TRANSPORTES
revistatransportes.org.br
anpet
associação nacional de pesquisa e ensino em transportes
anpet.org.br

Pedestrian behavior under the Theory of Planned Behavior: a scoping review

Comportamento do pedestre com base na Teoria do Comportamento Planejado: uma revisão de escopo

Márcia Lopes Rodrigues de Souza[1], **Michelle Andrade**[1], **Ingrid Luiza Neto**[2], **Samuel Morgan Teixeira Costa**[1]

[1]Universidade de Brasília, Brasília, Distrito Federal, Brasil
[2]Universidade Católica de Brasília, Distrito Federal, Brasil

Contact: marcia.lopes.souza@gmail.com, (MLRS); michelleandrade@unb.br, (MA); ingridluizaneto@gmail.com, (ILN); samuelmorganbh@gmail.com, (SMTC)

Submitted:
10 October, 2023
Revised:
29 February, 2024
Accepted for publication:
11 March, 2024
Published:
7 June, 2024
Associate Editor:
Flávio José Craveiro Cunto,
Universidade Federal do Ceará, Brasil

Keywords:
Pedestrian behavior.
Theory of Planned Behavior.
Scoping review.

Palavras-chave:
Comportamento do pedestre.
Teoria do Comportamento Planejado.
Revisão de escopo.

DOI: 10.58922/transportes.v32i2.2958

ABSTRACT
Understanding human behavior is essential to create safer environments for pedestrians, who stand out as one of the most vulnerable and complex elements of traffic. The Theory of Planned Behavior (TPB) has been widely used to understand the predictors of pedestrian behavior for the past 20 years. This scoping review aims to mapping and synthesizing the available knowledge on pedestrian behavior based on TPB. The review identified the most prevalent behaviors under investigation (i.e., violation, error, lapse, and safe behavior), as well as the most significant constructs and variables explaining pedestrian behavior. Risk behaviors that stood out in the reviewed studies were a) crossing in unauthorized areas; b) using a mobile phone while crossing; and c) walking and/or crossing while alcohol impaired. We conclude that TPB constructs can support road safety actions and guide the development of future studies focused on pedestrians.

RESUMO
O entendimento do comportamento humano é fundamental para viabilizar ambientes mais seguros, sobretudo considerando os pedestres, que se destacam como um dos elementos mais vulneráveis e complexos do trânsito. A Teoria do Comportamento Planejado (TCP) é amplamente empregada para a predição comportamental, apresentando resultados promissores no estudo do comportamento de pedestres há aproximadamente 20 anos. Esta revisão de escopo objetiva mapear e sintetizar o conhecimento disponível sobre o comportamento do pedestre com base na TCP. A revisão permitiu identificar os comportamentos mais estudados (violações, erros, lapsos e comportamento seguro) e os construtos e variáveis mais significativos na explicação dos comportamentos. Os comportamentos de risco com maior destaque nos estudos revisados foram a) atravessar em locais não autorizados; b) usar o celular durante a travessia; e c) caminhar e/ou realizar travessia embriagado. Conclui-se indicando que os construtos da TCP podem subsidiar ações de promoção de segurança viária e orientar o delineamento de estudos futuros voltadas para os pedestres.

1. INTRODUCTION

Pedestrians' injuries and fatalities are among the main road safety management concerns, resulting in approximately 23% of traffic deaths worldwide (WHO, 2023). The United Nations established the first and second Decades of Action for Road Safety from 2011 to 2020 and 2021 to 2030, respectively, and called upon member countries to develop actions to reduce road traffic deaths and injuries by 50% (WHO, 2011, 2021). Despite these efforts, traffic data reveal that much need to be done to increase the effectiveness of actions promoting pedestrian traffic safety.

The effectiveness of actions undertaken by different countries is threatened by pedestrians' violation of traffic rules, especially when they do not use the available safety devices to ensure their safe crossing (Kim, Kho and Kim, 2017; Mukherjee and Mitra, 2020). Studying pedestrian behavior and its predictors (whether psychological, social, or environmental) is important for promoting pedestrian road safety during crossing situations.

Psychological theories have been used to comprehend human behavior in different contexts. The Theory of Planned Behavior (TPB), proposed by Ajzen (1991), is one of the most prevalent for predicting human behavior, including pedestrian behavior studies (Xu, Li and Zhang, 2013). One pioneer research linking TPB with pedestrian behavior emerged over 20 years ago through Moyano-Díaz's (2002) study.

According to TPB, intention is the central aspect that leads an individual to perform a particular behavior, and it is explained by three constructs: attitude, subjective norm, and perceived behavioral control. Attitude is defined as the individual's positive or negative evaluation of performing a particular behavior. Subjective norm is the individual's perception of their peers' opinions regarding a specific behavior. Finally, perceived behavioral control reflects the individual's perception of their ability to perform the behavior under study. The constructs of TPB are therefore latent traits (factors) related to characteristics that are investigated but not directly observable.

Although TPB is recognized as suitable for explaining human behavior in various contexts, it has also faced criticisms regarding its validity and utility. Some researchers point out predictive validity problems, rarely producing high correlations between constructs (above 0.75 or 0.80) (Sniehotta, Presseau and Araújo-Soares, 2015). Thus, several studies propose including other variables to improve the predictive power of TPB, applying an extended version of the theory (Norman, Clark and Walker, 2005; Koh and Mackert, 2016). Understanding the advantages and limitations of the theory may support the decision whether to apply TPB (or its extended version) to a given situation.

It is important to assess the outcomes of employing TPB to examine pedestrian conduct, based on the body of scientific literature devoted to this purpose. Following a preliminary literature search, which yielded no reviews on pedestrian behavior grounded in TPB, this study seeks to systematically map and consolidate available knowledge on pedestrian using the scoping review methodology. The aim is to identify which TPB constructs and, when applicable, external variables have been significant in explaining the studied behaviors. We also intent to identify and analyze the outcomes of the reviewed studies.

This scoping review may guide researchers investigating pedestrian behavior towards instances where TPB, with or without additional external variables, has effectiveness in explaining the behavior under consideration. It will also contribute to identifying behaviors that can be properly studied based on TPB in future research. For policymakers, this study can contribute to identifying the antecedents of pedestrian violations and distraction that can be addressed in strategies to promote pedestrians' safety.

2. METHOD

Scoping review of the literature maps existing evidence in a particular research area, provides descriptions of reviewed studies, and lays groundwork for a systematic review. Unlike systematic reviews, scoping reviews encompass studies with diverse characteristics; they do not assess evidence quality and do not conduct meta-analyses (Munn et al., 2018).

To synthesize the available knowledge on pedestrian behavior based on the TPB, we used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews checklist (PRISMA-ScR) (Tricco et al., 2018). We selected the keywords "pedestrian" and "Theory of Planned Behavior" to assess the main traffic issues studied involving pedestrian behavior based on the TPB. An advanced search procedure was employed with the search strategy in the abstract ("pedestrian" OR "pedestrians") and in the text ("Theory of Planned Behavior" OR "TPB").

