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RESEARCH PAPER

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Questionnaire Design: Relation of Physical Activity and Safety

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Abstract

A safe neighborhood encourages residents to lead a more physically active lifestyle. Lack of physical activities elevates the risks of various health problems such as obesity and cardiovascular diseases. Various studies have discussed the effect of safety in physical activities of residents in their area. From a study reviewing previous models, it was observed that these models did not consider all the specified safety factors and their effect at the same time on physical activity. Moreover, in terms of safety in the neighborhood, the assessment factors and models of Tehran neighborhoods are neither standardized nor readily available. Therefore, this paper presents the development of a questionnaire aimed at measuring the safety factors associated with physical activeness of the residents in Tehran's urban neighborhoods. For this purpose, a pilot study, industry-recognized validity, tests, and expert review were employed. In this way, the needed data were collected using survey questionnaires that were distributed among 90 respondents in three neighborhoods of Tehran Metropolis. Finally, the data were analyzed using Structural Equation Modeling (SEM) by Smart Partial Least Squares (PLS) software. The questionnaire has six research constructs linked to five specified research indicators. It is available in both Farsi and English, and back translation was done by field experts to ensure its accuracy in representing the intended measurement. This questionnaire is expected to assist urban developers and managers in improving the safety condition in urban neighborhoods of Iran and consequently promoting physical activeness.

Keywords: *Physical activity, Safety, Urban neighborhoods, Questionnaire design.*

1. INTRODUCTION

A lack of physical activities has become an increasingly serious public health issue. This problem enhances the risks of obesity, cardiovascular diseases, hypertension, cancers, osteoporosis, diabetes, and mental illnesses [1], particularly obesity among children and adolescents [2]. Accordingly, it is of high necessity to propose a comprehensive plan for addressing lack of physical activities among community members such that to encourage them to be more physically active. For a residential area, it has been found that this is closely related to the range of safety facilities provided in the neighborhood [3].

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Some studies conducted on safety in neighborhoods include the "defensible neighborhood" concept of Newman [4] and "broken windows" concept of Wilson and Kelling [5]. However, neighborhood safety is yet to be adopted or further investigated in Tehran neighborhoods. Hence, the aim of this paper is to discuss a proposed flexible and adaptable design of safer community that will encourage the residents to be more physically active. In this regard, Ramkissoon et al. [6] and Monteith [7] have previously stated that a multi-aspect approach is able to provide a more holistic view on the similarities and discrepancies of a different design. Another advocate of a diverse measurement model is De Almeida [8] who highlighted the better results validation provided by the model.

According to Behzadfar et al. [9] and Yaghmayi and Baghdadi [10], physical activity and its related safety issues are important factors in Tehran urban

neighborhoods. Nevertheless, Shokoohi et al. [11] highlighted the lack of a study on safety factors associating with physical activity in Tehran neighborhoods as a concern for improving physical activity in Tehran neighborhoods.

Despite existing research, most of them did not consider all the safety factors associated with physical activity. This research gathered all those factors and modeled them as a whole. Moreover, in terms of safety in the neighborhood, the assessment factors and models of Tehran neighborhoods are neither standardized nor readily available. Therefore, the current research intends to fill these gaps.

One of the notable multi-aspect approaches developed to measure research variables was by Rad et al. [12]. The study focused on the factors affecting safety in urban neighborhoods. A subsequent study was done by the same authors on the corresponding correlation with physical activeness of the residents [13]. In another study, safety factors associated with physical activity in urban Tehran neighborhoods were investigated using the Structural Equation Modelling (SEM) [14]. The author also developed a survey questionnaire for the same purpose.

In the present study, SEM approach was employed to address a fundamental question: What are the appropriate and relevant questions on the evaluation of relationships between physical activities and safety measures in the neighborhoods of Tehran Metropolis?

2. RESEARCH METHOD

This section discusses the steps undertaken to develop the main questionnaire survey. This integrated questionnaire was established through extensive studies on published works relevant to the objective of this study. According to Williams [15], Reynolds et al. [16], and Sudman [17], seven main steps for developing this questionnaire survey are as follows:

1) Extract the relative questions during the literature review.
2) Optimize the relevance of the questions for the purpose of this study (as the pilot questions).
3) Validate the pilot questions through the expert review (Group Decision Making) to gather comments for improvement.
4) Translate the survey instrument.
5) Perform a pilot questionnaire survey.
6) Determine the validity and reliability of the questionnaire.

