

Medium-Term Health of Seniors Following Exposure to a Natural Disaster

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Abstract

The article aims to describe the medium-term impacts of a major earthquake event (Chile, February 27, 2010) on 26 seniors. The authors adopted a qualitative study approach. Data obtained using the Impact of Event Scale–Revised (IES-R) show the presence of manifestations of posttraumatic stress in the majority of respondents. In addition, data collected in interviews demonstrated a progressive deterioration of the health of respondents over a period of 4 years following the disaster. Seniors are particularly vulnerable to the effects of material loss, emotional stress, and postdisaster health complications. These impacts are exacerbated by low economic status. Furthermore, broader research is necessary involving elderly living in poverty who have survived natural disasters and others without such experiences, in order to better identify and differentiate between health complications associated with exposure to disaster events and those linked more strictly with natural aging processes.

Keywords

seniors, psychological health, physical health, earthquake

Introduction

Each year, millions of people throughout the world, many of them seniors, are affected by natural and technological disasters. Data collected for the year 2015 by the Centre for Research on the Epidemiology of Disaster (CRED) show that 346 natural disasters caused 22 773 deaths worldwide, further affected over 98.6 million people and caused material damages estimated at USD 66.5 billion.¹ It is worth noting that a number of authors have suggested that both the frequency of disaster events and the severity of their impacts have risen over time.^{2–4} As a result of such events, thousands of seniors are injured and suffer material losses. Many do not survive, either due to immediate causes during the disaster or in the days and weeks following exposure to the event. Data for disasters such as Japan's tsunami in 2011 and hurricane Katrina in 2005, as well as the heat waves and other increasingly significant weather changes noted in Europe and North America, show that although seniors form a minority of overall populations, they are overrepresented in the death and injury tolls associated with these events.^{5–9} It appears, moreover, that certain seniors are especially vulnerable to the impacts of disaster events,^{10–16} in particular individuals affected by health problems, loss of physical or cognitive autonomy, and hearing and mobility impairments.^{3,6,17–19}

Research has shown that seniors are more vulnerable than other age groups to the risk of injury and death during and in the aftermath of exposure to natural disasters.^{12,20–24}

disabilities, as well as those living on low incomes and those without a social support network, are among the groups recognized as particularly at risk of postdisaster health problems.^{12,17} For example, Chan et al²⁵ as well as Osaki and Minowa,²⁶ have shown that women, the elderly, and people with physical disabilities all present an elevated risk of death in the year following an earthquake.

Kovats and Kristie,²⁷ for their part, have examined the factors leading to increased risk of death during heat waves for people 65 years or older, noting that factors such as living alone, social isolation, inadequate air conditioning systems, and other housing characteristics, including living on the upper floors of apartment buildings, are all significant. In addition, Ticehurst, Webster, Carr, and Lewin,²⁸ in a study comparing the psychosocial consequences of an earthquake

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in Australia on people in 2 age groups (below 65 years and 65 years or older), found that seniors reported a greater incidence of symptoms associated with posttraumatic stress disorder (PTSD). Other studies have shown that, in addition, seniors face particular disruptions that unsettle their daily routines, beliefs, and values, as well as their personal and social relationships.²⁹⁻³¹ Along these lines of inquiry, a previous study by Labra and Maltais¹¹ on the effects of the 2010 earthquake in Chile showed the impacts on seniors are not only physical and psychological, but also affect behaviors and religious beliefs.

Studies into the impacts of natural disasters in the Canadian province of Québec—floods in 1996³² and a major ice storm in 1998³³—have shown that seniors' emotional experiences are variously affected during different stages of a disaster event. During the stage of danger, seniors experience feelings of anxiety, intense stress, and fear about their own and their family members' physical well-being.³² Labra and Maltais¹¹ have shown in addition that the feeling of taking care of family members is one of the negative emotions seniors experienced during the rescue and intervention phases following major floods. In a separate study, Maltais et al³¹ found that seniors were generally grateful for the assistance they received, yet feared for the future, in particular as to what would happen to their house, when they would be able to live in their own home again, what assistance they would receive in the future, and whether the government would help them to recover from their losses.³¹

