

Experiences and perceptions of natural hazards among international migrants living in Valparaíso, Chile

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ABSTRACT

International migrants are a socially vulnerable group within the context of disasters. However, disasters research focusing on this group is limited. This problem is the primary focus of the present study.

Aim: To explore responses, behaviors and experiences concerning natural hazards among migrants living in Valparaíso, Chile.

Methods: Following a constructivist paradigm, we conducted a case study. We interviewed twenty migrants. The interviews were analyzed using thematic analysis. The study was peer-reviewed by Universidad del Desarrollo Ethics Committee.

Results: Participants described intense emotional reactions when facing disasters that reduced their coping ability. Their limited knowledge about natural hazards and how to react, explains in part their responses and the difficulties they face. Participants compared their reactions with the behaviors exhibited by the local Chilean population who displayed very little fear and seemed to be used to these events. Finally, despite sharing the same native language, Spanish, preparation activities and warnings appear not to be reaching them.

Conclusions: There is an urgent need to implement culturally sensitive preparation strategies, through migrants' existing social networks, to address their needs and concerns and to enable them to cope with natural hazards. Emotional reactions appear to play an essential role in their response to natural disasters and should also be recognized and validated.

1. Introduction

Migration has grown significantly around the world in the past decades, explained by economic, political, education, conflict factors, among other reasons [11]. During the process of moving to a new place and, once migrants settle in the new location, they usually face several challenges. Among these, researchers have documented that migrants are likely to be exposed to higher risks associated with hazards of natural origin, as compared to native residents, and will usually face worse outcomes when disasters occur [17,45,62]. Different factors may explain these worse outcomes, including lack of experience with disasters, being unaware of these hazards, and having no knowledge and understanding of how to cope with them [12,35]. Moreover, migrants may also have specific vulnerabilities and face barriers when engaging

with and implementing risk reduction practices in the community. These reduced levels of preparedness are a product of a lack of sufficient economic resources, knowledge and experience of these events [28] and reduced social capital. In a world context with an urgent need to implement disaster risk reduction (DRR) strategies embedded in communities, we need to recognize and address international migrants' experiences of isolation and exclusion, and incorporate these in the DRR process [3]. This study aims to contribute to informing DRR strategies and respond to the 2015 Sendai framework for DRR [3] by exploring responses, behaviors and experiences concerning natural hazards among migrants living in Valparaíso, Chile.

Researchers [31] argue that multi-hazard disaster studies - understood as an approach that includes the presence of various types of disaster in the same territory - are interesting and relevant given that

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the reduction of risk in a community should consider all possible threats. However, multi-hazard studies have challenges; in particular, they may not afford a deeper understanding of the perceptions and behaviors that may vary in how they unfold across different types of disasters. In this study, since it is exploratory, we asked participants about their experiences and perceptions regarding disasters in general, and we did not ask or prioritize a specific one, since the area of Valparaíso is at risk of several hazards, mainly earthquakes, tsunamis or fire threats. In spite of this, in the interviews stories related to earthquakes and tsunami threats predominated and appeared to be very important for the migrants.

In summary, with this study we aimed to explore responses, behaviors and experiences concerning natural hazards among migrants living in Valparaíso, Chile, in order to inform future strategies that could help them to be better prepared to cope with these events. In this way, we expect to contribute to addressing the needs of migrants in the face of disasters, and to incorporate this knowledge so that these DRR strategies can reflect and take into account the migrants' own experiences and needs [53].

1.1. Disasters and migrants

In 2014, the Centre for Research on the Epidemiology of Disasters CRED [24] reported an increase in the number of disasters around the world in the previous sixteen years. Chile has not been immune from this process. Only in the past two decades, the Chilean population has suffered several major disasters, including earthquakes, tsunamis, volcanic eruptions, forest fires, and flash-floods [8]. According to the World Risk Report [61], Chile ranks 11 among the countries with highest exposure to risks for natural hazards. Thus, actions aimed to reduce risks and the potential consequences of disasters are required around the world, including Chile.

Disasters have important economic and social consequences for individuals, communities and, in general, for society, which have been widely described in the literature [38,39,7]. These consequences, however, differ across individuals and groups [15]. We know that individuals from some social groups will suffer worse consequences when these events occur, as compared to individuals from other groups. This social phenomenon is known as social vulnerability to disasters and refers to “the characteristics of a person or group in terms of their capacity to anticipate, cope with, resist, and recover from the impact of a natural hazard” ([60], p.11). The United Nations, as well as other organizations, has called for the inclusion of these vulnerable groups in the strategies implemented [54].

International migrants, rather than those moving internally from rural to urban areas, are one of those vulnerable groups. Overall, researchers agree that migrants may face worse consequences associated with exposure to disasters in comparison to native-born individuals, results that can be explained by the conditions in which they live, greater exposure to risks, and their limited preparation to cope with these events [17,45,62]. Researchers have reported that settled migrants usually live in worse conditions, have lower incomes, and are generally situated in a disadvantaged socioeconomic position [11]. Living in socially deprived neighborhoods will affect preparation actions needed to effectively cope with disasters [22], and access to resources required to carry out mitigation actions will be scarce [33,51]. Researchers have also reported that migrants will be less likely to respond to warnings in an effective way when disasters occur; for example, they will probably not evacuate when necessary [47], in some cases because they may lack transportation means to leave the zone, as was reported in a study after Hurricane Katrina [19]. On other occasions, this may also be because they have significant gaps in knowledge related to hazards, causes of disaster, and how to cope with and mitigate these [12,35]. Knowledge and coping strategies for facing disasters are related to cognitive processes such as risk perception [58], expectations regarding the outcomes of the actions to deal with those

events [43], and self-efficacy [6].

In other studies, researchers have reported that migrants live in high-risk areas, mainly because these are less expensive, and are therefore more prone to be exposed to hazards [34]. Other researchers have suggested that migrants may also perceive the risk associated with these hazards in different ways than the native population because of their limited experiences of exposure. In addition, a lack of upbringing that includes formal training and informal local knowledge can influence the way they cope with these events [35,41]. Therefore, a better understanding of how migrants perceive these events and identification of ways of working with them to address gaps in their knowledge and experience, should contribute to the design of preparedness actions in the context in which they live.

Migrants may also face additional challenges during the recovery and reconstruction phases. Some researchers have documented that illegal migrants may fear deportation and not search for help or take advantage of assistance programs [45]. Therefore, the consequences they face will prevent them from taking future actions to be better prepared to cope with these events, but also make them less likely to seek information from authorities and trust them enough to work with them because of this additional vulnerability.

Despite the increasing number of migrants who move to new locations, their high exposure to hazards, and the fact that they present conditions that make them vulnerable, very few studies have focused on this group. In studies of social vulnerability to disasters, migrants are frequently classified as a ‘special population’ along with the poor, elderly, and women-headed households [16,32,37]. In other studies that examine the role of ‘racial’ or ethnic identity or both identities [48], this focus can make it difficult to separate the role of their migratory status from the consequences they face. For example, in a study conducted after Hurricane Andrew, researchers reported that the last families remaining in temporary trailers nearly two years after the event were large three-generation households. This family composition is common among migrant populations, who often prefer to live in larger extended family groups [37]. Unfortunately, in this study researchers did not separate participants based on their migrant status, and we cannot conclude whether they were mostly migrants or native-born individuals. This is a significant limitation for our understanding of the role of migrant status on disaster outcomes, and to further understand their experience of these events.

