UHASSELT

KNOWLEDGE IN ACTION

School of Transportation Sciences

Master of Transportation Sciences

Master's thesis

Self-reported cycling behavior of adolescents in the Philippines

Mary Jane Perez

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

SUPERVISOR :
Prof. dr. Ariane CUENEN

CO-SUPERVISOR :
Prof. dr. Kris BRIJS

2023
2024

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ACKNOWLEDGEMENTS

I am grateful for the opportunity I have been given to conduct my master's degree at UHasselt. First and foremost, I would like to thank God for His unwavering guidance, wisdom, love, and strength throughout this journey. Without His grace, this achievement would not have been possible.

I would like to express my deepest gratitude to my promotor, Prof. dr. Ariane Cuenen, for her exceptional support, insightful feedback, and encouragement throughout my thesis. Your expertise, guidance, and endless patience have been very useful to my work. I appreciate your generous time in reviewing and correcting this dissertation.

A special thank you to my co-promotor, Prof. dr. Kris Brijs, for his invaluable ideas and feedback on how to start this thesis. Your constructive feedback and advice have significantly improved the quality of my work.

I am immensely grateful to VLIR-UOS for the scholarship that allowed me to pursue my academic goals.

To all my friends both in the Philippines and Belgium, for constant encouragement and belief in my ability to complete this degree.

To my family—Mama, Papa, Kuya, Ate, my adorable nephew, and my dog, Chichi —thank you for your endless love, patience, and encouragement. Your belief in me has been a constant source of inspiration, and I am forever grateful for your endless support to finish my studies.

Finally, I would like to extend my heartfelt thanks to all those who have contributed to this thesis in ways that may not be mentioned here. Your support and encouragement have been deeply appreciated.

Mary Jane Perez
June 2024

ABSTRACT

Cycling has grown in popularity in the Philippines as a transportation and recreational activity, especially during the COVID-19 pandemic. Despite the growing popularity of cycling in the Philippines, obstacles remain, including road safety concerns and a need for cycling infrastructure and facilities, especially in areas outside Metro Manila. Aside from road safety concerns and a need for cycling infrastructure, concerns like sociodemographic, parental support, and teacher influence can also be considered obstacles in cycling. Multiple studies have concentrated on cycling among children and adults. This has led to a need for more comprehension regarding the factors that impact cycling among adolescents. Adolescence is an important transitional period from childhood to adulthood as they may form behaviors that last into adulthood. According to the World Health Organization (WHO), cycling effectively improves fitness, and reduces the risk of obesity, and adolescents should do at least 60 minutes per day of moderate-to-vigorous intensity of physical activity. This study explores factors influencing the 12-18-year-old adolescent cycling behavior and cycling frequency and formulating policy recommendations that promote safe and sustainable cycling practices in the Philippines. Initially, an individual interview was conducted with 10 teachers and 10 parents/guardians, followed by an online questionnaire with the students. An online questionnaire was used with a sample size of 505 respondents. This study used the validated Cycling Behavior Questionnaire. The results showed differences between age and gender in cycling behavior. The traffic violations reported by adolescent cyclists were significantly higher in the case of males than females. Additionally, no gender-based differences were found regarding errors and positive behavior. Regarding age, this study found that younger adolescents (age = 12) are more likely to violate and show positive behavior and are less likely to make riding errors than older adolescents. This study also found different factors that affect the cycling frequency among adolescents. These include age, gender, encouragement from parents and teachers, social norms, perceived behavioral control, and intention. Lastly, this study also found several ways identified by adolescents, parents/guardians, and teachers that can contribute to the popularity or attractiveness of cycling among adolescents in the Philippines. These include improved cycling infrastructure, cycle accessibility, involvement in cycling and safety education programs, peer-led initiatives or encouragement, and parental or school involvement, such as community involvement and incorporating cycling into the curriculum.

Keywords

Cycling, adolescents, cycling behavior, cycling frequency, promote cycling, cycling in the Philippines

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LIST OF ABBREVIATIONS

CBQ	Cycling Behavior Questionnaire
DOTR	Department of Transportation
JHS	Junior High School
JRLMHS	Juan R. Liwag Memorial High School
MMDA	Metropolitan Manila Development Authority
PSA	Philippine Statistics Authority
SHS	Senior High School
WHO	World Health Organization

1. INTRODUCTION

Cycling has grown in popularity in the Philippines as a transportation and recreational activity, especially during the COVID-19 pandemic. According to National Economic and Development Authority, 2.1 million cycles were imported into the Philippines amid the global pandemic in 2020, which is 112% up from 2019 (Bosshard, 2022). To reduce traffic congestion and air pollution, the government and private organizations have launched programs and campaigns to promote cycling as an alternative mode of transportation, such as declaring November as National Bicycle Month, where all concerned agencies are assigned to execute a program that would transform the cities into a cycling-friendly city (National Bicycle Organization, 2014).

According to the 2017 National Household Travel Survey conducted by the Philippine Statistics Authority (PSA), only 1.2% of domestic travel is by cycling. This is considerably less than the percentage of journeys made by walking (20.6%) and motorized vehicles (77.8%). However, there are ongoing efforts to promote cycling as a sustainable mode of transportation in the Philippines. The government has implemented various initiatives to improve cycling infrastructure and encourage cycling for daily commutes. Cities like Marikina, Pasig, and Iloilo have implemented cycling-friendly policies and infrastructure, such as dedicated cycle path and parking facilities. The Department of Transportation (DOTr) recommends short-distance cycling, particularly in congested areas such as Metro Manila (DOTr, 2021). In addition, the Metropolitan Manila Development Authority (MMDA) has opened cycle paths, as shown in Figure 1 and Figure 2, on major roads and launched the Metro Manila Bike Share program to provide affordable and easily accessible cycle for public use (MMDA, 2021).

Figure 1. Cycling Infrastructure in Manila, Philippines
Source: (Department of Transportation)

Figure 2. Cycling Infrastructure in Quezon City, Philippines
Source: (https://newsinfo.inquirer.net/1390448/wide-sidewalks-bike-lanes-make-cities-safe)

Despite the growing popularity of cycling in the Philippines, obstacles remain, including road safety concerns and a need for cycling infrastructure and facilities, especially in areas outside Metro Manila. In 2021, the total number of recorded cycling-related road crashes in Metro Manila was 2397, wherein 33 were fatal, 1719 resulted in non-fatal, and 645 resulted in property damage (MMDA, n.d.). Nonetheless, the growing interest and support for cycling in the nation signify well for the cycling continued development and promotion.

Aside from road safety concerns and a need for cycling infrastructure, concerns like sociodemographic, parental support, and teacher influence can also be considered an obstacles in cycling. Multiple research studies have resulted in findings indicating that males exhibit higher levels of cycling activity than their female counterparts in terms of distance covered and frequency of trips. Additionally, these studies have identified a notable factor contributing to the lower participation of women in cycling: their perception of associated hazards (Gaspay et al., 2022; Tolentino & Sigua, 2022). Instances of harassment against female cyclists in the Philippines have been documented, with reports indicating that such incidents occur not only in physical settings involving people and car users but also in online spaces (Fragante, 2021; Osmena, 2021).

According to Telama et al. (2014), research indicates that early childhood is a critical period for the development of lifelong physical activity habits. It emphasizes the need to support physical activity during the early stages of life. Researchers recognize parents as crucial in promoting children's engagement in physical activity, as demonstrated by several factors (O'Connor et al., 2009). Studies have demonstrated that when parents combine regular supervision with other beneficial parenting strategies, such as assistance and effective communication, adolescents are less likely to participate in risky behaviors (Chen et al., 2008).

In addition to their parents, adolescents spend significant amounts of their time in school. According to Simpson et al. (2020), both teachers and parents have a crucial impact on the growth of the behavior of adolescents' personal lives, independence, self-identity, self-esteem, self-confidence, and self-management. Teachers have a substantial impact on the lives of teenagers. During this period, educators can significantly assist adolescents in developing a well-rounded character. Teachers provide knowledge to adolescents and equip them to recognize and understand the differences in their lives and the conflicting influences they encounter (Sehgal, 2022).

According to Aldred (2015), promoting child cycling is frequently identified as a policy objective, as it yields many advantages, such as health improvements, congestion reduction, and sustainable travel behaviors sustained throughout one's lifetime. The Cycling Action Plan formulated by the Scottish Government in 2010 shows a desire to enhance child cycling participation and foster a culture that promotes children's transition into adult cyclists. Nevertheless, the task of promoting child cycling has presented significant difficulties.

Cities include different cultural identities, unique requirements, and specific geographical or urban attributes that contribute to the establishment of secure and effective cycling infrastructures (Vassi & Vlastos, 2014). The previously mentioned attributes play an important role in shaping the cycling culture. As a result, to enhance cycling engagement, it is essential to understand the present state of events in different cities and the policies and measures implemented by governmental bodies and local authorities.

1.1 Research Area

A country in Southeast Asia, the Philippines is an archipelago consisting of more than 7,000 islands and islets. The three largest islands are Luzon, Visayas, and Mindanao. The climate of the Philippines is tropical and maritime, which is characterized by relatively high temperatures, humidity, and abundant rainfall. The Philippines is composed of 17 regions, 82 provinces, and 149 cities. Tagalog is the most widespread language of the Central Philippines.

One of the cities in the Central Luzon region is the City of Gapan, as shown in Figure 3, situated in the province of Nueva Ecija, it lies in the central part of the Philippines and has a total land area of 164.44 sq. km. As of the 2020 census, Gapan represents 5.32% of the total population of Nueva Ecija province, which is around 122,968 inhabitants (PSA, 2022). The municipality of Gapan has eight public secondary schools that offer both Junior and Senior strands, including the Juan R. Liwag Memorial High School (JRLMHS). JRLMHS is one of the most prominent public secondary schools in Gapan, in Bayanihan, one of the twenty-three barangays of Gapan. JRLMHS has a current population of 6,974 students comprising Junior High School (JHS) and Senior High School (SHS).

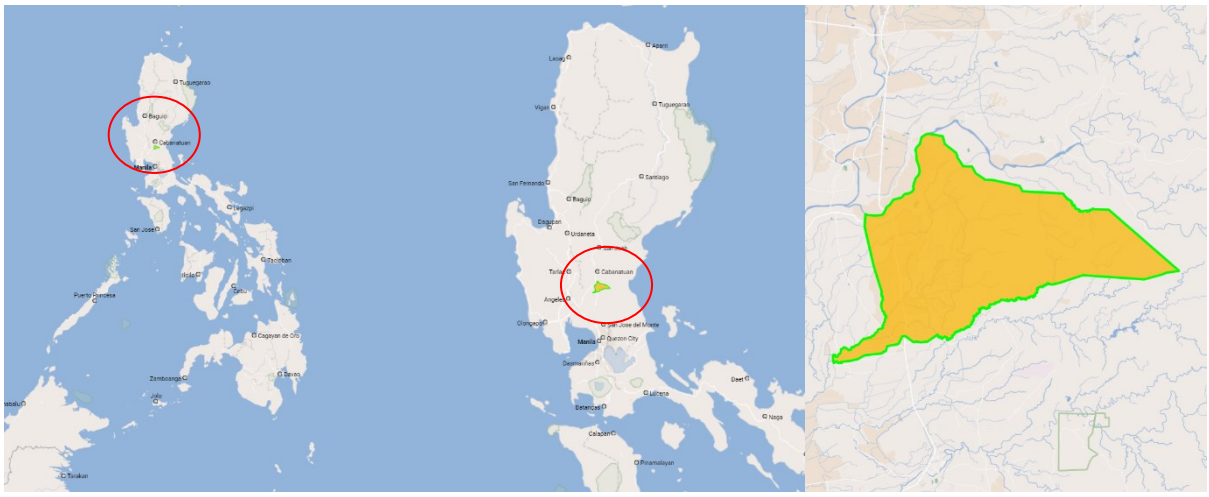

Figure 3. Map of the Philippines and the City of Gapan
Source: (https://citypopulation.de/en/philippines/luzon/admin/nueva_ecija/034908__gapan/)

1.2 Problem Statement

Multiple studies have emphasized the importance of cycling to adolescent's physical and mental health. According to a 2010 study by the World Health Organization (WHO), cycling effectively improves fitness and reduces their risk of obesity. In addition, cycling enhances cognitive function and academic performance (Pontifex et al., 2011). The Physical Activity Guidelines Advisory Committee (2008) reviewed the scientific evidence, resulting in the most comprehensive presentation of current knowledge. Strong evidence exists for improved cardiorespiratory endurance and muscular fitness, favorable body composition, bone health, and cardiovascular and metabolic health biomarkers in adolescents.

Cycling has been an important mode of transport in many Asian countries since the early 20th century). The cycle share ranges from 11% to 47%, and the cycle share is higher in cities with lower per-capita income. Some cities in China have excellent cycling infrastructure. However, they are being invaded more by electric cycles, causing some road dangers (Tiwari, 2008). In another Asian country, India, cycling use was 7-15% in large cities and 13-21% in medium and small cities. Its low cost and ease of use make it a transportation mode for students and low-income workers in India. However, the Indian cities do not have a cycling infrastructure, and the cyclists are forced to use the road with another motorized vehicle causing cyclists to be involved in 5% to 10% of total road related fatalities in medium and large cities (Tiwari & Jain, 2008).

Tiwari et al (2008) also show the three important factors that affect the use of cycles in Asian countries, such as the local cycling manufacturing industry, policy support from the government, and socio-economic conditions.

Taiwan has been recognized as the kingdom of cycling manufacturing, with 95% of the total sales for export and only 5% for domestic use. The main reason cycling is not commonly used for commuting is that people consider cycling as a lower form of transportation, and they lack planning in terms of safety (Chang et al., 2008). According to Abdullah (2018), cycling serves only 2% of daily commuter trips in Singapore. Weather and climate are cited as significant barriers to cycling success in tropical settings. The lowest cycling rates are observed during afternoon peak temperatures when the physical discomfort from the heat is maximum.

Additionally, the heavy rains during monsoon seasons also pose a risk as roads become slippery (Lee & Pojani, 2019).

In Bangkok, although there is no cycling data available for the entire city or region, several studies indicate that cycle ownership and use are significant, with 1% of the modal split of trips. Three factors influence cycling usage: traveling behavior factors, cycling promotion plans, and legislation related to cycling usage (Raha & Taweesin, 2013). Like in Taiwan, people in Bangkok also consider that using cycles or “maid bikes” is meant for poor people (Bakker et al., 2018).

Cycling rates in Philippine cities are not documented, but like in other Asian cities, there is a concern about the growing impact of increased motorization. In the Philippines, there are insufficient studies on the cycling behavior of Filipino adolescents, even though cycling encourages outdoor play, physical fitness, and independence among adolescents. Therefore, this study will investigate Filipino adolescents’ cycling behavior, attitudes, and practices.

It is crucial to understand the aspects that impact cycling in different age groups to enhance the percentage of people who choose cycling as their form of transportation. Multiple studies have concentrated on riding among children and adults (Briem et al., 2004; Useche et al., 2021; Yesiltepe et al., 2022; Kircher & Ahlström, 2023). This has led to a need for more comprehension regarding the factors that impact cycling among adolescents.

Adolescence is an important transitional period from childhood to adulthood. Adolescence is an important phase for most children as they may form behaviors that last into adulthood (Allen & Waterman, 2019). Adolescence theory states that physical growth, mental health, and emotional development are typical at this stage (Sanders, 2013). It is a stage characterized by physical, cognitive, emotional, and social changes that often lead to varied behavior (Palminteri et al., 2016). They are in a critical stage of their development and require guidance, support, and care from their parents and teachers (Luna, 2009).

Despite the benefits of cycling, the safety of young cyclists in the Philippines is a growing concern. The absence of cycling infrastructure and the frequency of road accidents pose a significant threat to people who cycle (Philippine Daily Inquirer, 2019). Understanding Filipino adolescents' cycling behavior and attitudes is crucial for promoting safe cycling practices and enhancing their cycling experience.

1.3 Research Objective

The study will explore factors influencing the 12-18-year-old adolescent’s cycle decisions, their cycling patterns, attitudes towards cycling, and safety practices in order to provide insights into the current cycling behavior of adolescents, cycling frequency, and formulate policy recommendations to promote safe and sustainable cycling practices in the Philippines.

1.4 Research Questions

This study will address the following research questions:

1. How does the adolescents behave while cycling?
2. What are the factors (e.g., parental involvement, teacher's influence, safety concerns, cycling infrastructure, socio-demographic) that affect the cycling frequency of adolescents?
3. How can cycling be promoted and made more attractive in the Philippines?

2. LITERATURE REVIEW

2.1 Factors that Affect Cycling Behavior

Adolescents' cycling behavior in the Philippines has received little attention in the literature. However, only some studies have examined this topic and provided insight into the factors that influence the cycling behavior of the general population.

2.1.1. Parental Attitudes

Parents can impact the frequency of children cycling through many methods. The desire to ensure children's safety and be perceived as a competent parent by society might impact parents' life and their ability to guide their children. Some parents may not view cycling as safe and believe ensuring their children's safety is a crucial aspect of being a responsible parent.

Parents and family members have a crucial impact on enhancing adolescents' well-being, as they offer a constructive support structure in which young people can navigate their developing sense of identity (Jiang et al., 2014). Although the impact of family influences on child development is significant, there is a lack of research investigating the cause-and-effect link between family-related factors and physical activity in adolescents. Comprehending these connections is crucial for creating intervention programs that prioritize the family and aim to encourage physical activity among adolescents.

Several research studies have established a strong connection between parents' physical activity levels and their children (Edwardson et al., 2010; Davison et al., 2003; Pugliese & Tinsley, 2007). Adolescents of parents with elevated levels of physical activity are more inclined to engage in independent outdoor activities (Santos et al., 2013).

Khozaei & Carbon (2022) found that parental stress considerably impacted children's avoidance of physical activity. Research has previously shown the negative impact of stress on an individual's physical activity. Salmon (2001) argued that individuals who are less affected by stress may be more inclined to engage in fitness training. Therefore, the lack of physical exercise among parents experiencing stress could impact their children's physical activity limitations. Furthermore, parents who experience higher levels of stress are more prone to maintaining negative thoughts and are inclined to anticipate adverse events. This could explain the increased likelihood of children exhibiting restrictive behaviors when they spend time outdoors.

De la Torre-Cruz et al. (2019) investigated how perceived parental support and parental modeling behavior influence the physical self-concept of adolescents. Clearly recognized relationships serve as the foundation for young individuals to engage in sports and adopt a healthy lifestyle.

Mandic et al. (2020) emphasized the significance of understanding parental views on barriers to cycling to school, as these views impact adolescents' transport choices. Parents' safety concerns are a significant obstacle to teenagers' cycling. Despite adolescents being involved in transportation choices, their parents still significantly influence their decision to cycle (Ghekiere et al., 2016).

A study conducted by Ghekiere et al. (2014) shows that parental perception of safety significantly influences cycling behavior among children aged 10-12 years. The research revealed that children and parents felt more comfortable when cycling facilities were present and physically separated from vehicles.

The family climate plays a crucial role in predicting various elements of adolescents' social adaption, including aggressive and hostile conduct. The family climate effectively encompasses the complex structure of family life, including emotional, systemic, and behavioral elements within the family unit (Kurock et al., 2022). An optimistic family atmosphere is a reliable indicator of adolescents' mental well-being. Adolescents from cohesive and supportive homes experienced more excellent sentiments of love, approval, and acceptance, increasing their sense of self-worth and confidence. A family environment characterized by positivity, minor conflict, absence of criticism, and non-aggressive behavior among its members might enhance the development of one's self-concept.

The study by Sbicigo and Dell'Aglio (2012) found that strong bonds and support within families and little conflicts were essential factors in predicting psychological well-being. On the other hand, the tendency to disregard themselves and the presence of hierarchical relationships showed a substantial positive association.

2.1.2. Teacher's Influence

Teachers can offer support by providing encouragement, treating pupils equitably, and offering them opportunities for growth. Elmore & Huebner (2010) found that students who perceive a positive connection with their teachers are more inclined to comply with teacher instructions, request assistance, and actively seek guidance. Cumulatively, these behaviors contribute to increased involvement in the learning process and improved academic achievements. Suldo and Huebner (2004) discovered that favorable school experiences prompted adolescents to cope with stressful events, decreasing harmful behaviors effectively.

Zins et al. (2004) argued that the impact of teachers on students' psychological and social well-being is beneficial. However, researchers still need to adequately explain or quantitatively assess the processes through which this influence occurs.

Alternatively, physical education teachers must enhance their students' motivation to engage in physical activity during physical education classes and beyond school hours (Spray, 2002; Standage et al., 2003). Enhancing methods of instruction to create appropriate motivation is crucial for attaining better levels of physical activity (Rosenkranz et al., 2012). Several studies have demonstrated the efficacy of training programs for physical education teachers in enhancing their motivational style, boosting their students' motivation, and increasing their inclination to engage in physical activity.

2.1.3. Safety Concerns

People often recognize accidents as a significant obstacle to the participation of adults and children in cycling activities. According to Aldred (2015), addressing deficiencies in bike infrastructure and enhancing cycle safety may provide a potential approach to improving the relatively low levels of child cycling.

Cycle helmets are important for decreasing the risk of brain injury in accidents and are mandatory in some countries, yet adolescents find them to be a barrier to cycling. Molina-García et al (2018) found that 20% of adolescents viewed wearing a helmet as a barrier to cycling to school. This might result from adolescents' unfavorable evaluation of their looks when wearing a helmet. Additionally, Finnoff et al. (2001) found that adolescents have less knowledge of the protective benefits offered by helmets. Hopkins and Mandic (2017) addressed the growing safety issues around educational institutions due to physical environment, traffic safety, and previous cycling incidents.

While individuals who engage in cycling and those who do not are generally knowledgeable about the various advantages of regular cycling, they often consider specific hazards that may influence their decision to refrain from using cycles. These concerns include inadequate physical fitness, inclement weather conditions, topography, and feeling unsafe while cycling, particularly in a society prioritizing car use (Useche et al., 2021).

