



# Assessing Urban Social Resilience to Natural Hazards and the Contribution of Its Dimensions: The Case of Tehran, Iran

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| ARTICLE INFO                                                                                                                                                                                                                                                                            | ABSTRACT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
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| <p>Article History:<br/>Received 2 February 2025<br/>Received in revised form 16 March 2025<br/>Accepted 8 May 2025<br/>Available online 9 September 2025</p> <p>Keywords:<br/>Social resilience; Disaster management; Natural hazards; Social participation; Coping skills; Tehran</p> | <p>This study assessed the social resilience of the city of Tehran, Iran, to natural hazards and the contribution of its constituent dimensions. In this applied, descriptive-analytical study, the questionnaire dimensions and items were first developed from the literature and from interviews with experts in disaster management and urban sociology; data were then collected with the resulting questionnaire from 384 residents of selected neighborhoods. The questionnaire measured five dimensions: knowledge, social participation, coping skills, sense of belonging and social security. Data were analyzed using confirmatory factor analysis, partial least squares structural equation modeling (PLS-SEM) and one-way analysis of variance. The overall mean social resilience score was 3.61 on a five-point scale, significantly above the midpoint. In the second-order model, coping skills (<math>\beta = 0.341</math>), knowledge (<math>\beta = 0.312</math>), social participation (<math>\beta = 0.285</math>) and sense of belonging (<math>\beta = 0.198</math>) contributed significantly to social resilience, whereas social security did not (<math>\beta = 0.061</math>). Social resilience also differed significantly across neighborhoods, from 3.88 in Elahiyeh to 3.31 in Javadieh. The findings indicate that social resilience in Tehran rests mainly on residents' action-oriented capacities (knowledge, skills and participation) and is unevenly distributed across urban space. Public education, emergency-response skills training and stronger neighborhood-based participatory institutions, particularly in disadvantaged neighborhoods, may therefore enhance the city's social resilience.</p> |

## 1. INTRODUCTION

### 1.1. Problem Statement

In recent decades, the increasing frequency and severity of natural hazards, including earthquakes, floods, droughts, and severe storms, has drawn the attention of researchers and urban planners increasingly toward the need to enhance the "resilience" of communities to hazards [1, 2]. Social resilience, as one of the main components of urban resilience, is a multidimensional concept that emphasizes the collective and individual capacities of a

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community to adapt, recover, and maintain its functioning in the face of shocks [3, 4]. From this perspective, a community with high levels of cohesion, participation, knowledge, and coping skills is better able to reduce damage and to recover more quickly in times of crisis [5, 6].

In Iran, the experience of destructive earthquakes, particularly the Bam earthquake (2003) and the Kermanshah Province earthquake (2017), has revealed weaknesses in disaster preparedness and response [12]. For this reason, the concept of resilience has gained a special place in urban policy-making and disaster management over the past decade and has expanded from a purely technical-physical approach to a human-social one [8, 9]. Nevertheless, disaster management in most Iranian cities remains focused mainly on technical and physical dimensions, whereas the theoretical literature emphasizes that resilience cannot be sustained without attention to a community's social and cultural capacities [10, 11].

Tehran, Iran's capital and largest city, lies in a seismically active region surrounded by active faults and has been struck by several destructive earthquakes in its history [13]. In addition to physical hazards, certain social indicators, such as unemployment, rural-to-urban migration, declining social cohesion, and weak civic participation, may also affect the level of social resilience [14]. Recent Iranian earthquakes, such as the 2017 Kermanshah earthquake, have clearly shown the gap between technical preparedness and social preparedness: in many urban areas, limited public awareness, weak emergency-response training, and a weak sense of belonging to the community slowed reconstruction and deepened the damage. Evidence from the response to that earthquake also points to weaknesses in preparedness and coordination [12], which are central to a community's capacity to cope with disasters [15]. Moreover, in some marginal neighborhoods, the sense of belonging and social trust has weakened, which in turn hinders the formation of effective social support networks. On the other hand, post-disaster experience shows that communities with self-help and group skills achieve faster and better-quality reconstruction [9, 16]. Weakness in any of the factors of knowledge, participation, skills, sense of belonging, or social security can weaken the entire social system in the face of sudden shocks [2, 17]. Therefore, the social resilience of the city needs to be analyzed not only from a physical perspective but also from cultural, institutional, and psychological perspectives [18].

