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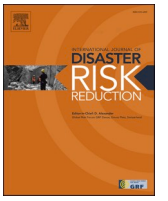

Life satisfaction during temporary housing after an earthquake: Comparing three cases in Italy

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ABSTRACT

A disaster has a considerable impact on people who have lost their homes. We analyzed the life satisfaction of displaced people accommodated in temporary housing after three strong earthquakes that occurred in Italy in 2009 (Abruzzo), 2012 (Emilia), and 2016–17 (Central Italy). Information was obtained through an anonymous survey on a large number of variables related to socio-demographic features, temporary housing type and quality, social support and protection network, personal psychological resources and preparedness, and psychophysical health. Responses were collected through face-to-face and telephone interviews, stand-alone paper-and-pencil questionnaires, or online (N = 261). In the whole-sample analysis, the significant predictors of life satisfaction were earthquake preparedness, which earthquake out of three was experienced, protection network, accommodation type and quality, and general health status, thus highlighting the complex and multi-faceted nature of the underpinnings of life satisfaction in people displaced after an earthquake. However, different predictors explained life satisfaction in the analysis of each earthquake, pointing to the need to consider their specificity and the local context. Nevertheless, the perceived quality of the accommodation was a significant predictor both in the whole-sample analysis and in the analysis of two earthquakes (2009 Abruzzo and 2012 Emilia), highlighting the importance of providing temporary houses with appropriate properties (privacy, space, thermal and acoustic insulation, light, quality of materials, surroundings) and placed in locations that allow the resumption of life activities (e.g., education, work, socialization, health and public facilities and services).

1. Introduction

The occurrence of a disaster of civil protection interest, whether of natural or anthropogenic origin, has an immediate, massive impact on the population affected, firstly in terms of victims and injuries, and secondly in terms of people who have lost their homes and have to be accommodated in temporary housing. The present study aims to contribute to the understanding of factors that predict life satisfaction during the temporary housing stay following a natural disaster, which can inform post-disaster interventions and

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policies.

Long-term stays in temporary accommodations are often accompanied by discomfort and adverse effects [1–4]. People in temporary accommodations may experience distress, which can result in lower levels of life satisfaction, and this effect may persist over time. The distress may stem from the temporary nature of their housing situation, which may make it difficult for individuals and families to plan for the future, re-establish life routines, and resume existing social connections or establish new ones. Moreover, the quality of the temporary accommodation may not be adequate in relation to the aspects supporting well-being, such as light, density, space, thermal and acoustic insulation, placement, and so on. The lack of stability, predictability, and quality in temporary housing may lead to ongoing stress and negative emotions that can contribute to a lower life satisfaction. Addressing the living conditions and quality of temporary accommodation is, therefore, crucial to mitigate these negative impacts. By identifying the specific factors that contribute to the discomfort and suffering of people living in temporary accommodation after a disaster and designing targeted interventions to address them, it could be possible to improve the quality of life and well-being of the affected population.

1.1. Rationale of the study

The present study strives to contribute to the understanding of factors that predict life satisfaction during temporary housing following a natural disaster. We aim to identify these critical factors in order to prevent or mitigate the discomfort and suffering of people living in temporary accommodation and, by doing so, to contribute to the development of effective disaster risk management strategies that address the needs of affected populations in a comprehensive and timely manner. A thorough understanding of the more significant factors (including technical, social, and psychological ones) can help identify specific criticalities and assess their solvability. It is known that, in a disaster risk management cycle (including, e.g., prevention, preparedness, emergency management, and emergency overcoming), critical issues requiring longer-term solutions may need to be addressed in the prevention phase to increase the population's resilience to disasters, even if they become evident during the emergency management phase. We, therefore, recognize the importance of considering a variety of variables and their temporal sequence in predicting life satisfaction during temporary housing.

Interventions and strategies aimed at preventing or mitigating the discomfort related to the temporary accommodation should be tailored to the specific needs of the affected population. For example, along with factors such as the size and intensity of the disaster event, the location and extent of the affected area, the availability and quality of the infrastructure and resources, also the specific characteristics and needs of the affected population should be considered when planning interventions. Indeed, the factors that contribute to the discomfort and suffering of people living in temporary accommodation may vary depending on the specific circumstances of the disaster. This requires a comprehensive and nuanced understanding of the specific challenges and criticalities that arise in the aftermath of each disaster, which can be informed by empirical research.

The present study is based on the experience of the population displaced in temporary accommodation after three earthquakes in Italy. The proposed approach stands out as a strength in the literature since few studies have explored a comprehensive and diverse set of predictors of displaced individuals' quality of life after earthquakes like the one we examined. Indeed, the study includes several variables of different types, such as socio-demographic, personal, structural, social, and health-related ones, which have not been previously considered at the same time in displaced people in other studies on earthquakes. The present study also acknowledges that the specific earthquake experienced may modulate the relevance of the diverse predictors of life satisfaction and aims to compare the predictors of life satisfaction in the three different case studies.

1.2. Objectives of the study

The present study has two main objectives. First, it aims to identify which variables predict life satisfaction during the stay in temporary housing following an earthquake. Second, it aims to compare the predictors of life satisfaction in three different case studies in Italy in order to understand if these variables are always the same or if they change case by case. To address these aims, four groups of variables associated with the time periods before, during, and after each earthquake were considered. Pre-existing variables or individual differences were present before the event, while earthquake consequences refer to the aftermath of the disaster. The temporary housing solutions represent the situation after the disaster, while the emotional and physical well-being variables measure the emotional consequences of such a temporary housing situation. Using a sequential set of variables is important for several reasons. First, it allows taking into account in a principled manner the complex relationships between various factors that predict individuals' satisfaction with life during temporary housing. Secondly, it provides a comprehensive understanding of the relevant predictors associated with the different stages of recovery after a disaster, which can inform policies and interventions aimed at supporting affected individuals. Finally, it helps to identify which factors are most relevant for improving emotional and physical well-being during temporary housing, which can guide the development of targeted interventions and support services for disaster-affected communities.

1.2.1. Variables related to pre-existing and individual differences

Several variables related to pre-existing and individual differences are important in determining life satisfaction during temporary housing because they are likely to influence how individuals cope with the challenges of living in a temporary home after an earthquake. Among these, we examined earthquake risk perception and preparedness, place attachment, general health status, resilience capability, and psychological vulnerability.

Individuals who have higher levels of earthquake risk awareness and earthquake preparedness may feel more in control and better equipped to handle the situation, leading to higher satisfaction with their temporary housing situation [5]. For example, disaster preparedness had a positive effect on individuals' happiness, life satisfaction, and the general health of households in the hardest-hit

areas of the Wenchuan and Lushan earthquakes [6]. Disaster risk perception was also found to mediate the relationship between disaster preparedness and general health, highlighting the importance of improving people's disaster preparedness behaviors and risk perception to enhance their quality of life [6]. A disaster preparedness intervention was found to decrease depression- and PTSD-related symptoms (PTSD: Post-Traumatic Stress Disorder [7]) and increase social cohesion in two earthquake-affected communities in Nepal, demonstrating that disaster preparedness can improve mental health, social cohesion, and overall community resilience in disaster-prone areas [8].

Individuals who hold a strong attachment to their previous home and community may struggle with adapting to their temporary housing, leading to lower satisfaction. Research has shown that, in crisis conditions, place attachment can cause strain, particularly among those whose livelihoods and resources are threatened, making people more vulnerable to stress and affective disruptions. For example, in the aftermath of the Deepwater Horizon drilling and oil spill disaster, which affected coastal Louisiana communities, community attachment was associated with higher levels of negative affect among households involved in the fishing, seafood, and oil industries [9]. However, other studies show a beneficial effect of place attachment on community resilience. A sense of place was a key factor in promoting individual resilience and supporting community resilience in a flood-impacted rural Australian town, but a negative relationship between a sense of place and the desire to relocate from the community was also found [10].

General health status, resilience capability, and psychological vulnerability may also affect how individuals cope with the stress of the earthquake and displacement and, consequently, their satisfaction with temporary housing. Life satisfaction and health-related quality of life are strongly interrelated in the general adult population [11], showing that individuals with the lowest level of life satisfaction have lower health [12] but also that lower health is associated with lower life satisfaction [13]. Seemingly, according to emotion theories, positive emotions and relations help people build lasting resources, such as trait resilience, which in turn lead to desirable life outcomes. Positive emotions predict increases in both trait resilience and life satisfaction, but growth in trait resilience mediates the relation between positive emotions and increased life satisfaction. Life satisfaction ultimately depends on growth in trait resilience, which involves emotion regulation, problem-solving, and the ability to change perspective [14]. A related construct, psychological vulnerability, defined as a cognitive belief that one's self-worth is dependent on the approval of others, is associated with negative cognitive schemas, susceptibility to stress, and has a negative impact on subjective well-being [15,16]. By examining these pre-existing and individual differences variables, the study aims to provide a more comprehensive understanding of the factors that influence life satisfaction during temporary housing.