Once a return to normal life sets in, seniors still face various emotions, such as feeling like strangers in their own homes or neighborhoods, feeling like they are not receiving sufficient help from family members, and despair over material losses and the health complications that frequently develop or worsen following a disaster event.^{29,34} Other studies show that while disasters can adversely affect seniors' physical and psychological health over the medium term, the gravity of those consequences diminishes over time.^{11,35} Yet despite these difficulties, seniors demonstrate resilience and many take an active part in postdisaster recovery initiatives in their community.^{36,37}

Tyler and Hoyt,³⁸ for their part, in a study of 651 participants aged 65 years and older who had experienced major flooding in the state of Iowa, pointed to a positive association between the presence of depressive manifestations prior to exposure to a natural disaster and the presence of such manifestations following a disaster. Furthermore, it appears that factors such as gender, ethnicity, access to information, and community resilience levels all have an incidence on psychological distress in seniors.^{5,39-41} According to Gignac, Cott, and Badley,⁴² seniors who reported feelings of powerlessness and loss of autonomy prior to a disaster event were also those most likely to develop health problems and report greater levels of stress following such an event.

Although many studies have shown that individuals aged 65 years and older are more adversely affected by disaster situations than younger demographic groups,^{25,26,43-52} other authors nevertheless argue that certain categories of seniors cope with disaster events as well, if not better, than younger adult populations.⁵³⁻⁶⁰ For example, Acierno, Ruggiero, Kilpatrick, Resnick, and Galea,⁶¹ in a study involving 1130 respondents aged 60 years or older and 413 young adults, who had experienced exposure to hurricanes in 2004, found that the older respondents reported lower levels of posttraumatic stress (PTS), as well as major depressive and generalized anxiety disorders. Similarly, Kohn, Levav, Garcia, Machuca, and Tamashiro⁶² reported no significant difference between PTS prevalence in seniors and young adults. Other authors, moreover, point out that older respondents' perceptions of effects on their physical health over the long term are no more negative than those of their younger counterparts.³¹

The present study focuses on the medium-term consequences of an earthquake event on individuals aged 55 years and older. The article has a dual objective: first, to identify the emotions experienced and losses incurred by survivors of Chile's major earthquake in 2010; second, to describe the impacts of the event on their personal and social relationships, as well as on their physical and psychological health.

The Chile Earthquake of February 27, 2010

According to the United States Geological Survey (USGS), the seismic event occurred at 3:45 AM local time, off the coast of Chile's Maule Region, reaching a magnitude of 8.8, for a duration of 3 minutes. The earthquake was the second largest ever recorded in Chile and, at the time, historically the fifth strongest earthquake recorded worldwide. The event affected 3 of Chile's administrative regions, comprising a population of 4 million, or 23% of the country's population. The official death toll was 521⁶³ and approximately 2 million people overall were affected. The Chilean government estimates that 440 000 homes were destroyed or heavily damaged, while cost of material damages to personal property and public infrastructure was estimated at USD 30 billion. In the major urban centers of Cauquenes, Talca, Curico, and Linares, many hospitals and up to 80% of heritage infrastructure sustained major damages.⁶⁴

Method

The present study adopted a qualitative research approach to describe the impact of the earthquake on the lives of 26 individuals, aged between 56 and 81 years at the time of the disaster. Fourteen women and 12 men participated in the study, 4 years after the event. All participants were residents of Maule, the region most directly affected by the earthquake and ensuing tsunami.

Recruitment of Participants

A nonprobabilistic method was used to select the sample. The first participants were recruited with the help of the president of the *Villa Olimpica* earthquake survivors association in Maule. Each participant received the information necessary to understand the goal and implications of the study. Participants were also informed of the ways in which their anonymity would be ensured. Additional participants were then recruited using the snowball sampling method,^{65,66} that is, they were referred by the initial group of participants. The method proved fruitful, as each of the participants was able to refer a new participant who met the study's inclusion criteria. The location and schedule of individual interviews were established in collaboration with each participant. The data collection period extended from January to March 2014.

