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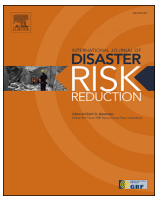

# Strengthening public health system resilience to disasters in Türkiye: Insights from a scorecard methodology

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ABSTRACT

*Background:* Türkiye is a country that faces many disasters, especially earthquakes and floods, which have serious short- and long-term consequences for public health. The importance of disaster risk reduction activities in building resilience before a disaster strikes is increasingly recognized. Furthermore, resilience assessment is considered to be the starting point for these activities. However, there is a substantial gap in the scientific evidence on systematic assessments of the resilience of the public health system and also a serious lack of activities to strengthen the system against disasters in Türkiye.

*Aim:* Using a Scorecard methodology, the study aimed to systematically assess the resilience of the public health system in Türkiye by examining key indicators related to disaster risk management and preparedness, and subsequently to recommend priority actions. A systematic assessment of resilience can provide the scientific evidence needed to identify weaknesses in the system. Furthermore, identifying priority actions based on this evidence allows progress to be made towards strengthening the system.

*Methods:* This mixed-methods study was conducted in two separate regions of Türkiye with the highest earthquake (Esenler/Istanbul) and flood risk (Ortahisar/Trabzon). Based on the Scorecard methodology, two-stage workshops (online and face-to-face) were held. During the online stage, qualitative data were collected by interviewing participants about their evaluation of the situation in the counties regarding the Scorecard indicators, and quantitative data were collected through scoring. In the face-to-face stage, strategies were developed to improve the resilience of the public health system. Quantitative data were expressed with numbers and percentages, and thematic analysis was utilized for qualitative data analysis.

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*Results:* The lowest scoring indicators were as follows (Esenler and Ortahisar, respectively): addressing mental health needs associated with disasters (2.17 ± 1.29; 2.27 ± 1.16), resilience of key healthcare facilities (2.22 ± 0.55; 2.91 ± 1.08), and protection and identification of ecosystem services (2.39 ± 1.04; 2.13 ± 1.49). In this study, participants recommended increasing the resilience of the public health infrastructure and improving human resources and ecosystem services to ensure the resilience of the public health system.
*Conclusions:* The study found that the weakest areas in terms of public health system resilience were the seismic safety and infrastructure of health facilities, the capacity of disaster-related mental health services, and disaster-related ecosystem services. To improve the resilience of public health systems, it is essential to strengthen these areas of weakness and ensure collaboration between all stakeholders in the system. The identification of weaknesses in the study has guided the determination of priority actions to build a baseline of resilience. In addition, the results of the study have highlighted priority areas for investment to improve disaster response and the overall health of the population in the context of disasters.

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## 1. Introduction

Disasters triggered by natural hazards and man-made disasters are sudden events that create challenges for humankind, causing great harm and property destruction [1]. Historically, the disaster management cycle (Fig. 1) focused on response and recovery activities. However, towards the end of the 20th century, the importance of being well prepared for disasters became better understood. As a result of this new understanding, the focus of disaster management has shifted considerably toward disaster risk reduction (DRR) activities [2,3]. The fundamental point of DRR is analyzing and managing the root causes of disasters and disaster risks to lower the potential of an event's disastrous consequences on all aspects of human life, economic loss, and public health [4].

Disaster risk reduction and healthcare always complement and support each other and underlie the Health Emergency and Disaster Risk Management (Health-EDRM) Framework [5,6]. This framework has communal goals with the Sendai Framework (2015), which is a non-binding agreement accepted by the United Nations and aimed at significantly decreasing disaster risks including health-related risks and improving community health [5,7].

The importance of this association is because disasters directly affect public health, resulting in injury, acute disease, and mental trauma in a short time. Additionally, disasters may have long-term impacts on public health and cause displacement of communities, environmental contamination, air pollution, infrastructure damage, and disruptions in healthcare services [8]. Reducing the short- and long-term impacts of disasters and mitigating further harm is a key responsibility of the public health system [9]. To maintain public health services in the event of a disaster, the public health system must be prepared and resilient [10]. According to the most commonly used definition, public health system resilience is the ability of health stakeholders, institutions, and communities to prepare for and respond effectively to a crisis, to sustain essential services throughout the crisis, and to reorganize as necessary on the basis of lessons learned during the crisis [11]. Health system resilience is vital in dealing with all kinds of catastrophic events and disasters [12,13].

### *1.1. The Health Emergency and Disaster Risk Management (Health-EDRM) System in Türkiye*

The Marmara earthquake (1999), which occurred in the region with the highest population density and where the country's most important industrial centers are located, was a turning point in the structuring of the Health Emergency and Disaster Risk Management (Health-EDRM) System in Türkiye. Until this earthquake, “disaster management” had covered damage recovery and reconstruc-

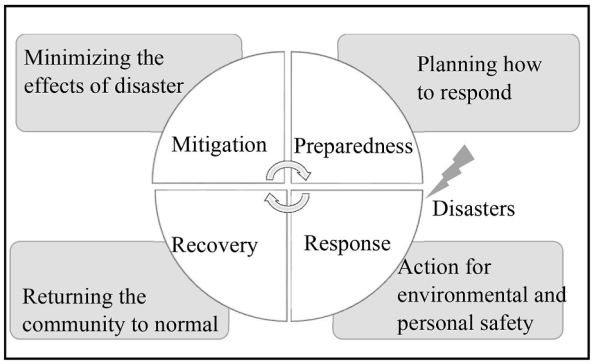


**Fig. 1.** Disaster management cycle [2].

tion activities after disasters, while on the other hand, preparedness and risk reduction activities had not been adequately considered. The Marmara earthquake pushed Health-EDRM to be phase-inclusive, rather than focusing on the response. In line with this new understanding, that is, being well prepared for and resilient to disasters, the National Medical Rescue Teams (UMKE) (2004) and the Disaster and Emergency Management Presidency (AFAD) (2009) under the Ministry of the Interior were established [14,15]. Having a centralized structure throughout the country, Health-EDRM is carried out under the responsibility of these two organizations, within the response framework and disaster risk reduction (DRR) plans made on a national and regional basis.

There is growing recognition of the importance of disaster risk reduction activities in building resilience before a disaster hits [3]. Furthermore, the starting point for these activities is considered to be the assessment of resilience [16]. However, while preparation for and response to disasters are being reinforced in Türkiye, there remains a substantial gap in the scientific evidence on systematic assessments of public health system (PHS) resilience. In addition, there is a serious lack of activities aimed at strengthening the system against disasters in the country. Given that the resilience of the PHS includes the ability to mitigate vulnerabilities, respond to shocks without significant disruption to public order, and recover quickly, this gap is of the utmost importance.

Assessing resilience is crucial if communities want to pursue progress toward resilience and prioritize their actions accordingly. Although there is some confusion about how to assess resilience, this can be achieved by providing a systematic process using a structured tool [16]. In this study, a Scorecard methodology was followed for this purpose, and the United Nations Public Health System Resilience Scorecard (Scorecard) was used for the first time in Türkiye. The aim of the study was to assess the resilience of the PHS to disasters and identify priority actions to improve it. Thereby, the study also sought to address the gap identified above. As a result of this systematic assessment, the weaknesses of the PHS were highlighted, and the actions needed to strengthen these weaknesses were identified and prioritized. In this respect, the study has the potential to contribute to improving the resilience of the PHS.