The searches were conducted in Scopus, Web of Science, Medline Pubmed, and Psycinfo databases, given their comprehensiveness and coverage in different fields. We limited the search to primary studies, peer-reviewed, and empirical research. There were no limitations on publication date or language. The search was conducted between June and July 2022, and the reference selection process was carried out by three judges, addressing the differences through consensus technique.

The search process returned 64 papers in Scopus, 52 in Web of Science, 27 in Medline Pubmed, and 31 in Psycinfo, totaling 174 references. All retrieved articles were imported into EndNote (2020). From the unified set, 90 duplicate articles were excluded, leaving 84 papers. From these, after reading titles and abstracts, theoretical or not empirical studies, with unavailable abstracts, with samples that did not address pedestrians or did not use TPB were excluded, resulting in 39 empirical studies. In the final stage, 4 articles that were not available for full reading were excluded. After exclusions, 35 articles were included in the review. Figure 1 presents the study selection flowchart, following the PRISMA-ScR method (Tricco et al., 2018).

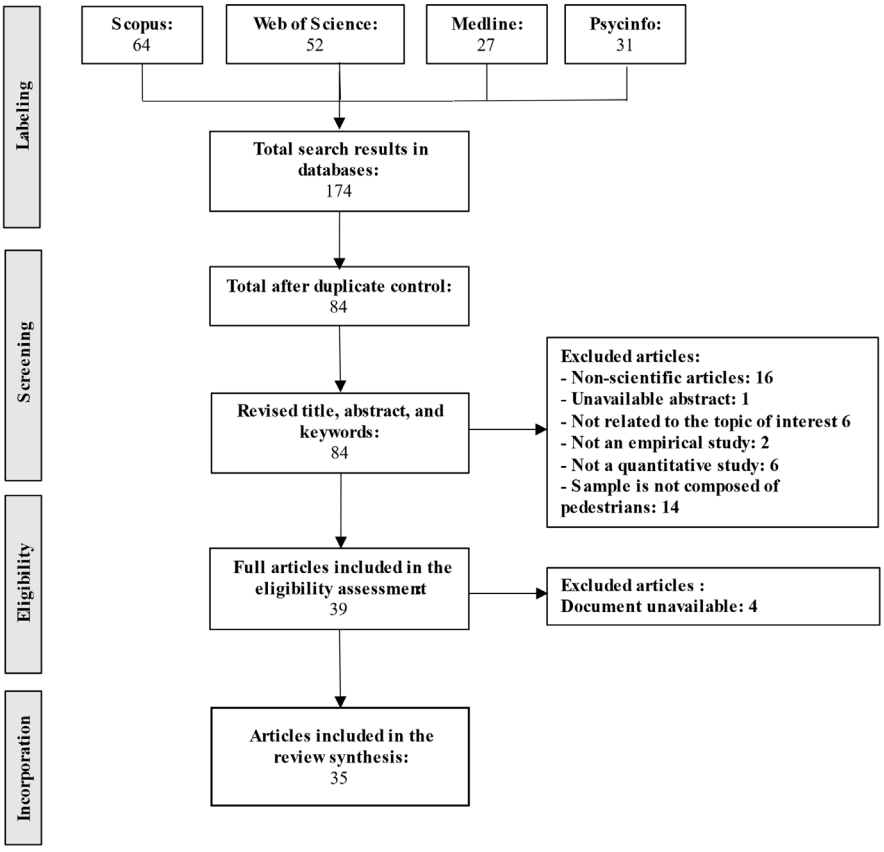

Figure 1. Flowchart of the search and article selection process.

The selected studies were categorized considering authorship, year of publication, country of origin, title, study objective, participants' age, sample size, data collection and analysis methods, dependent and independent variables, type of instruments used (self-reported questionnaire or observation technique), and the main results. Pedestrian behaviors were classified according to Deb et al. (2017) into: violations, errors, lapses, and safe behaviors (Table 1). Then, the articles were grouped and categorized into themes based on the similarity of objectives proposed in the studies.

Table 1: Definitions on pedestrian behavior dimensions [adapted from: Deb et al., 2017].

Pedestrian Behavior	Definition	Example
Violation	Deliberate deviation from social rules without intention to cause harm or damage.	Failure to use the nearby pedestrian crosswalk for crossing.
Error	Lack of understanding traffic regulations and/or the steps involved in the decision-making process.	Crossing diagonally for saving time.
Lapse	Forgetfulness, unintentional deviation, and lack of concentration to perform the task.	Forgetting to look for oncoming vehicles before crossing.
Safe	Avoiding violations or errors, ensuring compliance with traffic rules.	Avoiding crossing diagonally, using pedestrian devices for crossings, or letting other road users cross first.

Subsequently, we evaluated the variables that predict the constructs under study, associated with intention and/or the behavior itself, in addition to the specific constructs of the TPB (attitude, subjective norm, and perceived behavioral control). For the analysis, we calculated the frequency with which these variables significantly contributed to predicting the target construct(s) and synthetized the conclusions of the reviewed studies.

3. RESULTS

3.1. Overview on the included studies

The features of the 35 studies included in this review are detailed in the summary Table A1 provided in the Appendix 1. These studies reflect a growing interest in pedestrians' behavior in recent years, with publications spanning from 1998 to 2022. Notably, 71% of the studies were published between 2015 and 2022, while 17% between 2007 and 2014, and 11% prior to 2007. In terms of country distribution, there was a prevalence of studies coming from China (23%), Australia (14%), England and the United States, each comprising 11%.

The sample size ranged from 80 participants (Barton, Kologi and Siron, 2016) to 6,166 respondents (Oviedo-Trespalacios et al., 2021), totaling 19,907 participants across the studies. Participants' average age varied from 11 (Evans and Norman, 2003) to 92 years old (Holland and Hill, 2007). 77% of respondents were female. Self-reported questionnaires were predominantly used, with only one study incorporating video observation alongside questionnaires (Xiao, Liu and Liang, 2021). Regression analysis was the primary statistical method employed (66%), mainly to assess pedestrians' intention, followed by Structural Equation Modeling (23%) to examine pedestrians'

behavior. Most studies were conducted in urban areas, with only one study taking place on a highway featuring a pedestrian overpass (Sundararajan et al., 2020b).

3.2. Overview on study categorization

To conduct the categorization, we divided the studies into five traffic-related themes, based on their aim to explain pedestrian intention and/or behavior: 1) Crossing at intersections; 2) Crossing while using electronic devices; 3) Walking under the influence of alcohol; 4) Walking for leisure and other purposes; and 5) Interacting and trusting in automated vehicles. Table 2 shows that the majority of the studies focused on behavioral intention (n = 25), with only 10 studies addressing actual pedestrian behavior. Within the traffic-related themes, a considerable number of studies (n = 18) reported findings related to pedestrians crossing at intersections. Among these, 13 studies primarily examined pedestrian violations of traffic rules, i.e., crossing outside designated areas.

Table 2: Classification of the studies by goals and topics.

