



Understanding the factors influencing active mobility of teenagers through their school travel behavior in Aguascalientes, Mexico.

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STATEMENT OF AUTHENTICITY

This thesis contains no material which has been accepted for the award of any other degree or diploma in any institution and to the best of my knowledge and belief, the research contains no material previously published or written by another person, except where due reference has been made in the text of the thesis.

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ABSTRACT

In the attempt to improve the health and well-being of societies, many studies have been carried out to understand active mobility as a healthy and emission-free alternative transport mode. It is recognized that active mobility benefits health and could potentially reverse the trend of physically inactive lifestyles as well as the use of private vehicles. In this sense, policymakers and planners have implemented regulations and programs aimed to discourage the use of private vehicles and to promote active modes.

However, every day 500 children and tens of thousands of people die in the world due to traffic accidents, 92% of them occur in low- and middle-income countries (ITDP, 2018). In addition, in 2012, air pollution was the cause of the death of 3 million people and 169,250 children under the age of five (WHO, 2016). Despite the benefits of active mobility, statistics show that commuters who use active modes face barriers that can even cost their lives, specifically in low- and middle-income countries. Therefore, these drawbacks should be considered and addressed when promoting active modes.

In this sense, several programs focus on active school travel of children. By improving street design, reducing traffic speed and creating traffic-free zones around schools, these programs seek to encourage children to walk and cycle to school, while trying to discourage car travel on short distances. However, little research focuses on school travel behavior of teenagers (Emond & Handy, 2011) and little survey data has been collected directly from this target population (Kamargianni & Polydoropoulou, 2013).

This thesis contributes to the aim of closing of both gaps, understanding the factors associated with active mobility of teenagers focusing on their school travel behavior, through the analysis of data collected directly from adolescents of seven schools in Aguascalientes, Mexico. Quantitative research was conducted to collect primary data from 1,075 teenagers aged from 12 to 18 years gathered through an online survey. In addition, qualitative research was conducted with two focus groups in order to gain a deeper understanding of the results obtained through the online survey.

To analyze the data, cross-tabulations were selected to describe the variables and findings of the survey. In addition, chi-square tests were used to determine whether there is a significant relationship between the variables analyzed. After testing the significance of the relationships between the variables, Cramer's V association test was used to investigate the strength and type of the relationships. Finally, outcomes from focus groups were used to interpret the results from the data analysis and avoid own subjective interpretations.

The main outcomes of the analysis were not as initially expected. The present study did not show a significant association between distance and active school travel mode choice. Regarding the household characteristics, the analysis showed that the parental education level behaves in the opposite way than shown in previous research. Hence, the students whose parents have a lower education level are more willing to have an active school travel than the ones whose parents have higher levels of education.

In addition, the analysis showed that students claim to be more willing to cycle to school because it is good for the environment and health. Moreover, they would also cycle to school because it is free, fun and in order to be fit. Regarding the individual characteristics, the age variable had a moderate association with active school travel. Younger commuters tend to choose active modes

more than older ones. This behavior is the opposite to the research findings conducted with children, but similar to the travel behavior of adults.

The analysis showed that there was no association neither between the driver's license or permit ownership nor the bike ownership with school travel mode choice. By contrast, car ownership at home was proved to be moderately associated to school travel mode choice. Therefore, students who do not own a car at home were more inclined to choose active modes than the ones who own at least one car in the household. Furthermore, it was shown that students attending in morning schedules tend to prefer active commuting to school more than students attending in the afternoon.

With respect to the presumed results of the present study, it was demonstrated that even though most of students consider security and safety to be important when choosing their school travel mode, those variables have only a weak association with active school travel.

Until today, school travel is unavoidable. Specifically, the school system in Aguascalientes is mostly based on face-to-face teaching. Therefore, it can be seen as an opportunity to encourage active mobility among students. A transport mode that could not only benefit the environment but could also be a solution for traffic congestion in cities and a way to promote more active lifestyles among the target population.

However, in order to promote this emission-free transport mode, several issues must be addressed in advance, such as guaranteeing that students will arrive safely at their destinations. Therefore, policies and programs addressing road safety are definitely needed. However, the analysis showed that programs aiming at encouraging active school travel through addressing road safety focused on children, may not be applicable for adolescents. Therefore, understanding the adolescent target population, their needs and factors that influence active school travel could help to develop more effective programs for the promotion of active school travel among adolescents.

Keywords

Active mobility, teenagers, mode choice, school travel behavior, active school travel.

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LIST OF ABBREVIATIONS

BCC - Brisbane City Council

CICC - Comisión Intersecretarial de Cambio Climático

CMOV - Mobility Coordination of the State of Aguascalientes

COTEDUVI - Código de Ordenamiento Territorial, Desarrollo Urbano y Vivienda para el Estado de Aguascalientes

GHG - Greenhouse gas

IBD - Instituto Belizario Dominguez

IEA - Instituto de Educación de Aguascalientes

IMPLAN – Instituto Municipal de Planeación

INEE - Instituto Nacional para la evaluación de la Educación

INEGI - National Institute of Statistics and Geography

IMJUVE - Mexican Youth Institute

ITDP - Institute for Transportation and Development Policy

LGSV - Ley general de Seguridad Vial

NC - National Center for Safe Routes to School

NUA - New Urban Agenda

ONL - Observatorio Nacional de Lesiones

SEGGOB - Gobierno del Estado de Aguascalientes

SEP - Secretaria de Educación Pública

SMP - State Mobility Program

SuM4All - Sustainable Mobility for All

UN - United Nations

UNICEF - United Nations International Children’s Emergency Fund

WHO - World Health Organization

WRI - World Resources Institute

INTRODUCTION

1.1 OVERVIEW

In the attempt to improve the health and well-being of societies, many studies have been carried out to understand active transportation as a healthy and emission-free alternative transport mode. It is recognized that active transportation benefits health and could potentially reverse the trend of physically inactive lifestyles (Sallis et al., 2004; Shepard, 2008). Specifically, active commuting to school has been identified as an option to reverse the trend of increasing childhood obesity, and to implement a habit of an active lifestyle to be sustained in adolescence and adulthood early on (Tudor-Locke et al., 2012). Furthermore, findings of other research on active mobility suggests that it could reverse the use of private vehicles (Li & Kamargianni, 2018), which is usually associated with air pollution, noise pollution, traffic congestion, parking problems, and climate change (SuM4All, 2017).

Therefore, policymakers and planners in many cities have implemented regulations and programs aimed to discourage the use of private vehicles and promote active modes (ITDP, 2012; UN, 2017; IBD, 2017; SEGOB, 2018). Specifically, in order to promote active school travel, several cities have implemented programs such as KidsWalk-to-School, aimed at encouraging care takers to walk children to school (McDonald N., 2007); Walking school buses, aimed to encourage parents to escort kids to school by foot or bike from a meeting point or bus stop (Tudor-Locke et al., 2012); and Safe Routes to school, launched in 2005 by the federal transportation bill of United States, aimed at boosting walking and cycling to school for children, making it safer and more attractive transportation mode (McDonald N. et al, 2013).

Moreover, many studies in recent years have been done in school travel mode choice of children through parental travel behavior (Kamargianni & Polydoropoulou, 2013); however, little research focused in school travel behaviors of teenagers (Emond & Handy, 2011) and little survey data has been collected directly from this target population (Kamargianni & Polydoropoulou, 2013). This thesis aims to fill both gaps, to understand the factors associated with active mobility of teenagers through their school travel behavior, analyzing the data collected directly from adolescents of seven schools in Aguascalientes, Mexico.

Because transportation, health and environmental professionals use different terminology for similar concepts or same terminology for different concepts, it is necessary to clarify terms in this work. "Active mobility" (Shepard, 2008; Mitra, 2013) is defined as walking, cycling and any other transport mode driven by the physical activity of the human beings. It is also named as "Active commuting" (McDonald, 2007; Tudor-Locke et al., 2012; J.G. Su et al., 2013), "Active transportation" (McDonald, 2007; Buliung, 2017; J.G. Su et al., 2013), "Active Transport" (J.G. Su et al., 2013; Kamargianni & Polydoropoulou, 2013; Curtis et al., 2015), "Active travel" (Emond & Handy, 2011; J.G. Su et al., 2013; Curtis et al., 2015; Ding et al., 2017), and "non-motorized transport" (Ding et al., 2017).

In this research the target population of teenagers are defined as young people aged 12 to 18 years, enrolled and attending school. Furthermore, this research focuses on the analysis of their school travel behavior. A behavior is, by definition, the way in which something functions or operate, therefore, school travel behavior in this thesis is defined as the way in which trips to and

from school behaviors. Moreover, active school travel or active school commuting is understood as the trips to and from school by non-motorized transport modes.

In summary, researchers have studied the impact of walking and cycling from the point of view of transportation and health. Policy makers and practitioners have adopted the concept as well and promote it. However, to encourage young teenagers to commute by foot or bicycle some factors must be considered in advance. It is crucial to understand why people choose a specific transport mode, what are the main constraints for them to commute by non-motorized transport, what are the factors that promote these transport modes and the willingness of people to commute by active modes.

1.2 RESEARCH STRUCTURE

This thesis is organized as follows (Figure 1), the first section presents the problem statement, aims, objectives and overview of the research carried out. In the second section, existing literature and policies that influence active mobility are reviewed. The third section describes the methodologies used and how they are appropriate to solve the objectives of this research. The fourth section presents the descriptive analysis, findings and interpretation of results obtained through the methodologies. The fifth section comprises the discussion comparing the findings from the previous literature, current and future policies research and findings from the methodology and analysis of this work. Finally, the last section provides recommendations and conclusions.

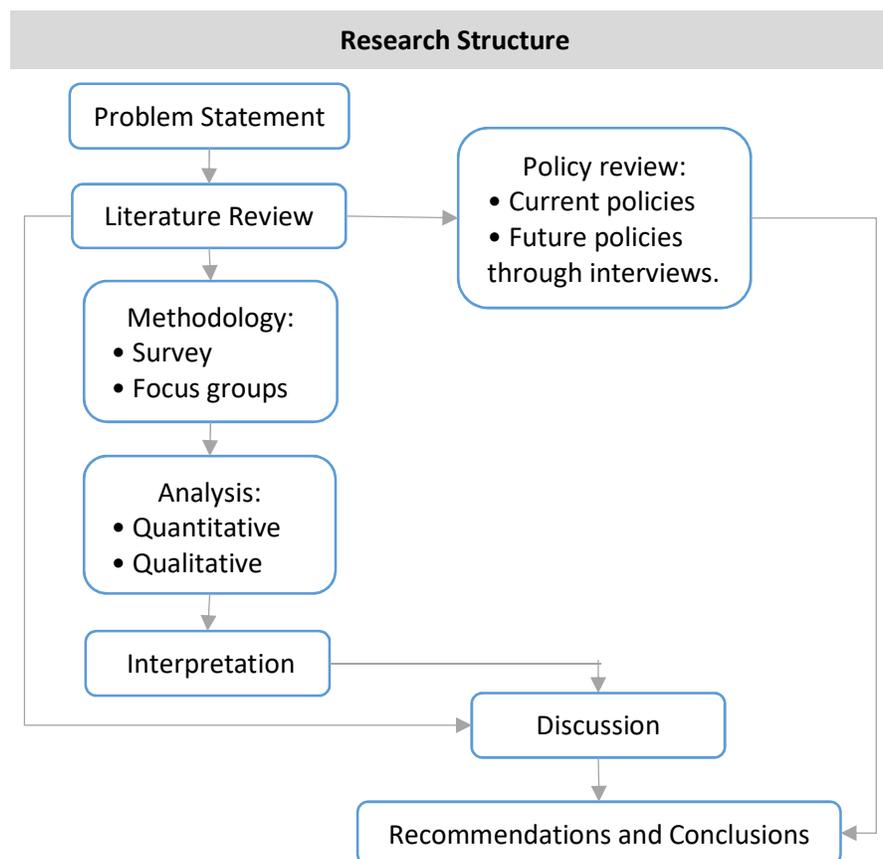


Figure 1: Research structure. Source: Own elaboration.

1.3 PROBLEM STATEMENT

According to the Global Mobility Report (SuM4All, 2017), the design of car-centered transport systems and the high car-dependence worldwide trend have caused problems such as road congestions, traffic-related deaths and accidents, greenhouse gas (GHG) emissions as well as contributing to the high levels of air and noise pollution. Particularly, private cars account for 75% of the passenger mobility worldwide.

Moreover, according to the Institute for Transportation and Development Policy (ITDP, 2018), 92% of traffic incidents that kill 500 children and injure tens of thousands of people daily in the world, occur in low- and middle-income countries. In addition, in 2012, air pollution was the cause of the death of 3 million people and 169,250 children under age of five; of which 87% occurred also in low- and middle-income countries (WHO, 2016).

In addition, according to the World Health Organization (WHO, 2017), one in ten children and adolescents between 5 and 18 years old are overweight or obese. A phenomenon that, studies have linked to the decrease of active school travel (Emond & Handy, 2011). Consequently, policy makers have implemented regulations and programs aimed at promoting active mobility as alternative transport mode beneficial to health and the environment.

Specifically, Mexico generates 1.68% of total global greenhouse gas emissions, which makes it the tenth country with the highest number of emissions (CICC, 2012). Particularly, the transport sector represents 20.4% of national emissions, of which 16.2% are generated mostly by the use of individual motorized transport (UN-HABITAT, 2014). Furthermore, Mexico ranks first in childhood obesity and the second in adult obesity (UNICEF, s.f.). Therefore, active mobility is also gaining popularity among policymakers and practitioners in this country as an alternative to address the previous issues.

However, regarding school travel in Mexico, most children and young people already walk daily to and from school (ITDP, 2018). In 2015, around 57% of children and young people aged 3 to 18 years enrolled in an educational institution, commuted by foot. In this sense, nationwide, the most common choice in this age range is walking. Nonetheless, according to the ITDP (2018), most Mexican cities have been designed prioritizing motorized transport and encouraging high speeds, placing pedestrians at risk, specifically children and young people. Hence, traffic accidents are the first cause of death of children between 5 and 9 years old and the second most common cause of death among young people aged 10 to 20 years nationwide.

In summary, active mobility, is being considered as an alternative to reverse the trend of the use of private vehicles, while at the same time benefiting health of the travelers and the environment. However, statistics show that active commuters face barriers that can even cost them their lives, specifically in low- and middle-income countries. Therefore, it is evident that there are not universal problems and solutions but rather that they must be studied in specific contexts.

1.4 AIMS

This thesis aims to understand the factors associated with the active mobility of teenagers, focusing on their school travel behavior. Moreover, it seeks to understand how previous research is applicable to this target population in the context of the city of Aguascalientes, Mexico, and to analyze how current and future mobility policies and programs address the issue.

1.5 OBJECTIVES

The first objective is to review the angles used by researchers to explain active transportation in general and active school travel in particular. The second objective is to review the policies on active transport at the international, national, state and municipal levels of Aguascalientes, Mexico. The third objective is to identify the factors influencing active school travel of teenagers in Aguascalientes, Mexico, to contrast them with the previous literature and policy review.

1.6 RESEARCH QUESTION AND HYPOTHESIS

The research questions are:

- What are the factors influencing active school travel of teenagers in Aguascalientes City?
- Are the current policies addressing the right issues to promote active modes of teenagers in Aguascalientes City?

The initial hypothesis is that several factors, including psychological ones such as perceived safety (in terms of traffic accidents) and perceived insecurity (in terms of crime) influence teenagers' choices of active modes. Presumed results are:

- Perceived insecurity and perceived lack of road safety are the main barriers for teenagers to choose active modes.
- Greater perceived distance from home to school influences negatively the preference of active modes.
- The lack of bicycle ownership and the low ability to ride a bicycle have a negative impact on the preference of active modes.
- The ownership of driver licenses or driving permits discourage teenagers from choosing active modes.
- Higher education levels of parents influence positively the preference of active modes.
- The lack of infrastructure for active mobility discourage teenagers from selecting active modes.

1.7 METHODOLOGY

In the attempt to answer the research questions of this thesis, primary and secondary research is used.

First, in the course of the secondary research, this thesis reviews the literature of active mobility in general and specifically the active school travel of children and teenagers and the different perspectives used by researchers, to gain the current understanding of this topic. In addition, policies related to both active mobility and school travel are reviewed.

Second, in the attempt to complement the secondary research, primary research is conducted. The quantitative research contains the collection of primary data from 1,075 teenagers aged 12 to 18 years gathered through an online survey. It is aimed to obtain the factors influencing active school travel of teenagers from two secondary schools and three upper medium level schools in the city of Aguascalientes, Mexico.

The qualitative research consists of the analysis of two focus groups aimed at gaining a deeper understanding of the results obtained through the online survey. The selection criteria of these groups were teenagers commuting to or from school by non-motorized modes.

LITERATURE REVIEW

2.1 OVERVIEW

Active mobility has been studied from different angles such as transportation and health. From the perspective of health, active mobility has been studied to address inactive lifestyles and related to obesity and cardiovascular diseases. Especially many studies have been carried out to analyze the benefits of active school travel in children. According to James Sallis (2004), one of the major public health problems are the physical inactive lifestyles; therefore, many studies have been carried out from this angle.

In addition, active mobility has been studied from the transportation viewpoint, as a way to address transport-related problems, such as car dependence, traffic congestion, greenhouse emissions, air and noise pollution (Ding et al., 2017) and traffic-related pedestrian injuries (Sallis, 2004).

2.2 ACTIVE SCHOOL TRAVEL

It is undeniable that walking in any amount and at any pace, results in an expenditure of energy. In this sense, this active mode is considered the most common weight-bearing activity and a form of weight control (Morris & Hardman, 1997). According to Morris & Hardman (1997), who studied the benefits of walking from a medical perspective, fast walking under medical control tests, can improve fitness and cardiac performance. Moreover, they state that all forms of energy expenditure can influence bodyweight, therefore, a more active lifestyle can regulate bodyweight without the necessary intensity of exercise to improve physical condition. Although their results correspond to women and men in general, similar results have been obtained with children and youth (Faulkner et al. 2009; Shepard, 2008). In this sense, Faulkner et al. (2009) estimated that young people who traveled daily by motorized means risk yearly weight gains of 0.91 to 1.36 kilograms.

Studies focused on children have found that active school travel contributes to a considerable portion of their physical activity, which in turn is associated with greater amounts of energy expenditure (McDonald, 2007). Noreen C. McDonald (2007) studied active school travels of children in the U.S. from 1969 to 2001, demonstrating that walking and cycling to school has decreased considerably, which translates into a great loss of daily physical activity for young people. The author states that the decrease in the active school travel was shown during the same period in which the rates of overweight children and adolescents increased rapidly. However, the relationship between them was not investigated and was left to future research. Nonetheless, a study with 114 children in England, aimed to analyze whether children who walk to school were more physically active, showed that only boys who walked to school were more active after classes than children commuting by car. The results were not potentially important for the girls, but the author argued that further analysis was necessary (Cooper, 2003).

Lubans et al. (2011) analyzed seven electronic databases with studies from 1980 to 2009, with the purpose of analyzing the relationship between active school travel and health-related fitness among young people. The study showed that active school transport was positively associated with cardiorespiratory fitness in youth. Whereas, evidence of the relationship between active

school commuting with muscular fitness or flexibility, was incorrect or limited by low study numbers.

Tudor-Locke et al. (2012) argued that active commuting to school not only benefits health but can also establish in childhood an early habit of active lifestyle that can be maintained in adolescence and adult life. Furthermore, they indicated that the patterns of physical activity throughout life are assumed to be established when we are children. Although, more research is needed to verify that active commuting to school behavior is maintained during adolescence and adulthood (Tudor-Locke et al., 2012); Through the analysis of a cross-sectional and a prospective study, the authors argued that inactive behaviors are related to obesity in children.

Even though there are relative benefits of active school travel for children, before promoting it openly, it is important to consider additional restrictions (Tudor-Locke et al., 2012). According to the authors, pedestrian safety, air pollution, crime, the availability of adequate infrastructure for active transportation to school, and the design of the school and neighborhood are important factors that must be weighed carefully against the relative benefits above.

On the other hand, considering that school travel by any means is unavoidable, it should be seen as an opportunity to obtain the aforementioned benefits of the physical activity that provides an active commuting (Tudor-Locke et al., 2012). In this sense, according to the authors, campaigns and programs such as “Safe Routes to School” and “Walking School Buses” are already addressing some of these issues. Through pushing to improve street design, reduce traffic speed and create traffic-free zones around schools (approximately 2 blocks), Safe Route to School program seeks to encourage children to walk and cycle to school, while trying to discourage car travel on short trips. In addition, Walking School Buses is a volunteer program where parents walk or cycle to school with a small group of children from a specific meeting point, usually a bus stop. According to the authors, this last program can potentially influence not only the physical activity of children but also the role model of parents.

Additional research suggests that programs addressing road safety such as Safe Route to School can encourage children to actively commute to school (McDonald, 2007; Curtis et al., 2015). However, most of the studies focuses on the factors that encourages or prevents active school travel. Therefore, more research is needed to measure the impact of active school travel on the environment and the impact of the previous programs on road safety.

Nonetheless, this research is based on the premise that active school travel can have a positive impact on health and the environment. Therefore, understanding the factors that explains that teenagers are willing or not to walk or cycle to school could contribute to the development of effective interventions to increase active school travel behaviors.

2.3 DRIVERS FOR ACTIVE SCHOOL TRAVEL

Distance to school is a crucial factor in determining mode of transport (Black et al., 2001). In this sense, several studies show that greater travel distances, both real and perceived, have been a great discouragement for children and youth to choose active modes to commute to school. For instance, a study in Ireland, with 4,013 adolescents aged from 15 to 17 years, showed that perceived distance is a major obstacle to active school travel and a predictive factor of mode choice among teenagers (Nelson et al. 2008). The further away a teenager lived from school, the less likely they chose an active mode to commute to school. The study revealed that the most of

active commuters lived at a distance of 4.02 km from school, therefore, this was the distance considered achievable by active modes.

Similarly, a study with students at Davis Senior High School in California in 2009, aimed to determine the factors influencing teenagers to cycle to high school, showed that perceived distance and having to cross a highway can be physical or psychological impediments for adolescents to cycle to school (Emond C. & Handy S., 2011). This investigation analyzed both perceived and actual distances, defining the short trip as a maximum distance from home to school of 2.5 miles (4.0 km). As a result, it was demonstrated that the perception of distance, even more than the actual distance, is an important determining factor to cycle to school. Hence, if a student perceives that he or she lives far from school, then they are less likely to cycle to school. On the other hand, the studies showed that parental encouragement tends to impact positively on cycling to school of teenagers (Emond C. & Handy S., 2011; Kamargianni & Polydoropoulou, 2013).

A study in Cyprus (Kamargianni & Polydoropoulou, 2013) showed, through a hybrid choice model, that travel time and travel costs influence school travel mode behavior of adolescents, the same way as it does in the behavior of adults. In this sense, participants from high income households were less willing to choose a non-motorized transport mode. Apart from that, teenagers preferred walking and cycling when infrastructure for active transport was available, such as bicycle paths and parking spaces for bicycles. In addition to the obvious availability of opportunities and resources, the authors analyzed that attitudes of teenagers, such as their willingness to walk or cycle to school, had a positive influence on the choice of these transport modes.

In addition, factors such as grades of students and level of education of their parents were analyzed. The results showed that students with higher grades were more willing to choose non-motorized transport than students with lower grades. Furthermore, students whose parents had higher education levels, bachelor's degree for the mother and master's for the father, were more willing to walk and cycle to school. Similar results were obtained by Emond & Handy (2011) in California.

In 2013, Raktim Mitra studied forty-two empirical studies focusing on young people from ≤ 13 to < 18 years old, in order to explore the existing evidence on school travel behavior. Half of the studies used a theoretical approach in understanding school travel. Five of them used an activity-trip approach to understand the relationships between parental travel and school travel behaviors. Three of them, focused mainly on the relationship between the built environment and, specifically, the active commuting to school of children. Most of the studies used logistic regression or the discrete choice models to explore school travel mode choice behavior.

The author shows that household attitudes and beliefs are likely associated with school travel mode choice. The convenience and social acceptance perceived by caregivers of taking children to school in a private vehicle was associated with the choice of this transport mode. On the other hand, environmental awareness, parental perception of having more physically active children and skilled in terms of road safety, were factors that increased the likelihood of walking. Furthermore, parents who supported active mobility and / or were aware of its importance, preferred active travel to school.

Interestingly, the study showed that age was strongly associated with the probability to actively commute to school, therefore, travel behavior of a child can differ from the travel behavior of an adolescent (Mitra, 2013). The author suggested that this "age-effect" is possibly related to the

physical and intellectual progress of children and adolescents as independent travelers. However, more research is needed to understand the difference between escort and independent travel.

Similar to most of studies, Raktim Mitra (2013) shows that the characteristics of the built environment, specifically travel distance to school, are associated with active commuting to school. Furthermore, parental concerns about pedestrian safety has a negative impact on the probability of active mode choice.

According to the author, travel behavior of adults, specifically active travel behavior, has been deeply analyzed. However, little research has been carried out to understand children and youth travel behaviors. In this sense, this thesis aims to contribute to fill this gap, through the analysis of school travel behavior of teenagers, to understand the factors that influence active commuting to school on this target population.

More recent research shows that automobile dependence and traffic-related challenges are generating attention on active mobility in developing countries (Ding et al., 2017). A hybrid choice model in China (Ding et al., 2017), was aimed to exploring the influence of attitudes to active commuting, in order to consider both the commonly used mode choice theory and the indirect effect of social factors. Although this study does not focus specifically on active school travel, but on active travel in general, it is a study conducted in a developing country that can help explore different outcomes.

The data collected in this study was through a survey of 2941 respondents aged <35 to >55 years in Zhenjiang city in 2015 (Ding et al., 2017). The survey design combined individual and household characteristics as well as attitudes towards active commuting. The study shows that attitude toward walk or cycle plays a significant role on active mode choice. Furthermore, age played an important role on the mode choice of active modes. In this sense, younger and older commuters are more willing to walk or cycle than middle-aged travelers. Moreover, characteristics such as bike ownership and driver licenses were important encouragers or barriers to active mode choice.

Although, Ding et al. (2017) showed that younger travelers may be more likely to choose active modes, the authors did not analyze variables such as pedestrian safety or security, which in this thesis is considered important for studies conducted in developing countries.

In summary, literature suggests that active mobility, specifically active school travel is related to health benefits due to the physical activity that provides. Furthermore, some relationships have been done to study active mobility to address traffic-related problems. However, most of studies focus on children rather than teenagers and the information is collected from adults, usually their care givers. In this sense, little research focuses on teenagers or collects data directly from the target population, a gap that this thesis aims to address.

2.4 MODE CHOICE

Active mobility is by definition a transport mode, therefore, in order to understand the factors associated with active mobility, it is important to understand mode choice, why people choose a particular mode of transport. Mode choice has been studied for decades as the third factor of the transportation forecasting model beside trip generation, and trip distribution. Right after studying what encourages people to move from one place to another and determine the trip distribution, transport planners have analyzed the mode choice to foresee users' decisions. In this sense, several approaches have been used to analyze mode choice, many of them are based on the analysis of the "built environment" (Erwin & Cervero, 2001; Saelens et al., 2003).

After reviewing this literature, it is obvious that the urban form and the built environment are real undeniable physical barriers or promoters to encourage active modes. However, these traditional mode choice model neglect a more complex process that involves the behavior of users (Kamargianni & Polydoropoulou, 2013). Therefore, a framework that includes the analysis of the behavior of students, perception of road safety and security, and willingness to use active modes for school travel is needed.

2.4.1 THEORY OF PLANNED BEHAVIOR

The theory of the planned behavior (Figure 2) is designed to predict and explain human behavior in specific contexts (Ajzen, 1991), therefore, it has been used to analyze mode choice (Bamberg et al., 2003). According to Ajzen (1991, p. 181), “the stronger the intention to engage in a behavior, the more likely should be its performance”, however this will happen only if they are under “control”, meaning that the person can freely decide to perform or not the behavior. Furthermore, a behavior is under control when it does not depend in any degree on non-motivational factors as availability of opportunities and resources. Consequently, this supports the principles of the theory of the built environment in the sense that the lack of infrastructure is obviously a barrier that does not depend on personal motivation, hence, the behavior is not under control.

