



RELATIONSHIP BETWEEN AGES OF CHILDREN RIDING BICYCLES INVOLVED IN TRAFFIC ACCIDENTS AND VIOLATIONS OF TRAFFIC LAWS AND ORDINANCES IN ISHIKAWA PREFECTURE

Hiroki Onishi¹, Makoto Fujii², Junichi Takayama³

¹ Nihonkai Consultant Co., Izumihonmachi, Kanazawa, Japan

² Kanazawa University, Division of Transdisciplinary Sciences, Kakumamachi, Kanazawa, Ishikawa, Japan

³ Kanazawa University, College of Science and Engineering, School of Geosciences and Civil Engineering, Kakumamachi, Kanazawa, Ishikawa, Japan

Abstract

In Japan, where the birthrate continues to decline, various initiatives are underway to promote traffic safety for children. Although these efforts have helped reduce the number of traffic accidents involving children, examination of the circumstances under which children were killed or injured in traffic accidents in recent years shows that accidents in which children were riding bicycles accounted for the highest percentage of accidents. We investigated the relationship between the ages of children involved in traffic accidents and violations of traffic laws using traffic accident statistics maintained by the Ishikawa Prefectural Police Headquarters. Our analysis of violations of laws and ordinances with respect to ages of bicyclists involved in car accidents at intersections found that, of all the age categories, elementary school students had the lowest rate of accidents with no violations and the highest rate of accidents involving failure to stop. Junior and senior high school students had lower rates of accidents involving failure to stop than elementary school students. Moreover, at non-intersections, driving safety violations were notably higher for accidents involving bicycling elementary school students than for those in other age groups.

Keywords: children, bicycle, traffic accident, violation of road traffic act

1 Introduction

In Japan, where the birthrate continues to decline, it is important to develop a road traffic environment that ensures the safety and security of children, who represent the next generation, and to promote traffic safety education. In recent years, for example, emergency safety inspections have been carried out on routes along which children travel in groups on a daily basis. Measures are underway to develop safe pedestrian spaces and ensure traffic safety on residential streets in Japan. An example is the Zone 30 Plus initiative, which is a measure to promote the development of safe and secure traffic spaces that prioritize people on residential streets by appropriately combining 30 km/h speed limit zones with physical measures—including speed bumps, rising bollards, and smooth pedestrian crossings—to slow traffic and protect pedestrians. As a result of these traffic safety efforts, the number of traffic accidents per year involving children has declined in recent years, as shown in Figure 1 [1]. On the other hand, as Figure 2 shows, in 2020, 42,804 people under the age of 19 were killed or injured in traffic accidents. “Riding a bicycle” was the most

common circumstance for these accidents, accounting for approximately 42 % of the cases (17,889 persons) [1].

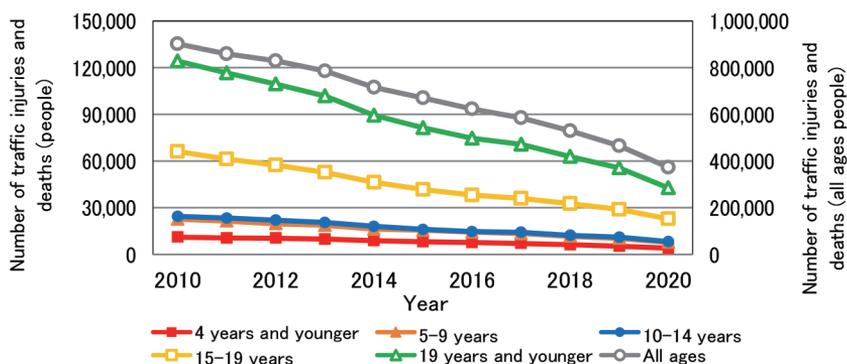


Figure 1 Number of traffic injuries and deaths by age group in Japan [1]

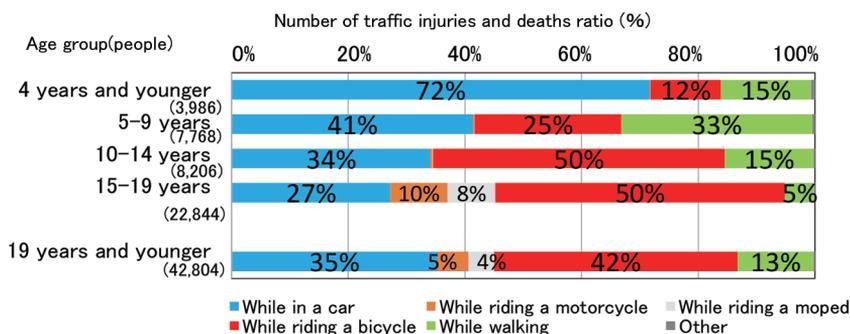


Figure 2 Number of traffic injuries and deaths by age group and circumstances in Japan (2020) [1]

To ensure the safety of children and cyclists, it is important to reduce the frequency of traffic accidents involving children riding bicycles. To do this, it is necessary to clarify when, where, with whom, why, and how children riding bicycles are involved in traffic accidents. The purpose of this study was to clarify the causes (the “why”) of traffic accidents involving children riding bicycles, utilizing traffic accident statistics maintained by the Ishikawa Prefectural Police Headquarters to analyze the relationship between the ages of the children involved in such accidents and the violations of laws and ordinances.

2 Previous research

Miyazaki and Morimoto [2] performed a comparative analysis of traffic accidents involving children on and off school routes in Utsunomiya City and found that most accidents on the school route occurred at low speeds. Inagaki et al. [3-5], who focused on pedestrian accidents involving children that occurred when they were crossing the street, conducted experiments to determine the effects of differences in vehicle distance and speed on the ability of elementary school children to make street-crossing judgments, as well as the timing of vehicle perception on children’s street-crossing judgments. Their results showed that, compared to adults, elementary school children have more difficulty judging vehicle speed and that a shorter perceived distance induces misjudgments.

