



Pedestrians' Outstanding Beliefs Regarding Bridge Use—A Directed Content Analysis

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ABSTRACT

Aims The purpose of this study was to explain pedestrians' perception of the factors affecting the use of bridges according to the theory of planned behavior.

Participants & Methods This qualitative study included 25 participants who were knowledgeable about pedestrian bridge use, and it was conducted in Yazd, Iran, from April to October 2018. Semi-structured interviews were used to extract the perceptions of behavioral, control, and normative beliefs of pedestrians. After transcribing the interviews, a directed content analysis was performed. Data analysis was performed by researchers with existing logic and MAXQDA 12 software. Finally, the beliefs of the pedestrian were extracted, and their outstanding beliefs were determined according to their frequencies.

Findings 18 subcategories, 42 integrated codes, and 331 codes were identified. "Less stress and more relaxation" were identified as the most important advantage, and "high energy consumption and traversing long distances" were identified as the main disadvantage of pedestrian bridge use. The most frequent verifiers were family members, and the main disapproving community was familiars, sick and disabled people, and family, respectively. "Unsafe and non-standard equipment and facilities" was introduced as the most important factor making it difficult to use the bridge, and the most effective facilitator was "providing amenities such as escalators".

Conclusion To increase using bridges by pedestrians, we require focusing on feeling more relaxed as the main advantage, family members as the main verifier, friends and peers as the most frequent disapprover, creating standard and safe facilities, and installing escalators the pedestrian bridges.

Keywords Beliefs; Theory of Planned Behavior; Bridge; Pedestrian; Qualitative Study

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Introduction

The number of deaths and injuries due to traffic accidents is still a global concern and the safety of vulnerable road users, especially pedestrians, is still a major problem [1]. One of the most important measures to increase the safety of pedestrians as the most vulnerable road users is to separate their passage from other road users (drivers and motorcyclists); for example, the construction of pedestrian bridges [2]. However, the use of this facility has not been welcomed by the majority of pedestrians. The rate of pedestrian bridge use in Vietnam, Turkey, and Malaysia has been reported 35.9%-96.5% [3], 6%-63% [4], and 19%-74%, respectively [5]. Pedestrians are injured for many reasons, including risky behaviors [6]. According to Iranian traffic statistics in 2006, 38% of accidents in Tehran were related to pedestrian behavior, such as not using the bridge [7]. In general, the use of pedestrian bridges varies significantly in different societies. Therefore, to improve safe traffic behaviors, basic and influential psychological factors affecting pedestrian traffic behavior must be fully understood at the individual level [8]. Theory-based qualitative data can provide necessary information to understand these factors and be used for targeted interventions. It should be noted that theory-based interventions are much more effective than non-theory-based ones [9].

Attitudes are strong predictors of behavior [10]. The theory of planned behavior (TPB) is one of the most complete and appropriate theories to study the behavior [11]. According to this theory, human behavior is directed by three factors: behavioral beliefs, normative beliefs, and control beliefs. Behavioral beliefs create a favorable or unfavorable attitude toward behavior. Normative beliefs are about how a person thinks that most important people in their life think they should or should not do a specific behavior. Normative beliefs lead to the formation of perceived social pressure or mental norms. Control beliefs are about internal and external factors that can make performing a behavior easy or difficult. These beliefs create perceived behavioral control [12]. The study of behavioral, normative, and control beliefs is the basis for intervention development [13, 14]. Outstanding beliefs are a limited number of very large beliefs about a particular behavior at a certain time [13, 15]. These beliefs emerge through qualitative research in a group of participants representing the target population. Qualitative studies are of great importance for a better understanding of the underlying cultural factors. Studies on the TPB have shown that few researchers have used qualitative studies to design targeted interventions, and most of them have used quantitative studies to examine pedestrian beliefs [16].

Pedestrians' salient beliefs have generally received little attention. In addition, people's beliefs are always different and vary from population to population [17]. The current study was conducted as part of a larger study based on the TPB that explored the use of the beliefs in developing an intervention for pedestrians (details of the larger study are discussed in a separate work).