However, Ajzen (1991) states that *actual* behavioral control, in other words, the obvious existence of opportunities and resources to achieve a behavior, is undeniable. Nonetheless, the *perceived* behavioral control, or people’s perception of the availability of opportunities and resources, plays an important role on intentions and actions. He states that *actual* behavioral control remains stable across situations and forms of actions, whereas *perceived* behavioral control usually varies across them. Consequently, as far as the perceived control is valid, it can be used to predict the likelihood of a fortunate behavioral intent. However, this will only happen if intentions and perception of control are assessed in relation to the particular behavior of interest and within the same context. This can be interpreted as in order to predict the behavior “active school travel”, then the intentions to assess must be “to actively commute to school”. Whereas, perception of behavior and intentions of “to commute by active modes” or “to commute to school” are useless for these predictions.

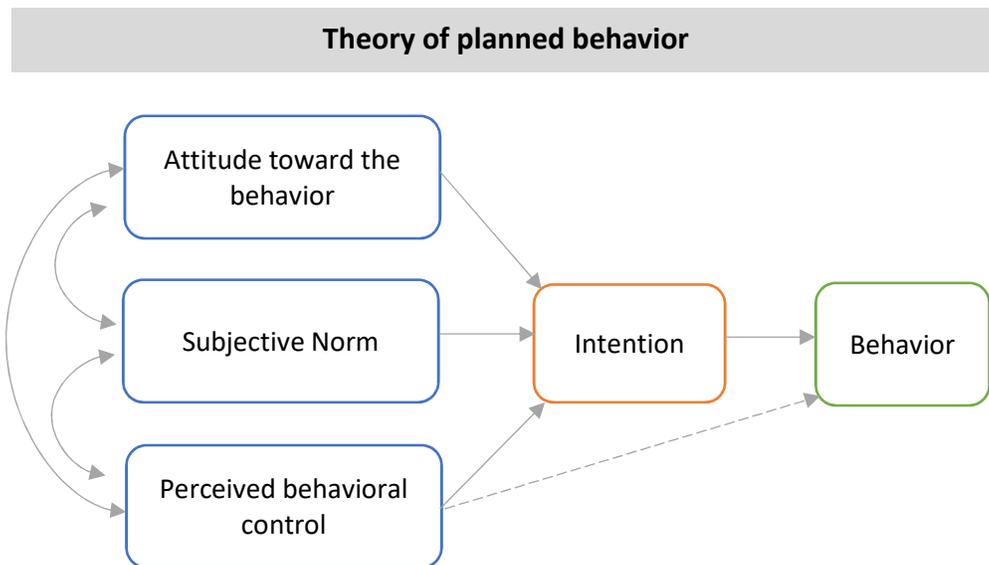


Figure 2: The theory of planned behavior Source: Own elaboration, based on Ajzen (1991).

The theory of planned behavior (Ajzen, 1991) states three independent factors that influence the intention (Figure 2). The first is the person's positive or negative assessment or valuation of the behavior itself, addressed as the "attitude towards the behavior". The second factor refers to the perceived social pressure to perform or not the particular behavior, identified as "subjective norm." The third and last factor that influences the intention is the "perceived behavioral control", defined previously as the perceived adversity of performing the behavior. Therefore, Ajzen stipulates that the greater the perception of behavior control and, the attitude and subjective norm of a person are more positive, the stronger the intention of the subject to perform the behavior should be.

This theory shows that these three aspects, the subjective norm, the attitude toward the behavior and the perceived control over the behavior influence the intention, therefore, the behavior can reasonably be predicted. However, the theory assumes that all other factors, such as the built environment and socioeconomic demography, are already working for the benefit of the prediction. This assumption is per se a limitation, due to the fact that according to literature review, these factors also commonly prevent the choice of active modes to commute to school.

Nonetheless, the theory shows that psychological constructs are drivers of behavior, therefore, aspects such as willingness to walk and cycle and attitudes towards the benefits for health and environment of active mobility, can influence in the choice of active school travel.

2.5 CONCLUSION

Literature shows that active mobility in general (Morris & Hardman, 1997) and as a transport mode, can positively impact to a certain degree the health of people (Sallis et al., 2004; Shepard, 2008). Specifically, active school travel can be a source of energy expenditure, associated with health benefits for children and youth (Cooper, 2003; McDonald, 2007). In addition, previous research suggests that active mobility can also be explored to address car dependence and traffic-related problems (Ding et al., 2017). However, in order to encourage people to commute by foot or bicycle, road safety and other factors must be also considered in advance (Tudor-Locke et al., 2012).

The literature review also shows that most studies have focused on the built environment and the traditional choice model where the availability of physical and socioeconomic conditions are strongly associated with mode choice. Therefore, availability or lack of resources, opportunities and infrastructure for walking and cycling are obviously promoters or barriers for active travel in general. Specifically, perceived and actual safety play an important role in school travel mode choice behavior. Moreover, previous research shows that the lack or availability of some resources, such as pedestrian infrastructure, bicycle lanes and parking spaces, along with the design of the neighborhood and school, are undeniable important factors influencing active mobility.

On the other hand, psychological factors such as the attitudes of travelers towards walking and cycling and sociocultural aspects such as social pressure to perform or not a particular behavior, can also influence mode choice. Therefore, these factors are also important when analyzing school travel behavior and, hence, they will be considered in this work.

MOBILITY POLICY REVIEW

3.1 INTERNATIONAL LEVEL

In 2010, the General Assembly of the United Nations proclaimed the period 2011–2020, the “Decade of Action for Road Safety”, in order to stabilize and reduce the expected number of fatalities in road accidents throughout the world. In this sense, the United Nations (UN, 2017) committed itself to improve road safety and include it in the planning and design of sustainable mobility and transport infrastructure through the New Urban Agenda (NUA, paragraph 113). In addition, it committed itself to promote a safe-system approach with awareness-raising initiatives, focusing primarily on meeting the needs of vulnerable sectors, such as women and girls, children and youth, the elderly and people with disabilities. Furthermore, the organization is committed to “adopt, implement and enforce” policies that protect and promote safe mobility for walking and cycling and prioritizing a safe and healthy trip to school for children.

Furthermore, the NUA (2017) establishes that the United Nations will encourage national, subnational and local governments to develop and expand financing instruments that allow them to upgrade to safe, enough and adequate infrastructure for pedestrians and cyclists (paragraph 118). Moreover, the UN committed itself to promote active modes, such as walking and cycling and prioritize them over private motorized transportation (paragraph 114a).

Apart from that, the NUA (2017) seeks to bring people into public spaces and promote active mobility to improve health and well-being. In this regard, the UN will support the implementation of well-designed networks of safe, accessible, green and quality streets and other public space. Areas shall be accessible to all and free from crime and violence, including harassment and gender-based violence (paragraph 100).

In terms of active school travel, programs such as safe routes to school mentioned in the literature review, seek to encourage active commuting to school by improving road safety for students. In the United States, programs such as “Walk to School Day” held every October and “Bike to School Day” held every May, seek to encourage families to celebrate the benefits of walking and biking while increasing local engagement for road safety (NC, 2018). In 2012, Vision Zero for Youth was launched in the USA, an initiative based on the premise that “zero” is the only acceptable number of traffic-related deaths and severe injuries. This initiative focuses on young people and seeks to promote safe active travel to school, reducing traffic speed in areas where children and youth travel (NC, 2018).

A similar program is implemented in Australia (cities of Brisbane and Gold Coast), aimed at providing free resources, tools and incentives to enable the stakeholders of a school community such as students, parents, caregivers and school staff to commute to school by active modes (BCC, 2018). This program is based on the premise that active school travel improves health and physical activity of travelers, as well as address traffic congestion, through the awareness and improvement of road safety.

The New Urban Agenda shows that at an international level, the benefits of active mobility are recognized, as well as the barriers and main limitations experienced by active travelers. Furthermore, it addresses and prioritizes vulnerable sectors, including young people and active

school travel. However, specifically for active school travel, the priority group are children and no specifications are made for the target population of this thesis.

Nonetheless, the prioritization of active modes over motorized transport, encouraging the improvement of infrastructure for active mobility and road safety, shows that policymakers understand the risks of active travelers and the challenges that must be addressed when promoting a mode shift. Moreover, considering crime, violence and harassment as restrictions on the use of public space shows that there is an understanding of the different factors that influence mode choice in different contexts around the world.

In addition, the programs aimed at promoting active school travel address road safety of children. However, little attention has been paid to adolescents as a target group and to the additional restrictions to mode choice caused by crime and violence.

3.2 NATIONAL LEVEL

In Mexico, the National Road Safety Strategy 2011–2020 aims to help reduce injuries, disabilities and deaths due to traffic accidents in the federal highway network and urban roads. Moreover, it seeks to promote the strengthening and improvement of medical care services for traffic accidents. However, actions are not articulated, due to the fact that each state and in some places, each municipality, have their own traffic or road regulations. Regulations that are sometimes even incompatible with each other (WRI, 2017). Therefore, according to the World Resources Institute Mexico (2017), in order to implement safe road systems, legally recognized mechanisms are needed. Mechanisms that systematize and coordinate the efforts, actions and competencies of the three levels of government.

In this sense, deputies of the Special Mobility Commission, as well as deputies from different parliamentary groups proposed the General Law of Road Safety in September 2017. This initiative establishes in its written justification that “the State, through the sectors involved, must guarantee the right to life and health of all Mexicans with the implementation of public policies and legal reforms to achieve the satisfaction of a public need” (LGSV, 2017, p. 01). WRI Mexico (2017) argues that this law is a first step in the right direction to meet the objectives, that Mexico undertook in 2011, when it signed the Decade of Action for Road Safety. The main commitment is to reduce deaths and injuries due to traffic events by 50%, therefore WRI Mexico (2017) urges the authorities to approve the initiative.

However, despite the efforts to pass several mobility initiatives, the Instituto Belizario Dominguez (IBD, 2017), the specialized body in charge of carrying out strategic research on the national development, studies derived from the legislative agenda and analysis of the situation in fields corresponding to the areas of competence of the Senate, carried out a study on urban mobility at the national level. The study shows that in the legislature LXIII (2015–2018), 21 mobility initiatives were submitted in their different modalities, of which none had been approved, 19 were pending review and in discussion, one had a negative judgement, and another one was withdrawn. These initiatives address issues such as the inclusion of people with disabilities, the establishment of a metropolitan fund and the regulation in terms of mobility, safe and secure mobility for women, sustainable mobility, road safety, right to mobility, the implementation of cyclist and pedestrian infrastructure, the prioritization of pedestrians and cyclists in the use of road space, as well as the inclusion and mobility of vulnerable groups. One particular initiative aims to ensure the accessibility and mobility of children and people with disabilities within educational and child care centers (IBD, 2017).

Apart from that, in terms of mobility programs, the ITDP Mexico (2018) proposed the program “Vision Zero for Youth: making streets safer one school zone at a time” in Mexico City. According to the ITDP, the program seeks to reduce the potential for traffic-related conflicts involving pedestrians. Therefore, it aims to implement preventive actions in risk areas nearby elementary and secondary schools throughout the city, under the premise of improving street safety by focusing on one school area at a time. The institute implemented a first pilot project in the city with the participation of local authorities, private sector and the community of the secondary school “Secundaria 4 Moisés Sáenz” during the 2017–2018 school year.

Initial identified problems prior to the implementation of the pilot project were: (1) long distance at the crossing of intervention, (2) large corner radius, allowing vehicles to turn at high speed, (3) parked vehicles and barriers that hinder visibility of crossing pedestrians, and (4) lack of pedestrian protection elements while waiting for crossing. According to the ITDP, monitoring and evaluating the pilot project demonstrated an improvement in crossing safety for the school community through (1) reducing the crossing distance by extending the corner of the sidewalk at the place of intervention, (2) reducing the turning speed of vehicles by designing this new sidewalk corner, (3) improving visibility to cross by reducing automobile parking spaces, and (4) protecting pedestrians by placing retractable bollards (ITDP, 2018).

In addition, in the state of Colima, Mexico, the program “Girls and Boys go first!”¹, seeks to carry out actions in school environments to reduce traffic-related deaths and injuries in the polygons of each municipality (WRI, 2018). Furthermore, one of the objectives is to implement a program for socialization and road culture, where stakeholders involved will work together to create a safer road environment for students and their companions. In this sense, the program funded by the BONTAR foundation, involves the participation of authorities at state and municipal levels, the WRI Mexico and the Global Road Safety Partnership.

In summary, mobility concerns are known and sometimes addressed at the national level, as demonstrated by road safety programs to encourage school communities to travel by active modes. Furthermore, several initiatives have been presented to address traffic-related issues, the inclusion of vulnerable sectors and the prioritization of active over motorized modes. However, there is no legal mechanism that regulates and unifies mobility criteria at all levels of the government. Especially, nonexistent or little funds and human resources are allocated to address active school travel.

3.3 STATE AND MUNICIPAL LEVEL

At the state level the Code of Territorial Organization, Urban Development and Housing (COTEDUVI its acronym in Spanish, 2013) is the instrument aimed to define the basic norms to plan, regulate and control territorial ordering of human settlements, urban development and the foundation, conservation, improvement and growth of population centers. This code regulated the implementation, control, assessment and evaluation of the infrastructure and road equipment, as well as the transit and local transport system until April 30th, 2018.

Apart from this chapter in the COTEDUVI (2013), the Road Law of the State of Aguascalientes (2016) established the norms to which the pedestrian and vehicular traffic of the State should be subject. Until 2018, this law regulated issues such as driver licenses, vehicle classification, vehicle registration and control, vehicular equipment, classification of public roads, road signs, traffic

¹ Original translation of “Las niñas y los niños ¡vamos primero!”

regulations, driving schools, obligations of traffic agents and infractions. It becomes apparent that the focus of this law was mainly the regulation of vehicle traffic, neglecting active modes, specifically the mobility of pedestrians and vulnerable groups.

However, since April 30th, 2018, the Road Law was abrogated by the Mobility Law of the State of Aguascalientes (MLA). This new law has the purpose of protecting the right to mobility, establishing the bases, norms and principles for the planning, programming, projection, regulation, coordination, implementation, management and control of mobility of people and transport of goods in the State of Aguascalientes and its municipalities.

This law hierarchizes mobility, prioritizes the displacement of pedestrians, specifically for people with limited mobility and cyclists in its first two categories. Moreover, the law includes concepts such as multimodality, which seeks to offer integrated services and transport modes to reduce the need for motorized and private vehicles, and sustainability, to reduce the negative effects of mobility on the quality of life and the environment.

The MLA (2018) has ten titles. The first title “General disposition” describes the concepts, definitions and authorities and their competences involved in the mobility of Aguascalientes and its municipalities. One of these terms is “right to mobility”, defined as the right of every person and community to have a mobility system of quality, accessible, continuous, efficient, safe, sustainable, sufficient and technologically innovative, that guarantees their displacement in conditions of equality and equity, allowing them to satisfy their needs, thus contributing to its full development.

In this sense, the MLA (2018) understands these concepts as follows: accessibility as the right of every person, without discrimination, to have mobility and transport systems adequate to particular social needs at their disposition; as well as to travel on public roads easily without physical obstacles and safely. Quality includes concepts as hygiene, comfort, travel time and environmental sustainability. Efficiency is defined as road communication to reduce travel cost and time. Technological innovation is understood as the promotion of technological systems and solutions that allow an efficient mobility and that generate a sustainable development in terms of energy efficiency and renewable energy sources. According to the MLA (2018), these attributes are intended to guarantee mobility under conditions of equality and equity, understood as the access to mobility without discrimination that threatens human dignity or their right to mobility.

This first title contains defined concepts such as bicycle parking, active mobility, limited mobility, pedestrian mobility, multimodality, public bicycle service, cycle path, among others that refer to the use of active modes. Moreover, this title seeks to promote actions at the governmental and private levels to prioritize pedestrian mobility, and to encourage the use of non-motorized, efficient vehicles with sustainable technological systems. It also prioritizes pedestrian and cyclist safety on public roads over motorize vehicles (MLA, 2018).

The MLA (2018), also establishes that is a responsibility of the municipality, in coordination with the state, to carry out education and information campaigns to raise the population’s awareness about the adverse effects produced by motorized transport modes on the environment, and the public need to avoid the excessive use of private cars. Furthermore, these campaigns aim to encourage people to use public transport and non-motorized transport modes. At the same time it establishes the attribution of the municipality to implement programs and educational campaigns in terms of road safety and mobility culture.

This law also describes the mobility planning instruments, such as the State Mobility Program (SMP) and the members of the State Mobility System, which includes local authorities, civil society and the advisory council. The advisory council is an auxiliary organ of technical consultation body integrated by local authorities, civil society, and allows the participation of public and private sectors, academic and research organizations, as well as public transport operators, to discuss public mobility programs and projects.

It aims to manage mobility in general and particularly active mobility, as well as mobility of vulnerable groups. The objectives of the SMP encompass the promotion of non-motorized mobility and “walkable cities” through the recovery of urban areas for pedestrians, and the promotion of road safety and all the measures that guarantee the “right to mobility”. The SMP will also establish social participatory instruments to reflect the interest of society on the issue. Moreover, the law establishes the creation of the State Fund for Mobility, aimed at capturing and managing public and private resources to finance measures in terms of mobility.

The third title of the MLA (2018) is a specific title for active mobility, which prioritizes the mobility of pedestrians, people with reduced mobility, children under twelve and the elderly. Specifically, in its article 53, it establishes that priority will be given to schoolchildren mobility. Therefore, the competent authorities shall protect through devices, signs and appropriate indications the transit of schoolchildren in school schedules and places. This title describes the rights and regulations related to pedestrians and cyclists, as well as for public transport users.

Because this law has been implemented for less than a year and there are nonexistent or just a few mobility policies at the municipal level, interviews were conducted with Gustavo Gutierrez de la Torre, Head of the Mobility Coordination of the State of Aguascalientes (CMOV) on December 13th, 2018 and the mobility team of the CMOV to gain a deeper understanding of current and future measures taken in terms of active mobility.

Therefore, according to Gustavo Gutierrez, “before the approval of this law, no efforts had been made to regulate and promote active mobility at the state level”. He states that in order to align actions at the different level of governments in terms of urban mobility, four pre-conditions are required to be fulfilled in advance. First, the political will, that in the case of Aguascalientes has been part of the political campaign strategies. Secondly, a normative framework, which is now addressed by the implementation of the Mobility Law of Aguascalientes. Third, institutional capacity, which is now being addressed through the creation of the CMOV and fourth and finally, a budget for mobility.

In this sense, the CMOV is working on the State Mobility Program to link and coordinate efforts through a Mobility Strategy that includes five axes (Gustavo Gutierrez). The first axis will address mobility management, including regulatory, governance and planning mobility processes. The second will focus on the transport of people, mainly on the management of public transport. The third axis will address active mobility issues and the inclusion of vulnerable groups. The fourth axis will focus on road safety and mobility culture. Finally, the fifth axis will address freight transport and logistics of goods.

Due to the current management of mobility at the national level, mobility projects are managed and executed at municipal level (Gustavo Gutierrez). Nonetheless, after the publication of the Mobility Program, municipal authorities must align their mobility objectives to the ones established in the program and develop their own programs, specifying the measures to comply with the general strategy. However, Gustavo Gutierrez assures that even though political will,

institutional capacity, and normative framework are more likely to exist now, the lack of a budget is a major barrier for the implementation of any project.

In terms of active mobility, Gustavo Gutierrez said that projects to promote a mode shift, where the most undesirable mode is the private vehicle and the most desirable an active mode, will focus on three target groups. The first target group will be government workers, the second private sector workers and the thirdly students. The projects for this last target group will focus on identifying main barriers for students to actively travel to school. Gustavo Gutierrez believes that focusing on school travel behavior is useful in identifying and addressing traffic-related challenges, due to the fact that mobility in the city changes drastically when schools are active (more traffic congestion) than when they are on vacation.

Therefore, policies have two purposes, to improve public transport and active mobility conditions to promote a mode shift towards more desirable transport modes, and to discourage the most undesirable transport modes. However, to promote active modes or the use of more desirable modes, Gustavo Gutierrez assures that it is important to address, in parallel and in advance, the issues and barriers that face the users of these transport modes. Moreover, not only real problems must be considered and addressed, but also perceived ones.

In terms of the communication strategy of the projects, Gustavo Gutierrez expressed that although there has been constant interaction with social networks, a consistent communication strategy is still pending. Moreover, he considers that the diffusion of projects is important, therefore, projects effectively announced on social networks may involve more participation by the society. An example is the “World Car Free Day”, implemented this year to promote the use of public space in a different manner than by car travel. It had a high participation rate due to the advertisement of the project. Another example is the “Ideas Forum”, which was the first citizen participation mechanism implemented by the government to involve society in the preparation of the State Development Plan. Furthermore, some of the ideas provided in this forum were considered in the elaboration process of the MLA (Gustavo Gutierrez).

In general, Gustavo Gutierrez believes that there are three main challenges in terms of active mobility. The first is to create technical capacity within the sector responsible for planning, design, maintenance and controlling of public space; since the current specialists are more experienced in the construction and maintenance of car-oriented infrastructure than of cycling infrastructure. Second, it is necessary to develop procedures to allow the financing of projects focused on active mobility. Finally, it is necessary to create institutional capacity to promote participatory processes when designing and implementing new projects, so that they meet the needs of the population.

The policy review shows that active mobility is gaining importance in Mexico and particularly in Aguascalientes. Specifically, active school travel is promoted with projects that focus on improving road safety at the national level. However, most of these projects focus on children and little attention has been paid to the target population of this thesis. Moreover, the lack of legal mechanisms to regulate and finance mobility issues at the three levels of the governmental system, could explain the implementation of independent programs at the municipal or state level instead of a network of similar projects throughout the country.

Specifically, in Aguascalientes, most efforts in terms of mobility has been focused on public transport, while projects promoting active mobility, especially active school travel are still pending. However, the implementation of the Mobility Law of Aguascalientes, which prioritizes pedestrians and cyclists over car users is already a first step in the promotion of active modes.

TARGET POPULATION AND CONTEXT

4.1 TARGET POPULATION

The city of Aguascalientes, the capital of the state with the same name, is located on the southern border of the state, in the central-northern region of Mexico. The metropolitan area of Aguascalientes includes the municipalities of Aguascalientes, Jesús María and San Francisco de los Romo.

The state of Aguascalientes has 1,312,544 inhabitants, of which 672,453 are women and 640,091 are men (INEGI, 2015). Furthermore, according to the National Institute of Statistics and Geography (INEGI its acronym in Spanish), 398,978 inhabitants over the age of three, attended school in 2015. Moreover, adolescents aged from 12 to 17 years represent 12.3 % of the total population of the state. However, only 81.9 % of these adolescents attend school.

The UNICEF (n.d.) defined adolescence as a stage of physical and emotional changes during the transition from childhood to adulthood, where personality is defined, and independence is shaped. Furthermore, according to the Mexican Youth Institute (IMJUVE, 2017), young people in the country are "the best bet for integral, fair and lasting development" due to their quantitative representation and their participation as actors of transformation and social renewal. Hence, this research focuses and defines teenagers from 12 up to 18 years who attend secondary and upper middle school as the target group.

In this sense, Table 1 shows that adolescents aged from 12 to 14 who attend school represents 59.7% of the target population, whereas 40.3% are represented by teenagers aged from 15 to 17 years. In total, 131,823 adolescents aged from 12 to 17 years in the State of Aguascalientes attend school.

Total target population and attending school (n, %)					
	Total target population state level		Subtotal target population attending school		Total target population attending school
Ages 12 to 14	84,510	52.5%	78,647	93.1%	59.7%
Female	41,753		39,322	94.2%	
Male	42,757		39,325	92.0%	
Ages 15 to 17	76,404	47.5%	53,176	69.6%	40.3%
Female	37,113		26,632	71.8%	
Male	39,291		26,544	67.6%	
Total	160,914	100.0%	131,823		81.9%

Table 1: Total target population and attending school (n, %). Source: Own elaboration with data from INEGI (2015).

4.2 EDUCATIONAL SYSTEM IN MEXICO

It is important to understand the educational system because, as analyzed in the literature review, one of the factors that influence mode choice is the distance from home to school. This factor is usually related to the availability and affordability of education. Furthermore, to understand the

school travel behavior of the target population, it is necessary to describe the education system in Mexico (Figure 3) and specifically the education system in Aguascalientes.

The Mexican Constitution (reform 2016) establishes that all citizens have the right to receive education. The State is responsible for providing fourteen years of education through the basic and upper medium levels. The basic level comprises twelve years of school through preschool, primary and secondary schools. The upper medium level comprises three years of school. According to this law, this public education must be secular, compulsory, free and of quality.

In this sense, primary education comprises six years of school for children aging from 6 to 12 and has been mandatory for parents and government to guarantee their access to school since 1934. From 1993, secondary school was declared also mandatory and comprises three years of school for teenagers aging from 12 to 14. Since 2002, preschool which comprises two years of education, for children aging from 3 to 5 is mandatory. Finally, in 2012, upper medium level education was declared compulsory as well (INEE, 2018).

Since the upper medium level is mandatory and provided by the state only since 2012, while secondary level has been compulsory and funded by the state for 9 additional years; It could be an important factor to consider when analyzing the responses of students at the secondary level compared to upper medium level students.

Specifically, in Aguascalientes, the school assignment criteria for the basic level include two requirements. The first is to have a sibling already enrolled in the institution and the second is to live within the area of influence of the requested school (IEA, 2018). The criteria themselves tend to avoid long school travel distances, which as the literature review showed, is a barrier to active mobility. However, no specific selection criteria were found for upper middle level students. Moreover, the analysis of supply and demand of upper middle schools in Aguascalientes is a limitation of this research.

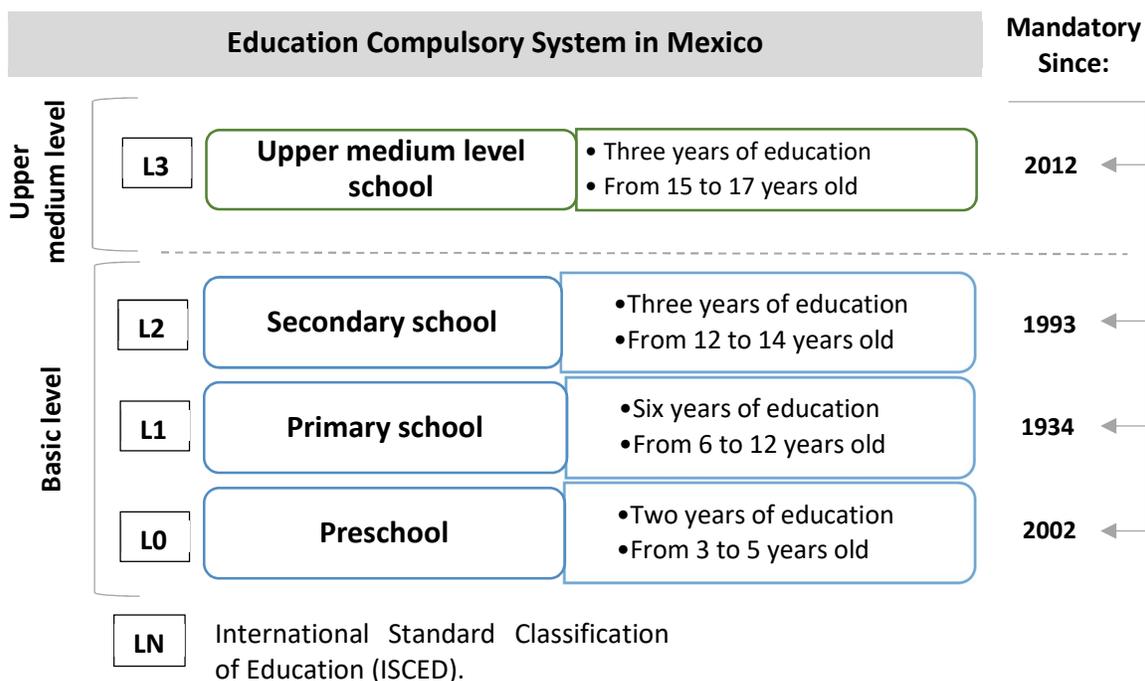


Figure 3: Education System in Mexico. Source: Own elaboration with data from INEE, 2018.

4.3 AGUASCALIENTES CITY CONTEXT

The metropolitan area of Aguascalientes recorded 1,220,000 trips per day, equivalent to 1.3 trips per person; of which travel for educational purposes accounted for 33% (IMPLAN, 2013). In addition, there were 4,386 traffic-related accidents, thereof 200 ended deadly in Aguascalientes in 2015. Moreover, of the people who lost their lives, 33.5% were pedestrians and 4% were cyclists (ONL, 2015).

