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Exploring the bereavement experiences and prevalence of prolonged grief disorder among 2023 Turkish earthquake survivors with advanced chronic disease: A mixed methods study

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ABSTRACT

Objective: To explore the bereavement experiences and prevalence of prolonged grief disorder (PGD) among 2023 Türkiye earthquake survivors with advanced chronic diseases.

Design/setting: A mixed design of qualitative and quantitative methods was used to provide a detailed understanding of the grief phenomenon in the context of bereaved adults with palliative care needs after the Earthquake in Türkiye.

Participants: A total of 143 participants completed the survey and interviews were conducted with 12 bereaved survivors with palliative care needs.

Results: Our results indicated a prevalence of PGD among bereaved adults of 23.8%. The traumatic death of first-degree relatives was associated with a higher PGD prevalence ($p < 0.001$). PGD developed in 50% of retired older adults (n=6). Six themes were generated: (1) bereavement reactions, (2) coping style, (3) disrupted grieving, (4) impact of grief on chronic disease, (5) moving forward, and (6) unmet needs.

Conclusions: To contribute poorer bereavement outcomes, we recommend a person-centred bereavement care that prioritises early identification and reduction of prolonged grief risk factors. The findings and proposed framework for bereaved survivors can be used in the development of an effective bereavement service model and can help mental health professionals and policy makers to respond more appropriately and sensitively to individuals' values, needs and preferences.

Key words Bereavement, Psychological trauma, Grief-related disorders, Earthquake

Strengths and limitations of this study

- This first mix methods study on bereavement among earthquake survivors with advanced chronic illness can contribute to preparing for future humanitarian crises that may lead to traumatic bereavement by providing recommendations for policy-driven bereavement care.
- Our study provides evidence that can be used to facilitate the development of an effective bereavement service model that provides high quality bereavement care, implemented from a person-centred perspective to respond more appropriately and sensitively to individuals' values, needs and preferences.
- The quantitative data demonstrates the high prevalence prolonged grief disorder among earthquake survivors, whilst explanatory qualitative data provide a comprehensive understanding of bereaved individuals' experiences.
- The fact that the data were collected from only one of the earthquake zones in 11 provinces and the small sample size limits the generalisability of the findings to other settings.

INTRODUCTION

Earthquakes are one of the most devastating natural disasters that occur suddenly causing death injuries to thousands of people within minutes. [1-3] The Türkiye earthquake on February 6, 2023 was measured at 7.7 ranked as the deadliest natural disaster of the Türkiye's history since the 1939 Erzincan earthquake. [4 5] The earthquake ruptured a 400 km segment of the East Anatolian Fault at a depth of 10 km and caused over 53,000 deaths and 107,000 injuries in 11 provinces. Apart from the destruction of the natural environment, the Türkiye earthquake caused long-lasting and widespread psycho-socio-economic issues among bereaved individuals, resulting in a high risk of prolonged grief disorder. [4]

Survivors become vulnerable to a variety of mental health problems including prolonged grief disorder after unnatural death which include sudden and violent deaths [6-9] such as disaster in Türkiye. [4] Prolonged grief disorder is a distinct syndrome that is characterised by intense and persistent symptoms by a constellation of cognitive, emotional, and behavioural responses. [6 7] The unexpected and unnatural death of a loved one causes other types of loss such as economic loss, physical injury puts individuals bereaved at greatest risk of prolonged grief disorder [10] In a systematic review and meta-analysis the estimated prevalence of prolonged grief disorder in an adult bereaved population was 9.8% following non-violent causes of death. [11] However, studies have reported that unnatural deaths are associated with a considerably higher rate of prolonged grief disorder compared to expected and natural deaths. [1 2 7 5 12] In the literature the prevalence of prolonged grief disorder among earthquake-bereaved survivors ranged from 8.5 to 79% following a natural disaster. [1 2 7 5 12] A recent systematic review and meta-analysis has highlighted that approximately half of the bereaved individuals have experienced symptoms which meet the diagnostic criteria for prolonged grief disorder.[12] Another study of a large sample of Chinese Sichuan earthquake survivors have found that the estimated 71% of bereaved adults have experienced the persistent symptoms of prolonged grief disorder. [2] Moreover, the risk for prolonged grief disorder following unnatural losses is at a low level in high-income countries compared to low-middle-income countries [12]. Prolonged grief disorder is also associated with loss of physical functioning. [13-15] Thus, there is an increase in hospital-based service utilisation for physical illness as a result of prolonged grief reactions [14 15]. Perez et al. (2017)[16] reported that

the individuals who have prolonged grief disorder had lower level of morning cortisol and diurnal cortisol. Zhou et al. (2020) [17] also confirmed that comorbid chronic physical diseases were associated with severe grief symptoms.

Given this background, there are several factors that make bereaved individuals vulnerable to develop prolonged grief disorders after the devastating earthquake in Turkey. These factors are as follows: living in a middle-income country, having a chronic disease and history of unnatural death of a loved one [1 2 12 17]. Whilst having a chronic disease and the unexpected and traumatic experience of a loved one's death are risk of factors developing prolonged grief disorder [1 2 7 12], there are no published studies focusing on the bereavement among earthquake survivors with advanced chronic illness who had faced the death of a loved one. Expanding our understanding of prolonged grief disorder is urgently needed to prepare for future humanitarian crises that may lead to traumatic bereavement and, to provide recommendations for policy-driven bereavement care. Therefore, this current study particularly aimed to explore the grief experiences of bereaved survivors with palliative care needs following the 2023 Turkey earthquake.

Aims and objectives

The aim of this mixed methods study was to explore the grief experiences of bereaved survivors with palliative care needs after the 2023 Earthquake in Turkey.

The objectives were: (i) to identify specific themes of bereavement experience among bereaved survivors, (ii) to investigate the prevalence and factors of prolonged grief disorder among earthquake survivors in a severely affected area 6 months after the earthquake, and (iii) to provide recommendations for improving bereavement care from the perspective of bereaved survivors.

METHODS

Design

A mixed design of qualitative using thematic analysis (semi-structured interviews) and quantitative (cross-sectional survey) methods were used to provide a detailed understanding of

the grief phenomenon in the context of bereaved survivors with palliative care needs after the Earthquake in Türkiye. The qualitative approach provides the exploration of grief experiences as described by bereaved survivors in the Earthquake context.[18] The quantitative approach is used to investigate the ratio and predictors of probable prolonged grief disorder. Mixed methods permitted to broadly explore and to gain a comprehensive understanding of bereaved individuals' experiences than only using one approach to data-gathering.[19]

In the absence of standardised guidelines to report mixed-methods research, the consolidated criteria for reporting qualitative research (COREQ) including their comprehensive 32-item checklist to support rigour and transparency in the design and conduct of the study component and the subsequent reporting of the qualitative research findings was used [20] The STROBE reporting guideline for cross-sectional studies was also used. [21]

Setting

Data were collected from the bereaved survivors living in Hatay, the province most affected by the 7.8 magnitude earthquake that occurred on 6 February 2023 in Türkiye. [4]

Participants

The sample included 143 individuals for this mixed methods design; (1) 143 bereaved survivors with palliative care needs after the 2023 earthquake in Turkey completed a cross-sectional survey between August 2023 and September 2023, (2) survey respondents who expressed an interest to provide further information were invited and participated in an in-depth qualitative interview regarding their experiences, and (3) of the 34 respondents who expressed an interest to be involved in follow-up research, a total of 12 bereaved individuals were interviewed between September 2023 and November 2023. (22 potential participants did not respond to the interview invitation).

Sampling and Recruitment

Purposive sampling was used when recruiting participants to capture diverse experiences. [22] Participants living in Hatay, the earthquake region with the most deaths among the 11 earthquake provinces [4], were reached through the temporary shelter community. Once initial participants were recruited, the team decided whether to recruit additional participants from

the shelter community via snowball sampling to ensure relevant diversity (in terms of age, gender and chronic disease) among participants.[22] No participants were known to the research team prior to recruitment. No incentives or payments were also provided to participants in this study.

The inclusion criteria were being exposed to the 2023 Turkey earthquake. Participants were also considered eligible to complete the survey if they were ≥18 years old, individuals who had faced the death of at least one first degree relative (parent, children or sibling) or second degree relative (aunt, uncle, grandparent, grandchild, niece or nephew) and, at least 6 months post bereavement. In addition, individuals who have cancer, congestive heart failure, chronic obstructive pulmonary disease or end-stage renal disease were included since these 4 conditions encompass a majority of patients living with either a chronic disease or a terminal illness [23] Bereaved family members who have amnesia or psychosis were also excluded.

Data collection

Quantitative

The bereaved people were contacted by the last author (MSc female student who specialise in internal medicine nursing) living in Hatay between August 2023 and September 2023, who explained the study to them in detail and gave them written informed consent before the study. A convenience sample was used for the quantitative part of the study. Survivors who met the inclusion criteria and agreed to participate in the study were included during the data collection period. The quantitative part of the study was completed with 143 participants over the age of 18 who completed the questionnaire, which is the Prolonged Grief Scale (PG-13) with 13 questions, individuals who consented for further follow-up were approached to take part in the qualitative study. Participants completed the questionnaire face-to-face with the research assistant in the participants tents.

Qualitative

The 12 semi-structured interviews were conducted by the first author (an experienced female assistant professor have experience of the palliative, end of life, bereavement care research). This criterion of sufficiency was based on previous studies focusing on the data saturation for thematic analysis, given a relatively homogenous sample . [24 25] Two pilot interviews were carried

out to test the appropriateness of the questions without requiring significant changes (see supplementary material 2).

Potential participants who meet the criteria was interviewed on Zoom. The interviews were audio recorded and lasted between 30 and 65 min. Last author visited all participants before the intervention in their tent and provided them a computer and helped individuals to connect the Zoom. Participants' permission to audio-record the interview was obtained. Semi-structured method has given the participants the opportunity to elaborate and explain specific issues. [26] The unstructured nature of the interview allowed the bereaved participants to present their narratives and thus express their experiences. Depending on the context of the narratives, the interviewer then asked such exploratory questions as "can you explain more?" Interviews began by asking participants about the relationship they had with the deceased who died in the Earthquake participants were also asked about how they managed to stay resilient in spite of such a tremendous loss what support services they received to cope with their grief (See the interview guide in supplementary material 2)

Measures

Demographic, bereavement -related, and chronic diseases-related characteristics were assessed with a self-constructed questionnaire (Supplementary material 1).

The Turkish form of Prolonged Grief Scale (PG-13) [27] developed by Prigerson et al. (2009)[6] was also used to assess symptoms of prolonged grief disorder of the bereaved individuals. The PG-13 contains 11 Likert type questions and two "yes/no" questions which is the latest structured diagnostic tool to assess prolonged grief by detecting prolonged impairment within social and occupational functioning. Likert type questions assesses 11 potential prolonged grief disorder symptoms in the previous month. Each of these items is answered on a 5-point scale ranging from 1 (never/not at all) to 5 (several times a day/severe) to represent increasing levels of symptom severity. The grief-score includes the sum of the score of each of the 11 grief symptoms and ranges from 11 to 55. The Turkish PG-13 has demonstrated predictive and criterion validity with good internal consistency (α = .90). [27]

Data analysis

Quantitative analysis

Quantitative data were analysed using descriptive statistics in SPSS V.29. Descriptive results of the study were presented as number (n), percentage (%), mean and standard deviation (SD). Chi-square test was used to compare the frequency of PGD between the categorical groups. Independent samples t-test was used to compare continuous variables between PGD and others.

Qualitative analysis

The narrative data was coded using thematic analysis which is a flexible method that allows to report on the experiences, meanings, and reality of participants in relation to the study intervention [28] NVIVO 11 software facilitated the organisation of the data. The six steps of thematic analysis method were used by two researcher (Ç.F.D., I.T.); familiarising yourself with your data; generating initial codes; searching for themes; reviewing themes; defining and naming themes and producing the report. [28] Two authors were independently reviewed the data resulting in the inclusion of one subtheme and renaming of one theme. Discussions between researchers resulted through critical dialogue about the themes that emerged.

Patient and public involvement

The study was conducted with a bereaved survivor acting as co-author (S.M). She was involved in all aspects of the study and for its entire duration, from design to tools development, data analysis, and writing. In addition, two participants provided feedback on the findings.

