Trauma Monthly 2019 Dec;24(6): 18-23
10.30491/TM.2019.104269
Trauma Monthly
Original Article

Psychometric Evaluation of the Safe Road-crossing Behaviors Scale: A Study among Iranian University Students

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Received July 23, 2019; **Accepted** August 28, 2019; **Online Published** November 24, 2019

Abstract

Background: Millions of pedestrians are seriously injured, disabled, or lose their lives in road traffic accidents annually. The availability of a standard scale specifically for predicting road-crossing behaviors would be beneficial in research applications and in tailoring interventions.
Objectives: The purpose of the current research was to psychometrically evaluate the safe road-crossing behaviors scale based on the Prototype Willingness Model (PWM) among college students.
Methods: In this cross-sectional study, a purposive and multi-stage sampling method was used to select 315 students from Kermanshah University of Medical Sciences (KUMS) during 2018. The studied social-cognitive determinants from the PWM included attitude, subjective norms, prototype, intention, and willingness. Participants completed a written self-report questionnaire. Data was analyzed using SPSS (ver. 20.0). Exploratory factor analysis (EFA) with VARIMAX rotation was applied to determine the number and composition of constructs.
Results: Five factors were extracted. The calculated Kaiser–Meyer–Olkin (KMO) value was 0.806. Overall, the PWM constructs explained 64.39% of the variance in the hypothesized model. Cronbach's alpha for the measured constructs of attitude, subjective norms, prototype, intention, and willingness were 0.87, 0.81, 0.68, 0.71, and 0.61, respectively.
Conclusion: The present study provides some support from among students at an Iranian university for the internal validity and reliability of the safe road-crossing behaviors scale. This scale could be used in planning interventions for the promotion of safe road-crossing behaviors among pedestrians.

Keywords: Attitude, Pedestrian, Students.

Introduction

Road traffic injuries (RTIs) are under-reported worldwide, especially in less developed countries (1). Annually, over 50 million pedestrians are injured in road traffic accidents globally, of which almost 1.3 million are killed, and millions endure serious injuries and live with long-term adverse health outcomes (2).

In Iran, RTIs are a major cause of injuries and the second leading cause of death in pedestrians. More than 2000 people are injured daily in RTIs in Iran, of whom approximately 70 are killed (3). Despite Iran's national policies for reducing fatal RTIs (e.g., increasing fines, heavy punishments for high speed, using surveillance cameras, improving the safety of roads and sidewalks, etc.), the incidence of RTIs in Iran is four times greater than the number of accidents in high-income countries (4).

Pedestrians are vulnerable road users and one of the most vulnerable groups to RTIs (5). A pedestrian is seriously injured every 9 minutes and killed every 2 hours in road accidents around the world, according to statistics (6). Unsafe road-crossing decisions of pedestrians are leading factors in the occurrence of accidents (7). In fact, poor compliance with traffic legislation is the main cause of road-crossing injuries among pedestrians (e.g., walking on the street) (8).

Crossing a road, as a critical skill, is a complex task, especially in urban life. Different situations lead pedestrians to select when, where, and how to cross the road; when an unsafe decision is made, the pedestrian increases his/her accident risk. To help reduce the number of road-crossing injuries, researchers have attempted to determine the situations (e.g., demographical, cognitional, mental, environmental, etc.) in which pedestrians may be at a heightened risk (9-11). The Prototype Willingness Model

(PWM), one of the most widely used social cognitional models of safety-related behavior, has two pathways to risk distinctions: a reasoned pathway predicted by intention and a social response pathway predicted by willingness (12-15). The PWM outlines three basic influences on an individual's decision (i.e. intention and willingness) to engage in a specific behavior. First is the individual's attitude regarding the behavior, which reflects the extent to which people believe that the behavior will lead to negative or positive consequences. Second is the subjective norm (SN) (i.e. perceived social pressure and motivation to meet others' expectations). Third is the prototype which reflects an image of people over-performing the risk behaviors (i.e. risk image) (16). Researchers need standard questionnaires to help them plan promotion programs (17).

Objectives

The purpose of the current research was to psychometrically evaluate a self-report scale to measure the determinants of safe road-crossing behaviors based on PWM constructs among a sample of Iranian university students.