There are other reasons for the differences found in responses between migrants and native residents of a country reported in various studies. These explanations emphasize the role of language and culture. In these studies, researchers have concluded that tailored materials, emergency alerts, text messages, and news coverage concerning disaster threats may be presented only in the population's local language, creating a major barrier for the migrant population who may not be fluent in it [49]. These barriers also pertain to post-emergency responses; illiteracy or lack of language proficiency is a severe disadvantage when seeking information and completing application forms [10,37]. Furthermore, cultural differences can cause misunderstandings and mistrust between response agency workers and migrant victims [37]. Burke et al.'s [10] study of disaster preparedness among Latino migrants suggests that providing disaster information in the native language of migrants and—when feasible—delivered in culturally appropriate formats such as *charlas* (talks) and brochures, can contribute to reducing vulnerability. Accordingly, they recommend tailoring messages and formats to the specific needs of each ethnic and cultural group.

A small number of these studies have found that belonging to a group of international migrants from a high-income class decreases the social vulnerability associated with disasters. For example, in 1960 when some areas of the United States were flooded affecting highly educated migrants, they were able to recover sooner [16]. These migrants, however, differ from those who have left their home countries in previous decades. These latter ones may not be as privileged as the ones

affected by the floods in the 1960s due to limited earlier educational opportunities. Typically migrants who live in countries prone to natural hazards are vulnerable; they are less wealthy and less educated than native residents.

Other researchers, however, suggest that the migration journey and the settlement process require physical and psychological assets that prepare this group to cope better with demands [1,53]. These findings may underscore the fact that migrants may be vulnerable and resilient at the same time, as has been proposed by [53]. The circumstances in which they left their country of origin, including social and political conflicts and other disasters, may have promoted the learning of skills and strategies that could be useful in the context of disasters. These findings reveal the need to recognize both the vulnerabilities and strengths of migrants in the disaster situations.

In a global context where both migration and exposure of people to disasters have increased steadily in the past decades [54], there is a need to prepare migrants better to cope with these events effectively. In fact, within the Sendai Framework for Disaster Risk Reduction [3], the United Nations (2015) has urged governments to implement preparation actions tailored to the needs of individuals and communities at risk. Within this context, the needs of international migrants must be recognized in order to design and implement preparedness activities. This study is intended to contribute to this goal by exploring the question: *what are the experiences and perceptions of natural hazards of immigrants living in Valparaíso, Chile?*

1.2. Study context

In Chile, international migration has increased significantly in recent years with migrant levels reaching 4.35% of the total population in the year 2017 [27]. Most migrants have settled in the north and central area of Chile; Valparaíso is one of the cities in which the most vulnerable immigrants have been concentrated from 1992 to today [55]. 5.4% of the total immigrant population in Chile lives in Valparaíso, and the percentage of immigrants according to the population size of Valparaíso is 2.3%. The majority of them come from countries in South America such as Perú, Colombia and Venezuela [27]. Most immigrants coming from other Latin American countries do so in search of job opportunities, and share the language of the native Chilean population [11]. As a result, local communities and authorities expect that migrants will be able to understand warnings and other messages associated with hazard events and cope effectively, even though there is no perfect warning system that could cover all the natural hazards [47]. However, their understanding of warnings does not necessarily depend on their fluency in Spanish because their knowledge of the territory in which they live and of the hazards they face is relevant as well [47,57]. Although in Chile procedures have been implemented to better prepare communities to cope with natural hazards, these strategies and management policies have not been inclusive, have not recognized diverse cultural needs, and there are no specific actions tailored to the migrant community in place.

Chile is located within the Pacific Ring of Fire and is prone to significant seismic and volcanic activity. In fact, the largest earthquake ever recorded occurred on the coast of southern Chile in 1960. The earthquake had a magnitude of 9.5 Mw on the Richter scale and triggered a tsunami that affected more than 2.5 million people, produced around 2000 fatalities and created permanent changes in the geography of the zone [4]. On February 27, 2010, another major earthquake (8.8Mw) affected the central coasts of Chile and also produced a tsunami. There were 521 lives lost as a consequence of this event, due to a lack of preparedness [20] and because authorities failed to warn of the approaching tsunami. The need to better prepare communities and individuals became clear after this event and actions to achieve this goal were implemented by ONEMI (Chilean National Emergency Office), with a particular focus on preparedness for earthquakes and tsunamis [21]. Chile's location explains the need for it to concentrate on

geophysical events (InterAcademy Panel on International Issues, 2009) in one of the most active zones of subduction between the Nazca and South American plates. Just in the past five decades, the central area of Chile has been affected by four major seismic events (> 8 Mw): (i) the Valparaíso earthquake in 1985 (8Mw), (ii) the Maule earthquake in 2010 (Mw 8.8) (The epicenter of the Maule earthquake occurred in the central-south area of Chile, but affected other locations in Chile), (iii) the Pisagua earthquake in 2014 (north of Chile, Mw (8.2), and (iv) the Illapel earthquake (8.3 Mw), with an epicenter located in the central-north area, which also affected the central zone of Chile [46]. All of these events affected Valparaíso and the population living there.

We conducted this study in Valparaíso because this area has been affected by different natural hazards and large numbers of international migrants live there [27]. Valparaíso is located 120 km northwest of Santiago (the capital), on the coast of Chile. It is a major seaport and the sixth largest city in Chile with almost 276,000 inhabitants. Valparaíso is recognized around the world for its topography; it is built on steep hills that overlook the Pacific Ocean. This city was listed as World Heritage Site in 2003 by UNESCO, and large numbers of tourists visit it annually.

Since 1985, Valparaíso has been exposed to at least eight major earthquakes (7.0Mw or higher); a tsunami followed two of these events. Lower magnitude earthquakes are frequent, and even only in the past year, Valparaíso has been affected by more than 204 earthquakes of 1.5Mw or more. Wildfires have also affected this city on several occasions; the worst one was in April 2014.

In Figs. 1–3, we present the distribution of native population and immigrants living in Valparaíso according to the last census completed in Chile [26].

Migrants have settled throughout the whole city, providing a challenge for authorities if they try to reach or assist them in a disaster. It is worth noting that there is a higher concentration of migrants living in the coastal zone of Valparaíso, which corresponds to the inundation zone, according to the estimations of ONEMI (Chilean National Emergency Office) and SHOA (hydrographic and oceanographic service of the Chilean Navy), Fig. 4. These locations require a mandatory evacuation when there is a tsunami warning [42]. Thus, migrants appear to have settled in hazard risk locations.

2. Methodology and data collection

A case study approach [13] was used to develop a contextual account concerning migrant communities living in Valparaíso and their experiences of natural hazards during the time they have been living in Chile. Researchers conducted the data collection onsite between April and September 2016. A later visit in 2016 was included to verify provisional findings with participants.