Ethical considerations

There was no potential harm for all participants on this research for there was no treatment. Before starting to conduct the study, ethics committee approval was be obtained for the study. Ethical approval has been obtained from the Mugla University ethics committee (Reference number: 230065). The participants were informed about the purpose of the study and their verbal written consents were obtained (only verbal consent was obtained for illiterate individuals). The researcher asked the literate participants to write their initial and the date in the tick box and to read out loud the consent form before sign. Participants were not forced to answer the questions within the survey and interviews. Respondents were only contacted to take part in interviews if they expressed an interest to be invited to provide further information. Participants were aware that they were free to withdraw at any point if they so wish without a requirement to justify their decision. Demographic data, informed consent and data from interviews were transcribed and saved on an encrypted device and stored along with the data

analysis in a locked drawer in a locked room in the university. There were no participant data on the transcription. Only the researchers have access to the data, it will be stored in a locked drawer in a locked room for 5 years. There was no identity of participants (name, address) on data sheet (anonymity). The participants' identifications were anonymised and coded in accordance.

RESULTS

143 bereaved participants completed the survey (Table 1). Most participants were women (n=86, 60.1%). About 79% of participants (n=113) were aged 50 years and over. About 55.9% (n=80) had graduated from primary school, 81.8% were married (n=117), 57.3% (n=82) reported that they were not working, and most participants had a low-income level. As a result of the destruction of many workplaces due to the earthquake, 61 of the participants (42.7%) reported that they had no income. Most participants had congestive heart failure (*n* =115, 62.5%), followed by cancer (*n* = 33, 17.9%).

Our results indicated a prevalence of PGD among bereaved adults of 23.8%. Furthermore, most of the participants (n=119, 83.2%) had a second-degree relative who had died, but the rate of prolonged grief disorder was significantly higher in participants who had experienced the death of a first-degree relative (p<0.001). In addition, PGD developed in 50% (n=6) of retired older adults (Table 1).

Table 1. Characteristics of the bereaved survivors

	PGD
Total (n=143)	**34 (23.8)**
Gender	
Female (n=86)	19 (55.9)
Male (n=57)	15 (44.1)
Test statistics	X2=0.337
p	0.689
Age	
Under 50 years old (n=30)	5 (14.7)
50 years and over (n=113)	29 (85.3)
Test statistics	X2=1.059
p	0.346
Education Level	
Illiterate (n=41)	9 (26.5)
Primary school (n=80)	21 (61.8)
Secondary school (n=7)	2 (5.9)
High school (n=9)	2 (5.9)
University (n=6)	0 (0)
Test statistics	X2=2.308
p	0.722

Occupation		
Not working (n=82)		19 (55.9)
Working (n=49)		9 (26.5)
Retired (n=12)		6 (17.6)
Test statistics		X2=5.361
p		0.074
Family Status		
Single (n=26)		8 (23.5)
Married (n=117)		26 (76.5)
Test statistics		X2=0.857
p		0.445
Closeness with the deceased		
First degree relative (n=24)		17 (50.0)
Second degree relative (n=119)		17 (50.0)
Test statistics		X2=35.239
p		**<0.001**
Income Level (mean: 4874.8 Turkish Liras)		4773.50
		t=0.814
		p=0.919
Chronic disease (A multiple choice option is available)	n	%
Congestive heart failure	115	62.5
Cancer	33	17.9
Chronic obstructive pulmonary disease	29	15.8
End-stage renal disease	7	3.8

The most prevalently identified PGD-13 items among the participants were as follows: "Longing/yearning for the person lost", "Intense emotional pain, sorrow, or pangs of grief", "Shocked, stunned or dazed by the loss", "Functional impairment (in social, occupational, or other areas)", and "Duration of symptoms of at least 6 months." The least common PGD-13 items were as follows: "Feeling emotionally numb since loss", "Avoiding reminders that the person lost is gone", "Feeling confused about role in life, feeling that a part of oneself has died" and "Trouble accepting the loss." (Figure 2).

Qualitative findings

Six main themes were generated from the analyses: (I) bereavement reactions; (II) coping style; (III) disrupted grieving; (IV) impact of grief on chronic disease; (V) moving forward; and (VI) unmet needs. Each main theme contains several subthemes reflecting the content of the experiences of grief among bereaved survivors (Table 2)

Bereavement Reactions

Bereaved participants' bereavement reactions toward the death of their loved ones were categorised as emotional, cognitive, behavioural and physical (Table 2).

The most typical responses participants experienced nine months after the death of loved one have been emotional ones such as emotional pain, guild, emotional numbness, loneliness and despair. Among them, emotional pain and numbness are most mentioned, which are also symptoms of the prolonged grief disorder. According to bereaved participants, the traumatic death of a loved one is overwhelming, and the pain cannot be expressed in words. One of the bereaved fathers shared his intense emotional pain, saying:

" Unfortunately, all of us (his wife and two children) were trapped under the rubble at the same time. My wife was trapped under the rubble, so I tried to cut her arm by counting one, two, three (crying). After about 20 hours, we were pulled out from under the rubble with the help of our neighbours, but we could not reach my daughter. Volunteers and municipal workers tried very hard to pull my daughter out of the rubble, but hours later they reached her dead body and said that the only way to get her out was to cut her into three pieces. There are no words to express my pain at that moment (crying). I begged them to take her out in one piece, then the workers hugged me and cried, promised to take her out in one piece and finally gave her to me in one piece. Wishing to die, I hugged the dead body of my beautiful daughter and stayed with her for hours..." (P8, bereaved father with heart failure) ..." (P8, bereaved father who has heart failure).

Some participants mentioned feeling of intense emotional pain caused emotional numbness. A bereaved mother whose son died in the earthquake stated:

"I'm breathing but there's no feeling. I do not know how I can explain this. My emotions disappeared. I think this unbearable pain eventually numbed me. " (P1, bereaved mother who has heart failure).

Coping style

Some bereaved participants attributed meanings to the traumatic death of their loved ones, which helped them in the grieving process. There is no one way for anyone to cope with the death of a loved one, and everyone finds peace at their own pace. Bereaved survivors are often told that time will heal all wounds. A bereaved woman who has been trying to cope with her grief shared her experience, saying:

"I think we also need to learn to suffer. Life is not always a bed of rosy. Sometimes there are rough roads, the important thing is to overcome the rough roads. Time heals… Time is cure of everything. Time heals…" (P4, bereaved woman who has health failure).

Making sense of death also helped to bereaved participants through spiritual and religious sense-making by explaining the death of their loved ones as part of a larger divine plan. Another bereaved woman whose sister died in the earthquake stated:

"I try to forget everything. After all, this disaster came from God. His plans are bigger than anything I can imagine. That's why I thank God every day." (P5, bereaved woman heart failure)

Disrupted grieving

Disruption to mourning rituals appeared affecting the grieving process of bereaved survivors, making the death seem 'surreal' and harder to accept. A bereaved woman whose sister and cousins died in the earthquake stated:

" You know how they say wounds heal day by day, on the contrary, they deepen. We still think our loved ones will come back... I still can't believe that what we went through was real. It was like a horror film. People were carrying their dead on their backs in black rubbish bags. No one could wash their deceased; our water was cut off and we slept with our deceased until the authorities gave us a mass grave. In the mass grave they opened big graves, and all the dead were buried on top of each other (crying). It was crowded there; everyone was in pain, and they didn't even know where they were going. I don't know, it's a pity..." (P11, bereaved woman who has heart failure).

Bereaved individuals expressed their specific concerns about unfinished business in the context of important things left unsaid or unresolved. Some felt regret and guilt for not being able to say goodbye and save their loved ones. A bereaved father whose daughter died in the earthquake stated:

" It's hard (sighs and wipes his tears). You know, when you think about it… I'm so sorry I couldn't hug her and tell her how much I love her. I'm so sorry I couldn't save her (crying). " (P3, bereaved father who has heart failure)

The loss of memories also disturbed the grieving process of bereaved survivors. They didn't just lose their homes and their neighbourhoods. This disaster took their memories with it. A bereaved man expressed his experience as follows:

" Yesterday I could not find the location of the house where I lived for 35 years. So even though people are trying to heal their wounds, it will take years to recover... The earthquake not only took away our houses, roads and neighbourhoods, but also our memories. This place is no longer like the city where I was born and raised. " (P6, bereaved father who has chronic obstructive pulmonary disease).

The impact of grief on chronic disease

Most bereaved survivors with advanced chronic diseases who experienced the traumatic death of a loved one complained that the severity of their disease symptoms increased after the earthquake.

A bereaved man stated:

"The more I get upset, the worse my illness gets. After the earthquake, I have greater fatigue, increased shortness of breath" (P10, bereaved man who has heart failure).

Similarly, another bereaved man said:

"After the earthquake, my illnesses increased, I swear, they did not decrease at all, they increased. I feel much more tired and weak after the earthquake. I had blood pressure, now it is always high. My blood sugar goes up and down. I don't know what to do. Our hospital was destroyed in the earthquake. There is no doctor or hospital to go to" (P3, bereaved father who has heart failure).

Moving forward

Each individual processes the death of a loved one in their own way. When they felt lost, they were able to take steps to live a happier and more fulfilling life. Bereaved survivors highlighted four factors that contributed to their resilience: being strong for others, new activities such as gardening or knitting, support from others and positive future thinking (Table 3).

A bereaved man who was trying to be strong for others shared his experience, saying: " I have two more children and a wife for whom I am responsible. I also have close friends and relatives.

I must be stronger for them. After all, life still goes on. " (P8, bereaved father who has heart failure).

Another bereaved man who had new activities after the earthquake, shared his experience as follows: "After the earthquake, we planted rocket, garlic and lettuce with the neighbours. Gardening makes us happy. If I didn't have new hobbies, I would keep thinking about the same things in my head. This is how I try to forget " (P10, bereaved man who has heart failure).

Some women, especially those living in Hatay which is the earthquake region, stated that they have not lost hope for the future: " Women from Hatay are strong and hardworking. We will make Hatay what it used to be. Whatever happens, we have not given up hope for the future " (P2, bereaved woman who has heart failure).

Unmet needs

Bereaved survivors mentioned four crucial unmet needs that could directly affect their health outcomes: basic needs such as safe drinking water and shelter, bereavement support, medical needs, and support needs with financial. For instance, a woman was feeling hopeless because she still couldn't meet her basic needs, even though nine months had passed since the earthquake: "We are still staying in the tent. Water remains a significant issue here: it is constantly cut off, and we are unable to access clean drinking water. There is no means of transport from one place to another. It has been nine months since the earthquake, but our transport and water problem are still not solved. " (P7, bereaved woman who has heart failure).

"Some bereaved survivors highlighted how the lack of bereavement support affected them: "I still don't want to believe that my daughter is dead. I have lost my appetite, and I don't enjoy what I eat anymore. I also can't sleep at night. Our psychology is very bad, but there are not enough doctors here and there is nowhere we can get support… There are still bodies under the rubble that have not been found. So, there is a dead smell everywhere. Recently, we heard that someone whose entire family died in the earthquake attempted suicide out of grief. We are all alone here with our grief. " (P8, bereaved father who has heart failure).

Table 2. Overview of qualitative themes.