The lead researcher collected the data through the use of semidirected interviews. All interviews were recorded on audio media and transcribed in their entirety by a research assistant who was a Spanish native speaker. Subsequently, the lead researcher translated the integral interview transcripts into French, a process that accounts in large measure for the amount of time passed between the data collection period and the completion of the present article. Interviews addressed diverse themes and subthemes to draw a comprehensive portrait of respondents' perspectives on their life paths and the consequences of the catastrophe on various aspects of their lives (psychological and physical health, changes in personal, social and family life, support received, and help-seeking). Many of the questions used were originally elaborated as part of a study into the impacts of a natural disaster that affected rural Quebec in 1996.⁶⁷ For the purposes of the study, a Spanish translation of a French-language questionnaire⁶⁷ was adopted and verified using a double back-translation method. This method allowed us to maximize the validity of the questions asked of participants. Participants' sociodemographic characteristics were collected using a short questionnaire composed of closed questions. The instrument also served to assess the presence or absence of PTS manifestations through the Impact of Event Scale-Revised (IES-R).⁶⁸ Containing 22 items, the IES-R measures intrusive experiences and avoidance responses in posttraumatic situations, for which respondents are asked to indicate frequency of occurrence during the preceding week.

Data Analysis

The data were processed and analyzed using Colaizzi's (1978) method, which allowed for the classification of diverse elements of participants' testimonies.⁶⁹ The method consists of 6 steps: (1) listening to the interviews and reading each transcript, to gain an overall impression of the content; in other words, the interview recordings and transcripts, as well as the lead researcher's notes, were subjected to multiple assessments in order identify elements of significance

and code the data; (2) identifying significant statements in the interviews to link them with the study's dimensions: it is during this step that the research team created initial codes based on elements identified as relevant in the previous step; (3) analyzing the meaning of the significant statements and attempting to reformulate them clearly: the researchers devoted particular attention to an exhaustive analysis of the emerging themes to develop an understanding of the significations previously identified in participants' testimonies; (4) grouping the identified units of meaning into broader themes or general tendencies: this involved classifying the collected information according to the commonality, specificity, or divergence of participant testimonies; in addition, the collected material was grouped into themes and subthemes, which facilitated access and reference to specific data; (5) consolidating the results of the analysis and attempting an exhaustive description of the phenomenon under study: the themes were subjected to comprehensive analysis to determine whether they had been correctly classified and interpreted; and (6) classifying the results by defining concepts, creating typologies and identifying associations. This final step was carried out in 2 complementary phases: (a) a revision of the identified themes and subthemes and (b) an identification of the principal concepts emerging from participants' testimonies, allowing for more accurate descriptions informed by the results obtained.

Ethical Considerations

The present study was validated by the UQAT research ethics committee (CER-UQAT) and posed no risks to the physical or psychological health of participants. A hard copy (paper) of respondents' personal data was stored in a locked file cabinet, access to which was restricted to one designated member of the research team. Pseudonyms were subsequently attributed to each of the senior participants to ensure confidentiality during data analysis and interpretation. The transcripts and the resulting database will be destroyed 5 years after project completion. Participants were asked to sign a consent form prior to each interview. All respondents participated on an entirely voluntary basis in the knowledge that they could at any time and without consequences withdraw from the study without justifying their decision.

Sociodemographic Characteristics of Participants

Table 1 outlines the relevant characteristics of the 26 individuals who participated in the study, showing that retired men and women, aged between 55 and 80 years, represented a majority in the sample. The majority of respondents had a spouse and adult children. All participants presented relatively low levels of education: the 14 most educated had obtained a secondary level diploma. All participants reported monthly incomes below minimum-wage levels, indicating economic vulnerability. As Table 1 shows, as well, 15

Table 1. Characteristics of Interviewees.

Characteristics	N = 26
Gender	
Male	12
Female	14
Age	
55-60	6
61-70	12
71-80	5
81-90	3
Studies completed	
Primary education	22
Secondary education	14
University degrees	0
Marital status	
Married (with children)	22
Widower	2
Occupation	
Work full (transport, fisheries, plumbing, security, etc)	5
Retired	21
Incomes	
Minimum-wage monthly income (USD 387 in January 2014)	26
Exposure	
Earthquake only	15
Tsunami and earthquake	11

respondents experienced exposure to the earthquake only, while the other 11 were survivors of both the tsunami and the earthquake.

Results

This section examines the data collected from 26 seniors who lived through the earthquake and tsunami event of 2010 in Chile. The first part will discuss the emotions that the respondents experienced during the earthquake, the losses they suffered, and subsequent changes in their personal and family lives. The second part will discuss the disaster event's impacts on their physical and psychological health.