2.1. Research participants and recruitment

This study focused on international migrants who had lived at least one year in Chile and had experienced natural hazards or warnings of tsunamis in Valparaíso. These immigrants were recruited at community centers, using the "snowball" sampling method to encourage more participants to take part in the study [44]. We contacted community centers through the local authorities in Valparaíso, with whom the research team maintains permanent contact. The study was conducted with 20 participants, a number that usually responds to initial saturation of information criteria [14]. The participants included were 12 women and 8 men. Participants were classified into two groups: those who came from Latin America and those who came from other continents. Fifteen participants had settled in Valparaíso; the remaining participants were either temporarily living there, searching for a job, or inhabitants due to particular circumstances - for example, the work of a partner. Of only three participants who had completely resolved their legal status in Chile, all were from Venezuela. We also interviewed two key informants: Chilean experts on disasters who were also familiar

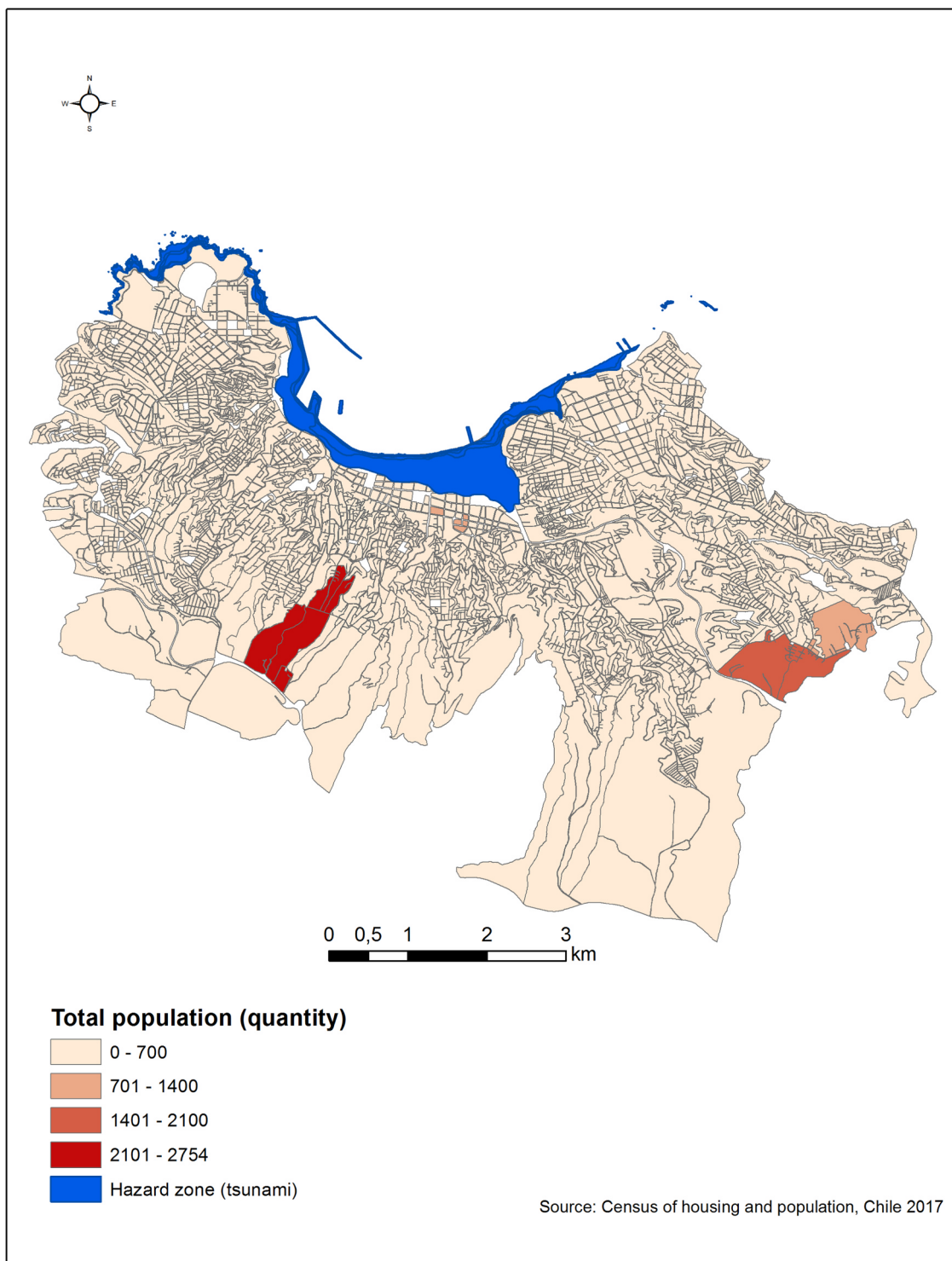


Fig. 1. Density Distribution of general population in Valparaíso. Sources: Census of housing and population, Chile 2017 [25,26]. The map was elaborated by the authors and it is not subject to copyright restrictions

with Valparaíso and its hazards.

A socio-demographic description of the group of immigrants who participated in interviews is presented in [Table 1](#).

2.2. Procedure

Interviews enabled a close empathic interaction with participants and explored specific aspects related to their experience with natural hazards. The interviews were carried out in places selected by the

participants, including their own houses, coffee shops, or other public places, but always safeguarding the confidentiality and privacy of the interviewees. The interviews were recorded and lasted between 30 and 50 min. Almost all the interviews were conducted in Spanish; one interview was conducted in English with a participant who grew up in the United States and later translated into Spanish for the thematic analysis.

Thematic guidelines for interviews focused on the following themes: (1) natural disasters in Chile; (2) experience and perceptions; and (3) coping strategies used in recent events and tsunami alerts in Valparaíso.

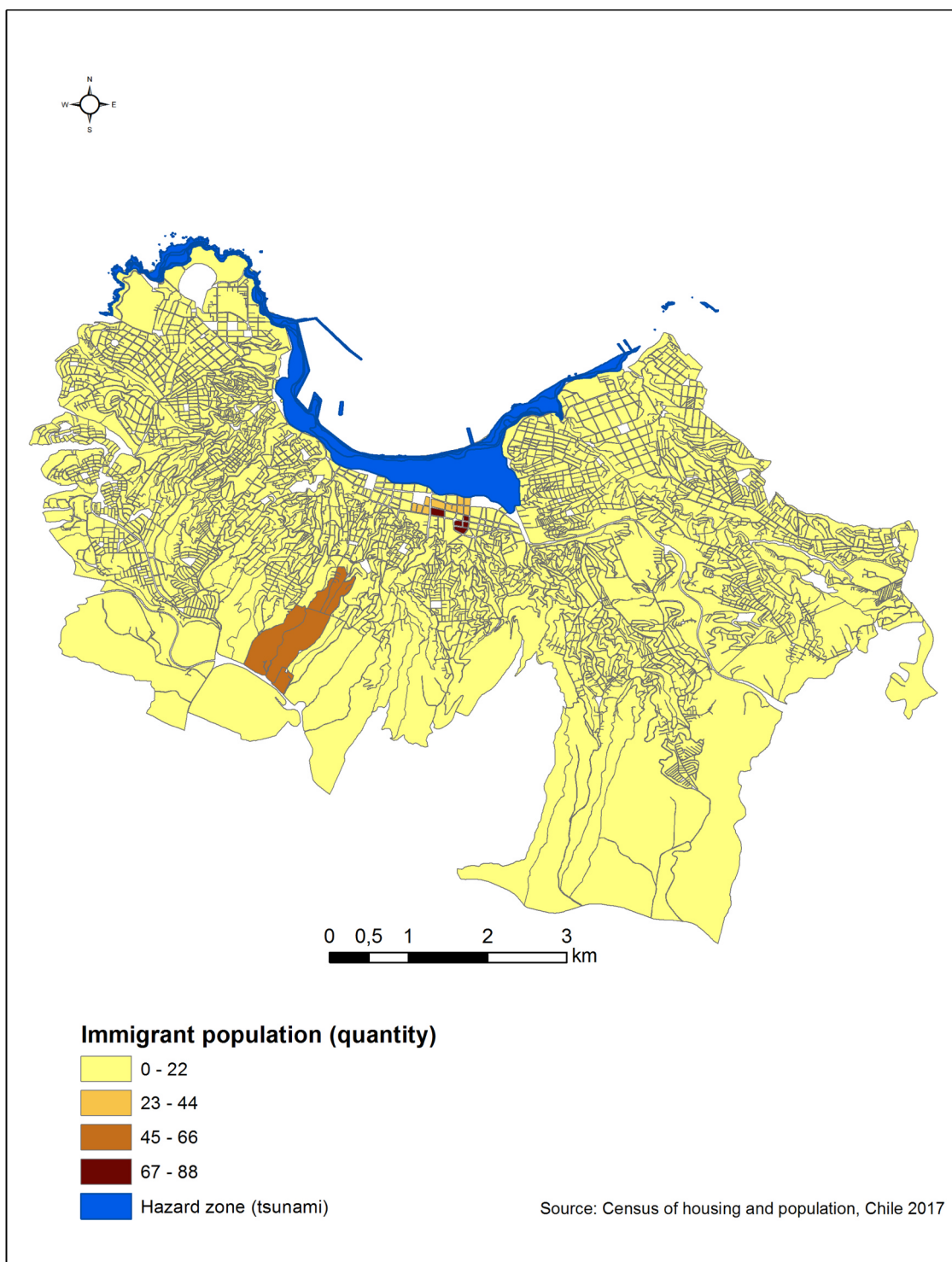


Fig. 2. Density Distribution of immigrants in Valparaíso.