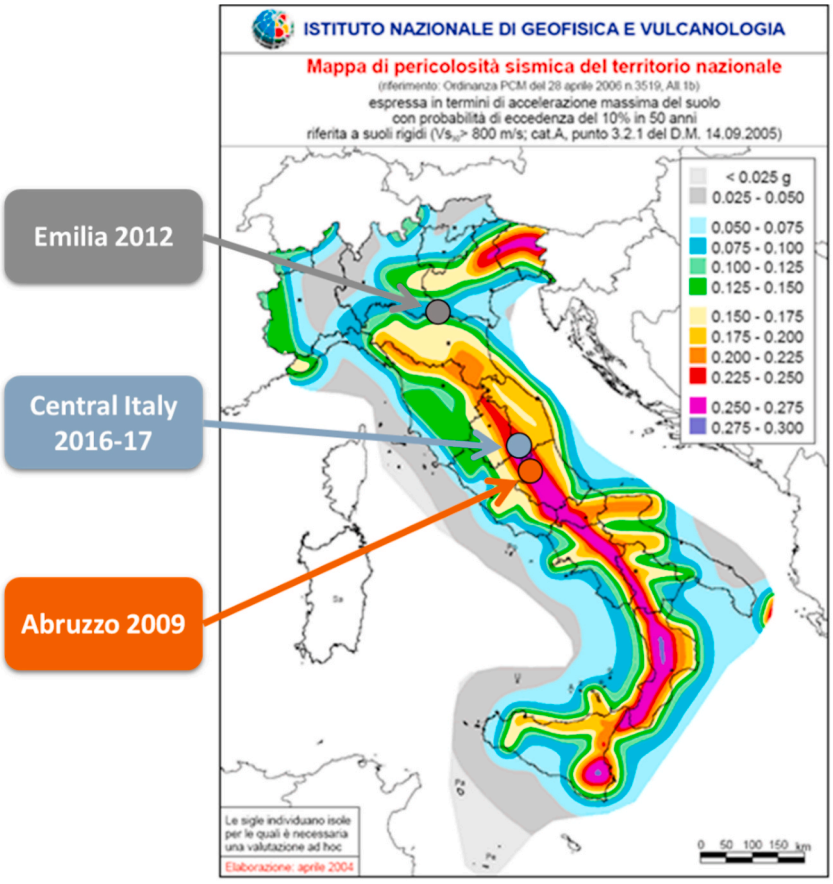

Fig. 1. National Seismic Hazard Map of Italy (475 years return period) [20]. The epicenters of the three earthquakes analyzed in this paper are marked with dots.

1.2.2. Earthquake consequences

The earthquake consequences that were examined in this study included which earthquake out of the three examined was experienced, whether participants were still residing in temporary housing and the duration of their stay in the predominant temporary housing. The different earthquakes examined had their own unique characteristics, such as the affected territories and the extent of the building damage. The available literature does not provide any direct comparison of the psychological impact of earthquakes on

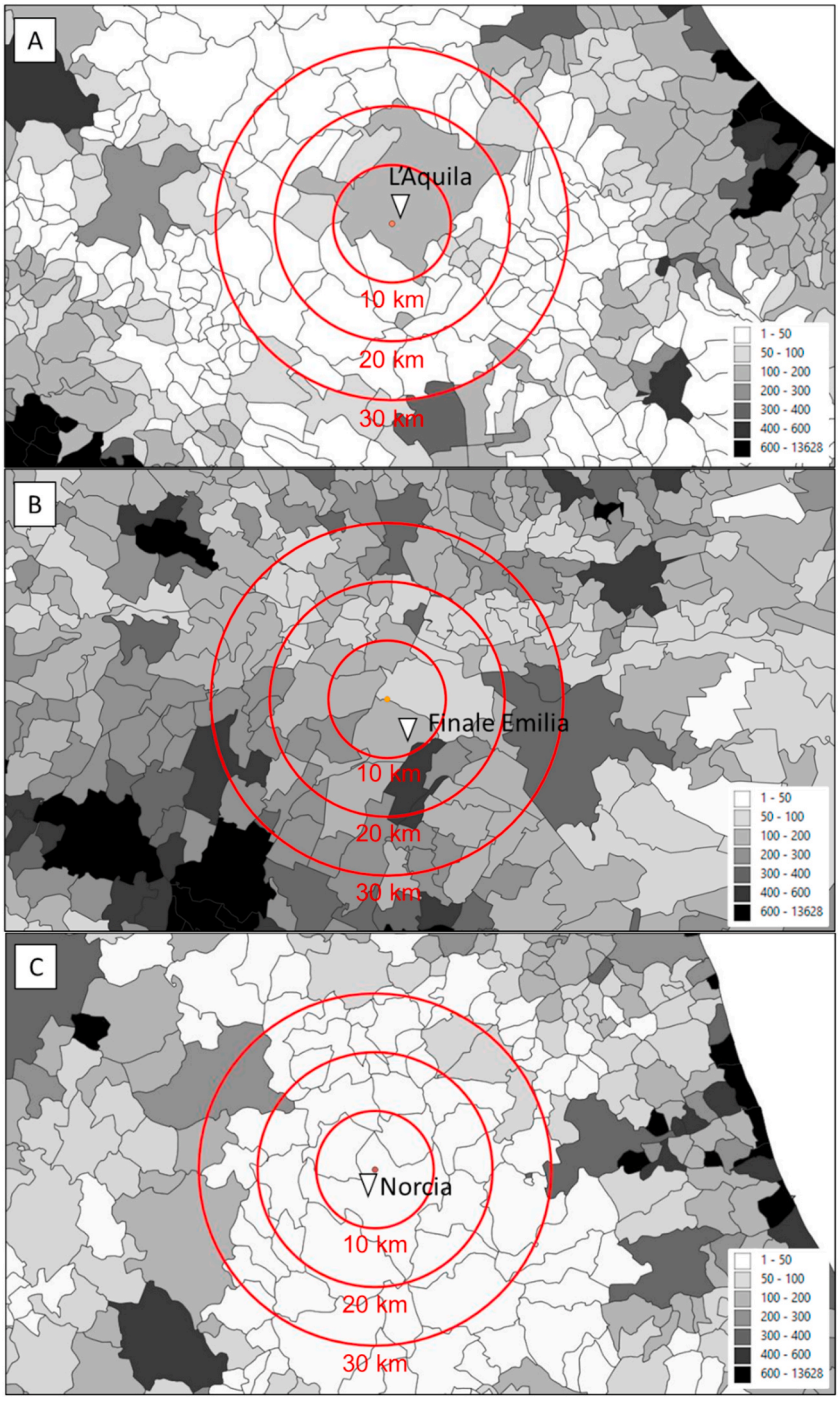

Fig. 2. Maps showing the population density (number of residents per km^2) in the epicentral areas of the analyzed earthquakes: A) 2009 Abruzzo, B) 2012 Emilia, C) 2016-17 Central Italy. Red circles have a radius of 10, 20, and 30 km from the strongest mainshock epicenters (A: L'Aquila event, April 06, 2009; B: Finale Emilia event, May 20, 2012; C: Norcia event, October 30, 2016). Population data from the Italian Census 2001 (2009 Abruzzo earthquake) and the Italian Census 2011 (2012 Emilia and 2016-17 Central Italy earthquakes). Data from ISTAT (http://dati.istat.it/).

populations in rural, urban, or industrial areas. However, recovery challenges may differ substantially between cities and rural areas because losses in urban settings are concentrated within densely populated regions, and the destruction of housing not only implies a consequent substantial financial investment but also constitutes a central element of the urban infrastructure [17]. The present study focuses on the three strongest earthquakes that occurred in Italy in the last 25 years: the 2009 Abruzzo earthquake, the 2012 Emilia earthquake, and the 2016-17 Central Italy earthquake (Fig. 1, [18,19]. Details are available in the Supplementary Materials, Table S1). The peculiarity of each of these earthquakes is described hereafter.

The duration of residence in prefabricated temporary housing has been identified as a significant factor in post-disaster psychological recovery. Participants who had lived in temporary housing for a longer period of time (more than four years) showed more severe psychological distress compared to those who had lived in temporary housing for a shorter period (less than three years) [21]. By considering the three different earthquakes and the length of temporary housing, our study aimed to better characterize and understand the consequences of the disaster and its impact on the living situation of the involved people.

1.2.2.1. The 2009 Abruzzo earthquake (urban environment). The mainshock of the Abruzzo seismic sequence, a moment magnitude Mw 6.3 earthquake, occurred on April 6, 2009, and caused 309 fatalities (Supplementary Materials, Tables S1–S4 and Fig. S1). It struck the city of L'Aquila, the capital of the Abruzzo region, and the surrounding areas of the Central Apennines. Severe damage is well represented by a maximum observed Intensity IX–X on the Mercalli Cancani Sieberg (MCS) scale. The seismic sequence continued with thousands of aftershocks, 7 of which were characterized by a moment magnitude greater than 5.0 [18].

The Abruzzo earthquake is an example of a seismic event affecting an urban reality. In 2009, L'Aquila was a city with a population of about 73,000 citizens [22], to which university students from outside should be added. The distribution of the population was mainly concentrated near the earthquake epicenter due to the very short distance of the city of L'Aquila from it (Fig. 2A). This also implies that a high concentration of damage, with many structural collapses, was observed in the city and its neighborhood, while in the rest of the area affected by the earthquake there were only small villages, which recorded barely damaging intensity values. The number of unusable private houses was about 34 thousand, 21 thousand of which were heavily damaged or collapsed.