Materials and Methods

Participants and Procedure

This study was a part of a research plan conducted among university students during autumn and winter, 2018, with the aim of providing information for planning interventions for the promotion of safe road-crossing behaviors among pedestrians. The participants were selected by cluster random sampling from among university students studying in seven schools in the Kermanshah University of Medical Science (KUMS). The recommended sample size for factor analysis is at least five samples per questionnaire item (18). The sample size in the current study was calculated at fifteen subjects per questionnaire item, and a sample of 315 was estimated. For subject selection and data collection, the following stages were conducted. First, each school was considered a cluster (cluster sampling). Next, the sample size for each school was determined based on its population coverage (proportional to size sampling). Then, students studying in each school were randomly selected for voluntary participation in this study.

Measure

The questionnaire comprised background variables and PWM constructs.

(A): The background variables included age (year), education level including MD (Doctor of Medicine), DMD (Doctor of Dental Medicine), Pharmacy and BSc (Bachelor of Science), gender (female, male), education level of parents (elementary school, secondary school, high school, academic), and economic status of family (weak, average, good, very good).

(B): The items which measured the PWM constructs were designed based on scales of safe road-crossing behaviors (12-15). A self-administered scale containing 20 items measured the five constructs. Specifically, attitude toward safe road-crossing behaviors and subjective norm toward safe road-crossing behaviors were measured by the responses to five items each. The scale for prototypes of risky road-crossing behaviors contained five items asking to what extent the presented characteristics of risky road-crossing behaviors were believed by pedestrians (i.e. confident, inexperienced, cool, etc.). Two items measured behavioral intention toward safe road-crossing behavior. To facilitate student responses to attitude, subjective norm, prototypes, and intention, items were standardized to a five-point Likert scale with scores ranging from 1 (very little) to 5 (very much). Furthermore, willingness to perform safe road-crossing behaviors was assessed by describing a scenario in which participants were asked to imagine themselves at a location with friends, and one friend encouraged the others to perform risky road-crossing behaviors. Willingness to perform safe road-crossing behaviors was measured by three questions asking the subjects how likely it would be that they would (1) accept her/his suggestion, (2) reject her/his suggestion, or (3) leave the location.

Designing the final questionnaire in the current study involved four phases: 1) translation and face validity of the original English version of the PWM construct items into Farsi; 2) evaluation of content validity, 3) psychometric testing for reliability, and 4) construct validity.

Translation and face validity

In the first phase, the original English version of the PWM constructs was forward-translated to Farsi. When a concept had no equivalent in the Persian language, it was modified to suit the cultural context. Back translation was done by a person who had full knowledge of both English and Persian languages. Furthermore, to assess face validity, both qualitative and quantitative methods were used. The difficulty, relevancy, clarity, and ambiguity of the

questionnaire was tested and approved by obtaining the opinions of experts (qualitative method). The item impact method was used for item reduction (quantitative method). In the item impact method, if the effect score was equal or greater than 1.5, none of the original items were omitted. A number of experts in the fields of education and psychology were interviewed face-to-face to determine the quality of the questionnaire's face validity, level of difficulty (difficulty in understanding the phrases and words), relevance (relevance and proper relationship of the expressions with the dimensions of the questionnaire), and ambiguity (the probability of misconceptions with expression or lack of understanding with meanings of words); then, recommended changes were applied to the questionnaire.

Evaluation of content validity

The content validity ratio (CVR) and content validity index (CVI) were calculated using Lawshe's table to assess content validity. The scale was given to a panel of twelve experts, including a health educator, a psychologist, and a behavioral change expert. The experts were asked to score each item using the following ratings: "fully necessary", "useful but unnecessary", and "unnecessary". The clarity, brevity, and difficulty of each question were also evaluated. Then, using the "necessity" and "total item scores", the CVR was calculated. Hence, some questions based on the experts' opinions were excluded from the questionnaire or modified. Given a panel of twelve experts and based on Lawshe's table, the acceptable lower limits for CVR and CVI were 0.62 and 0.79, respectively (19).

Psychometric testing for reliability

The purpose of the second phase of the study was to determine the scale's reliability. Cronbach's coefficient alpha and classical item analysis (CIA) were used to estimate the internal consistency of the various measures.

Construct validity

The Exploratory Factor Analysis (EFA) with VARIMAX rotation using factor loadings of 0.40 was used to allocate items to a subscale in the safe road-crossing behaviors questionnaire and to determine the degree to which this factor structure replicated the original. The factorability of items was measured using the Bartlett test. The Kaiser–Meyer–Olkin (KMO) test evaluated the sampling adequacy. The scree plot was used to confirm the strengths of the exploratory agents.

