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School of Transportation Sciences

Master of Transportation Sciences

Master's thesis

Socio-demographic and psychological factors influencing young adolescent pedestrians' road-crossing violations in Harare, Zimbabwe: An application of the extended theory of planned behaviour

Admire Betera

Thesis presented in fulfillment of the requirements for the degree of Master of Transportation Sciences, specialization Traffic Safety

SUPERVISOR :
Prof. dr. Davy JANSSENS

CO-SUPERVISOR :
dr. Veerle ROSS

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PREFACE

The thesis is a prerequisite for completing the VLIR-UOS International Master Programme, the Master of Transportation Sciences (including ICP) programme at Hasselt University. This study is an effort to contribute to the development of road safety in Zimbabwe by understanding one most under-researched vulnerable road user, the adolescent pedestrian. In addition, as a parent concerned about the safety of my children and as someone who lost a childhood friend in a traffic crash during adolescence, I desire to contribute to the creation of a child-friendly road environment.

First and foremost, I want to express my gratitude to the Creator for the gift of life and all the graces it brings.

Second, I enormously acknowledge VLIR-UOS for providing me with the funding opportunity to pursue a master's degree.

Third, a special thanks to Dr Davy Janssens, the UHasselt promotor, and Dr Veerle Ross, the UHasselt supervisor, for their support during the research, which took place during the global COVID-19 pandemic.

Fourth, I would like to express my gratitude to Professor TPZ Mpofu and Mr Offat Manyanhaire for their assistance in the development of the online questionnaire.

Fifth, sincere thanks go to the Warren Park D school heads, teachers, parents, and the young adolescents for their voluntary support during the study.

Sixth, a special thanks to my family, the House of Moses, who dedicated their time with me for my professional and academic endeavours despite the loss of a family member during the study.

Lastly, I express my great appreciation to my workmates, fellow students, and friends for supporting the master studies.

Disclaimer: This master's thesis was written in the year 2021, amid the COVID-19 crisis. The research results that constitute the foundation of this thesis have been influenced by the global health crisis because the Zimbabwe National Traffic Statistics Department and the study participants were under lockdown and gathering data was challenging, which also slowed the data analysis process.

SUMMARY

The study sought to examine the underlying sociodemographic and psychological factors influencing young adolescent pedestrians' road-crossing violations in Harare, Zimbabwe. The study's findings were intended to aid decision-making in relation to local child injury reduction strategies.

344 young adolescents were randomly selected from three primary schools in Warren Park, a high-density residential area in Harare, Zimbabwe, for a cross-sectional study. The participants were 10-14 years old (Mean=12.23 years, SD=1.26; 181 males (52.6%), 163 females (47.3%)).

The study employed an extended theory of planned behaviour (TPB) based self-reporting questionnaire Confirmatory Composite Analysis (CCA) was used to confirm the measurement model. Structural Equation Modelling (SEM) was used to analyse the structural relationship between variables. An independent t-test was used to measure associations between statistical means. ANOVAs were used to measure variation among and between groups. Pearson's correlation (r) coefficient measured the strength of relationships between variables.

Young adolescent pedestrians reported engaging in road-crossing violations. However, there were no significant mean differences ($t_{335.353}$=-4.639, p=.365) in road-crossing violations between 10-12-aged (mean=1.78, SD=.74) and 13-14-aged (mean=2.16, SD=.74) young adolescent pedestrians.

There were no mean differences in road-crossing violations between genders ($t_{331.322}$=2.388, p=.921) (males: mean=2.05, SD=.73; females: mean=1.85, SD.79).

There were statistically significant mean differences in road-crossing violations between the three household income groups (low, medium, and high) as determined by one-way ANOVA (F(2,341)=6.022, p=.003). Tukey's post hoc test revealed significant mean differences in road-crossing violations between young adolescent pedestrians from low-family-income (mean=1.99, SD=.75, p=.015) and those from medium-family-income background (mean=1.45, SD=.83). Therefore, young adolescent pedestrians from low-family income group were more likely to engage in road-crossing violations than their counterparts from the medium family income group.

One-way ANOVAs revealed statistically significant mean differences in road-crossing violations amongst young adolescents from the three residential area groups (F(2,341)=4.435, p=.013). There were statistically significant mean differences between young adolescent pedestrians residing in high-density residential areas (mean=2.00, SD=.72) when compared to low-density residential areas (mean=1.41, SD=.75, p=.010), and medium density areas (mean=1.93, SD=.83, p=.040), respectively. Therefore, young adolescent pedestrians residing in both high-density and medium-density residential areas were more likely to engage in road-crossing violations than those from low-density residential areas.

Attitudes (β=0.069, p=.004), subjective norms (β=0.072, p<.001), habits (β=-0.036, p=.025), and behavioural willingness (β=0.046, p=.008) were significantly and indirectly related to road-crossing violations through the mediation of behavioural intentions. Attitude (β=0.284, p<.001), subjective norms (β=0.294, p<.001), habits (β=-0.147, p=0.010), and behavioural

willingness (β=0.190, p<.001) explained 64% of the variance in behavioural intentions. On the other hand, behavioural intentions (β=0.244, p<.001), and habits (β=-0.608, p<.001) were significantly and directly related to road-crossing violations, and they explained 60% of the variance in road-crossing violations.

The addition of variables habits and behavioural willingness to the standard TPB (though behavioural willingness' direct effect was not statistically significant) improved the variances explained by the model from 62% to 64% for behavioural intention and 48% to 60% for road-crossing violations.

Administrators of health promotion programs will only plan and enforce strategies that positively impact teenage pedestrians' healthy crossing behaviour if these factors are correctly identified (Sucha, 2018). Therefore, health promotion programmes should address the predictors (subjective norms, attitude, habit, and behavioural willingness) of road-crossing violations in young adolescents in Harare. The study recommends further longitudinal studies involving adolescent pedestrians and the road environment and driver behaviour.

Keywords: pedestrian violation, young adolescent, extended theory of planned behaviour, Harare (Zimbabwe).

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LIST OF ABBREVIATIONS

CCA	Confirmatory Composite Analysis
CFA	Confirmatory Factor Analysis
IBM	International Business Machines
iRAP	International Road Assessment Programme
LMICs	Low- and Medium-Income Countries
NHTSA	National Highway Traffic Safety Administration
OECD	Organisation for Economic Cooperation and Development
PLS	Partial Least Squares
SEM	Structural Equation Model
SPSS	Statistical Package for Social Scientists
TPB	Theory of Planned Behaviour
UNICEF	United Nations Children's Educational Fund
WHO	World Health Organisation

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GLOSSARY OF KEY TERMS

Adolescents: children aged 10–19 years (UNICEF, 2012). Adolescence is the life phase between childhood and adulthood (WHO, 2021a). The age range falls within the young people group, which comprises 10-24-aged individuals (Csikszentmihalyi, 2021, February 20).

Child pedestrian: defined in this study as any child aged 0-14 years who travels partly or wholly by walking to and from school (DaCoTA, 2012; NHTSA, 2017; Setorwofia et al., 2020). This age group serves a dual role as the older children sub-group and as the young adolescents sub-group.

Child traffic injury: the physical damage that results when a child's body is suddenly subjected to a moving vehicle's energy in amounts that exceed the threshold of physiological tolerance (WHO, 2008).

Confirmatory composite analysis (CCA): is a partial least squares structural equation modelling method that confirms composite models' measurement quality (Schuberth, 2020).

Latent variable: a variable that cannot be observed directly and must be inferred from measured variables (Murti, 2016) and factors (i.e., factor analysis), constructs or unobserved variables.

Measured variable: is a measurable variable that can be observed directly. (Murti, 2016). Also known as observed variables, items, indicators, or manifest variables.

Model: Statement about relationships between variables (Murti, 2016).

Pedestrian violations: occur when a pedestrian crosses a roadway where traffic regulations do not permit doing so. Exemplary behaviours include: Not using a nearby pedestrian crosswalk to cross the road and crossing the street even though the pedestrian light is red (Demir, Ozkan & Demir, 2019; Reason et al., 1990; Deb et al., 2017).

Reliability: The degree to which several operationalizations of the same concept create consistent outcomes (Knoke, 2005).

Road traffic crash: a collision or incident which will or might not cause injury, taking place on a public road and involving a minimum of one moving vehicle (WHO, 2008).

Structural equation model (SEM): A multivariate equation model combining relations among unobserved constructs with links to empirical indicators (Knoke, 2005).

Validity: The degree to which the operationalizations of a variable accurately reflect the concept that they purport to measure (Knoke, 2005).

Young adolescents: children aged 10-14 years (WHO, 2021).

CHAPTER 1

INTRODUCTION

1.1 Global Status of Child Pedestrian Injury

Road traffic injury is a growing global public health problem and a leading cause of death and long-term injury for young children and young adults aged 5-29 (WHO, 2018; NHTSA, 2012; Deb et al., 2017; Hashemi Juzdani et al., 2020). About 500 children die every day and 100 000 every year globally in pedestrian crashes, with more than 90% of them living in low-and middle-income countries (LMICs) (Schwebel, 2017; WHO, 2008). Pedestrian injuries among children are most common in Africa and Asia, where it is common for people to walk along roads (Hyder et al., 2006; Linnan et al., 2007). In high-income countries, child pedestrian injuries due to road traffic crashes constitute between 5-10%, while in low-and middle-income countries, they lie between 30-40% (Toroyan & Peden, 2007). Global Burden of Disease studies show a 42% decrease in child pedestrian fatalities as a proportion of all-cause fatalities in high-income countries. In comparison, there is a 15.5% increase in low-income countries (Cloutier et al., 2020). The International Road Assessment Programme (iRAP) attributes the rise in child pedestrian fatalities in low-income countries to increased motorisation levels and a higher proportion of unsafe road infrastructure (WHO, 2018).

Child pedestrian injuries occur primarily in residential areas or close to the child's home, with 90% of the injured being alone at the time of injury (Stevenson, Sleet & Ferguson, 2015; Stevenson, Jamrozik & Burton, 1996). In most cases, child pedestrians are involved in crashes due to their behaviour, the road environment and driver behaviour (Rothman et al., 2014).

1.2 Child Pedestrian Injury in Africa

Child pedestrian injury is highest in Asia and Africa, where it is common for people to walk along roads (Peden et al., 2008; Hyder, Labinjo & Muzaffar, 2006). Road traffic death rates of children below 18 years in Africa's low- and medium-income countries account for 15.6 per 100 000 population (WHO, 2015). In Sub-Saharan Africa, about 10% of deaths among young men aged 15-29 result from road traffic crashes (Ncube, Lufumpa, Kayizzi-Mugerwa & Murinde, 2013). Pedestrians account for about 68% of road traffic injuries among children and adolescents in urban Africa (Huang, Stewart & Zegeer, 2002). In South Africa, about 22% of all pedestrian deaths involve under 15-year-olds (Van der Merwe & Dawes, 2007; Road Traffic Management Corporation (RTMC), 2011).

In Zimbabwe, about 24% of all pedestrian deaths for 2017 involved 0-15-year-olds (Zimbabwe Republic Police, 2017). However, at the same time, in many

such countries, crashes involving pedestrians are poorly reported in official traffic injury statistics, and the actual numbers are higher than what official reports reflect (WHO, 2013; Ncube, Lufumpa, Kayizzi-Mugerwa & Murinde, 2013). Even where there are considerable inconsistencies in official statistics, there are no analyses to ascertain whether the errors are because of incompetence or wilful manipulation for political reasons (Billingsley et al., 2017). Without valid data on the main risk factors, the number and characteristics of people injured or killed on the roads, the circumstances surrounding road accidents, and the degree to which measures are being deployed, injury reduction targets cannot be set (WHO, 2013a).

While parents help as satisfactory models in promoting safe pedestrian behaviours (Zeedyk & Kelly, 2003), empirical evidence points out that they do not naturally use the parent-accompanied crossing opportunity to train children in safe pedestrian decisions (Barton, Schwebel & Morrongiello, 2006). Parents tend to take care of all the crossing steps without discussing their children's behaviours (Zeedyk & Kelly, 2003). Although traffic professionals set the independent crossing age at ten years old, findings have shown that parents believed children as young as 7.6 years old were old enough to cross the street alone (MacGregor, Smiley, & Dunk, 1999; Percer, 2009). It is also vital to observe that children will often find themselves crossing a street unaccompanied by an adult at least once before turning ten years old (Thomson & Whelan, 2000; Percer, 2009). In most low-and-medium-income countries, including Zimbabwe, many school-going populations walk to and from school because of lower motorisation (Gupta et al., 2015; Mohan, 2002). In low-income residential areas, children often walk unaccompanied because of resources constraints, and competing domestic or occupational demands (Chakravarthy et al., 2007; Waylen & McKenna, 2002), thus increasing the risk of pedestrian injury due to risky road-crossing behaviour (Desapriya et al., 2011).

1.3 Risk Factors for Child Pedestrian Injury

1.3.1 Road-crossing Behaviour

Since the road environment is designed with adults in mind, children are put in more danger than is necessary when they come into contact with it (Peden et al., 2008). Children are most frequently injured when crossing the street (DaCoTA, 2012; Schieber & Thompson, 1996; Elias & Shiftan, 2014). Child pedestrians are the most vulnerable users of road infrastructure due to their lack of a protective shell, including the particular characteristics and behaviours affecting the nature of their interaction with vehicular traffic, especially at crossing points (OECD, 2001 & 2011; ERSO, 2008; Yannis, Golias & Papadimitriou, 2007; Papadimitriou et al., 2012; Bertulis & Dulaski, 2014). Most behavioural studies have examined crossing the street due to its association with most child pedestrian injuries (Snyder & Knoblauch, 1971; Schieber & Thomson, 1996). About more than half of observed child pedestrians were involved in unsafe crossing behaviours (Thomson & Whelan, 2000).

Most road traffic crashes involving children are "dart and dash" cases where the children fail to stop or slow down before setting about to cross the road (Peden et al., 2008; Mayr et al., 2003). Adolescents spend less time waiting on the curb before crossing than young children (Te Velde et al., 2005). They often run across the road instead of walking (Zeedyk, Wallace & Spry, 2002) and do not look out for oncoming traffic (Zeedyk, Wallace & Spry, 2002; Khan et al., 1999), forcing traffic to change its trajectory (Khan et al., 1999). Furthermore, about one-third of adolescents injured crossing the street frequently disobeyed pedestrian traffic rules (Joly, Foggin & Pless, 1991).

Children are at risk during mid-block dart-outs, dashes across intersections, and while alighting from buses (Schieber & Vegega, 2002; Winn, Agran & Castillo, 1991). A South African study by Koekemoer et al. (2017) discovered that children who spent more time walking engaged in riskier negligent behaviour and safer visual searching (sight) behaviour. Accustomedness to the road environment resulted in walking rather than running in tight fits when crossing the road. Where there are safe passages for pedestrian crossings, most pedestrians tend to use traffic gaps for crossing (Hamed, 2001). Generally, pedestrians are more likely to cross at any convenient location that shortens the walking distance to their destination (Sisiopiku & Akin, 2003).

1.3.2 Developmental Factors

As children grow up, their mobility and independence increase, and so do their risk of pedestrian injury (NHTSA, 2009; Peden et al., 2008); however, many popular parenting publications pay little attention to child pedestrian safety (Finello, 2005; Hochbaum, 2000; Koontz, 2001). On the other hand, traffic deaths are the leading cause of death for children aged 4 to 15 in the United States of America. (NHTSA, 2008).

Crossing a street safely is a multifaceted cognitive-perceptual process involving many steps (Schwebel et al., 2014). Child pedestrians must assess traffic conditions (direction and speed of approaching traffic) and make the appropriate crossing decision while respecting the uniqueness of each road-crossing location. However, the children's inability to properly assess and navigate both routine and dynamic crossing conditions demonstrate their restricted cognitive-perceptual abilities and experience (Dunbar et al., 2001; Schieber & Vegega, 2002).