## **1.2. Research Gap and Objectives**

Recent research emphasizes that social resilience is not a static attribute but a dynamic and continuous process shaped by collective learning, trust, social capital, and individual skills [5, 19]. Despite the growth of the literature in this field, three specific gaps remain. First, most Iranian studies have focused on the physical or economic dimensions of resilience, and its social dimensions, particularly at the urban scale, have received less attention. Second, many studies have been limited to describing indicators and have not statistically tested the relative contribution of each dimension to social resilience. Third, intra-urban differences in social resilience, that is, its unequal distribution across neighborhoods, have received little attention, even though the international literature emphasizes the spatial and unequal nature of resilience [17, 18].

Accordingly, the present study has three objectives: (a) to assess the level of social resilience of Tehran residents to natural hazards; (b) to determine the relative contribution of five dimensions, namely knowledge, social participation, coping skills, sense of belonging, and social security, to social resilience; and (c) to compare social resilience across different neighborhoods of the city. These dimensions were selected on the basis of international theoretical and empirical frameworks [2, 17] and previous empirical studies [7, 20, 21]. The ultimate aim is to develop a conceptual model that explains the relationships among these dimensions and assists policy-makers in enhancing social resilience. The results are expected to help urban managers and disaster-management institutions design neighborhood-based policies and programs to improve social resilience.

## **2. THEORETICAL FRAMEWORK AND LITERATURE REVIEW**

### **2.1. The Concept of Resilience and Its Evolution**

The term resilience was first used systematically in ecology; Holling defined resilience as the ability of a system to absorb changes and disturbances while maintaining its essential relationships and functions [22]. The concept later entered the social sciences, where it came to refer to the capacity of individuals and communities to adapt and

recover under adverse conditions [4, 16]. Adger defined social resilience specifically as the ability of groups or communities to cope with external stresses and disturbances resulting from social, political, and environmental change [3]. Alexander, tracing the etymology of the term, showed that it has acquired multiple meanings in its passage into the field of disaster risk reduction and should therefore be used with conceptual precision [10].

## **2.2. Models of Social Resilience**

In the 2000s, new approaches to disaster management introduced social resilience as a complement to technical approaches. Norris and colleagues proposed one of the first comprehensive models of community resilience, identifying four sets of adaptive capacities, namely economic development, social capital, information and communication, and community competence, as the basis of community resilience [2]. Cutter and colleagues proposed a place-based model for understanding community resilience to natural disasters [1] and later, by developing indicators of community resilience, demonstrated the uneven geography of resilience in the United States [17]. This line of research builds on earlier studies of social vulnerability, which, through the construction of the Social Vulnerability Index (SoVI), showed that vulnerability to hazards is strongly shaped by the socio-economic characteristics of populations [23].

Magis regarded community resilience as an indicator of social sustainability and, in her conceptual model, emphasized community resources, engagement, collective action, and learning [5]. Patel and colleagues, in a systematic review of 80 studies, identified nine core elements of a resilient community: local knowledge, community networks and relationships, communication, health, governance and leadership, resources, economic investment, preparedness, and mental outlook [19]. Manyena, in a critical analysis, has emphasized the "multiple faces" and "multiple spaces" of resilience, meaning that the values, institutional structures, and historical experiences of each society shape how resilience is defined and formed [9].

## **2.3. Social Capital and Resilience**

Globally, numerous studies have emphasized the importance of social capital, trust, and communication networks. Aldrich, comparing recovery after several major disasters, including the Tokyo (1923) and Kobe (1995) earthquakes, the 2004 Indian Ocean tsunami, and Hurricane Katrina, showed that social capital is among the strongest predictors of the speed of local recovery [11]. Aldrich and Meyer have further argued that social capital is the core of community resilience and that disaster-management policies should prioritize strengthening it [6]. Nakagawa and Shaw have likewise described social capital as the "missing link" in post-disaster recovery [24]. A similar approach can be seen in research on developing countries; Ainuddin and Routray, in a framework for community resilience in the earthquake-prone region of Baluchistan, Pakistan, emphasized the role of awareness, preparedness, social trust, and local institutions [14].

In Iranian research, the concept of social resilience has attracted attention since the early 2010s. Shaw and colleagues showed that citizens' knowledge and education have a significant effect on earthquake preparedness [7], and Aldrich has emphasized the importance of social networks, local institutions and civic participation in strengthening resilience [8]. Aldrich and Meyer likewise argue that social capital, including participation and trust, can matter more for disaster recovery than economic resources [21]. After the 2017 earthquake in Kermanshah Province, deficient response protocols and weak coordination among responding organizations were reported [12]; such weaknesses undermine communities' capacity to prepare for and respond to disasters [15].