In addition to using a conventional cycle, the purchase and use of e-bikes are on the rise in many countries and causing concerns regarding traffic safety. After controlling for age, gender, and cycling frequency, Schepers et al. (2014) discovered that electric bicycle users were more likely to get involved in an accident requiring treatment at an emergency department. Haustein and Møller (2016) discovered that 29% of electric bicycle users experienced crashes or safety-critical incidents that they believed would not have occurred if they were riding a regular bicycle.

2.1.4. Cycling Infrastructure

One study by Ong and Regalado (2017) examined cycling behavior in Metro Manila, including why people cycle and the barriers to cycling. Their research revealed that only a tiny fraction of the population uses cycling as a mode of transportation. The authors identified the need for more cycling infrastructure and the perception that cycling is dangerous due to the high volume of automobile traffic as one of the barriers to cycling.

Bogota is notable among low-cycling areas due to its elevated cycling levels. The presence of cycling infrastructure, reinforced by governmental determination and the efforts of advocacy groups, has notably increased riding activity in recent years in Bogota (Rosas-Satizábal & Rodriguez-Valencia, 2019).

Aguila and Cheng (2019) investigated cycling behavior in Cebu City, including the factors that influence cycling and the potential for cycling to alleviate traffic congestion. While cycling is uncommon in Cebu City, there is a growing interest in cycling as a mode of transportation, according to the study. According to the authors, the need for cycling infrastructure, such as bike lanes and parking facilities, is a significant barrier to cycling in the city.

Pucher and Buehler (2016) stated that cycling infrastructure can enhance cycling safety and increase cycling interest. Some studies have shown that gender has a role in determining preferences for cycling infrastructure. For instance, a study conducted in Australia revealed that men tend to prefer cycling on highways, but women are more inclined to choose off-road cycling (Heesch et al., 2012).

2.1.5. Socio-demographic

A study by Useche et al. (2021) found that Belgian cyclists reported a significantly higher incidence of traffic violations among men, while women reported more frequent positive behavior. This finding is consistent with previous studies on cycling behavior conducted in various European and Latin American countries. Gender differences found in self-reported traffic violations were explained by psychosocial variables such as differences in risk perception, cycling anger, and personality traits between male and female cyclists. A study in Australia with a sample of 1862 cyclists revealed that men were more likely to cycle either by recreation or by transport than women (Heesch et al., 2012). According to a study conducted by Roosta and Yadollahi (2022), it has been shown that men have a significantly higher tendency to use cycles for travel and transportation, nearly double that of women. In contrast, it can be observed that women primarily engage in bicycling activities for recreational and leisure purposes, as opposed to men.

In a 2010 focus group study in Australian public schools, Slater and Tiggemann (2010) found that adolescent girls often see physical activities as "masculine," which contributes to their withdrawal from such activities. Girls may hesitate to cycle due to concerns about their appearance and the possibility of being mocked when participating in physical activities like cycling.

Frater and Kingham (2018) stated that female adolescents were motivated to ride cycles due to the impact of their companions and parental norms. Female adolescents value socializing on their way to school. Encouraging them to bike together in groups could promote cycling as a social activity.

Grudgings et al. (2018) observed that the difference between male and female cycling rates is most significant in areas with lower levels of cycling attractiveness.

Another noteworthy topic related to age is the observation that while cycling distractions seem to rise with age, a negative correlation exists between the age of cyclists and traffic crash rates. This phenomenon can be understood with the findings of empirical studies, which have indicated that younger cyclists have a greater propensity for risk-taking activities and are more susceptible to traffic accidents than older individuals. However, younger cyclists have fewer distractions when cycling and tend to exhibit a greater propensity for engaging in dangerous behaviors. This tendency may help interpret why younger cyclists are more frequently involved in traffic accidents when compared to their older counterparts (Useche et al., 2018b).

Cycling habits among young individuals vary across different countries, with some nations showing a higher popularity of cycling compared to others. In the Netherlands, 52% of middle and high school students cycle to school (McDonald, 2012), whereas in Denmark, 37.4% of 6 to 17-year-olds cycle to school (Christiansen & Baescu, 2021).

Although there is no specific research on adolescents' cycling behavior in the Philippines, a lack of cycling infrastructure and the perception that cycling is dangerous discourage adolescents from cycling. In addition, cultural and societal factors may influence the cycling behavior. Additional research is required to fully comprehend adolescents' cycling behavior in the Philippines and develop effective strategies to promote cycling in the country.

2.2 Interventions to Promote Cycling and Make It More Attractive

Encouraging cycling as an attractive mode of transportation in the Philippines is a complex issue that necessitates a comprehensive strategy to address the numerous obstacles and difficulties cyclists face. Cycling promotion can have numerous advantages, such as reducing traffic congestion, enhancing air quality, and encouraging physical activity. Some suggested interventions to promote and make cycling more attractive in the Philippines are.

2.2.1 Developing Cycling Infrastructure

Developing cycling infrastructure, such as bike lanes and parking facilities, is crucial to promoting cycling in the Philippines. Previous research indicates that cyclists prefer infrastructure that is safe and comfortable. According to Berghoefer et al. (2022), a strict separation between motor and pedestrian traffic is not only safe. However, it is also associated with less focus on other road users, less stress, and good cycling flow.

Both male and female individuals exhibited a lack of inclination towards cycling on regular roads lacking dedicated cycle lanes. Qualitative data analysis revealed a preference across genders towards utilizing exclusive off-road paths developed for cycling (Heesch, K.C. et al., 2012).

Cyclists in countries like Britain commonly identify the perception of motor traffic danger as a significant obstacle to cycling among adults and children. The enhanced cycling infrastructure and improved cycle safety measures may be potential solutions for the consistently low levels of child cycling (Aldred, 2015).

Land use and urban planning regulations are influential infrastructure variables that significantly impact cycling, as they play a crucial role in promoting the utilization of cycles. Cities that possess a comprehensive network of bike lanes and are characterized by relatively low commuting distances exhibit elevated levels of riding for commuting purposes. Hence, the promotion of dense and mixed-use developments has the potential to mitigate commuting distances and foster the use of cycling as a mode of transportation (Maldonado-Hinarejos et al., 2014).

2.2.2 Increasing Awareness and Education

Increasing awareness and education about the benefits of cycling and safe cycling practices is another strategy to make cycling more attractive in the Philippines. Awareness and education are the first steps in increasing cycling participation. To inform people about the information and benefits of cycling, awareness is necessary for them to consider cycling as an option for daily transportation. Educational initiatives are also essential to assist individuals in acquiring the skills necessary to cycle, utilize infrastructure properly, and navigate traffic safely (BYCS Org, 2021).

According to Papavasileiou et al. (2018), designing and implementing cycling awareness programs in schools, the future citizen is educated to a great extent in the field of education for the environment and sustainability, acquiring all the skills and perspectives that will guide him in making conscious and deliberate decisions.

According to a study conducted by Teyhan et al. in 2016, implementing a cycle training program coupled with the ownership of cycle helmets among children has yielded advantageous outcomes. These benefits extend to their school commute and sustainably impact cycling behavior that persists into adolescence.

A study by Ducheyne et al. (2014) investigated the effectiveness of child cycle training in improving children's cycling skills while noting that it may not serve as a strategy for promoting increased cycling behavior.

2.2.3 Promoting a Cycling Culture

Promoting a cycling culture that values and supports cycling as a mode of transportation is another strategy that can make cycling more attractive in the Philippines. According to Hazael (2017), the best way to improve the cycling culture of children and parents is for parents to observe road safety rules when accompanying their children.

2.2.4 Addressing Safety Concerns

Safety concerns like road safety and theft prevention are critical for making cycling more attractive in the Philippines. According to Moudon et al. (2005), the most significant barriers preventing the promotion of cycling include inadequate, unfriendly, or hazardous infrastructure for cycle circulation, a lack of cycling conveniences, and unattractive ground conditions in circulation zones. Addressing safety concerns through interventions such as calming traffic measures, improved lighting, and bike theft prevention measures could also help to make cycling safer and more attractive.

Lumsdon et al. (2016) examined the barriers and solutions to promoting cycling among children in urban areas of the United Kingdom. Safety concerns, a lack of infrastructure, and a lack of cycling knowledge were identified as significant barriers to promoting cycling among children. The study recommended policy interventions that address these obstacles, such as expanding cycling infrastructure and implementing education programs that promote safe cycling practices.

Overall, the literature suggests that promoting cycling as an attractive mode of transportation in the Philippines requires a comprehensive approach that addresses barriers such as safety concerns, lack of infrastructure, and lack of knowledge about cycling. Developing cycling infrastructure, increasing awareness and education, promoting cycling culture, and addressing safety concerns are vital strategies to make cycling more attractive in the Philippines.

3. METHODOLOGY

This study uses a mixed-method research design that combines quantitative and qualitative data collection and analysis methods and adhere to ethical guidelines for research involving human subjects, including obtaining informed consent from participants' parents or guardians and ensuring confidentiality and anonymity of data.

3.1 Participants

The researcher asked for the approval from the head of the school division and principal to conduct the individual interviews and online questionnaire. The first phase involves interviewing 10 parents and 10 teachers from Juan R. Liwag Memorial High School in Gapan, Nueva Ecija. The next step involves administering an online questionnaire to adolescents in the Philippines to gather data on their cycling behavior. A sample of adolescents aged 12-18 were recruited from the same high school and the data were collected using an online questionnaire using Qualtrics. The study aims to gather responses of 365 respondents from the total population of 6974 students.

Respondents were granted an opportunity to win ten vouchers via Gcash worth 200 pesos each (approximately 4USD) and were shouldered by the researcher as an incentive for completing the online questionnaire. To ensure the confidentiality of respondents' information, they were asked to participate in the voucher drawing through an additional link provided after completing the online questionnaire. The total number of respondents is computed using the formula below with a 95% confidence level and standard deviation of 0.50.

$$sample\ size = \frac{\frac{z^2 x\ p(1-p)}{e^2}}{1 + \left(\frac{z^2 x\ p(1-p)}{e^2 N}\right)} = \frac{\frac{1.96^2 x\ 0.5(1-0.5)}{0.05^2}}{1 + \left(\frac{1.96^2 x\ 0.5(1-0.5)}{0.05^2(6974)}\right)} = 364.10 \approx 365$$

where:

z = z-score = 1.96 (95%)
p = standard deviation = 0.50
e = margin of error = 0.05
N = population size = 6974

The actual recorded respondents for this study were 696, where 517 completed the online questionnaire while 179 was not able to complete or finish the online questionnaire. It can be concluded that the number of collected respondents met the target.

3.2 Materials

3.2.1 Interview Questions

To have insights into the perceptions, attitudes, behavior, safety considerations, and strategies to promote cycling among adolescents, ten teachers and ten parents or guardians were interviewed. The interview questions for the teachers and parents/guardians can be found in

Appendix 2. The first part of the interview includes demographics such as age, gender, location, main mode of transportation, and experience about adolescents cycling habits.

The second part consists of the perceptions and attitudes about cycling (e.g., importance of cycling, health benefits, concerns or risks, positive impact, role of physical activity in the lives of adolescents). The third part of the interview questions is about the cycling behavior of the interviewee such as cycle ownership, cycling frequency, reason for cycling, participation with any cycling events, and the common routes or destination for adolescents. Fourth part of the questions includes the knowledge about safety education (e.g., wearing helmet, perceive cycling safety, challenges related to cycling safety).

The last part consists of questions about promoting cycling among adolescents. For parents, the questions include teaching and encouraging the adolescents how to cycle, initiatives or programs that can promote cycling, and infrastructure improvements that are necessary in the community. Additional questions were asked among teachers, such as, ways on how parents and teachers can collaborate to promote cycling among adolescents, and the current efforts between schools and families that enhance cycling.

3.2.2 Questionnaire

To measure how adolescent behave while cycling and to know the factors that affects the cycling frequency of adolescents, participants were asked to complete the online questionnaire (refer to Appendix 4 for the questionnaire). The first part of the online questionnaire includes questions on demographics such as gender, age and location. The second part of the online questionnaire aims to explore the factors that influence adolescents cycling behavior. It includes questions on cycling frequency, cycle types used, safety measures taken, reasons for cycling and not cycling, involvement in accidents, and opinions on cycling infrastructure. Responses will provide insights into barriers to cycling, preferences for safety measures, and suggestions for promoting cycling among adolescents.

The third part includes parental involvement in adolescents' cycling, such as the encouragement they receive from the parents or guardians, whether the parents or guardians cycle with the adolescents, and how the parents or guardians teach their adolescents to cycle. Additionally, the fourth part includes the school involvement in adolescents' cycling with questions about encouragement and lesson they receive from their teachers in terms of cycling and the initiatives to promote safe cycling.

The fifth part is about the cyclists' risky and positive behavior towards cycling using a 5-point Likert scale [1=almost never, to 5= almost always] (e.g., possible violations when cycling, errors, and positive behaviors). This part of the online questionnaire is based on the validated questions by Useche et al. (2021), known as the Cycling Behavior Questionnaire (CBQ). The sixth and seventh part is also based on the validated questions by Kummeneje & Rundmo (2020). This set of questions is used to assess the cyclists' attitudes towards safety and risk-taking behavior using a 5-point Likert scale [1=strongly disagree, to 5=strongly agree] (e.g., attitudes toward rule violation, dissatisfaction with the traffic rules).

The last part of the online questionnaire is a self-reported questionnaire to assess the cyclists' attitudes towards safety using a 5-point Likert scale [1=strongly disagree, to 5=strongly

agree] (e.g., attitudes, social norms, perceived behavioral control, and perceived behavioral intention).

3.2.3 Procedure

The first phase includes interviews with the parents and teachers to gain more in-depth insights into their cycling behavior, perceptions and attitudes, safety considerations, and strategies to promote cycling among adolescents. After the interview questions were approved, the questions were translated into Tagalog version. The interviews were conducted in English and Tagalog, the official language, and audio-recorded and transcribed verbatim. The interviewees were given a choice to answer in their most comfortable language, either in English or Tagalog. Interviews were conducted between December 2023 and January 2024. The interviewees were selected randomly by asking each participant on the school premises if they had time and wanted to participate in the study. Each interview was conducted physically, lasted 20-30 min, and was audio recorded after the written consent was collected. The researcher discussed the content of the written consent for the interview individually with the parents and teachers. The consent includes the study's objective, anonymity and confidentiality of the gathered data, duration of the interview, and contact information of the researcher for any concerns and issues. The interviews with the parents and teachers explore the factors influencing adolescents' cycling behavior, including perceptions, attitudes, safety, education, and promoting cycling.

The second phase is the distribution of the online questionnaire, which was conducted between January and February 2024. The online questionnaire was designed using the Qualtrics platform after the questionnaire was approved. The study ensures that the gathered data will be used solely for academic purposes and will be handled with the highest level of anonymity and confidentiality. Prior to conducting the research, parental or guardian consent (refer to Appendix 3) was obtained in accordance with ethical guidelines for minors' involvement in research. This form detailed the purpose of the study, ensured confidentiality and the voluntary nature of participation, and provided contact information for any questions or concerns. The consent form was distributed by one of the teachers in Juan R. Liwag Memorial High School to each adviser. Then, the advisers gave the consent form to each interested student. Once the consent form was collected, the adviser gave the Qualtrics link and the QR code to each student who submitted their consent form.

3.3 Data Analysis

3.3.1 Data Cleaning

The researcher carefully reviewed the responses before conducting data analysis to guarantee the precision and reliability of the data. An examination was conducted on the data to identify any missing responses and outliers. Outliers such as the respondents' age were detected using data screening methods, such as data inspection and data cleaning. To prevent non-response, a strategy was implemented in which the online questionnaire was designed to force respondents to provide answers to all questions. Additionally, the incomplete dataset was excluded from the analysis for participants who were not able to finish the online questionnaire. By excluding these instances, the researcher ensured that the final dataset for analysis exclusively consisted of comprehensive and dependable responses.

3.3.2 Statistical Methods

3.3.2.1 Qualitative Analysis

The recorded interview data was transcribed verbatim. Transcription involves converting spoken language into written text and translating statements from Tagalog to English. While some interviewees speak Tagalog, certain words or phrases are translated into English for clarity or emphasis. The translation process is carried out carefully to preserve the original meaning and context of the interviewees' statements. After the transcription, the interview data was imported to NVIVO 14, a qualitative data analysis software used for organizing, analyzing, and visualizing data and finding the patterns it contains. The researcher familiarizes herself with the data by reading through the transcribed interviews to understand the content and context of the data and identify the key themes, patterns, and areas of interest for analysis. The researcher used the NVIVO 14 to create and apply codes to relevant sections of the interview transcripts and was able to organize and visualize coded data by using the word cloud. Finally, the researcher reports the findings through a narrative description (quotes from the interview transcripts) and visual representation (word cloud).

3.3.2.2 Quantitative Analysis

R version 4.3.3 was used to perform the quantitative analysis. R Studio is a free and open statistical software based on R programming language used in data analysis. It is used to perform statistical computation, creating graph, and data cleaning (R Core Team, 2024). The descriptive statistics were used to organized, summarized, and present the data to describe the characteristics of a sample or population. The frequency and percentage were used to show the characteristics of the sample or population in this study. To assess the internal consistency and reliability of the online questionnaire, the Alpha coefficients (Cronbach's α) were used. Generally, values above 0.60 are deemed acceptable (Janssens et al., 2008). Cronbach's α were checked for the Likert scale questions and all categories were acceptable ($\alpha > 0.60$). This study used Analysis of Variance (ANOVA) model to check if there is a difference between the means of the categories. The study used the means of the Likert scales per category as the dependent variable, age and gender as the independent variables.

This study also used Confirmatory Factor Analysis (CFA) method to verify the factors established from a previous study to test if predefined structure and relationships exist and to determine which questions accurately measure each factor. The three parts of the online questionnaire were adapted from the study of Useche et al. (2021) and Kummeneje & Rundmo (2020), and this method tests if the questions do indeed measure or follow the factors already established. Hence, some variables may be removed from the factors. The factors considered is the subcategories in the online questionnaire (e.g., Violations, Errors) and the variables considered is the actual questions. To evaluate the goodness of fit of the confirmatory analysis model, several indices were used. The Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), Standardized Root Mean Square Residual (SRMR), and factor loadings (λ) were calculated to test the fit between the model and the data, as used in the previous study by Useche et al., (2021) and Kummeneje & Rundmo (2020). The standard cut-off of the model to indicate a satisfactory fit between the model and the data are CFI > 0.90 (Bentler, 1990), TLI > 0.90 (Bentler, 1990), RMSEA between 0.05 and 0.08 (Fabrigar et al., 1999), SRMR < 0.08 (Hu & Bentler, 1999), and $\lambda = 0.60$ (or at least around

0.55). The models that do not exactly meet one criterion but are near the cut-off or standard can still be considered, especially if the other criteria were met.

This study used ordered logistic regression to identify the factors that affect the frequency of adolescents' cycling, which was determined by using a 5-point Likert scale. The ordered logistic regression is applicable when the response variable is measured on an ordinal scale. In this study, the response variable represents cycling frequency, which is measured using a 5-point Likert scale, which is an example of an ordinal variable.

The likelihood ratio test is used to compare two models and to check if the variables are significant. This study used a significance level of 0.05 in the entire document except where otherwise specified. The variables that are not significant on the likelihood ratio test and with regression parameter (beta) estimates close to 0 will be removed from the model since it can be considered as factors that do not significantly affect the frequency of cycling.

4. RESULTS

4.1 Interview with the Teachers

Ten teachers were interviewed to gain insights into the perceptions, attitudes, behavior, safety considerations, and strategies to promote cycling among adolescents.

4.1.1 Demographics

Table 1. Demographic Profile of Interviewed Teachers

Variable	Category	Frequency
Age	26-30	2
	31-35	4
	36-40	2
	41-45	1
	46-50	1
Gender	Female	7
	Male	3
Location	Bayanihan	1
	Castellano	1
	Jaen	1
	Mangino	1
	Pambuan	1
	San Isidro	1
	San Nicolas	1
	San Roque	1
	San Vicente	2
Mode of Transportation	Tricycle	5
	Motorcycle	3
	Jeep	2

Table 1 summarizes demographic information obtained from the interview with the teachers. Most teachers fall within the age range of 31 to 35 years old, with four respondents. In terms of gender, seven female respondents participated in the interview, while three were male. The interviewed teachers come from various barangay, including Bayanihan, Castellano, Jaen, Mangino, Pambuan, San Isidro, San Nicolas, San Roque, and San Vicente. One or two teachers represent each barangay, indicating a spread of respondents across different areas. The teachers reported using different modes of transportation to commute to school. The most common modes were tricycles and motorcycles, with five and three respondents, respectively. Two teachers reported using a jeep as their primary mode of transportation.

Table 2. Teacher's Awareness of Adolescent Cycling Habits

Category		Frequency
Teachers aware of adolescents cycling in the community		6
Teachers' observation of adolescents cycling to school	Haven't seen	3
	Have seen	1

When asked about the teachers' awareness of adolescent cycling habits, the responses were categorized into 1) awareness of adolescent cycling in the neighborhood and 2) observation of adolescents riding bikes to school, as shown in Table 2. Six out of 10 teachers interviewed indicated awareness of adolescents cycling around their neighborhoods. Three teachers reported that they had not observed adolescents riding bikes to school. Conversely, one teacher reported having seen adolescents riding bikes to school.

4.1.2 Perceptions and Attitudes

The teachers were asked about the importance of cycling among adolescents, and the most frequently mentioned theme was the association between adolescent cycling and physical fitness or activity. The concept of eco-friendliness or environmental responsibility is also prominent among the perceived benefits of adolescent cycling. Another teacher also mentioned mental health, *"This boosts health for them to be physically active and fit and, at the same time, can help their mental health if they prioritize being physically active."* That indicates that at least one teacher recognizes the potential psychological benefits of cycling for adolescents. Another mentions that discipline is a potential benefit associated with adolescent cycling habits. Once mentioned, the concept of exercise highlights adolescents' recognition of cycling as a form of physical activity.