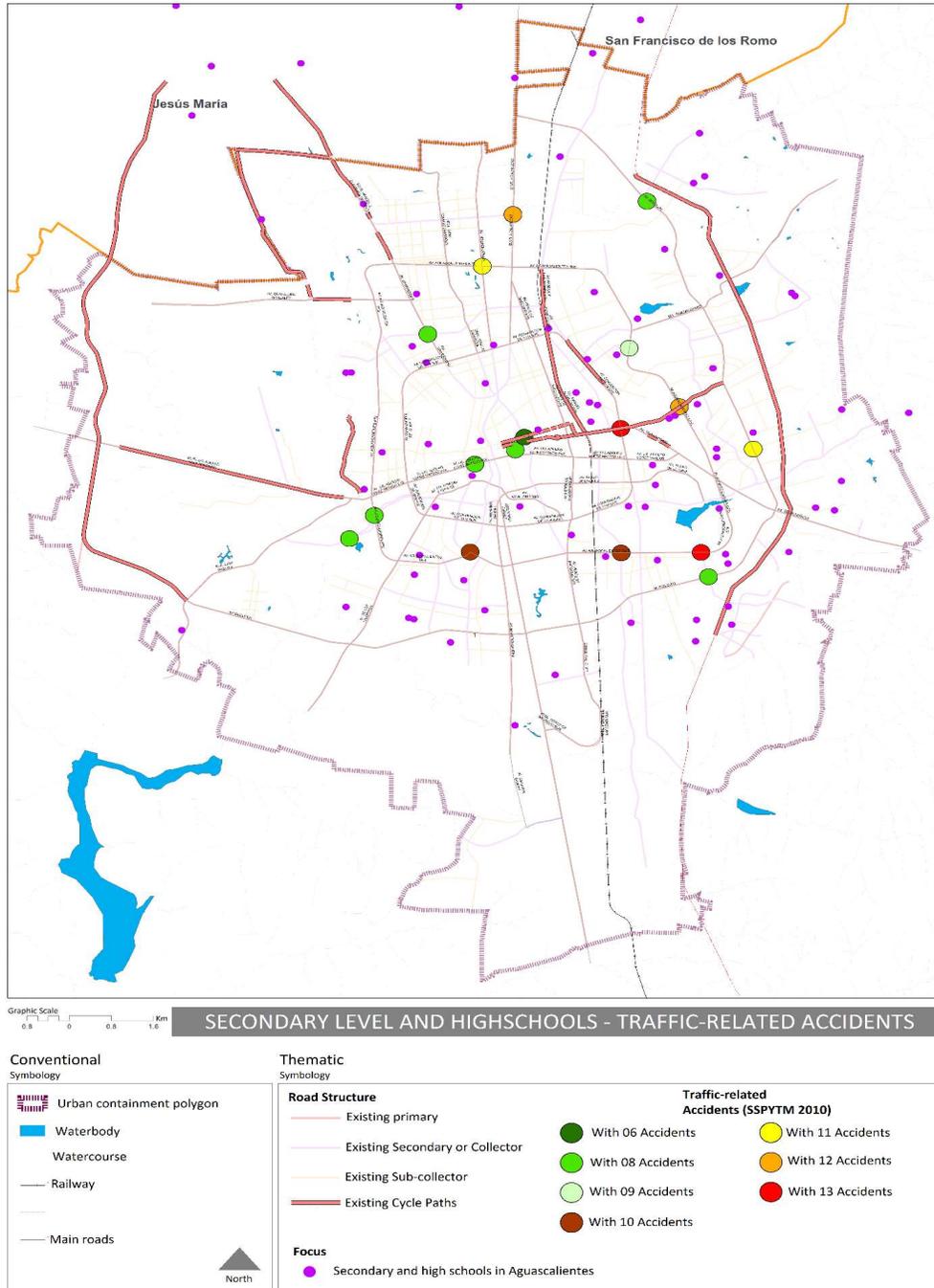


Figure 4: Secondary and Upper middle level schools vs Traffic related accidents. Source: Own elaboration with data from the CMOV (2018).

Figure 4 shows the location of all secondary and upper middle level schools in the city of Aguascalientes, the infrastructure currently available for cycling and the areas with the most traffic-related accidents reported in 2010. This map is useful to identify the school zones that are most at risk in terms of road safety and need urgent attention when analyzing active school travel behavior.

According to INEGI (2015), 95.5% of the target population living in the city of Aguascalientes attends school within the city. 4.4% attends schools in another municipalities. 0.48% attends school in a different state or country and the rest is not specified. Moreover, 64.9% spend less than 15 min to travel to school and 25.2% spend between 16 and 30 min (Table 2). Table 2 also shows that 69.58% of secondary level students aged between 12 and 14, spend less than 15 min to travel to school, whereas only 44.5% of upper level students aged between 15 and 17 spend the same time. Moreover, it is shown the older the students are, the more time they spend traveling to their place of study. As mentioned before, this fact could be related to the educational system in the country, specifically, the public education.

Travel time to the place of study (%)							
Population	<15min	16 to 30 min	31 min to 1 hr.	>1 hr. <2 hrs.	>2 hrs.	Do not travel	Total
Ages 12 to 14	69.5	26.6	3.5	0.3	0.0	0.5	98.2
Ages 15 to 17	44.5	38.3	15.7	1.3	0.1	0.3	98.7
Total	64.9	25.2	8.3	1.3	0.2	0.9	97.1

Table 2: Travel time to the place of study (in %). Source: Own elaboration with data from INEGI (2015).

The previous data analysis shows that most of students spend maximum 30 min to travel to school. Moreover, the most common mode choice of students is active mode (Table 3). However, there is also a difference with respect to the mode choice between secondary and upper level students by 27%. As mentioned above, this fact may be related to the education system. Interestingly, the second most common school travel mode is private motorized vehicles and the third most common one is public transport. Percentages in Table 3 can exceed 100% due to the fact that INEGI (2015) reflected data of all transport modes used for the school trip. Hence, a person can have more than one transport mode.

School travel mode choice (%)					
Population	Active	Public motorized	Private motorized	Other	Not specified
Ages 12 to 14	65.1	13.4	23.3	0.2	0.2
Ages 15 to 17	38.4	42.3	23.3	0.3	0.2
Total	57.1	19.2	25.6	0.2	0.3

Table 3: School travel mode choice (%). Source: Own elaboration with data from INEGI (2015).

The previous analysis described the target population of this thesis, as well as some characteristics of the school travel behavior of adolescents in Aguascalientes city. However, although basic information about school travel behavior is available, such as travel mode choice, travel distance and areas with the most traffic-related accidents; there is no or little information about the factors that influence active school travel as described in the literature review. Factors, such as the perception of security and road safety, are missing, which according to the hypothesis of this study may influence active school mode choice.

METHODOLOGY

5.1 OVERVIEW

Reviewing the relevant literature in the secondary research, revealed that different approaches for the analysis and interpretation of data exist. The methodology for this thesis is selected based on the literature review and available resources. Furthermore, it addresses the identified gap of the secondary research, which shows that information is generally provided by adults and merely little data has been collected directly from teenagers, the target population of this research.

In addition, the analysis above of the target population shows that the necessary data to answer the research question of this thesis is non-existing or insufficient. Therefore, an empirical data collection process is required to produce sound statistics and quantitative descriptions. In this sense, the selected method was a structured survey to ensure that the same data and information was collected consistently from each student and could be directly comparable.

Since the study population consists of teenagers and parental consent is legally required, the personal approach *in-person* surveys were not feasible and thus discarded. Moreover, time and spatial limitations as well as available resources were key factors for the selection of an online *special-purpose* survey applied to a sample of the target population.

The survey uses mostly conventional attitudinal scaled questions as applied in previous studies with a psychological approach (Emond & Handy, 2011; Kamargianni & Polydoropoulou, 2013; Ding et al. 2017). The approach attempts to consider the factors, specially the attitudes, influencing the active school travel.

To analyze the data, cross-tabulations were selected to describe the variables and findings of the survey. In addition, chi-square test is used to determine whether there is a significant difference between the expected and the observed frequencies in one or more categories of two variables. Moreover, after testing the significance of the relationship between the variables, an association test is used, to investigate the strength and type of relationship. However, it is important to highlight that association does not imply causation.

Since the research question of this study is to analyze the factors influencing active school travel, all variables are analyzed through the data collected from the users and tested against school travel mode choice. Moreover, in accordance to the theory of planned behavior (Ajzen, 1991), which establishes that the *perceived* control plays an important role on intentions and actions, this research analyzes the perception of insecurity, gathered from the users, and not insecurity itself (the *actual* control).

In addition to the survey, focus groups interviews were carried out as a qualitative data generation method in order to explore and clarify outstanding results of the survey. This method was used to explore the knowledge and experiences of teenagers and to examine not only what they think about the topic, which was already collected from the survey, but also why they think that way. Therefore, outcomes from focus groups were used to interpret the results from the data analysis and avoid own subjective interpretations.

5.2 SAMPLE DESIGN

The purpose of the survey was to provide statistical estimates of the characteristics of teenagers aged from 12 to 17 years with respect to active mobility, focusing on their school travel behavior in Aguascalientes, Mexico. Therefore, a sample design is required to collect data representative of the target population. This sample design uses an alpha level of 0.05, the level of acceptable risk in most educational research studies (Bartlett et al., 2001). Therefore, it means that 0.05 is the value that this research is willing to accept that the true margin of error exceeds the acceptable margin of error. In this sense, t-value for alpha level of 0.05 is 1.96 for samples sizes above 120.

In addition, as a general rule regarding the acceptable margin of error in educational and social research for categorical data is 5% (Bartlett et al., 2001). Hence, 0.05 is the margin error used in the sample design. With respect to the variance estimation, since it is an online survey and population will not be addressed in person, there is uncertainty in the characteristics of the respondents. Therefore, this research will use 0.5 as an estimate of the population proportion, which is the maximum value for variance, hence, will produce the maximum sample size.

In this sense, given the alpha level at 0.05, the acceptable error as 5% and the estimated standard deviation of the scale as 0.5, the sample size is determined using Cochran's sample size formula for categorical data (Bartlett et al., 2001) as follows:

$$n_0 = \frac{(t)^2 * (p)(q)}{(d)^2}$$
$$n_0 = \frac{(1.96)^2 * (0.5)(0.5)}{(0.05)^2} = 384$$

Where:

t = value for selected alpha level = 1.96

(p)(q) = estimate of variance = 0.25

(maximum possible proportion (0.5) * 1 – maximum possible proportion (0.5) produces maximum possible sample size).

d = acceptable margin of error = 0.5

Therefore, for the target population of 160,914 people (Table 1), the required sample size is 384 respondents. According to Table 1, teenagers in Aguascalientes aged 12 to 14 years represent 59.7% of the target population, which is why 229 students are required at this age. While teenagers aged 15 to 17 years represent 40.3% in total, therefore 155 students at this age group are required.

In this sense, 5 secondary and 7 upper medium level schools were selected based on their sustaining mode and degree of marginalization with data from SEP (2017). The selection criteria were based on the different sustaining modes, such as private, public and autonomous; and its degree of marginalization according to its location, as low, very low, medium, high and very high. Students were randomly selected in terms of gender and school schedule by the directors of each school.

The link of the online survey was tested with an authority of each school to clarify any doubts before it was applied to students. Consent was given by directors from each school, who decided

whether to send the link to the students by mail or to provide a space with computers and internet access to answer the survey.

5.3 SURVEY

The online survey comprised 30 questions to collect information in different categories (see Table 4). The category “Individual characteristics” aims to collect data such as gender, age, school level, and school schedule. The category “Household characteristics” aims to collect data such as car ownership, driver’s license (if ≥ 18 years old)² and driver’s permit (between 16 and 18 years old), bike ownership and parental education level, factors that, according to the literature review influence school travel mode choice. The category “School travel characteristics” aims to collect data on travel time to school, school travel mode choice and whether the student travels alone or accompanied with or without adults.

Variables used in data analysis	
Variable name	Variable description
Individual characteristics	
Gender	1 = Female; 2 = Male; 3 = Other
Age	1 = 12 to 14 years old; 2 = 15 to 17 years old; 3 = 18 years old
School level	1 = Secondary level; 2 = Upper medium level
School schedule	1 = Morning; 2 = Afternoon; 3 = Extended schedule
Household characteristics	
Car Ownership	1 = None; 2 = One; 3 = More than one
Driver's license or permit	1 = Yes; 2 = No
Bike Ownership	1 = Yes; 2 = No
Mother education	1 = Low; 2 = Mid; 3 = High; 4 = Other
Father education	1 = Low; 2 = Mid; 3 = High; 4 = Other
School travel characteristics	
Commute with	1 = Alone; 2 = Accompanied but without adults; 3 = With at least one adult
Time to school	1 = < 30 min; 2 = 31 to 1 hr; 3 = > 1 hr.
Mode choice	1 = Active; 2 = Private motorized; 3 = Public motorized; 4 = Other

Table 4: Variables used in data analysis. Source: Own elaboration.

Although specific education level of parents was requested (Table 5), the data was categorized, because one of the hypotheses refers to “high” level of parental education. Therefore, “high” education level was defined as bachelor’s and master’s degree. Moreover, mode choice was categorized into active, private motorized and public motorized modes (Table 5). The objective of this classification is to identify the differences between active and motorized modes. However, public transport and school transport are collective modes that require active mobility, at least to get to the bus stop. Hence, even though public motorized mode is not considered as an active mode, neither behaves as a private vehicle and, therefore, it was separated into a different category.

² In Aguascalientes it is possible to obtain a driver’s license at the age of 18 years. However, a driver’s permit can be obtained at the age of 16 years if the parents authorize it and require it (SEGGOB, 2018).

According to the literature, 4 km was the maximum distance considered achievable by active modes (Emond & Handy, 11). Therefore, travel time was also grouped into three categories, of which “less than 30 min” is considered in this work as achievable by active modes.

Groups of variables for analysis	
Group	Variables
Education level	
Low	Elementary; Secondary
Mid	Upper medium level
High	University; Master
Other	Other
Mode choice	
Active	Walking; Cycling; other active modes
Private motorized	Car / van; Motorcycle
Public motorized	Taxi; Public transport; School transport
Other	Other
Travel time	
< 30 min	< 15 min; 16 to 30 min
31 min to 1 hr	31 min to 1 hr.
> 1 hr	1 hr to 2 hrs.; > 2 hrs.
Attitudes towards active school travel	
	1 = Active; 2 = Private motorized; 3 = Other
ACS1	If I lived closer to school
ACS2	If fewer traffic accidents
ACS3	If less crime
ACS4	If infrastructure in good condition
ACS5	If travel as a group

Table 5: Groups of variables for analysis. Source: Own elaboration.

Furthermore, importance of several factors such as perceived distance, cost, comfort, weather, perceived security and road safety, were asked using a rating scale 1–5 (Table 6) to identify the ones that influence mode choice. In addition, students were asked to rate their current school travel to explore characteristics of the built environment that, according to the literature, influence active school travel mode choice. Moreover, the willingness to walk or cycle to school if a travel characteristic was improved, was also collected through a 1–5 rating scale to understand what should change, according to users, to encourage them to travel by active modes. Apart from that, awareness of environmental and health benefits was specifically asked to evaluate attitudes of students towards cycling to school. Finally, students were asked to rate current programs and those that are about to be implemented, aimed at promoting active mobility, to understand how policymakers and practitioners are addressing the needs of the target population.

Rating scales 1-5	
Influence school mode choice	1 = Not important; 5 = Very important
ISMC1	Distance to school
ISMC2	Travel cost
ISMC3	Comfort
ISMC4	Security (crime rate)
ISMC5	Safety (traffic accidents)
ISMC6	Weather
ISMC7	Only travel mode option
Rating of current school travel	1 = Very bad; 5 = Excellent
ST1	Number of bicycle lanes
ST2	Sidewalks conditions
ST3	Street lighting
ST4	Public transport connectivity
ST5	Other
Exploring cycling to school	1 = Totally disagree; 5 Totally agree
BR1	Because is good for environment
BR2	Because is good for health
BR3	Because I want to be fit
BR4	Because is free
BR5	Because is fun
BR6	In no case
Rating programs that promote active mobility	1 = Not interested at all; 5 = very interested
GPT1	Bike riding school
GPT2	Free bike sharing system
GPT3	Walking groups
GPT4	Cycling groups

Table 6: Rating scales 1-5. Source: Own elaboration.

5.4 FOCUS GROUPS

Two focus groups interviews were conducted to explore the peaks of survey results. In this sense, the main precondition for the selection of students was to be a teenager aged from 12 to 17 with an active school travel either on the way to school or back home. The directors of each school gave their consent and supported all arrangements for recruiting and carry out the focus group within the facilities and school hours.

The first focus group was conducted in the upper middle level school “Bachillerato del Deporte” on 6th December 2018. Seven students participated, of which three were female and four male. The activity lasted 50 min in which, first, the topic of active mobility was presented to the students, they were asked to consent to audio recording, and they were introduced to the ground rules of the activity dynamics. Secondly, introductory questions were asked such as name, school travel time and overall opinion of active mobility, to create an open environment and get an overview of the characteristics of the group. Third, students were requested to work in groups to list the pros and cons of active school travel and rate their importance.

Then, students were shown outstanding results from the survey and asked to express their thoughts and experiences about it. For instance, one of the survey questions showed that most students preferred to use a car instead of active modes, when they were asked to choose their ideal school travel mode if they did not have to worry about anything. In this sense, students were asked to explain the factors they believe influence the respondents to choose motorized over active modes.

In addition to analyzing the school travel behavior in Aguascalientes, students were requested to rate programs aimed at promoting active mobility currently implemented in Aguascalientes. As well as to play the role of “mobility ambassador” in order to express the governor what should happen to promote active mobility among teenagers.

Similarly, a second focus group was conducted at the upper middle school “Centro de Educación Media UAA Plantel Oriente” on December 10th, 2018. Nine students participated, of which two were female and seven male. The same procedure was applied to the second group in terms of questions and activities. Both focus groups were recorded, and field notes were taken to support the subsequent analysis.

5.5 CHI-SQUARE TEST

The chi-square test, also called Pearson’s chi-square test, is a non-parametric statistic, used to determine whether there is a significant difference between the expected and observed frequencies in one or more categories, when analyzing two categorical variables. Therefore, it is useful to test if there is a significant relationship between the variables in Table 4 and Table 6 with the school travel mode choice. The chi-square statistic is defined by:

$$\chi_c^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

Where:

O = Observed frequencies

E = Expected frequencies

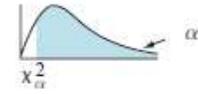
C = Degrees of freedom.

This analysis is done to reject the null hypothesis established by Karl Pearson H_0 that establishes that the variables are not related to each other (Lyman & Longnecker, 2001). Therefore, the null hypothesis H_0 can be rejected if the χ^2 exceeds the critical p -value = 0.05 and degrees of freedom $df = k-1$ showed in Figure 5.

The IBM SPSS statistics 22 software was used to develop the chi-square test and all numerical analysis. In this sense, the results are evaluated by comparing the p -value calculated by SPSS with the alpha level of 0.05, which provides a 95% confidence level. Therefore, p -value provided in the chi-square test must be less than 0.05 in order to be 95% sure that there is a significant association between the two variables. Furthermore, if p -value is less than 0.01, the significant association will have a 99% confidence level.

By design, a chi-square test can only show whether is a statistically significant relation among the variables. However, it does not show whether the relationship is strong, interesting or relevant (Lyman & Longnecker, 2001). Therefore, the Cramer’s V is the most common test to evaluate the strength when a significant Chi-square result has been obtained (McHugh, 2013). Because,

statistical strength tests are correlation measures (McHugh, 2013), this work uses Creamer's V test for the cases where Chi-square test results are significant.



Percentage points of the chi-square distribution

df	$\alpha = .999$.995	.99	.975	.95	.90
1	.000002	.000039	.000157	.000982	.003932	.01579
2	.002001	.01003	.02010	.05064	.1026	.2107
3	.02430	.07172	.1148	.2158	.3518	.5844
4	.09080	.2070	.2971	.4844	.7107	1.064
5	.2102	.4117	.5543	.8312	1.145	1.610
6	.3811	.6757	.8721	1.237	1.635	2.204
7	.5985	.9893	1.239	1.690	2.167	2.833
8	.8571	1.344	1.646	2.180	2.733	3.490
9	1.152	1.735	2.088	2.700	3.325	4.168
10	1.479	2.156	2.558	3.247	3.940	4.865
11	1.834	2.603	3.053	3.816	4.575	5.578
12	2.214	3.074	3.571	4.404	5.226	6.304
13	2.617	3.565	4.107	5.009	5.892	7.042
14	3.041	4.075	4.660	5.629	6.571	7.790
15	3.483	4.601	5.229	6.262	7.261	8.547
16	3.942	5.142	5.812	6.908	7.962	9.312
17	4.416	5.697	6.408	7.564	8.672	10.09
18	4.905	6.265	7.015	8.231	9.390	10.86
19	5.407	6.844	7.633	8.907	10.12	11.65
20	5.921	7.434	8.260	9.591	10.85	12.44
21	6.447	8.034	8.897	10.28	11.59	13.24
22	6.983	8.643	9.542	10.98	12.34	14.04
23	7.529	9.260	10.20	11.69	13.09	14.85
24	8.085	9.886	10.86	12.40	13.85	15.66
25	8.649	10.52	11.52	13.12	14.61	16.47
26	9.222	11.16	12.20	13.84	15.38	17.29
27	9.803	11.81	12.88	14.57	16.15	18.11
28	10.39	12.46	13.56	15.31	16.93	18.94
29	10.99	13.12	14.26	16.06	17.71	19.77
30	11.59	13.79	14.95	16.79	18.49	20.60
40	17.92	20.71	22.16	24.43	26.51	29.05
50	24.67	27.99	29.71	32.36	34.76	37.69
60	31.74	35.53	37.48	40.48	43.19	46.46
70	39.04	43.28	45.44	48.76	51.74	55.33
80	46.52	51.17	53.54	57.15	60.39	64.28
90	54.16	59.20	61.75	65.65	69.13	73.29
100	61.92	67.33	70.06	74.22	77.93	82.36
120	77.76	83.85	86.92	91.57	95.70	100.62
240	177.95	187.32	191.99	198.98	205.14	212.39

Figure 5: Percentage points of the chi-square distribution. Source: Lyman & Longnecker (2001)

5.6 ASSOCIATION TEST

Because all data analyzed in the present study are categorical data and significance of relationship between variables are analyzed through chi-square test, Cramer's V analysis is used to measure the association as follows:

$$V = \sqrt{\frac{\phi^2}{t}} = \sqrt{\frac{x^2}{nt}}$$

Where

t = smaller of the number of the rows minus one or the number of the columns minus one. If r is the number of the rows, and c is the number of columns, then:

$$t = \text{Minimum} (r - 1, c - 1)$$

Cramer's V has a value between 0 and 1, where 0 is interpreted as there is no association between two variables, and 1 means that there is a total association between them. Therefore, it means that the higher the value, the stronger the association (Liebetrau, 1983).

5.7 LIMITATIONS

The survey does not include potential important explanatory variables such as household income. Although road safety and security are addressed, it is not possible to know whether the answers are related to the perception of the respondents or whether they have experienced real incidents. Moreover, it is not possible to assure the seriousness, precision and honesty of the survey respondents. A few respondents used the "other" option to specify with humorous comments such as "A giant drone" or "a pink elephant" as preferred school travel mode. It was also noticed that the question related to the school travel costs did not specify if it was for one trip, daily or monthly, so the question could not be considered in the analysis.

In addition, the sample design of the survey comprised of 12 schools, selected through different characteristics to create a sample, that could be representative of the target population. However, only five of those schools were willing to participate in this process; none of which were private schools. Nonetheless, 54% of the responses were collected from one upper medium level school with an autonomous sustaining mode, which requires funding from its students, similar to private institutions. In addition, the data shows a greater participation of upper medium level students compared to secondary level students.

Despite that, all data for the analysis was used directly from respondents; which is why the data reflects the perception of the target population, but it could differ from real values. As an example, travel distance to school was analyzed through the travel time variable requested in the survey, while real travel distances were not measured. Moreover, travel time obtained from the survey did not referred to a specific travel mode option, therefore, a response of 30 min can mean by foot or by car, which means that they are not exactly comparable. Given more time to perform this research, real travel distances could have been measured and contrasted to perceived values.

6.1 QUANTITATIVE ANALYSIS

1,092 responses were collected from the survey with 30 questions and 1,075 completed all elements required for this study. Participants were excluded if their age was not in the range of 12 to 17 as required for this study and all trials with school authorities were discarded. Through the responses of the students, it was shown that only 2 out of 5 secondary schools and 3 out of 7 upper medium level schools participated³. Moreover, 11 respondents who selected “other” as transport mode to school were discarded from the analysis because they did not seem serious when completing the survey, for instance, giving responses such as “pink elephant or giant drone”. Hence, 1064 cases were considered valid to be analyzed.

Thereof, 52.3% were from female and 47% from male respondents. Of which, 222 students were between 12 and 14 years old, 776 were students aged from 15 to 17 and 66 were 18 years old. 217 students were at secondary level and 847 were at upper medium level. Moreover, 51.8% of students attended school in a morning schedule, 47.1% attended in the afternoon and 1.0% had an extended schedule.

6.1.1 SCHOOL TRAVEL CHARACTERISTICS

As the research hypothesis of this work focuses on the analysis of school travel behavior, all variables are described in terms of the school travel mode choice. In this sense, of the 1,064 valid responses, the most common mode choice among the respondents was private motorized, which represents 50.8% of the total. The second was public motorized which represents 29.8% of the total and the third, was active mode choice that represents 19.4% (Figure 6). These results differ considerably with those provided by INEGI (2015) analyzed previously (Table 3). Table 7 shows that, according to INEGI (2015), the most common school travel mode among teenagers in Aguascalientes is active mode that represents 57.1%, the second is private motorized that represents 25.6% and third, public motorized which represents 19.2%.

However, INEGI included the different transport modes used for the entire travel, which means that several transport modes were analyzed for one trip, which is why the total exceeds 100%. In this sense, even though a student can have a multimodal travel, this survey requested the student’s mode choice for the longest part of their school travel. Therefore, if the majority of the trip is made by a public motorized mode, connections such as walking to and from the bus stop are not reflected as active mode in this analysis.

School travel mode choice (% (n))		
Mode choice	Survey of present study	INEGI (2015)
Active	19.4 (206)	57.1
Private motorized	50.8 (541)	25.6
Public motorized	29.8 (317)	19.2
Total	100 (1064)	101.9 (387,216)

Table 7: School travel mode choice %(n). Source: Own elaboration.

³ See Annex IV for the location of the schools surveyed and the areas with the most traffic accidents.

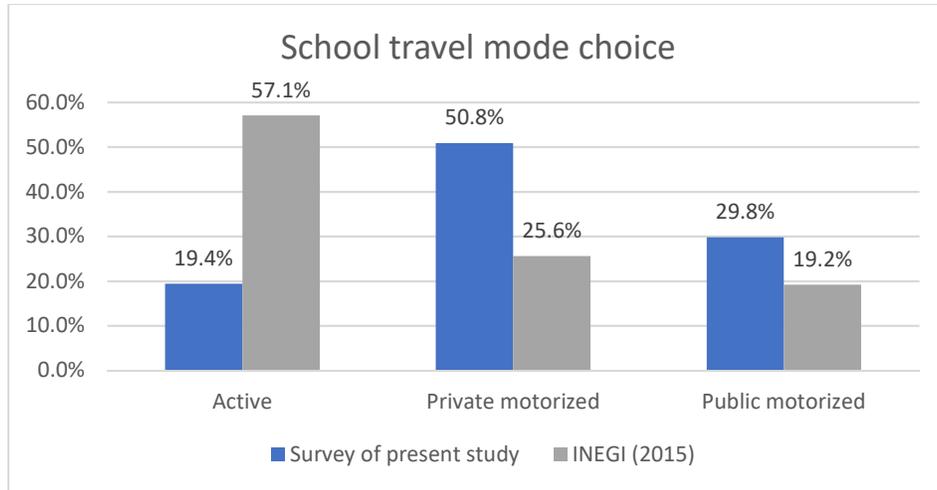


Figure 6: School travel mode choice. Present study vs INEGI (2015). Source: Own elaboration.