The review of previous studies shows that, although much research has been conducted on resilience, most of it has addressed physical or economic aspects, and the social dimensions, particularly at the urban scale in Iran, have been examined less. Moreover, most studies have been limited to describing indicators and have tested the relationships among them less often. By focusing on the statistical measurement of relationships among social components, the present study seeks to fill this gap in the Iranian literature on social resilience and to offer a model suited to the cultural and social conditions of Tehran.

## **2.4. Dimensions of Social Resilience in the Present Study**

**Knowledge and awareness.** Awareness of hazards and training in safe behaviors are among the main prerequisites of social resilience [25]. A community with greater general knowledge of hazards is less vulnerable in a crisis, and public education is regarded as one of the key success factors in natural disaster management [26]. "Local knowledge" also heads the list of core elements of resilience in the systematic review by Patel and colleagues [19]. Research has likewise confirmed the role of public education in increasing preparedness and reducing casualties [7].

**Social participation.** The active participation of citizens in local institutions, relief programs, and urban decision-making increases the sense of collective responsibility and enhances the community's capacity to mobilize resources during a crisis [11, 24]. Research on post-disaster recovery has also shown that communities with stronger social networks and local institutions recover more quickly [21].

**Coping skills.** Possessing the skills needed to cope with a crisis, such as first aid, stress management, and rapid decision-making, constitutes the practical aspect of resilience and enables citizens to apply their knowledge in real situations [9]. Training in coping skills in schools and neighborhoods can have a marked effect on preparedness [16]. "Preparedness", including planning, mitigation, and training, has been recognized as one of the core elements of community resilience [19, 25].

**Sense of belonging.** A sense of belonging to the local community is a key factor in cohesion and mutual support; people who feel a stronger sense of belonging to their neighborhood or city are more willing to participate in collective action during a crisis [5, 17]. Trust and stable social relationships also provide the basis for collective action and the joint management of resources [27].

**Social security.** A sense of physical, financial, and psychological security provides the necessary conditions for participation and cooperation during a crisis [2], and insecurity or social distrust can weaken resilience [4]. Nevertheless, some studies have shown that security alone does not guarantee resilience and that its effect operates through social capital and trust [6].

## 2.5. Conceptual Model, Research Questions, and Hypotheses

On the basis of the literature reviewed above, social resilience is treated in this study as a multidimensional construct composed of five dimensions: knowledge, social participation, coping skills, sense of belonging, and social security (Figure 1). Each dimension was measured with specific indicators, and their relationships were organized in the conceptual model shown in Figure 1. In this model, social resilience is the main variable (the overall construct), and knowledge, social participation, skills, sense of belonging, and social security are its dimensions. The relationships in the model are therefore interpreted not as the causal effect of an independent variable on a dependent variable, but as the contribution of each dimension to the overall construct of social resilience.

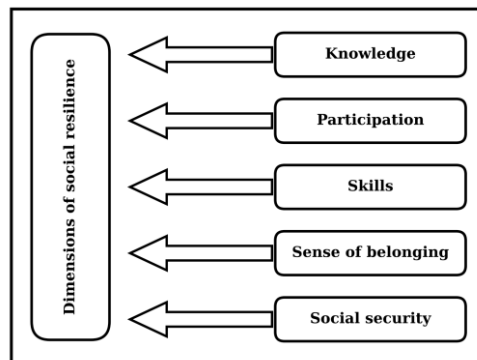


**Fig. 1.** Conceptual model of the study: the five constituent dimensions of social resilience (researcher-developed model based on [1, 2]).

The research questions are as follows:

**Question 1.** What is the level of social resilience of Tehran residents to natural hazards?

**Question 2.** Which of the dimensions of knowledge, social participation, coping skills, sense of belonging, and social security makes the greatest contribution to social resilience?

**Question 3.** Is there a significant difference in social resilience across the neighborhoods of Tehran?

The research hypotheses are as follows:

**Hypothesis 1.** Residents' knowledge of natural hazards makes a positive and significant contribution to social resilience.

**Hypothesis 2.** Social participation makes a positive and significant contribution to social resilience.

**Hypothesis 3.** Coping skills make a positive and significant contribution to social resilience.

**Hypothesis 4.** Sense of belonging makes a positive and significant contribution to social resilience.

**Hypothesis 5.** Social security makes a positive and significant contribution to social resilience.

### **3. METHOD**

#### **3.1. Research Design**

The present study is applied in purpose and descriptive-analytical in method and was conducted in two stages. In the qualitative stage, the dimensions and items of the research instrument were developed on the basis of a review of the theoretical literature and conceptual models, as well as interviews with experts in disaster management and urban sociology. In the quantitative stage, data were collected through a questionnaire and analyzed statistically. This sequence, in which the findings of the qualitative stage inform the construction of the instrument used in the quantitative stage, is consistent with the logic of exploratory sequential mixed-methods designs [28].