When asked about the health benefits of cycling that adolescents can gain, most agreed that it helps with cardiovascular health (7 mentions) and mental health (7 mentions). While mentioned less frequently than mental and cardiovascular health, physical fitness (2 mentions) is still recognized as a health benefit of cycling among adolescents. Another participant also mentioned strengthening muscles (1 mention), reducing stress levels (1 mention), and helping with weight management (1 mention).

The participants were asked about the concerns or risks associated with adolescents cycling within the community and most of them agreed that the inadequacy of infrastructure, such as the lack of bike lanes, was the most concerning, with nine mentions. Road safety, particularly the risk of accidents, is a significant concern raised by teachers with seven mentions. Teachers expressed concerns about reckless drivers posing a risk to adolescent cyclists. One participant mentioned, *"There are concerns about road safety, particularly with reckless drivers and inadequate bike lanes."* Teachers also identified a lack of awareness about traffic rules among adolescents and theft as a concern, with two mentions each. Another participant mentioned, *"Concerns include road accidents, theft, and lack of awareness among cyclists and motorists."* One teacher also mentioned, *"I think the lack of bike lanes and cyclists is not a priority in our area."*

The data reveals several positive impacts of adolescent cycling as perceived by teachers. Resilience, with seven mentions, emerges as the most frequently mentioned benefit.

Additionally, four mentions highlight cycling as boosting confidence. With three mentions, social skills are also acknowledged as a positive outcome, suggesting that cycling provides opportunities for adolescents to interact with peers. One participant mentioned, *“Cycling can boost confidence, social skills, and resilience among adolescents, fostering a sense of freedom and responsibility.”* Furthermore, teachers perceive cycling as a responsibility and independence, each with two mentions, mainly when adolescents ride alone. One participant mentioned, *“It can help them to be responsible enough, especially if they are riding alone.”*. Another participant also mentioned, *“Riding a bike can help the child become independent, especially when riding alone.”*

Participants were asked if there is sufficient community support for promoting cycling among adolescents, and 10 of them agreed that more community support should be needed. One participant mentioned, *"I do not think so. Cycling is not really a well-known activity, especially for young people."* Another participant mentioned, *"We need more infrastructure, education, and community engagement."* One teacher also mentioned, *"More advocacy and investment in cycling infrastructure are needed to create safer environments for adolescent cyclists."*

Participants were asked if there are any community-led initiatives that encourage safe cycling; six participants answered that there are no such initiatives in their community, and the remaining four were unaware if there is one in their community. One participant mentioned, *"I do not hear any about that."* Another participant also mentioned, *"I do not know, but it would be great if there is one."*

4.1.3 Cycling Behavior

The data regarding teachers' ownership of cycles reveals that 8 out of 10 teachers interviewed own a cycle, while two teachers do not. Safety reasons are cited as the primary factor influencing the decision of teachers who do not own a cycle. The cycling frequency among the interviewed teachers reveals that they predominantly cycle occasionally, typically during weekends. The primary purposes for riding include leisure activities, exercise, and running errands.

The common cycling routes or destinations where cycling is more common among adolescents, as perceived by teachers, indicate several locations. The most frequently mentioned destination is parks, with eight mentions identifying parks as common cycling areas for adolescents. Residential areas are also mentioned frequently, with five mentions noting that adolescents commonly cycle in residential neighborhoods. The relatively less crowded roads are identified as common cycling routes with four mentions. According to one participant, *“Popular cycling routes include riverside paths, parks, and quiet residential streets with minimal traffic.”* Additionally, two mention schools as common cycling destinations. Finally, recreational areas are mentioned once, indicating that adolescents may also frequent designated recreational spaces for cycling activities. Another participant also mentioned, *“Routes include parks, schools, and residential areas with minimal traffic”.*

Participants were asked if they participated in any organized cycling activities, such as biking to school programs or any community events; they said they did not participate for reasons like being unaware of cycling activities in their area and being too busy.

4.1.4 Safety Education

Eight out of ten participants ride a bike occasionally and wear helmets every time they cycle. When asked about the reasons for wearing a helmet, they said safety and to be a good example for adolescents. One of the participants mentioned, *"Yes, I prioritize safety and always wear a helmet when cycling, setting an example for adolescents."* According to the teachers, when asked about adolescents if they wear helmets, they do not usually see cyclists wearing helmets when cycling.

When asked if the teachers and adolescents received any safety education related to cycling at school, they all mentioned that they did receive safety education but not related to cycling. The students only had a short period of learning about cycling as part of the outdoor recreational activity in their Physical Education subject. One participant mentioned, *"They have one topic in Physical Education about outdoor recreational activity, if I am not mistaken, and one of them is biking."*

Ten participants agreed that having dedicated bike lanes, enough awareness, and better infrastructure can be an advantage to ensure safety while cycling within the community. A participant mentioned, *"Cycling safety varies depending on infrastructure and awareness; areas with dedicated bike lanes are generally safer."*

The challenges related to cycling safety as observed by the teachers shows that sharing the road with motor vehicles, with four mentions, was among the top challenges they have encountered. One participant mentioned, *"Challenges include sharing the road with motor vehicles."* Another challenge is the lack of cycle lanes, with three mentions. One participant said, *"Bicycle lanes and cyclists are not prioritized."* Lack of awareness and aggressive driving of motorists are other challenges, with two mentions each. Traffic congestion and poor road conditions are some challenges cyclists' experiences while cycling. One of the participants mentioned, *"Challenges include inadequate bike lanes, lack of driver awareness, and poor road conditions."* Another participant mentioned, *"Traffic congestion and aggressive driving pose significant challenges to cycling safety."*

Participants were asked about the situations that were personally encountered where cycling safety was a concern. With three mentions each, cycling during rush hour and cycling during adverse weather conditions were among the situations where cycling safety is a concern, according to the teachers. One participant mentioned, *"Yes, especially during rush hours when roads are congested, and drivers are impatient."* Another participant mentioned, *"Yes, particularly when cycling in unfamiliar areas or during adverse weather conditions."* Another situation is when sharing the roads with careless motorists and knowing that accidents are very common these days, with two mentions each. One participant said, *"Yes, particularly when navigating intersections or encountering aggressive motorists."* Another participant mentioned, *"Yes, especially since accidents are common these days."*

Table 3. Teachers' Insights on Cycling Safety Considerations

Safety Considerations	Mentions
choosing less busy routes	4
wearing bright clothing	4
adhere to traffic rules	3
using lights	3
advocate for safer cycling infrastructure	2
advocate for safer routes	1
cycling at normal speed	1
educate fellow cyclists	1
obey traffic signals	1
wearing protective gear	1

According to the teachers, Table 3 shows the safety considerations when cycling in the community. Choosing less busy routes and wearing bright clothing were among the top-mentioned safety considerations, with four mentions each. Another safety consideration is adhering to the traffic rules and using a bike light, with three mentions. One participant mentioned, *"I prioritize safety concerns by wearing bright clothing, using lights, and choosing less congested routes whenever possible."* With two mentions, advocating for safer cycling infrastructure can be considered a safety consideration, according to the teachers. A participant said, *"I advocate for safer cycling infrastructure and adhere to traffic rules to minimize risks."* With one mention each, advocating for safer routes, cycling at normal speed, educating fellow cyclists, obeying traffic signals, and wearing protective gear can also be considered in cycling safely. One participant said, *"Always looking around and cycling at a normal speed."* Another participant shares, *"I advocate for safer routes and educate fellow cyclists on riding techniques."*

4.1.5 Promoting Cycling

Table 4. Strategies Recommended by Teachers to Promote Adolescent Cycling

Category	Mentions
cycle to school if they leave nearby	1
ride a bike everyday	1
integrate bike safety lessons	1
incorporate cycling into the curriculum	7
organizing bike tours	1
incorporating biking into physical education classes	1
outdoor activities, bike-themed projects	1
through practical lessons on bike safety	2
environmental benefits	1
promoting cycling as a sustainable mode of transportation	1

Participants were asked how they can encourage adolescents to cycle; the majority of the teachers said to incorporate cycling into the curriculum by organizing bike tours, incorporating cycling into physical education classes, outdoor activities like cycling, bike-themed projects, through practical lessons on bike safety and raising the environmental benefits of cycling. One participant mentioned, *"Teachers can integrate cycling into the curriculum by organizing field trips or incorporating biking into physical education classes."* Another participant mentioned, *"Teachers can integrate cycling into the curriculum through outdoor activities, bike safety lessons, and promoting cycling as a sustainable mode of transportation."* Teachers also encourage adolescents to cycle every day, and, if they live nearby, at least try to cycle to school. One teacher mentioned, *"By encouraging everyone to cycle to school, especially if they live nearby. So that others will be encouraged too."* Another participant mentioned, *"Make it normal to ride a bike every day, especially when going to school."*

Teachers mentioned that initiatives or programs for parents-adolescents to cycle together, enhanced cycling infrastructure, cycling competitions, safety campaigns, government offering bike rentals, and bike-sharing programs could be implemented to promote safe and healthy adolescent cycling habits. One participant mentioned, *"Initiatives such as bike-sharing programs, cycling competitions, and safety campaigns can encourage healthy adolescent cycling habits."* Another participant mentioned, *"Encouraging students to cycle to school or some activities for parents and children to ride bicycles together."*

Figure 4. Teachers' Suggestions for Infrastructure Improvements to Enhance Adolescent Cycling Opportunities

Ten participants agreed that bike lanes should be the number one priority for infrastructure improvements, as illustrated in Figure 4. One participant said, *"Investing in bike-friendly infrastructure, such as bike lanes and secure parking facilities, can enhance adolescent cycling opportunities."* Infrastructure improvements such as bike parking, repair stations, and proper signage can also enhance adolescent cycling opportunities. One participant mentioned, *"Bike lanes and signage that will prioritize cyclists."* Another participant mentioned, *"Investing in bike-friendly infrastructure, including bike lanes, racks, and repair stations."*

Teachers can collaborate with parents or guardians to promote cycling among adolescents by establishing family cycling events, with seven mentions. Another way to promote cycling is to promote safe cycling routes and have an informative session on cycling safety and the benefits of active transportation, with two mentions each. One participant said, *"Schools can engage parents by hosting family biking events and providing resources on safe*

cycling practices." Another participant said, *"Schools can engage parents through informative sessions on cycling safety and the benefits of active transportation."* Creating a program to encourage adolescents to cycle and establishing a bike-to-school program can also help promote cycling among adolescents, with one mention each. One participant mentioned, *"By establishing a bike-to-school program to encourage the adolescent to cycle."*

The teachers were asked if there were any joint efforts between schools and families to enhance cycling safety; ten responded that there were none.

4.1.6 Summary

The data collected from teacher interviews provides valuable insights into adolescent cycling habits, perceptions, safety considerations, and strategies for promoting cycling. Awareness of adolescent cycling habits among teachers varies, with six out of 10 respondents indicating awareness of adolescents cycling in their communities. However, only one teacher reported seeing adolescents cycling to school, while three mentioned they had not observed such behavior. Perceptions and attitudes towards adolescent cycling highlight its numerous benefits, including physical fitness, eco-friendliness, mental health, discipline, and social skills. Despite these benefits, concerns such as inadequate infrastructure, road safety, theft, and lack of awareness about traffic rules are prevalent among teachers.

Regarding cycling behavior, most teachers own cycles and use them occasionally for leisure, exercise, and running errands. Common adolescent cycling destinations include parks, residential areas, less crowded roads, and schools. Safety education related to cycling appears limited, with only brief exposure in Physical Education classes. While teachers prioritize safety by wearing helmets, adolescents are not commonly seen doing the same.

Teachers recommend incorporating cycling into the curriculum, organizing bike tours, enhancing cycling infrastructure, and engaging parents through family cycling events to promote adolescent cycling. Collaboration between schools and families to improve cycling safety is minimal, with few joint efforts reported. Infrastructure improvements, particularly the implementation of bike lanes, are emphasized as crucial for enhancing adolescent cycling opportunities, alongside other measures like bike parking, repair stations, proper signage, and secure parking facilities.

4.2 Interview with the Parents/Guardians

In addition to the ten teachers who were interviewed, ten parents or guardians were also interviewed for this study to gain insights into the perceptions, attitudes, behavior, safety considerations, and strategies to promote cycling among adolescents.

4.2.1 Demographics

Table 5. Demographic Profile of Interviewed Parents/Guardians

Variable	Category	Frequency
Age	26-30	0
	31-35	1
	36-40	5
	41-45	3
	46-50	1
Gender	Female	6
	Male	4
Relationship to the Child	Mother	4
	Father	3
	Guardian	3
Location	Bayanihan	1
	Malimba	1
	Pambuan	1
	San Isidro	1
	San Leonardo	2
	San Lorenzo	1
	San Roque	2
	Sto. Cristo Norte	1
Mode of Transportation	Car	1
	Jeep	4
	Motorcycle	2
	Tricycle	2
	Walking	1

Table 5 summarizes demographic information obtained from the interview with the parents/guardians. Most parents/guardians fall within the age range of 36 to 40, with five respondents. Regarding gender, six female respondents participated in the interview, while four were male. The interviewed parents/guardians come from various barangay, including Bayanihan, Malimba, Pambuan, San Isidro, San Leonardo, San Roque, and Sto. Cristo Norte. One or two parents/guardians represent each barangay, indicating a spread of respondents across different areas. The parents/guardians reported using different modes of transportation to commute to school. The most common mode of transportation was a jeep, with four respondents. Motorcycles and tricycles came in second mode, with two respondents each. Two respondents reported using a jeep and walking as their primary mode of transportation.

4.2.2 Perceptions and Attitudes

The most frequently mentioned theme about the parental views on cycling importance: Cycling promotes independence, responsibility, and physical activity. According to the parents and guardians, the concept of eco-friendliness or environmental responsibility is also prominent among the benefits of cycling. One of the respondents said, *"Cycling is important as it encourages physical activity, independence, and a sense of responsibility. It also fosters a connection with the community and the environment."* Another respondent mentioned, *"Cycling is important as it promotes a healthy lifestyle and independence, and it is an eco-friendly mode of transportation. It also teaches them valuable skills like balance and road safety."*

When asked about the health benefits of cycling that adolescents can gain, most respondents agreed that it improves cardiovascular health, helps build muscle, contributes to maintaining a healthy weight, and improves mental health. One respondent mentioned, *"Improve mental health and physical as well, considering that the children today are always using cellphones."* Another respondent said, *"Cycling helps improve cardiovascular health, strengthens muscles, and contributes to maintaining a healthy weight. It is an enjoyable way for adolescents to stay active."*

The participants were asked about the concerns or risks associated with adolescents cycling within the community; most agreed that more designated bike lanes and safety education are necessary to overcome risks and concerns. One participant mentioned, *"One concern is the lack of designated bike lanes, making it challenging for adolescents to navigate traffic safely. Road conditions and reckless drivers also pose risks."* Parents also cited a lack of awareness among motorists about sharing the road with cyclists as one concern or risk. A participant mentioned, *"Lack of awareness among motorists about sharing the road with cyclists. Additionally, some roads need better maintenance to ensure safer cycling conditions."*

The data also reveals several positive impacts of adolescent cycling as perceived by parents and guardians. Promoting physical and social development and contributing positively to mental well-being. One participant said, *“Cycling encourages a sense of adventure, enhances problem-solving skills, and fosters friendships, contributing to physical and social development.”* Another participant mentioned, *“Cycling fosters independence, social interaction, and a sense of accomplishment. It contributes positively to physical and mental well-being, promoting a balanced lifestyle.”*

4.2.3 Cycling Behavior

The data regarding parents' or guardians' cycle ownership reveals that two out of 10 respondents interviewed own a cycle. Most of the respondents do not own a cycle due to not knowing how to cycle, space, and financial constraints. The frequency of cycling among the interviewed parents or guardians reveals that one parent rides at least three times a week while the other parents rarely use the bike because of the fear of cycling due to the absence of bike lanes in their area. One respondent mentioned, *"I rarely use the bike because of the fear of using a bike. Because of the weather and the lack of bike lanes,"* The primary reason for riding is recreation, a convenient mode of transportation, especially for a short distance, and running errands. In contrast to their parents or guardians, the data reveals that 5 out of 10 adolescents own a cycle. The frequency of cycling varies among adolescents, from riding a

few times a week and during weekends for recreational activities and short trips to nearby places.

The common cycling routes or destinations where cycling is more common among adolescents, as perceived by parents or guardians, indicate several locations. The most frequently mentioned destination is parks, with eight mentions identifying parks as common adolescent cycling areas. Riverbanks are also mentioned, with four mentions. One participant mentioned, *"There's a popular route along the riverbank and parks where adolescents often gather for cycling."* Open spaces or open areas were also cited, with three mentions of avoiding traffic. Another participant mentioned, *"Cycling is more common in parks and open areas, where adolescents can enjoy riding safely away from heavy traffic."* Lastly, with two mentions each, residential areas with less traffic and scenic areas were considered for safety reasons. One participant said, *"In our community, cycling is common in parks and residential areas with less traffic."*

The data reveals that parents or guardians and adolescents in their care have not participated in any organized cycling activities. Parents do not participate because of work and are unaware if there are any cycling activities in their community. One parent mentioned, *"No, I don't participate, and I am not sure if there are some activities like that in my community."* Another participant mentioned, *"We have not participated in any organized programs, but I am open to supporting initiatives that promote safe and enjoyable cycling experiences for adolescents."*

4.2.4 Safety Education

Two out of ten parents ride a bike but do not wear helmets every time they cycle because they only travel a short distance. One parent mentioned, *"I don't wear helmets. I just normally travel in a short distance."* In contrast to the parents' action, five adolescents who cycle always wear a helmet when cycling. One participant mentioned, *"Yes, my son wears a helmet every time he cycles. Safety is a priority, and we encourage his friends to do the same."*

The respondents were asked if they received any safety education related to cycling at school, and all of them answered that they did not receive and were unaware that adolescents receive any safety education at school.

The data also shows the challenges related to cycling safety as observed by the parents and guardians. Lack of cycling infrastructure, such as bike lanes, with seven mentions, was among the top challenges. One participant mentioned, *“The main challenge is the lack of dedicated bike lanes on major roads, making it challenging for adolescents to navigate safely through traffic.”* Other challenges that parents and guardians mentioned are the lack of respect from motorists, lack of adherence to traffic rules, occasional traffic congestion, and the need for better traffic management. One participant mentioned, *“Challenges include the lack of bike lanes and the need for better traffic management to ensure the safety of cyclists, especially during peak hours.”* Another participant mentioned*, “Limited bike lanes and occasional disregard for cyclists by some motorists pose challenges to cycling safety in our community.”*

According to the parents and guardians, the safety considerations when cycling in the community. Being extra careful when cycling was the priority due to the absence of bike lanes

in their community. Other safety considerations that need to be considered are thinking of safety first, always following the rules, always looking around, and cycling at a normal speed. A participant mentioned, *"You really need to be careful when using a bicycle, as there are no bike lanes in our community."* Another participant mentioned, *"Always ride a bike at a normal speed."*

4.2.5 Promoting Cycling

Parents and guardians were asked if they teach the adolescents to cycle, and only two parents answered that they taught them how to cycle. Another parent said that they did not teach the adolescent but were able to learn through their friend. The parent mentioned, *"I did not teach him, but I am also surprised that he now knows to cycle because of his friends."* Parents and guardians should always tell adolescents to follow traffic rules and wear helmets when cycling. One participant mentioned, *"They need to follow traffic rules and wearing helmets when cycling. Always look for the environment and check if it is really safe to cycle."*

Participants were asked how they could encourage adolescents to cycle; the majority mentioned that the parents or guardians should support cycling by promoting the benefits of cycling and fostering a positive attitude toward cycling. One participant mentioned, "*Parents can support by promoting the benefits of cycling and ensuring safety measures are followed."* Another participant mentioned, *"Parents can support by fostering a positive attitude towards cycling."*

Parents and guardians mentioned that focusing on community involvement, such as community workshops, cycling events, and bike-sharing programs, can effectively engage adolescents in cycling-related activities. Another is the partnership with the local authorities for infrastructure improvements, such as creating a bike lane and improving road conditions. One participant mentioned, *"Initiatives like community bike safety workshops, local cycling events, and collaboration with local authorities for infrastructure improvements would contribute to promoting safe and healthy cycling habits."*

Figure 5. Parental Suggestions for Infrastructure Improvements to Enhance Adolescent Cycling Opportunities

The provided data outlines various strategies to enhance cycling opportunities for adolescents, with a clear focus on infrastructure improvement, road safety awareness, and

collaborative partnerships, as shown in Figure 5. Across the references, there is a notable emphasis on upgrading bike lanes, creating bike-friendly routes, and installing bike racks to ensure safe and accessible pathways for cyclists, particularly adolescents. One participant mentioned, *"Improving bike infrastructure, creating bike-friendly routes, and installing bike racks at popular destinations would enhance cycling opportunities for adolescents."*

Additionally, there is a strong advocacy for raising awareness about road safety and cycling etiquette through better signage, awareness campaigns, and educational programs. These efforts are complemented by collaborative partnerships between local government, schools, and communities, which aim to promote a bike-friendly environment through infrastructure enhancements and cultural initiatives that encourage cycling as a viable mode of transportation and recreation among youth. One participant mentioned, *"Improved bike lanes, designated cycling zones, and awareness campaigns would significantly enhance cycling opportunities."* Another participant mentioned, *"Improved bike lanes, traffic safety education, and collaboration between local government and schools to create a bike-friendly environment would enhance cycling opportunities for adolescents."*

4.2.6 Summary

The data collected from the interview with the parents and guardians provides valuable insights into adolescent cycling habits, perceptions and attitudes, safety considerations, and strategies for promoting cycling. Regarding perceptions and attitudes, parents and guardians highlight the role of cycling in promoting independence, responsibility, physical activity, and eco-friendliness. They also recognized the health benefits such as improved cardiovascular health, muscle strength, weight management, and mental well-being. In contrast, the parents and guardians express concerns about the inadequate cycling infrastructure, lack of awareness among motorists, and road safety issues, which suggest the need for designated bike lanes and safety education among cyclists and motorists. Regarding cycling behavior, only two out of ten parents own a cycle due to reasons such as not knowing how to cycle and space constraints. Parents often cycle for recreation or short-distance travel. In contrast, half of the adolescents own cycle for recreational activities and short trips. According to the parents, common cycling destinations for adolescents include parks, riverbanks, open spaces, and residential areas with minimal traffic.