Finalize the main questionnaire survey.

3. THE STRATEGY OF RESEARCH

This section explains the seven main steps aforementioned in details. It should be emphasized here that the main objective of this study is to examine the relationship between safety in a Tehran neighborhood and the physical activeness of the residents through a questionnaire survey.

3.1. Extraction of relative questions from published literature

Rad et al. [13] highlighted the following aesthetical aspects of a neighborhood that affect residents' active involvement in physical activities including social, cultural, and psychological attributes; demographic variables and existence; accessibility and opportunities of physical facilities; physical environmental characteristics; and weather and safety. The authors further highlighted the significance of demographic effects; neighborhood and urban conditions; physical environment; satisfaction with local environment; urban neighborhood incivilities; and victimization experience as the key factors influencing safety in urban neighborhoods [12]. Rad et al. [18] published another study, in which they pointed out the necessity of including other safety factors associating with physical activity in urban neighborhoods; e.g., a fear to leave the house, the number of people around, problem with dogs, street lighting, traffic; victimization experience (i.e., vandalism, violence, attack or physically injured, and robbery).

According to Tilley and Sidebottom [19], the diverse safety interpretation of social groups is the main cause of introducing and designing appropriate community interventions to improve safety. In this regard, opinions of the academic staff of the Department of Urban and Regional Planning (Tehran University) were gathered to identify the factors corresponding to this research. Also mentioned by Swatt et al. [20], the main reason for gathering these factors might be the fact that a given factor may be effective in one neighborhood but not in others. The results of the Expert Questionnaire Survey revealed that 'problem with dogs' was nonsignificant in Tehran neighborhoods and thus was removed from the group of safety factors associating with physical activity in Tehran's urban neighborhoods.

After reviewing previous works such as Swatt et al. [20], Harrison et al. [21], Doyle et al. [22], Hooker et al. [23], Suminski et al. [24], Craig et al. [25], Wilcox et al. [26], and Ross [27], the finalized research questions were grouped into logical coherent parts with corresponding components and constructs. The extracted relative questions were then grouped accordingly to develop the questionnaire survey. As recommended by Williams [15], the wordings were short, simple, and specific so that the questions would remain clear and easy to answer.

3.2. Optimizing optimization of pilot questions from the literature

The literature has shown that Likert scale has been the main tool used to rate the safety factors associated with physical activities in urban neighborhoods. Thus, the five-item Likert scale was also employed in this study. In addition, according to Lorenc et al. [28] and Vagias [29], the most appropriate and relevant Likert

scale should be able to measure the entire response spectrum. In this research, the scale was established in a way that to measure negative (from the left) to positive (toward the right) responses. Other types of five Likert scale reported in the literature are as follows:

Table 1 Diverse type of five likert scale

Level of safety	Very safe	Safe	Neutral	Unsafe	Very unsafe
Level of likelihood	Very likely	Likely	Neutral	Unlikely	Very unlikely
Level of agreement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Level of interesting	Very interesting	Interesting	Neutral	Uninteresting	Very uninteresting
Level of frequency	Always	Often	Sometimes	Rarely	Never
Level of importance	Very important	Moderately Important	Neutral	Slightly important	Not very important
Rating scale	1	2	3	4	5

3.3. Validation of pilot questions through expert review

The Group Decision-Making approach was adopted by PVM et al. [30] in order to validate their research data. In this study, the pilot questions were given to the academic staff of the Department of Urban and Regional Planning in order to validate their relevance and also for their further improvement. The following six tables represent the questions of each safety factor associated with physical activeness of an urban Tehran neighborhood:

Table 2 Physical activity research questions

1- How likely is it for you to do physical activity in your neighborhood?
2- Please specify the importance of doing physical activity in your neighborhood for you?
3- Please specify how interesting is doing physical activity in your neighborhood for you?
4- Do you agree with "it is pleasant for me to go for physical activity in my neighborhood"?
5- Do you have experience to go for physical activity more than two hours of a week (sum of total times you went for physical activity in a week) in your neighborhood?