#### **3.2. Population, Sample Size, and Sampling**

The statistical population consisted of residents of selected neighborhoods of Tehran. The sample size was set at 384 using Cochran's formula for large populations at a 95% confidence level and a 5% margin of error [29]. Participants were selected randomly in the selected neighborhoods, and questionnaires were distributed across these neighborhoods. In total, 384 completed questionnaires were included in the analysis. Three neighborhoods representing different socioeconomic conditions were studied: Elahiyeh in the north ( $n = 130$ ), Narmak in the east ( $n = 128$ ) and Javadieh in the south of the city ( $n = 126$ ); within each neighborhood, respondents were selected at random from residential units.

#### **3.3. Instrument**

Data were collected using a researcher-developed questionnaire with five sections (knowledge, social participation, coping skills, sense of belonging, and social security). Items were rated on a five-point Likert scale (from "strongly disagree" = 1 to "strongly agree" = 5), and the score for each dimension was computed as the mean of its items. The face and content validity of the questionnaire were confirmed by expert judgment, and its construct validity was confirmed through factor analysis. Reliability was assessed using Cronbach's alpha, which was 0.82 for the questionnaire as a whole, indicating satisfactory reliability.

#### **3.4. Data Analysis**

The data were analyzed using SPSS version 26 and SmartPLS. First, descriptive statistics (mean, standard deviation, and frequency) were computed, and the normality of the data was examined with the Kolmogorov–Smirnov test. One-sample *t*-tests were used to compare the mean of each dimension with the theoretical midpoint of the scale (3). The adequacy of the data for factor analysis was assessed with the KMO index and Bartlett's test of sphericity, and the factor structure of the instrument was tested with confirmatory factor analysis. The contribution

of each dimension to social resilience was then estimated using partial least squares structural equation modeling. In this model, social resilience was specified as a second-order construct and the five dimensions as its first-order constructs, and the significance of the coefficients was assessed by bootstrapping [30, 31]. The second-order model was estimated using the repeated-indicators approach. In addition, pairwise relationships among the dimensions were examined using Pearson correlation coefficients, and differences in social resilience across neighborhoods were tested with one-way analysis of variance.

### 3.5. Ethical Considerations

Participation in the study was voluntary, the purpose of the study was explained to respondents, and the questionnaires were completed anonymously without recording any identifying information.

## 4. RESULTS

### 4.1. Demographic Characteristics of Respondents

The questionnaire derived from the theoretical framework was distributed randomly across the study neighborhoods, and 384 completed questionnaires were ultimately included in the statistical analysis. Of the respondents, 46.1% were women and 53.9% were men (Chart 1). Thirty percent of respondents had lived in their neighborhood for more than 20 years, 21% for 10 to 20 years, 18% for 5 to 10 years, 21% for 1 to 5 years, and 10% for less than one year (Chart 2). With respect to age, the largest group was aged 40 to 60 years (30%), followed by those aged 30 to 40 years (28%) and 20 to 30 years (25%); 11% were over 60 and 6% were under 20 (Chart 4). The distribution of educational attainment is shown in Chart 3. Table 1 summarizes these characteristics.

**Table 1.** Demographic Characteristics of Respondents (n = 384)

| Variable                                       | Category                  | %    |
|------------------------------------------------|---------------------------|------|
| <b>Gender</b>                                  | Female                    | 46.1 |
|                                                | Male                      | 53.9 |
| <b>Length of residence in the neighborhood</b> | Less than 1 year          | 10   |
|                                                | 1–5 years                 | 21   |
|                                                | 5–10 years                | 18   |
|                                                | 10–20 years               | 21   |
|                                                | More than 20 years        | 30   |
| <b>Age group</b>                               | Under 20 years            | 6    |
|                                                | 20–30 years               | 25   |
|                                                | 30–40 years               | 28   |
|                                                | 40–60 years               | 30   |
|                                                | Over 60 years             | 11   |
| <b>Education</b>                               | Below high-school diploma | 18   |
|                                                | High-school diploma       | 34   |
|                                                | Bachelor's degree         | 31   |
|                                                | Postgraduate              | 17   |