Figure 7 maps the network of students' mode choice to school and back home. In this sense, the thicker the line, the greater the variability of the transport mode used to commute to school than the one used to travel back home. In addition, Table 8 shows this variability in numbers. Therefore, it is shown that of the total of 206 students who actively commute to school, 184 return home in the same way, while 20 students switch to private motorized modes and only 2 to public motorized modes. On the other hand, even though the majority of private motorized users travel back home by the same mode, 57 students switch to active modes and 131 used public motorized modes. Interestingly, almost 35% of the students who used public motorized mode to school, travel back home by private motorized modes; while only 8 of these 317 students shift to active modes. Overall, Table 8 shows that although private motorized mode remains the most common mode choice back home, active and public motorized modes increase in this second trip.

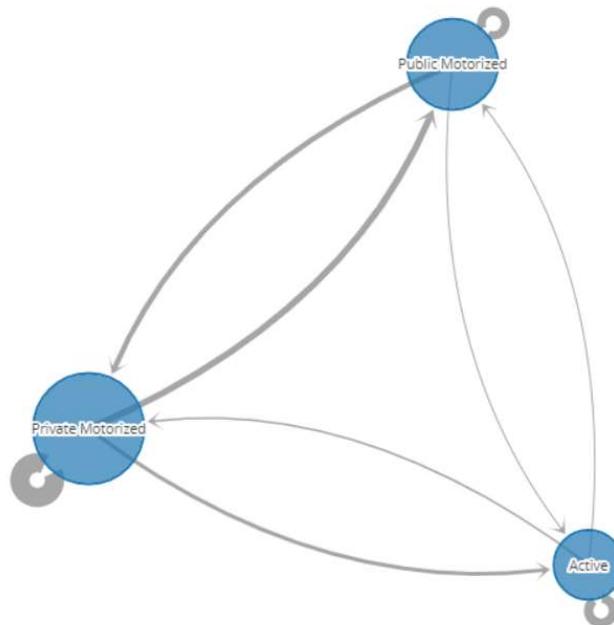


Figure 7: Mode choice to school vs mode choice back home. Source: Own elaboration.

Mode choice to school vs mode choice back home (%(n))				
To \ Back	Active	Private motorized	Public motorized	All
Active	17.3 (184)	1.9 (20)	0.2 (2)	19 (206)
Private motorized	5.4 (57)	33.2 (353)	12.3 (131)	51 (541)
Public motorized	0.8 (8)	10.5 (112)	18.5 (197)	30 (317)
All	23 (249)	46 (485)	31 (330)	(1064)

Table 8: Mode choice to school vs mode choice back home. Source: Own elaboration.

Although the use of active modes when students return to their homes increases by almost 4%, the graphs and tables in this analysis use data only from the mode choice to school, so the results can be compared with previous investigations and data from INEGI (2015).

In this sense, with respect to school travel time, both the current study and data from INEGI (2015) show that most students travel less than 30 min to school (Figure 8). This distance has previously been defined as acceptable for active modes. According to the literature review, long distances to school are discouraging for active school travel (Black et al., 2001). However, this study shows that despite the fact that 81.5% of respondents live within the category of acceptable distance of less than 30 min, private motorized modes are the most common school travel mode choice (Figure 6).

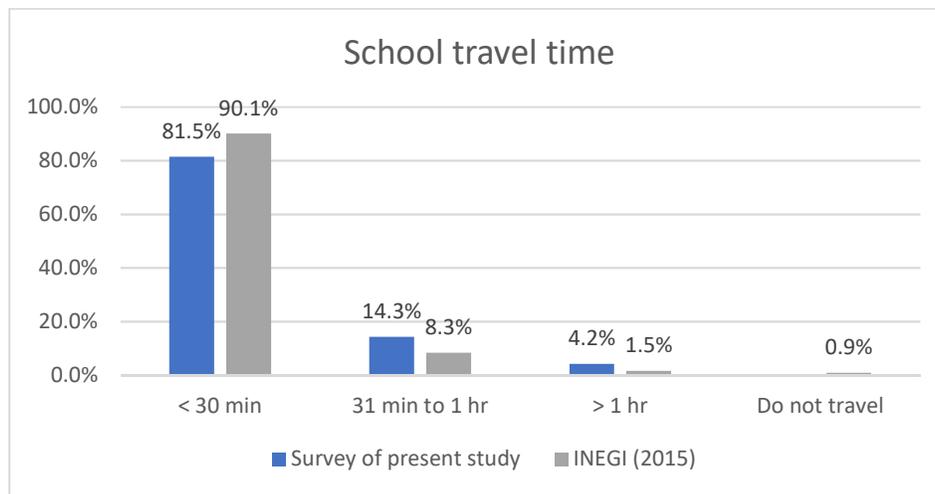


Figure 8: School travel time. Present study vs INEGI (2015). Source: Own elaboration.

In this sense, when analyzing travel time to school by mode choice, it is shown that although 81.5% of students live less than 30 min away from school, 47.5% commute by private vehicles and only 15.8% have an active school travel (Figure 9). As shown in the literature review, most studies on mode choice and school travel behavior evaluate the distance variable and report similarly that the greater the distance, the less likely it is that students commute to school by active modes (Black et al., 2001; Emmond & Handy, 2011; Kamargianni & Polydoropoulou, 2013).

However, the present study shows that for most students, distance is not the main barrier to active mode choice, since more than 80% live less than 30 min away from school. It is important to clarify that perceived distance to school was asked as time travel and was considered for this analysis. In this sense, the real distance value was calculated. Furthermore, the question requested travel time but did not specify the use of a particular mode, consequently, results show that students live less than 30 min from school, but it is not possible to identify whether the

duration refers to walking or in a private vehicle. Nonetheless, focus groups interviews were conducted to better understand other possible barriers for choosing active modes.

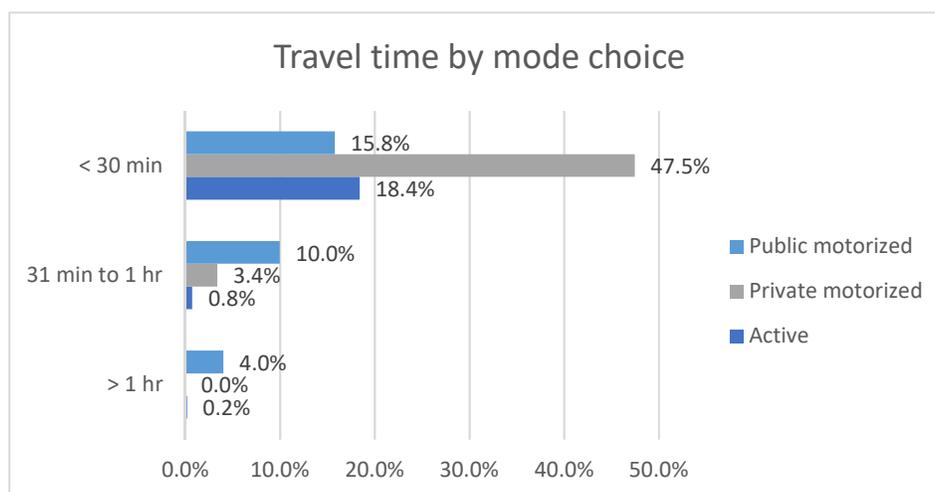


Figure 9: Travel time to school by mode choice. Source: Own elaboration.

Previous research has focused mainly on the analysis of the school travel behavior of children or travel behavior in general and has collected data mostly from adults. As shown in the literature review, programs aimed at promoting active modes focus on improving road safety, and in most of the cases include the participation of the parents to accompany children to school. Therefore, the present study asked students whether they travel alone or accompanied with or without adults, in order to understand the type of travel teenagers have.

Table 9 shows that almost 51% of students travel with at least one adult, of which 436 students travel by private motorized modes and only 63 have an active commuting to school. In this sense, it is shown that most of students who travel accompanied by at least one adult, use private motorized vehicles. The second most common travel option is traveling alone, which represents 36% of the total (Table 9). Of which most students use public motorized modes and active travel as the second most common option. Interestingly, it is shown that most of students who have an active school travel, commute unaccompanied.

School travel characteristics stratified by teenager's usual travel mode to school (% (n))				
Characteristic	Active	Private motorized	Public motorized	All %(n)
School travel characteristics				
Commute with				
Alone	29.8 (114)	14.4 (55)	55.9 (214)	36.0 (383)
Accompanied without adults	20.9 (29)	36.0 (50)	43.2 (60)	13.1 (139)
With at least one adult	11.6 (63)	80.4 (436)	7.9 (43)	50.9 (542)
Time to school				
< 30 min	20.3 (176)	49.9 (433)	29.8 (258)	81.5 (867)
31 min to 1 hr	13.8 (21)	54.6 (83)	31.6 (48)	14.3 (152)
> 1 hr	20.0 (9)	55.6 (25)	24.4 (11)	4.2 (45)

Table 9: School travel characteristics stratified by teenager's usual travel mode to school. Source: Own elaboration.

6.1.2 PERSONAL CHARACTERISTICS

Table 10 shows the personal characteristics stratified by the school travel mode choice collected from the target population. In this sense, it is shown that in terms of gender, approximately 30% of students, both female and male, commute in a similar way by public motorized modes. However, more female students commute by private motorized modes than male ones. Moreover, almost 55% of female teenagers travel in private vehicles, while only about 16% do so in active modes. Similar results were reported by students of another gender where private vehicles are the most popular mode choice and active mode the least popular.

In terms of age, younger travelers chose active modes by almost 49%. Similar to INEGI's (2015) data, this is the most common transport mode for people the age range from 12 to 14 years. However, this is not the case for older students where almost 53% of the respondents reported that private modes were their school travel mode choice (Table 10).

Similar results appear when describing the school level variable (Table 10). Table 10 shows that almost 80% of the respondents currently attend the upper middle level, while only 20% attend the secondary level. In addition, almost 51% of the youngest students who attend secondary level school have an active school travel, whereas only 11.3% of students aged 15 to 18 who attend upper middle level choose this type of transport mode. In this specific analysis it is important to bear in mind that no private school students responded to the survey. However, out of the 1,064 valid responses, 578 respondents attend school whose mode of support is autonomous ("Centro de Educación Media UAA Plantel Oriente"). There a study fee is charged similar to private schools. Considering that Kamargianni M. and Polydoropoulou A. (2013) demonstrated in their study that students from households with higher incomes were less willing to choose non-motorized transport modes, further work could focus on the analysis of the availability and affordability of education in Mexico and Aguascalientes, to explore whether the support mode of schools such as public, private and autonomous could also explain the preference of the respondents for private motorized modes.

Personal characteristics stratified by teenager's usual travel mode to school (% (n))				
Characteristic	Active	Private motorized	Public motorized	All %(n)
Individual characteristics				
Gender				
Female	16.2 (90)	54.4 (303)	29.4 (164)	52.3 (557)
Male	23.0 (115)	46.8 (234)	30.2 (151)	47.0 (500)
Other	14.3 (1)	57.1 (4)	28.6 (2)	0.7 (7)
Age				
12 to 14	48.6 (108)	40.5 (90)	10.8 (24)	20.9 (222)
15 to 17	12.0 (93)	53.6 (416)	34.4 (267)	72.9 (776)
18	7.6 (5)	53.0 (35)	39.4 (26)	6.2 (66)
School level				
Secondary level	50.7 (110)	38.2 (83)	11.1 (24)	20.4 (217)
Upper middle level	11.3 (96)	54.1 (458)	34.6 (293)	79.6 (847)
School schedule				
Morning	24.9 (137)	57.7 (318)	17.4 (96)	51.8 (551)
Afternoon	13.4 (67)	43.5 (218)	43.1 (216)	47.1 (501)
Extended schedule	18.2 (2)	45.5 (5)	36.4 (4)	1.0 (11)

Table 10: Personal characteristics stratified by teenager's usual travel mode to school %(n). Source: Own elaboration.

This study asked for the school schedule of the respondents to identify whether there is a difference between students attending in the morning, in the afternoon and extended school schedules. In this sense, Table 10 shows that the most common mode choice in all schedules is private motorized. However, when analyzing the second most common mode choice, it is shown that students who attend in the morning are more likely to use active modes than students attending in the afternoon or in the extended schedule, who prefer public motorized modes. Only 13.4% of students who attend in the afternoon schedule travel by active modes, whereas almost 25% of respondents attending in the morning schedule have an active school travel.

6.1.3 HOUSEHOLD CHARACTERISTICS

Table 11 analyzes the household characteristics of the respondents and compares them with their school travel mode choice. In this sense, it is shown that most of students that do not own a car at home have an active school travel. As described above, private motorized not only means private cars but also motorcycles. In this sense, although this category specifies the lack of car ownership at home, almost 9% of the students selected private motorized as transport mode. Therefore, the result can either be understood as travel by motorcycle or by private modes provided by others than the own household. In addition, Figure 10 shows that only about 12% of the respondents do not own a private car, whereas 88% have at least one private vehicle at home.

Household characteristics stratified by teenager's usual travel mode to school (% (n))				
Characteristic	Active	Private motorized	Public motorized	All %(n)
Household characteristics				
Car Ownership				
None	47.2 (59)	8.8 (11)	44.0 (55)	11.7 (125)
One	19.1 (84)	46.2 (203)	34.6 (152)	41.3 (439)
More than one	12.6 (63)	65.4 (327)	22.0 (110)	47.0 (500)
Driver's license or permit				
Yes	14.1 (13)	59.8 (55)	26.1 (24)	8.7 (92)
No	19.9 (193)	50.0 (485)	30.1 (292)	91.3 (970)
Bike Ownership				
Yes	19.3 (104)	54.5 (293)	26.2 (141)	50.6 (538)
No	19.4 (102)	47.1 (248)	33.5 (176)	49.4 (526)
Mother education				
Low	43.8 (114)	30.0 (78)	26.2 (68)	24.4 (260)
Mid	15.2 (48)	53.3 (168)	31.4 (99)	29.6 (315)
High	9.4 (42)	60.5 (270)	30.0 (134)	41.9 (446)
Other	4.7 (2)	58.1 (25)	37.2 (16)	4.0 (43)
Father education				
Low	42.7 (106)	31.9 (79)	25.4 (63)	23.3 (248)
Mid	17.9 (49)	47.3 (129)	34.8 (95)	25.7 (273)
High	9.1 (43)	61.1 (290)	29.9 (142)	44.6 (475)
Other	11.8 (8)	63.2 (43)	25.0 (17)	6.4 (68)

Table 11: Household characteristics stratified by teenager's usual travel mode to school %(n). Source: Own elaboration.

Interestingly, almost 14% of students who own at least one private vehicle at home, commute by active modes and almost 25% travel by public transport. It can also be understood that more than

70% of active travelers have a private vehicle at home (Figure 10). Moreover, Table 11 shows that even though 125 students do not own a car at home, only 59 of them travel by active modes.

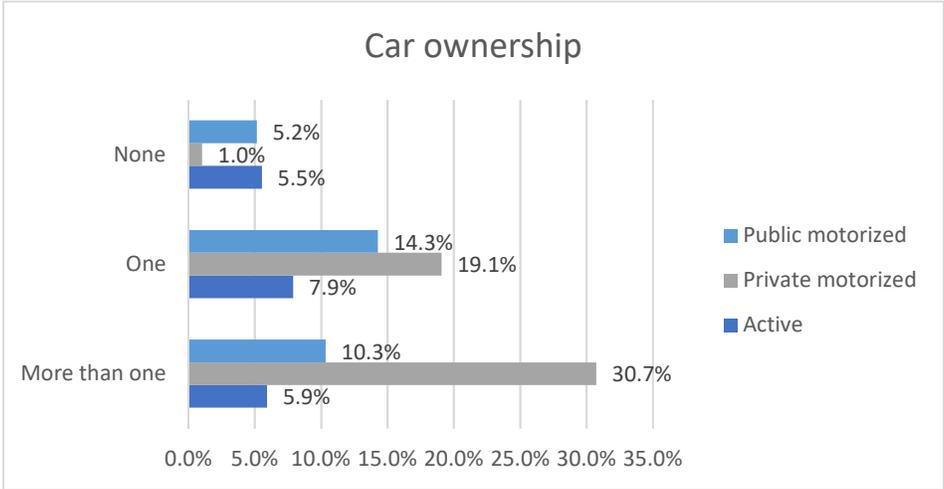


Figure 10: Car ownership vs school travel mode choice. Source: Own elaboration.

As shown in the study of Ding et al. (2017), the ownership of a bicycle and driver’s license can either encourage or prevent people from choosing active modes. In this sense, this information was requested considering that in Aguascalientes it is possible to obtain a driver’s permit from the age of 16 (with the consent of the parents), a driver’s license from the age of 18, and since the target population are students between this age range.

Therefore, Figure 11 shows that approximately 91% of respondents do not own a driver’s permit or license. However, Table 11 shows that of the 92 students who own a driver’s license or permit, 55 reported that they had a private motorized school travel while only 13 responded they had an active school travel. Hence, almost 60% of the students who own a driver’s permit or license travel by private motorized modes.

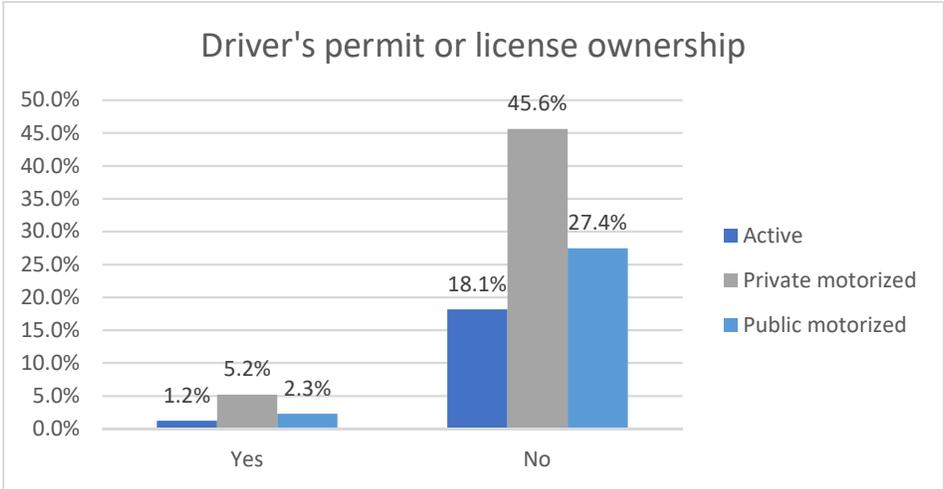


Figure 11: Driver's permit or license ownership. Source: Own elaboration.

As for the ownership of a bicycle, Table 11 shows that almost the half of the students owns a bicycle while the other half does not. In both cases, the most common mode choice is private motorized, the second is public motorized and the least common in both categories is active

travel. Figure 12 shows that both group of students who own a bicycle and those who do not, choose active mode to a similar extent of almost 10%. Moreover, students who own a bicycle use private motorized vehicles almost 5% more than students who do not own one. Those results do not align with the findings of the study by Ding et al. (2017) where people who own a bike were more likely to choose active travel mode to school.

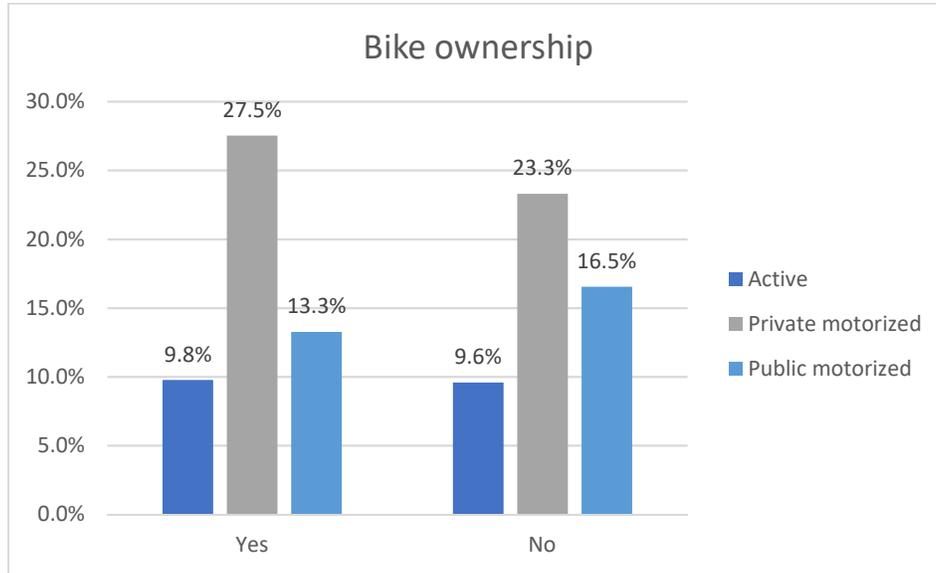


Figure 12: Bike ownership. Source: Own elaboration.

In some studies, it was demonstrated that students whose parents had high levels of education were more willing to walk and bike to school (Kamargianni & Polydoropoulou, 2013; Emond & Handy, 2011). However, Figure 13 shows that active school travel decreases as the level education of both parents increases. In this sense 114 students whose mothers have a low education level, travel by active modes, while only 42 of the students whose mothers have a high education level commute by the same mode (Table 11). In the same way, active school travel decreases when the father has a higher education level. By contrast, the use of private motorized modes increases as the parental level education increases. In this sense, only 78 students whose mothers have a low level of education commute by private motorized modes, whereas 270 students whose mothers' level of education is high commute by this mode (Table 11). Moreover, private motorized school travel behaves in a similar way for students whose fathers have a high level of education.

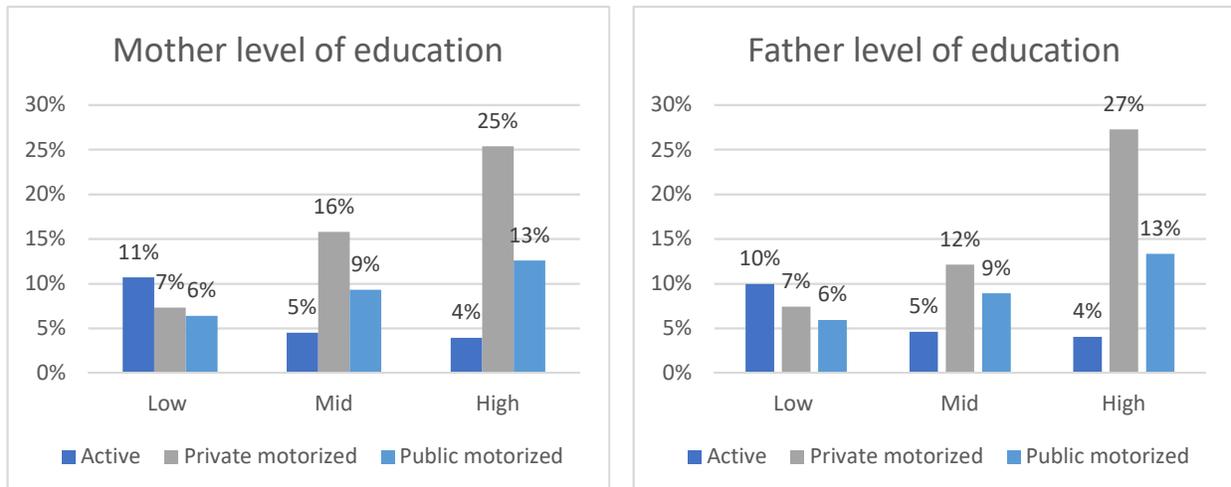


Figure 13: Parental level of education. Source: Own elaboration.

6.1.4 ATTITUDES TOWARDS ACTIVE SCHOOL TRAVEL

As demonstrated in some studies (Kamargianni & Polydoropoulou, 2013; Ding et al. 2017), attitudes towards walking or cycling to school have a positive influence on school travel mode choice. Therefore, this investigation tested five variables to assess the students' attitudes towards active commuting to school when specific conditions for their travel were met. Figure 14 shows that with almost 90% living closer to the school was the most mentioned characteristic that would make students considering travelling by active modes. The second most mentioned characteristic that would make students selecting active school travel was less crime, followed by less traffic accidents and the availability of infrastructure in good conditions. Even though in all five tested variables the most respondents would choose an active mode, a considerably big proportion of respondents would still opt for private motorized mode choice.

Table 12 shows that the variable "travel as a group", made private motorized a more chosen option for students compared to the rest of the variables. Furthermore, it shows that despite an improved road safety, 376 students would still prefer to commute by private motorized vehicles. Similar to the case when infrastructure is perceived in good conditions, where 361 students would prefer a private motorized travel.

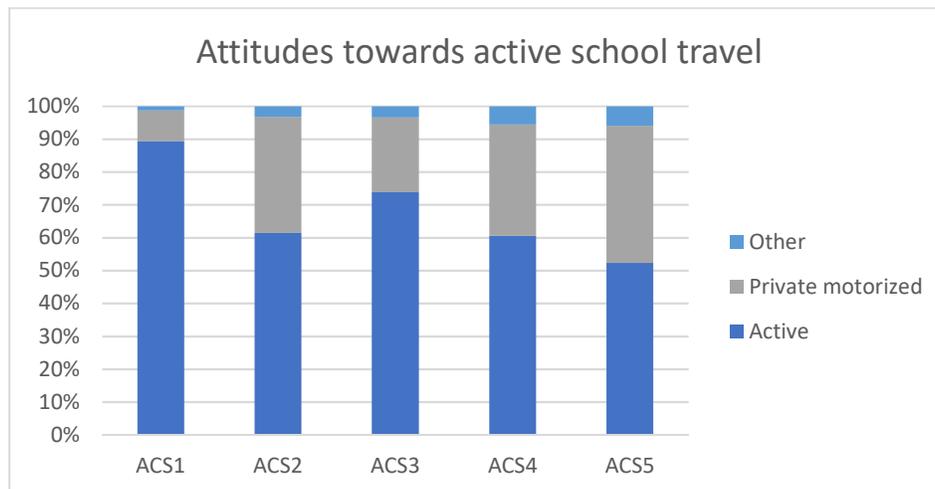


Figure 14: Attitudes towards active. Source: Own elaboration.

Code	Description	Active	Private motorized	Other
ACS1	If I lived closer to school	951	99	14
ACS2	If fewer traffic accidents	654	376	34
ACS3	If less crime	785	242	37
ACS4	If infrastructure in good condition	644	361	59
ACS5	If travel as a group	557	444	63

Table 12: Variables for "Attitudes towards active school travel." Source: Own elaboration.

6.1.5 IMPORTANCE OF FACTORS ON MODE CHOICE

In order to understand not only physical but also psychological characteristics, students were asked what the importance of certain factors is, to choose their school travel mode. Factors, such as the distance from home to school, travel cost, comfort, security, road safety, weather and if it is the only travel option for them. The scale used, as described in the Methodology section of the

present work, was a rating scale from 1 to 5, where 1 is not important and 5 is very important. For the purpose of this analysis, it is considered that 1 to 2 points tend to be not important, 3 is neutral and 4 to 5 tend to be important.

In this sense, Figure 15 and Table 13 displays the seven factors and their importance to mode choice according to the travelers. Therefore, it is shown that 49% of respondents believes that travel distance is important when they choose their travel mode, 21% have a neutral opinion and 30% said that distance is not important. Regarding travel cost, 45% of students consider that this variable is important for them when they choose their school travel mode, while 37% think this is not the case. Only a small difference is shown for the comfort variable, where 40% of respondents believe that comfort is not important, while 37% believe otherwise.

By contrast, a greater difference in the security rating is shown, where 62% of students responded that this factor is important for them when choosing their travel mode to school, while only 22% believes that it is not. Moreover, half of respondents think that safety is an important factor to choose their travel mode to school, while 30% believe otherwise.

As for the weather variable, a small difference is also shown, where 38% of students said it is not important, in contrast to the 40% of students who believe weather is important to choose their school travel mode. Finally, 39% of students think that their mode choice is the only option they have to travel to school, whereas 44% may have different options to travel to school. Chi-squared tests will be carried out to analyze whether there is a significant association between these variables and school travel mode choice. If so, an association test will be conducted to determine the strength of the relationship of these variables and active school travel.

