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Title: From Ontological Security Towards Disaster Psychological Recovery: Scale Development and Validation

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Abstract

Background: After the earthquake, communities faced various psychological challenges in safety and security assumptions and experienced ontological insecurity. Considering the role of ontological security and housing reconstruction on long-term psychological trauma recovery, the purpose of the research was based on the development and validation of a standard tool to measure this concept.
Materials and Methods: The research has a mixed method approach. In the qualitative phase, three primary earthquake survivors in Iran (the 1990 Manjil-Rudbar, the 2003 Bam, and 2017 Ezgeleh-Sarpol Zahab earthquakes) participated, and preliminary concepts were defined using grounded theory. In the second phase, the psychometric properties of the ontological security in the housing reconstruction framework were developed and examined through validity and reliability indices. In the quantitative phase, the developed questionnaire surveyed 322 earthquake survivors. Finally, a questionnaire of 48 items was developed.
Results: According to the findings in post-earthquake housing considering factors such as reconstruction flexibility, personalization, place familiarity, safety reassurance, physical-environmental characteristics affecting survivors' protective behavior, coping with physical-environmental concerns, safety perception through participation and interaction, safe refuges in the settlement and reconstruction acceleration would be effective in ontological security feeling and as a result psychological trauma recovery.
Discussion: Achieving ontological security in housing is a cognitive, emotional, and behavioral need which is possible through environmental control, stability, trust, and continuity.
Conclusion: The ontological security tool with a reliability value of 0.941 will be able to measure this factor in post-earthquake housing reconstruction with the lens of psychological recovery of survivors.
Keywords: Housing Quality, Security Measures, Validation Study, Multidimensional Scaling, Earthquakes, psychological recovery.

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1. Introduction

Natural disasters such as earthquakes are life-threatening, and cause property damages. Such experiences have some undesirable consequences, such as psychological trauma and homelessness, and, subsequently, ontological insecurity. [1] Theterm ontological security is conventionally defined as “security of being” [2] or “security not of the body but of the self, and the subjective sense of who one is”. [3] Giddens defines ontological security concept as the trust most humans have in maintaining their identity and the stability of material and social environments. The foundation of ontological security is a sense of confidence in people and things. "Being or phenomenological being in the world. This is an emotional phenomenon rooted in the unconscious" [4]. In the definition of ontological security, four major indicators are defined, which include (1) social and material stability, (2) implementing daily routines, (3) feeling the most control over life because of freedom from surveillance, and (4) building identities [5]. So, ontological security is related to the confident feeling, identity, stable cognitive and emotional frames and also a predictable and steady social and material environment [6,7]. The sense of ontological security enables one to face life's challenges and others from a fundamentally strong perspective [8]. Achieving this sense can be discussed and examined from different perspectives.

In contrast, in the event of a disaster according to Harris (2017), stressful events and damaging feelings of ontological security cause emotional distress and endanger the survivors' long-term mental health [9]. Based on the findings, the degree of disturbance in ontological security is determined by the scope of the threat [10]. In disaster circumstances, Harries (2018) prioritizes ontological security over physiological and safety needs and cites the home as one of the three most important post-disaster protective cocoons [11]. He acknowledges that the feeling of having a safe home is part of ontological security and releases people from existential doubts. It provides the belief that living continues without any threat to familiar assumptions about time, space, identity, and well-being as the way it has always been [11]. Therefore, following stressful situations, home, as an influential factor in ontological security, is an essential source for creating a sense of confident or trust in the perceived insecure world.

Although the researchers have used the concept of ontological security to explore a range of topics, the domain of home and housing dominates this literature. [12] It has proven that, on one hand, ontological security is rooted in mental health [13], and on the other hand, it is related to a sense of place [14] and having home [15]. Accordingly, housing is the central part of routine life and living place [16], home ownership [17,1], interior space design, configuration, and layout [18] Individual independence and resident’s participation in the housing [19] have the potential to improve the mental health of communities and individuals in the framework of home and housing. Through the lens of disaster, the concept of ontological security can be examined from the perspective of Dale and colleague. Dale et al. (2019) have noted the widespread application of this concept in relation to disaster and risk. From their perspective, in the context of hazards and disasters, ontological security usually focuses on themes of home and place.[20] Following the disasters, the home’s destruction as the primary source of shelter for the body is interpreted as the “symbolic end of the world” in the subconscious [21]. So, survivors not only want to be secure from future natural disasters, but they also need to feel security. [22] Thus, this feeling is a natural and deep survivor psychological need, especially in communities with different traumatic experiences and a high level of lack of environmental uncontrollability, discontinuity of life, routines, and existential threat. The nature of responsive housing for mental health in the frame of ontological security is a new approach with various dimensions and has been less addressed.