Owing to their physical, cognitive, and social development limitations, children are more exposed to risk in road traffic than adults (WHO, 2015). Physically, children are more susceptible to severe head injury than adults and may have difficulty interpreting images and sounds that may impact proximity judgment (Araki, Yokota & Morita, 2017). Besides, it is often difficult for the children to see surrounding traffic and drivers to see them (WHO, 2015). Also, the children have difficulties determining the speed and direction of approaching vehicles, and the risk increases with age as adolescents may be more prone to take risks (WHO, 2008; Meir, Oron-Gilad & Parmet, 2015). It is the inability to

deploy skills rather than a lack of perceptual or cognitive skills that contribute to increased susceptibility to traffic injury in adolescents aged 11-15 (Evans, 2003). Child pedestrians' extreme vulnerability as road users due to limited biomechanical tolerance to violent forces when impacted by a vehicle, and psychological limitations, is also compounded by drivers' failure to yield the right of way at crosswalks (Bertulis & Dulaski, 2014; Oxley et al., 2007; McMahon et al., 2008; Peden et al., 2008).

Adolescence is a stage of transition characterised by more in-depth environmental inquiry than by a desire for safety (Gicquel et al., 2017). Risk-taking is typical during adolescence, a distinct stage of a person's development (Courtois, 2011, as referenced by Gicquel et al., 2017). It is, in fact, a period in which neurological data shows that the frontal and temporal lobes have matured significantly. Adolescent behaviours (risky behaviours, sensation seeking, and impulsivity) are more common during adolescence and then declining after 25 years of age (Dayan & Guillery-Girard, 2011; Strang et al., 2013).

A developmental neuroscience-based viewpoint on adolescent risk-taking has grown in popularity in recent years (Strang et al., 2013; Grayot, 2020). This viewpoint, known as the "dual systems model" (DS) (Somerville et al., 2010; Steinberg, 2010) or "maturational imbalance theory" (Casey et al., 2011), contends that enhanced risk-taking is produced during adolescence by a "combination of increased reward sensitivity and immature impulse control" (Strang et al., 2013), both of which are linked to the development of two separate brain systems that evolve at distinct moments. This imbalance is caused by a maturational lag between two brain systems, namely, the social-affective brain, and the cognitive control system (Ross et al., 2016; Gicquel et al., 2017). The social-affective brain, also known as the "socioemotional" incentive processing system (Steinberg, 2010; Chein et al., 2011) or "ventral affective system" (Pfeifer & Allen, 2012), is housed in the ventromedial prefrontal cortex and ventral striatum (Strang et al., 2013). The "cognitive control" system (Steinberg, 2010; Chein et al., 2011) or "prefrontal control system" (Pfeifer and Allen, 2012) is primarily located in the lateral prefrontal, parietal, and anterior cingulate cortices (Wager & Smith, 2003; Owen et al., 2005). In a nutshell, the dual systems (DS) approach holds that risk-taking in mid-adolescence is a result of the socioemotional system's heightened reactivity against a backdrop of still evolving cognitive control (Strang et al., 2013). According to Barbalat et al. (2010), teenagers prefer riskier options because they have lower risk aversion than adults and place a lower value on the long-term implications of their decisions.

In a study involving young drivers, Mantyla et al. (2009) tested students to see if the development of the executive control system in the prefrontal lobe was linked to driving abilities. The study used a driving simulation test and six other experimental activities to assess young people's driving abilities. Individual differences in brain maturation had an impact on driving performance during the simulation exercise, according to the findings. The findings concurred with a study by Higelé and Hernja (2008) who concluded that emotional and psychological aspects of young drivers' behaviour, particularly in relation to risks, are today

recognized as the primary causes of the drivers' high involvement in traffic accidents.

1.3.3 Gender Factors

Although all children are vulnerable, boy teenagers are two times more often the victim of pedestrian injuries than girls (Schwebel, Davis & O'Neal, 2012; Durkin et al., 1998; DaCoTA, 2012; ETSC, 2005; Sentinella & Keigan, 2005; Dukehart et al., 2007). Risk-taking behaviour and peer pressure also increase the risk among male adolescents who are pedestrians; they believe that other children are more prone to injury than them (WHO, 2008; Schwebel & Barton, 2005; Gardner & Steinberg, 2005; Schwebel, Davis & O'Neal, 2012; WHO, 2015).

1.3.4 Socio-economic Factors

Common causal factors to child pedestrian injuries in traffic incidents are lower family socio-economic backgrounds, low paternal education, traffic exposure during the journey to school, lack of supervision during outdoor play and duration of outdoor recreation, and living in high-density residential areas (Lee et al., 2018; Roberts et al., 1995; Pernica et al., 2012; DiMaggio & Durkin, 2002; Braddock et al., 1991; Laflamme & Diderichsen, 2000). Hypothetically, low-income families' transport mode choice is related to their socio-economic status (SES) (Laflamme, 1998; Hippisley-Cox et al., 2002; Nantulya & Reich, 2002; Setorwofia et al., 2020).

1.4 Problem Statement

Child pedestrian accidents are a growing public health problem in Zimbabwe's urban areas (Sibanda, 2017). When crossing urban arterials or highways passing through suburban neighbourhoods to and from school, most schoolchildren participate in pedestrian violations (Kadani, 2016; Zimbabwe Republic Police, 2015). In addition, in certain situations, child pedestrians must cross a high-speed vehicular traffic environment intended for adults on their way to school (Poswayo, 2019; Peden et al., 2004; Nantulya & Reich, 2002). Unfortunately, most low- and middle-income countries (LMICs) have very little empirical evidence to explain the factors contributing to these fatal interactions (Yu et al., 2020; Gautam et al., 2021). Like most Sub-Saharan African countries, Zimbabwe struggles with a lack of accurate, fundamental data, such as the ages and gender of people killed on the roads (WHO, 2013a). Consequently, in Harare, pedestrian safety measures are implemented without the benefit of empirical evidence, resulting in a negligible effect on road safety.

Child pedestrian injuries or deaths when crossing the street during school trips are a health issue that should be prevented (Schwebel et al., 2014; Setorwofia et al., 2020). To aid in reducing child pedestrian accidents, a clearer understanding of their street-crossing behaviour is needed (Evans & Norman, 2003; Toroyan & Peden, 2007; Sullman et al., 2012). In one of Harare's high-

density residential areas, the study will investigate the underlying sociodemographic and psychological factors that affect 10-14-year-old child pedestrians' road-crossing violations.

1.5 Research Objective

The study examines the underlying sociodemographic and psychological determinants of young adolescent pedestrians' road-crossing violations in Harare, Zimbabwe.

1.5.1 Specific Objectives

a) To investigate the relationship between sociodemographic characteristics (age, gender, and socio-economic status) and young adolescent pedestrians' road-crossing violations in Harare, Zimbabwe.
b) To investigate the relationship between psychological determinants and young adolescent pedestrians' road-crossing violations in Harare, Zimbabwe.

1.6 Research Question

What are the underlying sociodemographic and psychological determinants of young adolescent pedestrians' road-crossing violations in Harare, Zimbabwe?

1.6.1 Sub-questions

a) What is the relationship between sociodemographic characteristics (age, gender, and socio-economic status) and young adolescent pedestrians' road-crossing violations in Harare, Zimbabwe?
b) What is the relationship between psychological determinants and young adolescent pedestrians' road-crossing violations in Harare, Zimbabwe?

1.7 Significance the study

Several reasons underpin the importance of this research. First, by applying the TPB, the study will help to understand the local setting regarding child pedestrians' road-crossing violations in Harare, Zimbabwe.

Second, adolescents are more daring, dangerous, and thrill-seeking than their younger and older counterparts (Tymula, et al., 2012). To enhance and sustain their well-being, young adolescents need age-appropriate knowledge and opportunities to design and implement interventions meaningfully (WHO, 2021b). Understanding the ecological and environmental background in which the children cross the street and their behaviours during their crossings is needed to develop these child pedestrian safety strategies (Schwebel et al., 2018). It is critical to take advantage of such opportunities to react to adolescents' unique needs and rights.

Third, the current study employed the Theory of Planned Behaviour to understand better the role of antecedents leading to young adolescent pedestrian intention to engage in road crossing violations. Empirical evidence points out that the use of psychological determinants in planning health promotion programs to increase healthy behaviour may offer significant injury risk reduction benefits (Mirzaei-Alvijeh et al., 2017; Jalilian et al., 2016; Mirzaei-Alavijeh, Ahmadi-Jouybari, Vaezi & Jalilian, 2018; Mirzaei-Alvijeh, Ghorbani & Jalilian, 2018; Baghiani-Moghadam, Mirzaei-Alavijeh & Zolghadr, 2012; Hosseini, Alavijeh, Matin, et al., 2016). Therefore, it is expedient to fully understand child pedestrian attitudes, perceptions, and behaviours at road-crossings to assist policy-makers in their efforts to improve pedestrian safety (Yannis et al., 2007).

Fourth, several road safety education programmes and applications to improve child pedestrians' knowledge and ability to cross streets safely have been carried out worldwide (Cross et al., 2000; Stevenson, Sleet & Ferguson, 2015). Unfortunately, much of the published work on child pedestrian behaviour was carried out in high-income countries where the children's traffic environment is different from that of low-income countries (Schieber & Vegega, 2002; Schwebel et al., 2018; Cloutier et al., 2020). Besides, children from low-income countries' high-density residential areas and low socio-economic backgrounds are the most affected by road traffic injuries (Elias & Shiftan, 2012; Laflamme & Diderichsen, 2000). So, identifying variations in behaviour within a locality informs effective interventions for specific target groups (Noerdfjaen, Jorgensen & Rundmo, 2009).

Fifth, where there is extensive awareness of demographic risk factors for child pedestrian injury (Christoffel, Peterson, & DiLilo, 2002; Doswell & Towner, 2002), many of the variables are not addressed in current approaches, thus failing to minimise child pedestrian injury (Cloutier et al., 2020). The limitations mentioned above, coupled with the drivers' inability to concede the right of way, where required by law, and the traffic environment have resulted in most child pedestrians being killed or injured while crossing the road (Zimbabwe Republic Police, 2015).

Sixth, recent studies have adopted the unusual and positive behaviour approach of driver behaviours to pedestrian behaviours (Demir, 2017). Errors and violations have distinctive properties (Reason et al., 1990): violations are intentional behaviours, while errors broadly encompass slips, lapses, and mistakes (Reason, 1990). Granie, Pannetier and Gueho (2013) distinguished between violations, errors, and positive behaviours in pedestrian behaviours. The researchers posited that pedestrian violations behaviour examples include crossing the street in places other than the pedestrian crossing and crossing the road while the pedestrian light is red. Pedestrian lapse includes forgetting to look before crossing while thinking about something else. Positive pedestrian behaviour includes stopping to let another pedestrian walk first on a narrow pavement. Other recent studies argue that violation of traffic rules or risk-taking behaviour are the prime factors contributing to pedestrian crashes (Diaz, 2002; King et al., 2009; Cinnamon et al., 2011). Therefore, most researchers prioritise pedestrian violations over pedestrian lapses and positive pedestrian behaviours.

Nevertheless, pedestrian violations have not been intensively studied, unlike driver violations (Rosenbloom, Nemrodov, & Barkan, 2004).

Seventh, young adolescents (10-14 aged) experience rapid physical, cognitive and psychosocial growth (WHO, 2021a). Physically, this age group achieves puberty while psychologically, they experience a rapid increase in mental and emotional development, including their health-related behaviours. Socially, the individuals in this age group begin their steps away from parental to their peers' and other adults' influence. "The period is marked by more in-depth environmental exploration than safety-seeking" (Gicquel et al., 2017:3). Several studies have described teenagers as the pedestrians most likely to engage in high-risk activities such as thrill-seeking, dangerous road-crossing activity, crossing at high-risk locations, and failing to use approved road-crossing sites despite having a thorough understanding of road safety laws (Greene et al., 2000; Musselwhite et al., 2010; Sullman & Mann, 2009). Granie et al. (2013) argue that young pedestrians have a higher tendency of violations. Therefore, understanding these pedestrian behaviours' sociodemographic and psychological determinants is pivotal towards a safe traffic environment (Demir, 2017). The study seeks to understand the underlying sociodemographic and psychological risk factors influencing 10-14 aged child pedestrians' road-crossing behaviours in a low-income country locality (Rothengatter, 2008; Brubacher et al., 2016).

1.8 Presuppositions of study

The researcher conducted the study hinging on the following assumptions:

The children in Warren Park D residential area represent same-age children from all other high population density residential areas of the Harare Metropolitan area of Zimbabwe. The study assumed that participants would provide honest responses to the survey due to the voluntary nature of participation. Theory of Planned Behaviour (TPB) also assumes that participants can make sound decisions (Kautonen et al., 2015, as cited in Burns, 2017).

1.9 Boundaries of study

This section specifies the study's boundaries for generalization and transferability of results. The study looks into the sociodemographic and psychological factors that affect 10-14-year-old young adolescent pedestrians' road-crossing violations in Harare's Warren Park D neighbourhood. Because the researcher knew one of the local primary school principals, the researcher chose the neighbourhood mostly for its convenience. However, this neighbourhood in Harare, Zimbabwe, is typical of densely populated residential districts where most pupils walk to and from school. On their route to school, some children from the neighbouring suburbs of Westlea, and Nkwisi Gardens cross the Harare-Bulawayo interurban and those from Kuwadzana and Crowborough suburbs cross the High-Glen ring road. Unfortunately, the Zimbabwe Republic Police (ZRP) Statistics Department could not supply any crash statistics due to the COVID-19 pandemic

lockdown. The children’s road-crossing violations data was collected using a self-report TPB-based questionnaire in a cross-sectional study design.

CHAPTER 2

LITERATURE STUDY

2.1 Theoretical Framework

A theoretical framework is a guide or "blueprint" (Grant & Osanloo, 2014) upon which research is built (Adom et al., 2018). It is likened to a travel map or plans to guide the research path (Sinclair, 2007); Fulton & Krainovich-Miller, 2010). The theoretical framework comprises theoretical principles, concepts, constructs, and tenets of a theory (Brondizio et al., 2014). Besides, it guides the research methodology (Grant & Osanloo, 2014) and helps the researcher situate and contextualise formal theories into the study (Ravitch & Carl, 2016). The theory of planned behaviour guides this current study with a primary aim to provide an improved understanding of the "psychosocial determinants of health behaviour" (Leles & Vieira, 2014).

2.1.1 Theory of Planned Behaviour

Ajzen (1991; 2011) designed the *theory of planned behaviour* (TPB) to predict and explain human behaviour in specific contexts while extending on an earlier *theory of reasoned action* (TRA) (Fishbein & Ajzen, 1975). TPB is the most commonly applied model of social cognitive determinants, positing that behaviour is directly determined by an intention to act (Peng, Zhi-cai & Lin-jie, 2014; Chatzisarantis & Hagger, 2007). According to the theory of planned behaviour, the primary predictor of actual behaviour in certain situations is the intention, which is determined by the attitude towards the behaviour, subjective norms, and perceived behavioural control (Zhou, Horrey & Yu, 2009; Ajzen, 2011; Armitage & Conner, 2001; Carlson-Gielen & Sleet, 2003).

Intention

Individual commitment to act is characterised by behavioural intention, resulting from a combination of three antecedents (Kagee & Freeman, 2017). The three antecedents of intentions: attitude, subjective norm, and perceived behavioural control (PBC) (Demir, 2017; Poulter et al., 2008). Behavioural intention is considered the immediate antecedent of behaviour (Knabe, 2012; Steinmetz et al., 2011).