More than 67,000 people were assisted. In the beginning, also taking advantage of the spring season, many tent camps were organized. They were dismantled in the following Autumn when different temporary housing solutions were adopted [18]:

- requisition of unused apartments;
- self-lodging financial support;
- durable and comfortable, seismically isolated, three-story buildings with limited land consumption (Project C.A.S.E., only adopted inside the Municipality of L'Aquila);

  small independent timber houses, with good comfort standards and size and a relatively limited lifetime, in the order of 10 years (Project M.A.P.). They are usually single-family one-story houses arranged in small settlements near the original village, out of the Municipality of L'Aquila.

1.2.2.2. The 2012 Emilia earthquake (industrial environment). The first mainshock of the Emilia Romagna, Veneto, and Lombardia seismic sequence (hereinafter 2012 Emilia; Mw 5.9) occurred on May 20, 2012, and caused 7 fatalities (Supplementary Materials, Tables S1–S4 and Fig. S1). It struck the central part of the Po Plain in Northern Italy (mainly the Emilia Romagna Region, and secondarily Lombardia and Veneto Regions). Ferrara, the nearest city, was about 30 km far from the epicenter to the East. A second mainshock (Mw 5.7) occurred on May 29 at about 12 km to the Southwest of the first one, and caused a further 19 fatalities. The cumulated damage of the two mainshocks resulted in a maximum intensity VII–VIII on the MCS scale [23], and VIII on the EMS scale (INGV-QUEST; [24]).

The 2012 Emilia earthquake is an example of a seismic event affecting an area with strong industrial development. The landscape is characterized by an alluvial plain dotted with small centers (10,000–30,000 people each) with a strong industrial vocation, distributed over a large area and affected by widespread medium-low level damage (Fig. 2B). More than 460 thousand people live in this territory, but the number of people assisted was relatively limited, in the order of 16 thousand people, and the number of private buildings damaged was 15 thousand. The damage to industrial buildings, as well as rural masonry buildings for agricultural and livestock activities, was particularly heavy [18].

The temporary housing solutions adopted for the 2012 earthquake took into account the limited number of homeless people and their widespread distribution in the epicentral area. The prevailing solutions were container houses, self-lodging financial support, and arrangements in rented houses found by local administrations.

1.2.2.3. The 2016-17 Central Italy earthquake (rural mountainous environment). This long seismic sequence was characterized by several mainshocks distributed in a North-northwest – South-southeast direction over a distance of 50 km (Supplementary Materials, Tables S1–S4 and Fig. S1). It caused 299 fatalities, all due to the first mainshock because, after it, most of the local population was accommodated in safe, temporary lodging. This mainshock (Mw 6.0) occurred on August 24, 2016, with its epicenter in Accumoli, a small village of the Central Apennines. Intensities up to X-XI on the MCS scale were observed [25]. On October 26, 2016, a second mainshock (Mw 5.9) hit an area to the North-northwest of the first mainshock, with the epicenter near the village of Visso. A few days later, on October 30, 2016, the strongest mainshock (Mw 6.5) occurred in an area located between the previous two mainshocks, with the epicenter near the town of Norcia. This event is the strongest one in Italy since the 1980 Irpinia earthquake (Mw 6.8, I_0 X MCS; [26,27]). After this third mainshock, the seismic sequence went on with seismic events characterized by a moment magnitude lower than 5.0 up to January 18, 2017, when four shocks ranging from Mw 5.0 to Mw 5.4 hit the southernmost part of the area already interested by the seismic sequence.

The 2016-17 Central Italy is an example of an earthquake that hits a mountainous environment with a predominantly rural vocation. The affected area mainly falls within the Central Apennines chain, characterized by small municipalities, each formed by

several localities and several sparse houses, and by a relatively low population density (in the order of 15 people per square kilometer, whereas about 200 is the mean national value [28]; Fig. 2C). For this reason, although the impacted area was really large, covering part of 4 Regions (Lazio, Abruzzo, Marche, and Umbria), the maximum number of assisted people was about 31,000, almost half of the maximum number of assisted people during the 2009 Abruzzo earthquake.

Summarizing, the 2016–17 earthquake essentially affected small villages, which displayed the greatest destructive intensities, and only some small towns, which showed damaging but not destructive intensity values. Due to the extension of the impacted area, however, the number of private buildings damaged reached 80 thousand and is the highest among the three earthquakes considered. The temporary housing solutions adopted were very diversified. They included hotels, container homes, self-lodging financial support, and small independent prefabricated houses with good comfort standards and size and a limited lifetime.

1.2.3. Temporary housing situation

The study included several variables related to the type and perceived quality of temporary accommodation and social support. Considering these variables is important because they can influence the psychological well-being of individuals who have experienced a disaster and are living in temporary housing, thus affecting their life satisfaction.

The quality of temporary housing, the type of accommodation, and the density of living conditions can all impact an individual's sense of comfort, safety, and stability, which can, in turn, affect their emotional and physical health and life satisfaction. Higher levels of housing satisfaction contribute to higher overall life satisfaction. Factors such as better structural quality, ownership, and lower person-per-room ratios were positively associated with higher housing satisfaction [29]. Therefore, housing satisfaction is an important factor in overall life satisfaction and is related to both the characteristics of the dwelling unit and the surrounding environment.

In addition, the level of social support that an individual receives can play a critical role in their recovery process [30,31]. Feeling supported and connected to others can provide a sense of nurturance and belonging during a stressful and uncertain time [32]. Holding more ties may offer more resources for mutual advantage and support in case of crisis and disasters [33]. For example, the resources that an individual can draw on through her or his social network and the extent of the protection net can partly explain the differential rates of community recovery, as was the case for the major earthquakes in Kobe, Japan (1995), and Gujarat, India (2001). In the aftermath of a disaster, social capital can serve as a buffer against negative outcomes [34].

Understanding the impact of variables related to the quality of temporary housing and to social support and protection on the well-being of individuals in temporary housing can inform interventions and policies aimed at fostering their recovery and promoting resilience.

1.2.4. Emotional and physical well-being

Our study considered several emotional and physical well-being variables related to the earthquake experience and temporary housing displacement. These variables include post-traumatic stress-related symptoms, health impairment as a consequence of the disaster, experience with death and suffering as a consequence of the disaster, and emotional well-being after the event.

Earthquakes are often associated with post-traumatic stress-related symptoms [35], which, in turn, are associated with lower levels of life satisfaction [36]. It is important to consider this variable because it may provide insights into the emotional impacts of the earthquake and temporary housing displacement on individuals.

Likewise, health impairment as a consequence of a disaster was also a significant predictor of life satisfaction in previous research, although to a small extent, considering that other factors, such as demographic variables, seem to have a greater impact [37]. Measuring the level of health impairment subsequent to the disaster can inform the development of interventions and support services for individuals who may require assistance. Experience with death and suffering as a consequence of the disaster can impact life satisfaction even well after the event [36,38]. A study found that losing a loved one due to Hurricane Katrina had a significant negative impact on the happiness of single mothers [39]. Losing a loved one due to a natural disaster can have a significant and lasting impact on individuals' mental health and well-being and may require additional support and resources for recovery. Finally, life satisfaction is also positively linked to a positive emotional state and conversely negatively associated with negative emotional states [40–42].

Understanding the prevalence and intensity of post-traumatic stress disorder symptoms and assessing individuals' experiences with death and suffering and emotional well-being can provide a more comprehensive understanding of their psychological and emotional state after the disaster. Overall, considering these variables can help researchers and practitioners develop a more comprehensive and nuanced understanding of the impacts of the earthquake and temporary housing displacement on individuals' well-being.

In the present study, therefore, we measured all the aforementioned variables to test their predictive role in explaining life satisfaction. We expected that being more prepared for a hazard, being more risk aware, and having more trait resilience capability and less psychological vulnerability would be related to higher life satisfaction. We also hypothesized that a higher place attachment and a lower general health status before the disaster would decrease life satisfaction. The specific earthquake experienced was expected to differentially affect life satisfaction, and the duration of the displacement was predicted to negatively impact life satisfaction. We expected that better quality, type, and lower density of temporary housing would be associated with higher life satisfaction. We also hypothesized that variables related to social support and protection would be positively related to life satisfaction. Conversely, we expected that more negative psychophysiological consequences, more experience with death, and a more negative emotional state would be associated with lower life satisfaction during temporary housing.

2. Method

2.1. Participants and procedure

People who had experienced one of the three earthquakes and the consequent temporary housing were contacted between February and July 2021 and invited to voluntarily participate in an anonymous survey (the complete questionnaire is presented in the Supplementary Materials). Participants were contacted with the help of local institutions (municipalities) and local organizations or by directly approaching them in public places. Participants' informed consent was obtained by all respondents. The Ethical Committee of the University of Trento approved the study (protocol 2020–039). Depending on the participant's needs and the situation, data collection was completed through face-to-face interviews, telephone interviews, stand-alone paper-and-pencil questionnaires, or online. The survey took about 30–50 min to be completed, depending on the subject's individual differences. Individuals were contacted in different municipalities and locations to represent the variety of conditions within the three epicentral areas (Fig. 2).