Study objectives/Traffic themes	Behavior [adapted from: Deb et al., 2017]			Total overall
	Violation	Lapse	Safe Behavior	
Behavior	4	1	5	10
Walking behavior			1	1
Crossing using electronic devices		1		1
Interacting and trusting in autonomous vehicles			1	1
Other pedestrian behavior while crossing	4		3	7
Intention	10	12	3	25
Walking behavior			1	1
Walking under the influence of alcohol		3		3
Crossing using electronic devices		8		8
Interacting and trusting in automated vehicles	1		1	2
Crossing at intersections	9	1	1	11
Total overall	14	13	8	35

3.3. Reviewed studies on pedestrian behavior

Among the studies that evaluated pedestrian behaviors *per si*, the majority employed Structural Equation Modeling to identify predictive variables. Overall, 70% of the studies focused on behaviors related to road crossing, with a significant portion addressing violations by young pedestrians in various countries such as Chile, Turkey, Iran, and China (Moyano-Díaz, 2002; Demir et al., 2019; Hashemiparast et al., 2020; Xiao, Liu and Liang, 2021). The perceived low risk among young pedestrians leads to higher-risk behaviors (Hashemiparast et al., 2020).

Regarding safe crossing using available pedestrian facilities, studies indicated that women more frequently adhere to traffic rules (Hemmati and Gharlipour, 2017). It was also observed that attitude and perceived behavioral control can positively influence the behavior of using overpasses

(Sundararajan et al., 2020b), while 'perceived consequence' and 'pedestrian expectation' are associated with safe crossing behavior (Sundararajan et al., 2020a).

3.4. Reviewed studies on pedestrian behavioral intention

Different studies sought to assess the behavioral intention of pedestrians to engage in crossing violations, crossing / walking using electronic devices or under the influence of alcohol. Overall, most studies employed Multiple Regression (n=21) for data analysis, and their results varied in terms of TPB constructs significance and other external constructs/variables.

'Perceived risk' was a joint predictor found in a study that assessed pedestrians' intentions to walk under the influence of alcohol, applied to adults in 16 countries (Oviedo-Trespalacios et al., 2021). In studies conducted with youth in Australia, age was not a significant predictor, and males showed higher intentions to walk intoxicated and lower risk perception compared to females (Haque et al., 2012; Gannon et al., 2014). In all three studies, the constructs of the Theory of Planned Behavior (TPB) were significant in predicting pedestrian behavioral intention.

In studies aiming to explaining pedestrians' intentions to cross while using cell phones, age was negatively related to attitudes. Young people showed more positive attitudes towards cell phone use while crossing than other age groups, regardless of the location of the studies. In these studies, attitude was the strongest predictor of intention (Barton, Kologi and Siron, 2016), followed by subjective norm (Hanan et al., 2015; Lennon, Oviedo-Trespalacios and Matthews, 2017), and perceived behavioral control (Hanan et al., 2015; Piazza et al., 2019; O'Dell et al., 2022).

Other studies demonstrate the potential of the TPB in predicting pedestrians' behavioral intentions to cross the roads in potentially hazardous situations. The results indicated that teenagers' motivation is associated with perceived behavioral control (Evans and Norman, 2003), while for adults, risky intention is associated with attitude (Holland and Hill, 2007; Zhou, Romero and Qin, 2016) and descriptive norm (Zhou, Romero and Qin, 2016).

Pedestrians' intentions in scenarios of conformity or non-conformity with other pedestrians were investigated in 3 crossing studies conducted in China, showing that pedestrians are more likely to cross when others are also crossing (Zhou, Horrey and Yu, 2009; Zhou and Horrey, 2010; Zhou, Romero and Qin, 2016). The constructs of the TPB and the perceived risk were predictors in both crossing scenarios, with attitude being the strongest predictor in the non-conformity situation, while perceived behavioral control was stronger in the conformity scenario (Zhou, Horrey and Yu, 2009). In the study conducted with adolescents, TPB and anticipated affect were significant predictors of intention (Zhou and Horrey, 2010).

3.5. Most significant psychosocial constructs and variables in pedestrian intention and/or behavior

Table 3 shows the most significant psychosocial constructs and variables, along with the number of times they were assessed and found to have a significant effect ($p < 0.05$ or $p < 0.001$) in predicting the intentions and/or behaviors studied. Constructs and variables considered in fewer than 3 published studies were not evaluated. In the analysis, 11 constructs and 2 variables were considered. Based on the results, the constructs of the TPB – attitude, perceived behavioral control, and subjective norm, are the most significant factors in pedestrian intention and actual behavior. Intention was a predictor of behavior in 10 studies.

Table 3: Constructs and variables measured and associated with pedestrian behavior and intention.

Constructs/Variables	Number of studies		Number of studies with significant *p**		Percentage of studies with significant *p* (%)**	
	I	B	I	B	I	B
TPB constructs						
Attitude	25	10	23	10	92	100
Subjective Norm	24	10	17	6	71	60
Perceived Behavioral Control	25	10	23	10	92	100
Intention	0	10	0	10	NE	100
Extended constructs						
Self-identity	3	0	2	0	67	NE
Anticipated affect	4	0	4	0	100	NE
Perceived risk	12	1	3	1	25	NE
Conformity	3	1	2	1	67	NE
Descriptive norm	3	0	2	0	67	NE
Moral norm	4	0	1	0	25	NE
Habit (past behavior)	5	1	5	0	100	NE
Sociodemographic variables						
Gender	12	0	3	0	25	NE
Age	11	0	6	0	55	NE

*$p<0.05$ or $p<0.001$. **Number of studies with significant p / Total of studies x 100. I = Behavioral Intention; B = Behavior; NE = Not Evaluated.

Constructs from other theoretical frameworks were incorporated into the original TPB model as predictors of intention in 12 studies, with a significance level of less than or equal to 5%. These include self-identity, anticipated affect, conformity, descriptive norm, habit, and age. Among these, habit and age were the most studied factors, being significant in predicting behavioral intention in 100% and 50% of the studies, respectively.

Age was significant in studies of pedestrian intention in crossing roadways. In these studies, younger pedestrians up to 26 years old were inclined to cross illegally (Evans and Norman, 2003; Zhou and Horrey, 2010). Conversely, older pedestrians, starting from 40 years old, indicated lower likelihood of crossing the roadway in violation/illegality (Holland and Hill, 2007; Zhou, Horrey and Yu, 2009).

Habit was significant in predicting intention in 5 studies, 4 of them assessing the intention to cross roadways in situations of violation, error, and lapse/distraction (Haque et al., 2012; Xu, Li and Zhang, 2013; Suo and Zhang, 2016; Soathong et al., 2021). The studies demonstrate that adult pedestrians tend to cross roadways without observing traffic rules in familiar urban environments, becoming an automatic response.

The constructs less frequently significant in predicting intention were perceived risk, moral norm, and gender. Among the TPB constructs, subjective norm showed the lowest percentage of significance per study in both pedestrian intention and behavior.

In pedestrian behavior studies, TPB constructs themselves participated in 10 studies with a significance level of 5% or less. Of these constructs, the subjective norm was the only factor that ceased to be significant in four studies (p=60%).