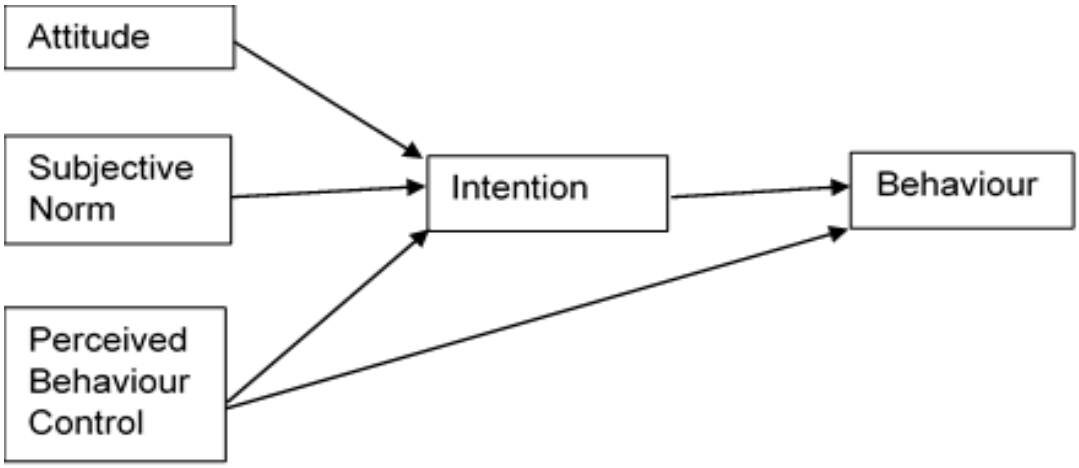

FIGURE 1 Theory of planned behaviour (Ajzen, 1991)

Attitudes

Attitudes are a person's positive or negative evaluation of performing focal behaviour (Mirzaei-Alvijeh et al., 2019a). Attitude is a function of a person's noticeable behavioural beliefs, representing perceived outcomes or attributes of the behaviour (e.g., taking exercise will reduce heart disease risk) (Conner, 2001).

Subjective Norms

Subjective norms are beliefs on whether or not a person should engage in a particular behaviour (e.g., "my family think I should take exercise") (Conner, 2001; Ajzen, 2006). Subjective norms are expected to measure individuals' social pressures to perform or not to perform a specific behaviour (Steinmetz, 2011). Thus, the subjective norm is a function of normative beliefs representing perceptions of specific significant social relations' preferences about whether one should engage in the behaviour (Ajzen, 2006).

Perceived Behavioural Control

Perceived behavioural control (PBC) is the individual's perception of the extent to which the actor's performance is easy or difficult (Ajzen, 1991; Steinmetz et al., 2011). PBC comprises a combination of perceived control and self-efficacy the individual requires to perform the targeted behaviour (Ajzen, 2015; Conner & Sparks, 2005). Control is the degree of perceived controllability of the behaviour, while self-efficacy is an individual's self-rated ability to perform target behaviour (ROSPA, 2017; Demir, 2017).

The connection between intentions and behaviour reflects that people tend to engage in behaviours they intend to perform (Conner & Armitage, 1998). Simultaneously, as intentions have determinants, the attitude, subjective norm, and PBC components also have their determinants (also known as indirect determinants of intentions).

PBC judgments are influenced by beliefs concerning whether one has access to the necessary resources and opportunities to perform the behaviour successfully, weighted by each factor's perceived power to facilitate or inhibit behaviour (Ajzen, 1991). In the TPB, actual behavioural control is assumed to moderate the effect of intention on behaviour, while perceived behavioural control (PBC) is supposed to moderate the effect of attitude and subjective norm on intention (Aijzen, 2020).

The TPB suggests that besides predicting intention, PBC can also predict the behaviour by accurately reflecting the actual control over the behavioural performance. This affiliation indicates that humans are more likely to engage in (attractive/desirable) behaviours they have control over and suggests that they are prevented from carrying out behaviours over which they have no control (Eagly & Chaiken, 1993; Conner & Armitage, 1998). Contrariwise, empirical evidence proposed that if intentions are held constant, the behaviour will be more likely to be performed as PBC increases. It is assumed that as a person's perceived behavioural control over a behaviour improves, so will their intention to conduct the behaviour (Steinmetz et al., 2011). Individuals tend to engage in health behaviour, according to the TPB, if they believe the behaviour can lead to specific results that they value (attitude) if they believe people whose opinions they respect, believe they should engage in the behaviour (subjective norms), and if they believe they have the resources and opportunities to do so (PBC) (Conner, 2001).

2.1.2 Rationale for TPB

Mainly, TPB is widely applied because it shows consistent explanatory power almost irrespective of domain. It offers a simple model of proximal influences on expectations and behaviour (Leandro, 2012). In their meta-analysis, Armitage & Conner (2001) found that TPB accounted for 27% of the variance in behaviour and 39% variance in intentions. On the other hand, McEachan et al. (2011) contend that PBC and intentions can explain 19% of the variance in various behaviours, while attitudes, subjective norm and PBC accounted for 44% of the variance in intentions. TPB also guides interventions: increasing the use of safety helmets and seatbelts and increasing compliance with speed limits (Brijs, Daniels, Brijs & Werts, 2011; Elliot & Armitage, 2009).

Several studies have supported using the theory of planned behaviour (TPB) to evaluate road-crossing behaviour (Jalilian et al., 2015). Previous studies on the application of the Theory of Planned Behaviour (TPB) to road-crossing behaviour include the prediction of road-crossing intentions among adolescents (11-14-year-olds) (Evans & Norman, 2003), corresponding to when the majority of adolescent pedestrian injuries occur, that is, travelling home from school (Tight, 1996; Tay, 2009), and intentionally crossing the road (Southwell et al., 1990) away from a road-crossing facility (Avery & Jackson, 1983). Other pedestrian behaviours where TPB was attempted and proved to explain behaviours and intentions effectively

include distracted walking (Barton, Kologi & Siron, 2016), red-light violations (Zhou, Romero & Qin, 2016), and walking while intoxicated (Gannon et al., 2014).

Because of its impacts on risk perception and behaviour in high-risk situations, attitude, as another predictor of human behaviour, is indirectly engaged in road accidents. (Lund & Rundmo, 2009). However, the application of TPB to pedestrian behaviours is seemingly incomplete (Demir, 2017). Also, inconsistent findings across studies could indicate that the theory fully condenses skill-based routine level performance.

2.1.3 Criticism of TPB

Some scholars criticise TPB for depending entirely on rational reasoning while denying any value to unconscious or heuristic processes (Sheeran, Gollwitzer & Bargh, 2013). Other researchers argue that TPB's predictive validity diminishes spontaneous risk-taking behaviours (Gibbons et al., 1998; Conner & Norman, 2005; Gibbons, Houlihan & Gerrard, 2009). For example, a pedestrian might have a negative view about pedestrian violations (negative attitudes) but may be willing to perform it when they have an opportunity (e.g., when there is a gap in the traffic) (Demir, 2017; Demir, Ozkan & Demir. 2018).

The criticisms led to the development of extended models. As was the case with the theory of reasoned action, extended to generate the TPB by adding real and perceived behavioural control, Ajzen (1991; 2020) hypothesised that the TPB could be augmented to include other predictor variables not already included in the theory. Numerous researchers came up with proposed additional predictors to improve the explanatory power of the original TPB (Ajzen, 1991; Fishbein & Ajzen, 2011; Gibbons & Gerrard, 1995; Conner & Armitage, 1998; Parker, Manstead, & Stradling, 1995; Rivis, Sheeran & Armitage, 2006). One such model is the prototype willingness model that explains young people's unexpected health-risk behaviours (Gibbons & Gerrard, 1995; Conner & Sparks, 2005).

2.1.4 Extended Theory of Planned Behaviour

The present study proposed an extended model of TPB by considering habit and behavioural willingness. It is not yet clear whether pedestrians' risk-taking behaviour is planned (as defined by TPB) or an automated response (habit) (Soathong et al., 2021).

Habit

A habit is a pattern of behaviour replicated so often that it no longer requires conscious thought (Encyclopedia.com, 2019). Habits are characterised by consistent, non-judgmental, or unconscious actions (Klockner & Blobaum, 2010). In psychology (Neal et al., 2012) and information systems (Polites & Karahanna, 2013), user habits have been studied extensively. Behavioural habits predict potential behavioural intentions and actual behaviour (Huma et al., 2017; Fu & Juan, 2017). Habits are pivotal in determining routine choice behaviour, while behavioural intentions influence behavioural choice in novel situations (Chen & Chao, 2011). Behavioural habits and intentions can influence behaviour

simultaneously, while strong behavioural habits can influence actual behaviour (Xin et al., 2019; Chatzisarantis & Hagger, 2007; De Pelsmacker & Janssens, 2007).

Road crossing as a daily task may not always pass through a deliberate thought process but can become habitual or automated when repeated actions (Xu et al., 2013; Ouellette & Wood, 1998; Aarts & Dijksterhuis, 2000; Soathong et al., 2021). In addition, numerous experimental and correlational studies have shown that habits and other automatic processes also influence the intention-social behaviour relationship (Aarts, Verplanken, & Knippenberg, 1998; Verplanken, Aarts, van Knippenberg, & Moonen, 1998; Gardner et al., 2020).

A defining characteristic of habitual behaviour is that goal activation mediates the relationship between situation and behaviour (Aarts & Dijksterhuis, 2000). Empirical evidence establishes that habitual behaviours are automatic. Their practice depends on the activation of a goal (goal-directed automaticity concept) (Aarts & Dijksterhuis, 2000; Sheeran et al., 2005; Soathong et al., 2021). Habit, also known as cue-dependent automaticity, once formed, are not frequently enacted unless the environmental triggers are often experienced (Gardner, 2012).

Behavioural Willingness

Like Ajzen (1991), Gibbons & Gerrard (1995) recognise intentions as powerful predictors and determinants of behaviour. However, the scholars suggest behavioural willingness as an additional key trigger (ROSPA, 2017). Behavioural willingness is the likelihood of an individual's thinking of carrying out a specific behaviour, dependent on the circumstances they might find themselves in (ROSPA, 2017; Gerrard et al., 2005). For instance, pedestrians might cross when the pedestrian signal is red because there will be no approaching vehicles. Thus, behavioural performance is possible through willingness, even if intentions are not favourable toward performance (Gerrard et al., 2008).

Behavioural willingness accounts for unexpected behaviour, specifically in young people (adolescents), who cannot predict how they will act in given situations because of their lack of experience to base judgments upon (Gibbons & Gerrard, 1995). Gibbons and colleague proposed that young people tend to make poor decisions when approached by risky situations (Demir, 2017). In simpler terms, the model frames the issue as what individuals are willing to do rather than what they plan to do. The present study intends to evaluate the psychological determinants of child pedestrian risk-taking behaviour using the extended TPB.

2.1.5 Application of TPB to risk-taking behaviour

The theory of planned behaviour (TPB) has been widely used in predicting people's intentions and behaviour, and its effectiveness has been shown in several research domains, including smoking (Guo et al., 2007) and drinking (Norman et al., 2007), among others. In road traffic safety, the theory has been applied in human factors research, such as drivers' intention and behaviour (Hou et al., 2021). Elliott et al. (2005) used the TPB model to perform a questionnaire analysis to find belief predictors of TPB variables that underpin drivers' intentions to obey

speed limits. TPB was able to justify 43 percent and 48 percent of the variance in hand-free and handheld cell phone usage while driving, according to Zhou et al. (2009).

Likewise, pedestrian behaviours have also been explained through the TPB; pedestrian decisions while crossing the street (Holland & Hill, 2007; Zhou et al., 2009; Diaz, 2002; Zhou & Horrey, 2010; Evans & Norman, 2003;), violations and pedestrian behaviours (Demir et al., 2019). For example, in a separate study by Zhou et al. (2016), the application of TPB on self-reported road-crossing violations and behavioural intentions among 18-39-aged revealed that the pedestrians had negative attitudes toward the behaviour of violating road-crossing regulations. Their perception was that social pressures from their family and friends influenced their risky behaviour and that such risky behaviour could injure them in a traffic accident. In contrast, Hashemiparast et al. (2020) found that 18-25-year-old respondents in an Iranian study who had previously been in an accident reported fewer safety behaviours while crossing the road than those who had never been in an accident. The current research will also attempt to apply the TPB to the road-crossing behaviours of 10-14-year-old young adolescent pedestrians in Harare, Zimbabwe.

2.2 Review of Findings of Previous Work

2.2.1 Sociodemographic factors influencing child pedestrian road-crossing violations

2.2.1.1 Developmental factors influencing child pedestrian road-crossing violations

As children grow up, their mobility increases, supervision decreases, they tend to travel independently farther from home, and their focus on play diverts their focus away from traffic (Hotz et al., 2009, Road Safety Analysis, 2010). Children's risk of getting injured in a road traffic crash is high due to lack of experience, limited cognitive and motoric skills, and small stature (Abele, Haustein & Moller, 2018; AAP, 2009; Schwebel et al., 2012; Meir et al., 2015; Schieber & Thompson, 1996; WHO, 2013b).

A US study observed elementary school children crossing a street and found out that less than 30% stopped at the kerb when crossing, 20% stepped dangerously into the lane, 20% passed outside the marked area, and 10% played in the street (Grayson, 1975; DaCoTA, 2012). While children aged 1-2 years are more likely to be hit by reversing cars, 3-9-year-olds are involved in mid-block "dart-outs" (Shieber & Vegega, 2002; Moller & Kreisfeld, 1997). More so, under 10-year-olds (5-9-year-olds) (Cloutier et al., 2020) are vulnerable to road traffic injury due to emerging independence. Yet, they have small physical stature and underdeveloped capabilities in dealing with traffic situations, both cognitive (attention focus, interpreting traffic signs) and perceptual (judging speed, locating sounds, peripheral vision) (Shieber & Vegega, 2002).

Two separate studies, regarding children aged 9 to 14 years (Toroyan & Peden, 2007) and aged 10 to 17 years (DaCoTA, 2012) reveal that children are sensation-seeking and tend to respond to peer pressure, peaking into late adolescence (Gardner & Steinberg, 2005; Morrongiello & Sedore, 2005). Other studies have also found that children are easily distracted by other stimuli, leading them into darting into the road with oncoming vehicles (Toroyan & Peden, 2007). Most children do not look when crossing the street (Dragutinovic & Twisk, 2006). High stimulation of socio-emotional networks suppresses activity in the immature cognitive-control network, thus increasing risk-taking behaviour (Steinberg, 2010; O'Neal et al., 2019). Risk-taking because of the competing networks increases between the 10-14 aged, when the cognitive-control network is undergoing significant developmental change (Shulman et al., 2016; Steinberg, 2010; UNESCO, 2012; WHO, 2021a). Risk-taking behaviour, typical for younger children and adolescents, may be deliberate because of a lack of knowledge or peer pressure (Schieber & Thompson, 1996; Schwebel et al., 2012; Gitelman et al., 2019).

Some researchers have shown that children are engaged in very few safe road-crossing behaviours (Percer, 2009). Zeedyk, Wallace & Spry (2002) carried out a treasure hunt game study with 5-6-year-olds, which involved several different types of street crossings. The researchers found out that only 11% of the children looked in any direction before reaching the curb; 41% stopped at the curb; 7% looked in any direction while waiting at the curb; 15% looked in any direction while crossing the street, and 74% ran or skipped while crossing the street. In another study by Thomson & Whelan (2000), about half of the 6-year-old participants stopped at the curb, but though they moved their heads 80% of the time, they seemed to be going through the motions instead of conducting a visual search.

Barton & Schwebel (2007) conducted a study employing the pretend road and found out that younger children and other children with less behavioural control exhibited riskier pedestrian behaviour. In the same survey, 5-6-year-olds were found to lack cognitive complexity to engage in safe crossing behaviours. Simultaneously, 7-8-year-olds demonstrated abilities to handle mental complexities and proved to be the ideal subjects for cognitive training methods. Wait times, attention to traffic, missed opportunities, and gap sizes were all positively related to age.