Regarding the risk of disasters in Türkiye, earthquakes are the first and foremost due to the country's location in the active seismic zone of the Mediterranean-Alpine region. The recent Kahramanmaraş earthquake of February 6, 2023 was the biggest disaster in Türkiye in the last century. It affected about one-eighth of the country's surface area, killed more than 50,000 people and damaged more than half a million buildings [17,18]. The second largest earthquake in the history of the Republic of Türkiye was the Marmara earthquake of 1999. According to official figures, the 7.4 magnitude earthquake affected approximately 14.5 million people, with 18,374 deaths, 36,948 injuries and 93,618 buildings severely damaged. Furthermore, the 2011 Van earthquake (magnitude 7.2), with a death toll of 644 people, and the Elazığ earthquake (magnitude 6.8), which caused the death of 41 people and injured 1631, are among the most significant disasters in Türkiye in recent times [19]. Flooding is the second most common disaster in Türkiye. According to the EM-DAT database, there have been 20 floods since 2000 and 364 people have died in these disasters [20]. For this reason, the study was carried out in Istanbul/Esenler, one of the most earthquake-prone regions of Türkiye, and Trabzon/Ortahisar, a region with a high risk of flooding.

This study is part of a broader project funded by the WHO titled “Systematically identifying and evaluating strategies for strengthening community resilience across multiple communities and countries” where the knowledge and experiences of people living, working, and researching in local communities is used to identify actions for mitigating the impact of future disasters, thereby providing the local perspectives required to develop generalizable and translatable strategies to “build back better” and strengthen community resilience.

## 2. Methods

### 2.1. Design

In the study, a concurrent embedded mixed-methods approach was employed, and two-stage workshops (online and face-to-face) were conducted in two counties: Esenler (Istanbul) and Ortahisar (Trabzon). This design allows for the simultaneous collection of quantitative and qualitative data, typically with a primary focus on one type of data [21,22].

In line with the study's objectives, the online phase involved assessing the resilience of the PHS to disasters and identifying their weaknesses quantitatively using the scorecard. This quantitative data formed the core of the study. Alongside the scorecard's implementation, semi-structured interviews were conducted to gather participants' insights on their counties' situation, ensuring accurate and appropriate scoring. These interviews offered a deeper understanding to complement the quantitative findings. In the face-to-face phase, identified weaknesses (scorecard items scoring below 3.5) were addressed, and actions for improvement were proposed. In this respect the qualitative data were used to support and to extend the quantitative data (Fig. 2).

### 2.2. Data collection tool

In this study, the Disaster Resilience Scorecard for Cities: Public Health System Resilience-Addendum (United Nations Public Health System Resilience Scorecard) was used as a data collection tool. The addendum (Scorecard) was developed by the United Nations Office for Disaster Risk Reduction (UNDRR) with the support of the WHO to remedy the shortcomings of the Disaster Resilience Scorecard for Cities, which does not adequately address disaster-related public health issues. The Scorecard contains 23 questions/indicators ranking the level of risk management and preparedness, each rated from 0 to 5, where 5 indicates the best practice [23].

It is widely acknowledged that self-assessment of the PHS is vital in order to be ready and able to respond to disasters [16]. Scorecard indicators allow stakeholders to gauge how resilient the PHS is to disasters including pandemics. Scorecard implementation also provides a platform for dialogue between stakeholders from different PHS sectors and creates a common understanding and vision among them to strengthen PHS resilience [23,24]. The Scorecard was implemented through workshops.

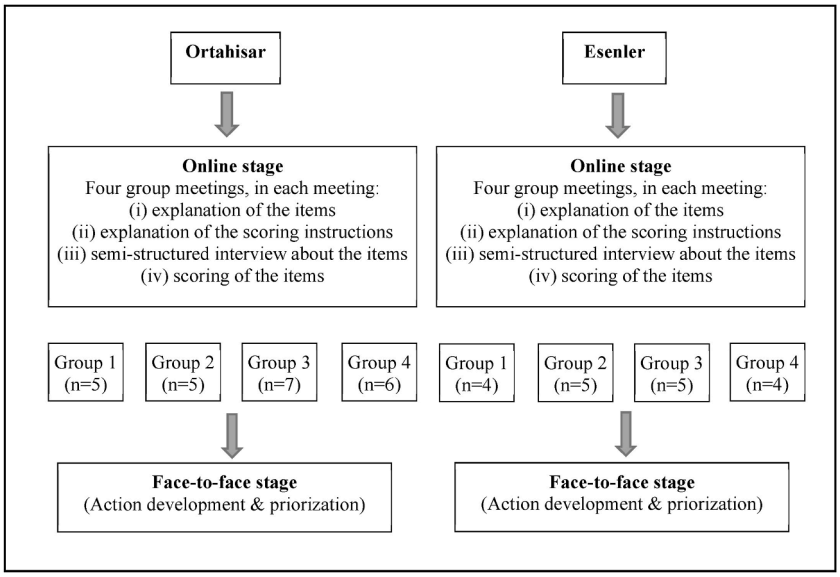


**Fig. 2.** Study flow chart.

### 2.3. Selection and description of participants

The term "public health system" includes health services and non-health services on which healthcare may be significantly reliant. Examples of health services include, but are not limited to, nursing homes, public health departments, health laboratory facilities, supply and distribution systems for pharmaceuticals, medical devices and equipment, environmental health systems, water and sanitation systems, and emergency management control centers. Non-health services include energy, water, communications, roads, and community awareness services, etc. [24]. Accordingly, this study used purposive sampling, with the aim of bringing together the different disciplines that make up the PHS in Esenler and Ortahisar. Having been working in the current position for at least six months and volunteering to participate in the research were selected as inclusion criteria for the sample. No exclusion criterion was used in the study.

The authorized persons, who were unit supervisors in their institutions, were invited through personal visits and official letters of invitation one month before the face-to-face workshop. These officials numbered 30 for Ortahisar and 29 for Esenler (both counties have a similar PHS structure; however, there are no nursing homes in Esenler), and in both counties, 28 of the invited participants attended the workshops (participation rate 93 % and 96.5 %, respectively).

Participants of the Esenler workshop were employed as follows: Municipality (5), Provincial Health Directorate (13), Universities (2), AFAD (5), Telecommunications (2), and UMKE (1). Eighteen of the participants attended both online and face-to-face workshops, while ten participants only attended face-to-face workshops.

Participants of the Ortahisar workshop were employed as follows: Municipality (3), Provincial Health Directorate (11), Universities (4), AFAD (5), nursing home (1), fire brigade (1), Red Crescent (1), and UMKE (2). While 17 of the officials participated in both stages, six participants only attended the online stage and five participants only participated in the face-to-face stage.

### 2.4. Data collection

#### 2.4.1. Online stage

In the online stage, quantitative data were obtained by scoring on the Scorecard. In this stage, qualitative data were gathered to unpack the reasons behind the obtained scores. Three steps were taken for scoring each indicator. Firstly, the indicator was read and explained (PŞ). The Scorecard has a specific explanation for each indicator, as well as specific scoring instructions for each of them. During the scoring, the relevant explanation and specific scoring instructions for each indicator were explained to the participants. No instructions were used other than the specific instructions contained in the Scorecard itself. Secondly, a semi-structured interview was performed to explore participants' opinions about the situation of the county regarding the indicator (PŞ), and lastly, participants were asked to individually give the score they deemed appropriate for the county (PŞ).