Participants & Methods

This qualitative study included 25 participants who were knowledgeable about pedestrian bridge use, and it was conducted in Yazd, Iran, from April to October 2018. Multi-stage sampling was used to select individuals. The research started with easy sampling and then snowballed and targeted sampling to access key people's opinions [18]. Research continued until data saturation fulfillment. Inclusion criteria included having a minimum of 18 years old, having the appropriate knowledge on safe traffic behaviors, participating in the study, and sharing experiences. Exclusion criteria were people's unwillingness to participate/ participation continuation in the study and retelling their experiences. Researchers tried to maximize the diversity of demographic characteristics of individuals (such as age, marital status, level of education, occupation) as much as possible.

Demographic (such as age, level of education, occupation, marital status, and position) was used, and according to the TPB, a questionnaire with open-ended questions (semi-structured interview) was designed to extract codes related to the reasons for the use of pedestrian bridges [19]. The topic guide is as follows:

-Attitude (behavioral beliefs)

a) What are the advantages of a bridge used for a pedestrian?

b) What are the disadvantages of a bridge used for a pedestrian?

-Subjective norm (normative beliefs)

a) Are there people or groups that approve of your bridge use? Who?

b) Are there people or groups that disapprove of your bridge use? Who?

-Behavioral control (control beliefs)

a) What factors or situations make it easy for you to use the bridge?

b) What factors or situations make it difficult or impossible for you to use the bridge?

The face and content validity of these questions was measured in a panel of 6 experts. In relation to face validity, the level of difficulty, ambiguity in expressions, and inadequacy of word meanings, and the degree of appropriateness were examined. As for content validity, grammar observance, use of appropriate words, and scaling were checked and comments were provided. The reliability of the

questions was also obtained by evaluating them in 20 samples ($\alpha=0.79$).

The study was approved by Tarbiat Modares University Ethics Committee. All participants consciously, voluntarily, and willingly participated in the interview and group discussions. They were aware that they could leave the study at any time without any punishment or loss of benefits. In addition, participants were assured that their information would be kept confidential and anonymous. After identifying knowledgeable people, the researcher contacted them by phone, introduced herself, stated the subject and objectives of the study, and invited them to participate in an interview or group discussion. The interviews were conducted in a semi-structured, face-to-face manner by the first researcher. Participants in each focused group discussion (FGD) were homogeneous. At the beginning of the interview, the researcher introduced herself and reminded the study subjects and goals and confidentiality regarding participants' names and information. After obtaining informed consent, the participants were asked to record the interview. In case of agreement, their voice was recorded, and otherwise, notes were taken. Next, the participants were asked to introduce themselves.

In the FGD, each question was discussed in-depth such as can you explain more? What do you mean? Can you give an example? Is there a topic you want to talk about? Used in the interview. These questions were asked both in the interview and in response to the questions. They raised the behavior of not using the pedestrian bridge in society as a social norm. This social norm was challenged; for example, it was asked, why do you say that people who do not use the bridge do not have a traffic culture? Why do you think so? All comments were collected by the researcher, and then the general comments of the group were expressed. Agreements, disagreements, and solutions were also questioned and added up. After each step, the researcher expressed the final general opinion of the group, and the participants declared their confirmation. A total of 3 semi-structured in-depth interviews and 4 FGDs were conducted, lasting 30-60 minutes and 90-120 minutes, respectively. Three people participated in interviews, and 22 people in FGDs. Interviews and FGDs took place in appointed areas, such as workplaces, healthcare centers, and public parks. In order to ensure the reliability and validity of the data, we followed the Lincoln & Guba recommendations to create credibility, confirmability, dependability, and transferability^[20]. Communication and engagement with participants continued for six months, which helped to the accuracy of the data by reporting to participants and providing opportunities for data collection.