In a UK study by Zeedyk et al. (2002), children aged 5-6 performed exceptionally poorly in looking for oncoming traffic when crossing the road. About 85% of the children failed to look for traffic on the main road before reaching the curb while stopping at the curb and crossing the street. However, some of the children looked for oncoming traffic, and it was a single gaze in an incorrect manner (that is, looking to the left when the vehicle approaching in the immediate lane came from the right.

Traffic risk perception (Meir et al., 2013, 2015; Meyer, Sagberg, & Torquato, 2014; Underwood et al., 2007) and visual search skills (Barton et al., 2012; Kovesdi & Barton, 2013; Whitebread & Neilson, 2000) start developing

between ages 4-13, and they improve safe pedestrian behaviour. As a result, young children (5-7 years) are highly likely to run instead of actively looking for traffic risks or focusing on their safety by walking (Wang et al., 2018). "Younger children also tend to rely only on distance while ignoring speed when evaluating safe traffic gaps'' (Connelly et al., 1998 as cited in Albert & Dolgin, 2010 pg 500). Preschool-aged children have slower reaction times than older children and adults, resulting in safe crossing gap decisions into risky ones (Pitcarin & Edlmann, 2000).

Adolescence is a time of possibility and danger (WHO, n.d; Backes & Bonnie, 2019). In one study, adolescent pedestrians exhibited a higher tendency toward violations (Granié et al., 2013). Likewise, in another study, adolescent pedestrians showed a more positive attitude towards violations than adults (Diaz, 2002). However, variations in the studied populations and age comparisons preclude firm conclusions regarding the relationship between age and child pedestrian injury risk (Schneider, 2020; Jacobsen, 2003). Nonetheless, the researcher proposes the following hypothesis:

H_1: 13-14 aged children are more likely to be more involved in road-crossing violations than 10-12 aged children.

2.2.1.2 Gender effects on child pedestrian road-crossing violations

Numerous studies have focused on pedestrian crossing behaviour determinants using different variables (Olawole, 2017). There has been extensive research on sociodemographic determinants of pedestrian behaviour such as age, gender, and socio-economic status (SES) (Ishaque & Noland, 2008; Gueguen & Pichot, 2001). Gender differences in street-crossing behaviour have been the focus of most research (Olawole, 2017), with findings supporting that unsafe road-crossing aspects vary between genders (Tiwari et al., 2007; Rosenbloom, 2009).

Although all children are vulnerable, boy teenagers are two times more often the victim of pedestrian injuries than girls (Schwebel, Davis & O'Neal, 2012; Durkin, Olsen, Barlow, Virella and Connolly, 1998; DaCoTA, 2012; ETSC, 2005; Sentinella & Keigan, 2005; Dukehart et al., 2007; Pless, Peckham & Power, 1989). Generally, male pedestrians have more traffic rule violations than females and positively tend to cross risky situations (Moyano-Diaz, 2002; Rosenbloom, Nemrodov & Barkan, 2004). A simple skills training experiment found male child pedestrians involved in risky crossing behaviours (Barton & Schwebel, 2007; Morrongiello & Rennie, 1998). Many psychologists attribute the male-female risk-taking disparity to gender roles (d'Acremont & Van der Linden, 2006). Social psychology research found that gender differences in risk-taking among the 12-16-aged child pedestrians were more due to sex stereotype conformity (level of masculinity) than biological sex (Schwebel, Davis & O'Neal, 2012; Granie, 2009; 2010). According to a related report, the more 9-14-year-old boys and girls conform to masculine expectations, the more they seek sensations and take risks (Granie et al., 2012).

A study that assessed the extent of child casualties on UK roads between 2004 and 2008 discovered that boys were more likely to be injured than girls

across all age groups (Road Safety Analysis Ltd, 2010). Male adolescents tend to be aggressive and sensation seeking, partly due to rising testosterone levels in puberty (Dragutinovic & Twisk, 2006). In addition, societal expectations, and gender role socialisation (offering greater freedom for boys to explore the environment) were found to influence pedestrian injury risk (Wazana et al., 1997; Toroyan & Peden, 2007; Morrongiello & Hogg, 2004; Stoker et al., 2015; Manocci et al., 2019;). Therefore, these findings lead to the formulation of the hypothesis:

H_2: Male children are more likely to adopt risky behaviour and are more involved in road-crossing violations than female children.

2.2.1.3 Socio-economic status' influence on child pedestrians' crossing behaviour

Socio-economic status (SES) is a primarily family-based characteristic determined by the parent's income and the highest level of education attained (Schieber & Vegega, 2002; Klaitman et al., 2018). Casualty analyses revealed a statistically significant positive correlation between road traffic casualty rates and deprivation levels (Wood et al., 2011). The risk of paediatric pedestrian injury is inversely related to family's socio-economic status, specifically low-income, low area-level educational attainment and poverty (Sharples et al., 1990; Laflamme & Diderichsen, 2000; LaScala, Gerber & Gruenewald, 2000; Quistberg et al., 2015; Morency et al., 2012).

The major social group through which a youngster is first exposed to social standards and traditions is his or her family. (Schieber & Vegega, 2002). Children living in socio-economically deprived or high-density residential areas are particularly susceptible to child pedestrian injuries likely because of increased exposure (Wazana et al., 1997; Mannocci et al., 2019; Laflamme & Diderichsen, 2000). Children in low-income settlements and informal settlements rely heavily on walking as their primary transportation mode (Behrens, 2003; Statistics South Africa, 2014). Consequently, the children walk more and live in areas of multi-family dwellings with more cars on the roads (Macpherson, Roberts & Pleiss, 1998; Morency et al., 2012; Wazana et al., 1997; Laflamme & Diderichsen, 2000). Similarly, children living in low-income countries are vulnerable to high rates of pedestrian injuries, likely due to limited funding allocated for safe pedestrian infrastructure and law enforcement, which in turn potentially increases high-speed traffic (Stoker et al., 2015; Ribbens et al., 2008). The studies support the need for further research into the effects of socioeconomic status on the likelihood to exhibit risky crossing behaviours by child pedestrians. Therefore, these findings lead to the formulation of the hypotheses:

H_3: Children from low-family-income are more likely to engage in road-crossing violations than children from middle- and high-income families.

H_{3a}: Children from high-density residential areas are more likely to engage in road-crossing violations than children from middle- and low-density residential areas.

2.2.2 Psychological factors' influence on child pedestrian road-crossing violations

Pedestrian behaviours have received less attention than driver behaviours (Rosenbloom, Nemrodov & Barkan, 2004). However, recently, interests in unsafe pedestrian behaviours started to rise (Qu et al., 2016). For the past two decades, empirical evidence has identified several personal factors influencing pedestrian behaviours: pedestrian density, socio-demographics, and attitudinal determinants of pedestrian violations (Demir, 2017). Evans & Norman (2003) posited that attitudes, subjective norms, and perceived behavioural control are essential predictors of pedestrians' street-crossing intentions. Evans (2003) applied an extended TPB to the road crossing violations of 11-14-year-old pedestrians. The additional variables were moral norms, anticipated affect, and self-identity. Regression analyses revealed an increased predictive utility of the TPB. Over and above the influences of gender and age, the TPB articulated 25% of the variation in road crossing intentions, with perceived behavioural control emerging as the strongest predictor.

Attitude has more value in explaining safe road-crossing behaviours (Jiang et al., 2017; Evans & Norman, 2003; Fruhen & Flin, 2015). Nordfjaern & Simsekoglu (2013) discovered pedestrian attitudes towards general rule violations and pedestrian safety as vital predictors of pedestrian behaviours. In a separate study, young pedestrians (17-25-year-old) were more favourable toward pedestrian violations than adult pedestrians (Moyano-Diaz, 2002). On the other hand, young males were more prone to exhibiting negative attitudes towards traffic rules than females (Kelley-Baker & Romano, 2010). Therefore, attitudes are correlated to reported behaviours (Nabi et al., 2007).

Behavioural intention is a crucial predictor of behaviour (Heath & Gifford, 2002). Evans (1999) testified a significant correlation between road-crossing intentions and performance among 12-year-olds on a simulated road-crossing task. In another study, child pedestrians who had previously been involved in a road traffic crash were more likely to intend to cross the road in the manner depicted in potentially hazardous scenarios (Evans & Norman, 1998). A similar study involving college students displayed significant relationships among attitude, subjective norms, behavioural intention, and safe road-crossing behaviours (Mirzaei-Alvijeh et al., 2019b; Jalilian et al., 2015). Beyond these studies, however, little is known about young Zimbabwean adolescents' pedestrian road-crossing behaviour.

The study will test the following hypotheses:

H4: Perceived behavioural control is positively related to road-crossing violations' intention.

H5: Subjective norms are positively related to road-crossing violations' intention.

H6: Behavioural attitude is positively related to road-crossing violations' intention.

H7: Road-crossing violations' intention is positively related to road-crossing violations.
H8: Perceived behavioural control is positively related to road-crossing violations.
H9: Habits are positively related to road-crossing violations' intention.
H10: Habits are positively related to road-crossing violations.
H11: Behavioural Willingness is positively related to road-crossing violations' intention.
H12: Behavioural Willingness is positively related to road-crossing violations.

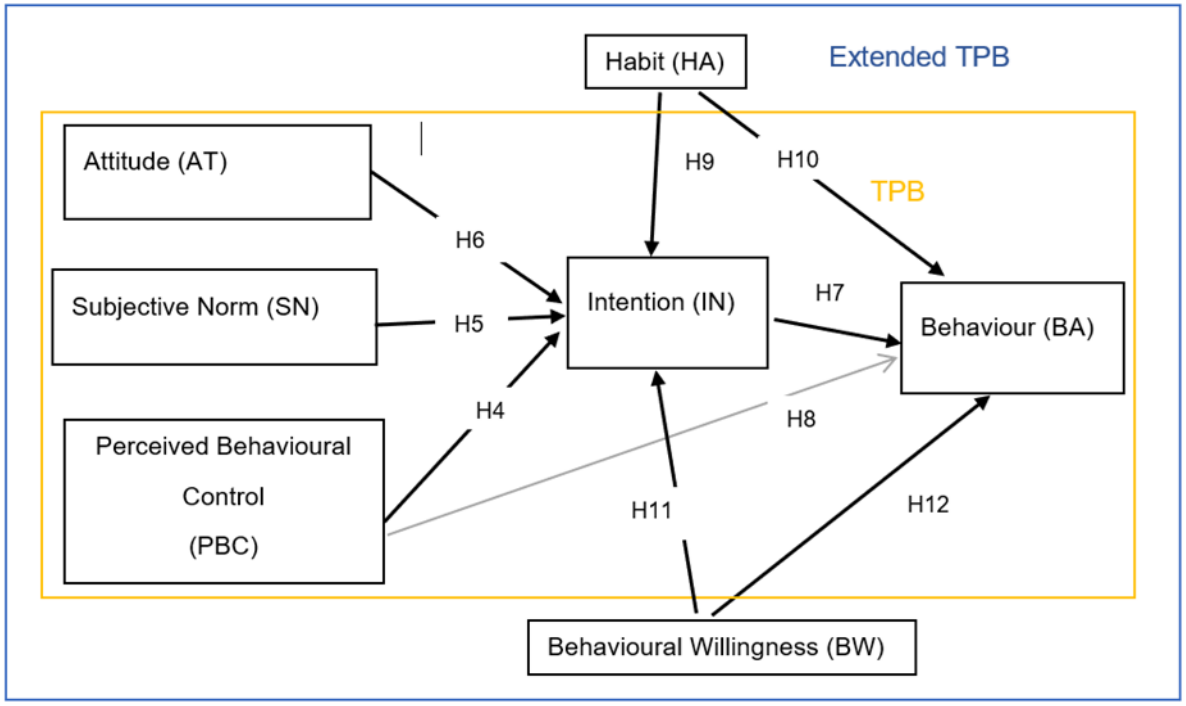

FIGURE 2 Structural model showing path hypotheses (H4-H12) (Author, 2021)

CHAPTER 3

METHODOLOGY

3.1 Research Design

The study employed a cross-sectional survey design. The survey was administered between 18 February 2021 and 31 March 2021 as an online questionnaire to 10-14 aged child pedestrians at three primary schools in Warren Park D suburb, Harare, Zimbabwe. A survey refers to a study concerned with describing a particular group's characteristics (Kothari, 2004). Cross-sectional surveys encompass collecting data at one point in time from a sample selected to represent a larger population (Owens, 2002). Advantages of a survey include gathering unique information, unbiased representation of the population of interest (statistical significance), standardisation of measurement, less expensive data to complement data from secondary sources, and elicitation of confidential information (Owens, 2002; Glasow, 2005). Conversely, disadvantages of a survey include inflexibility of design, not ideal for controversial issues, and possible inappropriateness of questions since they are created to accommodate a general population (Sincero, 2021).

3.2 Participants

Three primary schools in the Warren Park D suburb of Harare, Zimbabwe, with a total target group of 3375, were used to recruit children aged 10 to 14. According to the literature, the optimal sample size was 345 adolescents, with a 95% confidence level, a 5% margin of error, and a 50% response distribution (Qualtrics, 2012; The Survey System, 2012). The Qualtrics® created survey was distributed electronically via the parents' social media network, which is used by parents to communicate with the school principals. The researcher decided to use a simple random sampling method. Simple random sampling ensures that each case in the population has the same chance of being included in the survey (Taherdoost, 2016; Finch, 2013). The primary school heads contacted the parents of some 13–14-year-old pedestrians who were now in high school, inviting them to participate in the survey.

Large-scale surveys avoid collecting information from children because they will not always understand the questions or consent issues (UNICEF, 2012; WHO, 2021a). To avoid these issues, the current research used parental consent and their assistance in completing the survey to explore the sociodemographic and psychological determinants of the target group's road-crossing violations. Parents of target group children received a message via school heads informing them of the study and asking their children to participate in the survey (Thomson, 2008).

The researcher assured the participants and their parents of their voluntary participation, strict confidentiality, and anonymity of their responses. After that, participants and their parents were directed to the consent page through a link in the message, where they read and consented before proceeding to the survey page.

3.3 Self-report Questionnaire Preparation Procedure

The questionnaire items were adapted from TPB validated questionnaires from previous studies found in the literature (Evans, 2003; Demir, 2017; Deb et al., 2017; Reason et al., 1990; Granie et al., 2013; Eccles et al., 2004). The instrument was proofread by one of the school heads to ensure that it had the appropriate English language level for the target group. Two research experts from Zimbabwe Open University and two from Hasselt University assisted with confirming the questionnaire's content validity. Content validation is a process aiming at ensuring that a research instrument measures the content area it is expected to measure (Frank-Stromberg & Stromberg, 2004; Ayre & Scally, 2014).

A self-report questionnaire, which aims to provide a self-report on travel and road-crossing behaviour, is another way of studying pedestrian behaviour than direct observations (Evans & Norman, 2003; Zhou et al., 2009; Zhou & Horrey, 2010; Yagil, 2000; Gram, 2010). The approach also allows for grouping different behaviours into a behavioural variable system, making it easier to investigate behaviour factors (Elliot & Baughan, 2004; Granie et al., 2013). Finally, as seen during such fast-moving infectious disease outbreaks as the COVID-19, online questionnaires have proven successful (Geldsetzer, 2020; Boni, 2020).

3.4 Measures/Variables

The 36-item questionnaire (see Appendix I) had three sections: sociodemographic variables (9 items), self-report behaviour/road-crossing violations (5 items), and psychological variables (22 items) and took at least 10 minutes to complete, considering that parents had to assist their children.

3.4.1 Sociodemographic Characteristics

Sociodemographic items included age, gender, father's educational level, mother's educational level, father's employment status, mother's employment status, annual gross household income, living area, and accident history (see Table 1).