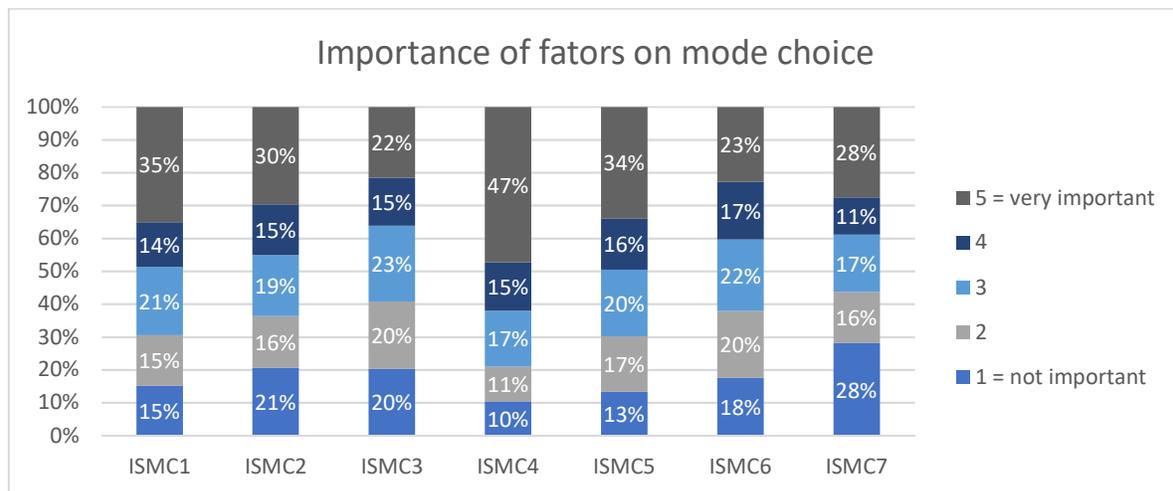


Figure 15: Importance of factors on mode choice. Source: Own elaboration.

Code	Description
ISMC1	Distance
ISMC2	Travel cost
ISMC3	Comfort
ISMC4	Security (crime rate)
ISMC5	Safety (traffic accidents)
ISMC6	Weather
ISMC7	Only travel mode option

Table 13: Variables for "importance of factors on mode choice." Source: Own elaboration.

6.1.6 RATING OF CURRENT SCHOOL TRAVEL

According to the theory of Planned Behavior (Ajzen, 1991), *perceived* behavioral control, or people’s perception about the availability of opportunities and resources, plays an important role on intentions and actions. Therefore, students were requested to evaluate characteristics of the built environment in order to portrait their *perceived* control when choosing their school travel mode. The scale used to measure the characteristics of the built environment (Table 14) such as, the number of bicycle lanes, the conditions of the sidewalks, street lighting, public transport connectivity and others, is a rating scale of 1 to 5, where 1 is very bad and 5 is excellent. For analytical purposes, it is considered that 1 to 2 points tend to be in poor conditions, 3 is neutral and 4 to 5 tend to be in good conditions.

In this sense, Figure 16 shows that all categories were rated in a similar way. According to the responses, the number of bicycle lanes was rated as the worst in this group of characteristics, with 71% of respondents who rated it as in poor conditions. In addition, sidewalks conditions were also rated as in poor conditions by 56% of respondents. Moreover, regarding public transport connectivity, more than half of respondents rated this variable in a similar way, that is, in poor conditions. As for street lighting and the “other” variable, were rated poorly by 48% and 47% of students, respectively. Similar to previous analysis, chi-square tests are required to test whether there is a significant relationship between the variables and active school travel.

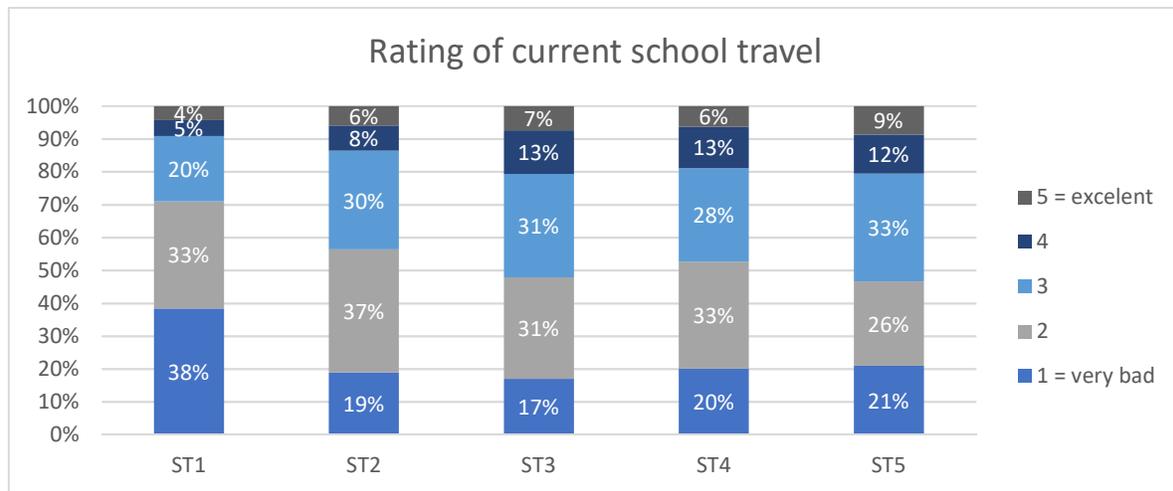


Figure 16: Rating of current school travel. Source: Own elaboration.

Code	Description
ST1	Number of bicycle lanes
ST2	Sidewalks conditions
ST3	Street lighting
ST4	Public transport connectivity
ST5	Other

Table 14: Variables for "rating of current school travel." Source: Own elaboration.

6.1.7 EXPLORING CYCLING TO SCHOOL

Table 15 describes the variables asked to students in order to evaluate their willingness to travel actively to school, specifically by bicycle. As demonstrated by Raktim Mitra (2013), environmental awareness and parental perception of having more physically active, were factors that increased the likelihood of active school travel. Therefore, six variables were evaluated to test whether similar concepts such as environmental, health and psychological benefits contribute to increasing the likelihood of cycling to school (Table 15). The rating scale used to measure the willingness to cycle to school was a 1 to 5 points scale, where 1 is totally disagree and 5 is totally agree. For analytical purposes, it is considered that 1 to 2 points tend to be in disagreement, 3 is neutral and 4 to 5 tend to agree.

In this sense, Figure 17 shows that 60% of the students fully agree with cycling to school because it is good for both the environment and health. By contrast, only about 15% and 11%, respectively disagree with cycling to school for these same reasons. Moreover, 65% and 63% of students, responded that they would travel to school by bicycle because is free and fun, respectively. Out of the six variables, the least accepted option where students agree with cycling to school is “to be fit”. Nonetheless, 55% of respondents agreed to cycle to school for this reason.

For the variable six “I would cycle to school in no case” a disagreement is considered positive, because it means that students do not agree with the statement, therefore, there may be cases in which they are willing to cycle to school. However, Figure 17 shows that 22% of respondents agree with the statement, which means that they are not willing to cycle to school in any case.

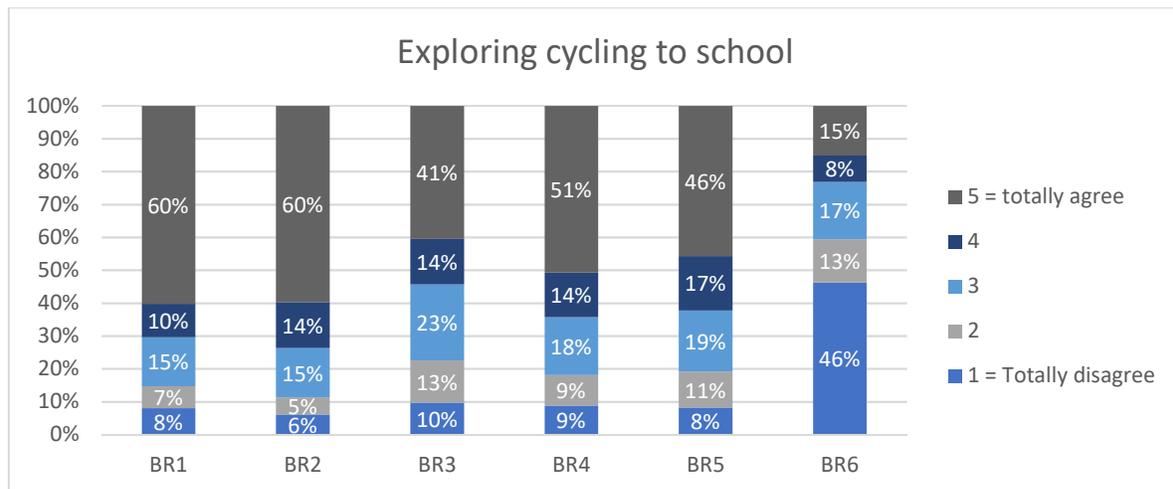


Figure 17: Exploring cycling to school. Source: Own elaboration.

Code	Description
BR1	Because is good for environment
BR2	Because is good for health
BR3	Because I want to be fit
BR4	Because is free
BR5	Because is fun
BR6	In no case

Table 15: Variables for “exploring cycling to school.” Source: Own elaboration.

One of the research hypotheses of the present study considers that cycling skills can be promoters or barriers for students to choose an active school travel. Therefore, participants of the focus groups were required to evaluate their ability to cycle. A rating scale of 1 to 5 points was used, where 1 means the student have no ability to ride a bike, while 5 means the student is a total expert. Analysis considered 1 to 2 points as no-biker and 3 to 5 as cyclist. In this sense, Figure 18 shows that 87% of respondents are “cyclists” and only 13% reported that they lack the skills to ride a bicycle.

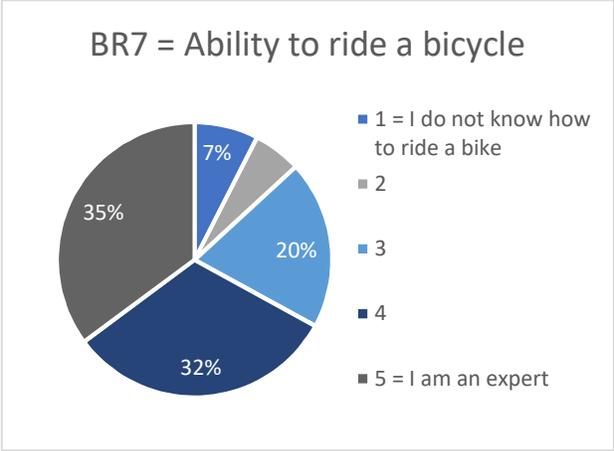


Figure 18: Ability to ride a bicycle. Source: Own elaboration.

In addition, students were asked to express their perception of safety and security specifically when cycling around the city (Table 16). A similar rating scale of 1 to 5 point was used, where 1 means not safe / secure at all and 5 means very safe / secure. In this analysis, 1 to 2 points are considered unsafe / insecure, 3 is neuter and 4 to 5 are considered as safe / secure.

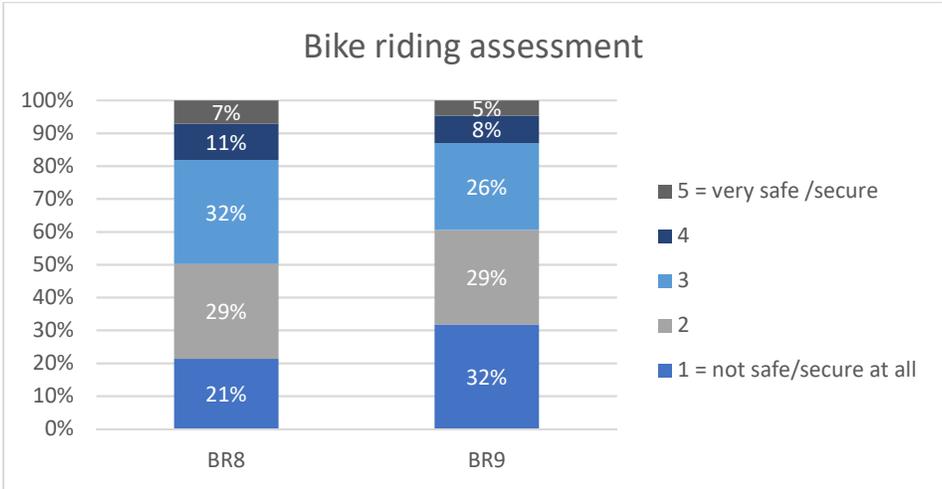


Figure 19: Bike riding assessment. Source: Own elaboration.

Code	Description
BR8	How secure do you feel when cycling around the city?
BR9	How safe do you feel when cycling around the city?

Table 16: Variables for “Bike riding assessment.” Source: Own elaboration.

In this sense, Figure 19 shows that half of the students do not feel safe when cycling throughout the city. Moreover, 61% of the respondents do not feel secure performing this same activity. As expected in the research hypothesis, these results may influence school mode choice, specifically, active mode choice. In this sense, it is expected that perception of unsafety and insecurity may prevent students from choosing active modes. Hence, chi-square tests and associations tests will be conducted to explore whether this presumed result applies to travel behavior of the target population.

6.1.8 RATING PROGRAMS AIMED AT PROMOTING ACTIVE MOBILITY

Students were asked to rate some programs aimed at promoting active mobility in order to test whether the programs are applicable to the target population (Table 17). The first program presented was a designated school to improve cycling skills, the second was a bike sharing system free of charge, and the last two final programs are walking and cycling groups to promote active school travel. As in the previous analysis, the rating scale used was 1 to 5 points, where 1 is not interested at all and 5 is very interested. In this sense, the analysis considers values of 1 to 2 as not interested, 3 as neuter and 4 to 5 as interested.

As shown in Figure 20, 39% of the students are interested in attending a designated school to improve their cycling skills. On the contrary, 42% stated not to be interested in this program, of which 29% chose “not interested at all”. With respect to the free bike sharing system, Figure 20 shows that 57% of the respondents are interested in this program. Interestingly, it is shown that although it is a system with no cost, still 25% of students claimed to be not interested.

Regarding walking groups to school, 41% of students claimed not to be interested in participating, whereas 36% think otherwise. In addition, 45% of respondents are interested in being part of a cycling group to school, whereas 34% are not. A more detailed analysis is required to determine whether the variables are related to school travel mode choice.

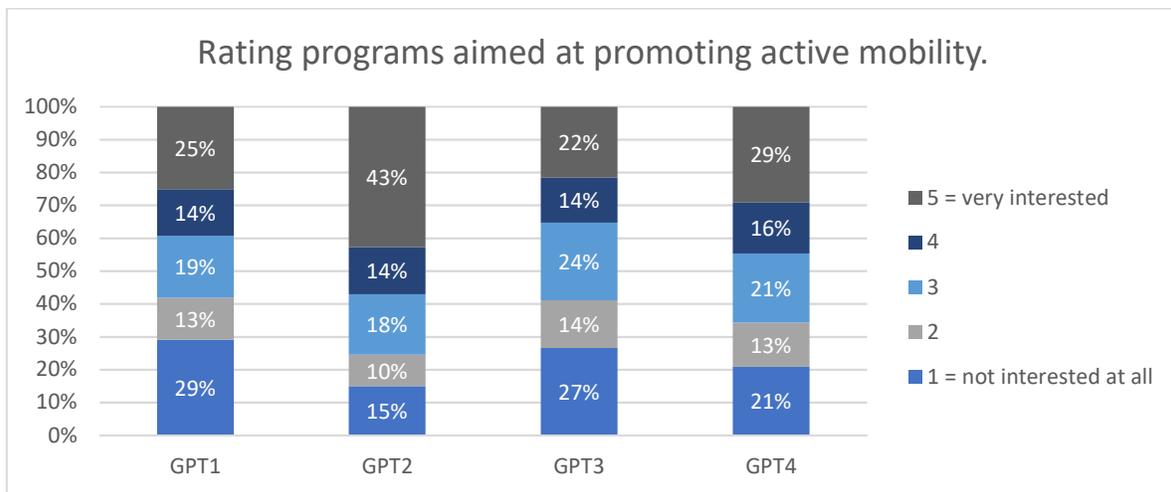


Figure 20: Rating programs aimed at promoting active mobility. Source: Own elaboration.

Code	Description
GPT1	Bike riding school
GPT2	Free bike sharing system
GPT3	Walking groups
GPT4	Cycling groups

Table 17: Variables for "rating programs aimed at promoting active mobility." Source: Own elaboration.

6.1.9 IDEAL SCENARIOS

Aligning to the study of Kamargianni & Polydoropoulou (2013), some scenarios were created to explore student’s attitudes towards active school travel when barriers are eliminated. The first scenario was portrayed as “Imagine you don’t have to worry about anything. How would you like to travel to school?”. The scenario was designed to avoid any barriers, so that students could be in “control”, which according to Ajzen (1991), means that the person can freely decide whether or

not to perform the behavior. Hence, students can freely decide whether or not to choose active modes.

The second scenario was, “Imagine you don’t have to worry about anything. With whom would you like to travel to school?” and third, “If commuting to school by any mode cost the same, which mode would you choose?”. This last scenario was designed to make all transport modes comparable by eliminating costs considerations and explore students’ school mode choices when money can be ignored.

Figure 21 shows the results for the first scenario, when students were asked not to worry about anything and choose their ideal transport mode to school. In this sense, even though no barriers interfered with their mode choice, the most common school travel mode selected was private motorized by approximately 60%. The second most common mode choice was active by 30% and only about 10% said the ideal trip would be using public motorized modes.

The second scenario is presented in Figure 22, where students were asked not to worry about anything and to select their ideal school travel companion. In this scenario, almost 60% of the students would like to travel to school with other young people. 27% of students would like to travel alone and only 13% would like to travel to school accompanied by at least one adult, although they do not have to worry about anything.

The last scenario, aimed at equalizing all transport modes in terms of costs, demonstrated that 77.4% of students would choose private motorized (Figure 23), whereas only 20% would use active modes. Interestingly, not even 1% of respondents selected public motorized mode as the ideal transport mode when all modes cost the same.

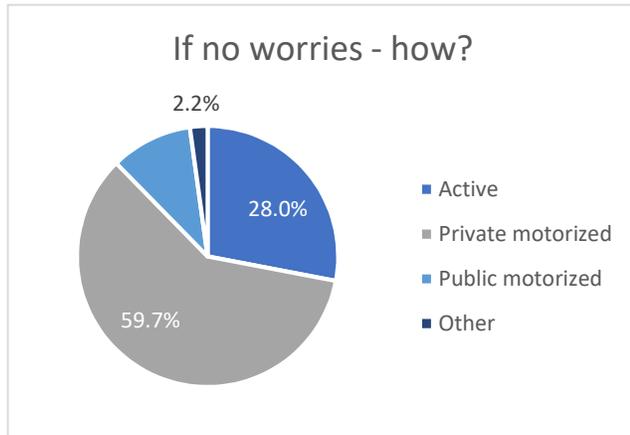


Figure 21: If no worries - how? Source: Own elaboration.

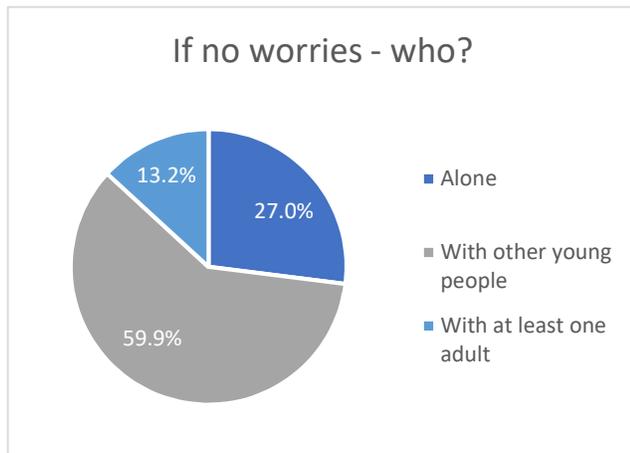


Figure 22: If no worries - who? Source: Own elaboration.

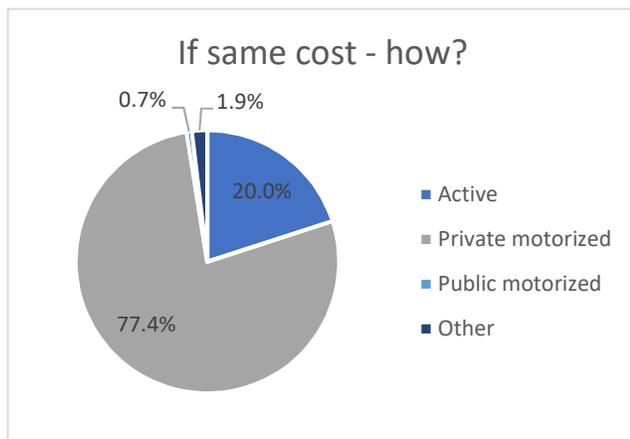


Figure 23: If same cost - how? Source: Own elaboration.

These scenarios were designed to assess the mode choice of the target population when main barriers are eliminated. However, the results show that most of students would prefer to travel to school by motorized modes instead of by active modes. Therefore, focus groups were conducted to explore in depth the possible reasons that encourage teenagers to prefer private motorized vehicles.

6.2 QUALITATIVE ANALYSIS

As described in section 5.4 FOCUS GROUPS, two focus groups were conducted to explore the results obtained in the survey in detail. Due to the fact that the research question of this work is to analyze the factors that influence active school travel, this method was used to understand what encourages students to choose this transport mode. In addition, this section analyses outstanding results of section 6.1.9 IDEAL SCENARIOS, where it was shown that most of respondents are willing to travel to school by motorized rather than by actives modes.

6.2.1 ADVANTAGES AND DISADVANTAGES OF ACTIVE MOBILITY

The first section of the focus groups was to assess the students’ awareness of active mobility. In this sense, it was shown that participants of the focus groups were aware of advantages and disadvantages of commuting actively (Table 18). The health and environmental benefits were the most mentioned advantages in both focus groups, while other unexpected answers were revealed. One of these unexpected answers, showed that active mobility can be an opportunity for people and especially for teenagers to memorize the city. This was represented as an opportunity not only to explore the city, but to memorize its details in a way that could not be possible when commuting by motorized modes. According to the participants, walking and cycling can be an opportunity to “experience the city differently”, accessing areas that are little or no transitable by motorized vehicles.

In addition, one of the answers that caused controversy in the first focus group was that an active travel can provide time for reflection. Participants, specifically cyclists, agreed that biking around the city provides an environment to immerse themselves into their own thoughts, which they had not perceived when commuting by motorized modes. However, they argued that this could also be a disadvantage, because cyclists should be fully focused in order to avoid accidents. Therefore, if cyclists use travel time to reflect, it would mean there is a possibility that they could be at higher risk to be involved in an accident.

Active mobility	
Pros	Cons
Health	Imprudent drivers
Memorize the city	Unsafety
Environment	Insecurity
Time to reflect	Infrastructure
Socializing	Weather
Comfort	
Free of charge	

Table 18: Pros and cons of Active mobility. Source: Own elaboration.

Another advantage revealed was that active mobility can be an opportunity to socialize. Although some participants argued that they have never socialize while cycling, others agreed that walking,

specifically walking in groups to or from school, give them the chance to be in contact with other young people, which isolated private vehicles do not provide.

Interestingly, comfort was also considered as an advantage, specifically for cycling. Participants claimed that due to the poor connectivity, using public transport requires the double amount of time to arrive at their destinations than by bicycle. Moreover, the use of private vehicles for those short trips would result in very expensive travels that can be overcome if they cycle to their destination. In this sense, another advantage that participants perceived about active mobility was that it is free.

On the other hand, several disadvantages were reported, where the most common were risk of traffic-related accidents and insecurity. In this sense, participants were asked whether they believe crime and road danger were real problems in the city or just a perception. With regard to road danger, 60% of participants claimed that they never had an accident, whereas the rest said they have had at least one. Both groups agreed that road danger was a real issue in Aguascalientes. Moreover, they affirmed that there is no “mobility culture” in Aguascalientes. Overall, the discussion showed that all, motorized vehicles drivers, non-motorized vehicles drivers and pedestrians are imprudent when commuting through the city.

In this sense, participants said that motorized vehicles drivers invade bicycle lanes, park in prohibited spaces, cross red lights and do not give way to active travelers. As for the cyclists, they were accused of driving between cars, invading sidewalks, crossing red lights and not giving way to pedestrians. Moreover, pedestrians were also portrayed as imprudent by crossing red lights, invading bicycle lanes and crossing avenues in forbidden areas.

Regarding insecurity, although participants said that it is a real issue in Aguascalientes, due to the fact that several of them have suffered or witnessed an act of vandalism, they also believe that in Aguascalientes it is not as severe as in other parts of the country. Furthermore, they believe that the long-term rooted social perception of insecurity led to an overrating of the issue.

Some other disadvantages were described, such as the weather and the poor conditions of the infrastructure for active mobility. Therefore, the lack of bicycle lanes, poor conditions of sidewalks or their non-existence were described as barriers to commute by active modes. Interestingly, only a few participants opposed the elevated pedestrian crossings built throughout the city. Figure 24 shows an example of these elevated pedestrian crossings that clearly prioritize the transit of motorized vehicles, forcing pedestrians to climb to cross the road. However, they challenged the angle of the inclination of the ramp, but not the existence of this type of crossings themselves. Moreover, most participants advocated that pedestrians should use these crossings because they are designated for them.

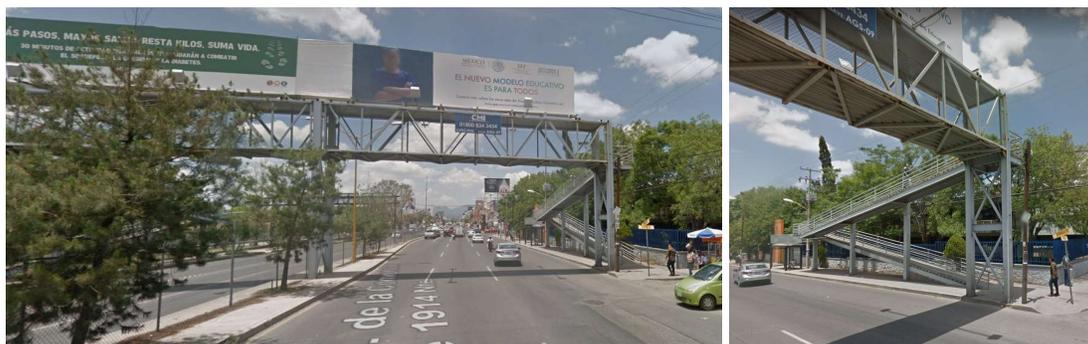


Figure 24: Elevated pedestrian crossing Av. De la Convención 1914 Nte. Aguascalientes. Source: Google Maps Accessed 29.01.19.

6.2.2 FACTORS INFLUENCING PRIVATE MOTORIZED CHOICE

The second section of the focus groups analyzed results obtained in the section 6.1.9 IDEAL SCENARIOS, where it was demonstrated that, even though ideal conditions were described, the most common mode choice to school was private motorized. In this sense, participants were requested to explain why they believe that the respondents would prefer motorized over active modes, although potential barriers in these scenarios were eliminated.

Focus groups participants listed several options, one of which was speed. In this sense, they believed that a possible explanation could be the speed provided by private motorized vehicles. In addition, comfort was also mentioned as an advantage, specifically when driving with other people or when the weather is bad. Moreover, they described it as “easier” to travel by this type of transport mode.

Apart from that, participants emphasized that considering that the respondents were asked not to worry about anything, a possible explanation would be the social status. They believed that owning a private motorized vehicle “makes a person look cool”. In this sense, participants described that it is socially accepted, esteemed and even encouraged to acquire a car. Moreover, this action of purchasing a car, makes a person to look wealthy and successful. Finally, laziness was also given as an explanation of this mode choice. Participants expressed that they believe people are “lazy” in general and that it is preferred to drive a motorized vehicle than to walk or ride a bike.

6.2.3 AMBASSADORS OF ACTIVE MOBILITY

In the last section of the focus groups interviews, participants were asked to imagine they were ambassadors representing the adolescents in Aguascalientes and had the opportunity to talk to the governor to promote active mobility. Therefore, they were asked to describe what needs to change in order to promote active mobility among the target population.

One of the suggestions was to implement a bike sharing system, emphasizing that although it does not have to be free, it must have a very low cost, so that it is affordable for people of their age. Another proposal was to implement thematic days without motorized vehicles, so they suggested that the government could encourage society to walk or cycle, by organizing car-free days throughout the year. Moreover, one proposal suggested to totally forbid the use of motorized vehicles on certain days. Hence, people could not evade the prohibition by purchasing another vehicle and would be forced to vary their transport mode throughout the week.