Table 3 Feel afraid to leave the house research questions

1- Please specify the likelihood that one or more below options happen to you while you leave the house for physical activity in your neighborhood?
• Someone will try to break into your home when you are not there.
• Someone will try to rob you or steal something from you when you are outside.
• Someone will try to attack you or beat you up when you are outside.
2- Please specify the importance of one or more below options (as issue) happen to you while you leave the house for physical activity in your neighborhood?
• Someone will try to break into your home when you are not there.
• Someone will try to rob you or steal something from you when you are outside.
• Someone will try to attack you or beat you up when you are outside.
3- Please specify how safe is your neighborhood from one or more below options happen to you while you leave the house for physical activity in your neighborhood?
• Someone will try to break into your home when you are not there.
• Someone will try to rob you or steal something from you when you are outside.
• Someone will try to attack you or beat you up when you are outside.
4- Do you agree with "I don't feel afraid of one or more below options happen to me while I leave the house for physical activity in my neighborhood?
• Someone will try to break into your home when you are not there.
• Someone will try to rob you or steal something from you when you are outside.
• Someone will try to attack you or beat you up when you are outside.
5- Do you have experience that one or more below options happen to me while you leave the house for physical activity in your neighborhood?
• Someone will try to break into your home when you are not there.
• Someone will try to rob you or steal something from you when you are outside.
• Someone will try to attack you or beat you up when you are outside.

Table 4 Number of people around research questions

1. How likely is it for you to feel afraid or unsafe of the crowded places or places with many people around while you do physical activity in your neighborhood?
2. Please specify the importance of the crowded places or places with many people around (as issue) while you do physical activity in your neighborhood?
3. Please specify how safe do you feel in the crowded places or places with many people around while you go for physical activity in your neighborhood?
4. Do you agree with "I feel safe when doing physical activity in the crowded places or places with many people around of my neighborhood"?
5. Do you have experience to feel unsafe or afraid of the crowded places or places with many people around while you do physical activity in your neighborhood?

Table 5 Street lighting research questions

1. How likely is it for you to refrain of going for physical activity at nights because of darkness of the streets or lack of street lighting?
2. Please specify the importance of street lighting as an issue for you to go for physical activity at night in your neighborhood?
3. According to the sufficiency of street lighting of your neighborhood please specify how safe do you feel when you go for physical activity at night in your area?
4. Do you agree with "my neighborhood's street lighting is good enough to make me feel safe when I do physical activity at night there"?
5. Do you have experience to feel afraid or being reluctant to go for physical activity at night in your neighborhood because of insufficient or unsuitable street lighting there?

Table 6 Traffic research questions

1. How likely is it for you to feel unsafe of traffic or cars with high speed in your neighborhood while you do physical activity in your neighborhood?
2. Please specify the importance of traffic or cars with high speed (as issue) in your neighborhood while you do physical activity there?
3. According to the traffic or cars with high speed in your neighborhood, please specify how safe do you feel when you go for physical activity in your neighborhood?
4. Do you agree with "the traffic or the speed of the cars in my neighborhood is not that serious to make me feel afraid or unsecure of doing physical activity there"?
5. Do you have experience to feel afraid or unsafe of traffic or the cars with high speed in your neighborhood while doing physical activity there?

Table 7 Victimization experience research questions

1. How likely is it for you to be the victim of vandalism, violence, attack or physically injured or robbery while you do physical activity in your neighborhood?
2. Please specify the importance of being the victim of vandalism, violence, attack or physically injured or robbery (as issue) while you do physical activity in your neighborhood?
3. Please specify how safe do you feel from being the victim of vandalism, violence, attack or physically injured or robbery when you go for physical activity in your neighborhood?
4. Do you agree with "my neighborhood is safe and free of vandalism, violence, attack or physically injured or robbery while I do physical activity there"?
5. Do you have experience to be the victim of vandalism, violence, attack or physically injured or robbery while you do physical activity in your neighborhood?

3.4. Translation of the survey instrument

Considering the study setting, which is Tehran urban neighborhood, the primary language of the questionnaire should be Farsi. However, the original questionnaire was developed in English, which thus warranted a translation from English to Farsi. In order to maintain its accuracy after translation, back-translation was performed by two

researchers in urban and regional planning who were fluent in both English and Farsi. There are three main well-known translation techniques, i.e., direct, parallel, and back translation. This translation was done based on the back translation approach, in line that Chen and Boore [31] who did the same. Also, as highlighted by Mullen [32], the most accurate and appropriate translation method is when the source of the questionnaire is translated into the target language and then translated back to the original language by a bilingual person. If the translation had been highly accurate, there should be no loss of information or misinterpretation induced by the back translation.