The semi-structured interviews were held to understand the situation of the counties regarding the Scorecard indicators and to ensure the most suitable/accurate scoring. Participants were interviewed as a group to allow them to listen to other participants' explanations. This group dynamic was important as participants came from different disciplines and each participant had knowledge about the indicators related to his/her own discipline. Therefore, during the interview, each participant was asked to explain their knowledge and experiences regarding the indicator being scored. Questions such as "in relation to this indicator, in your view, what is the status of Ortahisar/Esenler and what kind of activities are being carried out in Ortahisar/Esenler?" were asked. After each participant had expressed their knowledge and experience regarding the indicator, the whole group was asked if they had anything else they wanted to say. After this group interaction and information exchange, participants individually marked the score they deemed to be

appropriate on the scoring forms distributed by the researchers. Participants who could not decide which score was appropriate for any indicator after the group interaction were allowed not to score. The given scores were manually entered into the data set by the researchers and the average scores were calculated.

Interviews were audio recorded and transcripts were generated from these qualitative data. Two of the researchers (IT, PŞ) repeatedly read the transcripts for data coding to produce themes representing the core meaning of the participants' statements. Following this, the transcripts were translated into English. The quality assurance of the translation of the transcripts was conducted by an outsourced linguist fluent in both Turkish and English.

Both online stages, in Esenler and Ortahisar, were held as four separate group meetings. The meetings were held via the Microsoft Teams online video conferencing platform, which is widely used for communication and collaboration. During the meetings, participants marked their scores on the scoring forms (in Word document format). The scoring forms contained the items and the scoring ranges (from 0 to 5 for each of the items). Participants then returned the forms to the researchers and the scores were transferred to an Excel file by the researchers.

For these meetings, breakout groups were created by ensuring the presence of at least one official from AFAD, County Municipality, and County Health Department in each group to achieve the best possible group interaction and information exchange during scoring. Through the creation of the breakout groups, the aim was to gain certain advantages, such as enabling people to express their opinions more easily, providing them with more opportunities to talk, and enabling them to use their available time more efficiently. The online meetings were held on four different days in the week before the face-to-face workshop. Face-to-face workshops were held on November 3, 2021, in Ortahisar/Trabzon and on November 17, 2021, in Esenler/Istanbul.

#### *2.4.2. Face-to-face stage*

The aim of the face-to-face stage was to develop and prioritize strategies and actions to increase the resilience of society and the public health system to disasters, based on the results of the scoring in the online stage. According to the Scorecard methodology, participants can develop action plans for all indicators or only for those indicators that score below a certain criterion [24]. As it was considered a priority to develop action plans for the weakest areas, it was found appropriate to address items with low scores. Furthermore, it was taken into account that building the resilience of society at the highest possible level is one of the main objectives of the Turkish National Development Plan [25]. In addition, considering that five points reflects best practice for the Scorecard indicators, four and five points were regarded as target levels [23]. Thus, in the face-to-face stage, the weaknesses of the PHS in terms of indicators scoring below 3.5 were discussed and priority actions were identified for these indicators.

In this stage, breakout groups were formed by focusing attention on ensuring that those in the same group were at the online stage and that people in subordinate–superior positions were not combined. The results obtained from the group discussions were then presented to the whole group by a representative from each breakout group. After the presentation, all participants' opinions and suggestions were received. One person (other than the attending officials) was assigned to write down the discussions for each group; this person also recorded the discussions held in the plenary sessions. In this stage, actions with the highest impact and benefit and the lowest cost were evaluated as the most prioritized actions [26].

### *2.5. Sites description*

The study was carried out in a county of Istanbul, one of the provinces with the highest earthquake risk, and in a county of Trabzon, one of the provinces with the highest flood risk (Esenler and Ortahisar respectively) (Fig. 3).

#### *2.5.1. Esenler/Istanbul*

Istanbul is the industrial, manufacturing, and financial center of Türkiye, and approximately one-fifth of the country's population (15.8 million) lives in Istanbul [27]. Due to its geographical location, Istanbul may face many disasters. One of the most destructive of these disasters is earthquakes, and due to the tension on the faults recently, the possibility of a large-scale earthquake that will affect

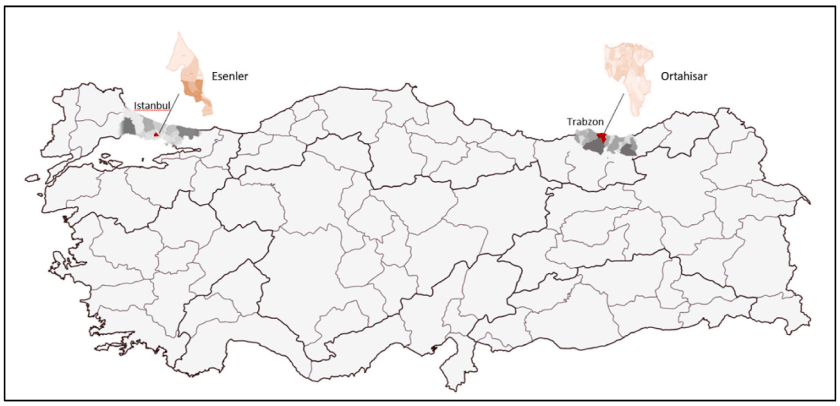


**Fig. 3.** Map of the workshop sites.

Istanbul is increasing [28]. Esenler is among the most vulnerable of Istanbul's 39 counties to a possible earthquake [29]. Consequently, it was deemed appropriate to conduct the workshop in Esenler, as it is among the counties with the highest disaster risk.

#### 2.5.2. Ortahisar/Trabzon

Trabzon is located in Türkiye's rainiest region, which is named the Eastern Black Sea Region. Due to the region's mountainous structure, heavy precipitation, and melting snow in the spring, disasters triggered by natural hazards such as floods and landslides are common in this region [30]. Trabzon has 18 counties, and the workshop was held in Ortahisar, which is the most populated county and where about half (334,228) of Trabzon's population lives [31].

### 2.6. Data analysis

The average scores given by the participants for the Scorecard indicators were processed using Microsoft Excel version 2013. Data saturation was considered to have been achieved when all participants had expressed their views on the indicator under discussion and expressed a wish to continue with the scoring.

Qualitative data were analyzed using the method of thematic analysis in six steps: data familiarization, initial coding, theme development, theme review, theme definition, and reporting the findings. Thematic analysis is an adaptable qualitative analysis technique that enables researchers to investigate participants' perspectives [32]. In the analysis, the audio file of the recorded interviews was listened to repeatedly to familiarize the researchers with the depth and breadth of the data content, and the recordings were then transcribed. Next, for open coding, the transcripts were read through a number of times and units of meaning were extracted and captured as codes [33]. In the next step, the sentences or paragraphs were coded according to their content and the meaning hidden in them. By placing the codes side by side in terms of similarities and differences, sub-themes and finally themes were created. To enhance the rigor of this study, two researchers (IT, PŞ) independently analyzed the themes. Afterward, the two researchers met to discuss and reach a consensus on the themes.

### Ethical approval

Ethical approval for this study was given by the Trabzon University Social and Human Sciences Research and Publication Ethics Committee with the number E−81614018-000-662 (July 13, 2021). All participants were informed prior to the online stages that a voice recording would be made during the interview, and that participation was voluntary.