3.4.2 Self-report Road-crossing Violations (BA)

Road-crossing violations were measured by five items that included one item on general road-crossing violations and four items on specific violations. The general road-crossing violations were measured by responses to the question 'Over the last three months, how often did you engage in pedestrian violations?'.

With respect to the specific items, responses to these questions measured specific road crossing violations that are prevalent in the local context: 'Over the last three months, how often did you cross outside the zebra crossing even though there was one nearby'; Over the last three months, how often did you cross the street even though the pedestrian light was red'; Over the last three months, how often did you cross the street even though the light was still green for vehicles'; 'Over the last three months, how often did you cross the street at an authorised person crossing before a school warden or police officer signalled cars to stop'. All items were measured using a five-point Likert Scale (Never=1 to Always=5).

3.4.3 Behavioural Intention (BI)

Responses to these three questions measured intention: 'Over the next five weeks I expect to engage in pedestrian violations'; 'Over the next five weeks I will likely engage in pedestrian violations'; and 'Over the next five weeks there is a chance that I will engage in pedestrian violations'. The Likert scale was 'strongly disagree (1) to strongly agree (5)'.

3.4.4 Behavioural Willingness (BW)

The questionnaire measured behavioural willingness by three items: "Suppose you are late for school, and you need to cross the street. How willing are you to engage in pedestrian violations?'; 'Suppose you are in a hurry to meet a friend on the other side of the road. How willing are you to engage in pedestrian violations?'; and 'Imagine another pedestrian of your age is engaging in pedestrian violations. To what extent would you be willing to engage in pedestrian violations too?'. The Likert scale was very unwilling (1) to very willing (5).

3.4.5 Habit (HA)

Five items measured habit. The questions were: 'Engaging in pedestrian violations is something…'; '…I frequently do'; '…I do automatically'; '…I do without having to remember consciously'; and '…I do without thinking'. The Likert scale was "strongly agree (1) to 'strongly disagree' (5).

3.4.6 Attitude (AT)

Responses to the following question measured attitude: 'For me, to engage in pedestrian violations would be…' The responses were 5-point Likert scale semantic differentials: very negative (1) to very positive (5); very foolish (1) to very wise (5); very bad (1) to very good (5); and very unpleasant (1) to very pleasant (5).

3.4.7 Subjective Norm (SN)

Responses to three items measured subjective norms: 'My close friends do not bother me engaging in pedestrian violations'; 'Most people who are important to me think that I …engage in pedestrian violations'; 'It is expected of me that I engage in pedestrian violations'. The responses for the first and third items were:

strongly disagree (1) to strongly agree (5); while for the second item: strongly should not (1) to strongly should (5).

3.4.8 Perceived Behavioural Control (PBC)

Two items measured Self-efficacy: 'If you are late for school and would need to cross the street, for you to avoid engaging in pedestrian violations would be…'; 'If other pedestrians of my age are engaging in pedestrian violations, for me to avoid pedestrian violations would be…'. Responses were from very difficult (1) to very easy (5). Controllability was measured by responses to two questions 'The decision to engage in pedestrian violations is beyond my control'; and 'Whether I engage in pedestrian violations or not, it is entirely up to me". Responses were from strongly disagree (1) to strongly agree (5).

3.5 Data Analysis Plan

The study analysed the data using Qualtrics™ and International Business Machines IBM® Statistical Package for Social Scientists, SPSS® version 26, R-Studio® 4.0.0, and SmartPLS® version 3.0. The TPB latent variables were measured through questionnaire items. For instance, questionnaire items related to violations measured the latent variable, pedestrian violations. The term "latent variable" refers to a variable that cannot be observed (Salkind, 2010). The presence of latent variables, on the other hand, can be identified through their effects on observable variables or questionnaire items.

Two multiple regressions are involved in the extended theory of planned behaviour. Attitudes, habits, behavioural willingness, subjective norms, and perceived behavioural control are all independent factors in the first multiple regression model, whereas behavioural intention is the dependent variable. In the second multiple regression model, road-crossing violations are the dependent variable, with intentions, habit, behavioural willingness, and perceived behavioural control as independent factors. The following paragraphs detail the study's data analysis stages, which include descriptive, and inferential statistics, construct validity and reliability measurements, and structural equation modelling using partial least squares (PLS-SEM).

3.5.1 Descriptive and Inferential Statistics

Descriptive statistics show the patterns or summaries in the data, that is, the means, distribution, and standard deviations.

Independent samples t-tests and ANOVAs were used to perform inferential statistics. Inferential statistics refers to the various methods in which statistics acquired from observations on samples from study populations can be utilized to determine if such populations are actually distinct (Hill, 2006). Independent Samples t-test analyses investigated the effects of age and gender on pedestrian violations. The Independent Samples t-Test is a parametric test that compares the means of two independent groups to see how the associated population means

vary statistically (Kent State University Libraries, 2021, April 12). Analysis of variance (ANOVAs) analysed the effects of family income and residential area on pedestrian violations behaviour. ANOVAs are used when three or more independent (unrelated) group means are compared (Lund Research Ltd, 2018; Qualtrics Experience Management, 2021). In addition, Tukey's post hoc test confirmed where the differences occurred between groups.

3.5.2 Construct Reliability and Validity

The degree to which a collection of measured objects accurately represents the latent theoretical construct that those items are meant to measure is construct validity (Hair et al., 2009). In other words, construct validity is the functional relationship between the observed variables and the latent variables assessed through factor loadings (Burns, 2017; Murti, 2016). The study used Confirmatory Composite Analysis (CCA) in Partial Least Squares Structural Equation Modelling (PLS-SEM) to measure construct validity (Dijkstra & Henseler, 2015). CCA is a composite-based extension of principal components analysis (PCA), which produces composite cores that are weighted linear combinations of measures used in follow-up analyses (Hair et al., 2020). The CCA is an emerging approach to confirm linear composite constructs in measurement models (Hair, Black et al., 2019; Schuberth et al., 2018). The technique is also an alternative to confirmatory factor analysis (CFA) when the researcher wants to confirm measurements in developing or adapting multi-item measures. However, the statistical goal of CCA differs from CFA. It aims to optimize variance derived from exogenous variables to promote the estimation of endogenous constructs and validation of measurement models (Hair et al., 2020). Advantages of CCA include: the number of items retained to measure constructs is higher, thus improving construct validity, it provides determinant construct scores (Rigdon et al., 2019), it can be applied in formative measurement models and is a preferred method when the aim of studies is prediction (Hair, Matthews, et al., 2017).

Model fit was assessed using a variety of indices, including the squared Euclidean distance (d_ULS), the geodesic distance (d_G), normed fit index (NFI) (Schuberth et al., 2018), Standardized Root-Mean-Square Residual (SRMR) (Dagnall et al., 2018; Xia & Yang, 2018). The use of a variety of indices ensures a thorough evaluation of model fit. However, in general, the more fit indices applied to a SEM, the more likely a miss-specified model will be rejected, implying that the risk of good models being rejected is increasing (Fan et al., 2016). Hu and Bentler (1999) suggested the use of a combination of at least two model fit indices. There are several indices with recommended cut-off values, but none of them serves as a universal rule of thumb for all applications (Fan et al., 1999; Hoyle, 2011; Chen et al., 2008; Kline, 2010).

Standardized Root Mean Square Residual (SRMR) is the square root of the difference between the sample covariance matrix residuals and the hypothesised covariance model residuals (Hooper et al., 2008). As a result, the average magnitude of observed and expected correlation differences can be used as an

absolute measure of (model) fit. (SmartPLS, 2020). SRMR has a range of values from 0 to 1.0, with well-fitting models yielding values of less than.05 (Byrne, 1998; Diamantopoulos & Siguaw, 2000).

However, there is a debate over the global acceptance of the model fit indices used by SmartPLS. The indices are still at the stage of refinement, making most researchers use covariance-based SEM such as AMOS. SmartPLS SEM is preferred if the main objective is prediction, and hence the indices are not of great concern (Sayidi, 2014). According to the Monte Carlo simulation results, CCA can be used for confirmatory purposes (Schuberth et al., 2018). It was discovered that the bootstrap-based test, when combined with various discrepancy tests, can be used to evaluate the composite model's overall model fit statistically.

3.5.3 Structural Equation Modelling

Partial Least Squares Structural Equation Models (PLS-SEMs) were employed to test hypotheses and verify the relationships between TPB variables empirically. Wold (1992) developed the PLS path modelling technique, which is essentially a series of regressions expressed in weight vectors (Henseler et al., 2009). In general, SEM has evolved into two approaches: covariance based (CB-SEM) and partial least squares based (PLS-SEM) (Girardelli & Patel, 2016). CB-SEM optimizes all construct path relationships at the same time, while minimizing model error (Hair et al., 2011; Ali, 2015). PLS-SEM is more concerned with maximizing R^2, or the level of variance explained by the model, while minimizing the overall error term (Astrachan et al., 2014; Hair et al., 2014). SEMs, as a multivariate statistical analysis method, allows for the verification of hypotheses concerning the influence of a set of variables on others (Gefenet et al., 2000). SEMs are commonly applied in testing and assessing direct and indirect effects on assumed multivariate causal linkages in models in various social and behavioural sciences (Ullman & Bentler, 2003; Yuan & Bentler, 2007; Hooper et al., 2008; Fan et al., 2016). SEMS can model nomological networks by expressing theoretical concepts as constructs and linking them with a structural model to investigate their relationships (Benitez et al., 2020). Besides, they overcome linear regression’s main shortcoming; the impossibility of verifying the causality among several variables (Jais, 2007). Cause-and-effect interactions are depicted as paths in SEM statistical models. A path is a predicted relationship between variables representing the causal and consequential structures of a theoretical proposition (Lowry & Gaskin, 2014). SEM methods are essential data analysis techniques applied in several programming packages (Knoke, 2005). Structural equation models (SEM) to incorporate empirical findings with relationships between unobserved constructs into a single integrated structure is a significant advantage (Liehr-Gobbers & Krafft, 2010).

3.6 Data Presentation

The study's results were presented using descriptive statistics and inferential statistics. The linear relationships between one or more independent variables and one or more dependent variables were also shown using structural models.

CHAPTER 4

FINDINGS

4.1 Socio-demographic Descriptives of Respondents

In total, 353 respondents took part in the online survey, with 9 questionnaires being omitted from the analysis: 8 (age groups outside the target group) and 1 (age within the target group but with substantial missing values). The 344 valid respondents (181 males=52.6%, 163 females=47.4%) had a mean (SD) age of 12.23 (1.26) years, with 10-year-olds (14%), 11-year-olds (12.2%), 12-year-olds (27.3%), 13-year-olds (29.9%), and 14-year-olds (16.6%) among them.

The 10-12-year-olds accounted for 184 (53.5%) of the total, with 97 males (52.7%) and 87 females (47.3%). The 13-14 age group accounted for 160 (46.5%) of the total, with 84 males (52.5%) and 76 females (47.5%).

The respondent characteristics are described in detail in Table 1 below.

TABLE 1 Descriptive statistics of respondent Socio-demographic characteristics (N=344)

Socio-demographic Variable		Size	%
Age 10-14 years (mean=12.23, SD=1.26)	10-year-olds	48	14.0
	11-year-olds	42	12.2
	12-year-olds	94	27.3
	13-year-olds	103	29.9
	14-year-olds	57	16.6
Gender	Male	181	52.6
	Female	163	47.4
Father's highest educational qualification	No formal qualifications	9	2.6
	Primary school	2	0.6
	Secondary School	86	25
	Technical and Vocational Education and Training	133	38.7
	University degree	96	27.9
	PhD	18	5.2
Mother's highest educational qualification	No formal qualifications	11	3.2
	Primary school	16	4.7
	Secondary School	153	44.5
	Technical and Vocational Education and Training	111	32.3
	University degree	53	15.4
	PhD	0	0
Father's employment status	Unemployed	2	0.6
	Employed	242	70.8
	Self-employed	97	28.4
	Retired	1	0.3
Mother's employment status	Unemployed	34	9.9
	Employed	187	54.4
	Self-employed	122	35.5
	Retired	1	0.3
Household Income per year USD (before tax)	Up to $1 000	118	34.3
	$1 100- $2 000	150	43.6
	$2 100-$3 000	54	15.7
	$3 100-$4 000	12	3.5
	$4 100 -$5 000	4	1.2
	$5 100-$6 000	3	0.9
	$6 100 or more	3	0.9
Living area	High-density residential suburb	231	67.2
	Medium-density residential suburb	98	28.5
	Low-density residential suburb	15	4.4
Previous accident involvement	No, never	231	67.2
	Once	88	25.6
	More than once	25	7.3

4.2 The Relation between Socio-demographic variables and Road-crossing violations

The following tests were carried out using an average score for all road-crossing violations items.

4.2.1 Effects of Age

The hypothesis that 13-14-year-old children are more likely than 10-12-year-old children to be involved in road-crossing violations was tested on the average score (overall and specific questions combined) using an independent samples t-test. However, there were no significant mean differences in road-crossing violations between 10-12-aged (mean=1.78, SD=.74) and 13-14-aged (mean=2.16, SD=.74) young adolescent pedestrians ($t_{335.353}$=-4.639, p=.365).

4.2.2 Effects of Gender

It was hypothesised that male young adolescent pedestrians were more likely to be involved in road-crossing violations than female, young adolescent pedestrians. However, there were no significant mean differences in road-crossing violations between male (mean=2.05, SD=.73) and female (mean=1.85, SD=.79) young adolescent pedestrians ($t_{331.322}$=2.388, p=.921).

4.2.3 Effects of Family Income

One-way ANOVAs were run to test the hypothesis that young adolescent pedestrians from low-family-income backgrounds were more likely to engage in road-crossing violations.

There were statistically significant mean differences in road-crossing violations between the three household income groups (low, medium, and high) as determined by one-way ANOVA (F(2,341)=6.022, p=.003). Tukey's post hoc test revealed significant differences in road-crossing violations between young adolescent pedestrians from low family income (mean=1.99, SD= .75, p=.015) and those from medium family income levels (mean=1.45, SD=.83). However, there were no significant mean differences between young adolescent pedestrians from the high family income group (mean=1.33, SD=.64) compared to low family income (mean=1.99, SD=.75, p=.086) and medium family income levels (mean=1.45, SD=.83, p=.941) in pedestrian violations, respectively. Therefore, young adolescent pedestrians from low-family income group were more likely to engage in road-crossing violations than their counterparts from the medium family income group.

4.2.4 Effects of Living Area

One-way ANOVAs revealed statistically significant mean differences in road-crossing violations amongst young adolescents from the three residential area groups (F(2,341)=4.435, p=.013). The road-crossing violations mean differences

between young teenage pedestrians from a medium density residential neighbourhood (mean=1.93, SD=.83, *p*=.656) were not statistically significant, according to Tukey's post hoc test compared to those from a high-density residential area (mean=2.00, SD=.72). However, there were statistically significant mean differences in road-crossing violations between young adolescent pedestrians from high-density residential area (mean=2.00, SD=.72) when compared to low-density residential areas (mean=1.41, SD=.75, *p*=.010), and young adolescents from medium density areas (mean=1.93, SD=.83, *p*=.040), respectively. Therefore, young adolescent pedestrians residing in high-density and medium-density residential areas were more likely to engage in road-crossing violations than those from low-density residential areas.

4.3 Descriptive Statistics of TPB variables

Table 2 shows the means and standard deviations (SD) of the scores for each questionnaire item.