The final sample included 261 individuals, 58 of whom were displaced after the 2009 Abruzzo earthquake, 126 after the 2012 Emilia, and 77 after the 2016-17 Central Italy ones. Overall, more than half of the sample was female (58.6%). At the time of the survey, participants were 50.1 years old on average (SD = 15.9). Their education level was generally rather high: 2.7% elementary school, 15.4% middle school, 46.2% high school, and 35.8% university. Households consisted of an average of 3.2 individuals (including the respondent). Self-evaluated physical health quality at the time of the survey was generally good (M = 2.86 on a 5-point scale; SD = 0.89). Participants' employment status at the time of the survey was as follows: 6.2% were students, 54.8% were employed, 16.2% were self-employed, 4.6% were unemployed, and 18.1% were retired. Their income class (total annual net earnings) was as follows: 1.2% no income, 7.9% up to 10,000 euros, 11.2% from 10,000 to 15,000 euros, 18.2% from 15,000 to 20,000 euros, 29.8% from 20,000 to 30,000 euros, 24.8% from 30,000 to 50,000 euros, and 7.0% over 50,000 euros (participants' complete socio-demographic features for each earthquake are reported in the Supplementary Materials, Table S5).

At the time of the disaster, participants lived predominantly in a home they owned (90%), while 6.2% lived in a rented home, and the rest had other forms of accommodation (3.8%). The great majority of the homes (94.2%) were not insured against earthquakes. Participants had lived for 28 years on average (SD = 18.1) in the location where the earthquake struck them. Approximately half of the displaced people (51.0%) had applied for and been granted the "Contributo di Autonoma Sistemazione" (C.A.S.),[1] a housing grant established by the State and issued by local government, while a minority (1.6%) had applied for it but had not been granted; the remainder (47.4%) had not applied for it. The length of the stay in the temporary housing ranged from a minimum of 0.1 to a maximum of 144 months, with a mean of 44.6 months (SD = 43.6). More than half of the respondents (57.6%) were still living in temporary housing when they responded to the survey.

The number and percentage of participants in the different kinds of accommodation are reported in Table 1. In the case of more than one type of accommodation, the values refer to the one in which the participants stayed the longest. Types 1, 3, and 4 characterize the first emergency period (Fig. 3). Hotels (type 5) are also taken into account in the same period but are often used for a longer period due to their greater comfort. The remaining types are used in the following months and years, a period that can be quite long in case of an earthquake. In particular, types 8 and 9 are prefabricated house types organized in small villages. Types 6, 7, and 10 are apartments in high-rise buildings that offer a similar level of comfort as standard apartments.

2.2. Measures

Although the survey measured a broader set of variables than is crucial for addressing the specific research questions of the present study, here we will focus only on those variables deemed relevant to it. After the description of the socio-demographic predictors and of the criterion variable (life satisfaction during temporary housing), we will describe the other predictors in temporal order, progressing from participants' evaluations referred to their condition before the earthquake (or stable individual differences) till their evaluations of the consequences of the seismic event.

2.2.1. Socio-demographic variables

We assessed several socio-demographic variables (age, sex, education, employment status, income at the time of disaster, number of household members) as well as other variables useful for the sample description: years lived in the house, ownership of the house, whether participants asked for a Contribution of Autonomous Accommodation (C.A.S.), and the damage suffered by their house (in terms of AeDES[2] classification).

2.2.2. Life satisfaction during temporary housing

Judgments about satisfaction with various aspects of life during the temporary housing displacement were measured as in previous studies [44]. The aspects of life considered were job prospects, educational opportunities, financial situation, personal safety, social life, outdoor activities, natural beauty, overall climate, and cultural opportunities. Participants were asked, "how satisfied were [are] you during the displacement with each of these specific aspects of your life?". Answers were provided on a scale from 1 (extremely

[1] The "Contributo di Autonoma Sistemazione" (C.A.S., Contribution for Autonomous Accommodation), is a housing financial grant issued by the local government to members of families who were ordered to evacuate their first housing unit that was declared uninhabitable due to the earthquake.

[2] According to the AeDES Form, the habitability of buildings is classified into six categories: (1) A - Habitable building, (2) B - Building temporarily uninhabitable (in whole or in part) but accessible with emergency measures, (3) C - Building temporarily uninhabitable to be thoroughly reviewed, (4) D - Building partially uninhabitable, (5) E – Building uninhabitable, (6) F - Building uninhabitable due to external hazard. The higher the value from 1 to 5, the higher the damage to the house. F does not follow the same progression; the external hazard could be, for example, a landslide or a damaged bell tower threatening the building [74].

Table 1
Number and valid percentage of participants in each type of accommodation in each disaster case studied.

Type of accommodation	2009 Abruzzo earthquake		2012 Emilia earthquake		2016-17 Central Italy earthquake		Overall	
	n	%	*n*	%	*n*	%	*n*	%
[1] Private car/camper/tent	10	17.5%	29	23.4%	1	1.3%	40	15.5%
[2] House of friends	1	1.8%	18	14.5%	1	1.3%	20	7.8%
[3] Gym/train wagon provided by the competent authority	0	0.00%	0	0.00%	0	0.00%	0	0.0%
[4] Tent/camper provided by the competent authority	2	3.5%	5	4.0%	1	1.3%	8	3.1%
[5] Hotel provided by the competent authority	4	7.0%	4	3.2%	4	5.2%	12	4.7%
[6] Rented apartment or house	7	12.3%	48	38.7%	13	16.9%	68	26.4%
[7] Apartment or house owned by respondent (e.g., second home)	2	3.5%	7	5.6%	4	5.2%	13	5.0%
[8] Container module or P.M.A.R. (Prefabricated Modular Removable Housing Units)	0	0.0%	4	3.2%	5	6.5%	9	3.5%
[9] M.A.P., S.A.E., M.A.P.R.E., P.M.R.R. (Temporary Housing Modules, Emergency Housing Solutions, Rural Prefabricated Emergency Housing Modules - Prefabricated houses or however of rapid realization, often in wood, with one or two stories maximum, monofamiliar, bifamiliar or disposed as rowhouse - Prefabricated Removable Rural Modular)	29	50.9%	8	6.5%	45	58.4%	82	31.8%
[10] C.A.S.E. (Ecocompatible Sustainable Anti-seismic Complexes - three-story buildings, with underground parking, in a green environment)	1	1.8%	0	0.0%	0	0.0%	1	0.4%
[11] Other	1	1.8%	1	0.8%	3	3.9%	5	1.9%
Missing	1		2		0		3	

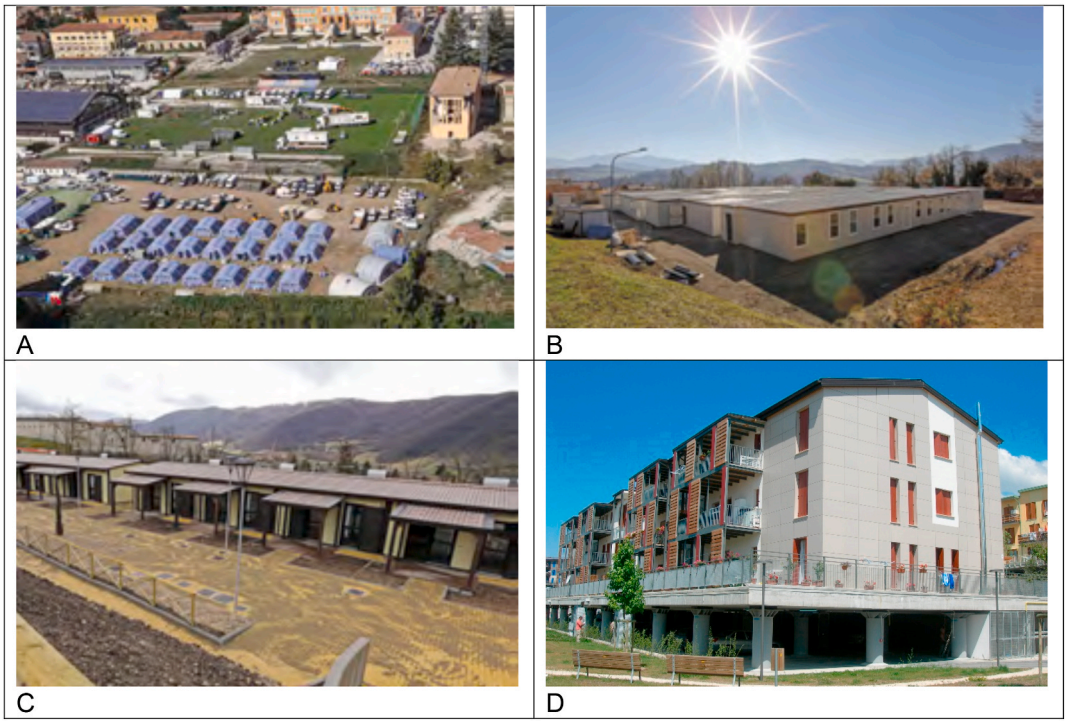

Fig. 3. Pictures showing some examples of temporary housing solutions. A) to C): solutions for the shelter of the population in the 2012-17 Central Italy earthquake. A) Amatrice, campsite. B) Camerino, container modules. C) Norcia, prefabricated temporary houses (from Ref. [43]). D) Abruzzo 2009: L'Aquila, a house built within the framework of the C.A.S.E. Project-Antiseismic Sustainable Eco-friendly Complexes (courtesy M. Dolce).

dissatisfied) to 5 (extremely satisfied). The responses were averaged into a composite measure (Cronbach's $\alpha = 0.86$), representing the degree to which individuals were satisfied with important aspects of their life during their stay in the temporary housing accommodations.