## 3. Results

### 3.1. Online stage

#### 3.1.1. Quantitative data

Workshops were organized in Esenler and Ortahisar with 28 participants each. 75.0 % of the participants were male. 30.36 % of the participants worked in the emergency management sector and 33.93 % in the health sector. Information about the workshop participants and their disciplines is presented in Table 1.

When the five indicators with the lowest scores for the counties were evaluated, it was found that items regarding identification of ecosystem services (A5.1; Esenler = 2.39 ± 1.04; Ortahisar = 2.13 ± 1.49), addressing mental health needs associated with disasters (A7.2; Esenler = 2.17 ± 1.29; Ortahisar = 2.27 ± 1.16), availability of funding to address public health impacts of disasters (A3.1; Esenler = 2.56 ± 0.86; Ortahisar = 2.83 ± 0.98), and resilience of key healthcare facilities against disasters (A4.1; Esenler = 2.22 ± 0.55; Ortahisar = 2.91 ± 1.08) were among the items with the lowest scores for both counties. In addition to these

**Table 1**
Demographic information about workshop participants[a].

| Demographic information | Ortahisar (n = 28) | | | | Esenler (n = 28) | | |
|---|---|---|---|---|---|---|---|
| | Online | In person | Both | Total | In person | Both | Total |
| **Gender** | | | | | | | |
| Male | 5 (17.86) | 2 (7.14) | 12 (42.86) | 19 (67.86) | 9 (32.14) | 14 (50) | 23 (82.14) |
| Female | 1 (3.57) | 3 (10.71) | 5 (17.86) | 9 (32.14) | 1 (3.57) | 4 (14.29) | 5 (17.86) |
| **Sector** | | | | | | | |
| Academic | 2 (7.14) | – | 1 (3.57) | 3 (10.71) | 1 (3.57) | 1 (3.57) | 2 (7.14) |
| Private | – | – | – | – | – | – | – |
| Government | 3 (10.71) | 5 (17.86) | 16 (57.14) | 24 (85.71) | 9 (32.14) | 17 (60.71) | 26 (92.86) |
| Non-profit | 1 (3.57) | – | – | 1 (3.57) | – | – | – |
| **Role/discipline** | | | | | | | |
| Emergency management | 2 (7.14) | 3 (10.71) | 4 (14.29) | 9 (32.14) | 2 (7.14) | 6 (21.43) | 8 (28.57) |
| Environmental health | – | – | 2 (7.14) | 2 (7.14) | – | 3 (10.71) | 3 (10.71) |
| School administrator | 2 (7.14) | – | 1 (3.57) | 3 (10.71) | 1 (3.57) | 1 (3.57) | 2 (7.14) |
| Food supply or logistics | 1 (3.57) | 1 (3.57) | – | 2 (7.14) | – | 3 (10.71) | 3 (10.71) |
| Healthcare | 1 (3.57) | 1 (3.57) | 7 (25) | 9 (32.14) | 5 (17.86) | 5 (17.86) | 10 (35.71) |
| Other | – | – | 3 (10.71) | 3 (10.71) | 2 (7.14) | – | 2 (7.14) |

[a] Percentages are based on the total number of participants. Online: Online workshop participants only, In Person: In-person workshop participants only, Both: Both online and in-person workshop participants.

items, the indicator related to resilience of the public health infrastructure (A8.1; Esenler = 2.22 ± 0.55; Ortahisar = 3.39 ± 1.03) in Esenler and the indicator related to communities' understanding and being able to fulfil their roles in maintaining public health regarding disasters (A7.1; Esenler = 2.94 ± 0.73; Ortahisar = 2.96 ± 1.22) in Ortahisar were determined to be among the lowest rated indicators (Table 2).

### 3.1.2. Qualitative data

In this section qualitative data from the study are presented based on the indicators with the lowest score (Table 3). Using the Scorecard structure, participants reported on the weaknesses of the public health system regarding disasters. The key themes, which

**Table 2**
Disaster Resilience Scorecard for Cities: Public Health System Resilience – Addendum (Scorecard) Indicator scores.

| Ref | Ortahisar | | Esenler | |
|---|---|---|---|---|
| | n | Mean ± SD | n | Mean ± SD |
| A1.1 | 23 | 3.65 ± 0.83 | 18 | 3.11 ± 0.47 |
| A2.1 | 23 | 3.78 ± 0.74 | 18 | 3.67 ± 1.24 |
| A2.2 | 22 | 3.27 ± 0.88 | 18 | 3.72 ± 1.41 |
| A2.3 | 23 | 2.96 ± 0.77 | 18 | 2.56 ± 1.15 |
| A3.1 | 23 | 2.83 ± 0.98 | 18 | 2.56 ± 0.86 |
| A4.1 | 23 | 2.91 ± 1.08 | 18 | 2.22 ± 0.55 |
| A5.1 | 23 | 2.13 ± 1.49 | 18 | 2.39 ± 1.04 |
| A6.1 | 23 | 3.17 ± 1.07 | 18 | 3.67 ± 0.84 |
| A6.2 | 23 | 3.48 ± 1.27 | 18 | 4.17 ± 0.86 |
| A6.2.1 | 23 | 3.65 ± 1.3 | 18 | 3.78 ± 0.94 |
| A6.2.2 | 23 | 4.09 ± 1 | 18 | 4.28 ± 0.83 |
| A7.1 | 23 | 2.96 ± 1.22 | 18 | 2.94 ± 0.73 |
| A7.1.2 | 20 | 3.8 ± 0.95 | 18 | 3.39 ± 0.5 |
| A7.2 | 22 | 2.27 ± 1.16 | 18 | 2.17 ± 1.29 |
| A8.1 | 23 | 3.39 ± 1.03 | 18 | 2.22 ± 0.55 |
| A8.2 | 22 | 3.68 ± 1.09 | 18 | 3.89 ± 0.83 |
| A8.3 | 23 | 3.39 ± 0.94 | 18 | 3.11 ± 0.47 |
| A9.1 | 23 | 4.0 ± 1.17 | 18 | 2.78 ± 0.88 |
| A9.2 | 23 | 4.17 ± 1.03 | 18 | 3.17 ± 1.25 |
| A9.3 | 22 | 3.73 ± 1.39 | 18 | 3.11 ± 1.41 |
| A9.4 | 23 | 3.57 ± 1.12 | 18 | 4.61 ± 0.61 |
| A10.1 | 23 | 3.09 ± 1 | 18 | 3.78 ± 0.94 |
| A10.2 | 23 | 3.43 ± 1.16 | 18 | 3.83 ± 1.29 |

SD: standard deviation.