During the FGDs, participants were asked to verify the general perceptions and opinions of each section that has been raised by the researcher. In case of

non-approval, the researcher would consider another general perception until agreement by participants. To ensure conformability, the researcher ignored her experiences and views during the coding process (bracketing). In case of ambiguity, the researcher provided the participants with a summary of the comments and, after confirmation, entered them into the research (member check). In addition, all codes, coded text sections, and subcategories were reviewed by two health education and promotion experts who were familiar with the TPB in addition to qualitative studies. Finally, the agreement was reached on the code assigned to the phrase or text and the appropriateness of the subcategory in which the merged codes were located. The disagreements in codes and subcategories were resolved through dialogue and referred to the original transcript and panel of experts. To ensure dependability, the text was transcribed and implemented immediately after each interview or discussion. Sampling was performed with maximum diversity to ensure data transferability, and a wide range of perspectives was considered.

Data extraction was performed by directed content analysis^[21]. Data collection and analyses were performed simultaneously. The coding was based on research questions. The authors reviewed research questions and then carefully passed through the entire text several times to gain a deeper understanding of participants' beliefs. Then, the answers were used in the three interviews and one FGD to create a coding framework, which was later used to encode the remaining answers^[15, 22]. To analyze the content, the researcher first created the main categories. Coding for each category was done inductively. The content-based method was used to build subcategories.^[15, 22] This was done by reading the answers and immediately using them as semantic units. A code was assigned to each semantic unit. Then codes were examined and classified based on meanings, similarities, and differences. Similar codes were merged to form subcategories^[23]. Subcategories were constantly compared to determine the conceptual and logical link between them and the main category. These subcategories were then located within the pre-existing main category. Data analysis was performed by researchers with existing logic and MAXQDA 12 software to facilitate data organization and their retrieval. Subsequently, the number of subgroups in each category was calculated separately, and the frequency analysis method was used to identify outstanding beliefs. Ajzen and Fishbein proposed three laws to determine most of the beliefs mentioned:

1. Consider the 10 or 12 beliefs that have the most frequency.
2. Consider all the beliefs mentioned by at least 10% or 20% of the participants.

3. Consider as many beliefs as necessary to form a certain percentage (for example, 75%) of the total answers mentioned [24]. Beliefs were selected that at least 10% of the participants had talked about it as an outstanding belief.

Findings

In this study, 25 pedestrians (11 women and 14 men), municipality employees, healthcare experts, and police were interviewed. Participants' age range was 19-54 years old, and the mean±SD of it was 35.72±9.55. 14 (56%) of participants were single. Participants' demographic characteristics were listed in Table 1.

Table 1) Demographic characteristics of the participants in the interview and group discussion

Variable		Percentage
Gender	Women	44
	Men	56
Age (Year)	18-23	4
	24-29	24
	30-35	36
	36-54	36
Level of education	Secondary school	12
	Diploma	20
	Associate and Bachelor	48
	MA	20
Occupation	Housewife	8
	Employee	52
	Workers and freelancers	20
	University student	20
Marital status	Single	56
	Married	44
Position	Pedestrian	72
	Municipal expert	12
	Healthcare expert	12
	Police	4

Content analysis in predictors of pedestrian bridge users led to the extraction of 190 primary codes, 42 integrated codes, and 18 subcategories placed in 6 predefined categories of the TPB.

Behavioral beliefs of pedestrians

Regarding the advantages and disadvantages of using a pedestrian bridge, data analysis led to the extraction of 94 primary codes and forming ten integrated open codes and five subcategories.

Advantages of using a pedestrian bridge: The majority of pedestrians referred to feeling well and secure when using the bridges. Some of them stated that the high speed of drivers and motorcyclists lead them to use the bridges to maintain their safety.

"If I had crossed the bridge, I would not have had any of these stresses." (p1)

"The important issue is the safety of the pedestrian. The person who uses the bridge prevents possible harm to himself." (P11)

Another viewpoint of participants was gaining energy and pleasure from the surroundings.

"There is a better view up there. We can see everywhere. Our tiredness goes out" (P22)

"I remember my child liked the bridge when he was little. I also enjoyed the surroundings." (P8)

Disadvantages of using the bridge: According to the participants' viewpoint, pedestrians have to travel long distances to use the bridges and spend much energy going up and down. Furthermore, using the bridges takes time for them.