Another request was to build more infrastructure for active travelers, specifically, cyclists claimed that there are not sufficient bicycle lanes for them. Therefore, the lack of infrastructure and the high speed of motorized vehicles nudge them to invade sidewalks, putting pedestrians at risk. In addition, students also urged the authorities to complete the projects that they start, so that bicycle lanes reach specific destinations instead of ending abruptly. An example of this was that bicycle lanes surrounding the city square are colorful and have a designated lane, but some these lanes end abruptly, leaving the cyclist in a vulnerable position with respect to motorized traffic.

Finally, an incentive system was proposed, where points can be obtained through the kilometers traveled by bicycle. In this sense, if a person accumulates a certain amount of points or is the person with the most points, that person could receive a reward, such as a new helmet or bicycle.

INTERPRETATION

7.1 OVERVIEW

Chi-square tests were performed to determine the significance of the relationship between independent variables analyzed in the section 6.1 QUANTITATIVE ANALYSIS with the dependent variable of school mode choice. Analysis of each variable are shown in ANNEX III – CROSS-TABULATIONS, CHI-SQUARE TESTS AND CRAMER’S V ANALYSIS. While, Table 19 presents the summary of variables, Pearson’s chi-square value, degrees of freedom, asymptotic significance and the percentage of cells that have expected count less than 5.

In order to interpret chi-square test, several assumptions must be met (McHugh, 2013). First, data to be analyzed should be displayed as frequencies instead of percentages. Second, the categories should be exclusive, meaning that one and only one subject fits in one level of each variable. Third, each subject should provide data to one and no more cells in the chi squared test, therefore, if variables are evaluated to compare the same subject over time, chi-square test should not be used. Fourth, the study groups must be independent, which means that each case must be provided by one different student. Fifth, although categorical data are analyzed in the present study, all variables should be codified as ordinal data. Finally, the value of the *expected* results provided by the chi-square test should be 5 or greater in at least 80% of the cells, and no cell should have an *expected* value of less than one.

A table of degrees of freedom (df) must be used, in addition to the chi-square test, to determine the level of statistical significance (McHugh, 2013). The IBM SPSS statistics 22 software was used to calculate both the values of chi-square test and the degrees of freedom. Furthermore, *p*-value is also provided by the software, which must be less than 0.05 to be considered significant.

For the cases in which the data set is too small to meet the sample size assumption of the chi-square test of a value of 5 or greater in at least 80% of the cells, the most common test to use is the maximum likelihood ratio chi-square test (McHugh, 2013). Therefore, the present work also uses the IBM SPSS statistics 22 software to calculate the maximum likelihood ratio chi-square test, when the assumption is violated by more than 20%.

7.2 CHI-SQUARE TESTS

Table 19 shows that the gender and school schedule variables violated the assumption of, cells with a value of 5 or greater, by more than the 20% allowed. Therefore, for these two variables, a maximum likelihood ratio chi-square test is presented in Table 20.

In addition, results from the chi-square test (Table 19) and the maximum likelihood ratio chi-square test (Table 20) show that there is a statistically significant relation between the dependent variable “school travel mode choice” and variables such as gender, bike ownership, GPT1: bike riding to school and GPT4: cycling groups in a 95% confidence level. Moreover, both tables show that 21 variables in total have a significant relation with school travel mode choice in a 99% confidence level. Hence, association tests for the 25 variables are required to determine the strength of each relationship.

Code	Variable	Chi-square value	df	p-value	Violation (%)
Individual characteristics					
	Gender	9.566	4	0.048	33.3
	Age	165.198	4	0.000	0.0
	School level	178.821	2	0.000	0.0
	School schedule	86.774	4	0.000	22.2
Household characteristics					
	Car Ownership	150.075	4	0.000	0.0
	Driver's license or permit	3.478	2	0.176	0.0
	Bike Ownership	7.492	2	0.024	0.0
	Mother education	144.396	6	0.000	0.0
	Father education	132.898	6	0.000	0.0
School travel characteristics					
	Commute with	420.752	4	0.000	0.0
	Time to school	4.172	4	0.383	0.0
Influence school mode choice					
ISMC1	Distance	118.713	8	0.000	0.0
ISMC2	Travel cost	190.373	8	0.000	0.0
ISMC3	Comfort	62.419	8	0.000	0.0
ISMC4	Security (crime rate)	50.057	8	0.000	0.0
ISMC5	Safety (traffic accidents)	69.901	8	0.000	0.0
ISMC6	Weather	30.950	8	0.000	0.0
ISMC7	Only travel mode option	103.248	8	0.000	0.0
Rating of current school travel					
ST1	Amount of cycle paths	36.155	8	0.000	0.0
ST2	Sidewalks conditions	26.369	8	0.001	0.0
ST3	Street lighting	20.553	8	0.008	0.0
ST4	Public transport connectivity	34.989	8	0.000	0.0
ST5	Other	28.053	8	0.000	0.0
Exploring cycling to school					
BR7	Ability to ride a bicycle	9.497	8	0.302	0.0
BR8	How secure do you feel when cycling around the city?	37.095	8	0.000	0.0
BR9	How safe do you feel when cycling around the city?	32.220	8	0.000	0.0
Rating programs that promote active mobility					
GPT1	Bike riding school	15.583	8	0.049	0.0
GPT2	Free bike sharing system	14.293	8	0.074	0.0
GPT3	Walking groups	10.555	8	0.228	0.0
GPT4	Cycling groups	18.363	8	0.019	0.0

Table 19: Chi-square significance tests. Source: Own elaboration.

In contrast, Table 19 shows that five variables have a p -value greater than 0.05. This means that there is not enough evidence to reject that the results could have occurred by chance. Therefore, the null hypothesis H_0 will be accepted in these five cases. Consequently, no association tests will

be performed for the variables: driver's license or permit ownership, travel time to school, BR7: ability to ride a bicycle, GPT2: free bike sharing system, and GPT3: walking groups.

The results are different of what was expected based on initial hypotheses. From what was shown through the literature review, strong associations were expected between variables such as driver's license or permit ownership, BR7: ability to ride a bicycle and specially, travel time to school (distance). However, chi-square test results show that the relation among these variables is not significant and therefore, performing an association test in these cases, is useless.

Variable	Value	df	p-value
Gender	9.568	4	0.048
School schedule	88.498	4	0.000

Table 20: Maximum likelihood ratio chi-square test. Source: Own elaboration.

7.3 ASSOCIATION TEST

According to chi-square test results, an association test was performed to determine the strength of the significant association between each pair of variables. Because the research question of the present work focuses on determining the factors influencing active school travel mode choice, all associations are measured against the presumed dependent variable "school travel mode choice".

In order to interpret the size of each association, the present study uses the convention of Rea & Parker (1992, p.203) described in Table 21.

Value of Cramer's V	Interpretation
.00 and under .10	Negligible association
.10 and under .20	Weak association
.20 and under .40	Moderate association
.40 and under .60	Relatively strong association
.60 and under .80	Strong association
.80 to 1.0	Very strong association

Table 21: Convention for describing the magnitude of association. Source Rea & Parker (1992, p.203).

In this sense, Table 22 shows that the variables for individual characteristics indicate the following:

1. The gender variable has a negligible association with the school travel mode choice. Although this variable has a significant p -value < 0.05 , the strength of the association is negligible. Therefore, the Cramer's V value for this variable suggests that in the city, all genders choose active modes in a similar way.
2. The age variable has a moderate association with school travel mode choice under a 99% confidence level. Therefore, younger students aged 12 to 14 years are more inclined to choose active modes than older students aged between 15 and 18 years.
3. The school level variable has a relatively strong association with the school travel mode choice under a 99% confidence level. In this sense, younger students attending secondary level tend to choose active modes more than older upper middle level students. This can be related to the fact that education for younger students in Mexico has been provided by the state since 1934 compared to education for upper middle level students, which only the state finances since 2012. Moreover, school assignment criteria for younger students specify that they should live within the school influence area (see section 4.2 EDUCATIONAL SYSTEM

IN MEXICO). Therefore, availability and proximity of secondary level schools may encourage teenagers to commute by active modes.

4. The school schedule variable is moderately associated to school travel mode. Hence, students attending in the morning schedule are more inclined to choose active modes than students attending in the afternoon or in extending schedules. As the variable analyzed is mode choice to school and not mode choice back home, it was expected that students attending in the afternoon would commute by active modes more than the ones attending in the morning. Since students attending in the afternoon have always daylight during their travel, whereas students attending in the morning may sometimes travel when it is still dark.

Code	Variable	Cramer's V	p-value
Individual characteristics			
	Gender	0.067*	0.048
	Age	0.279**	0.000
	School level	0.410**	0.000
	School schedule	0.202**	0.000
Household characteristics			
	Car Ownership	0.266**	0.176
	Bike Ownership	0.084*	0.024
	Mother education	0.260**	0.000
	Father education	0.250**	0.000
School travel characteristics			
	Commute with	0.445**	0.000
Influence school mode choice			
ISMC1	Distance	0.236**	0.000
ISMC2	Travel cost	0.299**	0.000
ISMC3	Comfort	0.171**	0.000
ISMC4	Security (crime rate)	0.153**	0.000
ISMC5	Safety (traffic accidents)	0.181**	0.000
ISMC6	Weather	0.121**	0.000
ISMC7	Only travel mode option	0.220**	0.000
Rating of current school travel			
ST1	Amount of cycle paths	0.130**	0.000
ST2	Sidewalks conditions	0.111**	0.001
ST3	Street lighting	0.098**	0.008
ST4	Public transport connectivity	0.128**	0.000
ST5	Other	0.115**	0.000
Exploring cycling to school			
BR8	How secure do you feel when cycling around the city?	0.132**	0.000
BR9	How safe do you feel when cycling around the city?	0.123**	0.000
Rating programs that promote active mobility			
GPT1	Bike riding school	0.086*	0.049
GPT4	Cycling groups	0.093*	0.019

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

* . Association is significant at the 0.05 level (2-tailed).

Table 22: Association analysis with Cramer's V. Source: Own elaboration.

The variables for the household characteristics indicate the following:

5. The car ownership variable is moderately associated with school travel mode choice. In this sense, students who do not own a car tend to prefer active school travel in a higher frequency than students who own at least one car at home. Although the results show an expected association, the relationship between active school travel mode choice and the ownership of a private motorized vehicle was expected to be stronger.
6. The bike ownership variable has a negligible association with school travel mode choice. The evidence shows that both variables are independent from each other. Hence, both students who own a bicycle and the ones who do not, choose active modes in a similar way.
7. The mother's education level variable has a moderate association with school travel mode choice under a 99% confidence level. Therefore, evidence support that teenagers whose mother has a low education level are more inclined to have active school travel than students whose mother have a high education level. Hence, the lower the mother's education level, the higher active school travel mode choice. This result opposes what was expected that maternal higher education level could encourage teenagers to prefer active over motorized modes.
8. The father's education level variable is also moderately associated to school travel mode choice. In this sense, evidence supports that similarly to the previous analysis of mother's education level, students whose father's education level is low, tend to choose active school travel more than students whose father has a high education level.

The variables for the school travel characteristics indicate the following:

9. The "commute with" variable has a relatively strong association with school travel mode choice under a 99% confidence level. Therefore, students who commute alone are more inclined to choose active modes than students commuting with a companion. Moreover, the students that travel accompanied, the ones whose companion is not an adult tend to prefer more active modes that students traveling with an adult.

The variables for the importance of influence on the school mode choice indicate the following:

10. The perceived distance variable is moderately associated with school travel mode choice. Hence, students who tend to choose active modes believe that travel distance is not important when selecting their school travel mode. By contrast, students who are more inclined to choose motorized modes tend to believe that distance is important when selecting their school travel mode.
11. The travel cost variable has a moderate association with school travel mode choice. This shows that students who tend to choose active travel believe that cost is not important when selecting their mode choice. As association does not imply causation, it is not possible to know whether active commuters choose active modes because cost is not important for them or they do not think that cost is important because they travel by active modes.
12. The comfort variable has a weak association with the school travel mode choice. This shows that overall, students tend to believe comfort is not important when choosing their school travel mode. Differently from what was expected of private motorized users that they would be more influenced by comfort.
13. The security variable is poorly associated to school travel mode choice. This suggests that overall, students believe security is important when selecting their mode choice, but this perception is not relevant enough to influence whether they choose an active school travel.

Considering that the association is only weak, the hypothesis of security influencing active mode choice is rejected.

14. The safety variable has a weak association with the school travel mode choice. Therefore, in general, students believe that safety is important when choosing their school travel mode. Similar to the previous analysis, the hypothesis of perception of safety influencing active mode choice must be rejected because of the existence of just a weak relationship.
15. Similarly, the weather variable has a weak association with school travel mode choice under a 99% confidence level. Hence, the variable does not influence their mode choice. Overall, motorized vehicle users and active travelers tend to perceive weather as not important.
16. The “only option” variable has a moderate association with school travel mode choice. Therefore, it is shown that active travelers tend to believe that their mode choice is not their only option. By contrast, users of public motorized modes, think that it is the only option they have for commuting.

The variables for rating the current school travel indicate the following:

17. The number of bicycle lanes variable has a weak association with school travel mode choice. Overall, students rated the number of bicycle paths in Aguascalientes poorly, but as it has only a weak association with the school mode they choose, it is not considered to influence active mode choice.
18. The sidewalk conditions variable has a weak association with school travel mode choice. Overall, students rated sidewalks in Aguascalientes as in poor conditions. Similar to the previous analysis, a weak association means that sidewalk conditions do not influence their school mode choice.
19. The street lighting has a negligible association with school travel mode choice. In general, all travelers rated street lighting in poor conditions. Because no relevant difference between students is shown, both variables are independent from each other.
20. The public transport connectivity variable has a weak association with school travel mode choice. Therefore, a weak relationship suggests that students do not choose, for instance private modes, because there is a poor connectivity of the public transport. Therefore, this variable does not influence school mode choice.

The variables for Exploring cycling to school indicate the following:

21. It is shown that the variable “how secure do you feel when cycling around the city?” has a weak association with the school travel mode choice under a 99% confidence level. It shows that all commuters in general feel insecure when cycling around the city but it does not influence their school travel mode choice. Therefore, there is not enough evidence to support that students commuting by private motorized modes feel especially insecure.
22. The variable “how safe do you feel when cycling around the city?” has also a weak association with the school travel mode choice. In this sense, even though overall, students believe they are not safe when cycling throughout the city; this fact does not really affect whether to choose an active school travel or not.

The variables for the Rating programs that promote active mobility indicate the following:

23. The program “bike riding to school” has no association with school travel mode choice. Therefore, students commuting by active or motorized modes, responded similarly that they are or not interested in attending a school to improve their cycling skills.

24. Similarly, the program “cycling groups” has no association with school travel mode choice. This shows that both, active travelers and motorized vehicles users rated similar their interest in becoming part of cycling groups to school.

8.1 Overview

This section is an interpretation of the obtained results described in the analysis section and serves as a discussion about the interaction between the analyzed variables and active school travel. Some assumptions are based on the characteristics of the target population, the city in which the study was conducted, and the results obtained from the focus groups. The described previous analysis confirms and rejects different claims made by previous studies, while others allow the development of recommendations for improvements, specifically for the target population.

As described before, according to the IMJUVE (2017), young people are “the best bet for integral, fair and lasting development” due to their quantitative representation and their participation as actors of transformation and social renewal. Therefore, this target population may be important when promoting active mobility. However, several factors can either discourage or promote active modes, specifically in their school travel mode choice.

The previous section showed that overall, most individual and household characteristics are associated to school travel mode choice, while factors such as security and safety presumably expected to be strongly related, had only a weak association. Although some variables cannot be compared with previous research, such as rate of road safety and security, this study analyzed them to explore their influence on active school travel when focusing on the target population in Aguascalientes, Mexico.

8.2 FEEDBACK TO PREVIOUS STUDIES

Main outcomes of the analysis did not behave as expected. In this sense, distance to school was expected to be crucial when determining mode choice according to Black et al. (2001). The authors claimed that greater perceived distances have been a great discouragement for children and youth to choose active school travel. Moreover, perceived distance was expected to be a major obstacle for active school travel (Nelson et al. 2008). However, the present study showed that there was no significant relationship between travel distance to school and the school travel mode choice of the target population. Hence, travel distance cannot be used to explain why 50% of the respondents travel to school by private motorized modes and only 19% travel by active modes. Although it was shown that more than 80% of the respondents lived within a 30 min distance from their school, which was considered as an acceptable distance to be traveled by active modes.

However, a limitation for this analysis is that distance was obtained as travel time instead of kilometers. In this sense, the analysis may not be significant because living within less than 30 min, does not specify whether they are traveled by car or by foot. Thus, a distance of 30 min by car may not be acceptable for active modes.

Nonetheless, other several factors could explain the preference for motorized modes, such as household income, car ownership or social status. For instance, an explanation can be that 54% of the respondents attend a school which sustaining mode is autonomous, as it was explained previously, this requires funding from its students, similar to private institutions. Therefore, this fact can mean that household income of these students may differ from the one of students attending in public institutions financed entirely by the state. Kamargianni & Polydoropoulou

(2013) showed in their study that participants from high income households were less willing to choose active modes. Therefore, a student that can afford a fee for education in a place where education is provided by the state, may be sign of having a high income, which is associated to discourage travelers from choosing active modes.

Another explanation can be the social status provided by the use of private vehicles, as shown in the focus groups, where students stated that owning a private motorized vehicle “makes a person look cool.”

By contrast, students were asked to rate the influence of distance on their school travel mode choice. In this sense, analysis showed that this variable is moderately associated to school travel mode choice. Hence, students who tend to choose active modes believe that travel distance is not important for them, while most of students that travel by private motorized modes tend to believe that distance is indeed important when selecting their school travel. This other variable behaves in accordance with what was expected from previous research of Black et al. (2001) and Nelson et al. (2008), that perceived distance influences active travel. Moreover, it could explain the fact that living less than 30 min far from school is not necessarily an acceptable distance if the reference is made in regard to motorized modes. Therefore, more research could be conducted to measure the actual travel distances to school instead of travel time distances and verify that this variable is really not significant to explain the school travel mode choice of the target population.

Regarding the household characteristics, parental education level was expected to have a significant association towards active school travel mode choice as shown by (Emond & Handy, 2011; Kamargianni & Polydoropoulou, 2013). As demonstrated in previous research, students whose parents have a higher education level are more willing to walk and cycle. However, even though education level of both parents is moderately associated to active school travel; the analysis of the present study showed that it behaves in the opposite way. Hence, the students whose parents have a low education level are more willing to have an active school travel than the ones whose parents have higher levels of education.

This result could also be explained with factors such as household income and car ownership. In this sense, parents with a low education level may not have a high income and resources to purchase a car, which could limit students to travel by private motorized modes. By contrast, parents with a high education level may have a higher income and the possibility to own a car, which was shown to be moderately associated to school travel mode choice.

In addition, Ratkim Mitra (2013) claimed that environmental awareness, parental perception of having more physically active children and skilled in terms of road safety increased the likelihood of walking. Therefore, the present study analyzed several variables to explore whether the target population would be similar, more willing to choose active modes. It was shown that students claimed to be more willing to cycle to school because it is good for the environment and health. Moreover, they said they would also cycle to school because is free, fun and in order to be fit. This result may suggest that the target population is aware of the benefits of active mobility and may be willing to cycle to school if the promotion of active mobility is based on these benefits, mainly environmental and health.

Regarding the individual characteristics analyzed, the age variable of the present study has a moderate association with active school travel. However, a strong association was expected from what Ratkim Mitra (2013) stated, that age is strongly associated with the probability of actively commuting to school. Moreover, the present study showed that younger commuters tend to

choose active modes more than older ones. Therefore, the behavior is opposite to research carried out on children as shown by Mitra (2013) and, on the other hand, it behaves similarly to studies on adults conducted by Ding et al., 2017. As described previously, this could be explained by the fact that education for younger students in Mexico has been provided since 1934 in comparison to education for upper middle level students that has been public only since 2012. Moreover, school assignment criteria for younger students specify that they should live within the school influence area. Therefore, availability and proximity of secondary level schools may encourage teenagers to commute by active modes.

Parental concerns about pedestrian safety was claimed to have a negative impact on the probability of active mode choice (Mitra, 2013). However, the previous analysis showed that variables as security and safety have only a weak association with school mode choice. Therefore, teenagers in Aguascalientes are equally concerned about both issues, but they do not encourage or prevent them from selecting active modes.

This could mean that students traveling by private motorized modes do not feel particularly insecure leading to the avoidance of active modes. Although active travelers feel as insecure as motorized users, it could also mean that they choose their transport mode because their travel options are limited or there are other factors in their favor, such as living close to school or not owning a car. Nonetheless, the lack of association between these variables, does not mean that active travelers are not at high risk of traffic-related accidents, as the statistics in section 4.3 AGUASCALIENTES CITY CONTEXT have shown.

According to Ding et al. (2017), the ownership of a bicycle is an important encourager and a driver license is a barrier to active mode choice when the target population are adults. However, the analysis showed that there was no association neither between the driver's license ownership nor the bike ownership with school travel mode choice. By contrast, car ownership at home was probed to be moderately associated to school travel mode choice. In this sense, the lack of car ownership is per se a limitation to select a private motorized mode to travel to school. Therefore, students who do not own a car at home were more inclined to choose active modes than the ones who own at least one car.

This study also analyzed the school level variable based on the educational system in Mexico and specifically, in Aguascalientes, which showed to be relatively strongly associated to active mode choice. Moreover, when analyzing Mexico's education schedule, it was shown that students attending in morning schedules tend to prefer active commuting to school more than students attending in the afternoon. As described previously, the variable analyzed was mode choice to school. Hence, it was expected that students attending in the afternoon would commute by active modes more than students attending in the morning. Since students in afternoon schedules have always daylight during their travel, whereas students in morning schedules may sometimes travel to school when it is still dark. Hence, this result may be explained by other factors such as age or the person who they travel to school with, factors that were moderate and relatively strong associated, respectively, to school travel mode choice.

In addition, Kamargianni M. & Polydoropoulou A. (2013), claimed that some characteristics of the built environment, such as the availability of infrastructure for active transport encourage teenagers to actively travel to school. The previous analysis showed that in general, teenagers rate the number of bicycle lanes, the sidewalk conditions, street lighting and public transport connectivity in Aguascalientes as poor. However, unlike what was expected from previous research, these variables have a weak or no association with active travel mode choice.

Nonetheless, since infrastructure for active mobility in general was rated poorly, the only hypothesis that can be rejected is that infrastructure in bad conditions is not a barrier for choosing active modes, but not that availability of infrastructure encourage students to select active modes. This last hypothesis could only be analyzed if there was infrastructure for active mobility available in good conditions.

8.3 HYPOTHESIS AND PRESUMED RESULTS

With respect to the presumed results of the present study, it was shown that, in general, most students considered that security and safety are important when choosing their school travel mode. However, because the association between each variables and school travel mode choice is weak, this means that this perception does not affect their mode choice. Therefore, there is sufficient evidence to reject the initial hypothesis that perceived insecurity or unsafety are the main barriers for teenagers to choose active modes. Moreover, it was shown through the focus groups analysis that students believe that although insecurity in the Aguascalientes is real, it is a deeply rooted problem in the people's minds that is overrated today.

The second expected result was that greater perceived distances influences negatively the preference for active modes. However, as shown previously, there was no significant association between the travel time to school of respondents and their school travel mode choice. Hence, there is not enough evidence to support that claim. Nonetheless, the importance students give to distance when selecting their school travel mode, is indeed moderately associated to it.

The third presumed result was that the lack of bicycle ownership and the low ability to ride a bike have a negative impact on the preference of active modes. In this sense, it was shown that neither of them was associated to school travel mode choice. Therefore, students who own a bike, chooses active modes similarly to students who do not own one. Moreover, active school travel and the ability of students to ride a bike are independent from each other.

The fourth presumed result was that driver's license ownership discourage teenagers from choosing active modes. Similar to the previous case, the difference between students who own a driver's license or permit was not large enough to be significant. Therefore, there is not enough evidence to support that the ownership of a driver's license can influence at all active mode choice. As 91.1% of respondents do not have neither a driver's license nor a permit, this could explain that students traveling to school by private motorized modes, may not drive themselves, but are driven by a companion. Moreover, this could be supported by the analysis of the "commute with" variable, which showed that students accompanied by adults, are more willing to travel to school by private motorize modes, than students who travel alone.

It was also expected that higher education level of parents influences positively the preference of active modes. However, it was demonstrated that even though both variables are moderately associated with school travel mode choice, school travel of teenagers in Aguascalientes behaves in the opposite way as expected. In this sense, analysis showed that the lower the parental education, the higher the likelihood to actively commute to school.

Finally, it was expected that the lack of infrastructure for active mobility prevent students from choosing active modes. Analysis showed that in general, built infrastructure for active mobility in Aguascalientes is poorly rated by the target population. However, the association between these variables and active school travel mode choice was only weak. Therefore, it is considered that this hypothesis is not applicable for teenagers in Aguascalientes.

8.4 RECOMMENDATIONS

Based on the premise that active mobility can benefit the environment, the health of travelers and can be a solution for traffic-related issues in cities; and considering that school travel is still today, unavoidable; some recommendations can be offered based on the analysis of school travel behavior of teenagers in Aguascalientes, Mexico. The following suggestions should lead to the promotion of active mobility among this target group.

It was shown that at the international level, benefits of active mobility are recognized, as well as main limitations for active travelers. Moreover, the proclamation of the “Decade of Action for Road Safety” shows that this problem must be addressed when encouraging society to choose active modes. In addition, policy makers and practitioners are correctly prioritizing vulnerable groups, in which the target population are included. However, regarding active school travel more importance has been given to children than to teenagers.

At the international and national level, programs to promote active school travel are mostly focused on children but little has been done to address the needs of adolescents. However, teenagers could be also considered when trying to promote a modal shift toward non-motorized modes and promoting more active lifestyles. Due to the fact that teenagers are at a development stage of deciding their mobility preferences for their own, they could be encouraged to perceive active mobility as a real alternative, and in best case, could avoid the purchasing of a car or a motorcycle.

This research showed that the mode choice of teenagers behaves sometimes like that of adults, but sometimes like that of children. For instance, analysis showed that students are not interested in becoming part of a walking groups to school. Therefore, programs like “school buses” may not succeed when targeting teenagers. The analysis also showed that teenagers were not interested in attending a school to improve their cycling skills. Hence, solutions and programs designed to address specifically adolescents needs, are required.

It is undeniable that at the municipal and national level legally recognized mechanisms are required. In this sense, according to the Interview with Gustavo Gutierrez, it is already in process as described in the section 3.3 STATE AND MUNICIPAL LEVEL. However, regulations to systematize and coordinate mobility at the three levels of the government are still pending.

In addition, analysis showed that in general, teenagers believe that the current infrastructure for active mobility in Aguascalientes is not sufficient or is in poor conditions. In this sense, as Gustavo Gutierrez said, it is necessary to create technical capacity within the sector responsible for the planning, design, maintenance and controlling of public space. Today it is more specialized in car-oriented infrastructure than in infrastructure for active mobility. Apart from that, Gustavo Gutierrez suggests to develop procedures, that can allow the financing of projects focused on active mobility.

Regarding road safety, programs such as vision zero for youth implemented in Mexico City, could also be implemented to create safe areas around schools and possibly encourage teenagers to commute by active modes in Aguascalientes. These programs that engage all parties involved such as parents, students, school staff, government and the community to create safe routes and safe conditions for students to arrive and leave school, could promote active modes. Moreover, this kind of participatory projects could generate a great social impact with little necessary funding.

Both survey analysis and focus groups showed that teenagers are interested in bike sharing systems. Moreover, a participant from the focus group stated that he did not own a bicycle and said that he would not purchase one “just” because the government would tell him, not even if it the president of the nation himself promoted it. Instead, he was more willing to use a bike sharing system that could be, if not free, at least affordable for people of his age.

If not the president, if not the government, then who do they trust or admire that can encourage them to use active modes? A focus group participant suggested that involving youtubers to promote active mobility among teenagers could be more successful than a message from authorities. In this sense, as Gustavo Gutierrez said, it is necessary to create institutional capacity to promote participatory processes in the design and implementation of new projects so that needs of particular groups, such as the target population, can be addressed as well.