Major themes	Sub-themes	Illustrative quotes
Grief reactions	-Emotional reactions including intense emotional pain, guild,	"...municipal workers tried very hard to pull my daughter out of the rubble, but hours later they reached her dead body and said that the only way to get her out was to cut her into three pieces. There are no

	emotional numbness, loneliness and despair.	words to express my pain…(crying). I begged them to take her out in one piece, then the workers hugged me and cried, promised to take her out in one piece and finally gave her to me in one piece. Wishing to die, I hugged the dead body of my beautiful daughter and stayed with her for hours..." (P8, bereaved man).
	-Cognitive reactions including emptiness, disbelieve about death and dreams regarding the deceased.	"All I feel is a great emptiness. I'm not even sure if I'm dreaming or if I'm dead. The other day I looked at my phone book and realised that most of my loved ones were dead. Not one, not two. Most of our loved ones are no longer alive. " (P11, bereaved woman).
	-Behavioural reactions including alcohol use and avoidance of reminders that the person is dead.	"I've been drinking more alcohol since the earthquake. Otherwise, it is very difficult to bear this pain. Sometimes I drink until three in the morning." (P6, bereaved man).
	-Physical reactions including loss of appetite and insomnia.	" After the earthquake, there was not a single day that I could sleep comfortably. I wake up three or four times a night. When I feel like I can't breathe, I wake up, sit down and smoke a cigarette…" (P1, bereaved woman).
Coping with grief	-Making sense of the death	"After all, this disaster came from God. His plans are bigger than anything I can imagine. That's why I thank God every day. " (P5, bereaved woman).
	-Reconstruction of meaning	"Life is not always a bed of roses. Sometimes there are rough roads, the important thing is to overcome the rough roads. Time heals... Time is the cure for everything. Time heals..." (P4, bereaved woman).
Disrupted grieving	-Disruption to mourning rituals	" …No one could wash their deceased; our water was cut off and we slept with our deceased until the authorities gave us a mass grave. In the mass grave they opened big graves, and all the dead were buried on top of each other… " (P11, bereaved woman).
	-Unfinished business	"…I'm so sorry I couldn't hug her and tell her how much I love her. I'm so sorry I couldn't save her (crying). " (P3, bereaved man).
	-The loss of memories	" ...The earthquake not only took away our houses, roads and neighbourhoods, but also our memories. This place is no longer like the city where I was born and raised. " (P6, bereaved man).
Impact of grief on chronic disease	-Increased metabolism problems -Increased cardiovascular problems	"After the earthquake, my illnesses increased, I swear, they did not decrease at all, they increased. I feel much more tired and weak after the earthquake. I had blood pressure, now it is always high. My blood sugar goes up and down. "(P3, bereaved man).
Moving forward	-Being strong for others	" I have two more children and a wife for whom I am responsible. I also have close friends and relatives. I must be stronger for them. After all, life still goes on. " (P8, bereaved man).
	-New activities such as gardening or knitting	"After the earthquake, we planted rocket, garlic and lettuce with the neighbours. Gardening makes us happy. If I didn't have new hobbies, I would keep thinking about the same things in my head. This is how I try to forget " (P10, bereaved man).
	-Support from others	"Here we cook together with the neighbours in the tents. We set a big table together and eat together. We are trying to get through these days by supporting each other. " (P7, bereaved woman).
	-Positive future thinking	" Women from Hatay (earthquake region) are strong and hardworking. We will make Hatay what it used to be. Whatever happens, we have not given up hope for the future. " (P2, bereaved woman).

Unmet needs	-Basic needs	"…Water remains a significant issue here: it is constantly cut off, and we are unable to access clean drinking water. There is no means of transport from one place to another. It has been nine months since the earthquake, but our transport and water problem are still not solved. " (P7, bereaved woman).
	-Bereavement support needs	"Our psychology is very bad, but there are not enough doctors here and there is nowhere we can get support… There are still bodies under the rubble that have not been found. So, there is a dead smell everywhere. Recently, we heard that someone whose entire family died in the earthquake attempted suicide out of grief. We are all alone here with our grief. " (P8, bereaved man).
	-Medical needs	"Hospitals and pharmacies were destroyed in the earthquake. Many people here could not access their medicine. We still don't have a hospital. Tents were set up for the medicines sent by volunteers, and volunteer pharmacists tried to help us as much as possible." (P8, bereaved man).
	-Support needs with financial	"Many businesses were destroyed in the earthquake. People became unemployed. The shopping centre where my children work was also destroyed. I am very worried about my children. Although ten months have passed since the earthquake, they could not find a job. " (P11, bereaved woman).

DISCUSSION

With our best knowledge, this is the first study to explore the grief experiences of bereaved earthquake survivors who have advanced chronic illness. The objectives were: (i) to identify specific themes of bereavement experience among bereaved survivors, (ii) to investigate the prevalence and factors of prolonged grief disorder among earthquake survivors in a severely affected area 6 months after the earthquake, and (iii) to provide recommendations for improving bereavement care from the perspective of bereaved survivors.

According to the results of this study, 23.8% of bereaved adults with advanced chronic disease had prolonged grief disorder. In a systematic review and meta-analysis the estimated prevalence of prolonged grief disorder in an adult bereaved population was 9.8% following non-violent causes of death. [11] Most studies have also reported that unnatural deaths are associated with a considerably higher rate of prolonged grief disorder compared to expected and natural deaths. [1 2 7 5 12] In the literature the prevalence of prolonged grief disorder among earthquake-bereaved survivors ranged from 8.5 to 79% following a natural disaster. [1 2 7 5 12] In a recent study conducted in Türkiye, the prevalence of PGD among bereaved adults eight years after the Van earthquake was found to be 8.9%. [5] Similarly, in Wenchuan earthquake, 8.47% of earthquake survivors were diagnosed with PGD seven years after the event. [1] However, a higher prevalence

of PGD was observed in the present study. This result may be attributed to the fact that the time elapsed after death in previous studies[1 5] (7-8 years) was much longer than that observed in our study (6-9 months) and that the previous studies population did not include people with advanced chronic diseases. Moreover, grief occurs differently across cultures, as evidenced by the prevalence of PGD and related factors. [29] For a deeper understanding of the grief phenomenon, there is a need for further studies using tools that address the psycho-social-cultural dimensions of individuals for bereaved people from different backgrounds.

The qualitative findings of this study have demonstrated that most bereaved survivors with advanced chronic diseases who have experienced the traumatic death of a loved one complained that the severity of their disease symptoms increased after the earthquake. It is known in the literature that grief may affect physical diseases. [16 17] Perez et al. (2017)[16] reported that the individuals who have prolonged grief disorder had lower level of morning cortisol and diurnal cortisol. Zhou et al. (2020) [17] also confirmed that comorbid chronic physical diseases were associated with PGD. The findings of this mixed-methods study have also highlighted, consistent with previous studies [1 12 30 31] , that closeness to the deceased has a significant impact on PGD after deaths associated with a natural disaster. Bereaved people who had experienced the death of a first-degree relative were at higher risk for PGD than those who had faced the death of someone else. [1 12 30 31] In some studies, in addition to closeness to the deceased, the risk factors of PGD have included educational status, age, and lower socioeconomic status.[1 32-35] In our study, in line with other studies [32 35], it was found that the risk of PGD development increased with aging. However, in contrast to previous studies, educational status was not a factor associated with PGD. The fact that only six of those included in this study had a bachelor's degree or higher may have affected the findings. In addition, since most bereaved individuals in our study had low economic status, it was not possible to make comparisons with people who have different economic income. In literature, women have generally been supposed to be more vulnerable to PGD than men.[32 36 37] Nevertheless, in this study, no significant effect of gender was found when other variables related to the earthquake or death were taken into account, which is similar to some previous studies [1 2 30 38] Inconsistent findings in studies may be due to the statistical methods (bi-variate regression vs. multivariate regression) used or diversity samples. [2] In addition, the fact that most of the women living in Hatay have husbands working abroad may contribute to their resilience by enabling them to take responsibility on their own.[39] In the qualitative findings of this study, some women emphasised how resilient they were. For

example, one woman said: " Women from Hatay are strong and hardworking. We will make Hatay what it used to be. Whatever happens, we have not given up hope for the future."

Some bereaved participants attributed meanings to the traumatic death of their loved ones, which helped them in the grieving process. There is no one way for anyone to cope with the death of a loved one, and everyone finds peace at their own pace. Bereaved survivors are often told that time will heal all wounds. Neimeyer (2010)[40] considers grief as a process of meaning reconstruction. A death of a loved one challenges indivudual's established set of meanings and these need to be reconstructed following bereavement. [41] Most bereaved participants included in this study have also highlighted that disruption to mourning rituals appeared affecting the grieving process of bereaved survivors. For example, washing the body of the deceased is an important ritual in Islam[42], but the bereaved individuals in this study mentioned that they could not even wash the deceased due to the lack of water after the earthquake. Funerals are a crucial component of cultural and religious bereavement systems, facilitating social and psychological support for the bereaved people and providing an opportunity to convey love and respect for the deceased.[42] In a a mixed-methods study of people bereaved during the COVID-19 pandemic, a bereaved daughter who has unfinished business described this process as 'a constant prolonging of a goodbye.' [43]

Whilst having a chronic disease and the unexpected and traumatic experience of a loved one's death are risk of factors developing prolonged grief disorder, [1 2 7 12] there are no published studies focusing on the bereavement among earthquake survivors with palliative care needs. This mixed methods study is important as it highlights the urgent need for early screening for the risk of PGD in earthquake survivors and the immediate initiation of bereavement interventions for individuals diagnosed with PGD. Moreover, there is no bereavement care national standards/frameworks/policy in Turkey; therefore, our study is also important in terms of providing evidence that will enable recommendations to be made to the Ministry of Health to improve policies and practices in this area.

Strengths and weaknesses

This study has several limitations. Firstly, the results and framework derived from findings might not be generalised to other settings or populations due to the small sample size; future studies may include a larger sample size which include the other 10 affected provinces. Secondly, in this

study, there is a lack of information on previous and post-trauma variables such as mental health conditions, previous losses, trauma exposure, cultural characteristics and social support following the disaster that may be associated with PGD. Thirdly, a limitation of the cross-sectional design is that there may be transient state factors that bias measurement and serve as sources of common method variance that influence observed correlations. [44] (For example, the mood of the individual completing the questionnaire may influence responses to items across scales, which may inflate correlations). However, our findings were strengthened by accessing explore the grief experiences of bereaved earthquake survivors by using the mixed methods, which enabled us to gain a deeper understanding of their views and experiences of bereavement.[19]

Conclusion and implications for policy and practice

Our results have highlighted that the prevalence of PGD among bereaved adults is highly prevalent and urgent attention is needed to support this vulnerable group. This first mix methods study on bereavement among earthquake survivors with advanced chronic illness can contribute to preparing for future humanitarian crises that may lead to traumatic bereavement by providing recommendations for policy-driven bereavement care. Based on study findings we make four recommendations for enhancing the support available to bereaved individuals with palliative care needs:

- Our findings strongly suggest that health care professionals, researchers, policy makers, and clinicians working with individuals who have experienced the traumatic death of a loved one should be aware of bereavement and PGD symptoms.
- The prioritisation of bereavement support for vulnerable groups at organisational level with national standards, frameworks, and policy.
- The use of tools for the early identification and reduction of risk factors for PGD, addressing the psycho-social-cultural dimensions of individuals. After screening for PGD risk as soon as possible in the earthquake region, person-centred bereavement interventions are needed for people diagnosed with PGD.
- Developing a personalised bereavement support system including financial/benefits advice, practical support as well as emotional support. There is a need for an effective bereavement service model shaped by bereaved survivors' personal experiences, and social and cultural

contexts that respond appropriately and sensitively to bereaved individuals' values, needs and preferences.

Our evidence-based recommendations and proposed framework (Figure 2) can also be used to better address bereaved individuals' support needs related to death, grief, and bereavement and reduce the risk of prolonged grief following deaths related to natural disasters. Future research may focus on identifying psycho-socio-cultural assessment and intervention strategies aimed at early identification and reduction of risk factors for poor bereavement outcomes in this vulnerable population.