"It takes a lot of energy and time to climb these stairs." (P2)

"I have to go 300 meters down, to reach a bridge. Go up, and then come back 400 meters. That is not worth it, so I cross the street." (P9)

Another disadvantage of bridge use was the feeling of being forced to use bridges due to obstacles and fences under the bridges.

"Every time I used the bridge, it was forced." (P1)

Fear was another factor that participants expressed abundantly. The source of fear identified height or fall, lack of support and unsafe equipment of bridges, darkness, and social insecurity.

"Vendors, beggars or addicts stand or sit at the entrance of the stairs or on top of the bridge. Their presence causes insecurity." (P10)

"The floorboards of the bridges were thin. It was not well welded; when you walk, they shake." (P1)

Every step you take, they make a sound, and you feel that you are falling now. I am afraid.

The salient beliefs of pedestrians can be seen in Table 2.

Table 2) Description of integrated codes, subcategories, and categories of perceived advantages and disadvantages of using a pedestrian bridge and the percentage of behavioral beliefs associated with them (n=25)

Categories	Integrated Codes	%
Perceived advantages		
Feeling peace of mind and life safety	Less stress and more relaxation	72*
	Feeling safe	8
Gain energy and enjoy the surroundings	The charm of the bridge and its surroundings	16 *
	Enjoy the surroundings	4
Perceived disadvantages		
Expenditure of time and energy and long distances	Spend much energy and walk a long way	88 *
	Time-consuming	28 *
Feeling compelled	Forced to use the bridge	4
Feelings of fear and social insecurity	Not feeling social security	44 *
	Feeling afraid of heights and falls	56 *
	Feeling scared because of lack of service support, darkness, unsafe and non-standard equipment)	52 *

*Beliefs that their frequencies of expression by participants were more than 10% and considered as outstanding belief.

Pedestrians' normative beliefs

Normative beliefs refer to important others whose views influence the bridge used by participants and can be considered a potential source of social pressure on pedestrians. Analysis of data on approvals and rejections of pedestrian bridge use led to the extraction of 35 initial codes and forming 12 integrated codes and seven subcategories.

Approvals of bridge use included family and social approvals. The frequency of codes indicated that

most approvals were done by family members and familiars. Participants stated:

"My family asks me to use the bridge to cross the street." (P24)

"If someone has a history of accidents and has experienced, he says do not rush. They approve using the bridge." (P16)

According to participants, those who refused to use the bridge were family, friends, or familiars.

They also said that people who in a hurry cross under the bridge, across the street.

"My friend pulled my hand and said let us go through the street." (P1)

Some of the participants mentioned limiting movement such as physical disability, illness, old age or carrying a load, etc.

"We do not use the bridge when my husband has shopped, or he has to carry our baby in his arms because it is difficult for him." (P10)

The frequency of codes showed that family members, sick and disabled people, familiars and hasty people have the greatest impact on the target group in rejecting the use of pedestrian bridges.

Bridge use approval and non-approval were both seen by Families and familiars. Furthermore, some participants stated that no one encourages or supports them, and the authorities pay attention to drivers and motorcyclists.

"No one encourages or approves us what we do." (p6)

Control beliefs of pedestrians

Control beliefs point to the factors that facilitate/complicate using pedestrian bridge use. Related data analysis led to the extraction of 203 primary codes, the formation of 21 integrated codes, and six subcategories.

Complicating factors in using the bridge: These factors had the greatest role in not using the bridge for pedestrians and include three subcategories: infrastructure, socio-cultural, and individual factors.