In addition, analysis showed that teenagers were more willing to cycle to school because it is good for the environment and for health. Therefore, communication campaigns can be based on environmental and health benefits of active mobility when promoting active school travel. Furthermore, it was shown that students were also willing to cycle to school because it is fun and although students are not interested in walking groups, they are interested in being part of cycling groups to school. Therefore, walking school buses, which are programs aimed to encourage parents to escort children to school by foot or bike from a meeting point or bus stop (Tudor-Locke et al., 2012), may also be applicable for teenagers if they are more oriented to cycling. Moreover, these programs could encourage teenagers in Aguascalientes to actively commute to school, while promoting a road safety culture for all, drivers and society in general.

This work showed that even though teenagers rated the conditions of their school travel as poor, they are willing to use active modes because of other attitudinal factors. Therefore, as shown in the focus groups, car-free days, promotion of active modes through celebrities, cycling groups to school could increase the diffusion of active mobility among teenagers in Aguascalientes. Moreover, projects where active travelers can be rewarded, for example, with no homework at school, discounts for the movies and theaters, or for acquiring a new bicycle, could be attractive incentives for students to actively travel to school.

Therefore, the attitudes of the target population are already in favor for the promotion of active mobility. However, it is undeniable that infrastructure and legal mechanisms are needed as well as addressing the barriers that active travelers face so that they can arrive safe to their destinations. Because, although security and safety variables were not associated to school travel mode choice, it does not mean that active travelers are not at great risk of traffic-related accidents, as shown in statistics at international, national and local level.

CONCLUSION

9.1 CONCLUSION

It is clear that to this day, school travel is unavoidable, specifically the school system in Aguascalientes is mostly based on face-to-face teaching. Therefore, it can be seen as an opportunity to encourage active mobility among students. A transport mode that could not only benefit the environment but could also be part of a solution against traffic congestion in cities, a way to promote more active lifestyles among the target population and improve the well-being of societies.

However, in order to promote this emission-free transport mode, several issues must be addressed in advance, such as guaranteeing that students will arrive safely to their destinations. Therefore, policies and programs addressing road safety are definitely needed. Nonetheless, there is no universal solution. In this sense, programs aimed at encouraging active school travel with focus on children, may not be applicable for adolescents. Therefore, understanding the target population, their needs and factors that influence active school travel is required.

In this sense, this research focused on analyzing the factors influencing active mobility of teenagers through their school travel behavior and to understand if local policies are in fact, addressing the right issues.

It was shown that most data to analyze mode choice and travel behavior has been collected from adults, whether the target population are children or adults themselves. However, little attention has been paid to adolescents and little data has been collected directly from them.

The initial hypothesis was that several factors, including psychological ones, influence teenagers to choose or not, active modes. Presumed results were that perceived insecurity and lack of road safety are main barriers for teenagers to choose active modes. This was rejected by the analysis that showed that even though most of students rated both variables as very important when selecting their school travel mode, the variables in fact have a weak association with the mode they actually choose to travel to school. However, no association does not mean that active travelers are not at great risk of traffic-related accidents, as shown in statistics at international, national and local level.

In addition, travel distance to school was expected to be crucial when determining mode choice. However, it was not significant for the present study. However, a limitation for this analysis was that distance was obtained as travel time instead of kilometers. In this sense, the analysis might not be significant because a distance of 30 min by car may not be acceptable for active modes. Nonetheless, another variable showed that students who do not believe distance is an important factor when selecting their school travel mode, were in fact more willing to commute by active modes.

Other presumed results were that the lack of bicycle ownership, the low ability to ride a bicycle and the ownership of a driver's license or permit discourage teenagers from selecting active modes. All of them were rejected because there was no significant or relevant association between them and active school travel. However, the car ownership variable, was probed to be moderately associated to the preference of motorized modes to travel school.

Interestingly, parental education was moderately associated to active school travel, however, in the opposite way as expected. Therefore, it was shown that students whose parents have low education level were more willing to actively commute to school than students whose parents have a high education level, who were more inclined to travel by motorized modes.

In addition, students showed to be more willing to cycle to school for other factors, such as environmental awareness and benefits of active mobility for health. Moreover, it was shown that programs like “walking school buses” can be interesting for teenagers if they are oriented to cycling, since it was shown that students tend to be interested in cycling groups to school. Therefore, future research could analyze whether cycling could be the active mode that could help promote active mobility among this target population.

The last presumed result was that the lack of sufficient infrastructure for active mobility discourages teenagers from selecting active modes. The study showed that students rated the existing infrastructure as insufficient or in poor conditions. However, this does not affect the way they choose to travel to school.

Using chi-squares and Cramer’s V tests, it was possible to measure if the analyzed variables were in fact relevant and applicable to understand what encourages or prevent teenagers to choose active modes when they travel to school. The analysis revealed some contradictions to prior statements. However, it does not necessarily indicate that previous statements are incorrect but that the target population deferred and the context of the area of analysis may influence the results.

Finally, this research aimed to answer whether the current local policies are addressing the right issues to promote active mobility among teenagers in Aguascalientes. The policy review showed that the subject is gaining more attention at the local level. Therefore, efforts and actions are being performed to address the issue. Nonetheless, it is shown that current legal mechanisms to regulate mobility in Aguascalientes require additional instruments and resources to meet the needs of the target population to promote active mobility.

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ANNEX I – SURVEY (ORIGINAL VERSION)

Rumbo a la escuela

Ir a la escuela es tu derecho y tu trayecto diario es muy importante. Queremos saber cómo te mueves, por qué lo haces, cuánto te tardas y cómo podemos mejorar tu viaje diario. Por favor contesta este cuestionario que nos ayudará a conocer cómo se mueven los jóvenes como tú, rumbo a su escuela. ¡Te prometemos que será breve!

*Obligatorio

¿Cómo te mueves?

En esta sección nos interesa conocer más acerca de tu viaje hacia tu escuela.

1. ¿Con quién viajas... *

Marca solo un óvalo por fila.

	Sól@	Acompañad@ pero sin adultos	Con al menos un adulto
hacia la escuela?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
de regreso a casa?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

2. ¿Cuánto tiempo tardas en llegar... *

Marca solo un óvalo por fila.

	máximo 15 min	de 16 min a 30 min	de 31 min a 1 hora	de 1 hora a 2 horas	más de 2 horas
a la escuela?	<input type="radio"/>				
de regreso a casa?	<input type="radio"/>				

3. ¿Cuánto dinero gastas en pasaje de ida y vuelta a la escuela? *

Escribe tu respuesta con dígitos enteros y decimales (si es necesario).

4. ¿Qué modos de transporte utilizas para ir... *

Puedes elegir más de una opción

Selecciona todas las opciones que correspondan.

	Caminando	Bicicleta	Auto o camioneta	Colectivo/autobús	Taxi	Motocicleta	Transporte escolar	Otro.
a la escuela?	<input type="checkbox"/>							
de regreso a casa?	<input type="checkbox"/>							

5. De acuerdo a tu respuesta anterior, ¿Qué modo utilizas en la mayor parte de tu trayecto... *

Marca solo un óvalo por fila.

	Caminando	Bicicleta	Auto o camioneta	Colectivo/autobús	Taxi	Motocicleta	Transporte escolar	Otro.
hacia la escuela?	<input type="radio"/>							
de regreso a casa?	<input type="radio"/>							

1- Nada importante 5- Muy importante

6. ¿Qué tan importante son para tí los siguientes factores cuando eliges el modo de transporte de la pregunta anterior para transportarte hacia la escuela? * Marca solo un óvalo por fila.

1- Nada importante 2 3 4 5- Muy importante

	1	2	3	4	5
Distancia a la escuela	<input type="radio"/>				
Costo de transporte	<input type="radio"/>				
Comodidad	<input type="radio"/>				
Crimen en la ciudad	<input type="radio"/>				
Accidentes viales	<input type="radio"/>				
Clima	<input type="radio"/>				
Es mi única opción	<input type="radio"/>				

El viaje ideal

7. Imagina que no tuvieras que preocuparte por nada. Cómo te gustaría viajar a la escuela? *

Marca solo un óvalo.

- Caminando
- En bici
- En transporte público
- En auto
- En transporte escolar
- Otros: _____

8. Si no tuvieras que preocuparte por nada. Con quién te gustaría viajar a la escuela? *

Marca solo un óvalo.

- Sol@
- Con otros jóvenes
- Con al menos un adulto

Muévete más

9. Yo iría a mi escuela en... *

Marca solo un óvalo por fila.

	Bicicleta	Caminando	Auto	Otro
si viviera más cerca del colegio si	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
hubiera menos accidentes viales	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
si hubiera menos delincuencia	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
si hubiera infraestructura en buen estado	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
si viajáramos en grupo	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

10. Si tuvieran el mismo costo ¿Cuál elegirías para ir a la escuela? *

Marca solo un óvalo.

- Una bici
- Un auto
- Otros: _____

11. Califica tu habilidad para andar en bici. *

Marca solo un óvalo.

	1	2	3	4	5	
No sé andar en bici	<input type="radio"/>	Soy un expert@ en la bici				

12. Hablando de crimen en la ciudad ¿Qué tan segur@ te sentirías viajando en bici desde/hacia la escuela? *

Marca solo un óvalo.

	1	2	3	4	5	
Nada seguro	<input type="radio"/>	Muy seguro				

13. Hablando de sufrir un accidente vial ¿Qué tan segur@ te sentirías viajando en bici desde/hacia la escuela? *

Marca solo un óvalo.

	1	2	3	4	5	
Nada seguro	<input type="radio"/>	Muy seguro				

14. ¿Cómo calificarías los siguientes aspectos en tu trayecto rumbo a la escuela? *

Marca solo un óvalo por fila.

	1-Muy malo	2	3	4	5-Muy bueno
Cantidad de ciclovías	<input type="radio"/>				
Condiciones de banquetas	<input type="radio"/>				
Iluminación de calles	<input type="radio"/>				
Transporte público	<input type="radio"/>				
Otros	<input type="radio"/>				

15. Yo asistiría a la escuela en bici... *

Marca solo un óvalo por fila.

	1-Totalmente en desacuerdo	2	3	4	5-Totalmente de acuerdo
Porque es bueno para el ambiente	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Porque es bueno para la salud	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Porque quiero tener buen cuerpo	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Porque es gratis Porque	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
sería divertido En	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ningún caso	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Un poco acerca de ti...

16. ¿Cuál es tu género? *

Marca solo un óvalo.

- Femenino
- Masculino
- Otros: _____

17. ¿Cuántos años tienes? *

Marca solo un óvalo.

- 12 a 14
- 15 a 17
- 18
- Otros: _____

18. ¿Qué cursas actualmente? *

Marca solo un óvalo.

- Secundaria
- Bachillerato o nivel medio superior

19. El nombre de tu escuela es... *

20. Tu horario escolar es... *

Marca solo un óvalo.

- Matutino
- Vespertino Jornada
- ampliada
- Otros: _____

21. ¿En qué colonia vives? *

22. ¿Cuál es el código postal de tu casa?

23. ¿Cuántos autos hay en tu casa? *

Marca solo un óvalo.

- Ninguno
- Uno
- Más de uno

24. ¿Tienes licencia o permiso de conducir?

Marca solo un óvalo.

- Sí
 No

25. ¿Tienes bicicleta propia? *

Marca solo un óvalo.

- Sí
 No

26. ¿Qué escolaridad tienen tus padres? *

Marca solo un óvalo por fila.

	Primaria	Secundaria	Preparatoria	Universidad	Maestría	Otra
Padre	<input type="radio"/>					
Madre	<input type="radio"/>					

Hablando del futuro

27. ¿Te interesaría asistir a una biciescuela para mejorar tus habilidades para andar en bici? *

Marca solo un óvalo.

1 2 3 4 5

No me interesa Me interesa mucho

28. ¿Te interesaría usar un sistema de bicicletas de gobierno gratuitas para ir a la escuela? *

Marca solo un óvalo.

1 2 3 4 5

No me interesa Me interesa mucho

29. ¿Te interesaría formar parte de algún grupo estudiantil que camina a la escuela? *

Marca solo un óvalo.

1 2 3 4 5

No me interesa Me interesa mucho

30. ¿Te interesaría ir a la escuela en bici como parte de un grupo? *

Marca solo un óvalo.

1 2 3 4 5

No me interesa Me interesa mucho

ANNEX II – SURVEY (TRANSLATION)

Survey Title: Way to school

Going to school is your right and we want to know what your trip to school is like. We want to know how you move, why do you do it this way, how long it takes you to get to school and what can be done better to improve your daily commute. Please, answer this survey that will help us to know how young people like you commute to school. We promise you it won't take you long.

Section 1. How do you move

1. ¿who do you commute...
 - i. to school with? / back home?
 - Alone
 - Accompanied but without adults
 - With at least one adult
2. ¿How long does it take to get from
 - i. home to school? / back home?
 - Maximum 15 min
 - From 16 to 30 min
 - From 31 min to 1 hr
 - From 1hr to 2 hr
 - More than 2 hr
3. ¿How much money do you spend on your trip to school?

Open question (validate data: number)
4. ¿What modes of transportation do you use to
 - i. go to school? / go back home? You can choose more than one option
 - Walking
 - Biking
 - Car
 - Bus / combi / colectivo
 - Taxi
 - Motorbike
 - School transport
 - Other...
5. Based on your previous answer, what mode do you use for most of your trip
 - i. To school? / back home?
 - Walking
 - Biking
 - Car
 - Bus / combi / colectivo
 - Taxi
 - Motorbike
 - School transport
 - Other...

6. Based on your answer to question 14, how important are these factors for you to choose this transport mode to travel to school?

	Not important 1	2	3	4	Very important 5
Distance to school					
Cost of transportation					
Comfort					
Security (crime rate)					
Road safety					
Weather					
It is my only option					

Section 2. The ideal trip

7. Imagine you don't have to worry about anything. What would be for you, the perfect way to go to school?
- By foot
 - By bike
 - By public transport
 - By car
 - By school transport
 - Other (specified)...
8. Imagine you don't have to worry about anything. Who would you want to go to school with?
- Alone
 - Accompanied but without adults
 - Accompanied with at least one adult

Section 3. Move more

9. I would go to school by...

	Bike	Walking	Car	Other
If I lived closer to school				
If there were fewer traffic accidents				
If there was less crime				
If there was infrastructure in good condition				
If I can travel in a group				

10. If commuting to school by any of these modes had the same cost, which mode would you choose?
- A bike
 - A car
 - Other...

11. Rate your ability to ride a bike.

Where 1 is: I don't know how to ride a bike and 5 is: I am an expert riding bikes.

1	2	3	4	5
---	---	---	---	---

12. How secure would you feel riding a bike to school?

Where 1 is: not secure at all and 5 is: very secure.

1	2	3	4	5
---	---	---	---	---

13. How safe would you feel riding a bike to school?

Where 1 is: not safe at all and 5 is: very safe.

1	2	3	4	5
---	---	---	---	---

14. How would you rate the following aspects on your trip to school?

	Very bad 1	2	3	4	Very good 5
Amount of cycle paths					
Sidewalk condition					
Street lighting					
Public transport connectivity					
Other...					

15. I would ride a bike to school...

	Totally disagree 1	2	3	4	Totally agree 5
Because is good for environment					
Because is good for health					
Because I want to be fit					
Because is free					
Because is fun					
In no case					

Section 4. A bit about you

16. ¿What is your gender

- Female
- Male
- Other

17. ¿How old are you?

- 12-14
- 15-17
- 18
- Other...

18. What level do you currently attend?

- Secondary
- Upper Middle

19. The name of your school is?
Open question
20. Your school schedule is...
 Morning
 Afternoon
 Extended day
21. What district do you live in?
Open question
22. ¿What is your postal code?
Open question (validate data: number)
23. How many cars do you have at home?
 None
 One
 More than one
24. Do you own a driver's license or permit?
 Yes
 No
25. ¿Do you own a bike?
 Yes
 No
26. ¿what education level has your Mother/father?
 Elementary level
 Secondary level
 Upper middle level
 Bachelor's
 Master's
 Other

Section 5. About the future

27. Would you be interested in attending a bike school to improve your cycling skills?
Where 1 is: not interested at all and 5 is: very interested.

1	2	3	4	5
---	---	---	---	---

28. Would you be interested in using a free bike sharing system to travel to school?
Where 1 is: not interested at all and 5 is: very interested.

1	2	3	4	5
---	---	---	---	---

29. Would you be interested in being part of walking groups to go to school?
Where 1 is: not interested at all and 5 is: very interested.

1	2	3	4	5
---	---	---	---	---

30. Would you be interested in being part of cycling groups to go to school?
Where 1 is: not interested at all and 5 is: very interested.

1	2	3	4	5
---	---	---	---	---

ANNEX III – CROSS-TABULATIONS, CHI-SQUARE TESTS AND CRAMER'S V ANALYSIS

Gender * Mode choice to school

Crosstab			Mode choice to school			Total
			Active	Private motorized	Public motorized	
Gender	Female	Count	90	303	164	557
		Expected Count	107.8	283.2	165.9	557.0
	Male	Count	115	234	151	500
		Expected Count	96.8	254.2	149.0	500.0
	Other	Count	1	4	2	7
		Expected Count	1.4	3.6	2.1	7.0
Total		Count	206	541	317	1064
		Expected Count	206.0	541.0	317.0	1064.0

Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	9.566 ^a	4	.048
Likelihood Ratio	9.568	4	.048
N of Valid Cases	1064		

a. 3 cells (33.3%) have expected count less than 5. The minimum expected count is 1.36.

Symmetric Measures	Value	Approximate Significance
Cramer's V	.067	.048
N of Valid Cases	1064	

Age * Mode choice to school

Crosstab			Mode choice to school			Total
			Active	Private motorized	Public motorized	
Age	12-14	Count	108	90	24	222
		Expected Count	43.0	112.9	66.1	222.0
	15-17	Count	93	416	267	776
		Expected Count	150.2	394.6	231.2	776.0
	18	Count	5	35	26	66
		Expected Count	12.8	33.6	19.7	66.0
Total		Count	206	541	317	1064
		Expected Count	206.0	541.0	317.0	1064.0

Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	165.198 ^a	4	.000
Likelihood Ratio	149.365	4	.000
N of Valid Cases	1064		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 12.78.

Symmetric Measures	Value	Approximate Significance
Cramer's V	.279	.000
N of Valid Cases	1064	

School level attending * Mode choice to school

Crosstab			Mode choice to school			Total
			Active	Private motorized	Public motorized	
School level attending	Secondary level	Count	110	83	24	217
		Expected Count	42.0	110.3	64.7	217.0
	Upper medium level	Count	96	458	293	847
		Expected Count	164.0	430.7	252.3	847.0
Total	Count	206	541	317	1064	
	Expected Count	206.0	541.0	317.0	1064.0	

Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	178.821 ^a	2	.000
Likelihood Ratio	158.018	2	.000
N of Valid Cases	1064		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 42.01.

Symmetric Measures	Value	Approximate Significance
Cramer's V	.410	.000
N of Valid Cases	1064	

School schedule * Mode choice to school

Crosstab			Mode choice to school			Total
			Active	Private motorized	Public motorized	
School schedule	Morning	Count	137	318	96	551
		Expected Count	106.8	280.4	163.8	551.0
	Afternoon	Count	67	218	216	501
		Expected Count	97.1	255.0	148.9	501.0
	Extended schedule	Count	2	5	4	11
		Expected Count				

	Expected Count	2.1	5.6	3.3	11.0
Total	Count	206	541	316	1063
	Expected Count	206.0	541.0	316.0	1063.0

Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	86.774 ^a	4	.000
Likelihood Ratio	88.498	4	.000
N of Valid Cases	1063		

a. 2 cells (22.2%) have expected count less than 5. The minimum expected count is 2.13.

Symmetric Measures	Value	Approximate Significance
Cramer's V	.202	.000
N of Valid Cases	1063	

Car ownership at home * Mode choice to school

Crosstab			Mode choice to school			Total
			Active	Private motorized	Public motorized	
Car ownership at home	None	Count	59	11	55	125
		Expected Count	24.2	63.6	37.2	125.0
	One	Count	84	203	152	439
		Expected Count	85.0	223.2	130.8	439.0
	More than one	Count	63	327	110	500
		Expected Count	96.8	254.2	149.0	500.0
Total	Count	206	541	317	1064	
	Expected Count	206.0	541.0	317.0	1064.0	

Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	150.075 ^a	4	.000
Likelihood Ratio	158.412	4	.000
N of Valid Cases	1064		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 24.20.

Symmetric Measures	Value	Approximate Significance
Cramer's V	.266	.000
N of Valid Cases	1064	

Driver's license or permit * Mode choice to school

Crosstab			Mode choice to school			Total
			Active	Private motorized	Public motorized	
Driver's license or permit	Yes	Count	13	55	24	92
		Expected Count	17.8	46.8	27.4	92.0
	No	Count	193	485	292	970
		Expected Count	188.2	493.2	288.6	970.0
Total		Count	206	540	316	1062
		Expected Count	206.0	540.0	316.0	1062.0

Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	3.478 ^a	2	.176
Likelihood Ratio	3.556	2	.169
N of Valid Cases	1062		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 17.85.

Symmetric Measures	Value	Approximate Significance
Cramer's V	.057	.176
N of Valid Cases	1062	

Bike ownership * Mode choice to school

Crosstab			Mode choice to school			Total
			Active	Private motorized	Public motorized	
Bike ownership	Yes	Count	104	293	141	538
		Expected Count	104.2	273.6	160.3	538.0
	No	Count	102	248	176	526
		Expected Count	101.8	267.4	156.7	526.0
Total		Count	206	541	317	1064
		Expected Count	206.0	541.0	317.0	1064.0

Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	7.492 ^a	2	.024
Likelihood Ratio	7.504	2	.023
N of Valid Cases	1064		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 101.84.

Symmetric Measures	Value	Approximate Significance
Cramer's V	.084	.024
N of Valid Cases	1064	

School level of father * Mode choice to school

Crosstab			Mode choice to school			Total
			Active	Private motorized	Public motorized	
School level of father	Low	Count	106	79	63	248
		Expected Count	48.0	126.1	73.9	248.0
	Mid	Count	49	129	95	273
		Expected Count	52.9	138.8	81.3	273.0
	High	Count	43	290	142	475
		Expected Count	92.0	241.5	141.5	475.0
	Other	Count	8	43	17	68
		Expected Count	13.2	34.6	20.3	68.0
Total		Count	206	541	317	1064
		Expected Count	206.0	541.0	317.0	1064.0

Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	132.898 ^a	6	.000
Likelihood Ratio	123.608	6	.000
N of Valid Cases	1064		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 13.17.

Symmetric Measures	Value	Approximate Significance
Cramer's V	.250	.000
N of Valid Cases	1064	

School level of mother * Mode choice to school

Crosstab			Mode choice to school			Total
			Active	Private motorized	Public motorized	
School level of mother	Low	Count	114	78	68	260
		Expected Count	50.3	132.2	77.5	260.0
	Mid	Count	48	168	99	315
		Expected Count	61.0	160.2	93.8	315.0
	High	Count	42	270	134	446
		Expected Count	86.3	226.8	132.9	446.0
	Other	Count	2	25	16	43
		Expected Count	8.3	21.9	12.8	43.0
Total		Count	206	541	317	1064
		Expected Count	206.0	541.0	317.0	1064.0

Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	144.396 ^a	6	.000
Likelihood Ratio	134.029	6	.000
N of Valid Cases	1064		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 8.33.

Symmetric Measures	Value	Approximate Significance
Cramer's V	.260	.000
N of Valid Cases	1064	

Commute to school with * Mode choice to school

Crosstab			Mode choice to school		
			Active	Private motorized	Public motorized
Commute to school with	Alone	Count	114	55	214
		Expected Count	74.2	194.7	114.1
	Accompanied but without adults	Count	29	50	60
		Expected Count	26.9	70.7	41.4
	With at least one adult	Count	63	436	43
		Expected Count	104.9	275.6	161.5
Total	Count	206	541	317	
	Expected Count	206.0	541.0	317.0	

Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	420.752 ^a	4	.000
Likelihood Ratio	464.286	4	.000
N of Valid Cases	1064		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 26.91.

Symmetric Measures	Value	Approximate Significance
Cramer's V	.445	.000
N of Valid Cases	1064	

Time from home to school * Mode choice to school

Crosstab			Mode choice to school			Total
			Active	Private motorized	Public motorized	
Time from home to school	< 30 min	Count	176	433	258	867
		Expected Count	167.9	440.8	258.3	867.0
	From 31 min to 1 hr	Count	21	83	48	152
		Expected Count	29.4	77.3	45.3	152.0
	More than 1 hr	Count	9	25	11	45
		Expected Count	8.7	22.9	13.4	45.0
Total	Count	206	541	317	1064	
	Expected Count	206.0	541.0	317.0	1064.0	

Chi-Square Tests		Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square		4.172 ^a	4	.383
Likelihood Ratio		4.446	4	.349
N of Valid Cases		1064		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 8.71.

Symmetric Measures		Value	Approximate Significance
Cramer's V		.044	.383
N of Valid Cases		1064	

Importance of distance for choice mode * Mode choice to school

Crosstab			Mode choice to school			Total
			Active	Private motorized	Public motorized	
Importance of distance for choice mode	Not important	Count	77	59	25	161
		Expected Count	31.2	81.9	48.0	161.0
	2	Count	34	94	36	164
		Expected Count	31.8	83.4	48.9	164.0
	3	Count	29	124	68	221
		Expected Count	42.8	112.4	65.8	221.0
	4	Count	14	69	62	145
		Expected Count	28.1	73.7	43.2	145.0
	Very important	Count	52	195	126	373
		Expected Count	72.2	189.7	111.1	373.0
	Total	Count	206	541	317	1064
		Expected Count	206.0	541.0	317.0	1064.0

Chi-Square Tests	Value	df	Asymptotic
			Significance (2-sided)
Pearson Chi-Square	118.713 ^a	8	.000
Likelihood Ratio	103.977	8	.000
N of Valid Cases	1064		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 28.07.

Symmetric Measures	Value	Approximate
		Significance
Cramer's V	.236	.000
N of Valid Cases	1064	

Importance of transport cost for choice mode * Mode choice to school

Crosstab			Mode choice to school			Total
			Active	Private motorized	Public motorized	
Importance of transport cost for choice mode	Not important	Count	110	83	26	219
		Expected Count	42.4	111.4	65.2	219.0
	2	Count	27	98	43	168
		Expected Count	32.5	85.4	50.1	168.0
	3	Count	21	116	60	197
		Expected Count	38.1	100.2	58.7	197.0
	4	Count	21	84	59	164
		Expected Count	31.8	83.4	48.9	164.0
	Very important	Count	27	160	129	316
		Expected Count	61.2	160.7	94.1	316.0
	Total	Count	206	541	317	1064
		Expected Count	206.0	541.0	317.0	1064.0

Chi-Square Tests	Value	df	Asymptotic
			Significance (2-sided)
Pearson Chi-Square	190.373 ^a	8	.000
Likelihood Ratio	170.403	8	.000
N of Valid Cases	1064		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 31.75.

Symmetric Measures	Value	Approximate
		Significance
Cramer's V	.299	.000
N of Valid Cases	1064	

Importance of comfort for choice mode * Mode choice to school

Crosstab			Mode choice to school			Total
			Active	Private motorized	Public motorized	
Importance of comfort for choice mode	Not important	Count	80	86	50	216
		Expected Count	41.8	109.8	64.4	216.0
	2	Count	39	109	70	218
		Expected Count	42.2	110.8	64.9	218.0
	3	Count	30	143	72	245
		Expected Count	47.4	124.6	73.0	245.0
	4	Count	17	81	58	156
		Expected Count	30.2	79.3	46.5	156.0
	Very important	Count	40	122	67	229
		Expected Count	44.3	116.4	68.2	229.0
Total	Count	206	541	317	1064	
	Expected Count	206.0	541.0	317.0	1064.0	

Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	62.419 ^a	8	.000
Likelihood Ratio	57.412	8	.000
N of Valid Cases	1064		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 30.20.