Safety education related to cycling appears lacking, with parents and guardians reporting no formal instruction received at school. Challenges related to cycling safety include inadequate infrastructure, lack of respect from motorists, and occasional traffic congestion. Safety considerations parents emphasize include being cautious due to the absence of bike lanes and adhering to traffic rules.

To promote cycling among adolescents, parents and guardians advocate for community involvement through workshops, events, and partnerships with local authorities for infrastructure improvements. Strategies include promoting the benefits of cycling, fostering positive attitudes, and ensuring safety measures. Infrastructure improvements, particularly bike lanes and road safety awareness campaigns, are highlighted as essential for enhancing cycling opportunities. Collaboration between government, schools, and communities is vital for creating a bike-friendly environment and encouraging safe and healthy adolescent cycling habits.

4.3 Questionnaire with the Students

The actual recorded respondents of the online questionnaire for this study were 696, of which 517 completed the online questionnaire while 179 were unable to complete or finish the online questionnaire. Additionally, 12 respondents who did not belong to the 12-18 age range were removed from the analysis. In total, 505 respondents were used for this study, with a response rate of 72.56%.

4.3.1 Demographics

Table 6. Demographic Profile of the Respondents

		Cyclists		Non-Cyclists	
		392	**77.62%**	**113**	**22.38%**
Gender	Male	215	54.85%	39	34.51%
	Female	172	43.88%	73	64.60%
	Non-Binary	2	0.51%	0	0.00%
	Prefer not to say	3	0.77%	1	0.88%
Age	12	13	3.32%	0	0.00%
	13	32	8.16%	2	1.77%
	14	34	8.67%	0	0.00%
	15	34	8.67%	0	0.00%
	16	43	10.97%	30	26.55%
	17	160	40.82%	57	50.44%
	18	76	19.39%	24	21.24%

Table 6 summarizes the demographic information of the 505 participants based on their cycling habits, gender, and age. The majority of the respondents (77.62%) cycled at least once a year. In terms of gender, a higher percentage of males (54.85%) reported cycling compared to females (43.88%), with a low percentage of non-binary and those who prefer not to disclose their gender, 0.51% and 0.77%, respectively. The highest participation in terms of age is 17-year-olds with 40.82%, followed by 16-year-olds with 10.97%. Table 6 also shows the percentage of the respondents who do not cycle with 22.38%. Some reasons for not cycling are the lack of access to cycle, safety concerns, lack of interest in cycling, and others, such as not knowing how to cycle, as shown in Figure 6. Out of the 113 respondents who do not ride cycle, 90 (79.65%) have stated that they are interested in cycling in the future. According to

non-cyclist respondents, some ways to make cycling popular among adolescents - specifically non-bikers - are improving cycling infrastructure, cycling accessibility, and involvement in programs.

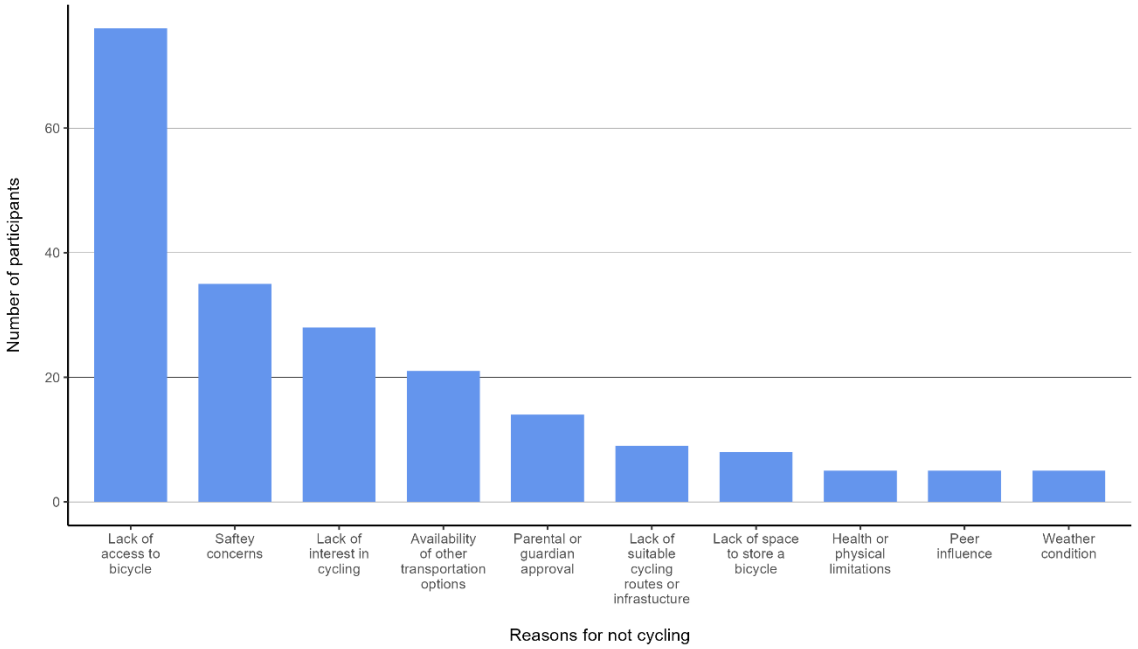

Figure 6. Reasons for Not Cycling

4.3.2 Adolescents' Behavior While Cycling

Table 7. Results of ANOVA for Part V of the Questionnaire

	df	Approx. f-value	p-value
Violations			
Age	1	1.86	0.17
Gender	1	5.18	**0.02**
Errors			
Age	1	6.61	**0.01**
Gender	1	0.57	0.44
Positive Behaviors			
Age	1	24.50	**<0.001**
Gender	1	0.48	0.48

Part V of the online questionnaire consists of questions about Useche's Cycling Behavior Questionnaire (CBQ), which has three categories: violations, errors, and positive behaviors. Table 7 shows that under a 5% level of significance, there is sufficient evidence to conclude that there are significant differences between the ages in terms of Errors and Positive

Behaviors. Younger adolescents (age = 12) are more likely to show positive behavior and less likely to make riding errors than older adolescents. However, there is no sufficient evidence to conclude that there are significant differences between the genders in terms of Errors and Positive Behavior. There is also sufficient evidence to conclude that there is a difference between genders under a 5% level of significance regarding violations. Traffic violations were significantly higher among male adolescents than female adolescents.

Table 8. Results of ANOVA for Part VI of the Questionnaire

	df	Approx. f-value	p-value
Pragmatic			
Age	1	37.40	**<0.001**
Gender	1	0.01	0.90
Enforcement			
Age	1	1.34	0.24
Gender	1	0.08	0.77
Rules			
Age	1	4.80	**0.03**
Gender	1	0.07	0.78

Part VI and Part VII of the online questionnaire consist of questions from the study of Kummeneje and Rundmo (2020). Table 8 shows that under a 5% level of significance, there is sufficient evidence to conclude that there are significant differences between the ages in terms of Pragmatic and Rules. Adolescents within the age range of 12 and 16-18 years of age tend to show pragmatic attitudes towards rule violations or those who violated the rules more often than other cyclists. Additionally, although the mean values are close to each other, adolescents within the age range of 12 and 17 years of age tend to show dissatisfaction to the traffic rules or the number of conflicts experienced when cycling.

Table 9. Results of ANOVA for Part VII of the Questionnaire

	df	Approx. f-value	p-value
Traffic Rules			
Age	1	34.53	**<0.001**
Gender	1	6.65	**0.01**
Conflict			
Age	1	22.80	**<0.001**
Gender	1	4.85	**<0.02**

Table 9 shows that under 5% level of significance, there is sufficient evidence to conclude that there are significant differences between the ages and genders across the averaged Likert ratings for Violations of Traffic Rules and Conflicts when Cycling. Regarding gender, male adolescents are more likely to violate traffic rules and do conflicts when cycling than female adolescents. Additionally, in terms of age, adolescents within the age range of 12 and 16-18 years of age are more likely to violate traffic rules than other adolescents. However, younger adolescents (12-15 age range) are more likely to do conflicts when cycling than older adolescents.

4.3.3 Factors Influencing Cycling Frequency

Majority of the respondents used standard cycle (381), electric cycle (23), and others (8) such as mountain cycle and fixed-gear. The majority of the respondents occasionally to almost never cycle (~69%), with the majority cycling for less than an hour per cycling trip. Table 10, hence, shows that the majority of respondents have relatively short and infrequent biking sessions.

Table 10. Frequency and Duration of Cycling

		n	%
Frequency	Very Frequently (daily)	32	8.16%
	Frequently (3-5 times a week)	88	22.45%
	Occasionally (1-2 times a week)	83	21.17%
	Rarely (1-2 times a month)	101	25.77%
	Almost Never (a couple of times per year)	88	22.45%
Duration	Less than 15 minutes	91	23.21%
	15 – 30 minutes	142	36.22%
	30 minutes – 1 hour	110	28.06%
	1 to 2 hours	29	7.40%
	At least 2 hours	20	5.10%

Table 11 shows the frequency of involvement of teachers and parents' encouragement in adolescents' cycling. Most respondents receive parents' encouragement occasionally to very frequently (327), while the teachers' encouragement is most commonly reported as almost never (109). Adolescents feel parents' encouragement to cycle more than the encouragement of their teachers.

Table 11. Frequency of Involvement of Teachers and Parents

Frequency	Parent Encouragement	Teacher Encouragement
Very Frequently	124	32
Frequently	101	90
Occasionally	102	91
Rarely	43	70
Almost Never	22	109
TOTAL	392	392

4.3.4 Confirmatory Factor Analysis of Adapted Questionnaire

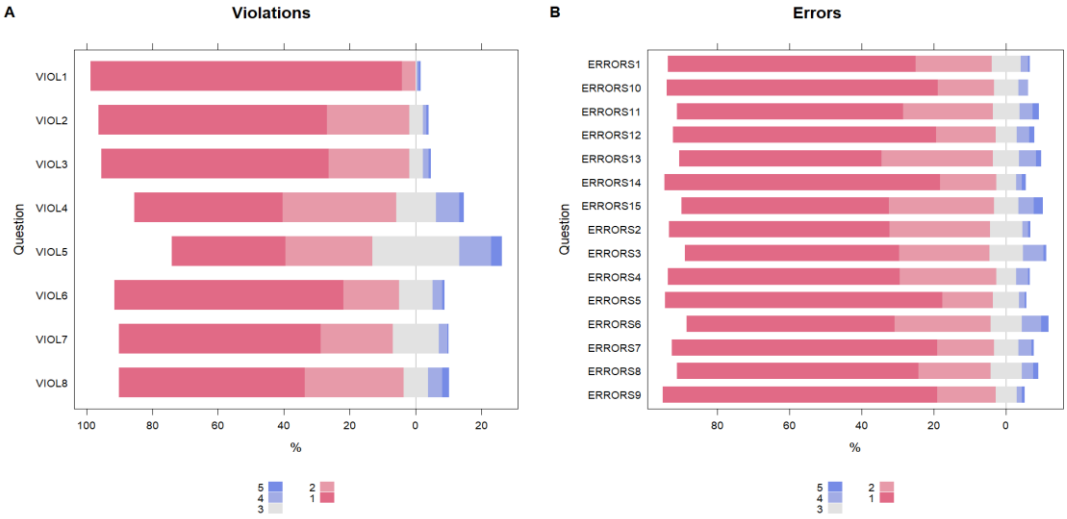

Figure 7. Risky Behaviors of the Respondents

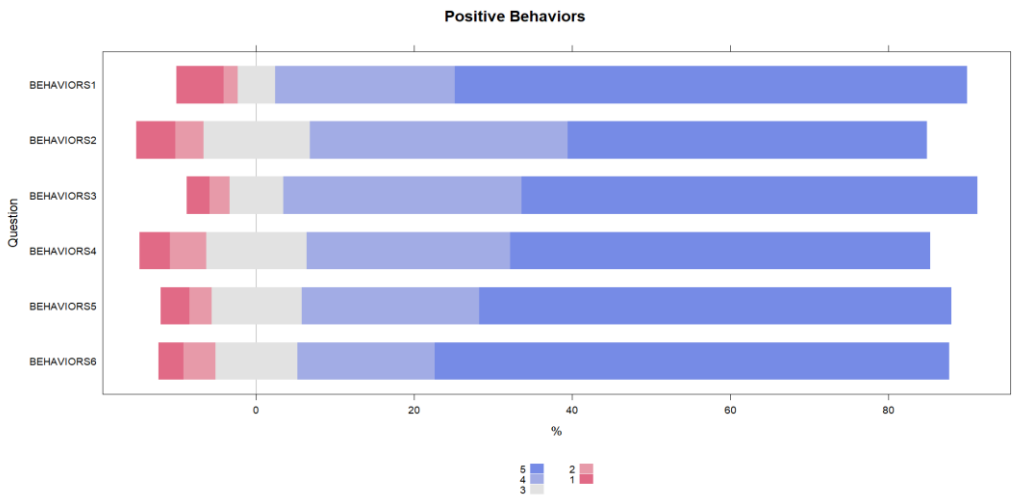

Figure 8. Positive Behaviors of the Respondents

Figure 7 and Figure 8 show the visualization of the percentage of the answers to the Likert scale question in risky and positive behaviors of the respondents. The figure helps in

knowing the distribution of the answers across the ratings. The variables are named in the order shown per factor on the online questionnaire, such as VIOL1, which is the first question under the violation category (refer to Appendix 4 for the list of questions). Most of the self-reported attitudes by the respondents were ideal when it comes to risky behaviors, with only a small percentage of the respondents answering Frequently and Almost Always, with a mean rating of violations = 1.58 and a mean rating of errors = 1.49. Accordingly, the ratings for questions regarding the self-reported positive behaviors were also ideal - mostly Frequently and Almost Always, with a mean rating of 4.29.

Table 12 shows the results of CFA for questions from the study of Useche et al. (2021) with an original number of 29 variables with factors categorized into violations, errors, and positive behavior. Since the statistics for the model are near or within the cut-offs, the model can be considered a good fit for the data. The CFI and TLI are near 0.90, and RMSEA and SRMR are within thresholds. Factor loadings are then checked to see the fit of individual variables. VIOL1 and VIOL6 are removed due to low factor loadings, as shown in Table 13.

Table 12. Results of CFA of all Variables for Part V of the Questionnaire

	Standard Cut-off for Good Fit of Models	**First Iteration**	**Second Iteration**
CFI	> 0.9	0.89	0.89
TLI	> 0.9	0.88	0.88
RMSEA	Between 0.05 and 0.08	0.06	0.07
SRMR	< 0.08	0.05	0.05
Factor loadings (λ)	0.6 (or at least around 0.55)	(see Table 13 for the value)	(see Table 14 for the value)

Factors = subcategories in the questionnaire (e.g., Violations, Errors)
Variables = actual questions

Table 13. Factor Loadings for Part V of the Questionnaire (First Iteration)

	Violations	**Errors**	**Behaviors**
VIOL1	**0.27**	0	0
VIOL2	0.57	0	0
VIOL3	0.60	0	0
VIOL4	0.55	0	0
VIOL5	0.73	0	0
VIOL6	**0.49**	0	0
VIOL7	0.60	0	0

VIOL8	0.63	0	0
ERRORS1	0	0.66	0
ERRORS2	0	0.68	0
ERRORS3	0	0.71	0
ERRORS4	0	0.77	0
ERRORS5	0	0.73	0
ERRORS6	0	0.75	0
ERRORS7	0	0.70	0
ERRORS8	0	0.71	0
ERRORS9	0	0.67	0
ERRORS10	0	0.70	0
ERRORS11	0	0.67	0
ERRORS12	0	0.71	0
ERRORS13	0	0.59	0
ERRORS14	0	0.74	0
ERRORS15	0	0.64	0
BEHAVIORS1	0	0	0.65
BEHAVIORS2	0	0	0.77
BEHAVIORS3	0	0	0.82
BEHAVIORS4	0	0	0.75
BEHAVIORS5	0	0	0.76
BEHAVIORS6	0	0	0.68

Variables are named in the order shown per factor on the questionnaire (e.g., VIOL1 = first question under Violation)

Table 14 shows the results of the second iteration of CFA with 27 variables. The statistics for the model are near or within the cut-offs, the model can be considered as a good fit to the data, the CFI and TLI are near 0.9 and RMSEA and SRMR are within thresholds. Factor loadings are then checked to see fit of individual variables and the factor loadings shown in Table 14 are acceptable. The second iteration are then considered as the final model for Part V. Variables are named in the order shown per factor on the online questionnaire (e.g., VIOL1 = first question under Violation)

Table 14. Factor Loadings for Part V of the Questionnaire (Second Iteration)

	Violations	Errors	Behaviors
VIOL2	0.54	0	0
VIOL3	0.57	0	0
VIOL4	0.58	0	0
VIOL5	0.74	0	0
VIOL7	0.60	0	0
VIOL8	0.65	0	0
ERRORS1	0	0.66	0
ERRORS2	0	0.68	0
ERRORS3	0	0.71	0
ERRORS4	0	0.77	0
ERRORS5	0	0.73	0
ERRORS6	0	0.75	0
ERRORS7	0	0.70	0
ERRORS8	0	0.71	0
ERRORS9	0	0.67	0
ERRORS10	0	0.70	0
ERRORS11	0	0.67	0
ERRORS12	0	0.71	0
ERRORS13	0	0.59	0
ERRORS14	0	0.74	0
ERRORS15	0	0.64	0
BEHAVIORS1	0	0	0.65
BEHAVIORS2	0	0	0.77
BEHAVIORS3	0	0	0.82
BEHAVIORS4	0	0	0.75
BEHAVIORS5	0	0	0.76
BEHAVIORS6	0	0	0.68

The results of CFA, as shown in Table 15, for questions from the study of Kummeneje and Rundmo (2020) with an original number of 9 variables with factors categorized into

pragmatic attitudes towards rule violations, attitudes towards cyclist enforcement, and dissatisfaction with the traffic rules. Since the statistics for the model are near or within the cut-offs, the model can be considered as a good fit to the data, within cut-offs except for RMSEA. Factor loadings are then checked to see the fit of individual variables.

Table 15. Results of CFA of all Variables for Part VI of the Questionnaire

	Standard Cut-off for Good Fit of Models	**First Iteration**
CFI	> 0.9	0.99
TLI	> 0.9	0.98
RMSEA	Between 0.05 and 0.08	0.05
SRMR	< 0.08	0.03
Factor loadings (λ)	0.6 (or at least around 0.55)	(see Table 16 for the value)

Factors = subcategories in the questionnaire (e.g., Pragmatic, Enforcement)
Variables = actual questions

Since the factor loadings are acceptable as shown in Table 16, the final model for Part VI is the result of the first iteration, which considers all nine variables.

Table 16. Factor Loadings for Part VI of the Questionnaire (First Iteration)

	Pragmatic	**Enforcement**	**Dissatisfaction**
PRAGMATIC1	0.83	0	0
PRAGMATIC2	0.78	0	0
PRAGMATIC3	0.81	0	0
PRAGMATIC4	0.72	0	0
PRAGMATIC5	0.59	0	0
ENFORCEMENT1	0	0.86	0
ENFORCEMENT2	0	0.87	0
DISSATISFACTION1	0	0	0.86
DISSATISFACTION2	0	0	0.78

Table 17 shows the results of CFA for questions from the study of Kummeneje and Rundmo (2020) with an original number of 10 variables with factors categorized into risk violation and risk conflict. The statistics for the model are not a good fit. Factor loadings are then checked to see if there is a variable with low loading and would be excluded.

Table 17. Results of CFA of all Variables for Part VII of the Questionnaire

	Standard Cut-off for Good Fit of Models	**First Iteration**	**Second Iteration**
CFI	> 0.9	0.85	0.94
TLI	> 0.9	0.80	0.91
RMSEA	Between 0.05 and 0.08	0.15	0.11
SRMR	< 0.08	0.15	0.05
Factor loadings (λ)	0.6 (or at least around 0.55)	(see Table 18 for the value)	(see Table 19 for the value)

Factors = subcategories in the questionnaire (e.g., Risk Violation, Risk Error)
Variables = actual questions

Table 18. Factor Loadings for Part VII of the Questionnaire (First Iteration)

	RiskViol	**RiskConflict**
RISKVIOL1	0.76	0
RISKVIOL2	0.83	0
RISKVIOL3	0.78	0
RISKVIOL4	0.60	0
RISKVIOL5	0.63	0
RISKVIOL6	0.60	0
RISKCONFLICT1	0	**0.07**
RISKCONFLICT2	0	0.7
RISKCONFLICT3	0	0.92
RISKCONFLICT4	0	0.87

Since RISKCONFLICT1, as shown in Table 18 has low factor loadings, it is removed from the variables. Table 19 shows the factor loadings for the second iteration of Part VII. The statistics for the model are near or within the cut-offs, the model can be considered as a good fit to the data, within the cut-offs except for RMSEA. Factor loadings are then checked to see fit of individual variables.

Table 19. Factor Loadings for Part VII of the Questionnaire (Second Iteration)

	RiskViol	RiskConflict
RISKVIOL1	0.76	0
RISKVIOL2	0.83	0
RISKVIOL3	0.78	0
RISKVIOL4	0.60	0
RISKVIOL5	0.63	0
RISKVIOL6	0.60	0
RISKCONFLICT2	0	0.77
RISKCONFLICT3	0	0.92
RISKCONFLICT4	0	0.88

4.3.5 Predicting Adolescents' Cycling Frequency

This study used ordered logistic regression to predict the factors that affect the frequency of adolescents' cycling, which was determined by using a Likert scale. Table 20 shows the different variables, the type of data, and the description used in the study.