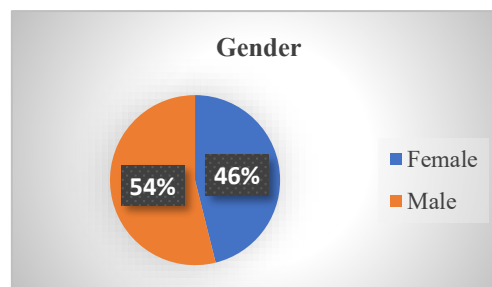


**Chart 1.** Gender distribution of respondents

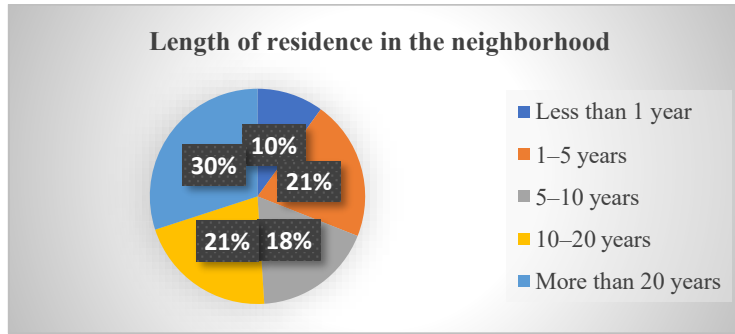


**Chart 2.** Respondents' length of residence in the neighborhood

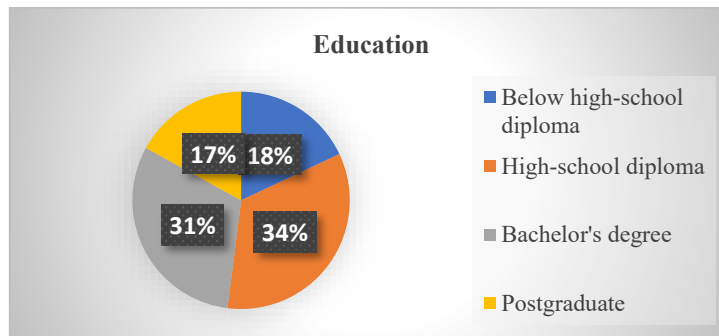


**Chart 3.** Respondents' educational attainment

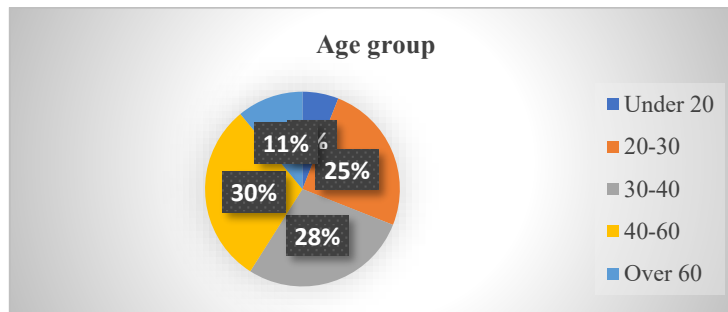


**Chart 4.** Age groups of respondents

#### 4.2. Descriptive Statistics of the Study Variables

Table 2 presents the means and standard deviations of the dimensions of social resilience. The means of all dimensions, as well as the overall mean of social resilience (3.61), were significantly higher than the theoretical midpoint of the scale (3). The highest means were observed for coping skills (3.82) and knowledge (3.74), and the lowest for social security (3.28) and sense of belonging (3.52). Thus, in answer to the first research question, the social resilience of Tehran residents is above average, but the dimensions related to social cohesion and perceived security are at a lower level than those related to knowledge and skills.

**Table 2.** Descriptive Statistics of the Dimensions of Social Resilience (n = 384; scale 1–5)

| Dimension                   | <i>M</i> | <i>SD</i> | Min | Max | One-sample <i>t</i> (test value = 3) |
|-----------------------------|----------|-----------|-----|-----|--------------------------------------|
| Knowledge                   | 3.74     | 0.61      | 2.3 | 4.8 | 23.77***                             |
| Social participation        | 3.69     | 0.57      | 2.1 | 4.7 | 23.72***                             |
| Coping skills               | 3.82     | 0.55      | 2.4 | 4.9 | 29.22***                             |
| Sense of belonging          | 3.52     | 0.68      | 1.8 | 4.6 | 14.99***                             |
| Social security             | 3.28     | 0.74      | 1.5 | 4.5 | 7.41***                              |
| Social resilience (overall) | 3.61     | 0.63      | 2.1 | 4.8 | 18.97***                             |

Note. \*\*\*  $p < .001$ ;  $df = 383$ . The *t* values were computed from the reported means, standard deviations, and sample size. The overall social resilience score equals the mean of the five dimensions.