**Table 3**
Narratives of participants about Scorecard indicators.

| Indicator/Participants | | Narratives |
|---|---|---|
| A5.1 | AFAD, Esenler | *"We observe that efforts to identify and protect these ecosystem services are minimal."* |
| | Municipality, Esenler | *"… more precisely, to create the green texture in the ecosystem, our Mayor started an urban transformation project."* |
| | Doctor, Ortahisar | *"The suitability of constructions for the ecosystem is not taken into account, constructions continue in river beds …… Unauthorized, unplanned constructions in rural areas disturb the ecological balance."* |
| | Municipality, Ortahisar | *"I can say that we are very actively carrying out projects such as a park project in each of our neighborhoods to increase green areas."* |
| A7.2 | Psychological Counselor, Esenler | *"There are not enough specialist psychiatrists, specifically in the Esenler county, …. In case of disaster, there will be a greater need for mental health workers."* |
| | Doctor, Ortahisar | *"Mental health services are adequate at small scales, but not sufficient for large-scale disasters."* |
| A4.1 | Municipality, Esenler | *"Most of the Family Health Centers, 80 % and above, are located downstairs in old buildings, buildings that are not compliant with the earthquake code in the current legislation, and I think these would likely not survive during a potential earthquake or related disaster."* |
| | Municipality, Ortahisar | *"… all health institutions in the county comply with the zoning laws. They may be appropriately constructed for disaster situations but not positioned considering disaster possibilities. There are also health facilities built according to the old regulations in the county."* … |
| | UMKE, Ortahisar | *"Even if these institutions themselves were not affected in a disaster, transportation routes would be blocked."* |
| A3.1 | UMKE, Ortahisar | *"In terms of financing, I do not know if there is a budget allocated by the hospitals or set aside by the health directorate. I am not aware of such a budget. There is no such budget as far as I know. However, in case of need, a quick transfer is provided from the central budget."* |
| | UMKE, Esenler | *"At the moment, although there are some funding mechanisms, they are things that have to be used either through the governorate or with the funding approval of the Ministry of Health. So I think there are problems with setting up county-specific funding or using it."* |
| A8.1 | AFAD, Esenler | *"Actually, as hospitals, yes, but health and family health centers do not have resilient infrastructures".* |
| A7.1 | Emergency physician, Ortahisar | *"Considering the level of education …. awareness is at a minimum level …… there are those in society who are seriously indifferent to this issue and there are those who are aware."* |

represent the most frequently discussed challenges, are as follows: (1) deficiencies in the identification and protection of the ecosystem, (2) inadequate disaster-related mental health services, (3) non-resilient critical healthcare facilities, (4) lack of defined and available funding for disaster-related public health issues, (5) weakness of the public health infrastructure, and (6) ineffective community engagement in maintaining public health in relation to disasters.

*3.1.2.1. Deficiencies in the identification and protection of the ecosystem.* With regard to ecosystem services, the general view among participants in both workshops was that ecosystem services are not adequately defined and protected. Some participants expressed this situation by saying "*we are busy with different priorities.*" In addition, in the Ortahisar workshop, it was pointed out that the risk of flooding in the region has increased due to inadequate protection of the ecosystem, especially due to unauthorized construction in rural areas and construction in stream beds. In response to these views, municipal officials gave information regarding their activities to protect the ecosystem, such as "*protecting the water basin*" and "supporting *agricultural activities.*"

*3.1.2.2. Inadequate disaster-related mental health services.* Considering mental health needs in the context of disasters, most participants defended the view that "*mental health needs are considered of secondary importance*". During the discussions, although officials from AFAD and UMKE reported that there were increasing efforts to improve psychosocial support for disaster-related mental health problems, particular attention was drawn to "*the inadequate capacity of mental health services*" and "*the lack of mental healthcare providers*" in this area. The inadequate inclusion of mental health needs in disaster planning was also highlighted as a major challenge.

*3.1.2.3. Non-resilient critical healthcare facilities.* In the Esenler workshop, it was noted that although the new buildings comply with earthquake regulations, the existing building stock is not earthquake resistant. It was noted that there are a large number of old health facilities in the county that were built according to the old zoning laws. The risk of earthquakes was mentioned in particular, and it was explained that most family health centers are not strong enough to continue their services after an earthquake. Furthermore, a large number of family health centers are located under buildings that could be at high risk of collapse. In Ortahisar, which has a rugged terrain, the criticism was made that critical healthcare facilities are highly likely to be affected by a possible disaster. Also, roads are likely to be affected, resulting in access problems to key health facilities.

*3.1.2.4. Lack of defined and available funding for disaster-related public health issues.* Participants expressed that there is no defined budget for public health risks and impacts of disasters. It was explained that funds are transferred from the budget of the relevant ministry or from AFAD according to the needs that arise in the event of a disaster. It was emphasized that there are some procedural and coordination difficulties in transferring funds from the central budget.

*3.1.2.5. Weakness of the public health infrastructure.* Participants in the Esenler workshop felt that in the event of a disaster, the public health infrastructure, including communications, power, clean water and wastewater, and transport-related services, would be severely disrupted and would take time to recover. It was emphasized that, in addition to hospitals, the infrastructure of family health centers would suffer serious damage in the event of a disaster, particularly an earthquake.

*3.1.2.6. Ineffective community engagement in maintaining public health in relation to disasters.* At the workshop in Ortahisar, participants shared activities aimed at ensuring that communities understand and are able to fulfil their role in the maintenance of public health in the event of a disaster. However, it was argued that these objectives had not reached the community sufficiently. At this point, emphasis was placed on the level of education. It was discussed that depending on the level of education in society, some groups have a serious awareness of the role they have to fulfil, while others are quite indifferent to the issue.

### *3.2. Face-to-face stage*

In this stage, data were gathered on the strategies developed by the participants to increase public health system resilience and their prioritization. The priority strategies for both counties are as follows: improving the capacity of mental health services to cope with disaster-related psychological problems, strengthening key health facilities against disasters, and identification and development of ecosystem services related to public health. The results of this stage are summarized in Table 4.

## 4. Discussion

In this study, public health system resilience against disasters was evaluated within the scope of 23 indicators in the Scorecard. The application of the Scorecard allowed public health system stakeholders to come together and to share experiences with each other. For each indicator in the Scorecard, there are options ranging from 0 to 5. Each of these options defines a level of resilience. As the score increases, it is assumed that the level of resilience within that indicator also increases, and 5 is considered the best level. A decrease in the score reflects weaknesses and challenges in resilience [24]. Therefore, the quantitative data obtained from the scoring contributed to the understanding of the strengths and weaknesses of the PHS in the face of disasters in Esenler and Ortahisar. The study also reveals qualitative data from the discussions of PHS officials in online group meetings. As these officials are experts and experienced in the relevant areas, the qualitative data contributed to highlighting the weaknesses of the system. As a result, the study found that the weakest areas in terms of public health system resilience were related to the capacity of disaster-related mental health services, ecosystem services, budget planning, and the resilience of health facilities and infrastructure.

Earthquake-resistant buildings are a vital element of disaster risk reduction [34]. In the Scorecard assessment, the items related to resilience of infrastructure and key health facilities in Ortahisar scored around 3 points and in Esenler around 2 points. These scores