Researchers have described ontological security theory as difficult to define and even more difficult to operationalize. [23] The conceptualization of ontological security also often seems inherently conservative. [20] For this reason, despite growing evidence of ontological security

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importance in disaster studies [11,8], there needs to be a clearer understanding of approaches to create or restore this feeling in post-disaster reconstruction. In research about natural disasters, the concept of ontological security is often used to study how to predict the impact of vulnerability on challenging people's knowledge about their physical environment. [24] Accordingly, the nature of responsive housing and the emotional and behavioral reasons that affect environmental biases are still unknown. In addition, it has been proven that survivors' reactions to different types of disasters are different from the perspective of ontological security and emotional and behavioral responses. [25] As a result the research purpose is conceptualizing a reconstructed ontological security within the framework of housing reconstruction after earthquake. In the line with this purpose, first, the research attempts to clarify the dimensions of ontological security in an earthquake setting. In order to achieve this, major earthquakes in Iran, including the 1990 Manjil-Rudbar, the 2003 Bam, and the 2017 Ezgeleh-Sarpol Zahab earthquakes, are studied. Second, in determining an approach to housing reconstruction that can provide a secure base for earthquake-affected individuals and communities as a source of desirable and sustainable places [26] survivors' insights were investigated. This approach in housing reconstruction can be practical for affected communities to leave their past behind and go to the next stage of life to rebuild or improve their sense of identity [13]. The research finding leads to development and determining the psychometric properties of a scale for measuring the sense of ontological security in housing as a healing space after earthquake.

2. Material and methods

Scales express latent structures that measure hypothetical behaviours and attitudes and provide a theoretical understanding of categories and concepts that are not directly measurable [27,28]. With such tools, the momentum behind measuring and improving an issue can continue due to a lack of clarity on what constitutes and how best to target focused intervention efforts [29]. This research uses a mixed method approach with a survey method to recognize the nature of ontological security post-earthquake housing reconstruction. Developing the scale within the proposed framework by O. Boateng et al. [30] has been performed. The research design process is described in Fig 1.

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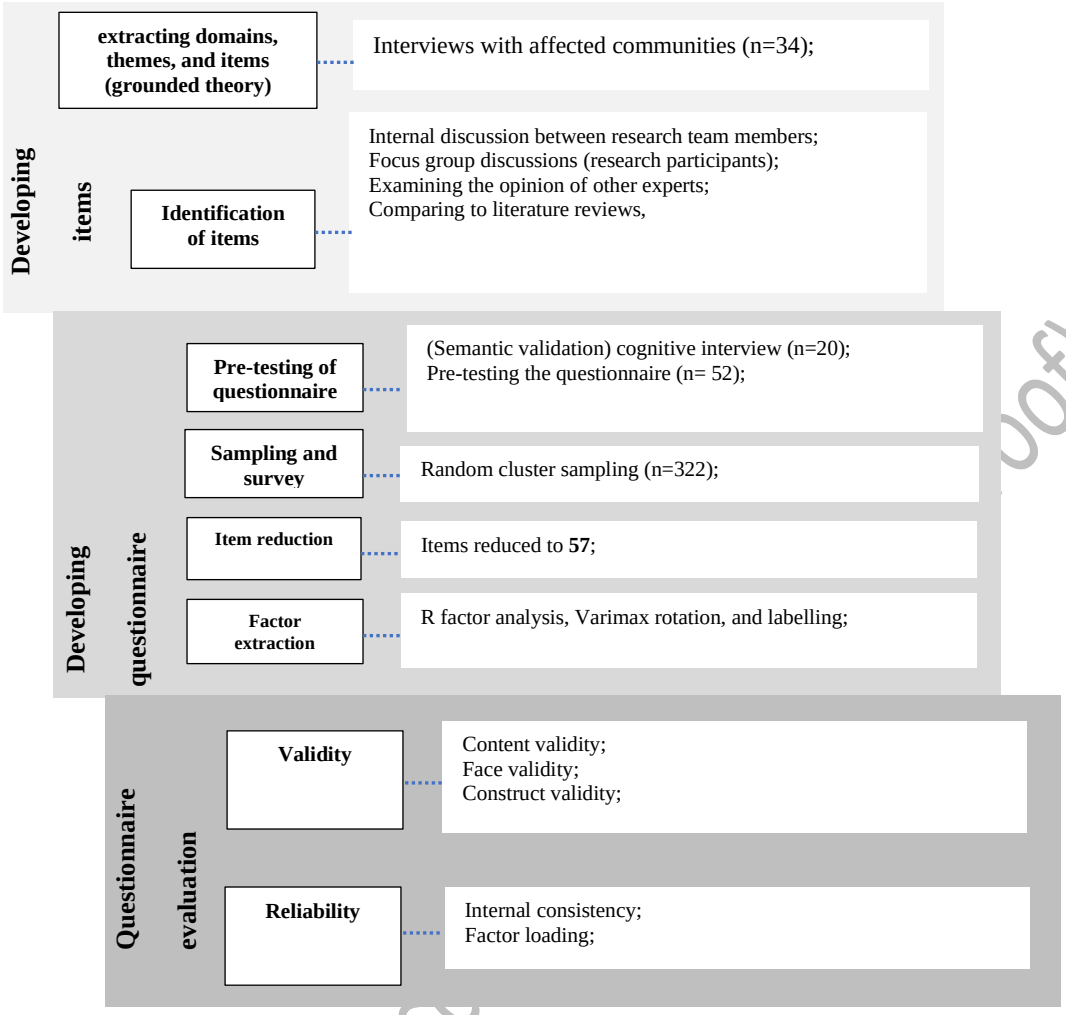