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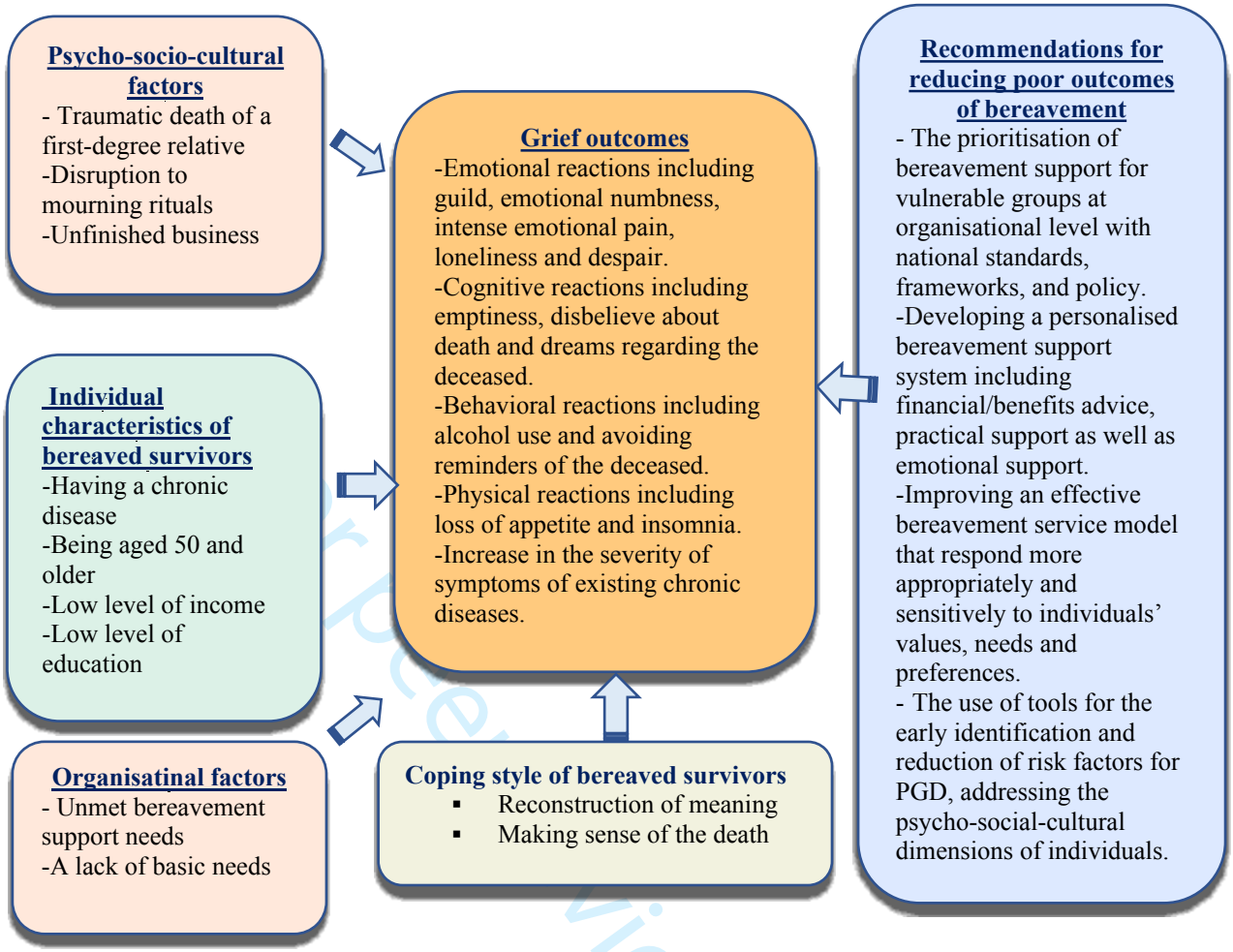

Fig 1. A proposed framework for bereaved survivors in the earthquake context

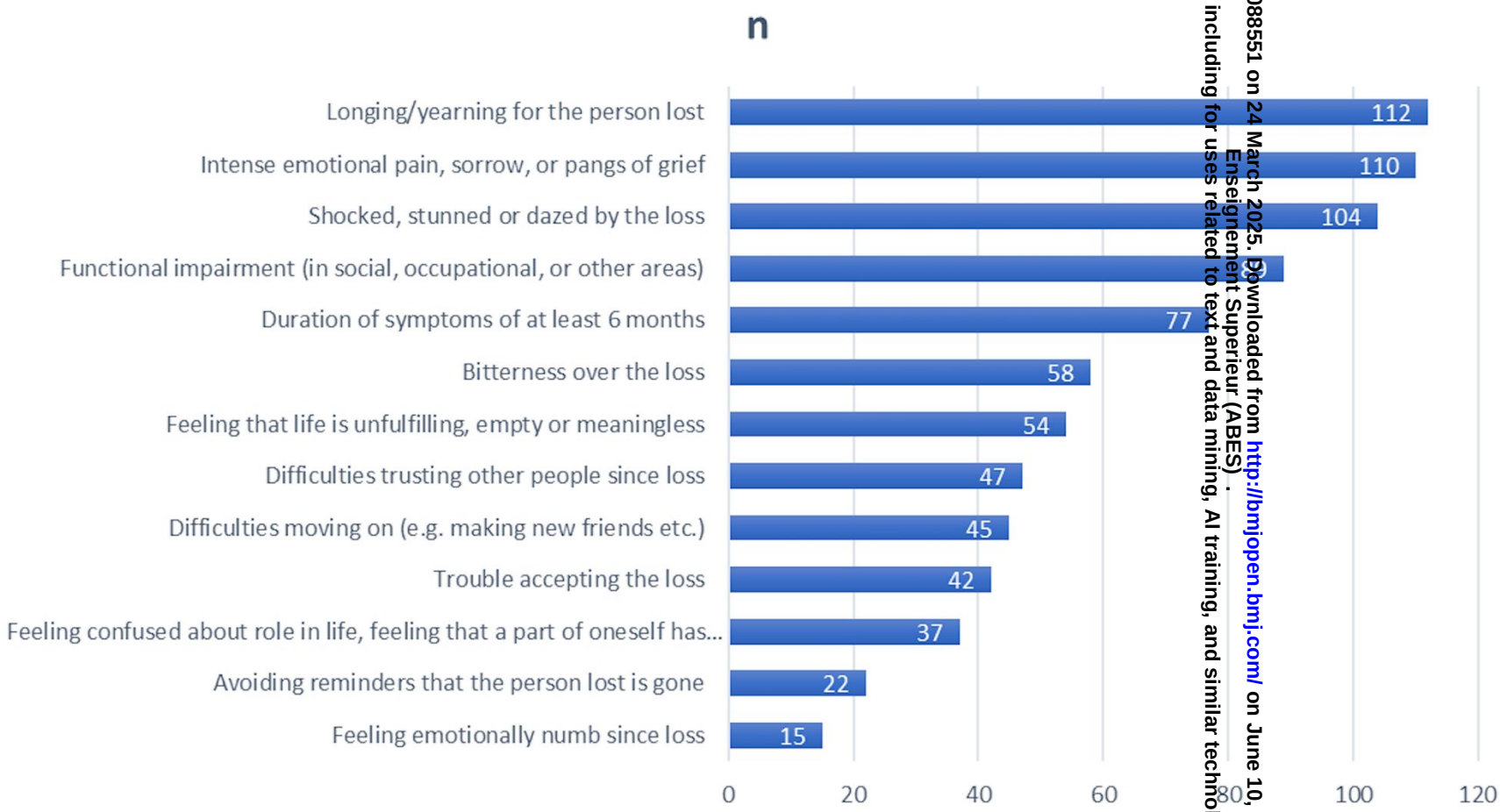

Fig. 2. The prevalence of PGD-13 items in participants

Supplementary material 1

Characteristics of the bereaved survivors

1) Gender:

2) Age:

3) Education Level:

- Illiterate
- Primary school
- Secondary school
- High school
- University
- Test statistics

4) Occupation: …….

5) Income Level:

6) Family Status:

- Single
- Married

7. Closeness with the deceased:……

8. Chronic disease (A multiple choice option is available):

- Congestive heart failure
- Cancer
- Chronic obstructive pulmonary disease
- End-stage renal disease

Supplementary material 2

1. Introduction

• Thank you for agreeing to take part.

• Give background & purpose to study: we want to identify ……This will help identify areas to improve ……. in the future.

• Acknowledge the loss of family members.

• Acknowledge that the topic is upsetting / sensitive. If they want to have a break at any time (and stop the recording) that is absolutely fine.

• Check what support is in place for after the interview/later that day (i.e. who), signpost to counselling services (give contact numbers).

• Explain the consent procedure, right to withdraw, confidentiality and audio recording of the discussion. Break at any time if required. Interview discussion to last 30–60 min. Check that they have understood the information sheet, confidentiality information and check understanding.

• Explain how the discussion that is going to take place will be used in the research.

• Findings will be published in academic journals

• Complete consent forms

I would really like to start by hearing about you and your and experience after the Earthquake. Is that okay?

1) Please describe your relationship with your loved who died in the Earthquake, starting as far back as you can remember; (2) How have your interactions with your surviving family members changed as a result of your grief and loss?; (3) What was it like to experience the death of your ……(Child/mom/dad/sibling)?; (4) How have you dealt with your grief related to the death of your loved one?; and (5) How have you managed to stay resilient in spite of such a tremendous loss?

What else could have been done to help you through your difficult time? (• Probe: institutional support: for views on counselling and support services offered, • Probe: professional support (staff) i.e. rapport, respect, empathy, listening, • Probe: social support (partner, family, friends) i.e. respect, empathy, listening, acknowledgement If there was one recommendation you could make what would it be? • Probe: views on how services could be improved to support bereaved survivors)

3- Closing (Any other comments, suggestions or questions)

I would like to ask you for your final thoughts reflections as we come to the end of our discussion. You have been through a difficult experience, and I am grateful that you have shared it. Your views are very valuable to us, and we hope that you have not found it too distressing to share your experience. Your views will help develop bereavement support; we will be able to highlight areas for change to make improvements for bereaved individuals.

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Exploring the bereavement experiences and prevalence of prolonged grief disorder among 2023 Turkish earthquake survivors with advanced chronic disease: A mixed methods study

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ABSTRACT

Objective: Whilst traumatic experience of a loved one's death and having a chronic disease are both risk factors for prolonged grief disorder, there are no published studies on bereavement amongst earthquake survivors with advanced chronic disease. The objective of this study to explore the bereavement experiences and prevalence of prolonged grief disorder (PGD) among 2023 Türkiye earthquake survivors with advanced chronic diseases.

Design/setting: A mixed methods design of cross-sectional survey utilising the Prolonged Grief Scale (PG-13) and semi-structured interviews as used to provide a detailed understanding of the grief phenomenon in the context of bereaved adults with advanced chronic disease after the Earthquake in Türkiye.

Participants: 143 participants completed the survey, and interviews were conducted with 12 bereaved survivors with advanced chronic disease.

Results: Our results indicated a prevalence of PGD among bereaved adults of 23.8%. The traumatic death of first-degree relatives was associated with a higher PGD prevalence ($p < 0.001$). PGD developed in 50% of retirees (n=6). Six themes were identified: (1) bereavement reactions, (2) coping style, (3) disrupted grieving, (4) impact of grief on chronic disease, (5) moving forward, and (6) unmet needs.

Conclusions: We recommend a person-centred bereavement care that prioritises early identification and reduction of prolonged grief risk factors. We propose a framework for bereaved survivors to use in the development of an effective bereavement service model. This model may be utilised by mental health professionals and policy makers to respond sensitively to the values, needs and preferences of bereaved survivors who have experienced the unnatural death of a loved one.

Key words Bereavement, Psychological trauma, Grief-related disorders, Earthquake

Strengths and limitations of this study

- Unique study combining both qualitative thematic analysis and quantitative analysis provides a comprehensive understanding of bereavement experiences.
- The quantitative survey, utilising the Prolonged Grief Scale (PG-13), facilitates the identification of prolonged grief disorder prevalence and its associated risk factors among bereaved survivors.
- The qualitative component, which is based on semi-structured interviews, offers in-depth insights into the lived experiences of bereaved individuals with advanced chronic illness following the earthquake.

- Data were collected from one of the earthquake zones in 11 provinces and the small sample size limits the generalisability of the findings to other settings.

INTRODUCTION

Prolonged grief disorder (PGD) is a distinct syndrome that is characterised by intense and persistent symptoms by a constellation of cognitive, emotional, and behavioural responses. [1 2] The unexpected and unnatural death of a loved one due to natural disasters, traffic accidents or suicides puts bereaved individuals to be at great risk for PGD.[3] Studies focusing on risk factors for prolonged grief disorder found that death of a partner or child, being female [10], living in a rural area, low monthly income and chronic diseases are associated with more severe PGD symptoms. [4] In addition, the risk for PGD following the unnatural death of a loved one is at a low level in high-income countries compared to low-middle-income countries. [5]

Earthquakes are one of the most devastating natural disasters that occur suddenly causing death injuries to thousands of people within minutes. [6-8] The Türkiye earthquake on February 6, 2023 was measured at 7.7 ranked as the deadliest natural disaster of the Türkiye's history since the 1939 Erzincan earthquake. [9 10] The earthquake ruptured a 400 km segment of the East Anatolian Fault at a depth of 10 km and caused over 53,000 deaths and 107,000 injuries in 11 provinces. Apart from the destruction of the natural environment, the Türkiye earthquake caused long-lasting and widespread psycho-socio-economic issues among bereaved individuals, resulting in a high risk of prolonged grief disorder. [9]

Survivors become vulnerable to a variety of mental health problems including prolonged grief disorder after unnatural death which include sudden and violent deaths [1 2 11 12] such as disaster in Türkiye. [9] In a systematic review and meta-analysis the estimated prevalence of prolonged grief disorder in an adult bereaved population was 9.8% following natural causes of death. [13] However, studies have reported that unnatural deaths are associated with a considerably higher rate of prolonged grief disorder compared to expected and natural deaths. [2 6 7 5 10] In the literature the prevalence of prolonged grief disorder among earthquake-bereaved survivors ranged from 8.5 to 79% following a natural disaster. [2 6 7 5 10] A recent systematic review and meta-analysis has highlighted that approximately half of the bereaved individuals following unnatural deaths, such as accidents and disasters have experienced symptoms which meet the diagnostic

criteria for prolonged grief disorder.[5] Similarly , another systematic review and meta-analysis published in 2024 reported the prevalence of prolonged grief disorder after natural disasters to be 38.81 % [14]. Studies show that time is also an influential variable on prolonged grief disorder and posttraumatic stress disorder[15 16] for example, after the death of a loved one, the bereaved individual recovers over time and the side effects of the prolonged grief disorder gradually decrease. PGD symptoms recover within 6 to 25 months after the death in people who experienced the death of a loved one from natural causes.[15 17 18] Nevertheless, prolonged grief disorder caused by unexpected disasters such as earthquakes has a longer recovery period.[6] Several studies[6 10] have followed bereaved people up to 7 and 8 years after an earthquake and reported that a small percentage (between 8.5%[6] and 8.9%[10]) still met the criteria for PGD.