2.2.3. Pre-existing individual differences

2.2.3.1. Risk awareness. Seismic risk awareness was measured through three questions that investigated how often, before the disaster, the participants thought about an earthquake, how worried they were about an earthquake, and how likely they judged an earthquake to happen in the future. Items were: (a) "In the years prior to the earthquake that affected you, how much did you think

about earthquakes?"; (b) "In the years prior to the earthquake that affected you, how concerned were you about earthquakes?"; (c) "In the years prior to the earthquake that affected you, how likely did you think an earthquake was to occur?". Responses could range from 1 (not at all) to 7 (very much). The second and third items were derived from previous literature on risk perception [45,46], assessing the analytical/deliberate component and the affective component of risk perception, respectively. A composite score was computed, averaging responses on the three items measuring risk awareness (Cronbach's $\alpha = 0.90$).

2.2.3.2. Earthquake preparedness. A preparedness index was derived from the Mulilis-Lippa Earthquake Preparedness Scale (MLEPS) [47] and adapted to reflect the country-specific scope of the study and the national emergency management system. The preparedness index measured the individual level of earthquake preparedness prior to the disaster. A total of 42 yes/no questions were asked, including questions on specific items to be used immediately after an earthquake owned by respondents (e.g., "Did you own a working flashlight?"), questions on the participants' level of knowledge (e.g., "Before the event, did you know you lived in an earthquake-prone area?"), and questions measuring whether the participants, prior to the event, were exposed to information or activities aimed at increasing their earthquake preparedness. For all items, "yes" was coded with 1, and "no" was coded with 0. An individual preparedness index was computed by summing all "yes" answers; thus, the index could range from 0 to 42.

2.2.3.3. Place attachment. Attachment to the place in which participants lived at the time of the earthquake was measured with the Place Attachment Scale [48]. The scale asks participants to report how much they agree or disagree with each of a set of eleven statements representing the extent to which they were attached to the place and community in which they lived, using a response scale ranging from 1 (completely disagree) to 7 (completely agree). Examples of statements include "The community reflected who I was", "People like me lived there", "The green areas there were special", and "That city was special to me". A composite mean score was calculated by averaging the responses to the eleven statements (Cronbach $\alpha = 0.93$).

2.2.3.4. General health status. Participants' self-reported general health status before the disaster (before) and at the time of the survey (after) was measured. In particular, respondents were asked the American Life Panel question (https://alpdata.rand.org/) from the Survey on Well Being (No. 20) (Well Being and Health - Module - Rate General Health, Question - ms20_RH001 GENERAL HEALTH RATING) also used in the WHO's generalized health assessment [49]. The question asked, "In general, would you say that your health [before the earthquake was/is now] … ". Possible responses ranged from 1 (poor) to 5 (excellent).

2.2.3.5. Resilience capability. The Brief Resilience Scale was used to measure an individual ability to recover from stressful conditions, known as individual resilience capability [50]. The scale asks to indicate the degree to which the participant agrees (from 1 = completely disagree to 7 = extremely agree) with each of a set of statements (e.g., "I tend to bounce back quickly after hard times"). The responses to the six items were averaged into a composite measure (Cronbach's $\alpha = 0.85$), representing the degree to which the individual holds individual resilience capability.

2.2.3.6. Psychological vulnerability. The Psychological Vulnerability Scale [16] asked the participants to indicate the degree to which a series of six statements best described them. The scale measures the degree to which the participant holds cognitive beliefs reflecting a dependence on external sources for self-affirmation (i.e., concrete achievements or other people), as opposed to a belief in the worth of one's inner qualities and character. The responses were provided on a scale from 1 (completely disagree) to 7 (extremely agree) and averaged into a composite measure (Cronbach's $\alpha = 0.75$), representing the degree to which the individual is psychologically vulnerable.

2.2.4. Earthquake consequences

2.2.4.1. Specific earthquake experienced. The specific seismic event experienced by participants was recorded as the 2009 Abruzzo earthquake, the 2012 Emilia earthquake, or the 2016-17 Central Italy earthquake.

2.2.4.2. Still in temporary accommodation. This variable recorded whether participants were still residing in temporary housing at the time of the survey (coded as 2) or not (coded as 1).

2.2.4.3. Length of stay in temporary accommodation. This variable measured the duration of the participant's stay in the predominant temporary housing in months.

2.2.5. Temporary accommodation and social support

2.2.5.1. Quality of the temporary accommodation. A series of questions investigated the perceived quality of the temporary housing on a series of characteristics (i.e., privacy, noise, space, light, temperature, quality, comfort, surroundings, and placement). The housing characteristics were measured by adapting an existing Housing Characteristics Scale [51]. Participants were asked to think about the temporary housing solution they have used for the longest time and to rate eighteen statements referring to its characteristics, indicating how much they agree or disagree on a scale from 1 (strongly disagree) to 7 (strongly agree). The items were averaged into a composite measure representing the degree to which the temporary housing was appreciated (Cronbach $\alpha = 0.82$).

2.2.5.2. Type of temporary accommodation. Participants were asked to report what type of temporary housing they had lived in since the disaster by indicating the accommodation used in the (a) short-term, (b) medium-term, (c) long-term, and (d) now. We also asked them to indicate how long the participant had lived in that temporary housing arrangement for each of these accommodations. The purpose was to determine the prevailing temporary accommodation, i.e., the arrangement in which the participant had lived for most of the time spent in temporary housing. This was necessary because explicit mention was made at some points of the questionnaire that subsequent questions regarding temporary housing would refer to the prevailing housing solution. Participants reported the type of temporary solution by selecting one option from the list of possibilities reported in Table 1. Due to the low frequency of some options, prior to conducting the statistical analyses, we recoded the Type of Temporary Accommodation variable (see Table 1) into three new accommodation types: 1 = tent/camper/gym (old types 1, 3, 4), 2 = container/modules (old types 8, 9), and 3 = house/apartment (old types 2, 6, 7), associated with an increasing degree of living quality. Due to their peculiar living conditions when compared to the other

Table 2
Correlation coefficients and descriptive statistics for the measured variables.

	1	2	3	4	5	6	7	8	9	10
1. Life Satisfaction	–									
2. Sex	.02	–								
3. Age	.06	−.12	–							
4. Education	−.07	.08	−.40***	–						
5. Income	.00	−.16*	.00	.18**	–					
6. Risk Awareness (before)	−.02	.04	.06	−.14*	−.09	–				
7. Earthquake Preparedness	.25***	−.13*	−.02	−.02	.04	.30***	–			
8. Place Attachment	.08	.02	.18**	−.15*	−.17**	.12	.10	–		
9. General Health Status (before)	.15*	−0.01	−.36***	.14*	.00	−.06	.12	.06	–	
10. Resilience Capability	.24***	−.09	.05	.07	.10	.03	.21**	−.01	.16*	–
11. Psychological Vulnerability	−.16*	.16**	−.24***	.11	−.13*	.00	−.11	−.03	−.01	−.48***
12. Still in Temporary House	.02	−.04	.19**	−.28***	−.11	.13	−.05	.19**	−.01	−.19**
13. Length of Temporary House Stay	.08	−.13*	.17**	−.11	−.08	−.11	−.17*	.17**	−.11	−.04
14. Quality of Accommodation	.41***	−.02	−.01	.08	−.01	−.25**	.14*	.01	.16*	.16**
15. Temporary House Type	−.02	.03	−.04	.17**	−.03	−.26***	−.06	−.07	.00	.00
16. Density	−.04	.01	−.03	−.07	.08	.00	.09	.01	.11	.04
17. Protection Net	.43***	.07	−.07	.04	−.11	−.03	.24***	.10	.15*	.21***
18. Perceived Social Support	.38***	.12	−.04	.14*	.00	.00	.15*	.07	.17*	.18**
19. Post-traumatic Stress Disorder	−.17**	.26***	.05	−.11	−.08	.11	−0.15*	.21**	.01	−.39***
20. Health impairment	−.15	.27***	.17**	−.09	−.11	.18	−.08	.14*	−.14	−.38***
21. Experience with Death	.10	.11	−.01	−.11	−.09	−.18**	.00	−.16**	−.01	.00
22. Emotional Well-being	.25***	−.23***	.02	.05	.07	−.03	.21**	.11	.09	.54***
23. General Health Status (after)	.33***	−.16*	−.26***	.13*	.07	.08	.24***	.06	.43***	.40***
N	237	248	248	247	229	245	248	244	245	247
Missing	11	0	0	1	19	3	0	4	3	1
Mean	3.32	1.59	50.01	3.14	4.57	2.55	13.59	5.46	3.71	4.33
Standard deviation	0.717	0.493	15.893	0.763	1.472	1.647	6.572	1.110	0.826	1.177
Minimum	1	1	18	1	1	1	1	1	1	1
Maximum	5	2	88	4	7	7	40	7	5	7
Range	1 to 5	1 to 2	1 to 100	1 to 4	1 to 7	1 to 7	0 to 42	1 to 7	1 to 5	1 to 7
Reliability	.86					.90		.93		.85

*p < .05; **p < .01; ***p < .001.

types of accommodation, we decided not to include hotels (old type 5; 12 participants) and C.A.S.E. (old type 10; 1 participant) in the new classification. Therefore, the sample size on which the statistical analyses were conduced was 248.