Symmetric Measures	Value	Approximate Significance
Cramer's V	.171	.000
N of Valid Cases	1064	

Importance of security (crime) for choice mode * Mode choice to school

Crosstab			Mode choice to school			Total
			Active	Private motorized	Public motorized	
Importance of security (crime) for choice mode	Not important	Count	46	33	32	111
		Expected Count	21.5	56.4	33.1	111.0
	2	Count	19	60	33	112
		Expected Count	21.7	56.9	33.4	112.0
	3	Count	31	107	43	181
		Expected Count	35.0	92.0	53.9	181.0
	4	Count	21	91	45	157
		Expected Count	30.4	79.8	46.8	157.0
	Very important	Count	89	250	164	503
		Expected Count	97.4	255.8	149.9	503.0
Total	Count	206	541	317	1064	
	Expected Count	206.0	541.0	317.0	1064.0	

Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	50.057 ^a	8	.000
Likelihood Ratio	45.173	8	.000
N of Valid Cases	1064		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 21.49.

Symmetric Measures	Value	Approximate Significance
Cramer's V	.153	.000
N of Valid Cases	1064	

Importance of safety (traffic-related accidents) for choice mode * Mode choice to school

Crosstab			Mode choice to school			Total
			Active	Private motorized	Public motorized	
Importance of safety (traffic-related accidents) for choice mode	Not important	Count	60	49	33	142
		Expected Count	27.5	72.2	42.3	142.0
	2	Count	34	93	52	179
		Expected Count	34.7	91.0	53.3	179.0
	3	Count	31	122	63	216
		Expected Count	41.8	109.8	64.4	216.0
	4	Count	16	105	44	165
		Expected Count	31.9	83.9	49.2	165.0
	Very important	Count	65	172	125	362
		Expected Count	70.1	184.1	107.9	362.0
	Total	Count	206	541	317	1064
		Expected Count	206.0	541.0	317.0	1064.0

Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	69.901 ^a	8	.000
Likelihood Ratio	62.782	8	.000
N of Valid Cases	1064		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 27.49.

Symmetric Measures	Value	Approximate Significance
Cramer's V	.181	.000
N of Valid Cases	1064	

Importance of weather for choice mode * Mode choice to school

Crosstab			Mode choice to school			Total
			Active	Private motorized	Public motorized	
Importance of weather for choice mode	Not important	Count	58	76	53	187
		Expected Count	36.2	95.1	55.7	187.0
	2	Count	45	118	53	216
		Expected Count	41.8	109.8	64.4	216.0
	3	Count	30	130	72	232
		Expected Count	44.9	118.0	69.1	232.0
	4	Count	26	101	59	186
		Expected Count	36.0	94.6	55.4	186.0
	Very important	Count	47	116	80	243
		Expected Count	47.0	123.6	72.4	243.0
Total	Count	206	541	317	1064	
	Expected Count	206.0	541.0	317.0	1064.0	

Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	30.950 ^a	8	.000
Likelihood Ratio	30.192	8	.000
N of Valid Cases	1064		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 36.01.

Symmetric Measures	Value	Approximate Significance
Cramer's V	.121	.000
N of Valid Cases	1064	

Importance of choice mode as an only option * Mode choice to school

Crosstab			Mode choice to school			Total
			Active	Private motorized	Public motorized	
Importance of choice mode as an only option	Not important	Count	103	146	50	299
		Expected Count	57.9	152.0	89.1	299.0
	2	Count	35	95	36	166
		Expected Count	32.1	84.4	49.5	166.0
	3	Count	17	110	58	185
		Expected Count	35.8	94.1	55.1	185.0
	4	Count	15	54	52	121
		Expected Count	23.4	61.5	36.0	121.0
	Very important	Count	36	136	121	293
		Expected Count	56.7	149.0	87.3	293.0
Total	Count	206	541	317	1064	

Expected Count	206.0	541.0	317.0	1064.0
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Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	103.248 ^a	8	.000
Likelihood Ratio	101.825	8	.000
N of Valid Cases	1064		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 23.43.

Symmetric Measures	Value	Approximate Significance
Cramer's V	.220	.000
N of Valid Cases	1064	

Ability to ride * Mode choice to school

Crosstab		Mode choice to school				
		Active	Private motorized	Public motorized	Total	
Ability to ride	I don't know how to ride a bike	Count	13	48	19	80
		Expected Count	15.5	40.7	23.8	80.0
2		Count	15	32	13	60
		Expected Count	11.6	30.5	17.9	60.0
3		Count	40	102	69	211
		Expected Count	40.9	107.3	62.9	211.0
4		Count	60	183	96	339
		Expected Count	65.6	172.4	101.0	339.0
	I am an expert riding bikes	Count	78	176	120	374
		Expected Count	72.4	190.2	111.4	374.0
Total		Count	206	541	317	1064
		Expected Count	206.0	541.0	317.0	1064.0

Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	9.497 ^a	8	.302
Likelihood Ratio	9.570	8	.297
N of Valid Cases	1064		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 11.62.

Symmetric Measures	Value	Approximate Significance
Cramer's V	.067	.302
N of Valid Cases	1064	

How secure if riding to school * Mode choice to school

Crosstab			Mode choice to school			Total
			Active	Private motorized	Public motorized	
How secure if riding to school	not secure at all	Count	40	117	70	227
		Expected Count	43.9	115.4	67.6	227.0
	2	Count	41	179	87	307
		Expected Count	59.4	156.1	91.5	307.0
	3	Count	63	169	105	337
		Expected Count	65.2	171.4	100.4	337.0
	4	Count	32	53	32	117
		Expected Count	22.7	59.5	34.9	117.0
	very secure	Count	30	23	23	76
		Expected Count	14.7	38.6	22.6	76.0
Total		Count	206	541	317	1064
		Expected Count	206.0	541.0	317.0	1064.0

Chi-Square Tests	Value	df	Asymptotic
			Significance (2-sided)
Pearson Chi-Square	37.095 ^a	8	.000
Likelihood Ratio	34.627	8	.000
N of Valid Cases	1064		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 14.71.

Symmetric Measures	Value	Approximate
		Significance
Cramer's V	.132	.000
N of Valid Cases	1064	

How safe if riding to school * Mode choice to school

Crosstab			Mode choice to school			Total
			Active	Private motorized	Public motorized	
How safe if riding to school	not safe at all	Count	52	179	107	338
		Expected Count	65.4	171.9	100.7	338.0
	2	Count	47	173	86	306
		Expected Count	59.2	155.6	91.2	306.0
	3	Count	66	132	83	281
		Expected Count	54.4	142.9	83.7	281.0
	4	Count	19	42	28	89
		Expected Count	17.2	45.3	26.5	89.0
	very safe	Count	22	15	13	50
		Expected Count	9.7	25.4	14.9	50.0

Total	Count	206	541	317	1064
	Expected Count	206.0	541.0	317.0	1064.0

Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	32.220 ^a	8	.000
Likelihood Ratio	28.972	8	.000
N of Valid Cases	1064		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 9.68.

Symmetric Measures	Value	Approximate Significance
Cramer's V	.123	.000
N of Valid Cases	1064	

Rate amount of cycle paths * Mode choice to school

Crosstab			Mode choice to school			Total
			Active	Private motorized	Public motorized	
Rate amount of cycle paths	Very bad	Count	109	187	113	409
		Expected Count	79.2	208.0	121.9	409.0
	2	Count	47	199	101	347
		Expected Count	67.2	176.4	103.4	347.0
	3	Count	28	111	72	211
		Expected Count	40.9	107.3	62.9	211.0
	4	Count	7	28	16	51
		Expected Count	9.9	25.9	15.2	51.0
	Excellent	Count	15	16	15	46
		Expected Count	8.9	23.4	13.7	46.0
Total		Count	206	541	317	1064
		Expected Count	206.0	541.0	317.0	1064.0

Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	36.155 ^a	8	.000
Likelihood Ratio	35.766	8	.000
N of Valid Cases	1064		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 8.91.

Symmetric Measures	Value	Approximate Significance
Cramer's V	.130	.000
N of Valid Cases	1064	

Rate sidewalks conditions * Mode choice to school

Crosstab			Mode choice to school			Total
			Active	Private motorized	Public motorized	
Rate sidewalks conditions	Very bad	Count	38	109	55	202
		Expected Count	39.1	102.7	60.2	202.0
	2	Count	71	208	119	398
		Expected Count	77.1	202.4	118.6	398.0
	3	Count	50	164	105	319
		Expected Count	61.8	162.2	95.0	319.0
	4	Count	21	37	24	82
		Expected Count	15.9	41.7	24.4	82.0
	Excellent	Count	26	23	14	63
		Expected Count	12.2	32.0	18.8	63.0
	Total	Count	206	541	317	1064
		Expected Count	206.0	541.0	317.0	1064.0

Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	26.369 ^a	8	.001
Likelihood Ratio	22.908	8	.003
N of Valid Cases	1064		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 12.20.

Symmetric Measures	Value	Approximate Significance
Cramer's V	.111	.001
N of Valid Cases	1064	

Rate street lighting * Mode choice to school

Crosstab			Mode choice to school			Total
			Active	Private motorized	Public motorized	
Rate street lighting	Very bad	Count	44	80	57	181
		Expected Count	35.0	92.0	53.9	181.0
	2	Count	58	169	102	329
		Expected Count	63.7	167.3	98.0	329.0
	3	Count	52	180	102	334
		Expected Count	64.7	169.8	99.5	334.0
	4	Count	25	75	41	141
		Expected Count	27.3	71.7	42.0	141.0
	Excellent	Count	27	37	15	79

	Expected Count	15.3	40.2	23.5	79.0
Total	Count	206	541	317	1064
	Expected Count	206.0	541.0	317.0	1064.0

Chi-Square Tests	Value	df	Asymptotic
			Significance (2-sided)
Pearson Chi-Square	20.553 ^a	8	.008
Likelihood Ratio	19.424	8	.013
N of Valid Cases	1064		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 15.30.

Symmetric Measures	Value	Approximate Significance
Cramer's V	.098	.008
N of Valid Cases	1064	

Rate Public transport connectivity * Mode choice to school

Crosstab		Mode choice to school			Total	
		Active	Private motorized	Public motorized		
Rate Public transport connectivity	Very bad	Count	55	102	57	214
		Expected Count	41.4	108.8	63.8	214.0
	2	Count	56	190	100	346
		Expected Count	67.0	175.9	103.1	346.0
	3	Count	41	159	103	303
		Expected Count	58.7	154.1	90.3	303.0
	4	Count	27	65	42	134
		Expected Count	25.9	68.1	39.9	134.0
	Excellent	Count	27	25	15	67
		Expected Count	13.0	34.1	20.0	67.0
	Total	Count	206	541	317	1064
		Expected Count	206.0	541.0	317.0	1064.0

Chi-Square Tests	Value	df	Asymptotic
			Significance (2-sided)
Pearson Chi-Square	34.989 ^a	8	.000
Likelihood Ratio	31.961	8	.000
N of Valid Cases	1064		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 12.97.

Symmetric Measures	Value	Approximate Significance
Cramer's V	.128	.000
N of Valid Cases	1064	

Rate Other * Mode choice to school

Crosstab			Mode choice to school			Total
			Active	Private motorized	Public motorized	
Rate	Very bad	Count	65	103	55	223
		Expected Count	43.2	113.4	66.4	223.0
Other	2	Count	48	154	71	273
		Expected Count	52.9	138.8	81.3	273.0
	3	Count	48	175	126	349
		Expected Count	67.6	177.5	104.0	349.0
	4	Count	25	63	38	126
		Expected Count	24.4	64.1	37.5	126.0
	Excellent	Count	20	46	27	93
		Expected Count	18.0	47.3	27.7	93.0
Total		Count	206	541	317	1064
		Expected Count	206.0	541.0	317.0	1064.0

Chi-Square Tests	Value	df	Asymptotic
			Significance (2-sided)
Pearson Chi-Square	28.053 ^a	8	.000
Likelihood Ratio	27.066	8	.001
N of Valid Cases	1064		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 18.01.

Symmetric Measures	Value	Approximate
		Significance
Cramer's V	.115	.000
N of Valid Cases	1064	

Interest in cycling school * Mode choice to school

Crosstab			Mode choice to school			Total
			Active	Private motorized	Public motorized	
Interest in cycling school	not interested at all	Count	54	162	94	310
		Expected Count	60.0	157.6	92.4	310.0
	2	Count	22	69	44	135
		Expected Count	26.1	68.6	40.2	135.0
	3	Count	31	113	57	201
		Expected Count	38.9	102.2	59.9	201.0
	4	Count	27	80	44	151
		Expected Count	29.2	76.8	45.0	151.0
	very interested	Count	72	117	78	267

	Expected Count	51.7	135.8	79.5	267.0
Total	Count	206	541	317	1064
	Expected Count	206.0	541.0	317.0	1064.0

Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	15.583 ^a	8	.049
Likelihood Ratio	14.969	8	.060
N of Valid Cases	1064		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 26.14.

Symmetric Measures	Value	Approximate Significance
Cramer's V	.086	.049
N of Valid Cases	1064	

Interest in free bike sharing * Mode choice to school

Crosstab			Mode choice to school			Total
			Active	Private motorized	Public motorized	
Interest in free bike sharing	not interested at all	Count	34	77	48	159
		Expected Count	30.8	80.8	47.4	159.0
	2	Count	20	54	28	102
		Expected Count	19.7	51.9	30.4	102.0
	3	Count	28	108	60	196
		Expected Count	37.9	99.7	58.4	196.0
	4	Count	18	85	49	152
		Expected Count	29.4	77.3	45.3	152.0
	very interested	Count	106	217	132	455
		Expected Count	88.1	231.3	135.6	455.0
	Total	Count	206	541	317	1064
		Expected Count	206.0	541.0	317.0	1064.0

Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	14.293 ^a	8	.074
Likelihood Ratio	15.018	8	.059
N of Valid Cases	1064		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 19.75.

Symmetric Measures	Value	Approximate Significance
Cramer's V	.082	.074
N of Valid Cases	1064	

Interest in walking groups * Mode choice to school

Crosstab			Mode choice to school			Total
			Active	Private motorized	Public motorized	
Interest in walking groups	not interested at all	Count	49	147	87	283
		Expected Count	54.8	143.9	84.3	283.0
	2	Count	19	88	47	154
		Expected Count	29.8	78.3	45.9	154.0
	3	Count	52	122	78	252
		Expected Count	48.8	128.1	75.1	252.0
	4	Count	31	76	39	146
		Expected Count	28.3	74.2	43.5	146.0
	very interested	Count	55	108	66	229
		Expected Count	44.3	116.4	68.2	229.0
	Total	Count	206	541	317	1064
		Expected Count	206.0	541.0	317.0	1064.0

Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	10.555 ^a	8	.228
Likelihood Ratio	10.954	8	.204
N of Valid Cases	1064		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 28.27.

Symmetric Measures	Value	Approximate Significance
Cramer's V	.070	.228
N of Valid Cases	1064	

Interest in cycling groups * Mode choice to school

Crosstab			Mode choice to school			Total
			Active	Private motorized	Public motorized	
Interest in cycling groups	not interested at all	Count	39	105	78	222
		Expected Count	43.0	112.9	66.1	222.0
	2	Count	21	81	41	143
		Expected Count	27.7	72.7	42.6	143.0
	3	Count	36	123	65	224
		Expected Count	43.4	113.9	66.7	224.0
	4	Count	28	88	49	165
		Expected Count	31.9	83.9	49.2	165.0
	very interested	Count	82	144	84	310
		Expected Count	60.0	157.6	92.4	310.0

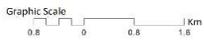
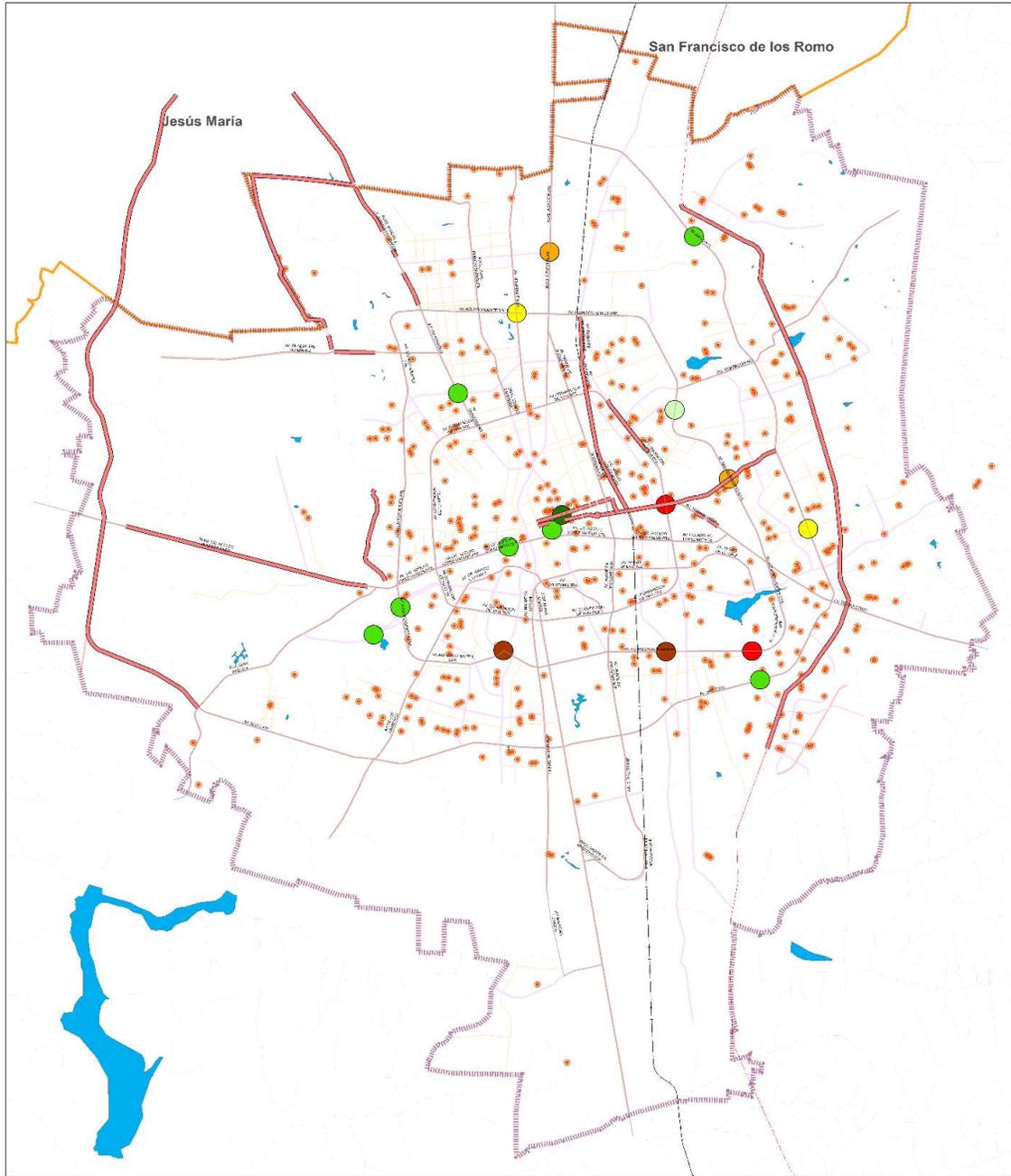
Total	Count	206	541	317	1064
	Expected Count	206.0	541.0	317.0	1064.0

Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	18.363 ^a	8	.019
Likelihood Ratio	17.689	8	.024
N of Valid Cases	1064		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 27.69.

Symmetric Measures	Value	Approximate Significance
Cramer's V	.093	.019
N of Valid Cases	1064	

ANNEX IV: MAPS SCHOOL'S LOCATION AND TRAFFIC ACCIDENTS IN AGUASCALIENTES



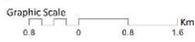
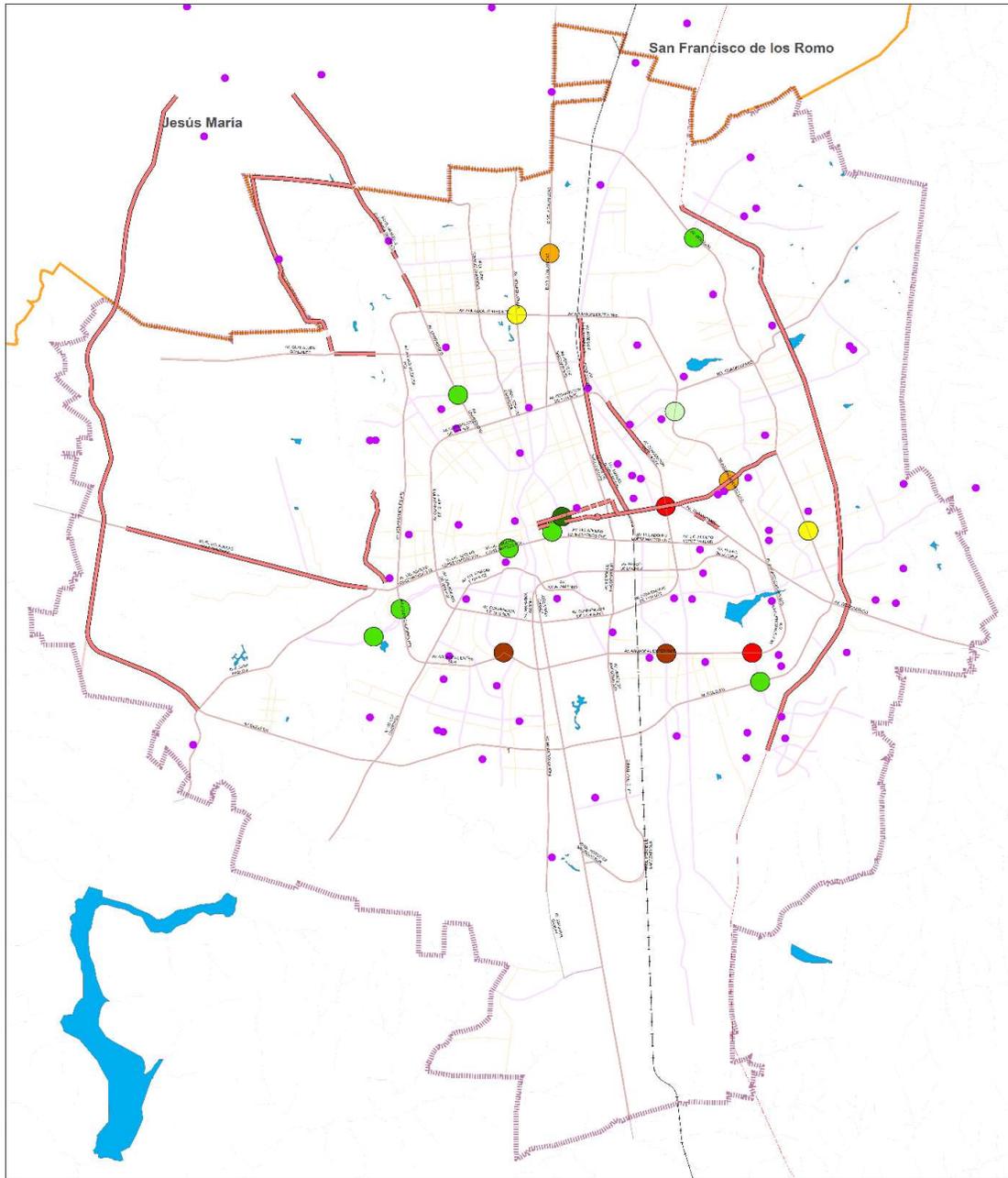
EXISTING SCHOOLS (ALL LEVELS) - TRAFFIC-RELATED ACCIDENTS

Conventional Symbology

	Urban containment polygon
	Waterbody
	Watercourse
	Railway
	Main roads
	North

Thematic Symbology

Road Structure	Traffic-related Accidents (SSPYTM 2010)



SECONDARY LEVEL AND HIGHSCHOOLS - TRAFFIC-RELATED ACCIDENTS

**Conventional
Symbology**

- Urban containment polygon
- Waterbody
- Watercourse
- Railway
- Main roads



**Thematic
Symbology**

Road Structure

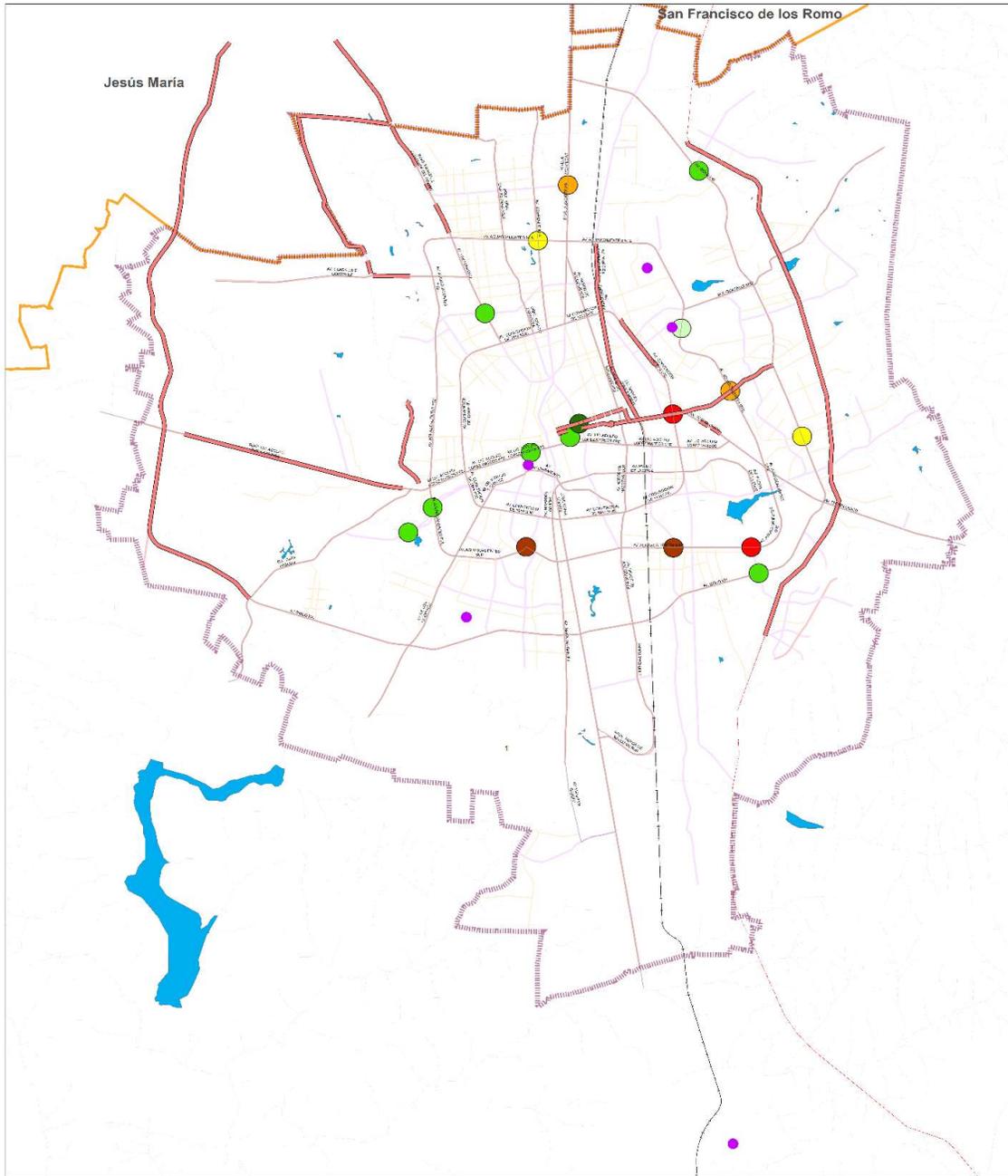
- Existing primary
- Existing Secondary or Collector
- Existing Sub-collector
- Existing Cycle Paths

Focus

- Secondary and high schools in Aguascalientes

**Traffic-related
Accidents (SSPYTM 2010)**

- With 06 Accidents
- With 08 Accidents
- With 09 Accidents
- With 10 Accidents
- With 11 Accidents
- With 12 Accidents
- With 13 Accidents



SURVEYED SCHOOLS - TRAFFIC-RELATED ACCIDENTS

Conventional Symbology

	Urban containment polygon
	Waterbody
	Watercourse
	Railway
	Main roads

Thematic Symbology

Road Structure		Traffic-related Accidents (SSPYTM 2010)	
	Existing primary		With 06 Accidents
	Existing Secondary or Collector		With 08 Accidents
	Existing Sub-collector		With 09 Accidents
	Existing Cycle Paths		With 10 Accidents
Focus			With 11 Accidents
	Schools surveyed		With 12 Accidents
			With 13 Accidents