Sources: Census of housing and population, Chile 2017 [25,26]. The map was elaborated by the authors and it is not subject to copyright restrictions

2.3. Data analysis

All data collected became written material. Field notes from interviews became lengthy notes, sorted by date. All interviews audio-recordings were transcribed verbatim. All data was electronically filed. Following the completion of the data collection and the organization of all the written material, the formal analysis of the data began for which we used a thematic analysis approach [50].

A first step in the formal data analysis was undertaken on site, after

the first four interviews. Researchers checked the resulting themes to inform future interviews. The recorded material was transcribed word by word replaying tapes at least twice to confirm the accuracy of the transcriptions. When all the material was ready for analysis, it was read one more time, generating initial codes and reflections. After this first reading, we generated and tested categories, with the support of the QSR NVivo 11 data management software. Transcripts were also read "horizontally," which involved grouping segments of text by category. Following the analysis and creation of categories, we examined them all

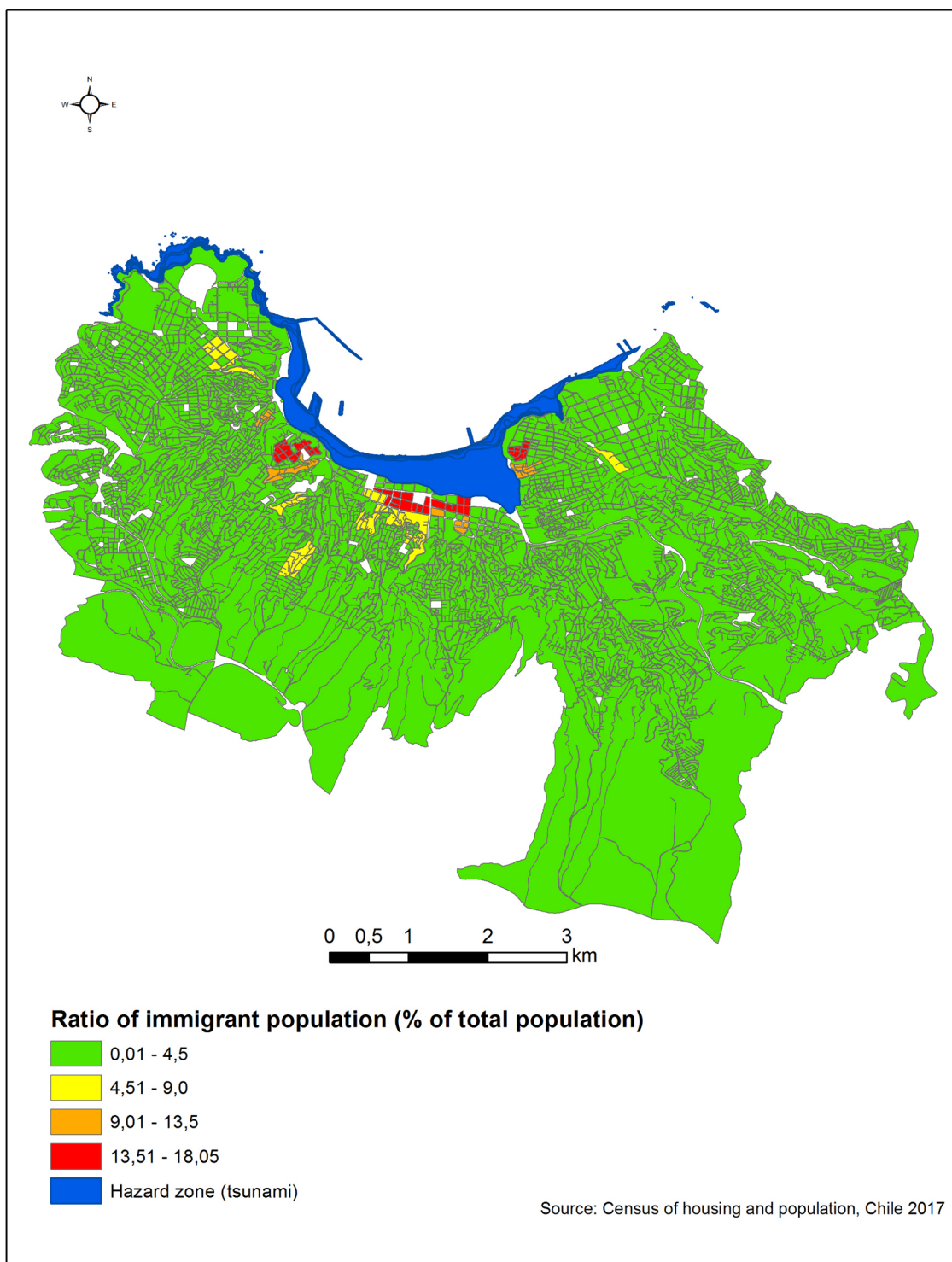


Fig. 3. Density Distribution of international migrant population in Valparaiso. Sources: Census of housing and population, Chile 2017 [25,26]. The map was elaborated by the authors and it is not subject to copyright restrictions

in search of patterns and themes. We checked the findings with some of the participants, to ensure they concurred with their own experience and perceptions.

The thematic analysis was done in Spanish, and the quotations selected for this paper were translated verbatim. We include in the manuscript the original quotations in Spanish (appendices).

2.4. Ensuring Rigor

Several authors emphasize the need to be explicit about the strategies used to ensure rigor when conducting a qualitative study (e.g., Barbour, 2001; [29]). These strategies must recognize both credibility and dependability [23]. In this study, we followed five strategies of rigor [29], these are:

- (1) Triangulation: The researcher(s) examines data collected from

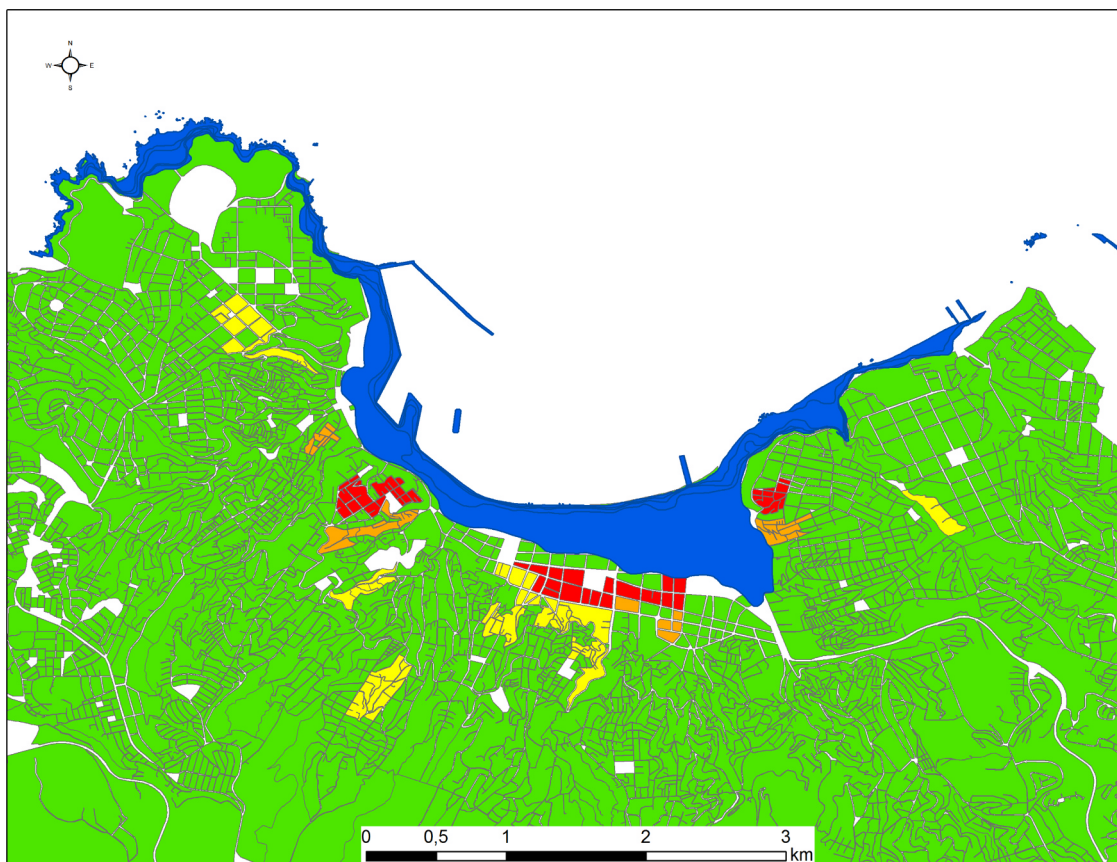


Fig. 4. Proportion of immigrants exposed to tsunamis in Valparaíso. Sources: Census of housing and population, Chile 2017 [25,26]. The map was elaborated by the authors and it is not subject to copyright restrictions

Table 1
Sociodemographic description of immigrants who participated in this study.

Participants (20)	Sociodemographic description
Age	Average 32.9 years Range 21–58 years
Sex	12 women 8 men
Marital status	11 single 5 married 4 divorced
Years living in Chile	Average 3 years Range 1–5 years
Country of Origin	Argentina 1 Bolivia 2 Colombia 1 Francia 1 Honduras 1 India 2 Italy 1 Peru 5 USA 1 Venezuela 5
Educational level	Less than high school 2 High school 8 Technical secondary studies 3 College or university graduate 5 Graduate school 2

diverse sources or by different methods. In this study, we employed different sources of information (migrants and experts).

(2) Peer Review: Two or more researchers review the data and analysis to evaluate the themes identified in the data, and to help to validate the findings. In this study we had expert validation to evaluate the findings and analysis.

- (3) Audit Trail: This represents the clarity and coherence of the rationale for theoretical, methodological, and analytic choices so that others can understand how and why particular decisions were made. We were explicit in the reports about all decisions and choices made.
- (4) Reflexivity: An explicit reflexive thread throughout the research seeks to recognize and value researchers’ participation in shaping the data and analysis. Reflexivity was vital in this study and included in all research reports.
- (5) Respondent Validation: After completing the thematic analysis, researchers went back to Valparaíso to discuss the findings with some research participants and local authorities. They provided feedback about these findings and confirmed whether they felt that they could identify with the social dynamics exposed; quotations from the respondent validation process were included in the results section.

This review was registered in the Universidad del Desarrollo Ethics Committee low-risk database after it was judged to meet previously determined criteria, and participants were informed accordingly.

3. Results

The presentation of the results are organized into three thematic axes, these are: (1) emotional experiences, which include experiences reported by the migrant community regarding disasters and drills while living in Chile; (2) main concerns expressed by the immigrant community regarding any future occurrence of a disaster; and (3) perceived needs, based on past disaster experiences, and recommendations from participants to address their needs and improve their well-being around disaster preparedness in Chile.

3.1. Emotional experience

Fear is the primary emotion described by international migrants when facing disasters in Chile. Fear will influence their decisions and behavior during and after the disaster. It was described by participants as irrational and useless when attempting to cope with the situation:

"Here [Valparaíso] shakes a lot... every day trembles and I would run out of the priest's house! From the second floor!... uuy... I would move down with my daughter... we were very afraid... Sometimes we would leave early in the morning, until the priest explained to us that there was nothing we could do by leaving, now... the fear has appeased, but I still fear them..." (Interview 3, Female, 25 years old, Honduras)

Usually, the local population knows that it is not necessary to run when there is shaking or an earthquake since buildings and houses in Chile are built with high seismic standards. The migrant population does not necessarily know this; therefore, many of them continue to feel fear when there is a small tremor and tend to run away from their houses. Some migrants understood that fear would not help them to cope with the event adequately, and stated that they need to "calm down" to behave in a better way:

"I only know that if I am with my son I must calm down, because I am more scared than him... Then, I must calm down, because if I don't I will affect him too" (Interview 8, Female, 32 years old, Bolivia)

Worry and anxiety are other frequent emotional reactions reported by participants, mainly when they are not with their families or close relatives:

"I was worried, I was more worried about my husband and my son... I was alone... I was going to visit my sister, so I was more worried for them than me, because the car was parked, and I was fine, the drama was they who were in the house (...) I am very fearful... what happens that I am fearful... I am very afraid and in reality, the one that reassures me is my husband, he tells me calmly, he... he is more... more like in this case... when this happens, he tells me... He tells me no... calm down... if you are going to run there, anything can fall..." (Interview 4, Female, 27 years old, Peru)

Emotional reactions reported by migrants have been reported in previous studies [59]. These authors mention that the migrant communities tend to report more psychological distress than the local people. The emotional reactions felt by migrants will impact their behavior during a disaster. For example, when there is an evacuation plan organized by the community that must be followed, they can want to escape and not follow the plan because of the fear generated by the event:

"Then I was coming and just started shaking and I ran off with my daughter, but one... the lady told me no... don't run, if nothing is going to happen, I was scared I was shaking, I did not want to leave and they did not let me get off the hill because I said tsunami warning... tsunami warning and they did not leave me because I was near the customs... They said no... all the people went up to the hill and I went down!... And I fought with a fireman, I hit a fireman (...) Because I... [he] wanted me to go up! I told him... like you will not leave me... I'm going to my house! Then I came walking from there to the house... With my baby, I arrived about nine and when I arrived there was nobody in the house, because everyone had left, I did not know... (Interview 3, female, 25 years old, Honduras)

The need to run and move towards open spaces has been described by other authors, who point out that in a disaster situation, people could engage in behaviors that turn out not to be useful as a response to a high-risk perception [59]. This escape in the case of a tsunami threat in Chile is complicated since there is a tendency to run towards the sea, in exactly the opposite direction of the official evacuation plans. In addition, in a scenario of evacuation, it is essential to consider the

places and locations routinely covered by immigrants in their everyday lives. For instance, in the previous quote, the participant described her daily practices and activities, that is close to the offices of customs and immigration, and close to her home, where her baby is. Thus, the familiar places and family dimension play a vital role in making people feel safe, even though they are not safe in the context of evacuation, as suggested in previous studies [36,56].