Figure 1. The process of questionnaire development and validation (authors)

2.1 Developing items: Developing or constructing a scale is collecting or writing the most appropriate items that make up the test questions [31] for the target population. Thus, using multiple items to measure latent structure can reduce measurement error and lead to more accurate findings [30]. In this study, the initial research concepts and themes were collected using the knowledge and latent experiences of the earthquake survivors. The extraction and design of the items and phrases of the initial questionnaire consisted of three steps: a) adopting the grounded theory (qualitative research and extracting appropriate phrases through content analysis technique); b) conducting desk study and extracting the phrases; and c) developing the initial questionnaire. The interviews were conducted in the form of a semi-structured questionnaire. In collecting data, in-depth interviews were conducted using purposive sampling with 34 of the 1990 Manjil-Rudbar, the 2003 Bam, and the 2017 Ezgele-Sarpozahab earthquake survivors (Table 1). The inclusion criteria were earthquake experience and willingness to participate in the study. In addition, a focus group discussion was held to measure the accuracy of extracted themes and concepts. The grounded theory obtained 96 concepts, 29 main concepts, nine themes, and one primary domain (Table 2).

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Table 1: The participants' socio-demographic status who attended the interview (authors)

		Participants (n=34)			
		Age	Gender	Education level	Socio-economic status
Major earthquakes in Iran	The 1990 Manjil-rudbar	45-75	F: 6 M: 4	Undergraduate:8 Graduate:2 Postgraduate:0	Middle-High:3 Poor- low:7
	The 2003 Bam	30-68	F: 8 M:6	Undergraduate:5 Graduate:7 Postgraduate:2	Middle- High:7 Poor- low:7
	The 2017 Ezgele-Sarpozahab	18-71	F: 5 M: 5	Undergraduate:6 Graduate:3 Postgraduate:1	Middle- High:6 Poor- low:4

The credibility of data was assured through peer checking and member checking. The findings were reviewed separately among the research team members through several discussions. Member checks occurred by summarizing the analyzed interviews and extracting codes from participants so the research team could be asked to incorporate their feedback and ideas for corrections.

2.2 Developing questionnaire: The initial questionnaire was based on a 5-point Likert scale: strongly agree, agree, neutral, disagree, and strongly disagree. This section considers three concepts of content, face, and construct validity to investigate the questionnaire's validity.