4. DISCUSSION

This review mapped the existing literature on the use of TPB to explain pedestrian intention and/or behavior. Results show that the most frequently evaluated topic deals with pedestrian behavior and/or intention in crossing urban streets. Crossing streets is a complex behavior that requires skills from individuals, mainly when outside designated areas. Over time, this behavior becomes automatic, and individuals tend to pay little attention to it, increasing the likelihood of pedestrian run over (Torquato and Bianchi, 2015). Pedestrian behavioral intention to use electronic devices, especially cell phones, while crossing has also been investigated. Walking while using a cell phone has become common, standing as a type of distraction that can interfere in the pedestrians' decision-making process when crossing streets and also contribute to pedestrian run over.

An important issue for road safety promotion is pedestrian behavior under the influence of alcohol. Few studies found in the review address this concern, despite alcohol use be one of the factors that contributes to pedestrian accidents (Oxley, Lenne and Corben, 2006; Velloso and Jacques, 2012). This approach, by means of the TPB, is still underexplored, and could be considered in future studies.

Not enough emphasis has also been given to investigating the impact of sociodemographic variables on pedestrian behavior, such as education level, whether the person drives or not, or if there are mobility limitations, among others. Although some studies have employed variables such as gender and age in their models, assessing the influence of sociodemographic aspects on pedestrian behavior should be the focus of future studies, as they could contribute to supporting the development of more effective education and guidance measures (Luiza Neto et al., 2020). It is important to assess whether there are significant behavioral variations among different pedestrian groups (i.e., men, women, youth, elderly, drivers), and develop specific interventions for each group.

Results predominantly feature research on pedestrian behavior in urban environments, as only one study seeks non-urban settings. Highways, for instance, present unique characteristics such as the presence of cargo vehicles, high speeds, extensive road width, and heavy traffic volume (Velloso and Jacques, 2012). In this environment, pedestrian vulnerability is accentuated, especially when walking along the margins of the roads and crossing outside designated areas (overpasses or underpasses). Therefore, this review highlights the limited attention given to studying pedestrian behavior on highways. It underscores the significant role that the road environment plays in human behavior, as this behavior both influences and is influenced by the physical and social elements presented there (Günther and Neto, 2015).

Behavioral studies related to physical elements also constitute a gap observed in the reviewed studies. Greater emphasis was placed on individual aspects at the expense of environmental ones. Factors such as the presence of crosswalks, overpasses, and sidewalks can influence the pedestrian's decision-making process regarding whether to behave safely or not. Pedestrians may exhibit risky behavior not only because they intend to do so but also because environmental components do not provide safe crossing conditions or do not afford the safer way to be followed. Additionally, significant differences may also be found when assessing pedestrian behavior in urban spaces versus non-urban, which could be investigated in future studies.

This review highlights that, despite TPB being a model for studying planned behavior, studies often only embrace the assessment of constructs that lead to the explanation of behavioral intention, without evaluating the behavior itself. This observation is important to consider in future studies, as the literature suggests that there may be a gap between intention and behavior (French et al., 2013).

It was also found that when behavior is considered in the study, it is usually not directly observed and is verified through self-reporting measures. A similar result was found in Armitage and Conner's (2001) meta-analysis on the evidence of the TPB. The authors pointed a significant difference in the explained variance when behaviors were directly observed (R^2=0.20) compared to a self-reported approach (R^2=0.31).

Observing behavior is less susceptible to cognitive biases and social desirability than using self-reported measures and, therefore, may result in more accurate findings (Fishbein and Ajzen, 2010). Despite this, research on human behavior often relies on self-reporting techniques, considering difficulties in observational studies, which are generally costly, and the behavior of interest may take time to occur. In self-reported studies, there is greater convenience in obtaining information and accessing participants from different demographic groups, especially using online questionnaires. As a disadvantage of self-reporting, there is the lack of personal contact with respondents (Günther, 2011), as well as potential response biases, since socially acceptable responses may be given (Huemer, 2018). These issues can be minimized by offering clear instructions on the importance of participants responding as honestly as possible. By using online questionnaires, respondents may feel more comfortable to provide honest answers compared to face-to-face interviews, which may induce a sense of embarrassment when revealing truths to an interviewer.

This review also shows that study context, type of behavior analyzed (violation, distraction, error, and safety behavior), pedestrian age, data collection method, and the constructs and variables added to the original TPB model can affect the prediction of pedestrians' intention and/or behavior. Its applicability to studies conducted in the context of pedestrian behavior has increasingly demonstrated solid results being presented in different countries, indicating the theory's robustness, considering the cultural specificities.

It is observed that new constructs have been incorporated into the original TPB model (e.g., self-identity, anticipated affect, conformity, descriptive norm, habit), contributing to the increase on the explained variance and, consequently, a better understanding of the aspects that predict pedestrian behavior. It is suggested that TPB can bring both academic and social contributions, supporting the study of different behaviors in traffic, as well as the development of public policies to encourage healthier and more sustainable modes of transportation.

5. REVIEW LIMITATIONS

Although the proposed study achieved its objectives, the results may have some limitations. Despite the comprehensive research strategy, this paper investigated peer-reviewed empirical articles in four bibliographic databases (Scopus, Web of Science, Medline Pubmed, and Psycinfo). Nevertheless, potentially important studies restricted to other databases, as well as dissertations and theses, were not included in this review. Finally, the impact of local culture on pedestrian behavior was not investigated as it was not a focal point of the reviewed literature. This omission highlights the need for incorporating this variable into future research endeavors.

6. CONCLUSIONS AND FUTURE STUDIES

A significant body of research aimed at explaining pedestrian behavior employs the TPB as a conceptual model. Many of these studies integrate additional variables and/or constructs drawn from other theoretical frameworks, resulting in the extended TPB structure. The present scoping review revealed that most of the studies focus on the behavior intention rather than the behavior itself. Additionally, applying the TPB to behaviors studied within a specific cultural and socioeconomic environment should not be directly transferred to different contexts. In essence, conducting specific studies that reflect the characteristics of each context is advisable. However, results obtained from previous studies are valuable for informing hypotheses regarding intervening factors in each behavior within a specific reality, and even for defining the methodology to be employed in the research (such as instrument development, data collection techniques, and data analysis methods). Among the types of risky pedestrian behaviors outlined in the reviewed studies, notable examples include crossing at unauthorized locations, using cell phones while crossing, and walking and/or crossing while intoxicated.

This review found that the most frequent predictors of pedestrian intention / behavior are the constructs of the basic TPB (attitude, subjective norm, and perceived behavioral control). Subjective norm was notably the weakest construct compared to the others within TPB. This consistent pattern suggests that inadequacies in the questionnaires used to measure the influence of various types of subjective norms (such as influence from parents, friends, grandparents, teachers, coworkers, etc.) may lead research to overlook the variability of social norms across different contexts and situations.

The study also revealed that although the constructs of the TPB were the primary predictors of pedestrian behavioral intention, other external elements also proved to be statistically significant, supporting the reliability of extended TPB models. Notably, these included constructs such as self-identity, anticipated affect, conformity, descriptive norm, habit, and age. These findings suggest that the applicability of the TPB can be enhanced by incorporating external predictors into the theory, thereby increasing the explanatory power of the behavior under investigation (Heath and Gifford, 2002).