TABLE 2 Mean and standard deviation of the score for each measured item

	Mean	SD		Mean	SD		Mean	SD
Road-crossing violations			**Behavioural Intention**			**Behavioural Willingness**		
BA1	2.37	.97	BI1	2.75	1.06	BW1	3.59	1.06
BA2	2.41	.97	BI2	2.99	1.12	BW2	3.35	1.00
BA3	1.68	.80	BI3	3.18	1.18	BW3	3.16	1.00
BA4	1.78	1.00	**Attitude**			**Subjective Norm**		
BA5	1.51	.93	AT1	2.22	1.01	SN1	2.42	.91
Habit			AT2	2.27	1.03	SN2	4.24	.67
HA1	3.36	.99	AT3	2.20	1.01	SN3	2.30	.88
HA2	3.36	1.03	AT4	2.22	1.01	**Perceived Behavioural Control**		
HA3	3.41	1.03				PBC1	3.38	1.03
HA4	3.48	1.01				PBC2	2.98	.96
HA5	3.64	.980				PBC3	2.42	1.03
						PBC4	3.55	1.03

4.4 Bivariate (Pearson's *r*) Correlation Analysis

Table 3 depicts the correlations between the TPB variables: road-crossing violations (BA), behavioural intention (BI), behavioural willingness (BW), habit (HA), attitude (AT), subjective norms (SN), and perceived behavioural control (PBC). All the correlations were statistically significant.

TABLE 3 Pearson's Correlation Coefficients for extended TPB constructs

Variables	Mean (SD)	BA	BI	BW	HA	AT	SN	PBC
Road-crossing Violations (BA)	1.96 (.76)	-						
Behavioural Intention (BI)	2.97 (1.05)	.582**						
Behavioural Willingness (BW)	3.37 (.92)	.474**	.648**					
Habit (HA)	3.44 (.89)	-.740**	-.652**	-.643**				
Attitude (AT)	2.23 (.98)	.557**	.703**	.568**	-.625**			
Subjective Norms (SN)	2.99(.433)	.244**	.576**	.431**	-.392**	.501**		
Perceived Behavioural Control (PBC)	3.09 (.583)	.361**	.571**	.620**	-.560**	.578**	.502**	-

***. Correlation is significant at the 0.01 level (2-tailed).*

4.5 Confirmatory Composite Analysis of the Measurement Model

The study measured the individual reliability of a load of each item. To measure construct validity in the questionnaire, CCA was conducted, and factor loadings (λ) together with *p*-values are shown in Table 4 below. CCA's primary goal was to confirm whether the items were measuring the construct they were intended to measure or constrain all redundant items in each construct (Schuberth et al., 2018). Redundant items have a factor loading of less than 0.5 or are strongly correlated with one another. According to the rule of thumb, items with a factor loading of less than 0.5 or are strongly correlated to each other should be restricted or excluded from the model. All factors loaded highly on their respective constructs, except for two items that were below the threshold of 0.5. However, in this study, they were retained because the constructs already had few items. As indicated in Table 4 below, item SN2 (-0.823) and PBC4 (-0.599) had loadings below 0.5. All the factor loadings were statistically significant.

TABLE 4 Factor loadings for the extended TPB measurement variables

Items	Original Sample (λ)	Sample Mean (M)	Standard Deviation (STDEV)	t-Statistics (|λ /STDEV|)	P Values
AT1 <- AT	0.951	0.951	0.012	80.216	0.000
AT2 <- AT	0.972	0.972	0.006	174.611	0.000
AT3 <- AT	0.970	0.971	0.006	165.864	0.000
AT4 <- AT	0.972	0.972	0.005	187.221	0.000
BA1 <- BA	0.863	0.862	0.017	49.755	0.000
BA2 <- BA	0.870	0.869	0.011	76.208	0.000
BA3 <- BA	0.867	0.865	0.016	55.117	0.000
BA4 <- BA	0.843	0.843	0.017	48.802	0.000
BA5 <- BA	0.594	0.591	0.048	12.377	0.000
BI1 <- BI	0.923	0.923	0.01	96.881	0.000
BI2 <- BI	0.952	0.952	0.008	122.649	0.000
BI3 <- BI	0.937	0.936	0.01	92.275	0.000
BW1 <- BW	0.908	0.909	0.014	63.811	0.000
BW2 <- BW	0.932	0.932	0.01	94.419	0.000
BW3 <- BW	0.869	0.87	0.018	47.177	0.000
HA1 <- HA	0.861	0.862	0.023	36.973	0.000
HA2 <- HA	0.905	0.906	0.018	49.765	0.000
HA3 <- HA	0.929	0.929	0.008	117.32	0.000
HA4 <- HA	0.901	0.9	0.014	63.74	0.000
HA5 <- HA	0.799	0.798	0.031	25.654	0.000
PBC1 <- PBC	0.781	0.781	0.029	27.178	0.000
PBC2 <- PBC	0.862	0.862	0.02	42.444	0.000
PBC3 <- PBC	0.816	0.817	0.023	35.913	0.000
PBC4 <- PBC	*-0.599*	-0.596	0.061	9.833	0.000
SN1 <- SN	0.853	0.851	0.02	42.811	0.000
SN2 <- SN	*-0.823*	-0.823	0.021	39.399	0.000
SN3 <- SN	0.879	0.879	0.011	78.48	0.000

The indices measured validity and reliability: Cronbach's alpha >0.7, average variance extracted (AVE) >0.5, and composite reliability (CR) >0.7 (Hair et al., 2009; Xin et al., 2019), the partial least squares reliability measure (rhoA) >0.7 (Zmnako & Chalabi, 2019; Dijkstra & Henseler, 2015). As mentioned earlier in Section 3.5, Cronbach's coefficients for all the constructs except SN and PBC were above 0.7, indicating that the measurement items' internal accuracy was appropriate. Average Variance Extracted (AVE) was measured for the model, and all the factors had values above the accepted threshold of >0.5. All constructs except SN and PBC (italicised) had composite reliability values above 0.7, which was also considered sufficient (Table 5).

TABLE 5 Construct reliability and validity of the TPB measurement model

Construct	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Attitude (AT)	0.976	0.976	0.983	0.934
Road-crossing violations (BA)	0.871	0.937	0.903	0.655
Behavioural Intention (BI)	0.931	0.931	0.956	0.879
Perceived Behavioural Control (PBC)	*0.343*	0.788	0.682	0.595
Subjective Norms (SN)	*-0.756*	0.818	0.501	0.726

Several model fit indices were used in this analysis of the standard TPB and extended TPB models. SmartPLS path modelling uses a bootstrap-based test for overall model fit (Dijkstra & Henseler, 2015) and by SRMR (Henseler et al., 2014). The discrepancy between the empirical indicator variance-covariance matrix and its predicted model-implied counterpart is assessed in both ways (Benitez et al., 2019). Therefore, the estimated model indices are preferred for interpretation, as shown in Table 6 below.

The SRMR for both models was above the threshold value <0.08, and the NFI was also outside the acceptable threshold value of >0.90. The d_ULS and d_G were both outside the good model fit threshold values. These two indices use the bootstrapping results to check whether the original sample value is smaller than the upper bound to indicate fit.

TABLE 6 Model fit indices for the standard TPB and extended TPB models

Fit index	Threshold value	Standard TPB Model	Extended TPB Model
SRMR	<0.08	0.095	0.082
d_ULS	<0.398 (95%CI)	1.73	2.544
d_G	<0.426 (95%CI)	0.611	0.846
NFI	>0.90	0.812	0.820

4.6 Structural Models

Using Partial Least Squares Structural Equation Modelling (PLS-SEM) methodology, the interaction between the measurement and structural models was defined (Ramirez, 2018; Ringle et al., 2015). Where the parameters are numerous and strongly collinear, partial least squares (PLS) is a recommended tool for constructing predictive models (Tobias, 1996; Hair et al.,2017). When regression analysis is performed on original, unstandardised variables, the raw coefficients generated are unstandardised (Statics How To, 2021). When only one measurement scale is used, they are often used for comparisons as they are intuitive (Analytics Vidhya, 2021, March 21). However, standardisation enables them to be compared within and across models, variables, and studies (R-

project.org, 2021). The process of altering the values of dependent and independent variables so that the mean and standard deviation become 0 and 1, respectively, is referred to as "standardization" (Siddiqui, 2020, September 4).

The parameter estimates obtained from a linear regression model when the independent variables or predictors and dependent variables or outcomes are standardised to have variance=1 are known as standardized (β or beta) coefficients (Horton, 2010, November 15). The researcher will interpret the estimates as partial correlation coefficients if the variables (independent and dependent) are standardized. To put it another way, now that the variables have been standardized, the researcher will use their regression coefficients to compare how closely they are related to the response variable. As a result, the parameters are interpreted as a change in the outcome, expressed in standard deviations, for each standard deviation change in the predictors (Bhalla, 2015, April). Even though this assessment overlooks the confidence limitations associated with each pairwise connection, standardized coefficients, regardless of how they are calculated, make it easier to evaluate which independent variables have the most robust relationship with the result or dependent variable. (Horton, 2010, November 15).

4.6.1 SEM Path Analysis

Path analyses were performed separately on the basic TPB model (Figure 3) and the expanded TPB model (Figure 4) to determine the contributions of the components in predicting pedestrian violations (Nguyen et al., 2020). The causal links between variables were explained via path analysis. Mediation, which argues that a variable can impact an outcome both directly and indirectly through another variable, is a common function of path analysis (Fan et al., 2016). In the TPB model, behavioural intention is a mediator that intervenes with the causal linkages. The mediating role of behavioural intentions in the relationships of the other constructs to road-crossing violations was examined using the *p*-values as proposed by Falk and Biesanz (2016).

The following relationships were examined in the standard TPB model: attitude, subjective norms, and perceived behavioural control are directly related to behavioural intentions. Perceived behavioural control and behavioural intentions are directly related to road-crossing violations. Therefore, in this model, attitudes ($p<.001$), subjective norms ($p<.001$), and perceived behavioural control ($p<.001$) are indirectly related to road-crossing violations through the mediation of behavioural intentions. Results revealed that the total indirect effect on road-crossing violations were significant from attitude ($p<.001$), perceived behavioural control ($p<.001$) and subjective norms ($p<.001$).

In the extended TPB model, the following relationships were examined: attitude, subjective norms, perceived behavioural control, habit, and behavioural willingness are directly related to behavioural intentions. Behavioural intentions, habit, and behavioural willingness are directly related to road-crossing violations. Therefore, in this model, attitude ($p=.004$), subjective norms ($p<.001$), perceived

behavioural control (p=.642), habit (p=.025), and behavioural willingness (p=.008) are indirectly related to road-crossing violations through the mediation of behavioural intentions. Results revealed that the total indirect effect on road-crossing violations were significant from attitude (p=.004), subjective norms (p<.001), habit (p=.025), and behavioural willingness (p=.008).

Table 7 shows results of the tests on the hypothesised relationships among the constructs in the extended TPB model. Four out of nine hypotheses were supported.

TABLE 7 Results of Hypothesis Testing

Hypothesis	Standardised Path Coefficient (β)	p-value	Result
H4: Perceived behavioural control is positively related to road-crossing violations' intention. [PBC-IN]	0.028	0.572	Not supported
H5: Social norms are positively related to road-crossing violations' intention. [SN-IN]	0.294	0.000	Supported
H6: Attitude is positively related to road-crossing violations' intention. [AT-IN]	0.284	0.000	Supported
H7: Road-crossing violations' intention is positively related to road-crossing violations. [IN-BA]	0.244	0.000	Supported
H8: Perceived behavioural control is positively related to road-crossing violations. [PBC-BA]	0.061	0.299	Not supported
H9: Habits are positively related to road-crossing violations' intention. [HA-IN]	-0.147	0.006	Not supported
H10: Habits are positively related to road-crossing violations. [HA-BA]	-0.608	0.000	Not supported
H11: Behavioural willingness is positively related to road-crossing violations' intention [BW-IN]	0.190	0.000	Supported
H12: Behavioural willingness is positively related to road-crossing violations [BW-BA]	-0.085	0.165	Not supported

4.6.1.1 Path Analysis Results for the Standard TPB Model

The standardized coefficients for the hypothesised standard TPB model are shown in Figure 1 below. Positive attitude (β =0.337, p<.001), positive subjective norms (β=0.370, p<.001) and positive perceived behavioural control (β=0.183, p<.001) significantly predicted behavioural intention. Attitude, subjective norms, and perceived behavioural control accounted for 62% of the variance in behavioural intention. On the other hand, positive behavioural intention (β=0.448, p<.001) and positive perceived behavioural control (β=0.320, p<0.001) predicted

road-crossing violations, and the model accounted for 48% of the variance in road-crossing violations. In summary, positive attitude, positive subjective norms, and positive perceived behavioural control significantly predicted behavioural intentions. On the other hand, positive perceived behavioural control and positive behavioural intentions significantly predicted road-crossing violations.

Additional analyses tested for the total indirect effects from attention, subjective norms, and perceived behavioural control to road-crossing violations.

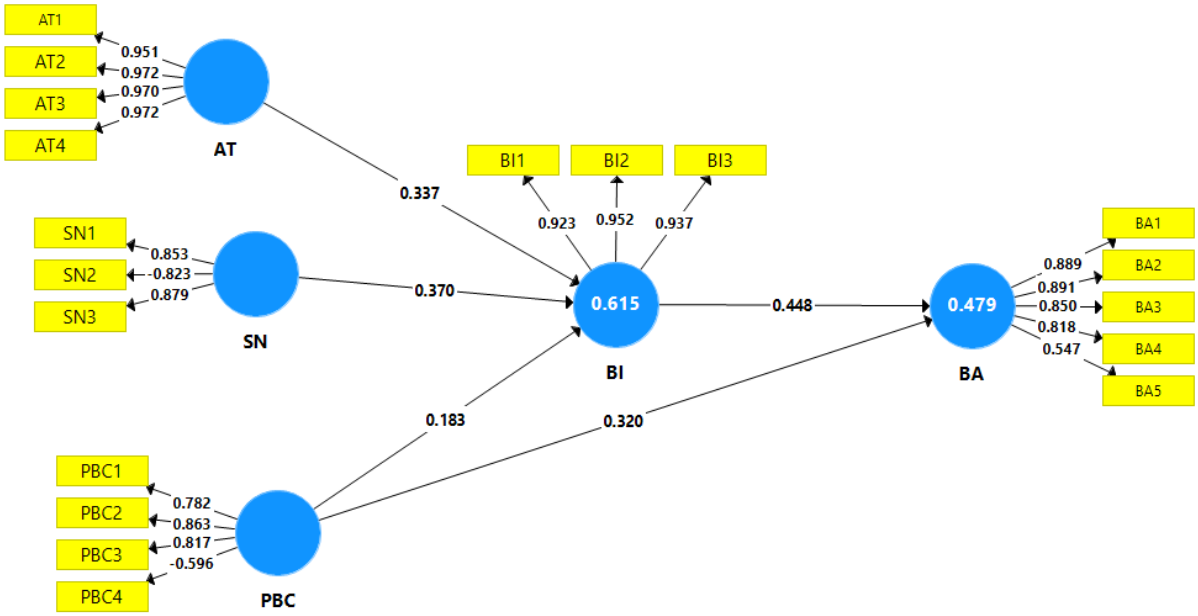

FIGURE 3 Path Coefficients and outer loadings for the standard TPB measurement model

The path coefficients for the TPB model are summarised in Table 8. All the values were statistically significant. Subjective norms were the highest predictor of behavioural intention, while behavioural intention also predicted road-crossing violations.

TABLE 8 Path Coefficient (β) values, mean, standard deviation, t-values and *p*-values for the standard TPB model

Path	Original Sample (β)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|β /STDEV|)	P Values
AT -> BI	0.337	0.335	0.049	6.872	0.000
BI -> BA	0.448	0.448	0.056	8.053	0.000
PBC -> BA	0.320	0.323	0.053	6.039	0.000
PBC -> BI	0.183	0.185	0.046	4.002	0.000
SN -> BI	0.370	0.372	0.05	7.399	0.000

4.6.1.2 Path Analysis Results for the Extended TPB Model

The extended TPB model (Figure 2) shows that habit (β =-0.147, p=.006), behavioural willingness (β=0.190, p<.001), attitude (β =0.284, p<.001), and subjective norms (β =0.294, p<.001) significantly predicted behavioural intention. However, perceived behavioural control (β =0.028, p=0.572) was not significant in predicting behavioural intention.