3.5. Pilot questionnaire survey

The pilot questionnaire survey was done in a small group. The results were analyzed to find out the suitability of the questions according to the research aim and principles.

3.6. Validity and reliability tests of designed pilot questionnaire

The validity and reliability of the questionnaire were also identified during the pilot study. The questionnaires were distributed to 90 residents in the following neighborhoods of Tehran: Abouzar Gharbi, Abbas Abad, and Tajrish neighborhoods. The Partial Least Squares (PLS) [14] approach was adopted for evaluating the developed model. The research model was developed by identifying the indicators (prepared questions) with respect to their relevant construct; i.e., safety factors associated with physical activity in urban neighborhoods. Figure 1 presents the designed model and results.

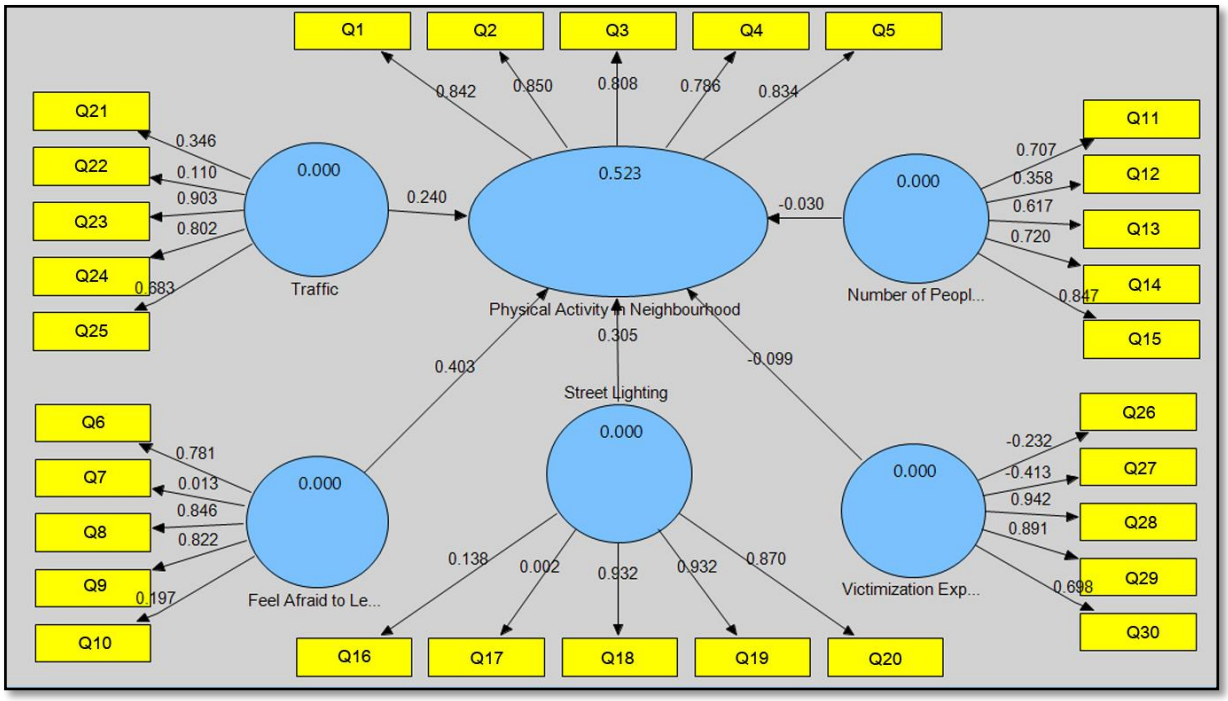

Fig. 1 PLS model measurement before removing unacceptable indicators (questions)

Figure 1 shows that six research constructs were linked with five specified research indicators. Loading values were assigned for each specific research construct and indicator. Then, the outer loading was calculated in order to examine the appropriateness of the research indicators. This outer loading demonstrates whether an indicator (question) appropriately measures the construct (factor). In other words, it assesses the reliability of the constructs [33]. According to Chin [34] and Gefen and Straub [35], the outer loading is acceptable when it is 0.007 and greater. In this study, the indicators with less than 0.700 outer loading were removed and the calculation was done again. This was repeated until all outer loadings reached 0.700 or above. The results are shown in Table 8. In this table, the red color signifies all indicators with less than 0.700 outer loading.