The results obtained can inform future studies that broaden the scope beyond behavioral intention and aim to investigate the factors involved in pedestrians' risky behaviors. Furthermore, these results can subside the development of effective strategies and public policies aimed at enhancing pedestrian safety.

ACKNOWLEDGEMENTS

We thank Prof. Maria Alice Prudêncio Jacques for her valuable contribution to the improvement of this article.

REFERENCES

Ajzen, I. (1991) The Theory of Planned Behavior, *Organizational Behavior and Human Decision Processes*, v. 50, n. 2, p. 179-211. DOI: 10.1016/0749-5978(91)90020-T.

Armitage, C.J. and M. Conner (2001) Efficacy of the Theory of Planned Behaviour: a meta-analytic review, *British Journal of Social Psychology*, v. 40, n. 4, p. 471-99. DOI: 10.1348/014466601164939. PMid:11795063.

Barton, B.K.; S.M. Kologi and A. Siron (2016) Distracted pedestrians in crosswalks: an application of the Theory of Planned Behavior, *Transportation Research Part F: Traffic Psychology and Behaviour*, v. 37, p. 129-37. DOI: 10.1016/j.trf.2015.12.012.

Deb, S.; L. Strawderman; J. DuBien et al. (2017) Evaluating pedestrian behavior at crosswalks: validation of a pedestrian behavior questionnaire for the U.S. population, *Accident; Analysis and Prevention*, v. 106, p. 191-201. DOI: 10.1016/j.aap.2017.05.020. PMid:28628811.

Demir, B.; T. Özkan and S. Demir (2019) Pedestrian violations: Reasoned or social reactive? Comparing theory of planned behavior and prototype willingness model. *Transportation Research Part F: Traffic Psychology and Behaviour*, v. 60, 560–572. DOI: 10.1016/j.trf.2018.11.012.

EndNote (2020) *Reference Management Software (20th version)*. Clarivate Analytics. Available at: <https://endnote.com//> (access: 12/11/2022).

Evans, D. and P. Norman (1998) Understanding pedestrians' road crossing decisions: an application of the theory of planned behaviour. *Health Education Research*, v. 13, n. 4, p. 481-9. DOI: 10.1093/her/13.4.481-a. PMid:10345902.

Evans, D. and P. Norman (2003) Predicting adolescent pedestrians' road-crossing intentions: an application and extension of the Theory of Planned Behaviour, *Health Education Research*, v. 18, n. 3, p. 267-77. DOI: 10.1093/her/cyf023. PMid:12828229.

Fishbein, M. and I. Ajzen (2010) *Predicting and Changing Behavior: the Reasoned Action Approach* (1st ed.). New York: Psychology Press, 538 p. DOI: 10.4324/9780203838020.

French, D.P.; C.D. Darker; F.F. Eves et al. (2013) The systematic development of a brief intervention to increase walking in the general public using an "extended" theory of planned behavior, *Journal of Physical Activity & Health*, v. 10, n. 7, p. 940-8. DOI: 10.1123/jpah.10.7.940. PMid:23131598.

Gannon, B.; L. Rosta; M. Reeve et al. (2014) Does it matter whether friends, parents, or peers drink walk? Identifying which normative influences predict young pedestrian's decisions to walk while intoxicated, *Transportation Research Part F: Traffic Psychology and Behaviour*, v. 22, p. 12-24. DOI: 10.1016/j.trf.2013.10.007.

Günther, H. (2011) Métodos de pesquisa em psicologia social. In Torres, C.V. e Neiva, E.R. *Psicologia Social: Principais Temas e Vertentes*. Porto Alegre: Artmed, 360 p.

Günther, H. and I.L. Neto (2015) Comportamento no trânsito: uma perspectiva da psicologia ambiental. In Olivato, A.; Bianchi, A.S.; Gondim, A.P.S. et al. (eds.) *Pesquisas sobre Comportamento no Trânsito*. São Paulo: Casa do Psicólogo, 384 p.

Hafeez, F.; U.U. Sheikh; A.A. Mas'ud et al. (2022) Application of the Theory of Planned Behavior in Autonomous Vehicle-Pedestrian Interaction, *Applied Sciences*, v. 12, n. 5, p. 2574. DOI: 10.3390/app12052574.

Hanan, S.A.; N.F. Said; A.A.M. Kamel et al. (2015) Factors that influences pedestrian intention to cross a road while using mobile phone, *International Journal of Economics and Financial Issues*, v. 5, p. 116-21.

Haque, R.; N. Clapoudis; M. King et al. (2012) Walking when intoxicated: an investigation of the factors which influence individuals' drink walking intentions, *Safety Science*, v. 50, n. 3, p. 378-84. DOI: 10.1016/j.ssci.2011.09.017.

Hashemiparast, M.; A. Montazeri; S. Nedjat et al. (2017) Pedestrian road crossing behavior (PEROB): Development and psychometric evalution, *Traffic Injury Prevention*, v. 18, n. 3, p. 281-285. DOI: 10.1080/15389588.2016.1174332.

Hashemiparast, M.; M. Sharma; M.A. Jafarabadi et al. (2020) Still careless: findings from a cross-sectional study of young pedestrians' risky road crossing behaviors, *Archives of Public Health*, v. 78, n. 1, p. 44. DOI: 10.1186/s13690-020-00421-2. PMid:32467756.

Heath, Y. and R. Gifford (2002) Extending the theory of planned behavior: predicting the use of public transportation, *Journal of Applied Social Psychology*, v. 32, n. 10, p. 2154-89. DOI: 10.1111/j.1559-1816.2002.tb02068.x.

Hemmati, R. and Z. Gharlipour (2017) Study of the safe behavior in road crossing using the theory of planned behavior among middle school students, *International Journal of Pediatrics*, v. 5, p. 5003-12. DOI: 10.22038/ijp.2017.22061.1847.

Holland, C. and R. Hill (2007) The effect of age, gender, and driver status on pedestrians' intentions to cross the road in risky situations, *Accident; Analysis and Prevention*, v. 39, n. 2, p. 224-37. DOI: 10.1016/j.aap.2006.07.003. PMid:16979132.

Hou, M.; J. Cheng; F. Xiao et al. (2021) Distracted behavior of pedestrians while crossing street: a case study in China, *International Journal of Environmental Research and Public Health*, v. 18, n. 1, p. 353. DOI: 10.3390/ijerph18010353. PMid:33466495.

Huemer, H.K. (2018) Cycling under the influence of alcohol in Germany, *Transportation Research Part F: Traffic Psychology and Behaviour*, v. 56, p. 408-19. DOI: 10.1016/j.trf.2018.05.013.

Jalilian, M.; F. Mostafavi; B. Mahaki et al. (2015) An application of a theory of planned behaviour to determine the association between behavioural intentions and safe road-crossing in college students: perspective from Isfahan, Iran, *JPMA. The Journal of the Pakistan Medical Association*, v. 65, n. 7, p. 742-6. PMid:26160084.

Jiang, K.; F. Ling; Z. Feng et al. (2017) Psychological predictors of mobile phone use while crossing the street among college students: an application of the theory of planned behavior, *Traffic Injury Prevention*, v. 18, n. 2, p. 118-23. DOI: 10.1080/15389588.2016.1236195. PMid:27648513.