Table 20. Variables on the Model

	VARIABLE NAME	TYPE	DESCRIPTION
DEPENDENT	Frequency of cycling (Freq.)	Categorical - Ordinal	5 - Very frequently (daily) 4 - Frequently (3-5 times a week) 3 - Occasionally (1-2 times a week) 2 - Rarely (1-2 times a month) 1 - Almost Never (a couple of times per year)
INDEPENDENT	Age	Continuous	
	Gender	Categorical - Nominal	4 - Prefer not to say 3 - Non-binary 2 - Female 1 - Male
	Accident Involvement	Binary	1 - Yes 0 - No

Parental Involvement (Parent)	Categorical - Ordinal	5 - Very frequently 4 - Frequently 3 - Occasionally 2 - Rarely 1 - Almost Never
Teacher Involvement (Teacher)	Categorical - Ordinal	5 - Very frequently 4 - Frequently 3 - Occasionally 2 - Rarely 1 - Almost Never
Violations (Viol) Errors Positive Behaviors (PBehaviors)	Continuous	Mean value of 5-point Likert questions under the category
Pragmatic Attitudes Towards Rule Violation (Prag) Attitudes Towards Cyclist Enforcement (Enforcement) Dissatisfaction with the Traffic Rules (Rules)	Continuous	Mean value of 5-point Likert questions under the category
Violation of Traffic Rules (TrafRules) Conflicts When Cycling (Conflicts)	Continuous	Mean value of 5-point Likert questions under the category
Attitudes Social Norms (Norms) Perceived Behavioral Control (Control) Perceived Behavioral Intention (Intention)	Continuous	Mean value of 5-point Likert questions under the category

The initial ordered logistic model (refer to Appendix 7 Table 29), where the beta estimate of each variable close or equal to zero may be removed. Since there are no beta estimate for the model close or equal to zero, the model can be considered as a good fit. Likelihood ratio test of the initial, shown in Table 21, will then be used to check if the variables are significant. Variables that are not significant in the likelihood ratio test and with beta estimates close to 0 may be removed from the model since it can be considered as factors

that do not significantly affect the frequency of cycling. These variables are PBehaviors and Conflicts.

Table 21. Likelihood Ratio Test of Initial

Variable	LR Test Statistic	Degrees of Freedom	p-value
Age	15.10	1	**0.00***
factor(Gender)	18.71	3	**0.00***
factor(Accident)	1.66	1	0.19
PARENT1	18.80	1	**<0.001***
TEACHER1	5.22	1	**0.02***
Viol	2.15	1	0.14
Errors	1.84	1	0.17
PBehaviors	0.39	1	0.52
Prag	1.019	1	0.31
Enforcement	1.88	1	0.16
Rules	3.10	1	0.07**
TrafRules	1.20	1	0.27
Conflict	0.26	1	0.60
Attitude	1.42	1	0.23
Norms	3.61	1	0.05**
Control	7.01	1	**0.00***
Intention	5.98	1	**0.01***

* = significant under 5% level of significance, ** = significant under 10% level of significance

Table 22. New Proposed Model

Variable	LR Test Statistics	SE	t-value	p-value (overall effect)
Age	14.40	0.07	-3.76	<0.001
factor(Gender)2		0.21	-4.42	
factor(Gender)3	20.51	1.42	-0.85	<0.001
factor(Gender)4		1.20	-0.93	
PARENT1	23.52	0.09	4.77	<0.001
TEACHER1	4.79	0.08	2.19	0.02
Norms	8.36	0.21	-2.83	0.00
Control	6.40	0.19	2.53	0.01
Intention	6.86	0.23	2.60	0.01

A likelihood ratio test is done in order to compare two models and see whether a simpler with fewer variables is more preferable than a more complex model with more variables. The simpler model that is compared is the model where some variables were removed from the original. For this test, the residual deviance and the degrees of freedom (number of parameters in the model) of the two models are compared.

Ho: Simpler model fits the data as well as the more complicated one (simpler will be used)

Ha: Simpler model does not fit the data as well as the more complicated one (more complex will be used)

The test is performed under 5% level of significance. Using the difference between the residual deviance of the proposed and the initial models, G^2 = 13.36 (df = 10), p-val = 0.20, Ho is not rejected. The simpler model can be used as the final model. Further, the proposed model is also significant when compared to the null model (containing only an intercept) with residual deviance difference G^2 = 224.86 (df = 9) and p-value < 0.00. Similar to the test above, this suggests that the more complex model (proposed) is more suitable than the simpler one (intercept-only).

Table 23. Final Model and Interpretation

Variable	Beta Estimate	Interpretation
Age	-0.27	Younger adolescents are more likely to cycle compared to older adolescents
Female	-0.93	Female adolescents are less likely to cycle compared to Male adolescents
Non-binary	-1.22	Non-binary adolescents are less likely to cycle compared to Male adolescents
Prefer not to say	-1.12	Adolescents in this category are less likely to cycle compared to Male adolescents
Parent Encouragement	0.44	More frequent encouragement increases frequency of cycling
Teacher Encouragement	0.19	More frequent encouragement increases frequency of cycling
Social Norms	-0.61	Higher average adherence to social norms decreases odds
Perceived Behavioral Control	0.50	Higher average perceived behavioral control increases odds of cycling more frequently
Perceived Behavioral Intention	0.62	Higher average perceived behavioral intention increases odds of cycling more frequently

Table 23 shows the results of the analysis where various factors are examined in relation to the frequency of cycling among adolescents. It reveals that younger adolescents are more likely to cycle frequently. Gender also plays a role, where female and non-binary adolescents are less likely to cycle more frequently compared to male adolescents. In addition, encouragement from parents and teachers creates a higher level of support, and more frequent encouragement increases the frequency of cycling. Regarding social norms, higher average adherence decreases the odds of cycling more frequently. On the other hand, in terms of perceived behavioral control and intention, a higher average perceived increases the odds of cycling more frequently.

5. DISCUSSION

This study aims to understand adolescents' behavior while cycling, identify the factors that affect the cycling frequency of adolescents, and the strategies to promote cycling in the Philippines. To understand the following aims, a combination of qualitative and quantitative methods is used. First, the researcher interviewed ten teachers and ten parents/guardians to gain insights about perceptions, attitudes, behavior, safety considerations, and strategies to promote cycling among adolescents. Additionally, the researcher did an online questionnaire among the adolescents of Juan R. Liwag Memorial High School to understand their cycling behavior.

5.1 Adolescents' Behavior while Cycling

The first aim of this study was to compare the CBQ scores on violations, errors, and positive behaviors as a function of demographics (age and gender). The results show the age and gender differences in terms of risky and positive behavior. The traffic violations reported by adolescent cyclists in the Philippines were significantly higher in the case of male than female adolescent cyclists, which has similar findings from the study of Feenstra et al. (2011), Useche et al. (2021), Useche et al. (2018b). However, no gender-based differences were found in the case of Errors and Positive Behavior, in contrast to the finding of Useche et al. (2021), where females report higher rates of positive behavior. Similar findings were found in the study of Useche et al. (2021) about the non-significant differences in terms of riding errors, suggesting that riding errors are more linked to cycling skills than risk perception. The gender differences observed in self-reported traffic violations can be explained by psychosocial factors: variations in risk perception, cycling anger, and personality traits among male and female cyclists (Møller & Haustein, 2017; Oehl et al., 2019; Useche et al., 2018b).

Regarding age-based differences, younger adolescents (age = 12) are more likely to violate and show positive behavior and less likely to make riding errors than older adolescents. In contrast to a study by Feenstra et al. (2011), no age differences were found in reported errors and violations using the Adolescents Cycling Behavior Questionnaire (ACBQ) and concluded that adolescents do not perform risky behaviors often. Although no specific studies addressed risk-taking and positive behavior among adolescents specifically, several studies show that the younger age group (<26 years) is involved in overall risky behavior (Hezaveh et al., 2018; Useche et al., 2019).

Cyclists' attitudes play a crucial role in traffic safety. These attitudes serve as predictive factors for their risk-taking behavior. Among these attitudes, pragmatic attitudes toward rule violations are particularly significant. For example, cyclists who find it acceptable to break traffic rules may be more likely to do so than those with stricter views. Additionally, dissatisfaction with traffic rules is linked to conflicts experienced while cycling. This dissatisfaction could stem from confusion about the rules or difficulties in adhering to them, leading to more clashes with other road users (Kummeneje & Rundmo, 2020). The results show a significant difference between the age in terms of Pragmatic Attitudes Towards Rule Violation and Dissatisfaction with the Traffic Rules. Older adolescents (16-18 years) are more likely to show pragmatic attitudes towards rule violations and dissatisfaction with traffic rules, suggesting that the younger cyclists are more cautious or rule-abiding.

5.2 Factors that Affect Cycling Frequency of Adolescents

This study found that several factors affect the cycling frequency among adolescents. These include demographics, encouragement, social factors, behavioral intentions, and control.

Regarding demographic factors, younger adolescents are more likely to cycle frequently. Younger cyclists have fewer distractions when cycling and tend to exhibit a greater propensity for engaging in dangerous behaviors, which helps interpret why younger cyclists are more frequently involved in traffic accidents when compared to their older counterparts (Useche et al., 2018b). Adolescents also prefer to cycle to exercise their independence (Lorenc, 2008). In addition, female adolescents are less likely to cycle more frequently compared to male adolescents. This can be influenced by societal norms, safety concerns, and cultural factors. Similarly, a study by McDonald et al. (2021) shows that boys usually cycle more than girls, especially in countries without a cycling culture. This can be explained by safety issues (Bonham & Wilson, 2012), lower level of confidence in traffic (Dill, 2017), and societal norms such as parents tend to impose greater control over girls than boys (McDonald et al., 2021).

Positive reinforcement and social support play a crucial role in promoting cycling behavior. Adolescents who receive more frequent encouragement (from peers, family, or teachers) are more likely to cycle. In their study, Dill and Voros (2006) found that people living in households where other cyclists were present or who observed adults cycling within their residence were more inclined to engage in cycling themselves. Additionally, a study by Sherwin et al. (2014) shows that social factors primarily influenced a minority of the events where individuals started riding frequently. Direct influence can come from family, friends, and classmates, while indirect influence might come from the social and cultural context.

This study also found that higher adherence to social norms also decreases the odds of cycling more frequently. This shows that adolescents are less likely to cycle when they go against social norms (e.g., cycling is not accepted in the community). Adolescents in this study do have a positive social norm towards cycling. However, factors such as the absence of cycle lanes, safety concerns, and less cycle access affect adolescents' cycling frequency. A study by Verhoeven et al. (2016) shows that higher social norms were positively associated with cycling to school and other destinations.

Adolescents with higher perceived behavioral control or adolescents who feel more confident in their cycling abilities are more likely to engage in cycling. This confidence could stem from factors such as experience, training, or self-efficacy beliefs. In addition, adolescents with stronger intentions to cycle are more motivated to cycle. Intentions can be influenced by various factors, including personal preferences, social norms, and perceived benefits of cycling. These research findings indicate that these psychological factors positively correlate with cycling frequency, where adolescents who possess confidence and motivation are more likely to cycle frequently. A study conducted by Cabral et al. (2018) demonstrates that the perception of behavioral control significantly influences the intention to engage in cycling and the actual performance of behaviors such as utility cycling and active travel. According to the Theory of Planned Behavior (TPB), human actions are influenced by three key variables: the individual's attitude towards the behavior, the social pressure or subjective norm to engage in the behavior, and the perception of control over it. These aspects collectively shape the

individual's behavioral intention (Ajzen, 2022). Perception of control is assumed to influence intentions and behavior (La Barbera & Ajzen, 2021). In addition, behavior can also be influenced by factors like attitudes and perceived social pressure (Ajzen & Kruglanski, 2019).

5.3 Ways to Promote Cycling and Make it More Attractive in the Philippines

Cycling is an eco-friendly mode of transportation and a way to promote physical activity and overall well-being. Adolescents can benefit significantly from cycling. Non-cyclists' adolescents were asked for the reason for not cycling. Reasons like lack of access to cycle, safety concerns, lack of interest in cycling, lack of cycling infrastructure, availability of other transportation mode, parental or guardian approval were among the reasons for not cycling in the Philippines. This study found several factors identified by adolescents, parents/guardians, and teachers that can contribute to the popularity or attractiveness of cycling among adolescents in the Philippines. Improved cycling infrastructure, cycle accessibility, involvement in cycling and safety education programs, peer-led initiatives or encouragement, and parental or school involvement can make cycling popular among adolescents. Additionally, parents and guardians also mentioned that focusing on community involvement, such as involvement in cycling programs, can effectively engage adolescents in cycling-related activities. Furthermore, teachers emphasized that incorporating cycling into the curriculum by adding cycling into physical education classes, and providing practical lessons on bike safety and the benefits of cycling can encourage adolescents to cycle.

Adolescents are more likely to cycle when they have safe and convenient routes. Investing in cycling infrastructure, separated from motorized traffic, can significantly increase cycling rates. Parents, guardians, and teachers mentioned that improving cycling infrastructure such as cycle lanes and installing cycle racks are some of the infrastructure improvements. Several studies indicate a positive correlation between cycling infrastructure and cycling frequency. These studies often assess infrastructure by quantifying the presence of cycle lanes and other related facilities. According to Buehler and Pucher (2012), cities with a greater supply of cycle paths and lanes have significantly higher cycling commute rates. Götschi et al. (2016) state that two critical factors in promoting cycling and improving safety are decreasing motorized traffic volumes and speeds and implementing infrastructure or cycling routes on less busy roads to separate cyclists from motorized traffic. In addition, a study by Verhoeven et al. (2017) stated that separating the cycling path from motorized traffic predominantly determined adolescents' preference to cycle for transport. Although peer-led initiatives or co-participation of friends are mentioned by the adolescents in this study, Verhoeven et al. (2017) also stated that co-participation of friends is an important factor for adolescents' cycling but showed that separation of cycle path is more important. Furthermore, the availability of cycling parking influences the decision to cycle for existing and potential cyclists. Insufficient or inadequate cycling parking facilities discourage individuals from cycling (Heinen & Buehler, 2019).

Adolescents need easy access to cycles in order to incorporate cycling into their life's physical activity. Several programs aim to increase cycle access through facilitating ownership or temporary use, such as cycle-sharing programs. Non-cyclists' adolescents mentioned that one of the reasons for not cycling is due to lack of access to cycles, wherein 90 out of 113 non-cyclists' respondents mentioned that they are interested in cycling in the future. Fasan et al. (2021) found that the accessibility and conditions of cycles were additional factors that influenced the use of cycles among adolescents.

Involvement in cycling education program in school shows an effect and influence on the change of knowledge, skills, safety awareness, and increasing cycling frequency and confidence (Richmond, S.A, et al., 2014; Hooshmand et al., 2014; Sersli et al., 2019). Van Hoef et al. (2022) conducted a study in Switzerland in which they implemented a cycling promotion program to examine its impact on adolescents' cycling skills and increase their awareness of road safety. The findings suggest that the program successfully improves adolescents' cycling skills, which is positively associated with regular cycling. Additionally, engaging in a cycling program implemented in schools can enhance adolescents' psychological and social well-being. A study by Dementyev et al. (2023) demonstrates a correlation between program participation and enhanced mental health and well-being, and a positive physical education experience among adolescents. Another study by Aranda-Balboa et al. (2022) shows that the school-based intervention is feasible in the school context since the cycling knowledge improved and the sessions' sense of enjoyment and usefulness were high after the school-based intervention. The sense of enjoyment increases the student's learning potential. Therefore, it is crucial to develop interventions that are highly satisfactory and enjoyable (Sersli et al., 2019).

Cycling training programs have significant potential to promote cycling among adolescents. Cycling training is a program designed to enhance participants' cycling skills and confidence. It encompasses many training levels, from basic training in a safe, traffic-free setting to more advanced training on public roads (Ducheyne et al., 2013). A study conducted in Hong Kong by Loo et al. (2020) revealed that cycling training positively impacted the cycling skills of school adolescents (ages 8-17). Additionally, their attitudes and behaviors towards cycling also showed significant changes. The adolescents demonstrated evident progress with each session of the cycling training.

The involvement of parents influences the behavior of adolescents. The mobility behaviors of children and young individuals are significantly shaped by the mobility behaviors of their parents (Susilo & Liu, 2016; Thigpen & Handy, 2018). Emond and Handy (2012) observe that parental cycling significantly influences the cycling behavior of young individuals, as their parents' encouragement and actions impact them. Furthermore, the impact of parents is consistently recognized throughout the stages of childhood and adolescence.

5.4 Limitations and Future Research

There were some limitations the researchers acknowledged. Firstly, this study focused only on cyclists aged 12-18 years old, whereas WHO (2023) defines adolescents as individuals in the 10-19 years age group. Secondly, the collected data were only limited to one school and did not capture the full picture of the cycling behavior of the adolescents, which might limit the geographical generalizability of the findings. Lastly, this study is a self-report data where participants may provide responses that they believe are socially acceptable (King & Bruner, 2020) or may have inaccurate perceptions of their cycling practices or beliefs.

For future research, a follow-up study should be conducted that includes adolescents ages 10, 11, and 19 years old to align with the WHO definition and provide a comprehensive understanding of cycling behavior across the entire adolescent age group. Secondly, recruit participants from a wider range of schools to strengthen the generalizability of the study. Lastly,

conduct observational studies to assess real-world cycling behavior and identify the discrepancies between self-reported and actual practices.

5.5 Recommendation:

Cycling's popularity has generally increased in the Philippines due to the pandemic, where cycling has become the temporary lockdown solution and the mode of transportation used by the community due to the halt of other transportation options (e.g., bus, jeep, train). However, despite the growing popularity of cycling, the Philippine government has shown limited support. This study shows differences in cycling behavior among adolescents between demographic factors such as age and gender. These differences show the need for targeted interventions designed to address specific demographic groups. Understanding these factors can develop strategies to promote cycling among adolescents.

To create a safe and encouraging environment for cyclists, a comprehensive approach that combines (5.5.1) infrastructure development, such as dedicated cycle paths, (5.5.2) educational initiatives, such as cycling safely and road rules, (5.5.3) community engagement, to promote cycling advocacy, and (5.5.4) parental and (5.5.5) school involvement, to encourage adolescents is necessary.

5.5.1 Infrastructure Development

This study emphasizes the need for infrastructure development to encourage cycling among adolescents. The most important component to address is the dedicated cycle path that will separate cyclists from vehicular traffic, prioritizing cyclists' safety. These paths can be either physical barriers or painted buffers, with a clear marking design to provide a secure environment for adolescent cyclists. Additionally, cycle parking facilities can reduce concerns about theft and ensure that cyclists have a safe place to leave their cycles, especially for short trips and errands. To address the lack of cycle accessibility, establishing a bike-sharing initiatives allows adolescents to rent cycles to increase access to cycles. This program can enhance accessibility, especially for those who do not own a cycle.

5.5.2 Educational Initiatives

In addition to the infrastructure development, educational initiatives such as awareness campaigns and safety education can help promote cycling culture among adolescents. Educational campaigns and community events can address gender stereotypes that discourage women from cycling. Campaigns can educate students, parents/guardians, and teachers about the benefits of cycling. These can be done by means of posters, informational sessions, and events about the positive impact of cycling on physical health, mental health, and the environment. In addition to the awareness campaigns, a platform such as a public service announcement will make the parents/guardians, teachers, and adolescents aware of any organized cycling activities within the community. To address the limited and minimal safety education in schools, local communities should organize regular workshops that focus on cycle handling, traffic rules, and usage of safety gear. Hands-on training sessions can significantly improve adolescents' confidence in cycling.

5.5.3 Community Engagement

Creating a cycling culture within the community can also influence adolescents' cycling participation. Organizing regular cycling events, such as group rides or cycling to school, can encourage participation among adolescents. In addition, building partnerships between schools, local communities, and cycling organizations can also promote cycling. Cycling workshops can be integrated into programs, such as physical education classes, or can be offered as after-school activities for students. Moreover, collaborating with local cycling organizations can also enhance the confidence of adolescents in cycling. Peer-led initiatives can also encourage adolescents to cycle. Encourage cycling enthusiasts to lead initiatives and mentor adolescents, as peer influence can greatly motivate adolescents to make cycling more popular and socially accepted.

5.5.4 Parental Involvement

The involvement of parents and guardians is important to promote cycling among adolescents. However, the parents and guardians feel too busy to participate in their adolescent's cycling experience. This study revealed that out of ten interviewed parents or guardians, only two teach their adolescents to cycle. In order to address this situation and to promote cycling culture among adolescents, enhancing parental involvement is necessary.

To promote cycling among adolescents, the parents or guardians should actively participate in their adolescent cycling experience by teaching them how to cycle. This strategy does not only help the adolescent to learn the necessary cycling skills but also builds a supportive environment that can motivate them to continue cycling. In order to increase parental involvement in cycling-related activities, parents and guardians should be encouraged to support their adolescents' cycling by means of informational sessions and workshops that will educate parents/guardians about the benefits of cycling, such as physical health benefits and mental health. This informational session can also provide proper safety measures and ways to ensure the cyclists' safety. By having the informational sessions, and parents/guardians can, therefore, remove the negative perception about cycling.

In this study, the majority of the parents/guardians do not own a cycle due to the reason of fear of cycling and the lack of cycling lanes in their area. In order to eliminate the fear among parents/guardians and adolescents, road safety awareness can be done to enhance cycling opportunities. This can encourage more parents/guardians to participate in any cycling-related activity with their adolescents. Additionally, the parents/guardians can then encourage adolescents by showing that cycling is a recreational and healthy activity, showing a positive attitude towards cycling, and setting good examples for them.

Parents and guardians emphasize that focusing on community involvement, such as community workshops, cycling events, and bike-sharing programs, can help adolescents engage in cycling-related activities. The parents and guardians also emphasize the need for partnerships with the local authorities for infrastructure improvements, such as creating cycle lanes, cycle racks, cycle-friendly routes, and improving road conditions. Improving the infrastructure and addressing the concerns that the parents/guardians thought about cycling can therefore change their perception towards cycling.