Figure 2 and Table 9 present the final result of the outer loading calculation of all indicators.

Table 8 Outer loadings before removing indicators with values bellow 0.700

F.N	The name of construct	Question number	Outer loadings	F.N	The name of construct	Question number	Outer loadings
1	Physical activity in neighborhood	Q1	0.842084	4	Street lighting	Q16	0.138321
		Q2	0.849942			Q17	0.001744
		Q3	0.807700			Q18	0.931852
		Q4	0.785597			Q19	0.931810
		Q5	0.834162			Q20	0.870429
2	Feel afraid to leave the house	Q6	0.781134	5	Traffic	Q21	0.345612
		Q7	0.012947			Q22	0.110017
		Q8	0.846276			Q23	0.902774
		Q9	0.821730			Q24	0.802380
		Q10	0.197320			Q25	0.683054
3	Number of people around	Q11	0.707297	6	Victimization experience	Q26	-0.232478
		Q12	0.357816			Q27	-0.412827
		Q13	0.616738			Q28	0.942215
		Q14	0.719849			Q29	0.890729
		Q15	0.846551			Q30	0.698044

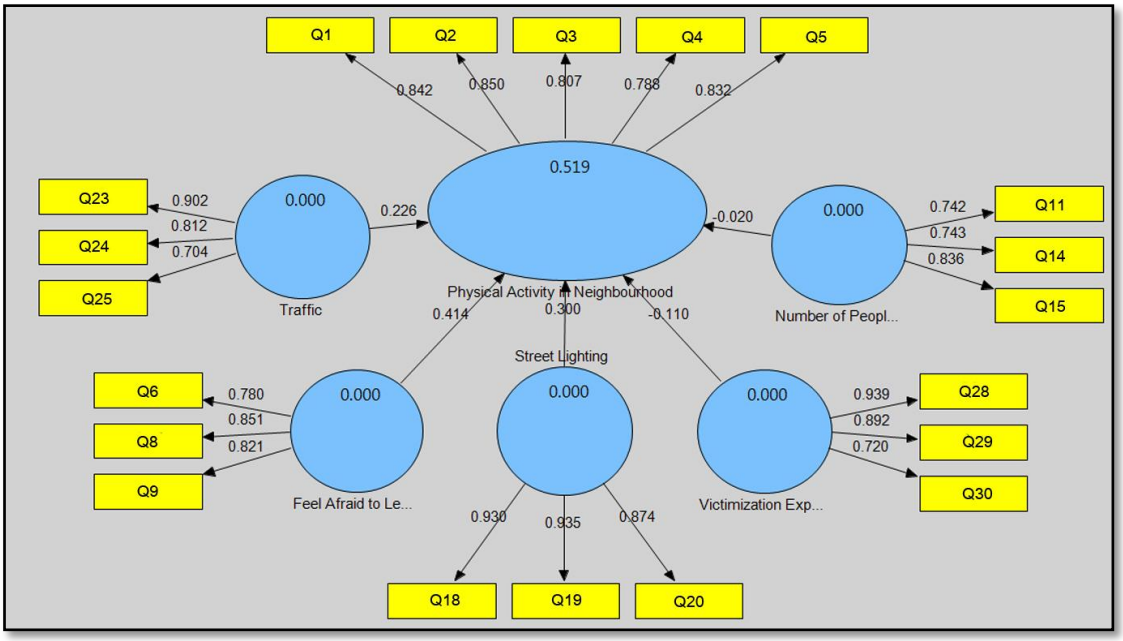

Fig. 2 PLS model measurement after removing unacceptable indicators (questions)

Table 9 Outer loadings after removing indicators with values bellow 0.700

F.N	The name of construct	Question number	Outer loadings
1	Physical activity in neighborhood	Q1	0.841521
		Q2	0.850123
		Q3	0.807466
		Q4	0.787730
		Q5	0.832494
2	Feel afraid to leave the house	Q6	0.780272
		Q8	0.850541
		Q9	0.820997
3	Number of people around	Q11	0.742304
		Q14	0.743416
		Q15	0.836075
4	Street lighting	Q18	0.930434
		Q19	0.935394

		Q20	0.874075
		Q23	0.901934
5	Traffic	Q24	0.811522
		Q25	0.703836
		Q28	0.938633
6	Victimization experience	Q29	0.892260
		Q30	0.719886
The sequence of deleting the questions		Q7-Q10-Q12-Q13-Q16-Q17-Q21-Q22-Q26-Q27	

The bottom of Table 9 shows that 10 indicators with less than 0.700 outer loading were removed from the model. For the remaining indicators, cross-loading was then performed to examine whether the indicators were loaded equally on the other constructs as well as their own theorized construct. A construct is loaded equally when the value is longer on the intended construct than other constructs. Table 10 presents the corresponding results.