#### 4.3. Normality and Sampling Adequacy

The Kolmogorov–Smirnov test indicated that the data were normally distributed ( $p > 0.05$ ). The KMO index was 0.78 and Bartlett's test of sphericity was significant ( $p < 0.001$ ); the data were therefore suitable for factor analysis.

#### 4.4. Confirmatory Factor Analysis

The confirmatory factor analysis showed that all items loaded on their respective dimensions with factor loadings above 0.6, significant at the 0.01 level. The fit indices of the measurement model were also within acceptable ranges (CFI = 0.91, RMSEA = 0.056,  $\chi^2/df = 2.43$ ), indicating a good fit of the five-dimensional structure of the instrument to the data.

#### 4.5. Structural Model: Contribution of the Dimensions to Social Resilience

The path coefficients between the first-order dimensions and the second-order construct of social resilience are reported in Table 3. Coping skills ( $\beta = 0.341$ ,  $t = 7.18$ ), knowledge ( $\beta = 0.312$ ,  $t = 6.42$ ), social participation ( $\beta = 0.285$ ,  $t = 5.87$ ), and sense of belonging ( $\beta = 0.198$ ,  $t = 4.11$ ) made positive and significant contributions ( $p < 0.001$ ) to social resilience. In contrast, the coefficient for social security ( $\beta = 0.061$ ,  $t = 1.04$ ,  $p = 0.298$ ) was not significant. Hypotheses 1 to 4 were therefore supported, and Hypothesis 5 was rejected.

**Table 3.** Path Coefficients of the Dimensions to the Social Resilience Construct

| Dimension            | Path coefficient ( $\beta$ ) | <i>t</i> | <i>p</i> | Hypothesis |
|----------------------|------------------------------|----------|----------|------------|
| Knowledge            | 0.312                        | 6.42     | < 0.001  | Supported  |
| Social participation | 0.285                        | 5.87     | < 0.001  | Supported  |
| Coping skills        | 0.341                        | 7.18     | < 0.001  | Supported  |
| Sense of belonging   | 0.198                        | 4.11     | < 0.001  | Supported  |
| Social security      | 0.061                        | 1.04     | 0.298    | Rejected   |

Note. Significance was assessed by bootstrapping.

#### 4.6. Comparison of Neighbourhoods

The one-way analysis of variance showed a significant difference in social resilience across the neighborhoods of Tehran ( $F(2, 381) = 30.32$ ,  $p < .001$ ,  $\eta^2 = .14$ ). Mean social resilience was highest in Elahiyeh ( $M = 3.88$ ), intermediate in Narmak ( $M = 3.63$ ) and lowest in Javadieh ( $M = 3.31$ ). Chart 5 compares the mean scores of the five dimensions in the three neighborhoods: Elahiyeh scored highest on every dimension, particularly coping skills (4.15) and knowledge (4.07), whereas Javadieh scored lowest, especially on social security (3.04).