**Table 4**
Recommended actions.

| İndicator | | Action |
|---|---|---|
| A7.2 | Esenler | Assemble a working group to evaluate the adequacy of the mental health service capacity in the county in case of a disaster and to eliminate the identified deficiencies. |
| | Ortahisar | Identify and train experts and counselors who will provide mental health services in the event of a disaster. |
| A4.1 | Esenler | Ensure that an adequate number and capacity of prefabricated facilities are available to replace key health facilities with high potential for damage. |
| | Ortahisar | Identify alternative institutions that will undertake the services of those health facilities that are likely to be affected in the event of a disaster, and plan the capacity increase in these alternative institutions. |
| A5.1 | Esenler | Establish a working group for the identification, control, and development of ecosystem services concerning public health in Esenler county. |
| | Ortahisar | Define elements that threaten the ecosystem for the rural and central parts of the county separately, and share tasks among the public health system stakeholders to eliminate these threats. |
| A3.1 | Esenler | Define a "disaster-related budget code" and "expenditure item" in the budget of each institution among public health system stakeholders. |
| | Ortahisar | Evaluate the adequacy of the reserve funds of institutions and organizations that are responsible for disaster response and ensure the unity of forces in disaster response by coordinating/combining the reserve funds of the institutions in the case of possible disasters. |
| A8.1 | Esenler | Establish control mechanisms to assess and monitor the resilience of public health facilities' infrastructure against disasters. |
| | Ortahisar | Strengthening public health infrastructure in its entirety so that its services can be maintained after the "most severe" disaster scenario. |
| A7.1 | Esenler | Collaborate with well-known people who have the means to reach large populations by using up-to-date communication opportunities to raise the awareness and sensitivity of society about their role in protecting public health before, during, and after a disaster. |
| | Ortahisar | Ensure that the local government conducts a detailed analysis of the social structure for which it is responsible, and that efforts to raise awareness of all segments of society concerning their expected roles are carried out according to this analysis. |

indicate that public health services will be significantly disrupted in the most likely and most severe scenarios. In addition, participants strongly argued that the existing building stock is not earthquake resistant. In fact, the recent Kahramanmaraş earthquake is evidence of the lack of earthquake resistance of building stock in Türkiye. More than half a million buildings, including hospitals and health facilities, were destroyed or severely damaged in the earthquakes that hit eleven provinces, causing significant financial losses. The lack of disaster resistance of the buildings is due to the fact that they were built according to the old regulations, which do not provide sufficient seismic resistance according to current standards [17]. The literature has identified many challenges to the implementation of building codes, such as municipalities only checking architectural plans, contractors not complying with the codes, use of poor-quality building materials, and failure to enforce building regulations [35,36]. Nevertheless, it was shown that compliance with modern building codes can significantly reduce property damage [37]. To ensure seismic safety, structural checks of existing buildings and urban transformation studies are underway in the country.

In Ortahisar, which has a rough terrain, some participants drew attention to how the roads that provide access to health facilities would be affected. Additionally, there was a general consensus among the participants that the activities of key health facilities could be disrupted due to the impacted roads. Furthermore, as in the example of the Japan earthquake (2011), roads can be directly affected by disasters, and also, during a disaster, evacuees can cause extreme traffic congestion [38]. In this regard, even if key healthcare facilities are resistant to disasters concerning their structural components, a significant risk may arise regarding logistics and supply chain management. Thus, to be better prepared for disasters, both comprehensive situational assessment and risk analysis for all key health facilities and access to these facilities in case of disaster should be considered.

The item related to ecosystem services scored around two in the study, indicating broad gaps in the detection and conservation of relevant ecosystem services. Furthermore, the common view of participants was that there are shortcomings in identifying and protecting ecosystem services. Regarding these services, land use, urban planning and environmental management need to be given appropriate focus for successful disaster risk management [39,40]. However, participants in the study said that all these ecosystem services were largely ignored. In parallel, some studies showing that ecosystem services were deteriorating in both counties support the participants' views [41,42]. Ecosystem-based disaster risk reduction is accepted as the key strategy to reduce disaster-related risk, especially for coastal disasters like floods and landslides [43,44]. The counties where the study was conducted are areas of high landslide and flood risk. In view of this important issue, there is an important need for further studies on the identification and protection of ecosystem services.

The Scorecard result, a score of around 2, showed that disaster-related mental health services could only be provided to a limited proportion of the population, such as 25–50 %. Furthermore, participants explained the reasons for this situation as "insufficient capacity of mental health services", and in particular, "lack of mental healthcare providers". Similarly, in a study conducted with mental healthcare providers after the Great East Japan Earthquake, one of the most frequently mentioned problems was human resources [45]. Additionally, one of the weakest aspects of mental health services after the 2015 Nepal earthquake was determined as human resources [46]. Although after the Marmara earthquake, the importance of mental health problems related to disasters became better understood, after the Van earthquake there were still some problems, such as a lack of coordination in mental health services [47]. This situation shows that evaluating mental health service capacity and eliminating existing deficiencies are vital for improving disaster-related mental health services.

Investing in disaster risk reduction (DRR) is key to reducing the damage caused by disasters, and the Sendai Framework highlights the importance of investing in DRR as one of the four critical actions [48]. The availability of finance is also a vital component of effective post-disaster recovery, which is recognized as an opportunity to "build back better" [49,50]. In the study, the scoring results showed that there are some known funding gaps (a score of around 3). Also, participants explained that "*there are problems with setting up county-specific* funding *or using it*". Similarly, a recent article reports that state and local public health agencies, emergency re-

sponse organizations, and healthcare facilities in the United States do not have defined funding mechanisms or clear lines of authority for disaster preparedness operations [51]. The evidence from the current study implies the need for locally identified and available funding for preparedness for and effective response to the public health impact of disasters in order to increase community resilience.

The results of the Scorecard showed that a broad section of the community understood its role in relation to disasters. In addition to this, however, the discussions among participants revealed that there are shortcomings in the fulfilment of these roles. The importance of society's knowledge and fulfilment of its roles regarding disasters was particularly highlighted in the COVID-19 pandemic [52]. Moreover, the importance of community-based DRR and community-based disaster mitigation for effective disaster management has been better understood in recent years [53,54]. The literature has shown that previous disaster experience, risk perception, public awareness and education levels are important for community participation in the disaster management process [55–57]. For both pre-disaster risk reduction and effective post-disaster response, it is important to raise disaster awareness in society, taking into account all these factors. Disaster management organizations have an important role to play in this regard.

Disaster preparedness has become a national policy in Türkiye. Disaster risk reduction targets are set in the National Development Plans, which are prepared every five years. In addition, the country has disaster-related laws and regulations, such as the Building and Earthquake Regulations and the Flood Regulations [58]. The results of this study showed the weakest areas and therefore the gaps in the implementation and control of existing disaster laws. In this respect, it can serve as a guide for policy and practice. The next step may be to increase the involvement of public health stakeholders in addressing areas of weakness and to take action on the implementation of identified strategies. As part of this process, the results of this study were presented by the corresponding author (IT) to the Turkish President at the meeting for the Turkish National Risk Shield Model, which was held to make cities more prepared and resilient to disasters [59]. The results of the study attracted a great deal of attention at the meeting. In this respect, it is expected that the results of the study will also have an impact on policies and practices related to disasters.

Strengthening disaster resilience is a cross-sectoral issue involving a wide range of stakeholders. This study contributed to collaboration between stakeholders from different disciplines and helped to raise awareness of pandemic and other disaster risks. The study also provided an opportunity for stakeholders to assess the resilience of the PHS indicators in a systematic way. Although the study has these advantages, studies that include broader PHS disciplines and involve more local governments can provide a platform for further discussion of disaster risk and the development of effective strategies.

## 5. Limitations

The study was carried out in only two counties in Türkiye. For this reason, although the results give an idea about part of the country, they cannot be generalized to the whole of Türkiye. Additionally, the public health system consists of many different disciplines. In the study, the number of workshop participants and their disciplines were limited.

## 6. Recommendations

Based on the evaluation of the Scorecard items, in order to increase resilience, the outcomes of this study suggest the following recommendations.

- Strengthening cooperation between stakeholders responsible for disaster risk management and governance mechanisms and other public health system stakeholders.
- Improving mental health service capacity to cope with disaster-related psychological problems by creating study groups to evaluate the adequacy of the mental health service capacity in case of a disaster, and to eliminate the identified deficiencies.
- Training health workers in disaster response and preparedness to enhance the resilience of the public health system.
- Collaboration and task sharing among all public health system stakeholders in order to identify, control, and improve public health-related ecosystem services.
- Identification of health institutions that are likely to be affected in case of a disaster, determination of alternative institutions that will undertake the services of these institutions, and planning of the capacity increase.