Table 2: Themes and concepts derived from grounded theory (authors)

Main domain			
Ontological security			
Primarily themes and concepts			
Personalization	▪ Housing design, construction process and policies personalization; ▪ Adaptable housing for users' individual and collective characteristics and norms; ▪ Housing personalization alternatives for identity continuity;	**Emergency escaping routes**	▪ Designing various open spaces; ▪ Low-rise building; ▪ Legibility and deletion obstacles in the escaping routes; ▪ Avoiding heavy and dangerous features in the escaping routs; ▪ Safe refuges toward inside and outside open spaces;
Safety perception	▪ Reconstruction monitoring by responsible individual and organizations; ▪ Awareness and training of survivors about housing security and safety; ▪ Participation and interaction of survivors	**Overcoming environmental-physical concerns**	▪ Safe housing location/far from the most affected neighborhoods; ▪ Addressing concerns related to home safety against future disasters;

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	with involved organizations in housing reconstruction;		▪ Avoiding some housing architectural elements and form; ▪ Attention to the role of architectural elements dimensions in possible future damages;
Housing flexibility/adaptability	▪ Reviving spatial-physical familiarity; ▪ Adaptable housing for different family structures and cultures; ▪ Construction process and policy flexibility;	**Place attachment**	▪ Place-based continuity; ▪ Housing reconstruction satisfaction; ▪ Greening reactions to crisis in housing yard and courts;
environmental distress (Solastalgia)	▪ Rupture from the past place and identity; ▪ Unpleasant changes;	**Reconstruction acceleration**	▪ Continuation and revitalization of material and livelihood resources; ▪ Participation and interaction with survivors; ▪ Uncomfortable post-disaster temporary shelters;
Human dignity	▪ Avoidance of certain cultural and gender biases; ▪ Proportion of assistance in housing reconstruction with the households' economic structure; ▪ justice in reconstruction policies;		

2.2.1 Content validity: Content validation plays a primary role in the development of any new instrument and provides evidence about the validity of an instrument by assessing the degree to which the instrument measures the targeted construct [32]. Lawshe's method was adopted for content validity analysis by calculating the Content Validity Ratio (CVR). According to Lawshe, the minimum acceptable CVR is 0.78. The questionnaire items were evaluated by a group of eight experts in housing architecture and environmental psychology. The items were rated as essential, functional, or unnecessary [33]. The revised binomial probability distribution for Lawshe's critical values was applied to excluded items deemed unnecessary. A scale content validity index was calculated for each theme. (Table 3)

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Table 3: The content validity of themes used in the questionnaire (authors)

Themes	CVR%
Personalization	0.79
Safety perception	0.96
Emergency escaping routes	0.93
Overcoming environmental-physical concerns	0.86
Housing flexibility/adaptability	0.83
Place attachment	0.94
Reducing environmental distress (Solastalgia)	0.80
Reconstruction acceleration	0.91
Human dignity	0.97

2.2.2 *Facevalidity*: To assess the understanding of the items based on the vocabulary of the respondents, 20 earthquake survivors evaluated the questionnaire items in the form of cognitive interviews as to whether they were able to understand the meaning and purpose of the questions correctly; the questions were relevant to the field of research; and finally, the scale length was appropriate. After reading the questionnaire, the participants answered the above questions and submitted their answers to the questionnaire in written form. In this phase, it was initially found that most respondents tended to be in the neutral range. So, this option was dropped, and the Likert scale was reduced to four. Secondly, the readability of some items was corrected based on common words. Qualitative face validity was determined by a panel including four architects and four environmental psychologists. These specialists evaluated the difficulty, inappropriateness, and ambiguity of the phrases. Their comments were used in the questionnaire. After the questionnaire was completed by the target group (20 participants and 8 experts), the face validity of the item was calculated using the impact score equation. [34] The impact scores equal to or greater than 1.5 are considered appropriate.

2.2.3 *Construct validity:* The final questionnaire was completed through random cluster sampling by 322 respondents from earthquake survivors. This phase was necessary to assess the construct validity and determine if the items represent their underlying conceptual structure well and measure it [35]. Construct validity was determined by the Kaiser-Meyer-Olkin (KMO). The obtained KMO value was 0.938. (Table 4)

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Table 4: KMO and Bartlett's test (authors)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.938
Bartlett's Test of Sphericity	Approx. Chi-Square	18585.490
	df	3570
	Sig.	.000

2.3 Questionnaire reliability

The reliability of the questionnaire was assessed using internal consistency and factor loading. Internal consistency: Cronbach's alpha coefficients > 0.7 represented acceptable reliability. The questionnaire was administered as a pre-test to assess the reliability. The participants in this section were 52 earthquake-affected survivors. Omitting three questions obtained a reliability value of 0.941.