Table 10 Cross-loadings of latent variables and indicators

Q.N	1*	2*	3*	4*	5*	6*
Q1	**0.841521**	0.500176	0.055833	0.586300	0.512266	0.323906
Q2	**0.850123**	0.450067	0.114893	0.442266	0.409002	0.240413
Q3	**0.807466**	0.562520	0.018685	0.318984	0.367404	0.161721
Q4	**0.787730**	0.567675	0.110229	0.489317	0.414539	0.067374
Q5	**0.832494**	0.535064	0.343048	0.400251	0.457774	0.182225
Q6	0.388384	**0.780272**	0.203453	0.304730	0.281854	0.263856
Q8	0.512666	**0.850541**	0.277429	0.408903	0.412584	0.260894
Q9	0.615808	**0.820997**	0.101981	0.481256	0.455170	0.202246
Q11	0.097667	0.159913	**0.742304**	0.118159	0.022932	-0.016365
Q14	0.055246	0.109029	**0.743416**	0.016629	0.018859	-0.111095
Q15	0.161609	0.217262	**0.836075**	0.103413	0.325270	0.114145
Q18	0.515148	0.471425	0.202819	**0.930434**	0.488735	0.564189
Q19	0.548085	0.503552	0.078700	**0.935394**	0.384501	0.460913
Q20	0.434608	0.389564	0.030618	**0.874075**	0.388403	0.456343
Q23	0.526946	0.543131	0.307143	0.411031	**0.901934**	0.323082
Q24	0.402067	0.284344	0.066122	0.245750	**0.811522**	0.038162
Q25	0.321364	0.298616	0.131846	0.490265	**0.703836**	0.336587
Q28	0.266402	0.252203	0.015571	0.476388	0.303342	**0.938633**
Q29	0.148872	0.181210	0.012668	0.499973	0.220410	**0.892260**
Q30	0.152894	0.318656	0.099399	0.426000	0.178395	**0.719886**

*Note: 1: Physical activity in urban neighborhood, 2: Feel afraid to leave the house, 3: Number of people around, 4: Street lighting, 5: Traffic, 6: Victimization experience.

As shown in Table 10, the loadings on the intended construct (bolded in the text) were all more than other existing loadings of each column. Accordingly, the composite reliability and Cronbach's Alpha values were established for each construct. Table 11 illustrates the obtained results.

Table 11 Composite reliabilities and Cronbach's Alpha of constructs in model

Construct	Composite reliability	Cronbach's Alpha
Physical activity in urban neighborhood	0.913659	0.881938
Feel afraid to leave the house	0.858143	0.758646
Number of people around	0.818262	0.718965
Street lighting	0.938103	0.901221
Traffic	0.849828	0.737231
Victimization experience	0.889947	0.815383

Henseler et al. [36] and Green & Salkind [37] highlighted that the acceptable composite reliability and Cronbach's alpha values should be equal or more than 0.8 and 0.6, respectively. As shown in Table 11, all constructs met the mentioned criteria. Finally, the discriminant validity of the questionnaire was established.

According to Fornell & Larcker [38] and Bollen [39], discriminant validity measures the average variance extracted for each construct (which should be more than 0.50) and the coefficient of determination (R2) among a construct and all other constructs. The correlation among the constructs should be lower than the square root of the extracted average variance [40]. Table 12 presents the calculated Average Variance Extended (AVE) value and the corresponding squares for each construct. Also, Table 13 presents the extracted values for discriminant validity.