Emotions Experienced During the Disaster

The participants' testimonies show that they experienced a range of emotions during the event. Among them, however, those most often cited were stupefaction, panic, and terror (n = 13). This respondent's testimony provides a representative example:

... my whole house was shaking, the neighbors were screaming, things were falling over in the house, everything was on the ground! My wife cut her feet running over broken glass, I was stuck inside and I couldn't get out. It was my daughter who helped me get outside. I prayed to God at that moment, because I felt very helpless, I didn't know what to do. (Juan)

Other emotions experienced by respondents, included, for example, the fear of imminent death and the destruction of personal goods (n = 14): "I thought I was going to die right then and there! Everything had fallen over, the TV . . . when we went outside the noise was infernal" (Rosa). For others, the night February 27, 2010, seemed like the end of the world (n = 12): "I felt that the world was going to end, because each tremor was stronger than the last one" (Ramon). Another emotion apparent in the testimonies of seniors was the fear of losing their home and that they might find themselves in the street, left with nothing (n = 14).

During the earthquake and after, when we left and we knew that tsunami was coming, I worried a lot about losing my house. At my age it's not easy to rebuild everything, to start again. There was a lot of people who lost their homes. Happily that didn't happen in our case. When I went back my house was still standing! There was mud and water, but I didn't lose my home! (Juan)

Feelings of panic and anxiety were also evident in the testimonies describing the minutes following the event. Some panicked and feared for their safety and that of their family. Participants also reported feeling high levels of anguish in the face of scale of the tremors, exacerbated by the fact that it occurred at night; it was dark, it was difficult to walk, doors wouldn't open, household possessions were crashing loudly to the ground, neighbors were screaming. The following testimonies are particularly evocative:

We were sleeping when the earthquake happened, then suddenly we woke up with the shaking and the noise; things were falling to the ground. We panicked and then our first reaction was to yell for everyone to get out of the house and find a safe spot outside. But then we couldn't get the door open, it was stuck, all the while things were falling to the ground. We despaired! (Rosa)

The moment the earthquake hit I was a bit afraid, but later it got worse when our neighbors started saying the sea would flood our houses. That's when I felt something that I don't even know how to describe. I was scared for my children and for myself, that we would die drowning and that the waves would carry us out into the deep water. (Maria)

Thus, the fact the event occurred at night (3:34 AM) was another important stress factor for the senior respondents. Their testimonies, in addition, demonstrate the distress they experienced when they felt that death was close.

Losses

None of the respondents needed to face the death of a loved one. Their material losses were considerable, however, as were the damages to public infrastructures and services. Seniors living in the coastal municipalities of Constitucion and Pellines, which received the brunt of the tsunami that followed the earthquake, suffered twice the levels of material

losses experienced by those affected exclusively by the earthquake. Two testimonies are particularly telling:

We really had major losses! The earthquake already damaged the house quite a bit and then the tsunami flooded the whole first floor. Try to imagine the mud everywhere. That's the way we found the house after we came down from the relief camp: water and mud everywhere! We lost everything. There was nothing left we could use: clothes, beds, everything. Everything was wet or covered in mud. (Aidé)

When I went with my husband to see my children in the town of San Javier, that's when I realized what happened. Before, there used to be houses along the beach in Pellines, but not anymore. The sea carried everything away . . . the only road that connected Pellines with the rest of the city was so damaged that it was almost impossible to drive. (Maria)

As the disaster occurred during the night, respondents left their homes without taking any basic goods necessary for survival. They also experienced difficulties in attempts to contact loved ones living elsewhere: "I was very anxious because I didn't know anything about what was happening with my family, my children, my grandchildren. It took days before we knew they were safe and sound" (Julia).