2.3.1 *Factor loading:* Factor analysis was also used to examine the interrelationships of the set of variables, and item reliability was calculated using factor loading. (Table 5) The obtained volume ≥ 0.5 indicates that the Variance between the structure and its indices exceeds its measuring error variance. In addition, Kendall's W was used to assess agreement among participants, particularly reliability. It ranges from 0 (no agreement) to 1 (complete agreement). (Table 5)

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Table 5: Calculating Kendall's W (authors)

Items	Mean	Kendall's W	Items	Mean	Kendall's W
1	292.1731	.941	49	292.2500	.941
2	291.9615	.941	50	292.2885	.940
3	292.0192	.941	51	292.2500	.941
4	291.8077	.942	52	292.5769	.940
5	292.1731	.942	53	292.6731	.941
6	292.2500	.941	54	292.5577	.941
7	291.9615	.940	55	292.3846	.940
8	292.3846	.941	56	291.9808	.941
9	292.3269	.941	57	292.1154	.940
10	292.4231	.941	58	292.0577	.940
11	291.9615	.941	59	292.3462	.942
12	292.1731	.941	60	292.1154	.940
13	291.7308	.941	61	291.8846	.941
14	292.3846	.940	62	291.7308	.940
15	291.8077	.940	63	291.8462	.940
16	292.3269	.940	64	291.8846	.940
17	293.0192	.941	65	291.8846	.940
18	292.8654	.941	66	291.9808	.941
19	292.4423	.941	67	292.4615	.941
20	292.0769	.940	68	292.1923	.941
21	291.8654	.940	69	292.4808	.941
22	292.3269	.941	70	292.2885	.941
23	292.0192	.941	71	292.2115	.940
24	291.9808	.940	72	292.4808	.941
25	292.3077	.941	73	292.2885	.941
26	292.5577	.941	74	292.2115	.940
27	292.4038	.941	75	292.1538	.941
28	291.8077	.941	76	292.3462	.941
29	291.8654	.941	77	292.4423	.941
30	291.8462	.940	78	292.0577	.940
31	291.8269	.940	79	291.9231	.942
32	291.8462	.940	80	291.7115	.940
33	291.9231	.941	81	291.9231	.940
34	291.9423	.940	82	292.2500	.941
35	292.5385	.941	83	291.8654	.940
36	292.4038	.941	84	292.1731	.940
37	292.4808	.940	85	292.0385	.941
38	292.0192	.940	86	292.1923	.941
39	292.1731	.940	87	292.0192	.941
40	292.0577	.940	88	291.9231	.941
41	292.0577	.940	89	291.8269	.941
42	292.3269	.941	90	291.5962	.941
43	292.4038	.940	91	291.7308	.941
44	292.0962	.941	92	292.5000	.940
45	292.1731	.940	93	292.2500	.941
46	292.5769	.941	94	292.0000	.941
47	292.4615	.941	95	292.0962	.941
48	292.2308	.940	96	291.8269	.941

3. Results

3.1 Determining the value of effective factors: eigenvalue indices, the ratio of Variance explained by each factor. Nine main factors with a specific value higher than one were obtained (Table 6).

Table 6: Total Variance for extracted factors (authors)

Factors	Items	Rotation Sums of Squared Loadings		
		Total	% of Variance	Cumulative %
Personalization	▪ Changing the housing functional spaces according to the household characteristics; ▪ Changing and controlling the housing interior design according to the resident's culture and identity; ▪ Personalizing the reconstructed housing based on social and individual norms; ▪ Supervision of households on housing construction; ▪ Survivors participation in the building process; ▪ Consultation and interaction with survivors in the housing design process; ▪ The possibility of creating the expected spatial privacy and boundaries in the housing; ▪ Adaptable housing according to resident's lifestyle; ▪ Flexible reconstruction process for victims' decision-making;	7.013	8.251	18.222
Reconstruction progress acceleration	▪ Unpleasant social circumstances in the camps and temporary accommodation; ▪ Trusting the responsible organizations and officials; ▪ The poor sanitary conditions in the camps and temporary shelters; ▪ Proximity to friends and relatives during temporary accommodation; ▪ Facilitating interaction with the involved teams and officials in the reconstruction; ▪ Land ownership;	4.332	5.096	23.318
physical-environmental characteristics affecting survivors' protective behaviour	▪ Household participation in the process of housing designing and building; ▪ Avoiding stairs in the design of escape routes; ▪ Earthquake-resistant doors and windows; ▪ Avoiding masonry houses because of previous traumatic experiences; ▪ Avoiding low height walls in the living spaces and heavy roofs in housing design; ▪ Avoiding high-rise houses because of escaping difficulties; ▪ Considering the roof form in the safety perception;	4.108	4.833	28.151