## 7. Conclusion

In the workshops, the Scorecard was used to evaluate public health system resilience in the Esenler and Ortahisar counties of Türkiye. The Scorecard's multidimensional systematic structure allowed participants to share their experiences concerning the COVID-19 pandemic and management of other disasters. Since Esenler and Ortahisar have the same administrative structure and health emergency management system, the indicators in the Scorecard mostly received similar scores. However, it was detected that there were scoring differences regarding some indicators between counties. It is suggested that these differences are largely due to the disaster risk and some institutional functioning differences between the counties. The workshops further revealed that in both counties, improving mental health service capacity to cope with disaster-related psychological problems, strengthening key health facilities to continue to be operational after a disaster, and identifying and protecting ecosystem services are among the issues that need to be addressed first to provide resilience against disasters. Further studies focused on these issues and based on cooperation between all public health system stakeholders are needed.

## CRediT authorship contribution statement

**Ismail Tayfur:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Perihan Şimşek:** Writing – original draft, Methodology, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Abdülkadir Gunduz:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Data curation, Conceptualization. **Mayumi Kako:** Writing – review & editing, Writing – original draft, Validation, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Shuhei Nomura:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Formal analysis, Conceptualization. **Benjamin Ryan:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Data availability

Data will be made available on request.

## References

[1] D. Hyndman, D. Hyndman, Natural Hazards and Disasters, Cengage Learning, 2016.
[2] H. Khan, L.G. Vasilescu, A. Khan, Disaster management cycle-a theoretical approach, Journal of Management and Marketing 6 (1) (2008) 43–50.
[3] A.T. Ismail-Zadeh, S.L. Cutter, K. Takeuchi, D. Paton, Forging a paradigm shift in disaster science, Nat. Hazards 86 (2) (2017) 969–988.
[4] J. Santamarta-Cerezal, J. Neris-Tomé, L.H. Gutiérrez, A. Eff-Darwich, Disaster Risk Reduction, an Overview. Environmental Security, Geological Hazards and Management, 2013 215.
[5] I. Kelman, M. Harris, Linking disaster risk reduction and healthcare in locations with limited accessibility: challenges and opportunities of participatory research, Int. J. Environ. Res. Publ. Health 18 (1) (2021) 248.
[6] WHO (World Health Organization), WHO guidance on research methods for health emergency and disaster risk management, 2021, https://apps.who.int/iris/handle/10665/345591. (Accessed 15 September 2020).
[7] A. Aitsi-Selmi, S. Egawa, H. Sasaki, C. Wannous, V. Murray, The Sendai framework for disaster risk reduction: renewing the global commitment to people's resilience, health, and well-being, International journal of disaster risk science 6 (2) (2015) 164–176.
[8] T. Giorgadze, I. Maisuradze, A. Japaridze, Z. Utiashvili, G. Abesadze, Disasters and their consequences for public health, Georgian Med. News 194 (2011) 59–63.
[9] S.S. Pourhosseini, A. Ardalan, M.H. Mehrolhassani, Key aspects of providing healthcare services in disaster response stage, Iranian journal of public health 44 (1) (2015) 111.
[10] L. Biddle, K. Wahedi, K. Bozorgmehr, Health system resilience: a literature review of empirical research, Health Pol. Plann. 35 (8) (2020) 1084–1109.
[11] M.E. Kruk, E.J. Ling, A. Bitton, et al., Building resilient health systems: a proposal for a resilience index, Bmj (2017) 357.
[12] D.A. Behrens, M.S. Rauner, M. Sommersguter-Reichmann, Why resilience in health care systems is more than coping with disasters: implications for health care policy, Schmalenbach Journal of Business Research (2022) 1–31.
[13] M. Rohova, S. Koeva, Health system resilience: review of the concept and a framework for its understanding, Journal of IMAB - Annual Proceeding (Scientific Papers) 27 (2021) 4060–4067 https://doi.org/10.5272/jimab.2021274.4060 [published Online First: Epub Date]|.
[14] M. Günaydın, Ö. Tatlı, E.E. Genç, Search and rescue organizations and national medical Rescue Teams (NMRT), Journal of Natural Hazards and Environment 3 (1) (2017) 56–63.
[15] B. Özmen, T. Özden, A Critical Evaluation Related to Disaster Management System of Türkiye, Journal of Istanbul University Faculty of Political Sciences, 2013 49.
[16] A. Ostadtaghizadeh, A. Ardalan, D. Paton, H. Jabbari, H.R. Khankeh, Community disaster resilience: a systematic review on assessment models and tools, PLoS currents 7 (2015).
[17] SBB (Presidency of the Republic of Türkiye, Strategy and Budget Directorate), Kahramanmaras and Hatay Earthquakes Report, 2023, https://www.sbb.gov.tr/wp-content/uploads/2023/03/2023-Kahramanmaras-ve-Hatay-Depremleri-Raporu.pdf, (Accessed 5 April 2023).
[18] Bianet (Independent Communications Network), Turkey's earthquake death toll surpasses 50,000, including 6,800 foreign nationals, 2023, https://m.bianet.org/english/crisis/275971-turkey-s-earthquake-death-toll-surpasses-50-000-including-6-800-foreign-nationals, (Accessed 5 April 2023).
[19] M. Fırat, Earthquake and social effects, Journal of Tezkire 80 (2022) 47–72.
[20] EMDAT (Emergency Events Database), 2023, https://public.emdat.be/data (Accessed 1 April 2023).
[21] F. Almeida, Strategies to perform a mixed methods study, European Journal of Education Studies 1 (5) (2018) 137–150.
[22] J.M. Turner-Cobb, J. Palmer, D. Aronson, L. Russell, S. Purnell, M. Osborn, D.S. Jessop, Diurnal cortisol and coping responses in close relatives of persons with acquired brain injury: a longitudinal mixed methods study, Brain Inj. 24 (6) (2010) 893–903.
[23] UNDRR (United Nations Office for Disaster Risk Reduction), Disaster Resilience Scorecard for Cities - Public Health System Resilience Addendum, 2019, https://www.unisdr.org/campaign/resilientcities/toolkit/article/public-health-system-resilience-Scorecard.html (Accessed 10 September 2020).
[24] S. Bhatia, The Public Health System Resilience Addendum: A Tool to Help Governments Manage Biological Hazards Better and Prepare for an Uncertain Future, 2021, pp. 297–306.
[25] UNESCO (United Nations Educational, Scientific and Cultural Organization), Sustainable development 2030 goals specialized committee, 2022, https://www.unesco.org.tr/Pages/108/219/S%C3%BCrd%C3%BCr%C3%BClebilir-Kalk%C4%B1nma-2030-Hedefleri-%C4%B0htisas-Komitesi (Accessed 24 August 2022).
[26] RHNTC (Reproductive Health National Training Center), Prioritization matrix, 2022, https://rhntc.org/sites/default/files/resources/rhntc_prioritization_matrix_8-29-2022.pdf (Accessed 24 August 2022).
[27] H.S. Karaalp-Orhan, Regional disparities in Turkey: a socio-economic perspective, Eur. J. Sustain. Dev. 9 (3) (2020) 103 03.
[28] F. Bulut, B. Aktuğ, C. Yaltırak, A. Doğru, H. Özener, Magnitudes of future large earthquakes near Istanbul quantified from 1500 years of historical earthquakes, present-day microseismicity and GPS slip rates, Tectonophysics 764 (2019) 77–87.