The majority of the senior participants ($n = 21$) reported that their household had suffered significant damages. Most of the homes in question were built of unfired clay bricks and had been standing for over 6 decades. The most common damages reported were cracked or fallen walls and caved-in roofs, as well as floors flooded with water and mud. All the respondents were homeowners and all had had a strong attachment to their homes, having occupied them for many years:

I lost my house, it was from the 50s, I lived there all my life! What you see now, that's not my house. The municipality gave me this small factory-built house. Minewas adobe and it was big! It didn't make it through the shaking in the earthquake, the walls were cracked everywhere. Couldn't live there anymore. Thank God nothing happened to me! (Jobita)

Damages to infrastructure and public services were considerable. The earthquake left behind crumbled buildings, broken bridges, and cracked roads: "A lot of bridges fell down, streets were cut in half where the ground rose" (Cano).

Medium-Term Changes in the Lives of Seniors After the Disaster Event

In addition to material losses, respondents cited a number of changes in their lives following the earthquake. These changes were generally characterized as negative and were still present in the lives of participants at the time of data collection, that is, 4 years after the earthquake/tsunami event. One of the negative effects, reported by nearly all the

participants, was the feeling of living in a constant state of alert ($n = 25$). This feeling of perpetual alert in the course of their daily life translates into reexperiencing the emotions and stress of that night each time they feel a slight tremor or other occurrence that reminds them of the earthquake. The same number of respondents also stated feeling more emotional in the 4 years since the event, a feeling they described as manifesting at random, without apparent reason and at various times of day. Some of the respondents reported, in addition, that they were less likely to laugh or experience pleasure since the event:

Even now, I cry a lot. Sometimes, I just feel this heartache coming up and I start crying! I wasn't like that before . . . I don't know why this happens. I remember that before I used to laugh a lot, things seemed pleasant and funny for me, but today I'm not the same. Now I feel a lot of pain, everything makes me cry. (Maru)

Every time there's a strange movement or sound, I'm always thinking that it's another earthquake. I start panicking and I can't move! I'm there like a statue, frozen, just waiting for the worst to happen. It scares me, because I'm alone in the house all day! (Carmen)

In correlation with this state of constant alert, respondents also reported experiencing manifestations of anxiety and stress more frequently than prior to the disaster. This was the case for 23 participants. Furthermore, 18 of the 26 interviewed seniors reported changes in sleep patterns in the 4 years following the earthquake/tsunami, including difficulties falling asleep and a heightened sensibility to noises during the night: "Any little sound wakes me up and then I can't get back to sleep anymore. I take pills for it, but I don't like it! If I don't take the medication I don't sleep at night." Some of the respondents stated feeling resigned to living with these sleep difficulties.

In terms of family and home life, however, it is worth noting that the participating seniors reported experiencing positive changes: strengthening of nuclear and extended family connections, more harmonious couples, better social relations. In particular, participants mentioned closer affective ties with family members, improved communication, and increased support and care from their children.

The positive of all that, if you can say it like that, is that I see my children more often. They come around to the house more. We get together as a family, it's nice to see my grandkids in my home. And now we're closer as a couple, we've got 50 years of marriage, but I do find that my wife is more tired and sick. (Mario)

We feel closer together, there is more love between us. Now we try to resolve our problems together. (Cano)

Respondents ($n = 7$) who stated that they had always had good relationships reported that the disaster event did not

Table 2. Principal Predisaster and Postdisaster Physical and Psychological Health Problems Reported by Seniors.

Health complications	Predisaster	Postdisaster
Physical	Shingles (herpes zoster) Hypertension Cataracts Hepatic cirrhosis Labyrinthitis Diabetes	Muscle and bone pain Erythroderma Hypertension Hyperthyroidism Fibromyalgia Physical fatigue Joint problems Dizziness Arthrosis Prostate cancer Inflammation de la prostate Carpal tunnel syndrome

affect their family dynamics. For others ($n = 5$), the changes in their personal relationships were only temporary, as the closer links and higher frequency of family visits subsided sometime after the event.

Seniors' testimonies on their social life and recreation since the disaster point toward 2 tendencies. A majority ($n=19$) stated that their social activity had diminished and even ceased entirely due to health problems that appeared or were aggravated following the disaster: "I participate less than I used to in activities . . . my health won't allow it anymore." Others ($n = 7$), however, remarked that this did not represent a change in their lifestyle: "I've never done a lot of social activities. I'm mostly at home with my wife and that's it" (Juan). The interviewed seniors did not view changes in their social and physical activities as particularly important, however.