The death of a loved one can be one of the most stressful life events [20]; stress caused by prolonged grief disorder has a negative impact on the prognosis of chronic diseases. [19-22] As a result of stress conditions, the hypothalamic-pituitary-adrenocortical axis is stimulated and activates the secretion of cortisol into the bloodstream. As an adaptation to the stressor, cortisol secretion first increases and then decreases to normal levels; however, this dysregulation of cortisol negatively affects physical health conditions. [22] Furthermore, this dysregulated cortisol patterns has been shown to lead to an increased risk of death in bereaved people [23 24]. Zhou et al. (2020) [4] confirmed that comorbid chronic physical diseases were associated with severe PGD symptoms. Similarly, Xiu et al. (2016)[25] reported that chronic physical diseases was significantly related to the risk of grief severity. However, these cross-sectional studies [4 25] did not reveal a specific rationale for the causal relationship between grief reactions and chronic physical diseases. Prolonged grief disorder may be associated with an increased risk of medical conditions such as cardiovascular disease, cancer and immunological dysfunction [19]. Thus, an increase in hospital-based service utilisation for chronic diseases as a result of prolonged grief reactions is . [21 22] In conclusion, chronic diseases do affect grief symptoms.[4] [25]although there is limited knowledge on the causal relationship between PGD and chronic diseases, Evidence suggests that prolonged grief disorder affects the prognosis of chronic diseases. [19-22] Thus, there is a dual effect: the presence of a chronic disease has been shown to be both a risk factor for PGD and adversely affects the prognosis of chronic disease. This renders individuals with chronic disease vulnerable to the development of PGD, with a particularly deleterious effect when compared to the general population.

Given this background, there are several factors that make bereaved individuals vulnerable to develop prolonged grief disorders after the devastating earthquake in Turkey: living in a middle-income country, having a chronic disease and history of unnatural death of a loved one [4-7]. Whilst having a chronic disease and the unexpected and traumatic experience of a loved one's death are risk of factors developing prolonged grief disorder [2 5-7], there are no published studies focusing on the bereavement among earthquake survivors with advanced chronic illness who had faced the death of a loved one. Expanding our understanding of prolonged grief disorder is urgently needed to prepare for future humanitarian crises that may lead to traumatic bereavement and, to provide recommendations for policy-driven bereavement care. Hence, this current study aimed to explore the grief experiences of bereaved survivors with advanced chronic disease following the 2023 Turkey earthquake.

Aims and objectives

The aim of this mixed methods study was to explore the grief experiences of bereaved survivors with advanced chronic disease after the 2023 Earthquake in Turkey.

The objectives were: (i) to identify specific themes of bereavement experience among bereaved survivors, (ii) to investigate the prevalence and factors of prolonged grief disorder among earthquake survivors in a severely affected area 6 months after the earthquake, and (iii) to provide recommendations for improving bereavement care from the perspective of bereaved survivors.

METHODS

Design

A mixed methods design of qualitative using thematic analysis (semi-structured interviews) and quantitative (cross-sectional survey) methods were used to provide a detailed understanding of the grief phenomenon in the context of bereaved survivors with advanced chronic disease after the earthquake in Türkiye. The qualitative approach provided the exploration of grief experiences as described by bereaved survivors in the Earthquake context.[26] The quantitative approach was utilised to investigate the ratio and predictors of probable prolonged grief disorder. Mixed methods permitted to broadly explore and to gain a comprehensive

understanding of bereaved individuals' experiences than only using one approach to data-gathering.[27]

In the absence of standard guidelines to report mixed-methods research, the consolidated criteria for reporting qualitative research (COREQ) including their comprehensive 32-item checklist to support rigour and transparency in the design and conduct of the study component and the subsequent reporting of the qualitative research findings was used [28] The STROBE reporting guideline for cross-sectional studies was also used. [29]

Setting

Data were collected from the bereaved survivors living in Hatay, the province most affected by the 7.8 magnitude earthquake that occurred on 6 February 2023 in Türkiye. [9]

Participants

The sample included 143 individuals; (1) 143 bereaved survivors with advanced chronic disease after the 2023 earthquake in Turkey completed a cross-sectional survey between August 2023 and September 2023, (2) survey respondents who expressed an interest to provide further information were invited and participated in an in-depth qualitative interview regarding their experiences, and (3) of the 34 respondents who expressed an interest to be involved in follow-up research, a total of 12 bereaved individuals consented and were interviewed between September 2023 and November 2023.

Sampling and Recruitment

The sample size formula for prevalence studies was utilised to ascertain the minimum required number of participants for the quantitative study. In a study conducted after the 2011 Van Earthquake in a similar population, PGD prevalence was reported to be 8.9%. The formula reported by Daniel (1999) [30] indicated that a minimum of 125 participants is required under the conditions of a 95% confidence interval, a 5% margin of error, and an 8.9% proportion. Considering the potential for attrition, the sample size was increased by 15% to 143 participants. Purposive sampling was utilised in the recruitment of participants, with the objective of capturing a wide range of experiences. [31] [32] Participants living in Hatay, the province with the highest number of fatalities among the 11 earthquake-affected provinces [4], were reached in the temporary shelter community (In Hatay, with a total population of 1,544,640 in 2023,

approximately 22,000 people died in the earthquake [33]). Subsequent to the recruitment of the initial participants, the team adopted a deliberate methodological approach to expand the study by recruiting additional participants from the shelter community via snowball sampling [31] with the objective of ensuring that the participant demographic reflected relevant diversity in terms of age, gender and chronic disease.

The inclusion criteria were being exposed to the 2023 Turkey earthquake. Participants were also considered eligible to complete the survey if they were ≥18 years old, individuals who had faced the death of at least one first degree relative (parent, children or sibling) or second degree relative (aunt, uncle, grandparent, grandchild, niece or nephew) as result of the earthquake and, at least 6 months post bereavement. In addition, individuals who have cancer, congestive heart failure, chronic obstructive pulmonary disease or end-stage renal disease were included since these 4 conditions encompass a majority of patients living with either a chronic disease or a terminal illness [34] Bereaved family members who have amnesia or psychosis were also excluded.

A total of 355 individuals were reached out to in this study, however, 132 of these were excluded from the study due to the absence of the aforementioned chronic disease. Furthermore, 28 individuals were excluded due to the absence of first- or second-degree relative loss. Finally, 7 individuals were excluded due to being younger than 18 years old. In addition, 35 individuals were rejected on the basis of their decision not to participate in the study. The quantitative study was conducted with 143 participants.

Data collection

Quantitative

The participants were contacted by the last author (MSc female student specialising in internal medicine nursing) who resided in Hatay between August 2023 and September 2023. The aim and scope of the study were explained in detail to the potential participants; written informed consent was obtained prior to the commencement of the study. agreed to participate during the specified data collection period. The quantitative phase of the study was completed with 143 participants over the age of 18 who completed the Prolonged Grief Scale (PG-13), a 13-item questionnaire designed to assess grief. Participants completed the questionnaire in person, with the research assistant present in their tents. Individuals who consented to further follow-up were approached to participate in the qualitative study.

Qualitative

Following the conclusion of the quantitative study, patients with PGD were selected for inclusion in the qualitative study. A total of 34 patients met the specified criteria for PGD.

The 12 semi-structured interviews were conducted by the first author (an experienced female assistant professor have experience of the palliative, end of life, bereavement care research). The criterion of sufficiency was based on previous studies focusing on the data saturation for thematic analysis, given a relatively homogenous sample . [35] [36] Semi-structured method has given the participants the opportunity to elaborate and explain specific issues. Two pilot interviews were carried out to test the appropriateness of the questions without requiring significant changes (Supplementary material 2).

Potential participants who meet the criteria was interviewed on Zoom. The interviews were audio recorded and lasted between 30 and 65 min. Last author visited all participants before the intervention in their tent and provided them a computer and assisted the individuals to connect the Zoom. Participants' permission to audio-record the interview was obtained.. [37] The unstructured nature of the interview allowed the bereaved participants to present their narratives and thus express their experiences. Depending on the context of the narratives, the interviewer then asked such exploratory questions as "can you explain more?" Interviews began by asking participants about the relationship they had with the deceased who died in the Earthquake participants were also asked about how they managed to stay resilient in spite of such a tremendous loss what support services they received to cope with their grief (See the interview guide in supplementary material).

Measures

A demographic, bereavement-related, and chronic disease-related characteristics form was developed by the researchers in accordance with the relevant literature[5] [6] [10] [25] , encompassing the following characteristics: gender, age, educational level, occupation, income level, marital status, chronic disease, and closeness with the deceased (Supplementary Material 1).

The Turkish form of Prolonged Grief Scale (PG-13) [38] developed by Prigerson et al. (2009)[1] was also used to assess symptoms of prolonged grief disorder of the bereaved individuals. The PG-

13 contains 11 Likert type questions and two "yes/no" questions which is the latest structured diagnostic tool to assess prolonged grief by detecting prolonged impairment within social and occupational functioning. Likert type questions assess 11 potential prolonged grief disorder symptoms in the previous month. Each of these items is answered on a 5-point scale ranging from 1 (never/not at all) to 5 (several times a day/severe) to represent increasing levels of symptom severity. The grief-score includes the sum of the score of each of the 11 grief symptoms and ranges from 11 to 55. The Turkish PG-13 has demonstrated predictive and criterion validity with good internal consistency (α = .90). [38]

Data analysis

Quantitative analysis

Quantitative data were analysed using descriptive statistics in SPSS V.29. Descriptive results of the study were presented as number (n), percentage (%), mean and standard deviation (SD). Chi-square test was used to compare the frequency of PGD between the categorical groups. Independent samples t-test was used to compare continuous variables between PGD and others.

Qualitative analysis

The narrative data was coded using thematic analysis which is a flexible method that allows to report on the experiences, meanings, and reality of participants in relation to the study intervention[39] NVIVO 11 software facilitated the organisation of the data. The six steps of thematic analysis method were used by two researcher (Ç.F.D., I.T.); familiarising yourself with your data; generating initial codes; searching for themes; reviewing themes; defining and naming themes and producing the report. [39] Two authors independently reviewed the data resulting in the inclusion of one subtheme and renaming of one theme. Discussions between researchers resulted through critical dialogue about the themes that emerged.

Patient and public involvement

The study was conducted with a bereaved survivor acting as co-author (S.M). She was involved in all aspects of the study and for its entire duration, from design to tools development, data analysis, and writing. In addition, two participants provided feedback on the findings.

Ethical considerations

Recalling a traumatic event by recounting it or answering questions may cause temporary stress for bereaved individuals. [40] however, it is unlikely to re-traumatise them or cause long-term harm [40]. Ethics approval has been obtained from the Mugla University ethics committee (Reference number: 230065).