2.2.5.3. Density in the temporary accommodation. The population density in the temporary housing was measured by asking how many people lived in the same household (including the respondent) and dividing this number by the area of the dwelling (m^2). For example, if three people lived in a house of 60 m^2, then the density was 0.05. Higher values indicate a higher density.

2.2.5.4. Protection net. Participants were asked to report how much help they received from a series of people after the earthquake using a scale from 1 (not at all) to 5 (very much). The sources of support considered (adapted from Ref. [52]) were: (a) relatives, (b) friends, (c) neighbors, (d) colleagues/employers, (e) other persons, (f) national institutions (Civil Protection Department, Government, Commissioner for Reconstruction), and (g) local institutions (Regional Civil Protection, City Mayor, health workers, volunteers, etc.). The seven items were averaged into a composite measure of protection net (Cronbach's $\alpha = 0.79$), representing the degree to which the individual felt supported after the disaster.

2.2.5.5. Perceived social support. A short version of the perceived social support scale F-SOzU K-6 [53] asked participants to think about their life while in the temporary housing solution and to say how much they agreed or disagreed with a set of six statements (e.g., "I experienced a lot of understanding and security from others"). Answers were provided on a scale ranging from 1 (completely disagree) to 7 (completely agree). The items were averaged into a composite measure (Cronbach's $\alpha = 0.87$), representing the degree to which the individual experienced social support during the temporary housing displacement.

2.2.6. Emotional and physical wellbeing

2.2.6.1. Post-traumatic stress disorder. The shortened SPAN Scale (Startle, Physiological arousal, Anger, Numbness), including items 17, 14, 11, and 5 from the original scale [54], was used to measure Post-Traumatic Stress Disorder (PTSD) [7]. Participants were asked to report how often and intensely they experienced a series of emotional events during the 2–3 months following the earthquake. Frequency was recorded on a scale from 1 (never) to 5 (every day), and intensity was recorded on a scale from 1 (not at all intense) to 5 (extremely intense). The events were: (a) "Have you been physically upset by reminders of the event?", (b) "Have you had difficulty concentrating?", (c) "Have you found it hard to imagine having a long life span fulfilling your goals?", (d) "Have you been avoiding any thoughts or feelings about the event?". Each frequency was then multiplied by the relative intensity, and the new eight variables were averaged into a composite measure of PTSD (Cronbach's $\alpha = 0.74$) ranging from 1 to 25 and representing the frequency with which the individual experienced the symptoms after the disaster, and the intensity of these symptoms.

2.2.6.2. Health impairment. The consequences of the earthquake on the health of the participants were measured by the one-item health impairment scale [55], which asked to what extent participants thought the event had compromised their health, using a

11	12	13	14	15	16	17	18	19	20	21	22	23
–												
.01	–											
−.17**	.44***	–										
−.19**	−.12	.12	–									
−.04	−.07	.24***	−.37***	–								
−.06	−.06	−.15*	−.23***	−.33***	–							
−.19**	−.09	.02	.33***	.01	−.01	–						
−.16	−.13	−.02	.29***	−.11	.09	.54***	–					
.27***	.14*	.00	−.11	.06	−.10	−.11	−.12	–				
.24***	.16*	.03	−.08	.07	−.07	−.08	−.09	.60***	–			
.09	−.12	−.11	.16*	.17**	−.04	.00	−.03	−.13	−.11	–		
−.49***	−.16*	.05	.18**	.05	−.01	.20**	.11	−.39***	−.34***	−.02	–	
−.22**	−.06	−.09	.19**	−.13*	.05	.21**	.17**	−.21**	−.39***	−.03	.52***	–
246	218	237	239	240	213	247	239	235	244	243	246	246
2	30	11	9	8	35	1	9	13	4	5	2	2
3.51	1.44	46.61	4.54	2.22	0.07	3.37	5.17	11.05	3.86	4.03	3.09	2.88
1.123	0.495	43.871	0.985	0.758	0.082	0.784	1.244	5.077	1.887	1.351	0.633	0.895
1	1	0.1	2.1	1	0	1	1.5	1.25	1	2	1	1
7	2	144	7	3	0.5	5	7	25	7	6	5	5
1 to 7	1 to 2	0 to 144	1 to 7	1 to 3	0 to 1	1 to 5	1 to 7	1 to 25	1 to 7	2 to 6	1 to 5	1 to 5
.75			.82			.79	.87	.74			.79	

scale from 1 (not at all) to 7 (very much).

2.2.6.3. Experience with death and suffering. Participants' experience with death and suffering as a consequence of the earthquake was measured using the direct experience index [56]. The index consisted of two questions. The first item asked to report if anyone they knew died due to the disaster ("Did someone you know die as a result of the disaster?"). Possible answers were 1 "at least one close friend or relative", 2 "someone I know other than a close friend or relative", and 3 "no one I know". The second question asked to report if anyone they knew had suffered from the disaster ("Has anyone you know suffered, i.e., suffered serious physical or psychological consequences, but not died, as a result of the disaster?"). Possible responses were 1 "at least one close friend or relative", 2 "someone I know other than a close friend or relative", and 3 "no one I know". The sum of the responses (which ranged from 2 to 6) was used for the analysis. Lower values represented the greater direct experience of suffering and death resulting from the earthquake.

2.2.6.4. Emotional well-being. To measure emotional well-being, we used the MOS 36-Item Short-Form Health Survey (SF-36; [57]), which asks to report how often (from 1 = never to 5 = always) the participant experienced a specified emotional state during the past 30 days. The emotional states were: (1) nervous, (2) feeling calm and peaceful, (3) having a lot of energy, (4) feeling downhearted and blue, (5) feeling worn out, (6) feeling happy, (7) feeling tired. The variable is computed by averaging the results across the seven items into a composite measure (Cronbach's $\alpha = 0.79$), representing the well-being experienced by the participant at the time of the survey. The variable could range from 1 to 5.

2.3. Data analysis strategy

Data analysis was carried out in three stages. Initially, we computed descriptive statistics and reliability (as internal consistency) for all the measures (see Table 2 and the previous descriptions of the variables). Then, we conducted a hierarchical linear regression analysis to determine which of the predictors were significantly related to life satisfaction during the stay in temporary housing, which was our main criterion variable, and to appraise the relative importance of the predictors. Initially, we carried out this analysis on the whole sample of individuals affected by the earthquakes, including the specific earthquake as a predictor (specific earthquake). Given that the specific earthquake variable turned out to be significant, we repeated the analysis separately for each seismic event. The alpha level was set to 0.05 for all the analyses.

In the hierarchical regressions, we entered the predictors in five steps, assuming that the variables included in a step could have been influenced by the variables entered in the previous steps but not vice-versa. This approach to the hierarchical order of entry is motivated by the need to respect causal priority and to ensure the removal of confounding or spurious relationships (see Ref. [58]). Thus, sociodemographic variables (i.e., sex, age, education, income) were entered in the first step of the analysis. The subsequent steps

followed the temporal pattern, with variables reflecting stable individual differences (place attachment, resilience capability, psychological vulnerability) or participants' status before the disaster (preparedness, risk awareness before, health status before the disaster) entered at step 2. Step 3 included the general consequences of the earthquake as related to its severity (specific earthquake experienced -only in the whole sample analysis, whether the individual was still in temporary accommodation and the length of stay in temporary accommodation). Step 4 considered the type and quality of temporary accommodation and social support (quality, type, and density of the temporary accommodation, protection net after the earthquake, and perceived social support while in temporary accommodation). Finally, step 5 included emotional and physical outcomes, such as symptoms of PTSD, health impairment after the earthquake, experience with death and suffering, emotional well-being in the past 30 days, and health status at the time of the survey.

3. Results

3.1. Descriptive statistics and preliminary analyses

Descriptive statistics, reliabilities, and correlation coefficients between the measured variables are presented in Table 2.

The mean scores in Table 2 reveal that participants, on average, experienced a moderate level of life satisfaction, perceived the quality of the temporary accommodations as moderately high, and reported a moderate population density in the accommodations. In contrast, risk awareness was generally low, in terms of both seismic risk awareness and earthquake preparedness. Perceived protection net was moderate; perceived support was generally high, as well as place attachment. Participants reported a moderate level of PTSD, a moderate to low level of health impairment, a low level of experience with death and suffering, and a moderate level of emotional well-being.

Correlation coefficients in Table 2 showed that life satisfaction during the stay in the temporary housing was slightly, although significantly, associated with prior earthquake preparedness as well as prior health status and pre-existing individual resilience capabilities. Life satisfaction was also associated to a moderate extent with the perceived quality of accommodation, the extension of the protection net on which earthquake survivors could count after the disaster, as well as with the perceived social support received during the stay in the temporary accommodation. Life satisfaction was also associated with less PTSD symptoms, more positive emotional well-being, and generally better health after the disaster. Most of the psychophysical variables were coherently correlated with each other, such that greater health impairment was associated with more symptoms of PTSD and lower well-being, and lower

Table 3
Hierarchical regression analysis predicting life satisfaction during temporary housing.