-Infrastructure factors: All participants stated lack of standard and safety equipment and facilities, shortage and lack of equipment, amenities and support services, and unavailability of bridges were the main factors in not using the bridge. Participants stated:

"Bridges have lots of stairs; they are narrow, tall and also non-stable." (P3)

"Power cables are placed on the floor of the bridge. Their cover has been damaged. In case of raining in winter, there is a high risk of electric shock." (p20)

"The elevator is broken; no one repair it." (P9)

"The Bridge is built where there is no pedestrian path." (P8)

-Socio-cultural factors: As seen in Table 3, being ridiculed by others and the presence of the opposite gender (cultural factor) makes it difficult for pedestrians to use the bridge. Other important factors mentioned by the majority of participants were the prevalence of non-use of bridges and the

habit of crossing the street and not receiving education from childhood.

"If we go up, they say how much you love yourself." (P3)

"I do not use the elevator with the gentlemen; I let them go, and then I take the elevator." (p13)

"I have seen many people crossing the street and do not use the bridge." (p19)

"Some people are accustomed to crossing the street and have acquired skills too." (P10)

The behaviors of motorcyclists and drivers were other factors that affected the behavior of pedestrians.

"The speed of drivers and motorcyclists is very high. I try to use the bridge. When they drive slowly, I will cross the street" (P3)

-Individual factors: More than half of the participants said they did not use the bridge when they were in a hurry or had a physical problem. "My mother has pain in the knee. She cannot use the bridge." (P1)

Some participants also noted laziness, impatience, and a desire to cross-level paths that prevented them from using the bridge.

"I am impatient for bridge use." (P2)

"Using the bridge, we cannot directly go to the other side." (P13)

Facilitating factors: These factors were in contrast to the complicating factors. If the complicating factors of using the pedestrian bridge are removed, the use of the bridge will be easier. In this category, three subcategories of socio-cultural, infrastructure, and security measures were formed.

-Infrastructure measures: Almost half of the participants mentioned that improving the structure of bridges and making them in a place accessible to pedestrians as well as their attractiveness were effective factors in facilitating the use of bridges. Participants pointed that the authorities should pay attention to the provision of facilities and amenities for pedestrians. The participants said:

"Bridge services must be completed. Elevator and escalator must be available." (P8)

"If the bridge is located in a good place, I use it." (P25)

"The shape of the bridge should be in harmony with the interior environment; it should be attractive." (P20)

-Socio-cultural measures: Some participants stated that educational and cultural, motivational activities could lead pedestrian to use the bridge

"Families are very influential.

It would be better than families as well as the community involved in raising awareness." (P3)

"Some people should be encouraged to use the bridge." (P3)

-Security: Some participants stated that security on bridges is very important. One of the participants said: "It would be nice if there were a camera inside the bridges." (P6)

Prominent pedestrians' beliefs about the facilitators and difficulties of using the bridge can be seen in Table 3.

Table 3) Description of codes, categories, and subcategories of barriers and facilitating Factors of using pedestrian bridges and the percentage of control beliefs associated with them (n=25)

Categories	Integrated codes	%
Bridge use complicating factors		
Infrastructure factors	Lack of safety and standard equipment and facilities	100 *
	Shortage and lack of equipment and amenities and support services	48 *
	Facilities unavailability	72 *
	Avoiding being ridiculed	4
Socio-cultural factors	Cultural barriers	4
	Prevalence of high-risk behavior among pedestrians	60 *
	Getting used to risky behavior riders and drivers high-risk behaviors	44 *
		4
Individual factors	Tendency to cross-level paths	12 *
	Being in a hurry	52 *
	Laziness	12 *
	Impatience	16 *
	Illness and disability	48 *
Facilitators		
Socio-cultural measures	Education and culturalization	32 *
	Encouragement and persuasion	24 *
	Patterning	6
Infrastructure measures	Proper structure	52 *
	Amenities	92 *
	Availability	48 *
	Charm	32 *
Security	Security	20 *

*Beliefs that their frequencies of expression by participants were more than 10% and considered as outstanding belief.

Discussion

This study aimed to explain the perception of pedestrians and identify their outstanding beliefs about the use of bridges. Findings showed that pedestrians' bridge the use or non-use can be explained by the TPB and behavioral, control, and normative beliefs.