The Consequences of the Disaster on the Physical and Psychological Health of Seniors

In terms of physical health, 11 of the respondents presented problems prior to February 27, 2010. As evident from Table 2, however, the occurrence of physical health problems among the sample of seniors affected by the event increased considerably in the 4 years following the disaster event. Indeed, the majority of respondents ($n = 22$) reported that their health had deteriorated significantly during that time.

Before the earthquake I was fine! I felt very strong. The illnesses started after . . . Sometimes I have muscle difficulties, I also feel this fatigue and I don't know why this happens. There are days when I don't feel I have the energy to get out of bed and go to work, but I go anyway. (Juan)

I don't know why, but since what happened February 27, I'm not the same. I've become a very sickly person. I feel like I catch everything now, I fall ill so easily, but it wasn't like that before, I was working in my little clothes shop that I owned. (Rosa)

It is essential to note, however, that a direct link cannot be drawn between physical health complications and the disaster event that preceded them, because these health problems may also be associated with the advancing age of the respondents. The health complications most often cited in participant testimonies include fatigue ($n = 20$), hypertension ($n = 15$), muscle and bone pain ($n = 12$), and arthritis ($n = 10$).

In terms of the psychological health—post disaster—of seniors participating in the study, sleep disorders were the most frequently cited problem ($n = 23$). A range of other complications were also reported, including stress ($n = 19$) and constant fear ($n = 19$), as well as manifestations of stress ($n = 15$), anxiety ($n = 12$), and anguish ($n = 11$). Table 3 displays reported psychological health problems in relation to their causes as described by elderly respondents.

The results, moreover, demonstrate the presence of PTS symptoms for a majority of respondents. This is reflected in results collected through the IES-R, as 18 seniors (69.2%) obtained a score equal to or higher than 33, indicating that they suffered from PTS. Six others obtained scores between 12 and 33, indicating they presented a number of PTSD symptoms. Only 2 participants (aged 56 and 57 years) obtained scores below 12, indicating an absence of PTSD symptoms. A greater proportion of women than men (56% vs. 44%) obtained scores above 33.

As Table 4 demonstrates, individuals who obtained scores above 33 on the IES-R presented a higher incidence of both physical and psychological health problems at the time of data collection. Moreover, among elderly respondents who obtained scores below 33, self-reported physical health problems appeared predominantly related to common symptoms of aging rather than to exposure to a traumatic event. At the time of data collection, all respondents, independently of the presence or absence of PTS manifestations, reported that they had not experienced any psychological health problems prior to the earthquake in 2010 and that they had never consulted with a psychological health specialist before their exposure to the event.

Discussion

The aim of the present qualitative study was to describe the medium-term impacts of a major disaster event on the lives of 26 people, aged 55 years and older. This section will discuss the consequences of the Chilean earthquake of February 27, 2010, in the light of the study's results and analysis, as well as the relevant literature. Although the senior participants' experiences of the disaster were individual and distinct from one another, the results nevertheless show that some of the event's impacts were common to all respondents.

In line with the literature on the medium-term impacts of disaster events on survivors,^{11,29,70-72} the results of the present study show that participants experienced a deterioration of their health, both physical (hypertension, shingles [herpes zoster], physical fatigue, muscle and bone pain, erythroderma,

Table 3. Psychological Health Problems.

Psychological health problems	Origins	Participants' descriptions (name, age)
Sleeping disorders	Sudden and startling awakening at 3:45 AM Noises of earthquake and tsunami.	Today I wake up at the slightest sounds. (Ramon, 68) Especially in the first year afterward, I had trouble falling asleep. I'm always thinking about the sounds of that night! (Humberto, 71)
Fear	Destructive power of events.	My daughter can't stay alone in the house, even now. She's afraid that another strong earthquake will happen. (Ema, 81)
Depression	Feelings of decreased capacity to deal with life's everyday challenges.	My depression was diagnosed by a doctor. I never had these things before the earthquake! (Rosa, 62) I've had a depression for some time now. There are days when I just don't feel like anything, I just want to sleep and sleep! (Juan, 57)
Hypervigilance	Perpetual feeling of alarm.	I leave clothes beside my bed and I clear a passage to the front door so I can get out of the house as quickly as possible. I've been doing that ever since. I try to always be ready! (Marta, 64)
Stress and anxiety	Vulnerability. Persistent thoughts of recurring earthquakes.	We feel bad in a way because at our age we're very dependent on others and this stresses me a lot. Imagine another earthquake, how will I get out with my wife? We have trouble walking! (Oscar, 79). There are people on TV who say that an even stronger one is coming in the North of the country! When I hear that I get very nervous and I can't stop thinking that it might happen again here (Aide, 67)
Panic anguish	Inability to escape the house.	We couldn't leave the house! We were stuck. I get very anxious thinking that it could happen again. (Carmen, 78)