	Model									
	Step 1		Step 2		Step 3		Step 4		Step 5	
	b	β	b	β	b	β	b	β	b	β
Intercept	3.40***		2.06**		1.39*		0.70		0.15	
Age	0.00	.03	0.00	.11	0.00	.07	0.00	−.00	0.00	.07
Education	−0.09	−.10	−0.11	−.12	−0.10	−.11	−0.15*	−.16	−0.13§	−.14
Sex										
2–1	0.02	.03	0.12	.17	0.07	.11	−0.05	−.07	−0.00	−.00
Income	0.02	.05	0.02	.04	−0.02	−.04	0.02	.03	0.02	.03
Risk Awareness (before)			−0.05	−.12	0.00	.02	0.02	.04	0.01	.03
Place Attachment			0.04	.06	0.03	.05	0.02	.04	0.01	.02
Earthquake Preparedness			0.02**	.23	0.03***	.29	0.02**	.19	0.02**	.18
Resilience Capability			0.10§	.17	0.10*	.18	0.05	.08	0.00	.00
Psychological Vulnerability			0.00	.00	0.03	.05	0.07	.10	0.08	.13
General Health Status (before)			0.12§	.14	0.14*	.17	0.05	.06	0.00	.00
Specific Earthquake										
Abruzzo 2009 – Central Italy 2016-17					0.41**	.63	0.44**	.64	0.51**	.74
Emilia 2012 – Central Italy 2016-17					0.58***	.84	0.55***	.79	0.51**	.74
Still in Temporary House										
2–1					0.17	.24	0.05	.08	0.06	.09
Length of Temporary House Stay					0.00	.04	−0.00	−.11	−0.00	−.13
Quality of Accommodation							0.21***	.29	0.16**	.22
Temporary House Type										
1–2							−0.48*	−.69	−0.53**	−.76
3–2							−0.35*	−.51	−0.31*	−.44
Density							−0.52	−.06	−0.43	−.05
Protection Net							0.21**	.24	0.22**	.24
Perceived Social Support							0.06	.11	0.06	.11
Post-traumatic Stress Disorder									−0.00	−.00
Health Impairment									0.00	.00
Experience with Death									0.06	.11
Emotional Well-being									0.06	.06
General Health Status (after)									0.18**	.24
R^2	.01		.15		.24		.46		.51	
ΔR^2			.14***		.09**		.22***		.05*	

§p < .10; *p < .05; **p < .01; ***p < .001.

well-being was associated with more symptoms of PTSD. Another cluster of correlations was related to the social support variables. Specifically, holding a larger protection net and perceiving greater social support were positively associated with a better general health status, better emotional well-being, more resilience capabilities, and less psychological vulnerability.

3.2. Predictors of life satisfaction during displacement in temporary housing

Prior to conducting the hierarchical regression analysis, we controlled for multicollinearity. Despite the presence of several significant correlations between pairs of variables in the correlation matrix (Table 2), none of the correlation coefficients exceeded an absolute value of 0.80, typically considered a threshold value to assess potential problems [59], indicating that multicollinearity was not a major concern. Indeed, the strongest correlation was 0.60 between health impairment and PTSD. Multicollinearity was also checked by computing VIF (variance inflation factor) values in the hierarchical regression analysis, and even in this case, no problematic values were detected (VIFs always below 2).

Then, as described in paragraph 3.3, hierarchical regression analysis was carried out by entering predictors of life satisfaction during temporary housing in five steps, following their temporal ordering, beginning with the variables referring to conditions existing before the event and progressing to the variables describing the consequences of the disaster.

Table 3 presents the results of the hierarchical regression analysis predicting life satisfaction during the temporary housing stay. As mentioned, the analysis comprises five steps, each including a different set of predictors.

In Step 1, demographic variables (age, education, sex, income) were included, and the R^2 was 0.01. None of the predictor variables in Step 1 were significant.

In Step 2, stable individual differences and variables related to participants' status before the disaster (place attachment, resilience capability, psychological vulnerability, earthquake preparedness, risk awareness before, and general health status before the disaster) were added, which significantly increased the R^2 to 0.15. This suggests that variables pre-existing the disaster were important predictors of life satisfaction during the temporary housing. However, only earthquake preparedness had a statistically significant effect. These results indicate that higher levels of earthquake preparedness were associated with higher levels of life satisfaction.

In Step 3, the general consequences of the earthquake were added, which further increased the R^2 to 0.24. Notably, the specific earthquake experienced was a significant predictor of life satisfaction, with participants who experienced the 2016-17 Central Italy earthquake reporting lower levels of life satisfaction compared to those who experienced the 2009 Abruzzo earthquake or the 2012 Emilia earthquake.

In Step 4, variables related to the temporary housing situation were added, which significantly increased the R^2 to 0.46. The quality of accommodation and the type of temporary housing were significant predictors of life satisfaction. Specifically, participants living in containers/modules (group 2) reported higher levels of life satisfaction than those living in tents/campers (group 1) and those living in houses/apartments (group 3). The quality of perceived accommodation was also a significant predictor of life satisfaction, even controlling for the type of accommodation. Moreover, the protection net significantly predicted life satisfaction.

In Step 5, variables related to emotional and physical outcomes were added, which further increased the R^2 to 0.51. General health status after the earthquake was a significant predictor of life satisfaction.

The significant increase in R^2 for each step suggests that the variables included in each step contributed to explaining unique variance in the prediction of life satisfaction during temporary housing, with the exception of socio-demographic variables. Overall, the final model explained 51% of the variance in life satisfaction during temporary housing, with the significant predictors in this model being earthquake preparedness, specific earthquake, quality of accommodation, temporary house type, protection net, and general health status after the disaster.

Overall, these findings highlight the importance of considering a wide array of variables related to different types of factors when predicting life satisfaction during a post-disaster temporary housing situation. This reflects the complexity of the post-earthquake situation, which is affected by a complex net of psychological, social, physical, and health-related factors.

3.2.1. Differences between case studies

The results of the hierarchical regression analysis on the whole sample suggested that the specific earthquake experienced had a significant impact on life satisfaction during the stay in temporary housing. To better understand whether the predictors in our study had a different role in predicting life satisfaction in the three earthquakes, we conducted a separate regression analysis for each case

Table 4
Significant predictors in the final regression models predicting life satisfaction during temporary housing on the whole sample and for each specific earthquake.

	Whole sample	2009 Abruzzo	2012 Emilia	2016-17 Central Italy
Place attachment			✓	
Earthquake preparedness	✓		✓	
Specific earthquake	✓	**NA**	**NA**	**NA**
Quality of accommodation	✓	✓	✓	
Type of temporary house	✓			
Protection net	✓		✓	
Social support				✓
General health status	✓		✓	
Health impairment			✓	

Note. √ means that the predictor is significant in the final model, while NA means that the predictor was not used in that model (it was used only in the whole-sample analysis).

study (Supplementary Materials, Tables 7–9). This approach allowed us to determine if the observed pattern of significant predictors was maintained in the individual earthquakes and to gain insights into the context-specific factors contributing to the observed differences in life satisfaction. However, it should be noted that reducing the sample size can also result in some predictors becoming nonsignificant due to reduced statistical power. Indeed, the a-priori sample size for the detection of a medium-size effect in a multiple regression with 23 predictors and a 0.80 power (alpha level = .05) is 166. This shows that the analysis on our whole sample is well-powered, while the analyses on the single earthquakes are underpowered. However, for exploratory purposes and for the sake of completeness, we deemed it worth carrying out also the analysis of each specific earthquake, given that there are reasons to think they may differ in various respects (e.g., areas and populations affected, time from the disaster).

The hierarchical regression analysis aimed to examine the predictors of life satisfaction after the 2009 Abruzzo earthquake showed that none of the sociodemographic variables was a significant predictor of life satisfaction at step 1. Pre-existing individual characteristics and conditions did not make a significant contribution to explained variance (step 2), as well as general consequences (step 3). The only significant contribution was at step 4 when the variables related to the accommodation were entered into the model ($\Delta R^2 = 0.32, p = .017$), with the quality of accommodation being a significant predictor of life satisfaction ($\beta = 0.77, p = .002$) that remains the only significant predictor also in the final model ($\beta = 0.82$, $p = .004$). Individuals who reported a better quality of accommodation showed higher life satisfaction during temporary housing. Overall, the final model explained 63% of the variance in life satisfaction.