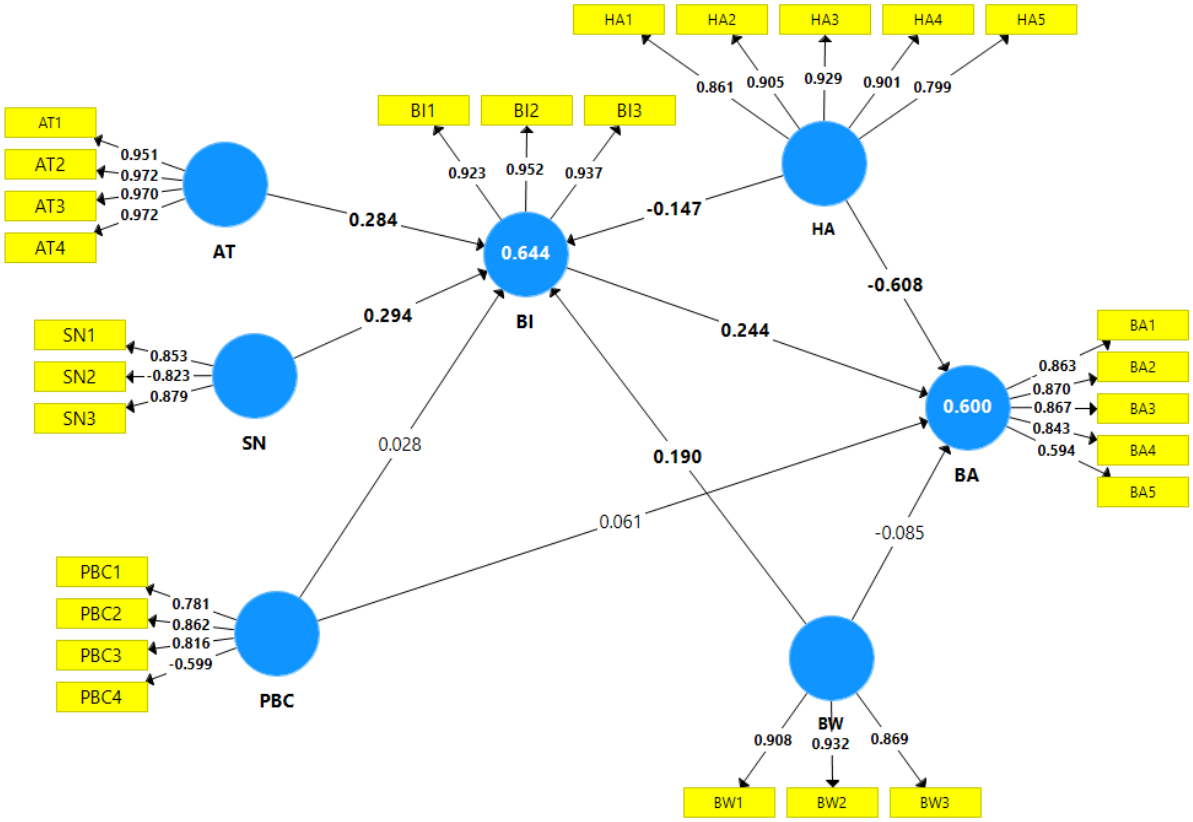

FIGURE 4 Path coefficients and outer loadings for the extended TPB measurement model.

On the other hand, habit (β =-0.608, p<.001) and behavioural intention (β =0.244, p<.001) significantly predicted road-crossing violations. However, perceived behavioural control (β =-0.061, p=0.299), behavioural willingness (β =-0.085, p=0.165) were not significant predictors of road-crossing violations. The model accounted for 64% of the variance in behavioural intention and 60% of the variance in road-crossing violations. In summary, habit, behavioural willingness, attitude, and subjective norms, were significant predictors of behavioural intention. On the other hand, habit and behavioural intention were significant predictors of road-crossing violations (see Table 9).

TABLE 9 Path coefficients Mean, Standard deviation, t-statistics, and *p*-values for the extended TPB model paths.

Path	Original Sample (β)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|β /STDEV|)	*P* Value
HA -> BA	-0.608	-0.606	0.055	11.104	0.000
HA -> BI	-0.147	-0.149	0.053	2.758	0.006
BW -> BA	-0.085	-0.079	0.061	1.392	0.165
PBC -> BI	0.028	0.026	0.05	0.566	0.572
PBC -> BA	0.061	0.06	0.058	1.039	0.299
BW -> BI	0.190	0.193	0.053	3.588	0.000
BI -> BA	0.244	0.242	0.066	3.686	0.000
AT -> BI	0.284	0.283	0.051	5.566	0.000
SN -> BI	0.294	0.292	0.051	5.776	0.000

Table 10 below summarises the standardised prediction estimates and model fit indices of the TPB model and the extended TPB model for comparison. The addition of habit and behavioural willingness, though behavioural willingness' direct effect was not statistically significant, improved the variances explained by the model from 62% to 64% for behavioural intention and from 48% to 60% for road-crossing violations.

TABLE 10 Direct and Indirect effects for the standard TPB and extended TPB models

		Standard TPB		Extended TPB	
Dependent Variable	Independent Variable	Standardised Coefficient (β)	*p-Value*	Standardised Coefficient (β)	*p-Value*
Indirect effect					
Behavioural intention	Attitude	0.337	<0.001	0.284	<0.001
	Subjective Norm	0.370	<0.001	0.294	<0.001
	Perceived Behavioural Control	0.183	<0.001	0.028	0.572
	Habit			-0.147	0.006
	Behavioural willingness			0.190	<0.001
Direct Effect					
Pedestrian violations	Behavioural intention	0.446	<0.001	0.244	<0.001
	Perceived Behavioural Control	0.320	<0.001	0.061	0.299
	Habit			-0.608	<0.001
	Behavioural Willingness			-0.085	0.165
N=341					
Model Fit Indices					
SRMR		0.095		0.082	
d_ULS		1.73		2.544	
d_G		0.611		0.846	
NFI		0.812		0.820	

4.7 Summary of the Results

The study employed the extended theory of planned behaviour model to examine behavioural intention and pedestrian violations among 344, 10-14-aged young adolescent pedestrians in Harare, Zimbabwe. The 344 valid respondents (181 males=52.6%, 163 females=47.4%) had a mean (SD) age of 12.23 (1.26) years, with 10-year-olds (14%), 11-year-olds (12.2%), 12-year-olds (27.3%), 13-year-olds (29.9%), and 14-year-olds (16.6%) among them.

The 10-12-year age group accounted for 184 (53.5%) of the total, with 97 males (52.7%) and 87 females (47.3%). The 13-14 age group accounted for 160 (46.5%) of the total, with 84 males (52.5 percent) and 76 females (47.5 %).

The study employed an extended theory of planned behaviour (TPB) based self-reporting questionnaire. Confirmatory Composite Analysis (CCA) was used to confirm the measurement model. Structural Equation Modelling (SEM) was used to analyse the structural relationship between variables. An independent t-test was used to measure associations between statistical means. ANOVAs were used to measure variation among and between groups. Pearson's correlation (r) coefficient measured the strength of relationships between variables.

Young adolescent pedestrians reported engaging in pedestrian violations. However, there were no significant mean differences ($t_{335.353}$=-4.639*, p*=.365) in road-crossing violations between 10-12-aged (mean=1.78, SD=.74) and 13-14-aged (mean=2.16, SD=.74) young adolescent pedestrians.

There were no mean differences in road-crossing violations between genders ($t_{331.322}$=2.388, *p*=.921) (males: mean=2.05, SD=.73; females: mean=1.85, SD.79).

There were statistically significant mean differences in road-crossing violations between the three household income groups (low, medium, and high) as determined by one-way ANOVA (F(2,341)=6.022, *p*=.003). Tukey's post hoc test revealed significant mean differences in pedestrian violations between young adolescent pedestrians from low-family-income (mean=1.99, SD=.75, *p*=.015) and those from medium-family-income background (mean=1.45, SD=.83). Therefore, young adolescent pedestrians from the low-family income group were more likely to engage in road-crossing violations than their counterparts from the medium family income group.

One-way ANOVAs revealed statistically significant mean differences in road-crossing violations amongst young adolescents from the three residential area groups (F(2,341)=4.435, *p*=.013). There were statistically significant mean differences between young adolescent pedestrians residing in high-density residential areas (mean=2.00, SD=.72) when compared to those living in low-density residential areas (mean=1.41, SD=.75, *p*=.010) and medium density areas (mean=1.93, SD=.83, *p*=.040), respectively. Therefore, young adolescent pedestrians residing in high-density and medium-density residential areas were more likely to engage in pedestrian violations than those from low-density residential areas.

Bivariate (Pearson's *r*) Correlation Analysis revealed significant correlations among all the extended TPB variables.

Confirmatory Composite Analysis revealed that all factor loadings highly significantly loaded onto their respective constructs except one item from subjective norm and another from perceived behavioural control. Thus, both fell short of the threshold of 0.5. However, the researcher retained the two items as the constructs had few items.

In the standard TPB model, attitude (β=0.151, $p<.001$), subjective norms (β=0.029, $p<.001$) and perceived behavioural control (β=0.081, $p<.001$) were significantly and indirectly related to road-crossing violations (total indirect effects) through the mediation of behavioural intentions. Attitude (β=0.337, $p<.001$), subjective norms (β=0.370, $p<.001$), and perceived behavioural control (β=0.183, $p<.001$) positively and significantly predicted behavioural intentions. As a result, they accounted for 62% of variances in behavioural intentions. On the other hand, behavioural intentions (β=0.446, $p<.001$) and perceived behavioural control (β=0.320, $p<.001$) positively and significantly predicted road-crossing violations, thus explaining 48% of variances in road-crossing violations.

In the extended TPB model, attitudes (β=0.069, $p=.004$), subjective norms (β=0.072, $p<.001$), habits (β=-0.036, $p=.025$), and behavioural willingness (β=0.046, $p=.008$) were significantly and indirectly related to road-crossing violations (total indirect effects) through the mediation of behavioural intentions. Attitude (β=0.284, p<.001), subjective norms (β=0.294, $p<.001$), habits (β=-0.147, $p=0.010$), and behavioural willingness (β=0.190, $p<.001$) explained 64% of the variance in behavioural intentions. On the other hand, behavioural intentions (β=0.244, $p<.001$) and habits (β=-0.608, $p<.001$) were significantly and directly related to road-crossing violations, and they explained 60% of the variance in road-crossing violations.

Comparison between the standard TPB and the extended TPB shows that the addition of variables habits and behavioural willingness (though behavioural willingness' direct effect was not statistically significant) improved the variances explained by the model from 62% to 64% for behavioural intention and 48% to 60% for road-crossing violations. Therefore, extending the TPB improved the utility to predict road-crossing violations among young adolescents in Warren Park, Harare, Zimbabwe.

CHAPTER 5

DISCUSSION

5.1 Main Findings and Comparison with Literature

The study found no significant mean differences in road-crossing violations between 13-14-aged and 10-12-aged young adolescent pedestrians. In addition, there were no significant mean differences in road-crossing violations between males and females. The findings opposed the existing studies (Tiwari et al., 2007; Rosenbloom, 2009; Elliot and Baughan, 2004).

However, young adolescent pedestrians from low-family income backgrounds were reportedly involved in road-crossing violations than those from medium-family income backgrounds. This concurred with previous studies (Sharples et al., 1990; Laflamme & Diderichsen, 2000; LaScala, Gerber & Gruenewald, 2000; Quistberg et al., 2015; Morency et al., 2012).

Also, young adolescent pedestrians from high-density and medium residential areas were more likely to engage in road-crossing violations than those from low-density residential areas. The findings concurred with previous studies (Wazana et al., 1997; Mannocci et al., 2019; Laflamme & Diderichsen, 2000).

The extended TPB model was able to explain the intentions to engage in road-crossing violations. Path analysis revealed that more positive subjective norms (β=0.294, p<.001), more positive attitude (β=0.284, p<.001), more positive behavioural willingness (β=0.190, p<.001) and negative habits (β=-0.147, p=0.010) were associated with a high intention to perform road-crossing violations. The study affirmed that all these independent variables were significant in the association with behavioural intention. The factors contributed to 64% of the variance in behavioural intentions. Behavioural intention (β=0.244, p<.001) and habit (β=-0.608, p<.001) significantly predicted road crossing violations, explaining 60% of the variances in road-crossing violations. Furthermore, the extended TPB has improved the ability to predict intention and road-crossing violations through the improvement in the variances explained. The results concur with previous studies on pedestrian violations where extended TPB models explained 56-65% of variances in intention and behaviour (Barton, et al., 2016; Holland & Hill, 2007).

Subjective norms were the highest predictor of intention. Peers and family members influenced young pedestrians to engage in road-crossing violations behaviour (Zhou et al., 2010; Peng et al., 2005). Elliot (2004) found among 11–16-year-olds that perceived pressure from friends was an essential factor in self-reported behaviours to make crossing decisions. Tolmie et al. (2006) also found peers to influence adolescents' riskier intentions and behaviour. Zhou, Horrey et al. (2009) found adolescent respondents showing greater intentions to cross in conformity situations.

Attitude has more value in explaining safe road-crossing behaviours (Jiang et al., 2017; Evans & Norman, 2003; Fruhen & Flin, 2015). Young males were prone to exhibiting negative attitudes towards traffic than females (Kelley-Baker & Romano, 2010).

Behavioural willingness increased the model's predictive capacity by its prediction of behavioural intention (Aijzen, 2011 as cited by Demir et al., 2019). Male young adolescent pedestrians were more willing to engage in pedestrian violations than young female adolescents.

Behavioural intention was a more important predictor of pedestrian violations. Many studies have revealed that intention is a crucial predictor of behaviour (Armitage & Conner, 2001; Heath & Gifford, 2002; Fishbein & Ajzen, 2010).

Habit also predicted pedestrian violations with no gender difference among the young adolescent pedestrians. It also contributed to the slight increase in the variances explained by the model. However, the habit was negatively and significantly correlated to pedestrian violations as depicted by Pearson's correlation coefficient ($r=-.740$, $N=344$, $p<.001$) and $\beta=-0.644$.

CHAPTER 6

RECOMMENDATIONS AND FUTURE RESEARCH

6.1 Practical Implications on Developing Safety Interventions

As a result, numerous earlier traffic safety studies (Elliott et al., 2005; Evans & Norman, 1998, 2003; Holland & Hill, 2007; Zhou, Wu et al., 2009; Zhou, Horrey, et al., 2009) frequently highlight the possibility to design treatments based on TPB results. The current study's findings could be utilised in road safety education for adolescents in Harare and other low-income countries. The extended TPB was found to be predictive of adolescents' road-crossing intentions, suggesting that it might be used to construct interventions to improve safer road-crossing behaviour among adolescents (Fishbein, 1993; Hardeman et al.,2002; Evans & Norman, 2003).

Schools are a focal point in a child's life. The areas around them exhibit a distinct pattern of activity for school-aged walkers, necessitating particular caution (Clifton & Kreamer-Fults, 2007 as cited in Setorwofia et al., 2020). The preparation of behavioural interventions towards reducing adolescent pedestrian violations needs to target attitudes, subjective norms, habits, and behavioural willingness. Administrators of health promotion programs will only plan and enforce strategies that positively impact adolescent pedestrians' healthy crossing behaviour if these factors are correctly identified (Sucha, 2018).