Some participants were likely to be illiterate and only verbal consent was obtained for illiterate individual. The researcher asked the literate participants to write their initial and the date in the tick box and to read out loud the consent form before signing. Respondents were only contacted to take part in interviews if they expressed an interest to be invited to provide further information. Participants were aware that they were free to withdraw at any point if they so wish without a requirement to justify their decision. Participants were not forced to answer the questions within the survey and interviews. There was no identity of participants (name, address) on data sheet or transcription. The participants' identifications were anonymised and coded in accordance. Demographic data, informed consent and data from interviews were transcribed and saved on an encrypted device and stored along with the data analysis in a locked drawer in a locked room in the university. Only the researchers have access to the data, it will be stored in a locked drawer in a locked room for 5 years.

RESULTS

143 bereaved participants completed the survey (Table 1). Most participants were women (n=86, 60.1%). About 79% of participants (n=113) were aged 50 years and over. Around 60% (n=80) had graduated from primary school, 81.8% were married (n=117), 57.3% (n=82) reported that they were not working, and most participants had a low-income level. As a result of the destruction of many workplaces due to the earthquake, 61 of the participants (42.7%) reported that they had no income. Most participants had congestive heart failure (*n* =115, 62.5%), followed by cancer (*n* = 33, 17.9%).

Our results indicated a prevalence of PGD among bereaved adults of 23.8%. Furthermore, most of the participants (n=119, 83.2%) had a second-degree relative who had died, but the rate of prolonged grief disorder was significantly higher in participants who had experienced the death of a first-degree relative (p<0.001). In addition, PGD developed in 50% (n=6) of retirees (Table 1).

Table 1. Characteristics of the bereaved survivors

	PGD	
Total (n=143)	**34 (23.8)**	
Gender		
Female (n=86)	19 (55.9)	
Male (n=57)	15 (44.1)	
Test statistics	X2=0.337	
p	0.689	
Age		
Under 50 years old (n=30)	5 (14.7)	
50 years and over (n=113)	29 (85.3)	
Test statistics	X2=1.059	
p	0.346	
Education Level		
Illiterate (n=41)	9 (26.5)	
Primary school (n=80)	21 (61.8)	
Secondary school (n=7)	2 (5.9)	
High school (n=9)	2 (5.9)	
University (n=6)	0 (0)	
Test statistics	X2=2.308	
p	0.722	
Occupation		
Not working (n=82)	19 (55.9)	
Working (n=49)	9 (26.5)	
Retired (n=12)	6 (17.6)	
Test statistics	X2=5.361	
p	0.074	
Family Status		
Single (n=26)	8 (23.5)	
Married (n=117)	26 (76.5)	
Test statistics	X2=0.857	
p	0.445	
Closeness with the deceased		
First degree relative (n=24)	17 (50.0)	
Second degree relative (n=119)	17 (50.0)	
Test statistics	X2=35.239	
p	**<0.001**	
Income Level (mean: 4874.8 Turkish Liras)	4773.50	
Test statistics	t=0.814	
p	0.919	
Chronic disease (A multiple choice option is available)	n	%
Congestive heart failure	115	62.5
Cancer	33	17.9
Chronic obstructive pulmonary disease	29	15.8
End-stage renal disease	7	3.8

The most prevalently identified PGD-13 items among the participants were as follows: “Longing/yearning for the person lost”, “Intense emotional pain, sorrow, or pangs of grief”, “Shocked, stunned or dazed by the loss”, “Functional impairment (in social, occupational, or other areas)”, and “Duration of symptoms of at least 6 months.” The least common PGD-13 items were as follows: “Feeling emotionally numb since loss”, “Avoiding reminders that the person lost

is gone", "Feeling confused about role in life, feeling that a part of oneself has died" and "Trouble accepting the loss." (Fig 2).

Qualitative findings

Six main themes were generated from the analyses: (I) bereavement reactions; (II) coping style; (III) disrupted grieving; (IV) impact of grief on chronic disease; (V) moving forward; and (VI) unmet needs. Each main theme contains several subthemes reflecting the content of the experiences of grief among bereaved survivors (Table 2). A proposed framework for mourners in the context of earthquakes is presented in Fig 1.

Bereavement Reactions

Bereaved participants' bereavement reactions toward the death of their loved ones were categorised as emotional, cognitive, behavioural and physical (Table 2).

The most typical responses participants experienced nine months after the death of loved one have been emotional ones such as emotional pain, guilt, emotional numbness, loneliness and despair. Among them, emotional pain and numbness were mentioned most which are also symptoms of the prolonged grief disorder. According to bereaved participants, the traumatic death of a loved one is overwhelming and the pain cannot be expressed in words. One of the bereaved fathers shared his intense emotional pain, saying:

" Unfortunately, all of us (his wife and two children) were trapped under the rubble at the same time. My wife was trapped under the rubble, so I tried to cut her arm by counting one, two, three (crying). After about 20 hours, we were pulled out from under the rubble with the help of our neighbours, but we could not reach my daughter. Volunteers and municipal workers tried very hard to pull my daughter out of the rubble, but hours later they reached her dead body and said that the only way to get her out was to cut her into three pieces. There are no words to express my pain at that moment (crying). I begged them to take her out in one piece, then the workers hugged me and cried, promised to take her out in one piece and finally gave her to me in one piece. Wishing to die, I hugged the dead body of my beautiful daughter and stayed with her for hours..." (P8, bereaved father who has heart failure).

Some participants mentioned feeling of intense emotional pain caused emotional numbness. A bereaved mother whose son died in the earthquake stated:

"I'm breathing but there's no feeling. I do not know how I can explain this. My emotions disappeared. I think this unbearable pain eventually numbed me. " (P1, bereaved mother who has heart failure).

Coping style

Some bereaved participants attributed meanings to the traumatic death of their loved ones, which helped them in the grieving process. There is no one way for anyone to cope with the death of a loved one, and everyone finds peace at their own pace. Bereaved survivors are often told that time will heal all wounds. A bereaved woman who has been trying to cope with her grief shared her experience, saying:

"I think we also need to learn to suffer. Life is not always a bed of roses. Sometimes there are rough roads, the important thing is to overcome the rough roads. Time heals… Time is cure of everything. Time heals…" (P4, bereaved woman who has health failure).

Making sense of death also helped to bereaved participants through spiritual and religious sense-making by explaining the death of their loved ones as part of a larger divine plan. Another bereaved woman whose sister died in the earthquake stated:

"I try to forget everything. After all, this disaster came from God. His plans are bigger than anything I can imagine. That's why I thank God every day." (P5, bereaved woman heart failure)

Disrupted grieving

Disruption to mourning rituals appeared affecting the grieving process of bereaved survivors, making the death seem 'surreal' and harder to accept. A bereaved woman whose sister and cousins died in the earthquake stated:

" You know how they say wounds heal day by day, on the contrary, they deepen. We still think our loved ones will come back... I still can't believe that what we went through was real. It was like a horror film. People were carrying their dead on their backs in black rubbish bags. No one could wash their deceased; our water was cut off and we slept with our deceased until the authorities gave us a mass grave. In the mass grave they opened big graves, and all the dead were buried on top of each other (crying). It was crowded there; everyone was in pain, and they

didn't even know where they were going. I don't know, it's a pity..." (P11, bereaved woman who has heart failure).

Bereaved individuals expressed their specific concerns about unfinished business in the context of important things left unsaid or unresolved. Some felt regret and guilt for not being able to say goodbye and save their loved ones. A bereaved father whose daughter died in the earthquake stated:

" It's hard (sighs and wipes his tears). You know, when you think about it… I'm so sorry I couldn't hug her and tell her how much I love her. I'm so sorry I couldn't save her (crying). " (P3, bereaved father who has heart failure)

The loss of memories also disturbed the grieving process of bereaved survivors. They didn't just lose their homes and their neighbourhoods. This disaster took their memories with it. A bereaved man expressed his experience as follows:

" Yesterday I could not find the location of the house where I lived for 35 years. So even though people are trying to heal their wounds, it will take years to recover... The earthquake not only took away our houses, roads and neighbourhoods, but also our memories. This place is no longer like the city where I was born and raised. " (P6, bereaved father who has chronic obstructive pulmonary disease).

The impact of grief on chronic disease

Most bereaved survivors with advanced chronic diseases who experienced the traumatic death of a loved one complained that the severity of their disease symptoms increased after the earthquake.

A bereaved man stated:

"The more I get upset, the worse my illness gets. After the earthquake, I have greater fatigue, increased shortness of breath" (P10, bereaved man who has heart failure).

Similarly, another bereaved man said:

"After the earthquake, my illnesses increased, I swear, they did not decrease at all, they increased. I feel much more tired and weak after the earthquake. I had blood pressure, now it is always high. My blood sugar goes up and down. I don't know what to do. Our hospital was

destroyed in the earthquake. There is no doctor or hospital to go to" (P3, bereaved father who has heart failure).

Moving forward

Each individual processes the death of a loved one in their own way. When they felt lost, they were able to take steps to live a happier and more fulfilling life. Bereaved survivors highlighted four factors that contributed to their resilience: being strong for others, new activities such as gardening or knitting, support from others and positive future thinking (Table 2).

A bereaved man who was trying to be strong for others shared his experience, saying: " I have two more children and a wife for whom I am responsible. I also have close friends and relatives. I must be stronger for them. After all, life still goes on. " (P8, bereaved father who has heart failure).

Another bereaved man who had new activities after the earthquake, shared his experience as follows: "After the earthquake, we planted rocket, garlic and lettuce with the neighbours. Gardening makes us happy. If I didn't have new hobbies, I would keep thinking about the same things in my head. This is how I try to forget " (P10, bereaved man who has heart failure).

Some women, especially those living in Hatay which is the earthquake region, stated that they have not lost hope for the future: " Women from Hatay are strong and hardworking. We will make Hatay what it used to be. Whatever happens, we have not given up hope for the future " (P2, bereaved woman who has heart failure).

Unmet needs

Bereaved survivors mentioned four crucial unmet needs that could directly affect their health outcomes: basic needs such as safe drinking water and shelter, bereavement support, medical needs, and support needs with financial. For instance, a woman was feeling hopeless because she still couldn't meet her basic needs, even though nine months had passed since the earthquake: "We are still staying in the tent. Water remains a significant issue here: it is constantly cut off, and we are unable to access clean drinking water. There is no means of transport from one place to another. It has been nine months since the earthquake, but our transport and water problem are still not solved. " (P7, bereaved woman who has heart failure).

"Some bereaved survivors highlighted how the lack of bereavement support affected them: "I still don't want to believe that my daughter is dead. I have lost my appetite, and I don't enjoy what I eat anymore. I also can't sleep at night. Our psychology is very bad, but there are not enough doctors here and there is nowhere we can get support… There are still bodies under the rubble that have not been found. So, there is a dead smell everywhere. Recently, we heard that someone whose entire family died in the earthquake attempted suicide out of grief. We are all alone here with our grief. " (P8, bereaved father who has heart failure).

Table 2. Overview of qualitative themes.

Major themes	Sub-themes	Illustrative quotes
Grief reactions	-Emotional reactions including intense emotional pain, guild, emotional numbness, loneliness and despair.	"...municipal workers tried very hard to pull my daughter out of the rubble, but hours later they reached her dead body and said that the only way to get her out was to cut her into three pieces. There are no words to express my pain…(crying). I begged them to take her out in one piece, then the workers hugged me and cried, promised to take her out in one piece and finally gave her to me in one piece. Wishing to die, I hugged the dead body of my beautiful daughter and stayed with her for hours..." (P8, bereaved man).
	-Cognitive reactions including emptiness, disbelieve about death and dreams regarding the deceased.	"All I feel is a great emptiness. I'm not even sure if I'm dreaming or if I'm dead. The other day I looked at my phone book and realised that most of my loved ones were dead. Not one, not two. Most of our loved ones are no longer alive. " (P11, bereaved woman).
	-Behavioural reactions including alcohol use and avoidance of reminders that the person is dead.	"I've been drinking more alcohol since the earthquake. Otherwise, it is very difficult to bear this pain. Sometimes I drink until three in the morning." (P6, bereaved man).
	-Physical reactions including loss of appetite and insomnia.	" After the earthquake, there was not a single day that I could sleep comfortably. I wake up three or four times a night. When I feel like I can't breathe, I wake up, sit down and smoke a cigarette…" (P1, bereaved woman).
Coping with grief	-Making sense of the death	"After all, this disaster came from God. His plans are bigger than anything I can imagine. That's why I thank God every day. " (P5, bereaved woman).
	-Reconstruction of meaning	"Life is not always a bed of roses. Sometimes there are rough roads, the important thing is to overcome the rough roads. Time heals... Time is the cure for everything. Time heals..." (P4, bereaved woman).
Disrupted grieving	-Disruption to mourning rituals	" …No one could wash their deceased; our water was cut off and we slept with our deceased until the authorities gave us a mass grave. In the mass grave they opened big graves, and all the dead were buried on top of each other… " (P11, bereaved woman).
	-Unfinished business	"…I'm so sorry I couldn't hug her and tell her how much I love her. I'm so sorry I couldn't save her (crying). " (P3, bereaved man).
	-The loss of memories	" ...The earthquake not only took away our houses, roads and neighbourhoods, but also our memories. This place is no longer like the city where I was born and raised. " (P6, bereaved man).