The hierarchical regression analysis computed on the 2012 Emilia earthquake data showed that no demographic variables were significant predictors at step 1, nor any of the pre-existing conditions at step 2, nor the general consequences at step 3. Accommodation and social variables entered at step 4 made a significant additional contribution to the model ($\Delta R^2 = 0.32$, $p < .001$). Specifically, participants who rated the quality of their accommodations more positively reported higher levels of life satisfaction ($\beta = 0.31$, $p = .03$), and the effect remained significant in step 5 ($\beta = 0.34, p = .017$). Protection net and place attachment were two other significant predictors in step 4 ($\beta = 0.36, p = .018$; $\beta = 0.34, p = .009$) and remained significant in step 5 ($\beta = 0.51, p = .002$; $\beta = 0.48, p = .001$). This suggests that having a stronger protection net and being more strongly related to the place and its community were associated with higher levels of life satisfaction after the earthquake. In step 5, among the emotional and physical outcomes of the disaster, having experienced less health impairment ($\beta = 0.57$, $p = .007$) and having better health ($\beta = 0.45$, $p = .009$) after the disaster were both predictive of greater life satisfaction. Moreover, earthquake preparedness became a significant predictor of life satisfaction ($\beta = 0.31, p = .015$). The final model accounted for 68% of the variance in life satisfaction during temporary housing, with the significant predictors in the final model being place attachment, earthquake preparedness, quality of accommodation, protection net, health impairment, and general health status after the disaster.

The hierarchical regression analysis predicting life satisfaction for the 2016-17 Central Italy earthquake shows that none of the variables in step 1 exhibited significant associations with life satisfaction. In step 2, among the individual differences and pre-existing conditions added to the model, earthquake preparedness showed a positive association with life satisfaction ($\beta = 0.33, p = .013$) as well as resilience capability ($\beta = 0.31, p = .037$). In step 3, the general consequences of the earthquake were added to the model, showing that still being in temporary housing was strongly associated with lower life satisfaction ($\beta = 0.89$, $p = .018$), with the effect of preparedness ($\beta = 0.30$, $p = .028$) and resilience capability ($\beta = 0.36$, $p = .015$) still being significant. In step 4, accommodation variables were added to the model as well as social support and protection net. Protection net was significantly associated with life satisfaction ($\beta = 0.28, p = .032$), while only preparedness remained significant ($\beta = 0.30, p = .044$). When the emotional and physical outcomes were added in step 5, the only final significant predictor became social support received during this stay ($\beta = 0.32, p = .022$). Overall the model explained 67% of the variance.

Overall, the results of the final models on the three earthquakes (summarized in Table 4) showed that the factors contributing to life satisfaction differ depending on the specific disaster experienced, with a single variable playing a role in two cases out of three (i.e., perceived quality of temporary accommodation). Indeed, for the Abruzzo 2009 earthquake, the only significant predictor was the quality of temporary accommodation. For the Emilia 2012 earthquake, the perceived quality of accommodation made a significant contribution to the final model, but several other predictors were significant: pre-existing variables such as earthquake preparedness and place attachment, the strength of the protection net, and the health outcomes (health impairment and general health status). For the Central Italy 2016–17 earthquake, instead, the social support received during the stay was the only significant predictors of life satisfaction in the final model.

4. Discussion

Overall, the results of the analysis of the whole sample demonstrate the complex and multifaceted nature of life satisfaction during temporary housing after a natural disaster. The findings suggest that a variety of factors, including earthquake preparedness, specific disaster experienced, temporary housing quality and type, protection net, and general health, predict life satisfaction in post-disaster recovery efforts. Indeed, the hierarchical regression analysis on the whole sample showed that earthquake preparedness was a significant predictor of life satisfaction during temporary housing. This highlights the importance of pre-disaster planning and preparedness efforts to improve outcomes for individuals during a post-disaster temporary housing situation. The analysis also found that the specific earthquake experienced significantly predicted life satisfaction during temporary housing. This confirms, not surprisingly, that the particular conditions under which each disaster occurs and its local context can affect life satisfaction during temporary housing. More interestingly, variables related to the temporary housing situation and to the social context were also found to be significant predictors of life satisfaction (type and perceived quality of temporary housing, presence of a valid protection net). Our findings suggest that the temporary housing solution needs to be appropriate, offering both adequate environmental conditions (such as privacy, space, light, acoustic and thermal insulation, building quality, and proper surroundings) and the possibility to resume

ordinary life activities (e.g., work, education, social and personal relations) due to an acceptable distance to relevant places and facilities. Moreover, the results underline the role of other people and the community in providing support to persons temporarily displaced during the disaster. Finally, physical well-being after the disaster was a significant predictor of life satisfaction, highlighting the importance of considering people's health in post-disaster recovery efforts.

The analysis of the three case studies highlighted the importance of understanding the unique effects of specific disasters on life satisfaction. While some predictors, such as temporary accommodation quality, were significant predictors across two earthquakes, others apparently had effects on single disasters only, depending on the context. Indeed, in the Abruzzo 2009 earthquake, perceived accommodation quality was the only significant predictor of life satisfaction. In Emilia 2012, along with accommodation quality, earthquake preparedness, protection net, health outcomes, and place attachment also emerged as significant predictors. In the most recent earthquake (Central Italy 2016–17), social support was the only significant predictor of life satisfaction in the final model. Due to the reduction in statistical power for the single-earthquake analysis, it would be risky to propose a strong interpretation of these differences. However, some of them may reflect the specificities of single earthquakes. The 2009 Abruzzo earthquake severely damaged urban areas, with many displaced persons needing a proper temporary accommodation, even for a long time (due to the length of the rebuilding process). Thus, temporary accommodation quality may have been especially important in this case. The 2012 Emilia disaster hit a densely-populated area with a dynamic work area and strong social bonds. Therefore, several individual and social factors, including attachment to the local community, may have played a role in post-disaster well-being. The 2016-17 Central Italy earthquake was the most recent one, and the significant predictor identified may have possibly reflected the need of social support during the adaptation processes and ongoing challenges still faced at the time of the survey by individuals living in an area with a low population density and a high number of small hamlets of municipalities.

Overall, the results of our study indicate that interventions and policies aimed at promoting well-being and recovery in the aftermath of natural disasters could focus on improving individual earthquake preparedness, providing higher-quality accommodations, strengthening the protection net, and addressing health outcomes, as suggested by the whole-sample analysis. Additionally, the analysis at the single-disaster level suggests that these interventions may benefit from being tailored to the specific local context by focusing on the specific needs of individuals affected by the disaster, which should be attentively appraised. Moreover, thanks to the broad perspective adopted in this study in terms of the number and type of variables measured, the whole sample analysis highlighted a rich pattern of predictors, encompassing individual, social, and structural variables. This unveils the complexity of the impact of the seismic event on the individual, which needs to be studied by including different types of reliably-measured variables in order to render an appropriate picture of the network of relations involved.

Indeed, our results strengthen and integrate, in the specific context of people displaced after an earthquake, the rather sparse evidence collected by other studies on the role of various predictors of life satisfaction after a disaster. This evidence indicates that a low-quality temporary house can increase the distress of displaced persons due to lack of privacy, limited natural light or space, noise, and inappropriate thermal conditions [51,60], but also due to inappropriate placement of the temporary house in relation to important services and life and socialization environments [61–63]. Social support, such as the one provided by a valid protection net, the community, or relevant others, seems able to mitigate the negative effects of the disasters on quality of life [33,64–67], albeit its effect has not always been observed. Additionally, people who are better prepared for the earthquake seem to have higher levels of life satisfaction [5,6]. Finally, people who lost their houses or were relocated to temporary houses due to an earthquake show lower physical and psychological health [68,69].

The nonsignificant predictors in our final models deserve some comment. For what concerns risk awareness before the disaster, it should be noted that this variable is positively correlated with earthquake preparedness (see Table 2), and we may consider it as a precursor of preparedness, which turned out as a significant predictor in the whole sample analysis. Similarly, for what concerns general health, it should be noted that this variable is correlated to all the other health-related variables in our study (PTSD symptoms, health impairment, and emotional well-being), which means that it could be considered as a more general indicator encompassing various facets of physical and psychological health. Therefore, even in this latter case, the results seem to be consistent with the overall pattern of results and with our expectations. Finally, and rather surprisingly, socio-demographic variables such as age, gender, education, and income did not contribute significantly to the prediction of life satisfaction in our study. However, these variables may have a weaker and indirect effect on life satisfaction, as other more immediate factors could influence it more, such as living in a better temporary house (for example, by renting it) or leaving the temporary accommodation sooner, having a stronger support network, or enjoying a better health status.

Although our study provided useful indications on the predictors of life satisfaction during temporary housing, further research is needed to better understand the complex interactions among the different factors we have highlighted and to prospectively inform the development of interventions that can promote recovery and well-being following natural disasters at the general and local level. In particular, a possible extension of our work could be to develop and test structural equation models for the prediction of life satisfaction of displaced persons, including the various types of predictors we considered (personal, social, structural), in order to better understand their interrelations as well as to further appraise their relative contribution. Moreover, the adoption of a longitudinal research approach would be useful to minimize potential problems related to respondents' memory biases and distortions, although several studies have shown that present and future behaviors and intentions are more based on the memory of past experiences than on the evaluations provided during these experiences [70–73]. Thus, recollections of past conditions experienced after an earthquake may even be more predictive of actual and future well-being than accurate reports of these conditions. Additionally, the time course of respondents' life satisfaction could be tracked over time in order to understand its variations and to identify the factors explaining its downfall after a disaster and its potential recovery over time. Finally, it could be very interesting and practically worth investigating to what extent the set of predictors we identified as relevant in our study is also important in other kinds of disasters that may lead to

displacements, such as the various types of extreme events related to climate change like wildfires and floods.

Declaration of competing interest

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

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

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