The emotional reactions of those who are not used to natural hazards are often ignored by the local population, who do not recognize the impact that these events have on migrants and act as if these events are ordinary for them:

"Exactly... I'm the one who runs away... And people [Chilean people] do not even feel it" (Interview 16, two women, 32 and 22 years old, Venezuela)

"Yes! There are people who tell me... No! Quiet... it is very quiet [the earthquake]! I'm just scared... I'm scared! Panic! It's not fear... it's panic" (Confirmation Interview, Woman, Argentina)

P: Is that this country there are many tremors, then as people say already... is trembling, it is normal, and one is afraid and laugh at one...

I: Ah!... you feel that they have laughed at you?

P: Yes because they say ha ha ha... you are afraid that nothing happens... They are still normal (Interview 3, Woman, 25 years old, Honduras)

The emotional reactions of the migrant community when facing disasters in Chile are not necessarily validated by the local population and exposes migrants to additional demands in a situation they do not know how to handle. This situation makes migrants vulnerable because they do not know how to react to these types of events and do not want to manifest fear and other emotions that are not validated.

3.2. Main concerns

The primary concern reported by migrants is they do not have enough information about natural hazards, in particular about earthquakes, despite being aware that earthquakes are common in Chile:

"But we do know that Chile is a pretty shaky place... no? Its geography is... its plates are always in movement and all the time the... the... every day the earth trembles (...) it does a lack a lot of information, especially to... to... to the people that come from outside, that sometimes because of ignorance, not... that is... they do not know..." (Interview 7, Male, 42 years old, Peru)

"We do not know about tsunamis in Chile - we have not seen anything about tsunamis. We have been in Chile for 7 or 8 months, we only know about earthquakes. We have not seen a tsunami, we have only seen earthquakes" (Interview 12, male, 21 years old, USA)

The information that participants claim they need is to know how to react and behave when there is a disaster because according to them they do not know what they have to do. This knowledge would probably contribute to reducing the anxiety and fear generated by the event itself:

"If I get to be affected by an earthquake in the street I do not know what I have to do..." (Confirmation Interview, Woman, Argentina)

"If the sea is going to leave?... since... what can you take then... everything I'm going to take?... Of course, because if the sea comes out... I think it's going to... all of us no and no matter how high we're going to go up, it's going to be... I mean, I do not think that... I would not have, as I can tell you, there would not be... a way to be able... to be able to save me, I think it would be... it would be awful" (Interview 2, Male, 46 years old, Peru)

Some authors have pointed out that information about how to

behave would reduce anxiety, but this may not be sufficient; cognitive and emotional elements and specific strategies to reduce anxiety should be taught, and authorities should ensure that people learn strategies of disaster preparedness [43].

Another major concern expressed by most participants in this study relates to having precise information about the channels that will allow them to reach their relatives and know how they are after a disaster. There is a desire to be close to family during and after disasters:

“What did you need at that time, what would you have liked at the time of the tsunami?... My daughter next door... The only thing I want is my daughter close to me” (Interview 1, female, 58 years old, Italy)

“I always live in fear that this [a disaster] will happen and I will not be with my son” (Interview 8, female, 32 years old, Bolivia)

Other authors have reported the need to be informed about the well-being of their loved ones in the native population as well; in fact, this is a typical concern which occurs to all people who experience a disaster situation [18,52].

Some participants expressed during interviews some lack of knowledge about natural hazards in Chile, and to have more information about these would help them to get used to these events and reduce their fear. This is also seen as necessary if authorities plan to help them to settle and stay in Chile. This findings suggest that not being able to cope with these events effectively appears to be a potential barrier for migrants in their plans to live and stay in Chile.

“You do not know that an earthquake of so many degrees does not happen, but there in my country, an earthquake is six, seven degrees is a disaster... And not here [Chile], because the buildings are made with an appropriate structure for earthquakes” (Interview 3, female, 25 years old, Honduras)

“On television and also because I have many Chilean friends, who go there to my country and told me that there were such problems here and that... I would not be able to get used to, because in Bolivia there is no such thing [earthquakes]” (Interview 8, Woman, 32 years old, Bolivia)

The need to “get used” to this type of event was confirmed by a national expert who works in the national office of emergency management,

“A person that is not used to an earthquake, his reaction is not the same! (...) Bolivia regarding the sea (...) Eee... even the seismicity, the seismicity in Bolivia, is not very often... But Peru, Ecuador, Chile, yes we have... We have the condition, the atmospheric conditions... there are few South American countries with the conformation that Valparaiso has, which is a forest fire that affects the hills, good and what we have seen, but also affects urban forest” (Expert Interview, Chile)

Getting used to these events is not an indication they have entirely lost the fear or anxiety generated by earthquakes and tremors. It is a recognition that these events are frequent in Chile and that they need to learn how to react and have action plans. Within this context, one of the main concerns of the migrant community is to have a close network which can approve or validate their emotional reactions.

“I think that... they are used to phenomena... But we are alarmed! but I feel that for Chileans it is something normal” (Interview 10, woman, 26 years old, Venezuela)

“But I live with a Chilean woman and she... if she does not pay attention! neither feels them [earthquakes] or anything... Nooo ... Ay! if it is shaking... ah! Well... she says it's okay... I'm scared and I say... stop is shaking!... [Chilean friend says] Let's go to sleep! shut up!” (Interview 16, two women, 32 and 22 years old, Venezuela)

3.3. Needs perceived by immigrants

Migrants also stress that they need to observe how the local community reacts and behaves in the face of disasters, and imitate some behaviors. They could learn from them and are open to using this as a strategy.

“They [Chilean] suggested watching what other people are doing; when other people start re-entering buildings then you can too. And the general protocol for us is to start walking home. Because all the students on my program are living in homestays, even if you're out, somewhere at a bar at two in the morning, you have to start walking... assuming that there's no communication, someone from our program will go to each house and check on our wellbeing” (Interview 12, Male, 21 years old, USA)

Regarding the delivery of information, many of the participants highlight the importance of incorporating diverse channels in the delivery of information, as well to provide information in other locations they commonly visit.

“No, that is, from the country where I come from, Bolivia, it is not a seismic zone, it could be said that we did not have how, well when I arrived I did not have any idea of how this earthquake situation could be faced, so well, it would be also useful that... just put the internet... that is, it would be good to talk with strangers from other places, that is, when I went to get my passport they did not tell me it is a seismic zone, take a brochure at least... I had two months, three months here and never happened. Luckily, I was with my partner who is Chilean, and he said it was normal and everything... we live in a safety zone [safety zone for tsunamis]” (Interview 17, male, 29 years old, Bolivia)

The migrants participating in this study perceive that they need to have comprehensible information about disasters, they recognize there are signs, but do not always understand them. The format in which the information is presented and delivered seems to be relevant.

“I would like them to have talks, every two or three months, in the common venues of each neighborhood, explaining to one where he should be guided in case of... an earthquake, in the case of a... of a storm, of a tsunami, I do not know... that is... we all went up to the hill, but suddenly we need more information” (Interview 11, woman, 29 years old, Colombia)

“Yes... evacuation routes, suddenly what you have to do first, step by step, what do I know, tell you, divide it in three steps, and... because the sirens [alerts] start to sound, they say tsunami warning and one gets more nervous, it... collapses, then suddenly by steps, indicate that one... one how you have to follow the steps, to save yourself... Where do you have to be?” (Interview 8, female, 32 years old, Bolivia)

Considering the emotional reactions of the migrant communities in the face of disasters, recognizing their concerns and attending to the needs they manifest, these findings stress the importance of planning and implementing culturally sensitive strategies. These could provide them with the skills and knowledge to be better prepared for these events during their life in Chile.

4. Conclusion and implications

The present work explored responses, behaviors and experiences concerning natural hazards among migrants living in Valparaíso, Chile, and reflects on their emotional reactions, concerns, and needs regarding these events. This reflection could help to understand how to support them to prepare for and to cope with disasters in Chile effectively, with a particular emphasis on earthquakes and tsunamis.