Statistical analysis

Quantitative variables (e.g., age) were described using mean±standard deviation (μ±SD), and qualitative/ categorical variables were expressed as frequencies and percentages. Data was analyzed using SPSS (Version. 20.0).

Ethical considerations

The Research Ethics Committee of KUMS approved the study protocol (KUMS.REC.1394.445). At the beginning of each textual questionnaire, volunteers were provided with an explanation of the study and voluntary participation, and the completion of the questionnaire was considered as informed consent to participate in the study.

Results

Of the 315 students, 301 of them voluntarily participated in the current study, which indicated a response rate of 95.5%. The mean age of students was 22.35 (SD=2.09) years (range=19 to 30 years). Most of the students (52.8%) were female. Approximately 46.5% were BSc students. About 52.2% of the students had an average economic status. Nearly 29.6% and 14.6% of the students reported that their father and mother, respectively, were academically educated. More details regarding the background variables of the students are shown in Table 1.

Table 1. Participants' demographic characteristics (n=301)

Variables	Number (%)
Gender	
Female	159 (52.8)
Male	142 (47.2)
Level of Education	
MD, DDS, or Pharmacy Students	161 (53.5)
BSc Students	140 (46.5)
Economic status of family (Describing someone's property, such as owning a house, furniture, car, etc.)	
Weak	22 (7.3)
Average	157 (52.2)
Good	109 (36.2)
Very Good	13 (4.3)
Father's Education	
Primary School	68 (22.6)
Secondary School	54 (17.9)
Diploma	90 (29.9)
Academic Education	89 (29.6)
Mother's Education	
Primary School	114 (37.9)
Secondary School	64 (21.3)
Diploma	79 (26.2)
Academic Education	44 (14.6)

The item impact score of every sentence was lower than 1.5; thus, none of the original twenty items were excluded, suggesting the content validity ratio and index for all items were passable. In the CIA method, one item of the prototype construct was found with a corrected item-total correlation (CITC) less than 0.40 ("The person with risky road-crossing behaviors is careless"), and it was deleted. Therefore, nineteen finalized items were applied for the explanatory and confirmatory factor analysis.

The KMO test, which is the effective index of the sampling, was measured at 0.806. Bartlett's test was also significant (p<0.001), indicating the data was appropriate for factorial analysis. The findings indicated that one item of the prototype construct had a factor loading greater than 0.40: "The person with risky road-crossing behaviors is selfish," and it was omitted. Based on Eigen values of ≥1.00 and factor loadings of ≥0.40, eighteen items were extracted, accounting for 64.39% of the variation. Internal consistency through Cronbach's alpha for all items ranged from 0.72 to 0.93 (Table 2), indicating an excellent internal consistency among items. More details of the exploratory factor analysis are shown in Table 1. The scree plot diagram of factors is shown in Figure 1.

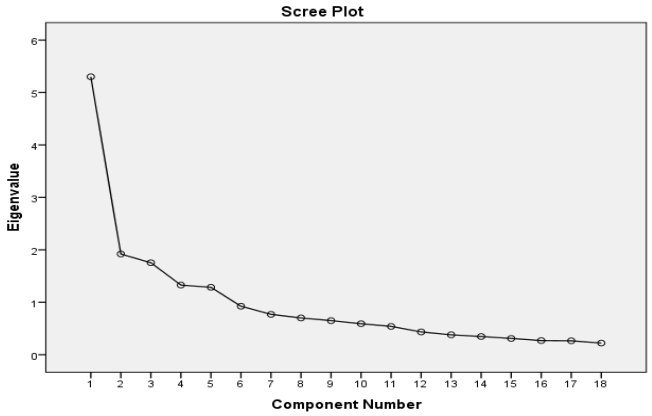

Figure-1. The scree plot of the factors studied among the subjects.

Discussion

The purpose of the current research was to design a valid and reliable scale to measure the cognitive determinants of safe road-crossing behaviors based on the PWM. The findings suggest that the five determinants of the PWM constructs which measure attitude towards safe road-crossing behaviors, subjective norms encouraging safe road-crossing behaviors, risk image toward risky crossing behavior, intention toward safe road-crossing behaviors, and willingness toward safe road-crossing behaviors were acceptably valid and reliable for measuring safe road-crossing behaviors. Thus, this scale could be applicable for predicting road-crossing behaviors among Iranian college students.

Based on the current findings, the internal consistencies of PWM constructs range from 0.61 to 0.82. In line with this study, Paris et al. carried out research with the aim of validating a scale to measure the contrived determinants of speeding behavior in road traffic and reported that internal consistencies of attitude, subjective norms, perceived behavior control, and intention ranged from 0.51 to 0.82 (20). The current findings are consistent with other studies.