Table 12 Average variance extracted (AVE)

Constructs	AVE	AVE's square
Physical activity in urban neighborhood	0.679287	0.824
Feel afraid to leave the house	0.600902	0.775
Number of people around	0.834892	0.913
Street lighting	0.655813	0.809
Traffic	0.731799	0.855
Victimization experience	0.679287	0.824

Table 13 Discriminant validity for model

F.N	1*	2*	3*	4*	5*	6*
1*	**0.824000**					
2*	0.637030	**0.817000**				
3*	0.155651	0.228211	**0.775000**			
4*	0.550096	0.501616	0.117302	**0.913000**		
5*	0.527957	0.483088	0.224573	0.460185	**0.809000**	
6*	0.236350	0.289856	0.043070	0.540571	0.285828	**0.855000**

*Note: 1: Physical activity in urban neighborhood, 2: Feel afraid to leave the house, 3: Number of people around, 4: Street lighting, 5: Traffic, 6: Victimization experience.

As shown in Table 12 and Table 13, all AVE and discriminant validity values are within the identified standard values, suggesting that the designed questionnaire survey is both valid and reliable.

3.7. The final questionnaire

Before finalizing the questionnaire, the questions with the mentioned acceptable values were given to the experts in the urban planning field for giving some comments and revisions. The final questionnaire is as shown in Table 14.

4. CONCLUSION

The aim of this research was to present the development of a questionnaire survey for measuring the safety factors associated with the physical activeness in Tehran neighborhoods. The objective of this research was to provide a guideline for improving both safety in the neighborhood and higher physical activeness among the residents. This questionnaire, which was designed in seven major steps, is expected to assist urban developers and managers to improve the safety conditions in urban neighborhoods of Iran.

Table 14 The final questions of questionnaire survey

Physical activity in Tehran urban neighborhoods
1. How likely is it for you to do physical activity in your neighborhood?
2. Please specify the importance of doing physical activity in your neighborhood for you?
3. Please specify how interesting is doing physical activity in your neighborhood for you?
4. Do you agree with "it is pleasant for me to go for physical activity in my neighborhood"?
5. Do you have experience to go for physical activity more than two hours of a week (sum of total times you went for physical activity in a week) in your neighborhood?
Feel afraid to leave the house in Tehran urban neighborhoods
6. How likely is it for you that one or more below options happen to you while you leave the house for physical activity in your neighborhood?
• Someone will try to break into your home when you are not there

- Someone will try to rob you or steal something from you when you are outside
- Someone will try to attack you or beat you up when you are outside

7. Please specify how safe is your neighborhood from one or more below options happen to you while you leave the house for physical activity in your neighborhood?

- Someone will try to break into your home when you are not there
- Someone will try to rob you or steal something from you when you are outside
- Someone will try to attack you or beat you up when you are outside

8. Do you agree with "I don't feel afraid of one or more below options happen to me while I leave the house for physical activity in my neighborhood"?

- Someone will try to break into your home when you are not there
- Someone will try to rob you or steal something from you when you are outside
- Someone will try to attack you or beat you up when you are outside

Number of people around in Tehran urban neighborhoods

9. How likely is it for you to feel afraid or unsafe of the crowded places or places with many people around while you do physical activity in your neighborhood?
10. Do you agree with "I feel safe when doing physical activity in the crowded places or places with many people around of my neighborhood?
11. Do you have experience to feel unsafe or afraid of the crowded places or places with many people around while you do physical activity in your neighborhood?

Street lighting in Tehran urban neighborhoods

12. According to the sufficiency of street lighting of your neighborhood please specify how safe do you feel when you go for physical activity at night in your area?
13. Do you agree with "my neighborhood's street lighting is good enough to make me feel safe when I do physical activity at night there"?
14. Do you have experience to feel afraid or being reluctant to go for physical activity at night in your neighborhood because of insufficient or unsuitable street lighting there?

Traffic in Tehran urban neighborhoods

15. According to the traffic or cars with high speed in your neighborhood, please specify how safe do you feel when you go for physical activity in your neighborhood?
16. Do you agree with "the traffic or the speed of the cars in my neighborhood is not that serious to make me feel afraid or unsecure of doing physical activity there"?
17. Do you have experience to feel afraid or unsafe of traffic or the cars with high speed in your neighborhood while doing physical activity there?

Victimization experience in Tehran urban neighborhoods

18. Please specify how safe do you feel from being the victim of vandalism, violence, attack or physically injured or robbery when you go for physical activity in your neighborhood?
19. Do you agree with "my neighborhood is safe and free of vandalism, violence, attack or physically injured or robbery while I do physical activity there"?
20. Do you have experience to be the victim of vandalism, violence, attack or physically injured or robbery while you do physical activity in your neighborhood?

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

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