5.5.5 School Involvement

Schools play an important role in shaping the student's knowledge and skills. The interviewed teachers received safety education in school but said that it is not directly related to cycling. Therefore, schools can develop programs integrating cycling education into the curriculum, particularly in physical education classes. The lessons can cover practical cycling skills such as learning how to ride a bike, road safety, health, and environmental benefits of cycling.

Schools can also develop programs that integrate cycling into daily routines, such as bike-to-school programs, incentives for cycling, and cycling integration into after-school activities. Offering incentives such as rewards or recognition for adolescents who cycle to school consistently can motivate more adolescents. Additionally, integrating cycling into after-school activities, such as cycling competitions or organizations, can provide more opportunities for adolescents to continue practicing and enjoying cycling outside the class schedule. However, these strategies can be done in connection with the enhanced infrastructure and partnership with the local authorities to ensure that cycling is safe.

Teachers were also asked if there are any joint activities between parents/guardians and the school that enhance cycling, and all of them said that there are none. This can be improved by both families and schools. Schools and families can have a joint initiative, such as family cycling events and promoting cycling as a bonding activity. Family cycling events, where the adolescents, parents/guardians, and teachers all participate together, not only promote physical activity but also strengthen the bonds between family and school relationships.

In addition, schools should also ensure safe cycling routes to and from school. In order to ensure the safety of adolescents cycling to and from school, schools should build partnerships with the local government authorities to create a cycle-friendly environment around schools. This includes advocating for developing safe and cycle-friendly routes, such as dedicated cycle lanes and traffic calming measures around school premises. This can encourage more adolescents to choose cycling as a mode of transportation going to school.

6. CONCLUSION

Cycling plays an important role in the lives of Filipino adolescents as a means of transportation and recreational activity. This study explores the cycling behavior and cycling frequency of adolescents in the Philippines. These findings provide an understanding of adolescent cycling behavior in the Philippines and recommendations for promoting cycling among adolescents. Identifying and addressing the factors that influence cycling behavior and frequency and implementing targeted interventions, policymakers and stakeholders can work towards creating a more encouraging environment for adolescent cyclists, which promotes healthier and more sustainable communities.

First, this study understands and emphasizes the differences in cycling behavior among adolescents between demographic factors, such as age and gender. The results show that traffic violations were higher in the case of male adolescents than in female adolescents. However, no gender-based were found in the case of errors and positive behavior. Regarding age, younger adolescents (age =12) are more prone to violation but also show positive behavior and are less likely to make riding errors than older adolescents. These differences show the need for targeted interventions designed to address specific demographic groups.

Secondly, factors such as demographics, social influences, and other psychosocial factors affect cycling frequency among adolescents. This study shows that in terms of demographic factors such as age and gender, younger adolescents and males are more likely to cycle than their counterparts. The study also shows that encouragement from parents and teachers increases the cycling frequency among Filipino adolescents. Furthermore, higher adherence to social norms, perceived behavioral control, and intention also increases the cycling frequency. However, this study shows that social norms decrease the cycling frequency of adolescents due to a lack of cycling infrastructure and safety concerns, affecting the cycling frequency. Understanding these factors can develop strategies to promote cycling among adolescents, such as enhancing safety measures and addressing societal norms that discourage certain groups, especially females, from cycling.

Lastly, this study emphasizes the role of infrastructure and cycle accessibility in promoting cycling, with improved cycling infrastructure, including dedicated cycle lanes and parking facilities, that will encourage adolescents to cycle more frequently. Additionally, initiatives such as cycling education programs in schools and peer-led encouragement can help promote the cycling culture among adolescents.

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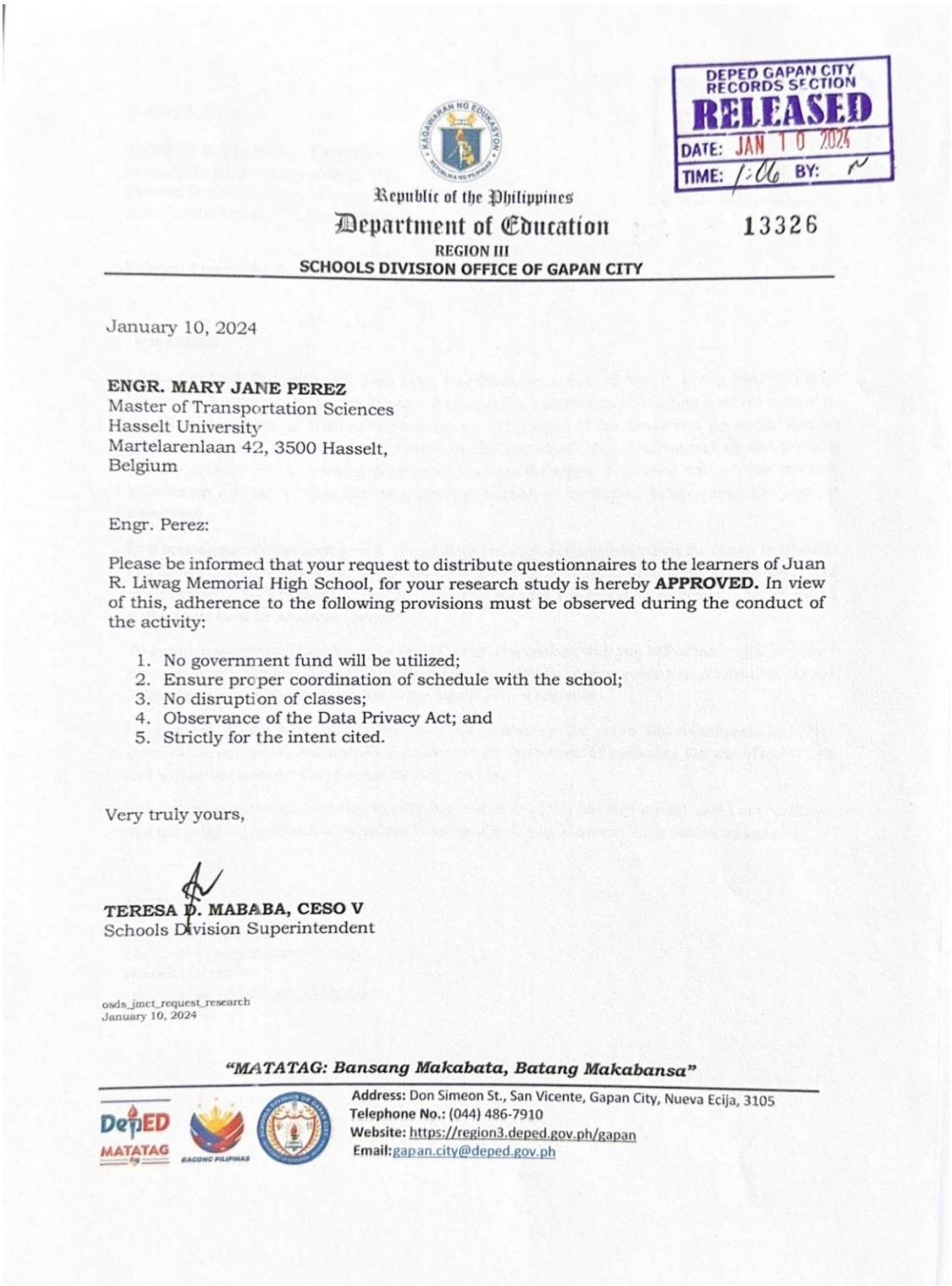
8. APPENDICES

APPENDIX 1 Request Letter to Conduct Data Collection



DEPED GAPAN CITY
RECORDS SECTION
RELEASED
DATE: JAN 10 2024
TIME: 1:06 BY:

Republic of the Philippines
Department of Education
REGION III
SCHOOLS DIVISION OFFICE OF GAPAN CITY

13326

January 10, 2024

ENGR. MARY JANE PEREZ
Master of Transportation Sciences
Hasselt University
Martelarenlaan 42, 3500 Hasselt,
Belgium

Engr. Perez:

Please be informed that your request to distribute questionnaires to the learners of Juan R. Liwag Memorial High School, for your research study is hereby **APPROVED.** In view of this, adherence to the following provisions must be observed during the conduct of the activity:

1. No government fund will be utilized;
2. Ensure proper coordination of schedule with the school;
3. No disruption of classes;
4. Observance of the Data Privacy Act; and
5. Strictly for the intent cited.

Very truly yours,

TERESA D. MABABA, CESO V
Schools Division Superintendent

osds_jmct_request_research
January 10, 2024

"MATATAG: Bansang Makabata, Batang Makabansa"

Address: Don Simeon St., San Vicente, Gapan City, Nueva Ecija, 3105
Telephone No.: (044) 486-7910
Website: https://region3.deped.gov.ph/gapan
Email: gapan.city@deped.gov.ph

DEPED GAPAN CITY
RECORDS SECTION
RECEIVED
DATE: 09 JAN 2023
TIME: 11:09 BY:

January 9, 2024

TERESA D. MABABA, CESO V
Schools Division Superintendent
Schools Division Office of Gapan City
San Vicente, Gapan City, Nueva Ecija

Subject: Request for Survey Data Collection Approval

Dear Madam,

I hope this letter finds you well. I am Mary Jane Perez, an alumna of Juan R. Liwag Memorial High School. I am currently taking my master's degree and is interested in conducting a survey within the Juan R. Liwag Memorial High School community. The purpose of this survey is to get insight into the cycling behavior of adolescents and various aspects that impact their decision-making and attitudes towards cycling. I believe that gathering insights from the school population will provide valuable information that can be beneficial to promote sustainable transportation habits among the younger population.

I am seeking permission from Juan R. Liwag Memorial High School to distribute the survey to students and the consent form to parents or guardians. The survey is designed to be concise, and it should take approximately 10-15 minutes to complete. The data collected will be kept confidential, and the results will only be used for academic purpose.

To ensure transparency, I am happy to share the survey questions with you beforehand. Additionally, I am open to collaborating with school administrators to schedule an appropriate time for distribution and collection to minimize any disruption to the regular school activities.

If approved, I will take full responsibility for overseeing the entire survey process, including distribution, collection, and analysis. I understand the importance of respecting the school's schedule and will ensure minimal disruption to the daily routine.

Your approval will contribute significantly to the success of this research project, and I am confident that the insights gained will be beneficial to the Juan R. Liwag Memorial High School community.

Sincerely,

Engr. Mary Jane Perez
Master of Transportation Sciences
Hasselt University
maryjane.perez@student.uhasselt.be
09664789455

APPENDIX 2 Interview Questions

Name:

Dear Respondents,

As part of my master's program in Transportation Sciences at Hasselt University, I am currently undertaking a master's thesis that focuses on the cycling behaviors of adolescents in the Philippines.

Objective: The primary aim is to get insight into the various aspects that impact their decision-making and attitudes towards cycling. This study aims to provide significant insights into promoting sustainable transportation habits among the younger population.

Confidentiality: The information you provide will be handled with the highest level of confidentiality, and the data gathered will be used solely for academic research objectives.

Instructions: Please take a few minutes to provide us with your honest opinions and insights. Your contribution will significantly enhance our comprehension of adolescent cycling behavior and facilitate the creation of initiatives to encourage sustainable and active lifestyles among adolescents.

Duration: This interview should take approximately 20-30 minutes to complete. I appreciate your valuable effort and significant input to this crucial research.

Contact Information: Should you have any questions or encounter any issues while completing the interview, please feel free to contact me at maryjane.perez@student.uhasselt.be

If you have complaints, you can contact the Data Protection Officer of UHasselt via dpo@uhasselt.be

Sincerely,

Mary Jane Perez

- **I agree and would like to participate in this interview.**
- **I disagree and would not like to participate in this interview.**

Interview with teachers (ENGLISH VERSION).

Part I: Demographics

1. Age: _____
2. Gender: _____
3. City and Barangay: _____
4. Main mode of transportation used to come to school: _____
5. Can you tell us about your experience with adolescents and their cycling habits?

Part II: Perceptions and Attitudes

1. Do you believe cycling is important for adolescents? Why or why not?
2. What health benefits do you think adolescents can gain from cycling regularly?
3. Are there concerns or risks associated with adolescents cycling in your community? If so, please describe them.
4. How can cycling positively impact adolescent's development and well-being?
5. In your opinion, what role does physical activity, like cycling, play in the lives of the adolescents?
6. Do you feel there is sufficient community support for promoting cycling among adolescents?
7. Are there any community-led initiatives that encourage safe cycling?

Part III: Cycling Behavior

1. Do you own bicycles? If not, what are the reasons?
2. Do you ride a bicycle? If yes, how often do you ride bicycles? (Daily, weekly, rarely, never)
3. If yes, what is the main reason for riding bicycles? (e.g., transportation, recreation, exercise, fun)
4. Are there specific routes or destinations where cycling is more common among adolescents?
5. Do you participate in any organized cycling activities, such as biking to school programs or community events?

Part IV: Safety and Education

1. Do you wear helmets when cycling? If yes, how often?
2. Do the adolescents wear helmets when cycling? If yes, how often?
3. Did you received any safety education related to cycling at school?
4. Did the adolescents received any safety education related to cycling at school?
5. How do you perceive cycling safety in your community, including factors like traffic, bike lanes, and road conditions?
6. Are there any specific challenges related to cycling safety that you have experienced or observed?
7. Have you personally encountered situations where cycling safety was a concern?
8. How do you navigate safety considerations when cycling in the community?

Part V: Promoting Cycling

1. How can teachers encourage more adolescents to cycle?
2. What initiatives or programs do you think would promote safe and healthy cycling habits among young people?
3. Are there any resources or infrastructure improvements that could enhance cycling opportunities for adolescents in your community?
4. How can teachers collaborate with parents or guardians to promote cycling among adolescents?

5. Are there any joint efforts between schools and families to enhance cycling safety?

Part VI: Closing Thoughts and Additional Comments

1. What are your final thoughts on cycling behavior among adolescents?
2. Can you share personal stories about adolescents and their cycling experiences?
3. Do you want to share any additional comments, concerns, or suggestions regarding this topic?

Panayam sa mga guro (TAGALOG VERSION)

Part I: Demograpiko

1. Edad: _____
2. Kasarian: _____
3. Tirahan (siyudad at baranggay): _____
4. Pangunahing transportasyon ginamit papunta sa paaralan: _____
5. Maaari mo bang sabihin sa amin ang tungkol sa iyong karanasan sa mga kabataan at kanilang mga gawi sa pagbibisikleta?

Part II: Mga Pagdama at Saloobin

1. Sa iyong tingin mahalaga ba ang pagbibisikleta sa mga kabataan? Bakit o bakit hindi?
2. Anong mga benepisyo sa kalusugan ang sa tingin mo ay makukuha ng mga kabataan mula sa regular na pagbibisikleta?
3. Mayroon bang mga alalahanin o panganib na nauugnay sa pagbibisikleta ng mga kabataan sa iyong komunidad? Kung gayon, pakilarawan ang mga ito.
4. Paano positibong makakaapekto ang pagbibisikleta sa pag-unlad at kapakanan ng kabataan?
5. Sa iyong palagay, anong papel ang ginagampanan ng pisikal na aktibidad, tulad ng pagbibisikleta, sa buhay ng mga kabataan?
6. Sa palagay mo ba ay may sapat na suporta sa komunidad para sa pagtataguyod ng pagbibisikleta sa mga kabataan?
7. Mayroon bang anumang mga inisyatiba na pinamumunuan ng komunidad na naghihikayat ng ligtas na pagbibisikleta?

Part III: Pag-uugali ng Pagbibisikleta

1. Ikaw ba ay may sariling bisikleta? Kung hindi, ano ang mga dahilan?
2. Gaano ka kadalas sumasakay ng bisikleta? (Araw-araw, lingguhan, bihira, hindi kailanman)
3. Ano ang pangunahing dahilan ng pagbibisikleta? (hal., transportasyon, libangan, ehersisyo, kasiyahan)
4. Mayroon bang mga partikular na ruta o destinasyon kung saan mas karaniwan ang pagbibisikleta sa mga kabataan?
5. Ikaw ba ay nakikilahok sa anumang organisadong aktibidad sa pagbibisikleta, tulad ng pagbibisikleta sa mga programa sa paaralan o mga kaganapan sa komunidad?

Part IV: Kaligtasan at Edukasyon

1. Ikaw ba ay nagsusuot ng helmet kapag nagbibisikleta? Kung oo, gaano kadalas?
2. Nagsusuot ba nang helmet ang mga bata kapag nagbibisikleta? Kung oo, gaano kadalas?
3. Nakatanggap ka ba ng anumang edukasyong pangkaligtasan na may kaugnayan sa pagbibisikleta sa paaralan?
4. Nakatanggap ba ang mga kabataan ng anumang edukasyong pangkaligtasan na may kaugnayan sa pagbibisikleta sa paaralan?
5. Paano mo nakikita ang kaligtasan ng pagbibisikleta sa iyong komunidad, kabilang ang mga salik tulad ng trapiko, mga daanan ng bisikleta, at mga kondisyon ng kalsada?
6. Mayroon bang anumang partikular na hamon na nauugnay sa kaligtasan ng pagbibisikleta na iyong naranasan o naobserbahan?
7. Nakatagpo ka na ba ng mga sitwasyon kung saan ang kaligtasan ng pagbibisikleta ay isang alalahanin?
8. Paano ka nag-navigate sa mga pagsasaalang-alang sa kaligtasan kapag nagbibisikleta sa komunidad?

Part V: Pagsusulong ng Pagbibisikleta

1. Paano mahihikayat ng mga guro ang mas maraming kabataan na magbisikleta?
2. Anong mga inisyatiba o programa ang sa tingin mo ay magtataguyod ng ligtas at malusog na gawi sa pagbibisikleta sa mga kabataan?
3. Mayroon bang anumang mga mapagkukunan o pagpapahusay sa imprastraktura na maaaring magpahusay ng mga pagkakataon sa pagbibisikleta para sa mga kabataan sa iyong komunidad?
4. Paano makikipagtulungan ang mga guro sa mga magulang o tagapag-alaga upang itaguyod ang pagbibisikleta sa mga kabataan?
5. Mayroon bang magkasanib na pagsisikap sa pagitan ng mga paaralan at pamilya upang mapahusay ang kaligtasan ng pagbibisikleta?

Part VI: Pangwakas na Kaisipan at Karagdagang Komento

1. Ano ang iyong huling mga saloobin sa pag-uugali ng pagbibisikleta sa mga kabataan?
2. Maaari ka bang magbahagi ng mga personal na kwento tungkol sa mga kabataan at kanilang mga karanasan sa pagbibisikleta?
3. Gusto mo bang magbahagi ng anumang karagdagang komento, alalahanin, o mungkahi tungkol sa paksang ito?

Interview with the parents (ENGLISH VERSION).

Part I: Demographics

1. Age: _____
2. Gender: _____
3. Relationship to the child: _____
4. City and Barangay: _____
5. Main mode of transportation used to come to school: _____
6. Can you tell us about your experience with adolescents and their cycling habits?

Part II: Perceptions and Attitudes

1. Do you believe cycling is important for adolescents? Why or why not?
2. What health benefits do you think adolescents can gain from cycling regularly?
3. Are there concerns or risks associated with adolescents cycling in your community? If so, please describe them.
4. How can cycling positively impact adolescent's development and well-being?
5. In your opinion, what role does physical activity, like cycling, play in the lives of the adolescents?

Part III: Cycling Behavior

1. Do you own bicycles? If not, what are the reasons?
2. Are the adolescents in your care own bicycles? If not, what are the reasons?
3. How often do you ride bicycles? (Daily, weekly, rarely, never)
4. How often the adolescents in your care ride bicycles? (Daily, weekly, rarely, never)
5. What is the main reason for riding bicycles? (e.g., transportation, recreation, exercise, fun)
6. Are there specific routes or destinations where cycling is more common among adolescents?
7. Do you participate in any organized cycling activities, such as biking to school programs or community events?
8. Do the adolescents participate in any organized cycling activities, such as biking to school programs or community events?

Part IV: Safety and Education

1. Do you wear helmets when cycling? If yes, how often?
2. Do the adolescents wear helmets when cycling? If yes, how often?
3. Did you received any safety education related to cycling at school?
4. Did the adolescents received any safety education related to cycling at school?
5. How do you perceive cycling safety in your community, including factors like traffic, bike lanes, and road conditions?
6. Are there any specific challenges related to cycling safety that you have experienced or observed?
7. Have you personally encountered situations where cycling safety was a concern?
8. How do you navigate safety considerations when cycling in the community?

Part V: Promoting Cycling

1. Do you teach your adolescent on how to cycle safely?
2. How do you teach your adolescent to cycle safely?
3. How can parents encourage more adolescents to cycle?
4. What initiatives or programs do you think would promote safe and healthy cycling habits among young people?

5. Are there any resources or infrastructure improvements that could enhance cycling opportunities for adolescents in your community?

Part VI: Closing Thoughts and Additional Comments

1. What are your final thoughts on cycling behavior among adolescents?
2. Can you share personal stories about adolescents and their cycling experiences?
3. Do you want to share any additional comments, concerns, or suggestions regarding this topic?

Panayam sa mga magulang (TAGALOG VERSION)

Part I: Demograpiko

1. Edad: _____
2. Kasarian: _____
3. Relasyon sa bata: _____
4. Tirahan (siyudad at baranggay): _____
5. Pangunahing transportasyon ginamit papunta sa paaralan: _____
6. Maaari mo bang sabihin sa amin ang tungkol sa iyong karanasan sa mga kabataan at kanilang mga gawi sa pagbibisikleta?