Impact of grief on chronic disease	-Increased metabolism problems -Increased cardiovascular problems	"After the earthquake, my illnesses increased, I swear, they did not decrease at all, they increased. I feel much more tired and weak after the earthquake. I had blood pressure, now it is always high. My blood sugar goes up and down. "(P3, bereaved man).
Moving forward	-Being strong for others	" I have two more children and a wife for whom I am responsible. I also have close friends and relatives. I must be stronger for them. After all, life still goes on. " (P8, bereaved man).
	-New activities such as gardening or knitting	"After the earthquake, we planted rocket, garlic and lettuce with the neighbours. Gardening makes us happy. If I didn't have new hobbies, I would keep thinking about the same things in my head. This is how I try to forget " (P10, bereaved man).
	-Support from others	"Here we cook together with the neighbours in the tents. We set a big table together and eat together. We are trying to get through these days by supporting each other. " (P7, bereaved woman).
	-Positive future thinking	" Women from Hatay (earthquake region) are strong and hardworking. We will make Hatay what it used to be. Whatever happens, we have not given up hope for the future. " (P2, bereaved woman).
Unmet needs	-Basic needs	"…Water remains a significant issue here: it is constantly cut off, and we are unable to access clean drinking water. There is no means of transport from one place to another. It has been nine months since the earthquake, but our transport and water problem are still not solved. " (P7, bereaved woman).
	-Bereavement support needs	"Our psychology is very bad, but there are not enough doctors here and there is nowhere we can get support… There are still bodies under the rubble that have not been found. So, there is a dead smell everywhere. Recently, we heard that someone whose entire family died in the earthquake attempted suicide out of grief. We are all alone here with our grief. " (P8, bereaved man).
	-Medical needs	"Hospitals and pharmacies were destroyed in the earthquake. Many people here could not access their medicine. We still don't have a hospital. Tents were set up for the medicines sent by volunteers, and volunteer pharmacists tried to help us as much as possible." (P8, bereaved man).
	-Support needs with financial	"Many businesses were destroyed in the earthquake. People became unemployed. The shopping centre where my children work was also destroyed. I am very worried about my children. Although ten months have passed since the earthquake, they could not find a job. " (P11, bereaved woman).

DISCUSSION

To our knowledge, this is the first study to explore the grief experiences of bereaved earthquake survivors who have advanced chronic illness. The objectives were: (i) to identify specific themes of bereavement experience among bereaved survivors, (ii) to investigate the prevalence and factors of prolonged grief disorder among earthquake survivors in a severely affected area 6

months after the earthquake, and (iii) to provide recommendations for improving bereavement care from the perspective of bereaved survivors.

According to the results of this study, about a quarter of bereaved adults with advanced chronic disease had prolonged grief disorder. Lundorff et al. (2017)[13] estimated the prevalence of prolonged grief disorder in an adult bereaved population at 9.8% following non-violent causes of death. Most studies have also reported that unnatural deaths are associated with a considerably higher rate of prolonged grief disorder compared to expected and natural deaths. [2 6 7 5 10] There was a large range in prevalence of prolonged grief disorder among earthquake-bereaved survivors (8.5% to 79%) reported in several studies following a natural disaster. [2 6 7 5 10] In a recent study conducted in Türkiye, the prevalence of PGD among bereaved adults eight years after the Van earthquake was found to be 8.9%. [10] Similarly, in Wenchuan earthquake, 8.47% of earthquake survivors were diagnosed with PGD seven years after the event. [6] However, a higher prevalence of PGD was observed in the present study. This result may be attributed to the fact that the time elapsed after death in previous studies[6 10] (7-8 years) was much longer than that observed in our study (6-9 months) and that the previous studies population did not include people with advanced chronic diseases. It appears that time is an important factor in the recovery of people with long-term bereavement disorders. [16] A study of a large sample of Chinese Sichuan earthquake survivors found that the PGD rate decreased from 79% (1-1.5 years after the earthquake) [7 41] to 8.47% after 7 years following the earthquake [6]. Nevertheless, the lack of serious attention to the affected people and preventive measures after natural disasters can lead to serious consequences, such as suicide [14]. In addition, grief occurs differently across cultures, as evidenced by the prevalence of PGD and related factors.[42] In the literature, it has been emphasised that cultural differences as well as the religious and spiritual beliefs of the survivors are effective factors in the development of prolonged grief disorder.[14] For a deeper understanding of the grief phenomenon, there is a need for further studies using tools that address the psycho-social-cultural dimensions of individuals for bereaved people from different backgrounds.

The qualitative findings of this study have demonstrated that most bereaved survivors with advanced chronic diseases who have experienced the traumatic death of a loved one complained that the severity of their disease symptoms increased after the earthquake. The death of a loved one can be one of the most stressful life events. [20] Several studies have shown that stress caused by prolonged grief disorder has a negative impact on the prognosis of chronic diseases. [4 19-22 43]

Furthermore, studies show that dysregulated cortisol patterns lead to an increased risk of death in bereaved people. [23 24] Zhou et al. (2020) [4] also confirmed that comorbid chronic physical diseases were associated with PGD. The findings of this mixed-methods study have also highlighted, consistent with previous studies [5 6 44 45], that closeness to the deceased has a significant impact on PGD after deaths associated with a natural disaster. Bereaved people who had experienced the death of a first-degree relative were at higher risk for PGD than those who had faced the death of someone else. [5 6 44 45] In some studies, in addition to closeness to the deceased, the risk factors of PGD have included educational status, age, and lower socioeconomic status.[6 41 46-48] In our study, in line with other studies [46 48], it was found that the risk of PGD development increased with aging. However, in contrast to previous studies, educational status was not a factor associated with PGD; however, only six out of bereaved individuals included in this study had a bachelor's degree or higher which may have affected the findings. In addition, since most bereaved individuals in our study were of low economic status, it was not possible to make comparisons with others in different economic groups. In literature, women have generally been more vulnerable to PGD than men[46 49 50]. In this study, no significant effect of sex was found when other variables related to the earthquake or death were taken into account, which is similar to some previous studies [6 7 44 51] Inconsistent findings in studies may be due to the statistical methods used (bi-variate regression vs. multivariate regression) or diversity variation in the study population. [7] Most of the women living in Hatay have husbands working abroad and this may contribute to their resilience.[52] In the qualitative findings of this study, some women emphasised how resilient they were:

" *Women from Hatay are strong and hardworking. We will make Hatay what it used to be. Whatever happens, we have not given up hope for the future.*" (P2).

Some bereaved participants attributed meanings to the traumatic death of their loved ones, which helped them in the grieving process. There is no one way for anyone to cope with the death of a loved one, and people find peace at their own pace. Bereaved survivors are often stated that time will heal all wounds. Neimeyer (2010)[53] considers grief as a process of meaning reconstruction. A death of a loved one challenges an individual's established set of meanings and these need to be reconstructed following bereavement. [54] Most bereaved participants included in this study have also highlighted that disruption to mourning rituals appeared affecting the grieving process of bereaved survivors. For example, washing the body of the deceased is an important ritual in Islam[55], but the bereaved individuals in this study mentioned

that they could not even wash the deceased due to the lack of water after the earthquake. Funerals are a crucial component of cultural and religious bereavement systems, facilitating social and psychological support for the bereaved people and providing an opportunity to convey love and respect for the deceased.[55] In a mixed-methods study of people bereaved during the COVID-19 pandemic, a bereaved daughter who has unfinished business described this process as 'a constant prolonging of a goodbye.' [56]

The initial response of the Turkish government faced significant challenges due to the scale of the disaster and the existing regional complexities. [57] The 2023 Turkey earthquake has highlighted critical aspects of disaster preparedness and response that need to be improved. Addressing systemic issues such as compliance with building codes, developing early warning systems, and improving crisis communication are key steps in preparing for possible future disasters.[57] In addition, the Turkish Psychiatric Association organised a comprehensive programme of initial, medium and long-term actions for psychosocial support and psychiatric care. Volunteers were recruited, webinars were organised and an online support system for health workers and first responders was established. [58]

Whilst having a chronic disease and the unexpected and traumatic experience of a loved one's death are risk of factors developing prolonged grief disorder, [2 5-7] there are no published studies focusing on the bereavement among earthquake survivors with advanced chronic disease. This mixed methods study highlights the urgent need for early screening for the risk of PGD in earthquake survivors and the immediate initiation of bereavement interventions for individuals diagnosed with PGD. Moreover, there is no bereavement care national standards or frameworks or policies in Turkey; therefore, our study is also important in terms of providing evidence that will enable recommendations to be made to the Ministry of Health to develop policies and improve practice in this area.

Strengths and weaknesses

The present study is not without limitations. Firstly, the results and framework derived from the findings may not be generalised to other settings or populations due to the relatively small sample size. It is recommended that future studies include a larger sample size, which may include the other 10 affected provinces in Türkiye.

Secondly, the study lacks detailed information on pre- and post-trauma factors. Such factors include pre-existing mental illness, history of bereavement, trauma exposure, cultural influences and social support systems. All of these factors may potentially influence prolonged grief disorder (PGD). It is therefore recommended that future research adopts a longitudinal approach to assess how these variables evolve over time and interact with grief-related outcomes.

In addition, the diverse experiences of all bereaved people may not be fully captured by the study setting - a temporary shelter community. Some survivors may have moved to other cities to stay with relatives, and their grief trajectories may differ. Future research should consider a more inclusive sampling strategy that includes participants from a range of living arrangements.

This study did not investigate how long it takes for the affected population to recover. Further studies are recommended to investigate the recovery duration of the affected population.

Notwithstanding these limitations, the study's utilisation of a mixed-methods design serves to reinforce the findings by offering both quantitative prevalence data and in-depth qualitative insights into the lived experiences of bereaved survivors. This methodological approach contributes to the extant evidence base for the improvement of bereavement interventions in disaster contexts and informs the development of a sustainable, culturally sensitive bereavement support model. [27]

In contrast to the previous studies conducted in high-income countries, this research examines PGD in a middle-income country affected by a large-scale natural disaster. The findings contribute to the global understanding of grief in culturally diverse populations and highlight the importance of context-sensitive bereavement care.

Conclusion and implications for policy and practice

The results of this study have highlighted that the prevalence of PGD among bereaved adults is high and that this particularly vulnerable group requires urgent attention. This first mixed-methods study of bereavement among earthquake survivors with advanced chronic illness can help prepare for future humanitarian crises that may lead to traumatic bereavement by providing recommendations for policy-driven bereavement care. We propose a framework for bereaved survivors to use in the development of an effective bereavement service model. This model may be utilised by mental health

professionals and policy makers to respond sensitively to the values, needs and preferences of bereaved survivors who have experienced the unnatural death of a loved one.

Based on the study findings, we make four recommendations to improve support for bereaved people with advanced chronic disease:

- Raise awareness of symptoms of bereavement and post-traumatic grief disorder (PGD) amongst healthcare professionals and researchers.
- It is imperative that bereavement support for vulnerable groups is prioritised at the organisational and policy level. This should be accompanied by the establishment of national standards, frameworks, and policy.
- The utilisation of instruments for the timely identification and mitigation of risk factors for PGD, with a focus on the psycho-social-cultural dimensions of individuals, is important.
- The implementation of person-centred bereavement interventions is also crucial for individuals diagnosed with PGD.
- It is imperative to acknowledge the heightened vulnerability to prolonged grief disorder individuals afflicted with chronic illnesses, among older survivors and those who have experienced the loss of first-degree relatives by developing targeted outreach initiatives to ensure early identification and support for at-risk individuals e.g. by mobile health services and community-based interventions.
- The development of a personalised bereavement support system, encompassing financial and benefits advice, practical assistance, and emotional support.
- The development of an effective bereavement service model is evident, one that is shaped by bereaved survivors' personal experiences and social and cultural contexts.