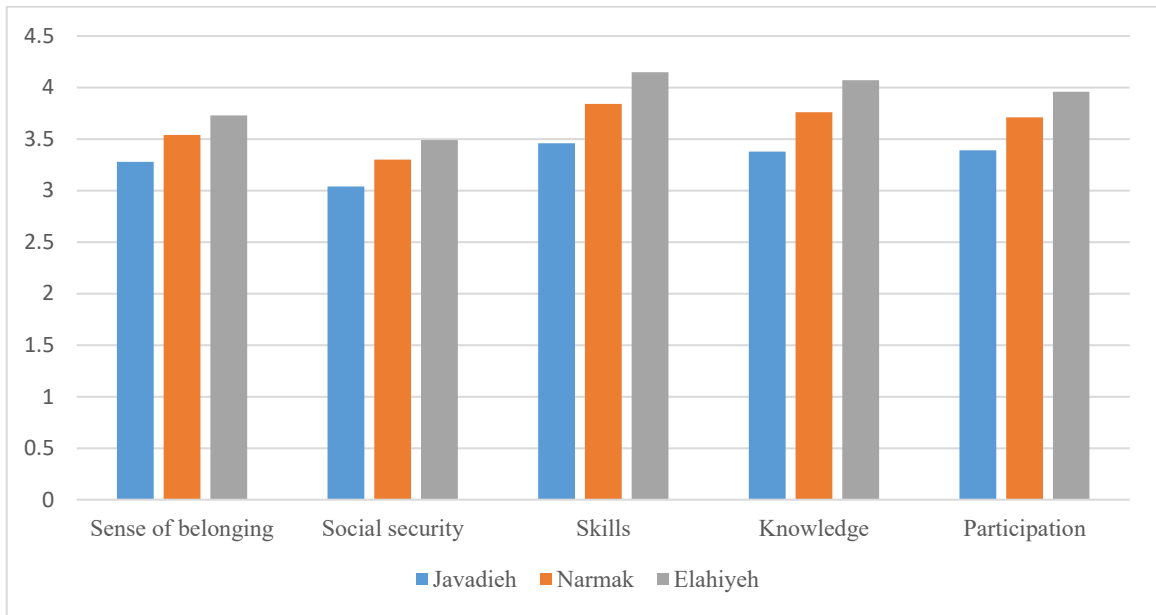


**Chart 5.** Comparison of mean scores on the dimensions of social resilience in the study neighborhoods of Tehran

#### 4.7. Summary of Answers to the Research Questions and Hypotheses

**Table 4.** Summary of Answers to the Research Questions and Results of Hypothesis Testing

| Question or hypothesis                             | Result                                                                          |
|----------------------------------------------------|---------------------------------------------------------------------------------|
| <b>Question 1: Level of social resilience</b>      | Above average (3.61 out of 5), with an uneven distribution across neighborhoods |
| <b>Question 2: Largest contribution</b>            | Coping skills, followed by knowledge and social participation                   |
| <b>Question 3: Differences among neighborhoods</b> | Significant differences; highest in Elahiyeh and lowest in Javadieh             |
| <b>Hypotheses 1–4</b>                              | Supported (positive and significant contribution)                               |
| <b>Hypothesis 5 (social security)</b>              | Rejected (contribution not significant)                                         |

## 5. DISCUSSION

### 5.1. Level and Distribution of Social Resilience

The findings showed that the overall mean of social resilience in Tehran is above average (3.61 out of 5), but its spatial distribution is uneven. Elahiyeh showed higher levels of knowledge, skills, and social cohesion, whereas lower levels of resilience were found in Javadieh, a lower-income neighborhood in the south of the city. These differences are rooted in structural factors such as educational attainment, income, housing type, and access to urban services; for example, Elahiyeh, which has a higher economic and educational status, scored higher on knowledge and skills, whereas in neighborhoods such as Javadieh, which have lower levels of services and social cohesion, social resilience is weaker. The stronger the communication networks, education, and sense of belonging in a neighborhood, the greater its capacity to respond to and recover from crises [5, 6]. This pattern is consistent with perspectives that regard resilience as a spatial phenomenon dependent on socio-economic conditions [17, 18], and with studies of social vulnerability showing that the socio-economic characteristics of populations shape the distribution of vulnerability [23]. The question "resilience for whom?" raised by Cutter [18] is particularly relevant here: an acceptable citywide mean can conceal substantial inequalities among neighborhoods.

In addition, the higher means for knowledge and skills relative to sense of belonging and social security suggest that Tehran residents, probably influenced by repeated public warnings about the risk of a major earthquake in the capital and the preparedness training that has accompanied them, possess relatively good individual capacities, whereas the collective and institutional dimensions of resilience are at a lower level. This finding suggests that investment in social cohesion and local trust could serve as a complement to educational policies.

## **5.2. Contribution of Knowledge, Skills, and Participation**

Coping skills, knowledge, and social participation made the largest contributions to social resilience. This result is consistent with the model of Norris and colleagues, which regards information and communication and community competence as core capacities of resilience [2], and with the systematic review by Patel and colleagues, which identifies local knowledge and preparedness as core elements of a resilient community [19]. Knowledge enhances public awareness and preparedness and enables citizens to adopt appropriate preventive and responsive behaviors during a crisis [25, 26]. Skills represent the practical aspect of resilience and reflect the ability to apply knowledge in real situations; citizens with first-aid and emergency decision-making skills respond more effectively.

The significant contribution of social participation is consistent with the findings of Aldrich, who regards social capital and participation as key factors in post-disaster recovery [6, 11]. People's participation in decision-making and local activities increases the sense of collective responsibility and mutual trust and enables faster mobilization of resources and information [24]. Notably, the largest contributions came from the action-oriented dimensions of resilience, namely skills, knowledge, and participation, which, unlike contextual conditions, can be strengthened through education and planning. In other words, social resilience depends more on the "active actions" of citizens than on "passive" environmental conditions, and the human factor and social learning play a greater role than any other factor in a community's ability to withstand crises. Social resilience emerges from the threefold interaction of education, skills, and participation, and without strengthening these three, the other dimensions are not sufficiently effective on their own.