Part II: Mga Pagdama at Saloobin

1. Sa iyong tingin mahalaga ba ang pagbibisikleta sa mga kabataan? Bakit o bakit hindi?
2. Anong mga benepisyo sa kalusugan ang sa tingin mo ay makukuha ng mga kabataan mula sa regular na pagbibisikleta?
3. Mayroon bang mga alalahanin o panganib na nauugnay sa pagbibisikleta ng mga kabataan sa iyong komunidad? Kung gayon, pakilarawan ang mga ito.
4. Paano positibong makakaapekto ang pagbibisikleta sa pag-unlad at kapakanan ng kabataan?
5. Sa iyong palagay, anong papel ang ginagampanan ng pisikal na aktibidad, tulad ng pagbibisikleta, sa buhay ng mga kabataan?

Part III: Pag-uugali ng Pagbibisikleta

1. Ikaw ba ay may sariling bisikleta? Kung hindi, ano ang mga dahilan?
2. Ang mga kabataan sa iyong pangangalaga ay may sariling bisikleta? Kung hindi, ano ang mga dahilan?
3. Gaano ka kadalas sumasakay ng bisikleta? (Araw-araw, lingguhan, bihira, hindi kailanman)
4. Gaano kadalas ang mga kabataan sa iyong pangangalaga sumakay ng bisikleta? (Araw-araw, lingguhan, bihira, hindi kailanman)
5. Ano ang pangunahing dahilan ng pagbibisikleta? (hal., transportasyon, libangan, ehersisyo, kasiyahan)
6. Mayroon bang mga partikular na ruta o destinasyon kung saan mas karaniwan ang pagbibisikleta sa mga kabataan?
7. Ikaw ba ay nakikilahok sa anumang organisadong aktibidad sa pagbibisikleta, tulad ng pagbibisikleta sa mga programa sa paaralan o mga kaganapan sa komunidad?
8. Ang mga kabataan ba ay nakikilahok sa anumang organisadong aktibidad sa pagbibisikleta, tulad ng pagbibisikleta sa mga programa sa paaralan o mga kaganapan sa komunidad?

Part IV: Kaligtasan at Edukasyon

1. Ikaw ba ay nagsusuot ng helmet kapag nagbibisikleta? Kung oo, gaano kadalas?
2. Ang mga kabataan ba sa iyong pangangalaga ay nagsusuot ng helmet kapag nagbibisikleta? Kung oo, gaano kadalas?
3. Nakatanggap ka ba nang anumang edukasyong pangkaligtasan na may kaugnayan sa pagbibisikleta sa paaralan?
4. Ang mga kabataan ba ay nakatanggap ng anumang edukasyong pangkaligtasan na may kaugnayan sa pagbibisikleta sa paaralan?
5. Paano mo nakikita ang kaligtasan ng pagbibisikleta sa iyong komunidad, kabilang ang mga salik tulad ng trapiko, mga daanan ng bisikleta, at mga kondisyon ng kalsada?
6. Mayroon bang anumang partikular na hamon na nauugnay sa kaligtasan ng pagbibisikleta na iyong naranasan o naobserbahan?

7. Nakaranas ka na ba nang sitwasyon kung saan ang kaligtasan sa pagbibisikleta ay nakakabahala?
8. Paano ka naglalakbay sa mga pagsasaalang-alang sa kaligtasan kapag nagbibisikleta sa komunidad?

Part V: Pagsusulong ng Pagbibisikleta

1. Tinuruan o tinuturuan mo ba ang iyong anak kung paano magbisikleta nang ligtas?
2. Paano mo tinuruan o tinuturuan ang iyong anak na magbisikleta nang ligtas?
3. Paano mahihikayat ng mga magulang ang mas maraming kabataan na magbisikleta?
4. Anong mga inisyatiba o programa ang sa tingin mo ay magtataguyod ng ligtas at malusog na gawi sa pagbibisikleta sa mga kabataan?
5. Mayroon bang anumang mga mapagkukunan o pagpapahusay sa imprastraktura na maaaring magpahusay ng mga pagkakataon sa pagbibisikleta para sa mga kabataan sa iyong komunidad?

Part VI: Pangwakas na Kaisipan at Karagdagang Komento

1. Ano ang iyong huling mga saloobin sa pag-uugali ng pagbibisikleta sa mga kabataan?
2. Maaari ka bang magbahagi ng mga personal na kwento tungkol sa mga kabataan at kanilang mga karanasan sa pagbibisikleta?
3. Gusto mo bang magbahagi ng anumang karagdagang komento, alalahanin, o mungkahi tungkol sa paksang ito?

APPENDIX 3 Consent Form

Dear Parents/Guardian,

As part of my master's program in Transportation Sciences at Hasselt University, I am currently undertaking a master's thesis that focuses on the cycling behaviors of adolescents in the Philippines.

I would like to invite your child to participate in the survey for the thesis titled "*Self-Reported Cycling Behavior of Adolescents in the Philippines*."

Objective: The primary aim is to get insight into the various aspects that impact their decision-making and attitudes towards cycling. This study aims to provide significant insights into promoting sustainable transportation habits among the younger population.

Confidentiality: The information that your child provide will be handled with the highest level of confidentiality and anonymity, and the data gathered will be used solely for academic research objectives.

Duration: This survey should take approximately 10-15 minutes to complete. I appreciate your valuable effort and significant input to this crucial research. The child is additionally protected by the right to withdraw from the survey at any point during its duration.

Contact Information: Should you have any questions or encounter any issues while completing the survey, please feel free to contact me at maryjane.perez@student.uhasselt.be

If you have complaints, you can contact the Data Protection Officer of UHasselt via dpo@uhasselt.be

Sincerely,

Mary Jane Perez

Signing the form below will allow your child to participate in the study during school hours without your presence. If you do not sign and return this form, the researcher will understand that you do not wish to allow your child to participate.

CONSENT FORM

I, the parent or guardian of _____, permit his/her participation in answering the questionnaire in the research mentioned above.

_____ _____

Signature of Parent or Guardian Date

APPENDIX 4 Questionnaire

Dear respondents,

As part of my master's program in Transportation Sciences at Hasselt University, I am currently undertaking a master's thesis that focuses on the cycling behaviors of adolescents in the Philippines.

Objective: The primary aim is to get insight into the various aspects that impact their decision-making and attitudes towards cycling. This study aims to provide significant insights into promoting sustainable transportation habits among the younger population.

Confidentiality: The information you provide will be handled with the highest level of confidentiality, and the data gathered will be used solely for academic research objectives.

Instructions: Please take a few minutes to provide us with your honest opinions and insights. Your contribution will significantly enhance our comprehension of adolescent cycling behavior and facilitate the creation of initiatives to encourage sustainable and active lifestyles among adolescents.

Duration: This survey should take approximately 10-15 minutes to complete. I appreciate your valuable effort and significant input to this crucial research. You have the right to withdraw from the survey at any point during its duration.

Contact Information: Should you have any questions or encounter any issues while completing the survey, please feel free to contact me at maryjane.perez@student.uhasselt.be

If you have complaints, you can contact the Data Protection Officer of UHasselt via dpo@uhasselt.be

Sincerely,
Mary Jane Perez

QUESTIONNAIRE (*Qualtrics*)

Part I: Participant's Information

1. How old are you? _____
2. Gender:
   - Male
   - Female
   - Non-binary/Third Gender
   - Prefer not to say
3. In which city do you live? _____
4. In which barangay do you live? _____

Part II: Factors Influencing Cycling

1. Do you ride a bicycle at least once in a year?
   - Yes
   - No

   If yes, questions.

   1.1What type of bicycle do you use?
   - Standard bicycle
   - Electric bicycle
   - Others (please specify): ____

   1.2 How often do you ride your bicycle?
   - Very frequently (daily)
   - Frequently (3-5 times a week)
   - Occasionally (1-2 times a week)
   - Rarely (1-2 times a month)
   - Almost Never (a couple of times per year)

     If Occasionally, Rarely, Almost Never:

     1.2.1 What is/are the most important reason(s) you ride a bicycle less often? (Select one)
     - Lack of access to bicycle
     - Safety concerns
     - Lack of interest in cycling
     - Lack of suitable cycling routes or infrastructure
     - Peer pressure or social stigma
     - Weather conditions (e.g., rain, heat)
     - Availability of other transportation options (tricycles, jeepneys, buses)
     - Health or physical limitations
     - Peer influence
     - Parental or guardian approval
     - Other (please specify): _____

   1.3 What is the purpose of your cycling trips? (Select all that apply)
   - Transportation to school and hobbies
   - Recreation and fun
   - Exercise or fitness

- Running errands
- Other (please specify): _____

1.4 On average, how long (per day) are your cycling trips?

- Less than 15 minutes
- 15 – 30 minutes
- 30 minutes – 1 hour
- 1 to 2 hours
- At least 2 hours

1.5 Where do you most often ride your bicycle? (Select all that apply)

- On sidewalks
- On dedicated bike lanes or paths
- On the road with traffic
- In parks or recreational areas
- Within the home vicinity
- Other (please specify): _____

1.6 What safety measures do you take when cycling? (Select all that apply)

- Wear a helmet
- Use hand signals for turning
- Obey traffic rules (stop signs, traffic lights, etc.)
- Ride with adult supervision
- Ride with friends or peers
- Carry reflectors or lights on your bicycle
- None of the above
- Other (please specify): _____

1.7 Do you wear a helmet when you ride your bicycle?

- 1 = Almost never
- 2 = Rarely
- 3 = Occasionally
- 4 = Often
- 5 = Almost always

If almost never/rarely,

1.7.1 What is the reason why you almost never or rarely wear a helmet when you ride bicycle?

- No helmet
- Cultural or Social Norms
- Environment is safe
- Lack of Awareness
- Other (please specify): _____

1.8 What do you think would make cycling more popular among adolescents in our area? (Select all that apply)

- Improved cycling infrastructure (bike lanes, paths)
- Safety education and campaigns
- Organized cycling events or clubs
- Peer-led initiatives or encouragement
- More access to bicycles (e.g., bike-sharing programs)

- Parental involvement
- School partnerships
- Other (please specify): _____

1.9 Are there enough safe and designated bike lanes or paths in your area for cycling?

- Yes
- No
- I'm not sure

1.10 What type of cycling activities or events would you be most interested in? (Select all that apply)

- Group rides with friends or family
- Cycling safety workshops
- Bicycle maintenance workshops
- Local cycling races or competitions
- Bike tours to explore the area
- No activities or events
- Other (please specify): _____

1.11 Have you ever been involved in a bicycle accident?

- Yes
- No

  1.11.1 If yes, who did you collide with?

  - A pedestrian
  - Another cyclist
  - A car
  - Other (please specify): _____

  1.11.2 If yes, how many times have you been involved in an accident?

  Slider from 1 to 10

  1.11.3 If yes, what are the consequences of the accident?

  - No damage
  - Material damage
  - Light injuries
  - Heavy injuries
  - Death
  - Other (please specify): _____

If no, questions.

1.1 What are the reasons you do not ride a bicycle? (Select all that apply)

- Lack of access to bicycle
- Safety concerns
- Lack of interest in cycling
- Lack of suitable cycling routes or infrastructure
- Lack of space to store a bicycle
- Weather condition (e.g., rain, heat)
- Availability of other transportation options (tricycle, jeepneys, buses)

- Health or physical limitations
- Peer influence
- Parental or guardian approval
- Other (please specify): _____

1.2 Would you be interested in learning to ride a bicycle in the future?

- Yes
- No
- Not sure

If yes, question:

1.2.1 What would make you more interested in trying cycling in the future?

- Access to affordable or available bicycles
- Safety measures (bike lanes, safer road conditions, educational programs)
- Riding with friends and family
- Encouragement from parents, teachers, or peers
- Environmental concerns
- Fun and recreational
- Convenience over Public Transportation
- Other (please specify): _____

1.3 Would you consider getting a bicycle in the future if you don't have one now?

- Yes
- No
- Not sure

If no, question:

1.3.1 What is/are the reason/s you do not want to have a bicycle?

- Concerns about safety on the road
- Poor road conditions
- Limited storage space at home
- Weather conditions (e.g., rain, heat)
- Availability of other transportation options (tricycle, jeepneys, buses)
- Financial constraints
- Health or physical limitations
- Lack of cycling infrastructure (e.g., bike lanes, bike racks)
- Distance to daily destinations
- Concerns about bicycle theft
- Others (please specify): _____

1.4 What do you think would make cycling more popular among adolescents in our area? (Select all that apply)

- Improved cycling infrastructure (bike lanes, paths)
- Safety education and campaigns
- Organized cycling events or clubs
- Peer-led initiatives or encouragement
- More access to bicycles (e.g., bike-sharing programs)
- Parental involvement
- School partnerships
- Other (please specify): _____

1.5 Are there enough safe and designated bike lanes or paths in your area for cycling?

- Yes
- No
- I'm not sure

1.6 What type of cycling activities or events would you be most interested in? (Select all that apply)

- Group rides with friends or family
- Cycling safety workshops
- Bicycle maintenance workshops
- Local cycling races or competitions
- Bike tours to explore the area
- No activities or events
- Other (please specify): _____

---- end of questionnaire for those who answers no---

Part III: Parental Involvement in Adolescent's Cycling

1. Do your parents or guardians encourage or allow you to cycle?

1 = Almost never
2 = Rarely
3 = Occasionally
4 = Often
5 = Almost always

2. Do your parents or guardians ride bicycles with or alongside you?

1 = Almost never
2 = Rarely
3 = Occasionally
4 = Often
5 = Almost always

If occasionally, often, almost always.

2.1 How do your parents encourage or motivate you to cycle?

- Praise and positive reinforcement
- Offer rewards or incentives
- Lead by example (you also cycle)
- Encourage participation in cycling events or clubs
- Provide freedom and independence in their cycling choices
- Create challenges or goals (e.g., bike tours, distances)
- Other (please specify): _____

3. Do your parents or guardians try to teach you how to cycle safe?

1 = Almost never
2 = Rarely
3 = Occasionally
4 = Often
5 = Almost always

If occasionally/often/almost always, question.

3.1 How do they teach you how to cycle safe?

- At home via exercises
- Through school-based programs
- Bicycle safety workshops or classes
- Online tutorials or courses
- Community-based cycling events or workshops
- In-person lessons with a cycling instructor
- Peer-to-peer learning within a cycling group or club
- Safety demonstrations at local parks or recreational areas
- Participation in organized cycling events or races

Part IV: School Involvement in Adolescent's Cycling

1. Do your teachers encourage or allow you to cycle?

1 = Almost never
2 = Rarely
3 = Occasionally
4 = Often
5 = Almost always

2. Do your teachers try to teach you how to cycle safe?

1 = Almost never
2 = Rarely
3 = Occasionally
4 = Often
5 = Almost always

If occasionally/often/almost always, question.

2.1 How do they teach you how to cycle safe?

- Through classroom lessons on cycling safety.
- By incorporating cycling safety topics in Physical Education classes.
- Through distribution of educational materials.
- By encouraging discussions on safe cycling practices.
- Through integration of cycling safety into the school curriculum.
- Other (please specify): _____

3. Are there specific programs or initiatives in your school aimed at promoting safe riding practices?

- Yes
- No

3.1 If yes, please provide details: _____

4. How often do your teachers emphasize the importance of wearing helmets while cycling?

1 = Almost never
2 = Rarely
3 = Occasionally
4 = Often
5 = Almost always

5. Are there resources provided by your teachers, such as posters or handouts, that highlight cycling safety tips?
   - Yes
   - No
6. Do your teachers engage in discussions with students about their personal cycling experiences and safety concerns?
   - Yes
   - No

Part V: Assessing Cyclists' Risky and Positive Behaviors (Validated CBQ)

Estimate how often you do the following when cycling (Likert Scale).

1 = Almost never
2 = Rarely
3 = Occasionally
4 = Often
5 = Almost always

Violations:

1. Cycling under the influence of alcohol and/or other drugs or hallucinogens.
2. Going against the direction of traffic (wrong way).
3. Zigzagging between vehicles when using a mixed lane.
4. Handle potentially obstructive objects (food, packages, cigarettes, etc.) while riding a bicycle.
5. Feeling that sometimes I'm going at a higher speed than I should be going at.
6. Crossing what appears to be a clear crossing, even if the traffic light is red.
7. Carry a passenger on your bicycle without it being adapted for such a purpose.
8. Having a dispute in speed or "race" with another cyclist or driver.

Errors:

9. Unintentionally crossing the street without looking properly, making another vehicle brake to avoid a crash.
10. Colliding (or being close to it) with a pedestrian or another cyclist while cycling distractedly.
11. Brake suddenly and be close to causing an accident.
12. Fail to notice the presence of pedestrians crossing when turning.
13. Not braking on a "Stop" or "Yield" sign and being close to colliding with another vehicle or pedestrian.
14. Braking very abruptly on a slippery surface.
15. While you're distracted, you do not realize that a pedestrian intends to cross a crosswalk, so you do not stop to let him or her do so.
16. Not realizing that a vehicle that was parked intends to leave and having to brake abruptly to avoid colliding with it.
17. When you drive on the right, you do not realize that a passenger is getting out of a vehicle or bus and is close to hitting him or her.
18. Trying to overtake a vehicle that had previously used its indicators to signal that it was going to turn, having to brake.

19. Misjudging a turn and hitting something on the road or being close to losing balance (or falling).
20. Unintentionally hitting a parked vehicle.
21. Failing to be aware of the road conditions, therefore, falling over a bump or hole.
22. Mistaking one traffic signal for another and maneuvering according to the latter.
23. Trying to brake but not being able to use the brakes properly due to poor hand positioning.

Positive Behaviors:

24. I stop and look on both sides before crossing a corner or intersection.
25. I try to move at a prudent speed to avoid sudden mishaps or braking.
26. I usually keep a safe distance from other cyclists or vehicles.
27. I always use the indicated lane when I use the bike path (or bike lane).
28. I avoid cycling under adverse weather conditions.
29. I avoid cycling if I feel very tired or sick.

Part VI: Assessing Cyclists' Attitudes Towards Safety (Kummeneje & Rundmo, 2020)

To what extent do you agree or disagree with the following statements?

1 = Strongly Disagree
2 = Disagree
3 = Neither agree nor disagree
4 = Agree
5 = Strongly Agree

1. It is acceptable to break the rules as a cyclist when no others are involved.
2. It is acceptable to cycle through a red traffic light when no others are present.
3. It is acceptable to take chances as a cyclist when only you are exposed to risk.
4. Breaking rules does not necessarily make you a less safe cyclist compared with those who always follow the rules.
5. It is acceptable to cycle after drinking alcohol (<0.2‰).
6. There should be more traffic surveillance for cyclists.
7. There should be severe punishments for cyclists who break traffic rules.
8. Many traffic rules for cyclists are impossible to comply with.
9. The traffic rules for cyclists are too complicated to adhere to in practice.
10. It is no wonder that many cyclists violate traffic rules.
11. Many traffic rules for cyclists are unnecessary.
12. Cyclists should always follow the rules.
13. Sometimes it is necessary to bend the rules as a cyclist to make sure of arriving.
14. It is more important to get ahead as a cyclist than always to follow the rules.
15. It is important to have road safety campaigns directed towards cyclists.
16. Part VII: Assessing Cyclists' Risk-Taking Behavior (Kummeneje & Rundmo, 2020)
17. Cycle when using mobile phone.
18. Cycle in the dark without cycle lights.
19. Cross the road when a traffic light is red.
20. Use a pedestrian crossing when the light is red for pedestrians.
21. Cycle after drinking alcohol (<0.2‰).

22. Cycle against traffic in one-way streets.
23. Fail to notice a vehicle approaching from a side road.
24. Brake hard because a vehicle is approaching faster than expected.
25. Turn quickly away from a vehicle to avoid an accident.
26. Brake hard down and/or turn quickly to avoid hitting a pedestrian.

Part VIII: Assessing Cyclists' Attitudes Towards Safety (Self-Reported)

To what extent do you agree or disagree with the following statements?

1 = Strongly Disagree
2 = Disagree
3 = Neither agree nor disagree
4 = Agree
5 = Strongly Agree

Attitudes

1. I think it's essential to be visible to motorists when cycling, for example, by using lights and reflective gear.
2. I feel safe when riding my bicycle on the road.
3. I am concerned about the risk of accidents while cycling.
4. I believe that cycling is an environmentally friendly mode of transportation.
5. I enjoy cycling for leisure and exercise.
6. I believe that more dedicated bike lanes and paths should be created in our city.
7. I think wearing a helmet while cycling is important for safety.
8. I feel confident in following traffic rules while cycling.
9. I believe that cycling can reduce traffic congestion and improve air quality.
10. I feel that drivers are generally respectful and considerate of cyclists.
11. I would cycle more often if safer and more convenient cycling routes were available.

Social Norms

12. My parents encourage me to engage in cycling activities.
13. My parents are concerned about my safety while cycling.
14. My parents' cycling behavior influences my decision to cycle.
15. My teachers are supportive when it comes to engaging in cycling activities
16. My friends are supportive when it comes to engaging in cycling activities.
17. I do not feel any pressure from my friends to engage in or refrain from cycling.
18. My friends influence my compliance to safety measures, such as wearing helmets or reflective gear, while cycling.
19. My community supports and encourages cycling as a mode of transportation.
20. "Cycling is socially acceptable in my community."
21. "Cyclists are respected road users in my community."

Perceived Behavioral Control

22. I possess the necessary cycling skills to navigate various terrains.
23. I am confident enough to cycle safely in different traffic conditions.
24. I find it easy to incorporate cycling into my daily routine.

25. I feel the support of friends or family in my decision to cycle.
26. I find it easy to start cycling regularly.

Perceived Behavioral Intention

27. I am interested enough to incorporate cycling into my regular activities.
28. I am motivated to start or continue cycling.
29. My friends' positive opinions about cycling influence my intentions to cycle.
30. My family's positive attitudes towards cycling impact my intentions to cycle.
31. My peers would support my decision to cycle regularly.