Kaye, S-A; X. Li; O. Oviedo-Trespalacios et al. (2022) Getting in the path of the robot: Pedestrians acceptance of crossing roads near fully automated vehicles, *Travel Behaviour and Society*, v. 26, p. 1-8. DOI:10.1016/j.tbs.2021.07.012.

Kim, M.; S.Y. Kho and D.K. Kim (2017) Hierarchical Ordered model for injury severity of pedestrian crashes in South Korea, *Journal of Safety Research*, v. 61, p. 33-40. DOI: 10.1016/j.jsr.2017.02.011. PMid:28454869.

Koh, H.E. and M. Mackert (2016) A study exploring factors of decision to text while walking among college students based on Theory of Planned Behavior (TPB), *Journal of American College Health*, v. 64, n. 8, p. 619-27. DOI: 10.1080/07448481.2016.1215986. PMid:27448769.

Koh, H.; J. Oh and M. Mackert (2017) Predictors of playing augmented reality mobile games while walking based on the theory of planned behavior: web-based survey, *JMIR mHealth and uHealth*, v. 5, n. 12, e191. DOI: 10.2196/mhealth.8470. PMid:29229586.

Le, T.P.L.; A. Leung; I. Kavalchuk et al. (2021) Age-proofing a traffic saturated metropolis – Evaluating the influences on walking behaviour in older adults in Ho Chi Minh City, *Travel Behaviour & Society*, v. 23, p. 1-12. DOI: 10.1016/j.tbs.2020.10.008.

Lennon, A.; O. Oviedo-Trespalacios and S. Matthews (2017) Pedestrian self-reported use of smart phones: positive attitudes and high exposure influence intentions to cross the road while distracted, *Accident; Analysis and Prevention*, v. 98, p. 338-47. DOI: 10.1016/j.aap.2016.10.028. PMid:27825043.

Luiza Neto, I.; L.H. Matsunaga; C.C. Machado et al. (2020) Psychological determinants of walking in a Brazilian sample: an application of the Theory of Planned Behavior, *Transportation Research Part F: Traffic Psychology and Behaviour*, v. 73, p. 391-8. DOI: 10.1016/j.trf.2020.07.002.

Moyano-Díaz, E. (2002) Theory of Planned Behavior and pedestrian's intentions to violate traffic regulations, *Transportation Research Part F: Traffic Psychology and Behaviour*, v. 5, n. 3, p. 169-75. DOI: 10.1016/S1369-8478(02)00015-3.

Mukherjee, D. and S. Mitra (2020) A comprehensive study on factors influencing pedestrian signal violation behaviour: experience from Kolkata City, India, *Safety Science*, v. 124, p. 104610. DOI: 10.1016/j.ssci.2020.104610.

Munn, Z.; M.D. Peters; C. Stern et al. (2018) Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach, *BMC Medical Research Methodology*, v. 18, n. 1, p. 143. DOI: 10.1186/s12874-018-0611-x. PMid:30453902.

Norman, P.; T. Clark and G. Walker (2005) The theory of planned behavior, descriptive norms, and the moderating role of group identification, *Journal of Applied Social Psychology*, v. 35, n. 5, p. 1008-29. DOI: 10.1111/j.1559-1816.2005.tb02157.x.

O'Dell, A.; A.J. Filtness and A.P. Morris (2022) Predicting the intention of distracted pedestrians at road crossings, *Accident; Analysis and Prevention*, v. 173, p. 106707. DOI: 10.1016/j.aap.2022.106707. PMid:35594743.

Oviedo-Trespalacios, O.; A.K. Çelik; A. Marti-Belda et al. (2021) Alcohol-impaired walking in 16 countries: a theory-based investigation, *Accident; Analysis and Prevention*, v. 159, p. 106212. DOI: 10.1016/j.aap.2021.106212. PMid:34098429.

Oxley, J.; M. Lenne and B. Corben (2006) The effect of alcohol impairment on road-crossing behaviour, *Transportation Research Part F: Traffic Psychology and Behaviour*, v. 9, n. 4, p. 258-68. DOI: 10.1016/j.trf.2006.01.004.

Piazza, A.; A. Knowlden; E. Hibberd et al. (2019) Mobile device use while crossing the street: utilizing the theory of planned behavior, *Accident; Analysis and Prevention*, v. 127, p. 9-18. DOI: 10.1016/j.aap.2019.02.006. PMid:30826696.

Rosenbloom, T.; A. Beigel and E. Eldror (2011) Attitudes, behavioral intentions, and risk perceptions of fatigued pedestrians, *Social Behavior and Personality*, v. 39, n. 9, p. 1263-70. DOI: 10.2224/sbp.2011.39.9.1263.

Seles, E. and Y. Afacan (2019) Exploring the relationship between health and walkability, *Open House International*, v. 44, n. 1, p. 44-52. DOI: 10.1108/OHI-01-2019-B0006.

Sniehotta, F.F.; J. Presseau and V. Araújo-Soares (2015) On the development, evaluation and evolution of health behaviour theory, *Health Psychology Review*, v. 9, n. 2, p. 176-89. DOI: 10.1080/17437199.2015.1022902. PMid:25739803.

Soathong, A.; S. Chowdhury; D. Wilson et al. (2021) Investigating the motivation for pedestrians' risky crossing behaviour at urban mid-block road sections, *Travel Behaviour & Society*, v. 22, p. 155-65. DOI: 10.1016/j.tbs.2020.09.005.

Sundararajan, K.D.; K. Ambak; B.D. Daniel et al. (2020a) Pedestrian behavioural intention to use crossing facilities based on extended Theory of Planned Behaviour, *Jurnal Kejuruteraan*, v. 32, n. 3, p. 523-30. DOI: 10.17576/jkukm-2020-32(3)-17.

Sundararajan, K.D.; K. Ambak; B.D. Daniel et al. (2020b) Willingness to use overhead bridge facilities based on Theory of Planned Behavior, *International Journal of Integrated Engineering*, v. 12, n. 4, p. 232-40, Available at: https://core.ac.uk/reader/328161690 > (accessed 11/12/2020).

Suo, Q. and D. Zhang (2016) Psychological differences toward pedestrian red light crossing between university students and their peers, *PLoS One*, v. 11, n. 1, e0148000. DOI: 10.1371/journal.pone.0148000. PMid:26824667.

Torquato, R.J. and A.S. Bianchi (2015) *Uma análise da percepção de risco de pedestres e dos comportamentos de riscos de travessia*. In Olivato, A.; Bianchi, A.S.; Gondim, A.P.S. et al. (eds.) *Pesquisas sobre Comportamento no Trânsito*. São Paulo: Casa do Psicólogo, 384p.

Tricco, A.C.; E. Lillie; W. Zarin et al. (2018) PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation, *Annals of Internal Medicine*, v. 169, n. 7, p. 467-73. DOI: 10.7326/M18-0850. PMid:30178033.

Velloso, M.S. and M.A.P. Jacques (2012) On-the-spot study of pedestrian crashes on Brazilian Federal District rural highways crossing urban areas, *Transportation Research Part F: Traffic Psychology and Behaviour*, v. 15, n. 5, p. 588-99. DOI: 10.1016/j.trf.2012.06.001.