Behavioral beliefs: In the present study, feeling more relaxed and less stressed was identified as the most important perceived advantage. These results were in line with Anciaes & Jones [25] and Razi & Madzlan [2] that pedestrians consider footbridge as a safe crossing. A study showed that passing vehicles' speed affects pedestrians' choice about crossing the street [26] and forces them to use the bridge to be more relaxed and less stressed.

Saving energy and time were other prominent beliefs of the participants about not using the bridge. These results were in line with other studies [2, 4, 25, 27, 28]. Razzaghi's study showed that the loss of energy and exhaustion during climbing stairs is one of the most important factors affecting the use of the bridge [27].

Feelings of fear and lack of social security were introduced as the most important disadvantages of using the bridge. The study results were consistent with other research that showed the fear of height [3, 29], feeling of insecurity, and disturbance [30] decrease using the bridge.

These factors played an important role in pedestrians' attitudes toward these facilities. Effective intervention should focus on these beliefs.

Normative beliefs: The results showed that family and familiars have an effective role in approving and disapproving the use of bridges, respectively. The present study results were in line with the study of Moshki *et al.* [31]. Studies have shown that mothers are the most important reference persons [32]. Family and acquaintances both seem to have affirmative and negative roles. Family's affirmative role is stronger, and acquaintances and friends are still the main disapprovers of using bridges.

Control Beliefs: Results showed that individual factors such as haste play a role in not using the bridge and having the tendency of crossing under the footbridge. It was in line with Hasan *et al.*'s study [29] and Rezaghi *et al.* [27]. Other factors like limited physical ability due to age, disability, carrying objects, or holding a child can prevent a bridge. These were in consist of other studies [2, 33].

The present study showed that infrastructure factors are outstanding beliefs that increase the perceived control and ease of using a bridge by pedestrians. Other studies referred to the effect of the structural elements on the bridge usage rate [2, 34]. Constructional standards and safe bridges, proper location, and easy access considering safe and comfortable equipment and supporting services can reduce pedestrians' stress and fear. As seen, some factors restrict the movement of a person (physical barrier or disability); hence some structural or escalator changes should be done to promote bridge use. These results were in line with the Räsänen finding that showed that escalators had increased the use of the bridge [4]. Furthermore, due to a lack of facilities, the unsafe crossing is the only way to cross the road [35]. It would be better authorities pay special attention to pedestrian safety in their city plans.

Socio-Cultural factors also another important factor in not using bridges. The prevalence of crossing through the street, not using overpasses, jumping, or bypassing obstacles under bridges, makes safe crossing difficult. These results were in line with other studies [3-5]. In addition, some phenomena such as social conformity [36] and the collective crossing [37] help this condition. According to the participants, habits affect people's traffic behaviors. Hidalgo-Solórzano considered that the absence of safety culture is the main reason for accidents and claimed pedestrians' irresponsible behaviors originate from culture concepts [30]. Numerous studies have also shown the power of cultural factors on the behavior of pedestrians [38]. The habituation of high-risk behaviors and the prevalence of not using bridges have created a vicious cycle. It becomes difficult to intervene and change pedestrians' unsafe behavior due to habits cause resistance to change [39]. According to the WHO in the Ottawa Charter

Statement, people's health is not separate from their daily living environment^[40].

Given these factors, cultural, social, security, and structural measures can be taken simultaneously to improve the use of bridges. These results are useful not only in designing the questionnaire but also in designing the intervention. This study, like other studies, suffered from some limitations to accomplished, such as difficult access to participants, poor transferability, and small sample size.

Conclusion

Based on the findings, bridge use increase depends on the pedestrians' beliefs. Some of these beliefs are related to internal factors (advantages and disadvantages) and a larger part to external factors (infrastructure, socio-cultural factors, security, etc.). Special attention should be paid to the identified beliefs to design any intervention program, and all factors should be considered simultaneously. Performing an intervention such as cultural changes and education without considering the infrastructure factors, social norms, security, monitoring and support of services and equipment, and providing amenities will not impact pedestrians' safety.

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