Place familiarity	▪ The housing interior design relationship to the residents' culture and identity; ▪ Continuation of the past valuable housing architecture; ▪ Considering the household orders in housing reconstruction policies, ▪ Using familiar materials, colours, and forms; ▪ Considering the role of the natural landscape in housing yards; ▪ Land ownership and stable living place;	4.022	4.732	32.883
Safety reassurance in housing	▪ The earthquake-resistance and high quality housing materials; ▪ The structural earthquake-resistance; ▪ Training survivors about the changes that reduce the safety and strength of housing; ▪ The responsible organizations continuous monitoring on the implementation of regulations and building codes in the construction process;	3.974	4.675	37.558
Coping with physical-environmental concerns	▪ Ensuring the earthquake-resistance of rooms and other spaces; ▪ Using light materials in the roof and walls; ▪ Using high-quality construction materials; ▪ Considering the safe height of interior walls, ▪ The doors and windows forms and safe dimensions;	3.575	4.206	41.764
Safety perception through participation and interaction	▪ Satisfaction with the safety and strength of the housing with the survivors' supervision during the reconstruction process; ▪ Ensuring housing safety by survivors monitoring the housing and interior spaces construction; ▪ Interaction and consultation with victims in the housing design process;	3.315	3.900	45.664
Reconstruction flexibility	▪ The housing interior design controlling; ▪ The flexibility of housing spaces layout and plan; ▪ The housing functional spaces flexibility; ▪ The possibility of making desired changes in the house yard and green spaces;	3.273	3.850	49.514
Safe refuges in the settlement	▪ Wide openings toward open spaces; ▪ Quick access to the yard; ▪ Possible escaping to the open space or yard; ▪ Adjacent wide and open alleys and streets;	3.025	3.558	53.073

3.2 Standardizing the scale: To standardize the scale, descriptive statistics (maximum, mean, and minimum) plus skewness and kurtosis of the raw scores obtained for the nine main factors within the range of 1 and -1 were used, with the results showing normal data distribution. Table 7 presents the results of calculating the scale's reliability separately for each factor. According to the table, all factors have had a normal distribution.

Table 7: Descriptive statistics of extracted factors (authors)

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Personalization	322	38.1273	5.42803	-.439	.136	-.9954	.271
Reconstruction acceleration	322	28.3602	3.59223	-.727	.136	-.103	.271
Physical-environmental characteristics affecting protective behavior	322	24.6863	3.05062	-.978	.136	.9946	.271
Place familiarity	322	27.6460	3.67768	-.586	.136	.008	.271
Safety reassurance in housing	322	21.5031	2.67357	-.737	.136	-.372	.271
Coping with physical-environmental concerns	322	20.6366	2.87133	-.608	.136	.250	.271
Safety perception through participation and interaction	322	13.2795	2.37645	-.706	.136	.103	.271
Reconstruction flexibility	322	13.9720	2.13905	-.805	.136	.447	.271
Safe refuges in the settlement	322	16.9876	2.45581	-.412	.136	-.855	.271
Valid N (listwise)	322						

4. Discussion

For the survivors, the earthquake is an existential experience that creates a gap between the past and the future. For this reason, how people overcome this experience is important, and they gain a sense of continuity and trust in their usual living environment. [35] Individuals and communities will have emotional, cognitive, or behavioral reactions in the face of disruption or reduction in the sense of ontological security. [25]