WHO (2011) Global Plan for the Decade of Action for Road Safety 2011-2020. Available at: <https://www.who.int/publications/m/item/global-plan-for-the-decade-of-action-for-road-safety-2011-2020> (accessed 10/08/2023).

WHO (2021) Plano Global: Road Safety Decade 2021-2030. Available at: <https://www.who.int/pt/publications/m/item/global-plan-for-the-decade-of-action-for-road-safety-2021-2030> (accessed 10/08/2023).

WHO (2023) Global Status Report on Road Safety 2023. Available at: <https://iris.who.int/bitstream/handle/10665/375016/9789240086517-eng.pdf?sequence=1> (accessed 02/24/2024).

Xiao, Y.; Y. Liu and Z. Liang (2021) Study on road-crossing violations among young pedestrians based on the theory of planned behavior, *Journal of Advanced Transportation*, v. 2021, p. 6893816. DOI: 10.1155/2021/6893816.

Xu, Y.; Y. Li and F. Zhang (2013) Pedestrians' intention to jaywalk: automatic or planned? A study based on a dual-process model in China, *Accident; Analysis and Prevention*, v. 50, p. 811-9. DOI: 10.1016/j.aap.2012.07.007. PMid:22836117.

Zhao, X.; X. Li; A. Rakotonirainy et al. (2022) Predicting pedestrians' intention to cross the road in front of automated vehicles in risky situations, *Transportation Research Part F: Traffic Psychology and Behaviour*, v. 90, p. 524-36. DOI: 10.1016/j.trf.2022.05.022.

Zhou, H.; S.B. Romero and X. Qin (2016) An extension of the theory of planned behavior to predict pedestrians' violating crossing behavior using structural equation modeling, *Accident; Analysis and Prevention*, v. 95, n. Pt B, p. 417-24. DOI: 10.1016/j.aap.2015.09.009. PMid:26433568.

Zhou, R.; W.J. Horrey and R. Yu (2009) The effect of conformity tendency on pedestrians' road-crossing intentions in China: an application of the theory of planned behavior, *Accident; Analysis and Prevention*, v. 41, n. 3, p. 491-7. DOI: 10.1016/j.aap.2009.01.007. PMid:19393798.

Zhou, R. and W.J. Horrey (2010) Predicting adolescent pedestrians' behavioral intentions to follow the masses in risky crossing situations, *Transportation Research Part F: Traffic Psychology and Behaviour*, v. 13, n. 3, p. 153-63. DOI: 10.1016/j.trf.2009.12.001.

Appendix 1. List of Studies.

Table A1: Summary of Reviewed Studies

Author(s)/Year/ Country	Dependent Variables Targeted by the Research Objective	Type of behavior	Independent Variables investigated	Sample	Method of data collection	Method of data analyses
		Deb et al. (2017)				
1 – Pedestrian crossing intention and/or Behavior						
Evans and Norman (1998) (England)	Intention	Violation	Self-identity Gender Age	N = 210 (17 to 75 years old)	Self-reported questionnaire Potentially dangerous scenarios: A) Dual roadway; B) Pedestrian crossing when traffic signal activated by button; C) Residential street.	Multiple linear regression
Moyano-Díaz (2002) (Chile)	Intention and behavior	Violation	Age Gender Car crash history (5 years)	N = 146 Students (17 to 26 years old or +)	Self-reported questionnaire	Structural Equation Modeling
Evans and Norman (2003) (Gales)	Intention	Violation	Anticipated affect Moral norm Self-identity Age Gender	N = 1833 Students (11 to 14 years old)	Self-reported questionnaire handed in classroom. Dangerous street crossing scenario.	Hierarchical Multiple Regression Analysis
Holland and Hill (2007) (England)	Intention	Violation	Risk perception Affective attitude Age Gender Being or not a driver	N = 293 (17 to 92 years old)	Self-reported questionnaire - Scenario A: Crossing the street when the pedestrian light is red. - Scenario B: Crossing the street when traffic is heavy. - Scenario C: Crossing the street near a curve.	Hierarchical Multiple Regression Analysis
Zhou, Horrey and Yu (2009) (China)	Intention	Violation	Affect Moral norm Risk perception Conformity Self-identity Age Gender	N = 426 (18 to 81 years old) Residents of Beijing	Self-reported questionnaire Scenarios considering the pedestrian light red: a) Non-compliance; b) Compliance.	Hierarchical Multiple Regression Analysis
Zhou and Horrey (2010) (China)	Intention	Violation	Anticipated affect Moral norm Risk perception Conformity measures Sensation seeking Age Gender	N =510 Students of Beijing (12 to 19 years old)	Self-reported questionnaire handed in classroom. It used two scenarios (non-conformity with other pedestrians; and conformity with others). Same scenarios mentioned in the study of Zhou, Horrey and Yu (2009).	Hierarchical Multiple Linear Regression

Note: Habit = Past Behavior.

Table A1: Continued...

Author(s)/Year/ Country	Dependent Variables Targeted by the Research Objective	Type of behavior: Deb et al. (2017)	Independent Variables investigated	Sample	Method of data collection	Method of data analyses
1 – Pedestrian crossing intention and/or Behavior						
Rosenbloom, Beigel and Eldror (2011) (Israel)	Intention	Lapse	Risk perception Age Gender Marital status Car crash history	N = 205 Adult students Group 1: median age = 34.48 Group 2: median age = 32.29	Self-reported questionnaire. Grupo 1: 139 participants Grupo 2: 66 participants	Linear regression – Stepwise method
Xu, Li and Zhang (2013) (China)	Intention	Violation	Injunctive norm Descriptive norm Persona norms Past behavior (habit) Gender Age Driver's license	N = 323 adults Graduation students and local residential community (20 to 50 years old)	Self-reported questionnaire. In-person, with professional assistance	Multiple linear regression
Jalilian et al. (2015) (Ira)	Intention	Safe	Safe crossing Age Gender	N = 278 university students (17 to 37 years old)	Self-reported questionnaire PBS (Pedestrian Behavior Scale – 38 items)	Linear regression
Suo and Zhang 2016 (China)	Intention	Violation	Past behavior (habit)	N = 228 (17 to 25 years old) Groups: university students; employed colleagues; and unemployed colleagues.	Self-reported questionnaire Scenario: Traffic light red for pedestrians while people crossing and others waiting for the light to turn green	Hierarchical Multiple Linear Regression
Zhou, Romero and Qin (2016) (China)	Intention	Violation	Descriptive norm Risk perception Conformity tendency Age Gender Driver's license Driving frequency Monthly Income Educational degree	N = 260 (17 to 60 years old)	Self-reported questionnaire Scenario: Traffic light red for pedestrians	Structural Equation Modeling
Hemmati and Gharlipour (2017) (Ira)	Intention and behavior	Safe	Parents' Educational degree Parents' type of work Gender	N = 364 High school students (14 to 15 years old)	Self-reported questionnaire.	T-test, chi-*square* and Pearson's correlation coefficient
Demir et al. (2019) (Turkey)	Intention and behavior	Violation	Similarity Favorability Willingness	N = 486 Graduation students (mean of 21 years old)	Self-reported questionnaire	Structural Equation Modeling
Hashemiparast et al. (2020) (Ira)	Intention and behavior	Violation	Risk perception Sociodemographic variables Run over history	N = 562 (18 to 25 years old)	Self-reported questionnaire based on the structured questionnaire on pedestrian crossing behavior from Hashemiparast et al. (2017).	T test, Covariance and Multivariate Variance analysis (ANOVA and MANOVA)

Note: Habit = Past Behavior.