Migrant communities in Chile have emotional reactions that they believe undermine their ability to cope with disasters; this is explained in part by the limited information and knowledge they have on how to address these kinds of events. This phenomenon is even more

significant for migrants because the Chilean population shows no great fear and appears to be used to earthquakes, and does not validate the emotional reactions of migrants. Moreover, if migrants expect to learn from native population, observing an absence of behavioral response among them does not make it possible to learn and imitate their appropriate disaster-related behavior.

Emotions and risk perception associated with these events appear to differ between migrants and natives [62]. Risk perception is the process of interpreting the signals of an event, in this case, disasters, and from that interpretation to determine if there is a risk or not [58]. When people do not have enough information, or they are not sure how to react, they may unwittingly choose courses of action that increase, rather than decrease, the danger they are in, as in the case of the migrant women who described running to the sea during a tsunami threat. This behavior, despite being perceived as useless by the participants in the study, indicates high-risk perception, which could be a great motivator to search for information about what to do in such situations [43]. Paton [43] suggests that authorities should seek community motivations to generate preparedness strategies for disasters since this is a cognitive variable understood as the precursor to adopting protective behaviors.

As the literature points out, risk is a socially constructed phenomenon [30]. In the case of Chile, although the migrant community recognizes their own risk facing a disaster, they appear to be somehow confused about this risk. For example, when there is an earthquake (or tremor) that is not perceived as dangerous by some Chileans, migrants feel confused about how to react. This is a problem not easy to solve; some authors [5] emphasize that the feeling of complacency reduces the motivation to carry out mitigation and preparedness actions, and could affect both the local population as well as migrants. However, at the same time, migrants may maintain a high perception of risk because they do not know how to cope with these events.

Wachinger et al. [58] suggest that a high-risk perception would not necessarily be related to preparedness behavior. They point out that one of the reasons that these phenomena may not be related is that individuals can understand the magnitude of the risk, but they could perceive themselves as having few resources to deal with the situation, and therefore a deficient outcome expectancy [43] results from a feeling of confusion, ignorance or a lack of personal resources or capabilities. In this context, the participants in this study, expressed fear about the possibility of being exposed to disasters in Valparaíso, but they also manifested a lack of information and practical knowledge about how to deal with these events. Benight and Bandura [6] state that self-efficacy, defined as the assessment performed by a person about their effectiveness to face a situation, is relevant to carrying out actions of disaster preparedness, coping and recovery; if a person forms a favorable outcome expectancy then self-efficacy level increases to cope with environmental hazards that are increasingly being referred to as "natural" disasters [43].

Our findings confirm the need for generating strategy information about disasters tailored to the needs of each community or group, which also address their emotional needs for safety and relatedness to their families and communities. Urgent delivery of information is required to teach the immigrant community about how to act, but also about how to manage their emotional reactions to be able to face disaster situations, for example, avoiding behaviors of escape and promoting informed disaster evacuation behaviors.

Wachinger et al. [58] suggest that preparedness strategies should be organized and tested in conjunction with the community, as an essential element for disaster-preparedness behavior that includes being able to trust authorities [9], and as a way to strengthen confidence, generating a close relationship among the community and the authorities. In this way, it could generate a sense of community belonging, which has also been identified by some authors as a relevant contributor to disaster-preparedness [43]. This sense of community belonging could be especially relevant for migrant communities since they are in a new country, and they are creating a new social network [40] and social identities.

This study has some limitations that are important to recognize. One is related to its exploratory nature and the limited number of participants; it is unlikely that these results could represent the entire migrant community inhabiting Valparaíso. However, it is relevant to mention that the majority of participants in this study were from a Latin American country, which matches the profile of immigrants described by the census carried out in Chile in the year 2017 [27]. Participants were also part of the "productive ages group", coinciding with the predominant motivation for migrating to Chile, a social landscape that has been characterized by the predominance of migrants' efforts to secure employment and economic opportunities for their families [11]. Still we do not claim that these results are representative of the entire immigrant population and focus instead on the reason why the concept of *transferability* rather than representation [44] plays a prominent role in qualitative research in referring to results that can be "transferred" to similar populations. Consequently, these findings may transfer to other groups within the wider population of migrants in Valparaíso, while also recognizing and emphasizing the need to conduct future studies that explore their experiences in greater depth.

Finally, our study highlights the relevance of implement within communities around the world, including Chilean, strategies and information delivery actions about disasters preparedness that are adapted and tailored to the emotional and cultural needs of all groups inhabiting a territory [2], in line with the recommendations from the United Nations and the Sendai framework [3]. There are some specific strategies that could be considered by the local authorities in Chile within public policies aimed at the prevention of and mitigation of damage from disasters; recommendations that emerge from this study include the need to develop targeted interventions and the need for teams of researchers to explore better ways to communicate that can address the cultural needs of migrant communities in different contexts:

Strengthen information dissemination strategies around specific measures to cope with disasters [10]. Diversify the channels through which information is shared with and transmitted to the population about how to prepare for and deal with disasters in Chile specifically what to do in the face of high waves and tsunamis. For example, the participants in this study suggested that this information can be delivered in consulates and immigration offices, a measure that is not currently carried out. Consider delivery of information in more than one language (at least in Spanish and English), thereby recognizing and considering the high presence of diverse migrant communities. And, as suggested by our participants, disseminate this information in places that are familiar to them.

Considering that some participants had no legal migration status in Chile at the time of their interview and this is probably experienced more commonly among other members of this community, it is crucial to separate the support provided to those affected by disasters and the migratory status of the population [45]. The authorities should specify, through various communication channels, that the help and support provided for disaster preparedness in Chile is not conditional on their immigration status. In this way, it becomes clear that everybody, regardless of whether or not they have their immigration documents regularized, will be able to access information and support during any disaster.

Strengthen support strategies between the native and the migrant communities. Implement strategies aimed at integrating the local population into the migrant community in preparation actions that involve coping and evacuation actions. According to the participants of this study, Chileans' "wisdom" given by experience, allows them to face the occurrence of disasters with appropriate emotion. In this way, we suggest implementing strategies that encourage the support of the local community towards the foreign migrant community during disasters, as well as, during preparation and evacuation exercises. The migrant experiences we found of not receiving emotional support post-disaster may have implications for a sense of broader social identity (e.g., national civic), and might have an impact on the willingness of migrants to support and help the native population [63]. This possibility warrants further

research because providing appropriate training and disaster communications to migrants may encourage them to help others when a disaster occurs, regardless of whether they are fellow migrants or not.

Some authors have pointed out that maintaining a moderate risk perception could be a motivator to make preparation strategies against disasters [43]. Therefore, the emotional experiences reported by the participants could be used by local authorities to generate strategies with this population that has already been alerted to the potential risks of natural hazards. An important element to take into account is to strengthen the feeling of trust, confidence, self-efficacy, and sense of community [9], which should be incorporated into the management of culturally appropriate disasters preparation strategies for migrants' communities.