APPENDIX 5 Teachers' Interview Results Word Cloud

Figure 9. Teachers' Perspective on Cycling Importance

Figure 10. Teachers' Insight on Adolescent Concerns and Risks in Cycling

Figure 11. Teachers' Perspective on the Positive Impact of Cycling

Figure 12. Teachers' Insights on Adolescent Cycling Routes and Destinations

Figure 13. Teachers' Perceptions of Challenges in Cycling Safety Among Adolescents

Figure 14. Teachers' Concerns Regarding Cycling Safety

Figure 15. Teachers' Strategies for Encouraging Adolescent Cycling

Figure 16. Teachers' Initiatives to Promote Safe and Healthy Cycling Habits

Figure 17. Collaboration Strategies between Teachers and Parents/Guardians for Promoting Adolescent Cycling

APPENDIX 6 Parents' Interview Results Word Cloud

Figure 18. Word Cloud Depicting Parental Views on Cycling Importance

Figure 21. Parental Perspective on the Positive Impact of Cycling

Figure 19. Parental Perspective on the Health Benefits of Cycling

Figure 22. Parental Insights on Adolescent Cycling Routes and Destinations

Figure 20. Parental Insight on Adolescent Concerns and Risks in Cycling

Figure 23. Parental Perceptions of Challenges in Cycling Safety Among Adolescents

Figure 24. Parental Insights on Community Cycling Safety Considerations

Figure 25. Parental Strategies for Encouraging Adolescent Cycling

Figure 26. Parental Initiatives for Promoting Safe and Healthy Cycling Habits

APPENDIX 7 Questionnaire Summary Results

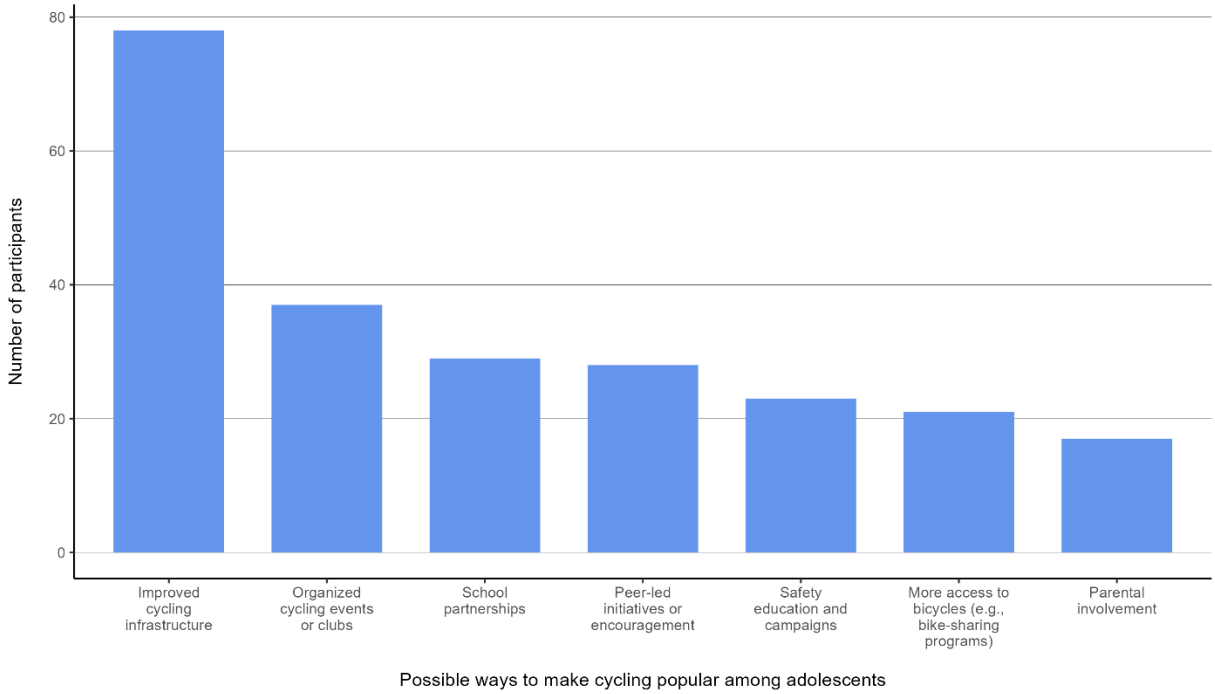


Figure 27. Possible Ways to Make Cycling Popular among Adolescents (According to Non-Cyclists)

Table 24. Dimension of Cyclists' Risky and Positive Behaviors

	Strongly Disagree	Disagree	Neither agree / Disagree	Agree	Strongly Agree
Violations	**55.73%**	**27.07%**	**11.51%**	**4.42%**	**1.23%**
Going against the direction of traffic (wrong way).	69.10%	25.00%	4.34%	1.02%	0.51%
Zigzagging between vehicles when using a mixed lane.	68.90%	24.50%	4.34%	1.79%	0.51%
Handle potentially obstructive objects (food, packages, cigarettes, etc.) while riding a bicycle.	44.90%	34.40%	12.20%	7.14%	1.28%
Feeling that sometimes I'm going at a higher speed than I should be going at.	34.20%	26.50%	26.50%	9.69%	3.06%
Carry a passenger on your bicycle without it being adapted for such a purpose.	61.20%	21.90%	14.00%	2.55%	0.26%
Having a dispute in speed or "race" with another cyclist or driver.	56.10%	30.10%	7.65%	4.34%	1.79%
Errors	**66.83%**	**21.72%**	**7.38%**	**3.18%**	**0.90%**
Unintentionally crossing the street without looking properly, making another vehicle brake to avoid a crash.	68.40%	21.20%	8.16%	2.04%	0.26%
Colliding (or being close to it) with a pedestrian or another cyclist while cycling distractedly.	61.00%	27.80%	9.18%	1.53%	0.51%
Brake suddenly and be close to causing an accident.	59.20%	25.00%	9.44%	5.61%	0.77%
Fail to notice the presence of pedestrians crossing when turning.	64.00%	26.80%	5.61%	3.32%	0.26%
Not braking on a "Stop" or "Yield" sign and being close to colliding with another vehicle or pedestrian.	76.80%	14.00%	7.40%	1.53%	0.26%
Braking very abruptly on a slippery surface.	57.40%	26.50%	8.93%	5.36%	1.79%
While you're distracted, you do not realize that a pedestrian intends to cross a crosswalk, so you do not stop to let him or her do so.	73.20%	15.80%	6.89%	3.57%	0.51%
Not realizing that a vehicle that was parked intends to leave and having to brake abruptly to avoid colliding with it.	66.80%	19.90%	8.93%	3.06%	1.28%

When you drive on the right, you do not realize that a passenger is getting out of a vehicle or bus and is close to hitting him or her.	75.80%	16.30%	5.87%	1.53%	0.51%
Trying to overtake a vehicle that had previously used its indicators to signal that it was going to turn, having to brake.	75.00%	15.60%	6.89%	2.55%	0.00%
Misjudging a turn and hitting something on the road or being close to losing balance (or falling).	62.50%	24.70%	7.65%	3.57%	1.53%
Unintentionally hitting a parked vehicle.	72.70%	16.60%	5.87%	3.57%	1.28%
Failing to be aware of the road conditions, therefore, falling over a bump or hole.	55.90%	30.90%	7.40%	4.59%	1.28%
Mistaking one traffic signal for another and maneuvering according to the latter.	76.30%	15.60%	5.61%	1.53%	1.02%
Trying to brake but not being able to use the brakes properly due to poor hand positioning.	57.40%	29.10%	6.89%	4.34%	2.30%
Positive Behaviors	**4.00%**	**3.23%**	**10.01%**	**25.17%**	**57.63%**
I stop and look on both sides before crossing a corner or intersection.	5.87%	1.79%	4.85%	22.70%	64.80%
I try to move at a prudent speed to avoid sudden mishaps or braking.	4.85%	3.57%	13.50%	32.70%	45.40%
I usually keep a safe distance from other cyclists or vehicles.	2.81%	2.55%	6.89%	30.10%	57.70%
I always use the indicated lane when I use the bike path (or bike lane).	3.83%	4.59%	12.80%	25.80%	53.10%
I avoid cycling under adverse weather conditions.	3.57%	2.81%	11.50%	22.40%	59.70%
I avoid cycling if I feel very tired or sick.	3.06%	4.08%	10.50%	17.30%	65.10%

Ratings given on a 5-point scale from 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, and 5 = Disagree.

Mean values in bold.

Table 25. Dimension of Cyclists' Attitudes Towards Traffic Safety

	Strongly Disagree	Disagree	Neither agree / Disagree	Agree	Strongly Agree
Pragmatic Attitudes Towards Rule Violation	**60.20%**	**20.56%**	**13.11%**	**4.90%**	**1.22%**

It is acceptable to break the rules as a cyclist when no others are involved.	62.00%	21.90%	11.00%	4.08%	1.02%
It is acceptable to cycle through a red traffic light when no others are present.	61.20%	22.20%	11.20%	3.83%	1.53%
It is acceptable to take chances as a cyclist when only you are exposed to risk.	58.20%	21.40%	14.80%	4.85%	0.77%
Breaking rules does not necessarily make you a less safe cyclist compared with those who always follow the rules.	52.00%	18.90%	19.10%	7.91%	2.04%
It is acceptable to cycle after drinking alcohol (<0.2‰).	67.60%	18.40%	9.44%	3.83%	0.77%
Attitudes Towards Cyclist Enforcement	**13.15%**	**7.91%**	**16.05%**	**27.45%**	**35.45%**
There should be more traffic surveillance for cyclists.	13.80%	7.40%	14.80%	27.60%	36.50%
There should be severe punishments for cyclists who break traffic rules.	12.50%	8.42%	17.30%	27.30%	34.40%
Dissatisfaction with the Traffic Rules	**15.80%**	**17.25%**	**49.10%**	**15.05%**	**2.81%**
Many traffic rules for cyclists are impossible to comply with.	14.30%	16.10%	49.70%	16.60%	3.32%
The traffic rules for cyclists are too complicated to adhere to in practice.	17.30%	18.40%	48.50%	13.50%	2.30%

Ratings given on a 5-point scale from 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, and 5 = Disagree.

Mean values in bold.

Table 26. Dimensions of Cyclists' Risk-taking Behavior

	Strongly Disagree	Disagree	Neither agree / Disagree	Agree	Strongly Agree
Violation of Traffic Rules	**68.87%**	**19.13%**	**8.29%**	**2.98%**	**0.72%**
Cycle when using mobile phone.	73.20%	18.40%	7.40%	0.51%	0.51%
Cycle in the dark without cycle lights.	74.00%	18.10%	5.61%	1.53%	0.77%
Cross the road when a traffic light is red.	72.20%	19.60%	4.85%	2.55%	0.77%
Use a pedestrian crossing when the light is red for pedestrians.	61.20%	22.40%	9.18%	5.87%	1.28%
Cycle after drinking alcohol (<0.2‰).	72.40%	16.10%	8.67%	2.30%	0.51%
Cycle against traffic in one-way streets.	60.20%	20.20%	14.00%	5.10%	0.51%
Conflicts When Cycling	**30.80%**	**11.41%**	**16.25%**	**18.12%**	**23.38%**
Fail to notice a vehicle approaching from a side road.	62.00%	22.20%	11.20%	3.57%	1.02%
Brake hard because a vehicle is approaching faster than expected.	26.00%	12.20%	18.10%	19.40%	24.20%
Turn quickly away from a vehicle to avoid an accident.	16.60%	5.87%	17.60%	26.50%	33.40%
Brake hard down and/or turn quickly to avoid hitting a pedestrian.	18.60%	5.36%	18.10%	23.00%	34.90%

Ratings given on a 5-point scale from 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, and 5 = Disagree.

Mean values in bold.

Table 27. Dimensions of Cyclists' Attitudes, Social Norms, Perceived Behavioral Control, and Perceived Behavioral Intention

	Strongly Disagree	Disagree	Neither agree / Disagree	Agree	Strongly Agree
Attitudes	**2.76%**	**2.46%**	**14.15%**	**33.40%**	**47.24%**
I think it's essential to be visible to motorists when cycling, for example, by using lights and reflective gear.	4.59%	1.28%	8.93%	30.10%	55.10%
I feel safe when riding my bicycle on the road.	4.59%	9.69%	32.90%	32.10%	20.70%
I am concerned about the risk of accidents while cycling.	3.06%	3.06%	11.00%	36.50%	46.40%
I believe that cycling is an environmentally friendly mode of transportation.	1.53%	2.04%	11.50%	33.90%	51.00%
I enjoy cycling for leisure and exercise.	2.30%	0.51%	9.44%	40.10%	47.70%
I believe that more dedicated bike lanes and paths should be created in our city.	1.79%	0.26%	9.44%	31.90%	56.60%
I think wearing a helmet while cycling is important for safety.	1.79%	1.02%	8.42%	29.10%	59.70%
I feel confident in following traffic rules while cycling.	3.06%	1.28%	11.20%	39.00%	45.40%
I believe that cycling can reduce traffic congestion and improve air quality.	1.79%	1.02%	12.50%	30.10%	54.60%
I feel that drivers are generally respectful and considerate of cyclists.	4.08%	6.38%	28.10%	33.70%	27.80%
I would cycle more often if safer and more convenient cycling routes were available.	1.79%	0.51%	12.20%	30.90%	54.60%
Social Norms	**4.06%**	**4.24%**	**23.04%**	**35.08%**	**33.60%**
My parents encourage me to engage in cycling activities.	5.10%	7.65%	31.90%	25.80%	29.60%
My parents are concerned about my safety while cycling.	2.04%	1.79%	11.20%	38.80%	46.20%
My parents' cycling behavior influences my decision to cycle.	7.14%	7.14%	26.30%	28.10%	31.40%
My teachers are supportive when it comes to engaging in cycling activities	8.67%	6.63%	32.10%	29.80%	22.70%
My friends are supportive when it comes to engaging in cycling activities.	3.57%	2.81%	21.20%	44.60%	27.80%

I do not feel any pressure from my friends to engage in or refrain from cycling.	1.79%	1.79%	18.10%	44.10%	34.20%
My friends influence my compliance to safety measures, such as wearing helmets or reflective gear, while cycling.	3.06%	4.34%	21.40%	31.90%	39.30%
My community supports and encourages cycling as a mode of transportation.	4.34%	6.12%	27.30%	35.20%	27.00%
“Cycling is socially acceptable in my community.”	1.79%	1.02%	15.10%	40.60%	41.60%
“Cyclists are respected road users in my community.”	3.06%	3.06%	25.80%	31.90%	36.20%
Perceived Behavioral Control	**4.69%**	**7.65%**	**22.48%**	**33.52%**	**31.62%**
I possess the necessary cycling skills to navigate various terrains.	3.57%	6.89%	22.40%	37.50%	29.60%
I am confident enough to cycle safely in different traffic conditions.	4.59%	8.67%	22.40%	33.20%	31.10%
I find it easy to incorporate cycling into my daily routine.	6.12%	8.16%	24.00%	30.60%	31.10%
I feel the support of friends or family in my decision to cycle.	4.85%	4.59%	21.90%	34.40%	34.20%
I find it easy to start cycling regularly.	4.34%	9.95%	21.70%	31.90%	32.10%
Perceived Behavioral Intention	**2.86%**	**5.76%**	**24.54%**	**33.48%**	**33.34%**
I am interested enough to incorporate cycling into my regular activities.	3.32%	6.12%	27.80%	32.70%	30.10%
I am motivated to start or continue cycling.	3.32%	6.63%	23.50%	33.20%	33.40%
My friends’ positive opinions about cycling influence my intentions to cycle.	3.32%	6.12%	23.70%	31.90%	34.90%
My family’s positive attitudes towards cycling impact my intentions to cycle.	3.06%	6.89%	22.70%	33.40%	33.90%
My peers would support my decision to cycle regularly.	1.28%	3.06%	25.00%	36.20%	34.40%

Ratings given on a 5-point scale from 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, and 5 = Disagree.

Mean values in bold.

Table 28. Summary Table Per Average Questions

	Mean
Violations	**1.68**
Going against the direction of traffic (wrong way).	1.38

Zigzagging between vehicles when using a mixed lane.	1.40
Handle potentially obstructive objects (food, packages, cigarettes, etc.) while riding a bicycle.	1.85
Feeling that sometimes I'm going at a higher speed than I should be going at.	2.20
Carry a passenger on your bicycle without it being adapted for such a purpose.	1.58
Having a dispute in speed or "race" with another cyclist or driver.	1.65
Errors	**1.49**
Unintentionally crossing the street without looking properly, making another vehicle brake to avoid a crash.	1.44
Colliding (or being close to it) with a pedestrian or another cyclist while cycling distractedly.	1.52
Brake suddenly and be close to causing an accident.	1.63
Fail to notice the presence of pedestrians crossing when turning.	1.48
Not braking on a "Stop" or "Yield" sign and being close to colliding with another vehicle or pedestrian.	1.34
Braking very abruptly on a slippery surface.	1.67
While you're distracted, you do not realize that a pedestrian intends to cross a crosswalk, so you do not stop to let him or her do so.	1.42
Not realizing that a vehicle that was parked intends to leave and having to brake abruptly to avoid colliding with it.	1.52
When you drive on the right, you do not realize that a passenger is getting out of a vehicle or bus and is close to hitting him or her.	1.34
Trying to overtake a vehicle that had previously used its indicators to signal that it was going to turn, having to brake.	1.36
Misjudging a turn and hitting something on the road or being close to losing balance (or falling).	1.56
Unintentionally hitting a parked vehicle.	1.44
Failing to be aware of the road conditions, therefore, falling over a bump or hole.	1.64
Mistaking one traffic signal for another and maneuvering according to the latter.	1.35
Trying to brake but not being able to use the brakes properly due to poor hand positioning.	1.65
Pragmatic Attitudes Towards Rule Violation	**1.66**
It is acceptable to break the rules as a cyclist when no others are involved.	1.60

It is acceptable to cycle through a red traffic light when no others are present.	1.62
It is acceptable to take chances as a cyclist when only you are exposed to risk.	1.68
Breaking rules does not necessarily make you a less safe cyclist compared with those who always follow the rules.	1.89
It is acceptable to cycle after drinking alcohol (<0.2‰).	1.51
Attitudes Towards Cyclist Enforcement	**3.64**
There should be more traffic surveillance for cyclists.	3.65
There should be severe punishments for cyclists who break traffic rules.	3.62
Dissatisfaction with the Traffic Rules	**2.71**
Many traffic rules for cyclists are impossible to comply with.	2.78
The traffic rules for cyclists are too complicated to adhere to in practice.	2.65
Violation of Traffic Rules	**1.47**
Cycle when using mobile phone.	1.36
Cycle in the dark without cycle lights.	1.36
Cross the road when a traffic light is red.	1.40
Use a pedestrian crossing when the light is red for pedestrians.	1.63
Cycle after drinking alcohol (<0.2‰).	1.42
Cycle against traffic in one-way streets.	1.65
Conflicts When Cycling	**3.36**
Brake hard because a vehicle is approaching faster than expected.	3.03
Turn quickly away from a vehicle to avoid an accident.	3.54
Brake hard down and/or turn quickly to avoid hitting a pedestrian.	3.50

Attitudes	**4.19**
I think it's essential to be visible to motorists when cycling, for example, by using lights and reflective gear.	4.29
I feel safe when riding my bicycle on the road.	3.54
I am concerned about the risk of accidents while cycling.	4.20
I believe that cycling is an environmentally friendly mode of transportation.	4.30
I enjoy cycling for leisure and exercise.	4.30

I believe that more dedicated bike lanes and paths should be created in our city.	4.41
I think wearing a helmet while cycling is important for safety.	4.43
I feel confident in following traffic rules while cycling.	4.22
I believe that cycling can reduce traffic congestion and improve air quality.	4.34
I feel that drivers are generally respectful and considerate of cyclists.	3.74
I would cycle more often if safer and more convenient cycling routes were available.	4.35
Social Norms	**3.89**
My parents encourage me to engage in cycling activities.	3.67
My parents are concerned about my safety while cycling.	4.25
My parents' cycling behavior influences my decision to cycle.	3.69
My teachers are supportive when it comes to engaging in cycling activities	3.51
My friends are supportive when it comes to engaging in cycling activities.	3.90
I do not feel any pressure from my friends to engage in or refrain from cycling.	4.07
My friends influence my compliance to safety measures, such as wearing helmets or reflective gear, while cycling.	4.00
My community supports and encourages cycling as a mode of transportation.	3.74
"Cycling is socially acceptable in my community."	4.19
"Cyclists are respected road users in my community."	3.95
Perceived Behavioral Control	**3.79**
I possess the necessary cycling skills to navigate various terrains.	3.82
I am confident enough to cycle safely in different traffic conditions.	3.77
I find it easy to incorporate cycling into my daily routine.	3.72
I feel the support of friends or family in my decision to cycle.	3.88
I find it easy to start cycling regularly.	3.77
Perceived Behavioral Intention	**3.88**
I am interested enough to incorporate cycling into my regular activities.	3.80
I am motivated to start or continue cycling.	3.86
My friends' positive opinions about cycling influence my intentions to cycle.	3.89
My family's positive attitudes towards cycling impact my intentions to cycle.	3.88

My peers would support my decision to cycle regularly.	3.99

Table 29. Ordered Logistic Model (Initial)

Variable	Beta Estimate	Standard Error	t-value
Age	-0.28	0.07	-3.85
factor(Gender)2	-0.92	0.21	-4.24
factor(Gender)3	-1.25	1.43	-0.87
factor(Gender)4	-0.59	1.20	-0.49
factor(Accident)1	0.29	0.22	1.28
PARENT1	0.42	0.09	4.27
TEACHER1	0.20	0.09	2.28
Viol	0.27	0.18	1.47
Errors	-0.28	0.21	-1.35
PBehaviors	0.08	0.14	0.62
Prag	-0.18	0.18	-1.00
Enforcement	-0.14	0.10	-1.37
Rules	0.24	0.14	1.76
TrafRules	0.23	0.21	1.09
Conflict	-0.04	0.09	-0.51
Attitude	-0.22	0.18	-1.18
Norms	-0.43	0.23	-1.88
Control	0.52	0.19	2.64
Intention	0.59	0.24	2.42