Table A1: Continued...

Author(s)/Year/ Country	Dependent Variables Targeted by the Research Objective	Type of behavior	Independent Variables investigated	Sample	Method of data collection	Method of data analyses
		Deb et al. (2017)				
1 – Pedestrian crossing intention and/or Behavior						
Sundararajan et al. (2020a) (Malasia)	Intention and behavior	Safe	Perceived consequence Expectation Perceived safety	N = 274 (21 to 30 years old)	Self-reported questionnaire at signalized intersections	Structural Equation Modeling
Sundararajan et al. (2020b) (Malasia)	Intention and behavior	Safe	Overpasses perceived quality Sociodemographic variables	N = 200 Scholl and university students (78,5% younger than 30 years old)	Self-reported questionnaire	Multiple Regression Analysis
Soathong et al. (2021) (New Zealand)	Intention	Violation	Habit Gender	N = 400 (17 to 65 years old)	Self-reported questionnaire	Structural Equation Modeling
Xiao, Liu and Liang (2021) (China)	Intention and behavior	Violation	Age	N = 395 (20 to 30 years old). Graduation students	Self-reported questionnaire Local investigation (videos)	Structural Equation Modeling
2 - Pedestrian behavior while crossing using electronic devices.						
Hanan et al. (2015) (Malasia)	Intention	Lapse	TCP constructs	N = 107 (19 to 26 years old) University students	Self-reported questionnaire Scenario: Using a cell phone while crossing near a curve	Multiple Regression
Barton, Kologi and Siron (2016) (United States)	Intention	Lapse	Age Car crash history Fear of negative evaluation	N = 80 (18 to 30 years old) University students	Self-reported questionnaire Scenarios: Crossing the street while distracted (sending messages, listening to music, receiving phone calls, and using apps)	Linear regression
Koh and Mackert (2016) (United States)	Intention	Lapse	Risk perception/ Self-efficacy Personal norms Age Gender Educational degree	N = 329 (18 to 35 years old) University students	Self-reported questionnaire Scenario: a) Sending messages while walking b) Reading text messages while walking	Hierarchical Regression
Lennon, Oviedo-Trespalacios and Matthews (2017) (Australia)	Intention	Lapse	Group norm Use of cell phone Audio interaction	N = 363 (18 to 65 years old)	Self-reported questionnaire	Hierarchical Multiple Regression
Koh, Oh and Mackert (2017) (United States)	Intention	Lapse	Automaticity tendency Immersion Leisure	N = 441 N1= 262 (University students) (18 to 34 years old); N2 = 197 workers (18 to 64 years old)	Self-reported questionnaire	Hierarchical Multiple Regression

Note: Habit = Past Behavior.

Table A1: Continued...

Author(s)/Year/ Country	Dependent Variables Targeted by the Research Objective	Type of behavior Deb et al. (2017)	Independent Variables investigated	Sample	Method of data collection	Method of data analyses
2 - Pedestrian behavior while crossing using electronic devices.						
Jiang et al. (2017) (China)	Intention	Lapse	Descriptive norm Moral norm Risk perception Use of cell phone Crossing frequency Compensation perceived capacity Past behavior Age Gender	N = 405 (17 to 26 years old) University students	Self-reported questionnaire	Hierarchical Multiple Regression
Piazza et al. (2019) (United States)	Intention	Lapse	TCP constructs	N = 480 (18 to 24 years old) University students	Self-reported questionnaire	Multiple Regression
Hou et al. (2021) (China)	Intention and behavior	Lapse	Conformity sensation Cell phone use Safety awareness	N = 387 (17 to 60 years old)	Self-reported questionnaire	Binary Logistic Regression
O'Dell, Filtness and Morris (2022) (England)	Intention	Lapse	Traffic density Vehicle speed Type of crossings	N = 81 (18 to 65 years old or +) University students	Self-reported questionnaire Scenarios: a) use of maps on cell phones; b) talking to other pedestrians; c) use of headphones	Multiple Regression
3 – Pedestrian walking beahvior						
Seles and Afacan (2019) (Turkey)	Intention and behavior	Safe	Sustainable urban development	N = 220 (18 to 80 years old)	Self-reported questionnaire	Structural Equation Modeling
Le et al. (2021) (Vietnam)	Intention	Safe	Habit Quality of the safe environment Destiny proximity	N = 832 (55 to 72 years old) Elderly	Self-reported questionnaire	Structural Equation Modeling
4 – Pedestrian walking behavior under alcohol effect						
Haque et al. (2012) (Australia)	Intention	Lapse	Anticipated regret Habit Risk perception	N = 215 (17 to 25 years old) University students	Self-reported questionnaire	Hierarchical Multiple Analysis
Gannon et al. (2014) (Australia)	Intention	Lapse	Norms (friendship, parents, university peers) Risk perception Gender Age	N = 118 (17 to 25 years old) University students	Self-reported questionnaire	Hierarchical Multiple Regression
Oviedo-Trespalacios et al. (2021) (16 countries)	Intention	Lapse	Risk perception Age Gender	N = 6.166 (18 to 88 years old) Students and professional employers	Self-reported questionnaire *[adapted from:* Gannon et al. (2014) and Haque et al. (2012). Four groups of countries: 1) Check Republic, Spain and Australia; 2) Russia e Finland; 3) Japan and 4) 10 countries, including Colombia, China e Romania.	Hierarchical Multiple Regression

Note: Habit = Past Behavior.

Table A1: Continued...

Author(s)/Year/ Country	Dependent Variables Targeted by the Research Objective	Type of behavior	Independent Variables investigated	Sample	Method of data collection	Method of data analyses
		Deb et al. (2017)				
5 - Pedestrian behavior when crossing roads in front of autonomous vehicles (AV)						
Hafeez et al. (2022) (27 countries)	Intention and behavior	Safe	TCP constructs	N=949 (18 years old a 60years old +)	Self-reported questionnaire	Structural Equation Modeling
Kaye et al. (2022) (Australia)	Intention	Safe	Perceived utility Ease of use Performance expectation Effort expectation Age Gender Educational degree Risk Exposure Personal Innovation	N = 485 (18 to 85 years old) Australia residents	Self-reported questionnaire	Hierarchical Multiple Regression
Zhao et al. (2022) (Australia)	Intention	Violation	Risk perception Trust in vehicle Predictability Trust in the vehicle	N = 493 (18 to 77 years old)	Self-reported questionnaire 4 Scenarios – 2 considering automated vehicles and 2 considering actual driver.	Hierarchical Multiple Regression

Note: Habit = Past Behavior.