶ Choose one of the following answers
Please choose **only one** of the following:

○ Supporting individual livelihoods and businesses

○ Rebuilding infrastructure

○ Strengthening community bonds

○ Rebuild public sector provisioning services

○ Address immediate needs of affected population (e.g., shelter)

○ Stimulate the local economy

○ Psychological support

○ Build strong social ties in the community

○ Other:

○ Not aware

Other:

Only answer this question if the following conditions are met:
Answer was 'Other:' at question ' [G03Q04]' (What do you think helps people best to rebuild and bounce back after a disaster?)

Please write your answer here:

In your opinion, which category defines best whether people are vulnerable after a disaster?

❶ Choose one of the following answers
Please choose **only one** of the following:

- ◯ Pre-existing vulnerabilities
- ◯ Lack of social support
- ◯ Lack of support from authorities
- ◯ Loss of infrastructure
- ◯ Economic loss or poverty
- ◯ Psychological impacts or trauma
- ◯ Injuries and deaths
- ◯ Other:
- ◯ Not aware

Other:

Only answer this question if the following conditions are met:
Answer was 'Other:' at question ' [G03Q05]' (In your opinion, which category defines best whether people are vulnerable after a disaster?)

Please write your answer here:

VULNERABLE GROUPS 3

How well would you say the current disaster management plans in your region serve the above-mentioned vulnerable groups?

❶ Choose one of the following answers
Please choose only one of the following:

○ Not at all

○ Rather badly

○ Rather well

○ Very well

○ I don't know

Are there initiatives in place to reach vulnerable groups in particular in terms of disaster management education?

❶ Choose one of the following answers
Please choose only one of the following:

○ Yes

○ Partly

○ No

○ Not aware

If yes, for which vulnerable groups?

Only answer this question if the following conditions are met:
Answer was 'Yes' or 'Partly' at question ' [G03Q08]' (Are there initiatives in place to reach vulnerable groups in particular in terms of disaster management education?)

Please choose all that apply:

- [ ] People with low income
- [ ] Children/minors
- [ ] Elderly people
- [ ] Pregnant people

- [ ] Single parent families with minor children
- [ ] Homeless people
- [ ] People with mental disorder/disability/illness
- [ ] People with physical disorder/disability/illness

- [ ] Migrants, refugees, asylum seekers
- [ ] Other:
- [ ] Not aware

Other:

Only answer this question if the following conditions are met:
Answer was at question ' [G03Q08a]' (If yes, for which vulnerable groups?)

Please write your answer here:

FEEDBACK

Did you find this questionnaire understandable?

❶ Choose one of the following answers
Please choose **only one** of the following:

○ Yes

○ Partly

○ No

Do you have anything else to add concerning the topic or the structure of the questionnaire?

Please write your answer here:

Thank you for filling out this questionnaire! Your answers will contribute to the creation of a Smart City Digital Twin, which will be used to identify and address vulnerabilities in disaster situations.

If you have any comments or would like to retroactively have your data deleted, please contact us under: dpo@pantheon.eu (mailto:dpo@pantheon.eu).

25.04.2023 – 07:55
Submit your survey.
Thank you for completing this survey.

APPENDIX D: SHORT PROJECT DESCRIPTION

Community-Based Smart City Digital Twin Platform for Optimised DRM operations and Enhanced Community Disaster Resilience

PANTHEON overview

In the past two decades, the international disasters database EM-DAT has recorded 7,348 natural disasters resulting in the loss of 1.23 million lives and affecting over 4 billion others. These environmental catastrophes have caused a total of US$2.97 trillion in economic damages worldwide.

The PANTHEON project aims to enhance current disaster resilience models by developing evidence-based tools for policy analysis and evaluation. PANTHEON will create a community-based digital framework for disaster resilience using Smart City Digital Twin (SCDT) technology and emerging innovations such as earth observation sensing and drone technology. By integrating the PANTHEON platform and technologies with Internet of Things (IoT) infrastructure and multisource data, the project will enable the assessment of risks and vulnerabilities with greater accuracy and enable better decision-support for national and regional stakeholders during disasters. Ultimately, the PANTHEON platform will facilitate Community-Based Disaster Risk Management (CBDRM) and improve decision-making during and after disasters. For the specific developments in the project, our research focuses on Greece (Athens) and France (Paris) as pilot regions.

Involvement of stakeholders and community representatives

PANTHEON aims to achieve this by analysing region-specific hazards, vulnerabilities and existing capacities, as well as the legal and regulatory environments and the participatory consultation through a Community-Based Advisory Board. Therefore, the integration of technology will be accompanied by the involvement of various community representatives, stakeholders and experts to allow for diverse perspectives and identify concerns, opportunities and challenges, while resolving perceived conflicts through better mutual understanding. In our quest to create a demand-oriented and participatory design of the technology, PANTHEON will prioritize the involvement of representatives of vulnerable groups such as children, the elderly, and disabled individuals in increasing risk awareness and building community resilience.

To achieve these objectives and ensure a project outcome that best serves communities' needs, participation in interviews, questionnaires and/or the Advisory Board is greatly appreciated. Different perspectives are very valuable in this context: Through your participation and expertise, you not only directly support the project, but can also actively contribute to the development process for better disaster management and community resilience in the targeted regions, which can then benefit a general approach.