Table 4. Self-Reported Postdisaster Health Problems in Relation Posttraumatic Stress Manifestations.

Presence of posttraumatic stress manifestations (n = 18)	Absence or near-absence posttraumatic stress manifestations (n = 8)
Physical health problems present during data collection period	Physical health problems present during data collection period
Shingles (herpes zoster)	Cataracts
Hypertension	Diabetes
Physical fatigue	Labyrinthitis
Muscle and bone pain	Hyperthyroidism
Erythroderma	Joint problems
	Hepatic cirrhosis
	Dizziness
Psychological health problems present during data collection period	Psychological health problems present during data collection period
Sleep disorders	Sleep disorders
Fear	Moderate hypervigilance
Depression	
Hypervigilance	
Stress and anxiety	
Panic anguish	

cancer) and psychological (sleep disorders, depression, stress, fear, hypervigilance, stress and anxiety, panic anguish, loss of motivation), following the disaster event (see Table 4). Previous studies have also identified some of these same health problems as consequences of exposure to disaster events, including hypertension, fatigue, stress and anxiety, as well as sleeping disorders.^{6,11,17,33} According to Tyler and Hoyt,³⁸ certain manifestations frequently present themselves

following a natural disaster, including depressive symptoms³⁸ and PTS manifestations⁶¹; this was also the case for participants in the present study.

Results obtained in the present study show that a majority (18 of 26) of seniors obtained a score of 33 or higher on the IES-R, indicating that they suffered from PTS. Six others presented a number of PTSD symptoms. Specifically, the factors related to reported manifestations of psychological health complications among participants included sudden and startling awakening at 3:45 AM, noises of the earthquake and tsunami, the destructive power of the events, and feelings of decreased capacity to deal with life's everyday challenges (see Table 3). These results corroborate those obtained by Norris et al⁷³ and Fontalba-Navas et al,³⁹ indicating that PTS is prevalent following a natural disaster, as well as those of Jia et al,⁴⁸ which showed that advanced age combined with fear for one's physical safety during a traumatic event increase PTSD prevalence. As demonstrated in participant testimonies, the fear experienced during the disaster event subsequently became a lasting fear that translated into a constant state of alert that was still present 4 years following the event. This was the case for 25 respondents. Moreover, 14 participants reported the fear of imminent death (their own and that of their family members) during the earthquake, a result comparable to that reported by Labra and Maltais¹¹ in a study also concerned with the same disaster event, involving 7 adults aged 55 years and over.

Changes in psychological health may be related to a variety of factors affecting the lives of senior survivors. Participants presented a number of protective factors, including the absence of cognitive disorders and physical

disabilities, the presence of support networks, and the fact that they had not lost loved ones in the disaster. Certain vulnerability factors were also present, however, including belonging to a low-status socioeconomic group (24 participants reported incomes placing them below the poverty line), high levels of material losses, and limited use of health and social services following exposure to the disaster. The same vulnerability factors have been reported previously by a number of authors.^{12,17,48,74-77}

Participant testimonies reflected the scope and gravity of material damages to both personal goods and public infrastructure, as well as the emotions linked with these losses, in particular anguish, stress, and insecurity. The emotional impacts of material losses are significant, because they may be at the origin of subsequent mental health difficulties. Indeed, it appears that, in disaster contexts, material losses carry greater predictive validity for future manifestations of psychological problems than do indicators linked with survivors' perceptions of disaster intensity.^{39,78} Thus, the greater the material destruction, the greater was the impact of the event on the mental health of survivors. This is also paralleled by the findings of Maltais, Simard, et al,⁶⁷ for whom the emergence of postdisaster psychological health complications is linked primarily with the level of effort required of survivors to regain a state of equilibrium following a disaster event. In the present study, the majority of respondents linked the major material loss (damage to their homes) with significant emotional loss, which manifested as a lasting negative effect on their lives 4 years after the event. A number of studies, in addition, have suggested previously that seniors are particularly vulnerable to the impacts of personal loss in disaster contexts.¹¹⁻¹⁵