[29] İ.S. Karapinar, Earthquake risk analysis and damage assessment of districts of Istanbul, Niğde Ömer Halisdemir Üniversitesi Mühendislik Bilimleri Dergisi 7 (2) (2018) 741–750.
[30] Ö. Yüksek, M. Kankal, O. Üçüncü, Assessment of big floods in the eastern Black Sea basin of Turkey, Environ. Monit. Assess. 185 (1) (2013) 797–814.
[31] DOKA (Eastern Black Sea Development Agency), Trabzon, 2022, https://www.doka.org.tr/bolgemiz_trabzon-TR.html (Accessed 2 April 2022).
[32] L.S. Nowell, J.M. Norris, D.E. White, N.J. Moules, Thematic analysis: striving to meet the trustworthiness criteria, Int. J. Qual. Methods 16 (1) (2017), 1609406917733847 https://doi.org/10.1177/1609406917733847 [published Online First: Epub Date]|.
[33] C. Rivas, Coding and analysing qualitative data, Researching society and culture 3 (2012) 367–392.
[34] Improving the Seismic Resilience of Housing in Developing Countries: Time to Transform Local Government Building Departments. MATEC Web of Conferences, EDP Sciences, 2018.
[35] A review of the implementation of Iranian national building code; Current challenges and future directions, in: 16th World Conference on Earthquake Engineering, 2017.
[36] A. Nwadike, S. Wilkinson, Challenges facing building code compliance in New Zealand, International Journal of Construction Management 22 (2020) 1–11 https://doi.org/10.1080/15623599.2020.1801336 [published Online First: Epub Date]|.
[37] FEMA (Federal Emergency Management Agency), Building codes save: a nationwide study of loss prevention, 2020, https://www.fema.gov/sites/default/files/2020-11/fema_building-codes-save_study.pdf (Accessed 5 April 2022).
[38] Y. Hara, M. Kuwahara, Traffic Monitoring immediately after a major natural disaster as revealed by probe data–A case in Ishinomaki after the Great East Japan Earthquake, Transport. Res. Pol. Pract. 75 (2015) 1–15.
[39] S.F.T. Mallma, Mainstreaming land use planning into disaster risk management: trends in Lima, Peru, Int. J. Disaster Risk Reduc. 62 (2021) 102404.
[40] S. Mukherjee, S. Kar, S. Pal, Environmental Disaster Management and Risk Reduction, 2021, pp. 221–252.
[41] E. Aktürk, N. Güneroğlu, Degradation of coastal ecosystem services in southern Black Sea: a case study of Trabzon city, Ocean Coast Manag. 213 (2021) 105837.
[42] M. Kucukmehmetoglu, A. Geymen, Measuring the spatial impacts of urbanization on the surface water resource basins in Istanbul via remote sensing, Environ. Monit. Assess. 142 (1) (2008) 153–169.
[43] K. Sudmeier-Rieux, T. Arce-Mojica, H.J. Boehmer, et al., Scientific evidence for ecosystem-based disaster risk reduction, Nat. Sustain. 4 (9) (2021) 803–810.
[44] U. Nehren, K. Sudmeier-Rieux, S. Sandholz, M. Estrella, M. Lomarda, T. Guillén Bolaños, The Ecosystem-Based Disaster Risk Reduction Case Study and Exercise Book, 2014.
[45] M. Seto, H. Nemoto, N. Kobayashi, et al., Post-disaster mental health and psychosocial support in the areas affected by the Great East Japan Earthquake: a qualitative study, BMC Psychiatr. 19 (1) (2019) 1–13.
[46] S. Sherchan, R. Samuel, K. Marahatta, N. Anwar, M.H. Van Ommeren, R. Ofrin, Post-disaster mental health and psychosocial support: experience from the 2015 Nepal earthquake, WHO South-East Asia journal of public health 6 (1) (2018) 22–29.
[47] F. Altun, Psychosocial services in disasters: a comparative analysis of Marmara and the Van earthquake, Istanbul Sabahattin Zaim University Journal of Social Sciences 4 (8–9) (2016) 183–197.
[48] A.D.R. Center, Sendai Framework for Disaster Risk Reduction 2015–2030, United Nations Office for Disaster Risk Reduction, Geneva, Switzerland, 2015.
[49] B. Rouhanizadeh, S. Kermanshachi, T.J. Nipa, Exploratory analysis of barriers to effective post-disaster recovery, Int. J. Disaster Risk Reduc. 50 (2020), 101735 https://doi.org/10.1016/j.ijdrr.2020.101735 [published Online First: Epub Date]|.
[50] M. Ishiwatari, D. Sasaki, Disaster risk reduction funding: investment cycle for flood protection in Japan, Int J Environ Res Public Health 19 (6) (2022), https://doi.org/10.3390/ijerph19063346.
[51] R. Katz, A. Attal-Juncqua, J.E. Fischer, Funding public health emergency preparedness in the United States, Am J Public Health 107 (S2) (2017) S148, https://doi.org/10.2105/ajph.2017.303956.
[52] M. Wanjari, D. Mendhe, P. Wankhede, S. Alwadkar, Social responsibilities in COVID-19: pandemic, Journal of Pharmaceutical Research International 33 (2021) 149–153, https://doi.org/10.9734/JPRI/2021/v33i46A32851.
[53] T.B. Corbin, Chapter 2 - community based mitigation strategies: building resilience in rural Appalachia, in: H. Grover, T. Islam, J. Slick, J. Kushma (Eds.), Case Studies in Disaster Mitigation and Prevention, Butterworth-Heinemann, 2023, pp. 19–44.
[54] D. Van Niekerk, L.D. Nemakonde, L. Kruger, K. Forbes-Genade, Community-based disaster risk management. Handbook of Disaster Research, 2018, pp. 411–429.
[55] M. Valibeigi, M. Feshari, F. Zivari, A. Motamedi, How to improve public participation in disaster risk management: a case study of Buein Zahra, a small city in Iran, Jamba 11 (1) (2019) 741 https://doi.org/10.4102/jamba.v11i1.741 [published Online First: Epub Date]|.
[56] S. Ali, A. George, Fostering disaster mitigation through community participation- case of Kochi residents following the Kerala floods of 2018 and 2019, Nat. Hazards 111 (1) (2022) 389–410 https://doi.org/10.1007/s11069-021-05058-0 [published Online First: Epub Date]|.
[57] T. Que, Y. Wu, S. Hu, J. Cai, N. Jiang, H. Xing, Factors influencing public participation in community disaster mitigation activities: a comparison of Model and nonmodel disaster mitigation communities, Int. J. Environ. Res. Publ. Health 19 (19) (2022) 12278.
[58] B. Tercan, Disaster policy and urban transformation in Turkey, Abant Cultural Research Journal 3 (5) (2018) 63–74.
[59] DoC (Presidency of the Republic of Türkiye, Directorate of Communications), Türkiye national risk Shield Model opinions and recommendations, 2023, www.iletisim.gov.tr/images/uploads/dosyalar/Turkiye_Ulusal_Risk_Kalkani_Modeli_Gorusler_ve_Oneriler_.pdf (Accessed 12 November 2023).