4.1 Sense of control and familiarity: Cognitively, loss of control [36] is one of these consequences. Based on the findings, two factors, including **flexible** housing and personalization in housing reconstruction, have been identified as factors affecting the sense of control. The post-earthquake housing reconstruction literature has acknowledged the need for long-term, flexible permanent housing to meet the needs and expectations of psychologically affected people [37]. In addition, in the relief process with the permanent housing reconstruction, the stakeholders need to be able to modify and adapt their homes [38]. Also, as Yang and Hui acknowledge, the reconstructed houses must meet traumatized people's different and unique needs and avoid creating new problems for families. [39] Therefore, environmental affordances in order to adjust to cognitive biases are one of the fundamental needs. Flexibility is a prerequisite for functions such as personalization and, as a result, place familiarity in housing reconstruction. **Personalization** in housing reconstruction after disasters triggered by natural hazards has explicitly addressed the importance of designing a welcoming and familiar environment through housing and space control [40]. Its importance has been seen in all stages of resettlement after the disaster [41,42]. The possibility of personalization will help the emergence of lifestyles, identities, desires, and individual norms and will encourage survivors to participate in reconstruction.

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One of the results of housing personalization is the revival of lost familiarity after disaster and destruction. Place **familiarity** acts as the initial stage of the process of connecting a place. It is "the ability to describe or even present an image of a place based on mental images, memories, and perception of the place dimensions, physical characteristics, and experiences" [43]. This concept provides the ability to create a sense of security about the place in the person [43]. Revival of place familiarity helps to perpetuate values, culture, attachments, and place ownership. Housing flexibility, personalization, and place familiarity contribute to the continuity of individual, collective, and environmental identity. These factors cause control over the housing and living environment and will ultimately help improve or create a sense of ontological security. This finding is valid on the findings of Hawkins and Maurer (2011). According to their research, in response to the physical and psychological loss of home after Hurricane Katrina and the experience of ontological insecurity, survivors will experience nostalgia and a sense of tangible and intangible loss of places that previously provided them with a sense of security and stability. [44] Following that, people in post-earthquake places and communities are trying to restore ontological security by reviving place familiarity and place attachment.

4.2 Restoring trust and confident through a sense of safety and security: The next category of influential factors in housing reconstruction focusing on ontological security is related to the perceived threat. With the loss of ontological security after the earthquake, people experience psychological reactions such as fear, anxiety, stress [45] and cognitive uncertainty [46], and an increase in the prevalence of death-related thoughts [47]. In order to regain a sense of continuity, the disaster survivors must find trust in the environment. [35] For this reason, restoring ontological security, as a mental sense of existential security, can redirect the risk perception. [24] As a result, one of the vital needs in the housing reconstruction is a sense of confidence and reassurance in the living environment. The factors arising from this need have appeared more prominently than others. In housing reconstruction, this need has been highlighted in concepts such as **Safety reassurance** and safety perception. Safety reassurance in housing is a quality in the place reconstruction that people feel the probability of disaster reoccurrence is reduced due to the actions taken, or if a disaster occurs again, they can better respond to it and overcome the possible problems [49]. This factor will be possible in housing through reassurance to housing materials and forms, architectural elements, structural earthquake resistance, survivors' training, and supervision of involved organizations in the construction process. Another psychological-cognitive need is **safety perception through the participation of survivors and effective interaction** with them. Safety perception includes knowledge about safety and risks related to hazards, prevention techniques, and safety culture in practice [50]. In the meantime, it has been proven that the participation of victims in the planning, design, and construction of housing after the disaster and training during the reconstruction will be effective in the assumption of safety perception [51]. Facilitating interaction with relevant people and organizations in reconstruction leads to satisfaction and reassurance.

Wakefield and Elliott (2000) state that people will have "action-focused" reactions to ontological insecurity. These reactions are practical, and strategies focused on them will include radical reactions in response to risk factors and individual actions. [52] The action-focused responses in housing reconstruction that can help restore confidence in housing and living environment are the existence of **safe refuges** and **physical-environmental characteristics affecting protective behavior**. When a person faces disasters triggered by natural hazards or circumstances, reminding them, as well as the perception and assessment of disaster risks, act as a precondition for a behavior such as emergency escaping or any other protective behavior. So, the more highly negative the earthquake consequences are on the residents' perception and sensitivity to risk, the more it is possible to choose a

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strategy to escape from buildings to prevent further damage [53]. Also, as a protective behavior, they think of solutions in their housing to reduce damage in future earthquakes. So, the type of structure and characteristics of buildings are known to be effective in protective behaviors [53]. From this point of view, fears arising from earthquakes play an essential role. Therefore, safe housing against earthquakes, safe roofs made of light materials, and spatial enclosures will effectively overcome these fears. As a result, considering such characteristics in the built environment helps to **cope with the physical-environmental concerns** arising from the earthquake. This psychological mechanism contributes to a sense of ontological security.