Living on a low income increased the respondents' vulnerability to material losses and negative impacts on health. A link may be drawn here with Durant⁷⁴ and Brockie and Miller,⁷⁹ whose studies found that populations in zones susceptible to disaster events tend to be socioeconomically disadvantaged and are dependent on deficient infrastructures that do not meet safety standards, which increases their vulnerability to such events, particularly so in the case of seniors. This is reflected in the case under study, as participants presenting the lowest socioeconomic status in the study sample also suffered the greatest levels of loss. Moreover, as reported by Seplaki et al,⁷⁷ socioeconomically disadvantaged seniors are particularly vulnerable to the consequences of residential damages; this may be linked with the greater incidence of health problems and loss of physical and cognitive autonomy in this population.^{3,6,18} More research is necessary to understand more fully the impacts of disasters on seniors in other socioeconomic groups.

Exposure to the disaster, in addition, had repercussions for respondents' personal relationships and social lives, including their social roles and involvement in social activities. These results corroborate those of previous studies, which found that exposure to a natural disaster can have

both positive and negative impacts on spousal, family, and social relationships.^{29,30,32,71} For the seniors participating in the study, the family appeared to be the primary resource in terms of support networks. Indeed, respondents generally perceived that changes in their spousal and family relationships had been positive, due to a strengthening of ties following the earthquake. This finding has been noted previously in the literature²⁹ and cited as a protective factor because the presence of effective social support favors the recovery of disaster survivors.^{80,81} Nevertheless, many participants also reported a decrease in social activity and physical exercise. It appears, therefore, that the disaster event and subsequent difficulties have resulted in increased isolation for senior survivors. The results of the present study suggest that a degradation of seniors' support networks in a postdisaster context can have damaging effects on their physical and psychological health. Further development of knowledge on the deterioration of seniors' social networks is necessary to identify intervention strategies that can better support this population.

Limitations

Certain limitations of the present study suggest that caution must be applied in considering its results. First, it is difficult to establish a direct association between exposure to disaster and the subsequent deterioration of participants' physical health, because the majority of the health complications cited by respondents are known to appear and intensify with advancing age. In other words, given that 40 years had passed between the disaster event and the data collection period, it is highly probable that external variables had an incidence on the deterioration of elders' physical and psychological health in that intervening period. A second limitation was that participants were asked to analyze the disaster and its effects retrospectively, 4 years after the event occurred. A final limitation concerns ecological and external validity. The present study examined exclusively the reported behaviors of individuals whose homes were severely damaged during a natural disaster event. It is, therefore, not possible to generalize the results to other categories of survivors or types of catastrophic events, such as technological disasters. Moreover, the limited number of participants must also be considered a limitation.

Conclusion

Study participants reported generally negative changes in both physical (muscle and bone pain, erythroderma, hypertension, hyperthyroidism, fibromyalgia) and psychological health (depression, anxiety, loss of motivation, anguish). It appears that following exposure to natural disasters, material losses are more determinant of subsequent psychological health problems among elders than are indicators related to the perceptions of event intensity.¹¹ Longitudinal studies involving elders

who have survived disasters and groups not exposed to similar events will be necessary to better identify and distinguish between physical and psychological health problems originating in disaster event exposure and those stemming from natural aging processes. Moreover, participants' testimonies reveal that they faced various difficulties in the 4 years following the disaster, including a decrease in social activity, economic insecurity, and significant material losses. The respondents' low incomes further exacerbated their vulnerability to material damages and health complications.

It is important to note that the generally low incomes of participants in the present study increased their vulnerability to both material losses and health problems. It would be highly informative, therefore, to develop further comparative knowledge on the consequences of disaster events on elders living in more favorable socioeconomic conditions. Future studies should also consider levels of objective and subjective social support in postdisaster contexts to develop an understanding of the links between these variables and the incidence of postdisaster health problems and their role in elderly disaster survivors' adaptation processes.

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