Attitudes can be addressed towards safe behaviours through focusing on internal controls (Evans and Norman, 1998). As a result, it is critical to take steps before adolescence to support the formation and maintenance of positive road safety attitudes (Harre et al., 2000)

Far more needs to be understood about peer influence, which may play a key role in prevention strategies (Pfeffer & Hunter, 2013). More research is required to determine the best ways to use peer influence to improve young people's wellbeing and the best ways to combat negative peer influence (Tome et al., 2012; Glaser et al., 2010; Simoes et al., 2006). Zhou and Horrey (2010) suggest that understanding and perhaps refocusing on some of the important factors that lead to traffic rule violations may be beneficial. Young adolescents with higher subjective norms (or adolescents in general) may receive more attention or instruction in safety education programs, making them less likely to follow the conduct of other pedestrians in breaking traffic rules and putting themselves in danger.

Habit was also a significant predictor of intention in this study, suggesting that interventions should focus on the automated actions of crossing the road in potentially dangerous situations vs using road-crossing facilities.

Understanding how reactive decisions in social settings interact with human temporal expectations may be a fruitful avenue for preventive efforts towards behavioural willingness (Lewis et al., 2018).

6.2 Limitations

There are some limitations to the research. Since road-crossing violations were self-reported in the sample, they were not naturalistic observations of road-crossing situations. Study participants often provide responses that they believe are socially appropriate (Burns, 2017; Auger et al., 2007). It is also possible that some misinterpretation of the questionnaire items occurred. However, the self-report procedure has been proved helpful in some previous studies (Hashemiparast et al., 2020; Xu et al., 2013: Moyano-Diaz, 2002). To compensate for bias, some of the items were reverse-scored.

While the theory of planned behaviour has aided behavioural scientists in health behaviour research, it has been discovered that the causal sequence from intentions to the base components should be reciprocal (Sussman & Gifford, 2018). The ability of cross-sectional research to predict outcomes is limited by the simultaneous evaluation of predictor and outcome since there is usually no evidence of a temporal relationship between the variables (Carlson & Morrison, 2009). It is impossible to build an actual cause and effect relationship without longitudinal evidence (Solem, 2015).

Not all of the items in the analysis met Cronbach's alpha and factor loadings criterion. Since some constructs had few items in the measurement instrument, the researcher did not drop some items with low factor loadings, lowering the quality of the findings. Future studies would need to have more items to avoid this limitation.

The study's data collection was restricted to one high-density residential area in Harare Metropolitan Province, which affects the results' generalisability. Due to the COVID-19 pandemic, schools were closed, which hampered the data collection process. In addition, the means of disseminating the questionnaire had to be adapted to the local context since internet access was only afforded by a minority. Because browsing websites is not included in the affordable local internet data packages provided by the mobile service providers, not all interested pupils were able to participate in the survey. To overcome this obstacle, the researcher had to enlist the help of teachers who were home-tutoring the target age group to do the survey using their mobile phones. The researcher covered the cost of internet data. As a result, only the pupils taking home lessons were able to participate in the survey.

SEM analysis of the TPB survey data was carried out in SmartPLS® SEM, a partial least squares-based method that various researchers still debate due to its infant model fit indices. Besides, the technique is mainly used in the information management domain. This places some limitations on the universal acceptance of the study’s results in the domain of behavioural science. However, the factor loadings were compared to R-studio® results, and they agreed. Future studies

would require further research into testing the method's efficacy through other widely used techniques in behavioural sciences.

Besides, the study also did not control for socio-demographic variables in the model. Future studies could focus on such areas.

The research is an initial attempt to understand the road-crossing violations among young adolescents in Harare, Zimbabwe. However, the socio-demographic characteristics and the psychological determinants of young adolescents are yet to be extensively studied in the local context. Therefore, to better understand the road-crossing behaviour of child pedestrians (especially young adolescents) in Harare, Zimbabwe, future longitudinal research is needed. Future research should seek further and convergent evidence from different local residential areas, cities, and samples (Zhou & Horrey, 2010). Furthermore, road-crossing behaviour is affected by various environmental, personal, and social factors in addition to one's country of residence (Pele et al., 2017). Therefore, to fully comprehend the interactions between road users, studies must also look at the road environment and driver behaviour.

CHAPTER 7

CONCLUSIONS

7.1 Conclusions

This study shows conclusively that young adolescent pedestrians' socio-demographic features (particularly, family income and living area) can influence their road crossing behaviour. The extended TPB is crucial in predicting determinants of health behaviour. In addition, the study contributes to the notion of planned behaviour by showing how the young adolescents' positive attitude, positive subjective norms, positive perceived behavioural control, negative habits and positive behavioural willingness influenced their intention to engage in road-crossing violations.

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APPENDIX A: Online Questionnaire Sample

Initial information note made available to the persons concerned (data subject) (e.g., by email) BEFORE the person concerned could click through the link to the questionnaire.

Dear Parent/Guardian,

I am contacting you within the framework of an academic research project, with your child's school head's permission.

As part of a survey for my Master thesis on child pedestrian road-crossing behaviours, I have drawn up an online survey. With this survey's results, we hope to understand better the *underlying behavioural risk factors on child pedestrian road-crossing behaviour in Harare, Zimbabwe.* The study requires the participation of the **10-14 aged child pedestrians** with consent and assistance from their legal guardians.

The survey takes about 10 minutes to complete. It is important to note that your answers will be treated with strict confidentiality. The data will be stored in a secure institutional server for five years. The data will only be accessed by the researcher (Admire Betera) and the UHasselt, IMOB research team members.

Thank you for taking the time to assist me in my educational endeavours.

Best regards,

Betera Admire

Consent information note that the researcher gave to the person concerned AFTER clicking through via link (i.e., the first page of the survey).

Description of the research project

Title of the research: *Evaluation of the effects of underlying risk factors on child pedestrians' road-crossing behaviour in Harare, Zimbabwe.*

Name + contact details of the researcher:

Admire Betera, +263-778495422

email: admire.betera@student.uhasselt.be

Purpose and methodology of the research:

To gain more knowledge about child pedestrian road-crossing behaviours and their socio-demographic and psychological determinants in a low-income country context. Identification of the variations in road-crossing behaviour within Harare will inform effective interventions toward reducing child pedestrian injuries along the route to school. The study is done based on an online questionnaire.

Duration needed to answer the questionnaire: about 10 minutes.

Before starting the survey, please read the information below thoroughly:

- I have read the above information about this study (e.g., research objective).
- I understand the purpose of this research and what is expected of me during this research.
- I understand that I will sign for consent and assist my child to complete the online survey.
- I understand that my participation in this study is voluntary and that I have the right to discontinue my participation at any time during the intake (by closing the browser window). I do not have to give a reason for this, and I know that no disadvantage can arise for me.
- I understand that the research results may be used for scientific purposes and may be published in an aggregated form. No identifying information will be stored or published, and my data's confidentiality is guaranteed at every stage of the research.
- I am aware that the research data will be kept for five years and deleted after this period.
- For questions, I know I can contact after my participation: Admire Betera (admire.betera@student.uhasselt.be; WhatsApp +263-778 495 422).
- For any complaints or other concerns regarding the processing of data, I can contact the UHasselt data protection officer: dpo@uhasselt.be
- For more information about exercising my rights or submitting a complaint, please see our Privacy statement.
- I have read and understood the above information and received answers to all my questions regarding this study.
- By clicking on 'I agree to participate in this study/project and agree that the data/answers related to my child's road crossing behaviour will be registered', it indicates that I am the legal guardian of the participant and allow him or her to take part in this research.
- I have read this consent form or have had it read to me; my questions have been answered to my satisfaction, and I voluntarily agree that I will help my child participate in this research study.

- 'I agree to participate in this study/project and that the data/answers related to my child's road crossing behaviour will be registered.'

Section A: Socio-demographic Characteristics

1. Please indicate your age: …….

2. Please indicate your gender

- Male (1)
- Female (2)

3. What is your father's highest qualification?

- No formal qualifications (1)
- Primary school (2)
- Secondary School (3)
- Technical and Vocational Education and Training (4)
- University degree (5)
- PhD (6)

4. What is your mother's highest qualification?

- No formal qualifications (1)
- Primary school (2)
- Secondary School (3)
- Technical and Vocational Education and Training (4)
- University degree (5)
- PhD (6)

5. Father's Employment status

- Unemployed
- Employed
- Self-employed
- Retired

6. Mother's Employment status

- Unemployed
- Employed
- Self-employed
- Retired

7. Household Income per year USD (before tax)

- Up to $1 000 (1)
- $1 100- $2 000 (2)
- $2 100-$3 000 (3)
- $3 100-$4 000 (4)
- $4 100 -$5 000 (5)
- $5 100-$6 000 (6)
- $6 100 or more (7)

8. Living area

Definition: Residential suburbs are classified based on the income levels and sizes of residential stands in the area.

High-density residential suburb or low-income housing has stands of sizes 70-290m^2.

Medium-density residential suburb or medium-income housing has stands of sizes 300-790m^2.

Low-density residential suburb or high-income housing has stands of sizes 800-2000m^2.

- High-density residential suburb
- Medium-density residential suburb
- Low-density residential suburb

9. Have you, as a child pedestrian ever been involved in an accident on the roads where anyone (you or someone else) was injured?

- No, never (1)
- Once (2)
- More than once (3)

Section B: Self-reported behaviour

Definition

Pedestrian violations occur when a pedestrian crosses a roadway where traffic regulations do not permit doing so. Exemplary behaviours include:

Not using a nearby pedestrian crosswalk to cross the road and crossing the street even though the pedestrian light is red (Demir, Ozkan & Demir, 2019; Reason et al., 1990; Deb et al., 2017).

10. Pedestrian violations (general)

Over the last three months, how often did you engage in pedestrian violations?

- Never
- Rarely
- Sometimes
- Often
- Always

11. Pedestrian violations (specific)

Over the last three months, how often did you…

11a. Cross outside the zebra crossing even though there was one nearby.

- Never
- Rarely
- Sometimes
- Often
- Always

11b. Cross the street even though the pedestrian light was red.

- Never
- Rarely
- Sometimes
- Often
- Always

11c. Cross the street even though the light was still green for vehicles.

- Never
- Rarely
- Sometimes
- Often
- Always

11d. Cross the street at an authorised person crossing before a school warden or police officer signalled cars to stop.

- Never
- Rarely
- Sometimes
- Often
- Always

Section C: Psychological Characteristics

Target behaviour*: Engaging in pedestrian violations.*

12. Behavioural Intention

Over the next five weeks…

12a. I expect to engage in pedestrian violations.

- Strongly disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly agree

12b. I will likely engage in pedestrian violations.

- Strongly disagree
- Disagree
- Neither Agree nor Disagree

- Agree
- Strongly agree

12c. There is a chance that I will engage in pedestrian violations.
- Strongly disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly agree

13. Behavioural Willingness

13a. "Suppose you are late for school, and you need to cross the street." How willing are you to engage in pedestrian violations?
- Very unwilling
- Unwilling
- Neither Willing nor Unwilling
- Willing
- Very willing

13b. "Suppose you are in a hurry to meet a friend on the other side of the road." How willing are you to engage in pedestrian violations?
- Very unwilling
- Unwilling
- Neither Willing nor Unwilling
- Willing
- Very willing

13c. "Imagine another pedestrian of your age is engaging in pedestrian violations." To what extent would you be willing to engage in pedestrian violations too?
- Very unwilling
- Unwilling
- Neither Willing nor Unwilling
- Willing
- Very willing

14. Habit

Engaging in pedestrian violations is something…

14a. I frequently do.
- Strongly Agree
- Agree
- Neither Agree nor Disagree
- Disagree
- Strongly Disagree

14b. I do automatically.
- Strongly Agree
- Agree
- Neither Agree nor Disagree
- Disagree
- Strongly Disagree

14c. I do without having to remember consciously.
- Strongly Agree
- Agree
- Neither Agree nor Disagree
- Disagree
- Strongly Disagree

14d. I do without thinking.
- Strongly Agree
- Agree
- Neither Agree nor Disagree
- Disagree

- Strongly Disagree

14e. I would find hard not to do.

- Strongly Agree
- Agree
- Neither Agree nor Disagree
- Disagree
- Strongly Disagree

15. Attitudes

"For me, to engage in pedestrian violations would be…"

15a…

- Very negative
- Negative
- Neither positive nor negative
- Positive
- Very positive

15b…

- Very foolish
- Foolish
- Neither foolish nor wise
- Wise
- Very wise

15c…

- Very bad
- Bad
- Neither good nor bad
- Good
- Very good

15d…

- Very unpleasant
- Unpleasant
- Neither pleasant nor unpleasant
- Pleasant
- Very pleasant

16. Subjective Norms

16a. My close friends do not bother me engaging in pedestrian violations.

- Strongly disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly agree

16b. Most people who are important to me think that I …engage in pedestrian violations.

- Strongly should
- Should
- Neither should nor should not
- Should not
- Strongly should not

16c. It is expected of me that I engage in pedestrian violations.

- Strongly disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly agree

17. Perceived Behavioural Control

Self-efficacy

17a. If you are late for school and would need to cross the street, for you to avoid engaging in pedestrian violations would be…

- Very Easy
- Easy
- Neither Easy nor Difficult
- Difficult
- Very Difficult

17b. If other pedestrians of my age are engaging in pedestrian violations, for me to avoid pedestrian violations would be…

- Very Easy
- Easy
- Neither Easy nor Difficult
- Difficult
- Very Difficult

Controllability

17c. The decision to engage in pedestrian violations is beyond my control.

- Strongly disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly agree

17d. Whether I engage in pedestrian violations or not, it is entirely up to me.

- Strongly disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly agree

Thank you for your participation!

APPENDIX B: Factors and corresponding measures

Factor	Measure items
Road-crossing violation behaviour (BA)	BA1 Over the last three months, how often did you engage in pedestrian violations?
	BA2 Over the last three months, how often did you cross outside the zebra crossing even though there was one nearby?
	BA3 Over the last three months, how often did you cross the street even though the pedestrian light was red?
	BA4 Over the last three months, how often did you cross the street even though the light was still green for vehicles?
	BA5 Over the last three months, how often did you cross the street at an authorised person crossing before a school warden or police officer signalled cars to stop?
Road-crossing violation Intention (BI)	BI1 Over the next five weeks I expect to engage in pedestrian violations.
	BI2 Over the next five week I will likely engage in pedestrian violations.
	BI3 Over the next five week there is a chance that I will engage in pedestrian violations.
Behavioural Willingness (BW)	BW1 "Suppose you are late for school, and you need to cross the street." How willing are you to engage in pedestrian violations?
	BW2 "Suppose you are in a hurry to meet a friend on the other side of the road." How willing are you to engage in pedestrian violations?
	BW3 "Imagine another pedestrian of your age is engaging in pedestrian violations." To what extent would you be willing to engage in pedestrian violations too?
Habit (HA)	HA1 Engaging in pedestrian violations is something I frequently do
	HA2 Engaging in pedestrian violations is something I do automatically
	HA3 Engaging in pedestrian violations is something I do without having to remember consciously
	HA4 Engaging in pedestrian violations is something I do without thinking.
	HA5 Engaging in pedestrian violations is something I would find hard not to do
Behaviour Attitude (AT)	AT1 For me, to engage in pedestrian violations would be (very positive-very negative)
	AT2 For me, to engage in pedestrian violations would be (very foolish-very wise)
	AT3 For me, to engage in pedestrian violations would be (very bad-very good)
	AT4 For me, to engage in pedestrian violations would be (very unpleasant-very pleasant)
Subjective Norm (SN)	SN1 My close friends do not bother me engaging in pedestrian violations
	SN2 Most people who are important to me think that I …engage in pedestrian violations.
	SN3 It is expected of me that I engage in pedestrian violations.
Perceived Behavioural Control (PBC)	PBC1 If you are late for school and would need to cross the street, for you to avoid engaging in pedestrian violations would be…
	PBC2 If other pedestrians of my age are engaging in pedestrian violations, for me to avoid pedestrian violations would be…
	PBC3 The decision to engage in pedestrian violations is beyond my control.
	PBC4 Whether I engage in pedestrian violations or not, it is entirely up to me.