The current findings also showed that the PWM determinants explained 64% of the variance of the hypothesized model. These results indicated PWM could, to a considerable extent, predict safe road-crossing behaviors. Consequently, the current findings confirm that PWM is a suitable model for predicting safe road-crossing behaviors. Paris et al. indicated that attitude, subjective norms, and perceived behavior control variables explained 64% of the variance of the intention to respect speed limits among 184 Flemish drivers (20). Rivis et al. indicated that the theory of planned behavior and the prototype willingness model explained 65% of the variance in driving while intoxicated (13). Furthermore, Elliott and Thomson reported that extended TPB explained 68% of the variation in intention of offending drivers' speeding behavior (21). Self-reports on road-crossing behaviors can thus be a reasonable approximation of the actual performance (20). Therefore, our scale is very valuable for planning safe road-crossing behaviors promotion programs.

The current findings indicated that attitude towards safe road-crossing behaviors has more value for estimation in the hypothesized model. Several studies have reported the important role of attitude in explaining safe road-crossing behaviors (22-24). Consistent with the current findings, Jiang et al. stated that attitude is a significant predictor of mobile phone use intention while street-crossing in university students (22). Moreover, Evans and Norman studied 1833 adolescents in Glamorgan, and their results indicated a significant correlation between attitude and road-crossing intention (23). A similar study carried out among college students in the Isfahan University of Medical Sciences revealed significant relationships among attitude, subjective norms, behavioral intention, and safe road-crossing behaviors (25).

Table 2. The findings of factor analysis assessment among participants

No	Items and Constructs	1	2	3	4	5
1	**Attitude**					
	Safe road-crossing behaviors (paying attention to red lights, no talking on a cell phone, using pedestrian bridge, using the crosswalk when road-crossing)					
	Gives peace of mind.	0.778				
	Increases my self-confidence.	0.749				
	Prevents car accidents.	0.823				
	Decreases road traffic injuries.	0.820				
	Prevents disturbances and traffic jams.	0.735				
2	**Subjective Norms**					
	My friends perform safe road-crossing behaviors.		0.655			
	If I take safe road-crossing behaviors, my friends will affirm it.		0.806			
	I accept my friend's opinion regarding safe road-crossing behaviors.		0.699			
	My family encourages me to perform safe road-crossing behaviors.		0.739			
	Most encourages me to take safe road-crossing behaviors.		0.675			
3	**Prototype**					
	Inexperienced			0.822		
	Confident			0.869		
	Brave			0.521		
4	**Intention**					
	I'll always perform safe road-crossing behaviors.				0.832	
	I'll encourage my friends to perform safe road-crossing behaviors.				0.840	
5	**Willingness**					
	If your friend encourages you to perform risky road-crossing behaviors, what is your reaction?					
	I accept her/his suggestion.					0.743
	I reject her/his suggestion.					0.654
	I leave the location					0.768
	Variance (%)	29.44	10.63	9.74	7.37	7.14
	Total Variance	64.38				
	Alpha coefficient of the structures	0.87	0.81	0.68	0.71	0.61

Specifying the social cognitive determinants also assists policymakers and health educators to tailor effective interventions. It seems that planning health promotion programs to increase positive attitudes toward safe road-crossing behaviors may be the usefulness of the results in order to promote safe road-crossing behaviors among pedestrians.

The current research had several limitations. First, data was collected only from among a sample of medical college students in western Iran; thus, the results may not be generalizable to other populations. Second, this study did not assess the external validation of the scale with the goal of establishing a relationship between our scale and others

Conclusions

Generally, the findings from the current research provide support for the face, content, and construct validity and the internal consistencies of the safe road-crossing behaviors

scale based on the prototype willingness model; however, estimates of external validity need further exploration. Our scale contributes to the recent literature by presenting a scale that can be used to measure the cognitive determinants of safe road-crossing behaviors.

Acknowledgments

The authors gratefully acknowledge participants for their contribution in the study. Also, authors would like to thank the Research Council of Kermanshah University of Medical Sciences for the financial support.

Authors' Contribution

All authors pass the four criteria for authorship contribution based on the International Committee of Medical Journal Editors (ICMJE) recommendations.

Conflict of Interests

The authors declared no potential conflict of interests with respect to the research, authorship, and/or publication of this article.

Funding/Support

The authors received no financial funding or support for the research.

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