Our evidence-based recommendations and proposed framework (Fig 1) can also be used to better address bereaved individuals' support needs related to death, grief, and bereavement and reduce the risk of prolonged grief following deaths related to natural disasters. Future research may focus on identifying psycho-socio-cultural assessment and intervention strategies aimed at early identification and reduction of risk factors for poor bereavement outcomes in this vulnerable population.

Contributors

ÇFD and IT designed the study. ÇFD and SM conducted the interviews. ÇFD and IT analysed the data, and ÇFD, IT, SM contributed to the drafting of the manuscript and approved the final version of the manuscript. ÇFD is responsible for the overall content as guarantor.

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Competing interests None declared.

Data availability

The datasets supporting the conclusions of this study are available from the corresponding author upon request.

Ethics statements

Patient consent for publication

Not required.

Ethics approval

Recalling a traumatic event by recounting it or answering questions may cause temporary stress for bereaved individuals. [40] however, it is unlikely to re-traumatise them or cause long-term harm [40]. Ethics approval has been obtained from the Mugla University ethics committee (Reference number: 230065).

Participants gave informed consent to participate in the study before taking part. Some participants were likely to be illiterate and only verbal consent was obtained for illiterate individual. The researcher asked the literate participants to write their initial and the date in the tick box and to read out loud the consent form before signing. Respondents were only contacted to take part in interviews if they expressed an interest to be invited to provide further information. Participants were aware that they were free to withdraw at any point if they so wish without a requirement to justify their decision. Participants were not forced to answer the questions within the survey and interviews. There was no identity of participants (name, address) on data sheet or transcription. The participants' identifications were anonymised and coded in accordance. Demographic data, informed consent and data from interviews were transcribed and saved on an encrypted device and stored along with the data analysis in a locked

drawer in a locked room in the university. Only the researchers have access to the data, it will be stored in a locked drawer in a locked room for 5 years.

Provenance and peer review

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Figure Legends

Figure 1. A proposed framework for bereaved survivors in the earthquake context

Legends. PGD - Prolonged Grief Disorder

Figure 2. The prevalence of PGD-13 items in participants

Legends. Figure shows the number of respondents for each of the items, PGD - Prolonged Grief Disorder

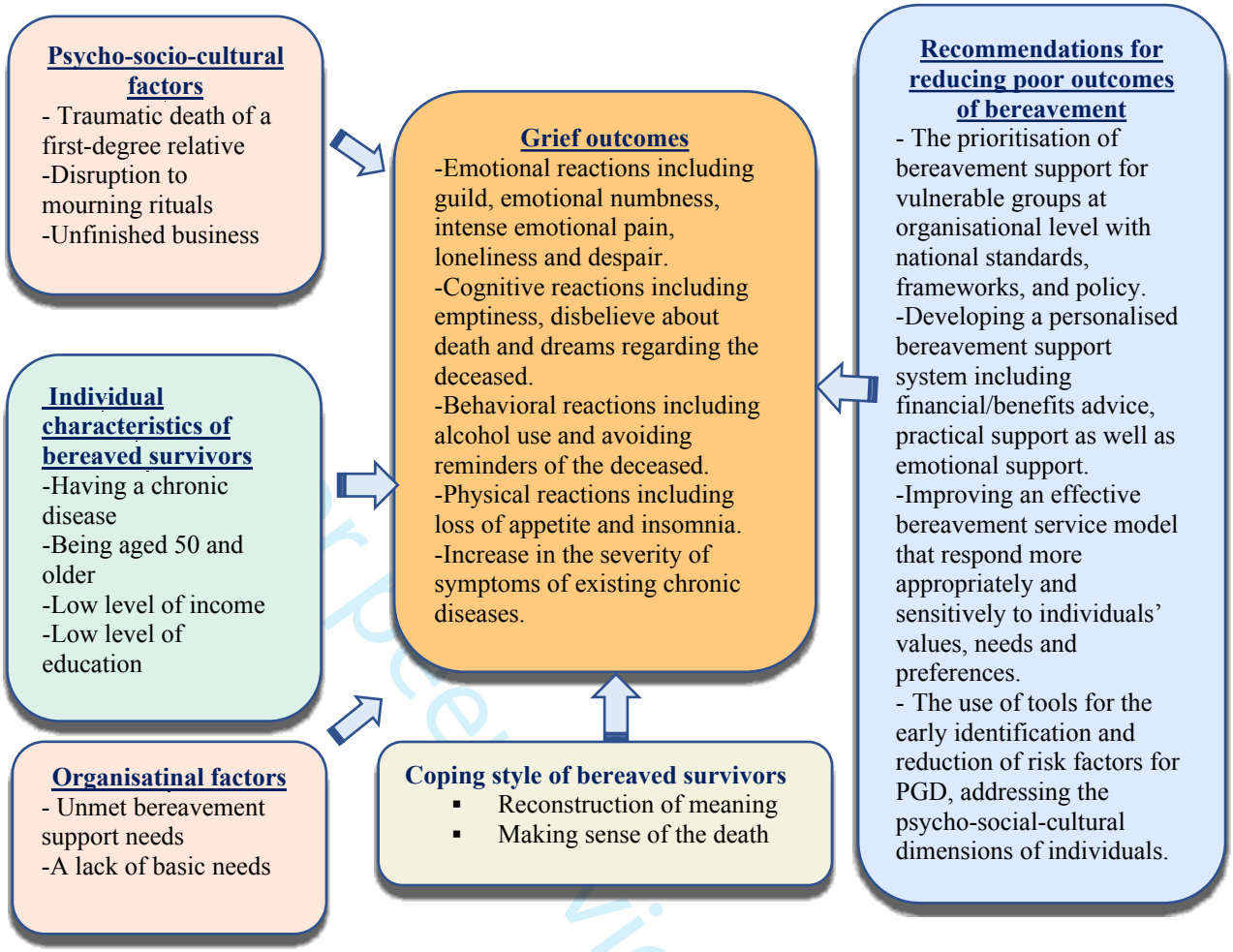

Fig 1. A proposed framework for bereaved survivors in the earthquake context

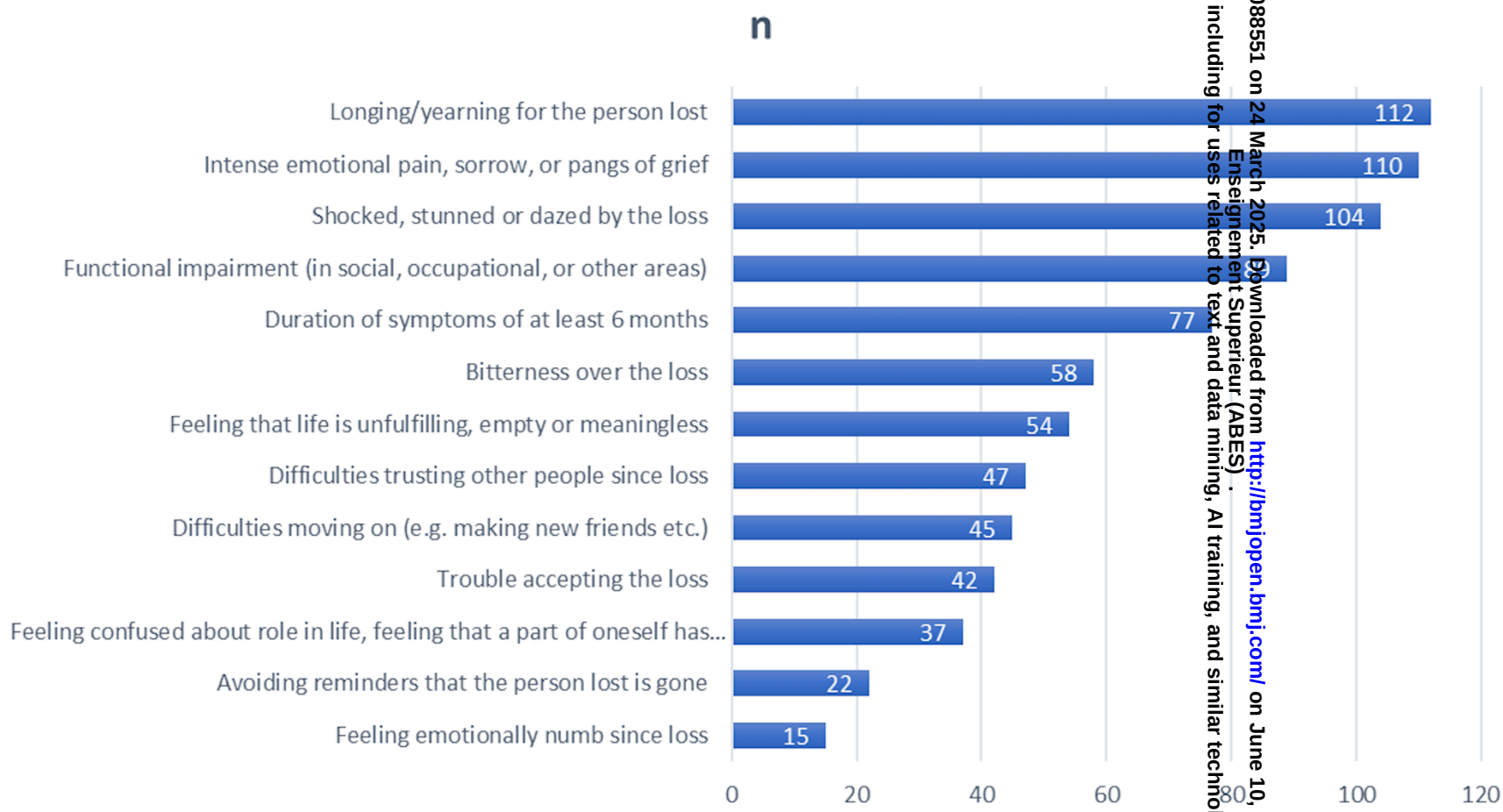

Fig. 2. The prevalence of PGD-13 items in participants

Supplementary material 1

Characteristics of the bereaved survivors

1) Gender:

2) Age:

3) Education Level:

- Illiterate
- Primary school
- Secondary school
- High school
- University
- Test statistics

4) Occupation: …….

5) Income Level:

6) Family Status:

- Single
- Married

7. Closeness with the deceased:……

8. Chronic disease (A multiple choice option is available):

- Congestive heart failure
- Cancer
- Chronic obstructive pulmonary disease
- End-stage renal disease

Supplementary material 2

1. Introduction

• Thank you for agreeing to take part.

• Give background & purpose to study: we want to identify ……This will help identify areas to improve ……. in the future.

• Acknowledge the loss of family members.

• Acknowledge that the topic is upsetting / sensitive. If they want to have a break at any time (and stop the recording) that is absolutely fine.

• Check what support is in place for after the interview/later that day (i.e. who), signpost to counselling services (give contact numbers).

• Explain the consent procedure, right to withdraw, confidentiality and audio recording of the discussion. Break at any time if required. Interview discussion to last 30–60 min. Check that they have understood the information sheet, confidentiality information and check understanding.

• Explain how the discussion that is going to take place will be used in the research.

• Findings will be published in academic journals

• Complete consent forms

I would really like to start by hearing about you and your and experience after the Earthquake. Is that okay?

1) Please describe your relationship with your loved who died in the Earthquake, starting as far back as you can remember; (2) How have your interactions with your surviving family members changed as a result of your grief and loss?; (3) What was it like to experience the death of your ……(Child/mom/dad/sibling)?; (4) How have you dealt with your grief related to the death of your loved one?; and (5) How have you managed to stay resilient in spite of such a tremendous loss?

What else could have been done to help you through your difficult time? (• Probe: institutional support: for views on counselling and support services offered, • Probe: professional support (staff) i.e. rapport, respect, empathy, listening, • Probe: social support (partner, family, friends) i.e. respect, empathy, listening, acknowledgement If there was one recommendation you could make what would it be? • Probe: views on how services could be improved to support bereaved survivors)

3- Closing (Any other comments, suggestions or questions)

I would like to ask you for your final thoughts reflections as we come to the end of our discussion. You have been through a difficult experience, and I am grateful that you have shared it. Your views are very valuable to us, and we hope that you have not found it too distressing to share your experience. Your views will help develop bereavement support; we will be able to highlight areas for change to make improvements for bereaved individuals.