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Appendix. Spanish version of quotations reported in the results section

Emotional Experience

"Acá [Valparaíso] tiembla mucho, después de eso... temblaba todos los días y salía corriendo de la casa del padre!... Del segundo piso!... uuuuy... Salía con mi hija para abajo [indica hacia el mar], porque había una venezolana conmigo también, me teníamos mucho miedo... A veces en la madrugada salíamos hasta que el padre (un cura) nos explicó que no hacíamos nada con salir, pero ahora ya... se ha apaciguado un poco el miedo, pero igual todavía me da miedo..." (Entrevista 3, Mujer, 25 años, Honduras)

"Solo sé que cuando estoy con mi hijo tengo que calmarme, porque yo me asusto más que él... Entonces, tengo que calmarme, porque si no lo voy a afectar a él también" (Entrevista 8, Mujer, 32 años, Bolivia)

"Estaba preocupada, yo más estaba preocupada por mi esposo y mi hijo... Yo iba sola... Me iba a ver a mi hermana, entonces yo más estaba preocupada por ellos que por mí, porque yo el carro se estacionó y estaba bien, el drama era ellos que estaban en la casa (...) yo soy muy temerosa... lo que pasa que soy temerosa... yo soy muy miedosa y en realidad el que a mí me tranquiliza es mi esposo, me dice tranquila, él... él es más... más como en este caso... cuando sucede esto, él me dice... Él me dice no... tranquila... si vas a correr para allá, te puede caer cualquier cosa..." (Entrevista 4, Mujer, 27 años, Perú)

"Entonces yo me estaba viniendo y justo empezó a temblar y salí corriendo con mi hija, pero una... la señora me dijo no... no corras, si no va a pasar nada, yo tenía miedo estaba temblando, no me quería irme y no me dejaban bajar del cerro porque decía alerta de tsunami... alerta de tsunami y no me dejaban porque estaba cerca de la aduana... Decían no... toda la gente subía para el cerro y yo bajaba!... Y me peleé con un bombero, le di un combo al bombero, ¿Por qué? él quería que subieras? P: Porque yo... [él] quería que subiera! yo le dije... como tú no me vas a dejar... yo me voy para mi casa! entonces me vine caminado desde allá hasta la casa... Con la niña, llegué como a las nueve y cuando llegué no había nadie en la casa, porque todos se habían ido, yo no sabía..." (Entrevista 3, mujer, 25 años, Honduras)

"Exacto... yo soy la que salgo corriendo... Y la gente ni lo siente" (Entrevista 16, bipersonal, dos mujeres, 32 y 22 años, Venezuela)

"Sí! hay gente que me dice... No! Tranquila... si estás muy suave! Yo igual tengo miedo... Tengo miedo! Pánico! No es miedo... es pánico" (Entrevista de Confirmación, Mujer, argentina)

"Es que este país hay muchos temblores, entonces ya como que la gente dice ya... está temblando, es normal, y uno está con miedo y se ríen de uno... I: Ah!... tú sientes que se han reído de ti? P: Si porque dicen ja... ja... tienes miedo eso no pasa nada... Siguen normal" (Entrevista 3, Mujer, 25 años, Honduras)

Main concerns "Pero sí tenemos conocimiento de que Chile, es un cinturón bastante pues... no? Su geografía es bastante... sus placas siempre están en movimiento y todo el tiempo la... la... todos los días la tierra tiembla (...) hace bastante falta de mucha información, sobre todo a lo... a lo... a las personas que vienen de fuera, que a veces por desconocimiento no... o sea... no saben..." (Entrevista 7, Hombre, 42 años, Perú)

"Si me llega a agarrar un terremoto en la calle no sé lo que hago..." (Entrevista de Confirmación, Mujer, argentina)

"Si se va a salir el mar?... ya que... que puede llevar pues... me llevara con todo lo que voy a llevar?... Claro porque si se sale el mar ya... yo creo que nos va a... a todos no y por más alto que vamos a subir igual va a ser... O sea, creo que para mí no... no habría, como le puedo decir, no habría... una forma de poder... de poder salvarme, yo creo que sería... sería difícil" (Entrevista 2, Hombre, 46 años, Perú)

"I: que necesitaba usted en ese momento, qué le hubiera gustado tener en el momento del tsunami?... P: A mi hija al lado... Lo único que quería mi hija al lado" (Entrevista 1, mujer, 58 años, Italia)

"Siempre vivo temerosa de que pase eso y yo no esté con mi hijo" (Entrevista 8, mujer, 32 años, Bolivia)

"Uno no sabe que un terremoto de tantos grados no pasa nada, pero allá en los países de uno, un terremoto es de seis, siete grados es un desastre... Y acá no, pues los edificios están hechos con estructura para los sismos" (Entrevista 3, mujer, 25 años, Honduras) "Por televisión y también porque tengo muchas amistades chilenas, que van allá a mi país y me contaban que habían ese tipo de problemas acá y que yo no me iba a poder acostumbrar, porque en Bolivia no hay eso" (Entrevista 8, Mujer, 32 años, Bolivia) "Quien no está acostumbrado a un sismo, su reacción no es la misma! (...) Bolivia respecto al mar (...) Eee... incluso la sismicidad, la sismicidad en Bolivia, no es muy recurrente... Pero Perú, Ecuador, Chile, sí tenemos... Tenemos la condición e... mmhm... en condiciones atmosféricas... bueno en sí, después del tema de los tsuna... de los incendios forestales, es otro tema al cual en Argentina no se está acostumbrado, en... en pocos países sudamericanos con la conformación que tiene Valparaíso, que es un incendio forestal que afecta a los cerros, bueno ya lo que hemos visto, pero afecta también urbano forestal" (Entrevista Experto, Chile)

"Yo creo que lo... o sea... están acostumbrados a los fenómenos... Pero... pero si el tema... bueno para nosotros... por ejemplo, es un tema totalmente... enorme, no?... es algo delicado, nosotros nos alarmamos! pero siento que para los chilenos es algo normal" (Entrevista 10, mujer, 26 años, Venezuela)

"Pero yo vivo con una chilena y ella... si no le presta atención! ni los siente ni nada... Nooo... Ay! si tembló... ah! Bueno... Está bien... Yo toda asustada y digo... párense está temblando! ... [La amiga chilena dice] Deje dormir! [La amiga chilena la aconseja] Sí... cállense... acuétese" (Entrevista 16, bipersonal, dos mujeres, 32 y 22 años, Venezuela)

Needs perceived by immigrants

"No, o sea, del país donde vengo, Bolivia, no es una zona sísmica se podría decir así que no teníamos como, bueno cuando llegue yo no tenía nada de idea de cómo se podría afrontar esta situación de terremotos, así que bueno, sería también útil que no se, igual pongan internet... o sea, igual sería bueno hablar con las extranjeras de otros lugares, o sea cuando yo fui a sacar el pasaporte no me dijeron es una zona sísmica, tome este folleto por lo menos... Llevaba como dos meses, tres meses acá y pasó. Por suerte yo estaba con mi pareja que es chilena, y bueno, él me dijo que era normal y todo. Pero vivimos en una zona libre...en Cerro Barón (...) Es puro extranjero y dice que el salió y había gente igual perdida, asustada, gente abrazada del poste y me contaba eso. [I: No saben cómo reaccionar...] No saben cómo reaccionar, sí?" (Entrevista 17, hombre, 29 años, Bolivia)

"A mí me gustaría que hubieran como de pronto charlas, cada dos, tres meses, en las sedes comunes de cada barrio, explicándole a uno hacia dónde debe guiarse en caso de... de un terremoto, en caso de un... de una marejada, de un tsunami, no sé... o sea... todos subimos para el cerro, pero de pronto haber como más información" (Entrevista 11, mujer, 29 años, Colombia)

"Sí... las rutas de evacuación, de repente que es lo que uno tiene que hacer primero, por pasos, qué se yo, por decirle, repartirlo en tres pasos, e... porque empiezan a sonar las...las sirenas, que dicen alerta de tsunami y uno se pone más nervioso, se... se colapsa, entonces de repente por pasos, indicar que uno... uno cómo tiene que seguir los pasos, para salvarse pues... Donde uno tiene que estar?" (Entrevista 8, mujer, 32 años, Bolivia)

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Conflicts of interest

The authors have declared no competing interests.

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