4.3 Stablishing the stability of the material and social environments: Another psycho-environmental need of earthquake survivors to achieve ontological security in housing is the stability of the material and social environments. **Reconstruction acceleration** is another factor that can affect stability by accelerating to have a living routine and home. After disasters triggered by natural hazards such as earthquakes, time is one of the influential factors that play a prominent role in the final results of recovery and reconstruction achievements. In this factor, environmental factors in temporary housing and human-social factors related to similar communities involved in reconstruction will be effective. It should be noted that ontological security in a traumatized condition can lead to severe coping mechanisms [8]. In addition, this factor contributes to individuals' sense of existential safety [54] resulting from the risk perception, which is represented and revived through wider concepts such as "home" [9], reviving life routines [53], as well as control and stabilization [13] to improve mental health and help feel self-support and recovery.

The above study has enhanced understanding of ontological security in housing after earthquake; however, the identified limitations indicate a need for further empirical research in this area. First, since the research was cross-sectional, a multi-case study approach was chosen to increase the reliability of the findings. As a result, the research did not consider any cultural perspectives while interpreting the data. Longitudinal research using ethnographic methods in a specific cultural context allows for a more comprehensive exploration of individuals' life histories and the concept of ontological security in post-disaster housing. Second, the role of gender in the responses was not considered in data collection. As a result, the final findings are more general than gender-based perspectives. Considering this issue, could have provided additional avenues for understanding the gender-based responses. Third, because in all earthquakes studied, survivors used government loans and assistance to rebuild their homes, there is a possibility of some bias in the responses.

5. Conclusion

In the reconstruction, nine main factors will be influential and load to measure and ensure ontological security in housing reconstruction after the earthquake. It seems that factors including;

- Physical-environmental characteristics affecting protective behavior;
- Safety reassurance;
- Coping with physical-environmental concerns caused by the earthquake;
- Safety perception through participation and interaction and;
- Safe refuges in the settlement can facilitate protective behaviors

are important in facing risk perception, fears, anxiety and shattered assumptions related to earthquake experiences. As a result, the feeling of safety and security disrupted during the disaster can be restored, and help survivors recover and heal. In addition, factors such as:

- Reconstruction flexibility;

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- Personalization;

Providing control over the living space can reduce learned helplessness, which is one of the main psychological consequences of the earthquake psychological trauma. These factors can induce the self-efficacy feeling that is one of the primary psychological recovery. Also,

- Place familiarity; and
- Reconstruction progress acceleration;

help the continuity and stability of the survivors whose earthquake has disrupted their lives and identity.

This scale will have both research and programmatic utility and be useful for researchers interested in housing reconstruction. In addition, it can be adopted in various affected communities to understand how to create or improve ontological security as an important factor in earthquake psychological trauma recovery. For future studies in this field, it is recommended to adjust this scale to other types of disasters. In addition, longitudinal research in a specific cultural context would also have the potential to expand this scale.

6. Ethical considerations

6.1 Authorship and Acknowledgements: the manuscript have been read and approved by all authors and they agree to the submission of the manuscript to the Journal. All authors have been accredited as appropriate upon submission of the manuscript, all the authors have, 1) substantial contributions to conception and design of, or acquisition of data or analysis and interpretation of data, 2) drafting the article or revising it critically for important intellectual content and 3) final approval of the version to be published.

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6.2 Compliance with ethical guidelines: The present study was conducted based on the principles of research ethics. In the qualitative part of data collection, all participants verbally gave their consent to participate in the research. All interviews were conducted under the supervision of a trauma psychologist. Participants were free to leave the research process at any time. They were also informed that all their identity and personal information would be kept confidential.

6.3 Conflict of Interest and Source of Funding: the authors declare no conflict of interest. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

6.4 Appeal of Decision: The decision on a paper is final and cannot be appealed.

6.5 Permissions: The authors confirm that no previously published illustration were used in this article.

6.6 Plagiarism: The authors are aware of the consequences of plagiarism and pledge that this article is written based on principles focused on non-plagiarism.

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