## **5.3. Sense of Belonging and Social Security**

Sense of belonging made a positive and significant but smaller contribution. This suggests that belonging provides the motivation and emotional bond needed for collective action but does not lead to effective resilience without skills and participation. In other words, a sense of belonging is a necessary but not sufficient condition for resilience [5].

The contribution of social security was not significant. One possible explanation is that security is a contextual condition whose effect operates indirectly, through increased trust or social participation [6]. Another explanation is that social security, which had the lowest mean and the greatest dispersion among the dimensions, may have measured a concept distinct from the other dimensions in this sample. Because the dimensions are defined in this model as constituents of the overall construct, a non-significant coefficient for one dimension is not, by itself, sufficient reason to remove it from the concept of resilience; its loading and theoretical basis should also be considered [30, 31].

## **5.4. Novelty and Scientific Contribution**

The present study contributes to the literature on social resilience in Iran in three ways. First, it models social resilience as a multidimensional, second-order construct and statistically estimates the relative contribution of its dimensions. Second, it shows that action-oriented dimensions (skills, knowledge, and participation) contribute more to social resilience than contextual dimensions (security). Third, by comparing neighborhoods, it reveals the unequal and spatial nature of social resilience in an earthquake-prone Iranian city.

## **5.5. Limitations**

The findings should be interpreted in light of several limitations. First, the study is cross-sectional and does not permit causal inference. Second, the data are self-reported and may be affected by social desirability or common method bias. Third, reliability was reported only for the questionnaire as a whole, and reliability and validity indices for each dimension (Cronbach's alpha, composite reliability, and average variance extracted) were not reported.

Fourth, the sample was limited to selected neighborhoods of Tehran, and generalization of the results to the whole city or to other cities should be made with caution. Fifth, the instrument was researcher-developed, and social resilience was measured as perceived resilience rather than on the basis of the community's actual performance during a crisis.

### **5.6. Suggestions for Future Research**

Future studies are recommended to (1) use longitudinal designs to examine changes in social resilience before and after educational programs or hazard events; (2) test the mediating role of trust and participation in the relationship between social security and resilience; (3) incorporate structural neighborhood factors, such as income, education, and housing quality, into multilevel models; and (4) compare the results for Tehran with those of other earthquake-prone cities in Iran.

## **6. CONCLUSION AND PRACTICAL RECOMMENDATIONS**

This study aimed to assess the social resilience of Tehran to natural hazards and to determine the contribution of its dimensions. The findings showed that social resilience is a multidimensional and dynamic phenomenon composed of knowledge, participation, skills, sense of belonging, and social security, among which the action-oriented dimensions, namely coping skills, knowledge, and participation, make the largest contributions. Social resilience in Tehran is generally above average, but it is unevenly distributed across neighborhoods, and its potential capacity has not been fully realized. Factors such as insufficient and discontinuous education, weak participatory local institutions, and social inequality may prevent this capacity from being fully realized.

Accordingly, the following measures are recommended:

1. Institutionalizing training in resilience and hazard preparedness in schools, universities, and urban neighborhoods.
2. Establishing and strengthening local volunteer networks and Community Response Teams for rapid action during crises.
3. Strengthening social capital and public trust through neighborhood-based cultural and social programs.
4. Increasing citizens' practical skills in relief, first aid, and emergency management.
5. Using local media and online platforms to raise public knowledge of hazards.
6. Prioritizing disadvantaged neighbourhoods, such as Javadieh, in the allocation of resilience-building programs and resources.

Overall, the findings of this study indicate that social resilience is not only an inherent capacity but also a process that can be taught and managed. By adopting a human-centered approach based on improving knowledge, skills, and collective participation, urban planners and disaster managers can significantly increase the city's social resilience to future hazards. Put simply, the future of social resilience in Tehran depends on the awareness, capability, and solidarity of its own residents.

### **Author contributions**

The author was responsible for the conception and design of the study, data collection and analysis, and preparation of the manuscript, and read and approved the final manuscript.

### **Use of generative AI**

During the preparation of this work, the author used generative AI tools to assist with translation into English and to improve the language and readability of the manuscript. After using these tools, the author reviewed and edited the content as needed and takes full responsibility for the content of the publication.

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## Competing interests

The author declares that there are no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Ethics approval and consent to participate

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Participation was voluntary, the purpose of the study was explained to respondents, and the questionnaires were completed anonymously without recording any identifying information; the results were reported only in aggregate form. As this was an anonymous, non-interventional survey, formal approval from an ethics committee was not obtained.

## Data availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request, subject to ethical and confidentiality considerations.

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