In addition, they conducted a questionnaire survey on the impact of providing information to parents about their children’s street-crossing judgment characteristics that had been revealed in previous studies and were able to demonstrate a positive change in attitudes toward speed control when driving a car and guidance to children.

Nakamura et al. [6] investigated bicycle traffic safety education for elementary school students by measuring the effects of different teaching materials on children’s awareness and behavioral changes in bicycle traffic behavior. They showed that the workshop environment was the teaching tool that best enabled active and independent participation. Kotake et al. [7] conducted a questionnaire survey of students and teachers from elementary school to high school in Hyogo Prefecture, focusing on bicycle use, and observed that a lack of education, especially among junior and senior high school students, resulted in low interest in traffic safety and low awareness of violations. Yano and Mori [8] analyzed the number of young people, from first graders in elementary school through third graders in high school, killed or injured in traffic accidents while walking or riding bicycles and categorized the numbers in terms of commuting to or from school, private use, and gender, focusing on changes after entering school.

It is clear from this review that many studies have been conducted on road safety for children and on road safety education for children who ride bicycles. However, these studies have failed to analyze the relationship between the ages of the bicycle-riding children involved in traffic accidents and the occurrence of violations of laws and ordinances in those accidents, with the aim of clarifying the causes of traffic accidents involving children riding bicycles. Therefore, this was the purpose of this study.

3 Research method

3.1 Traffic accident data used

In this study, we used traffic accident statistics maintained by the Ishikawa Prefectural Police Headquarters. Traffic accidents recorded in official traffic accident statistics are defined as accidents involving death or injury of persons caused by vehicular traffic, streetcars, or trains on roads, as specified in Article 2, Paragraph 1, Item 1 of the Road Traffic Act. For each traffic accident, one record is kept of the details of the traffic accident and the parties involved. We examined the records of traffic accidents that occurred in Ishikawa Prefecture between 2009 and 2019 and involved a bicyclist as the first or second party. We considered the following entries in the traffic accident statistical data: participant type (car, bicycle, pedestrian, etc.), ages of the parties, violations of laws and ordinances (first and second parties), and road type (intersection, near intersection, non-intersection (road sections of uninterrupted flow, etc.)). Of approximately 90 violations of laws and ordinances involved in the accidents reviewed, we identified the ten most common violations (shown in Table 1) for use in the analysis, along with the category “no violation.” We grouped the rest of the violations under the category “other violations.”

Table 1 Violations used in the analysis

Type of violation
Ignoring signal, division of traffic, reduced speed location, failure to stop
Proceeding safely at an intersection (cross-road vehicle, other)
Safe driving (inattention to movement, safe speed, failure to observe safety regulations, etc.)
Other violations

3.2 Analysis method

With respect to the relationship between bicycle riding accidents and violations of laws and ordinances (first and second parties), according to the National Police Agency’s traffic accident statistics, safe driving violations were the most common violations. In terms of age, the accidents fall into two age categories: those involving the “elderly” (65 years old or older) and those involving the “non-elderly.” Because the purpose of this study was to analyze the relationship between the ages of the children involved in accidents and violations of laws and ordinances, we split the “non-elderly” category into six categories: preschoolers (age 6 or younger), lower-grade elementary school students (ages 7 to 9), upper-grade elementary school students (ages 10 to 12), junior high school students (ages 13 to 15), high school students (ages 16 to 18), and adults (ages 19 to 64). These six categories were added to “elderly (65 years old or older),” for a total of seven age categories. As shown in Figure 3, in the majority of bicycle riding accidents, the other party was an automobile. We therefore aggregated the violations of laws and ordinances in bicycle vs. car accidents and analyzed them by age.

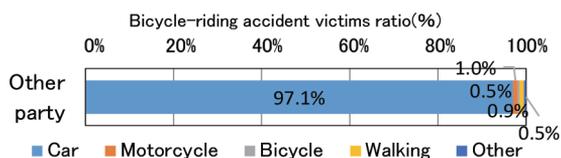


Figure 3 Distribution of ages of bicycle-riding accident victims

4 Relationship between age and violations of laws and ordinances in bicycle vs. car accidents

4.1 At intersections

Figure 4 presents the distribution of the violations of laws and ordinances by age of bicyclist in bicycle vs. car accidents that occurred at intersections in Ishikawa Prefecture between 2009 and 2019. For adults and the elderly, the results show similar trends, although the percentages of unsafe-driving violations vary.

For preschoolers, the results were similar to those for adults and the elderly, with the most common violations being “unsafe driving (failure to observe safety regulations)” and “not proceeding safely at an intersection (cross-road vehicle).” The number of speed violations in reduced-speed zones was higher than for all age groups. This may be because preschool children have not yet received traffic safety education and are not aware of where they should slow down.

For elementary school students, the rates of accidents that did not involve any violation on the part of the bicyclist were the lowest rates among all age categories, with approximately 20 % for the lower grades and approximately 19 % for the upper grades. Since elementary school students are generally considered to have received traffic safety education at least once while in school, it is possible that knowledge of traffic rules learned through this education is not retained or that their understanding of the rules is insufficient. For accidents in which violations of laws and ordinances occurred, the rates of failure-to-stop violations were higher among elementary school students than among the other age groups, i.e., approximately 21 % for the lower grades and approximately 19 % for the upper grades. These findings suggest that it is important for elementary school students who ride bicycles to understand the necessity of stopping at intersections.

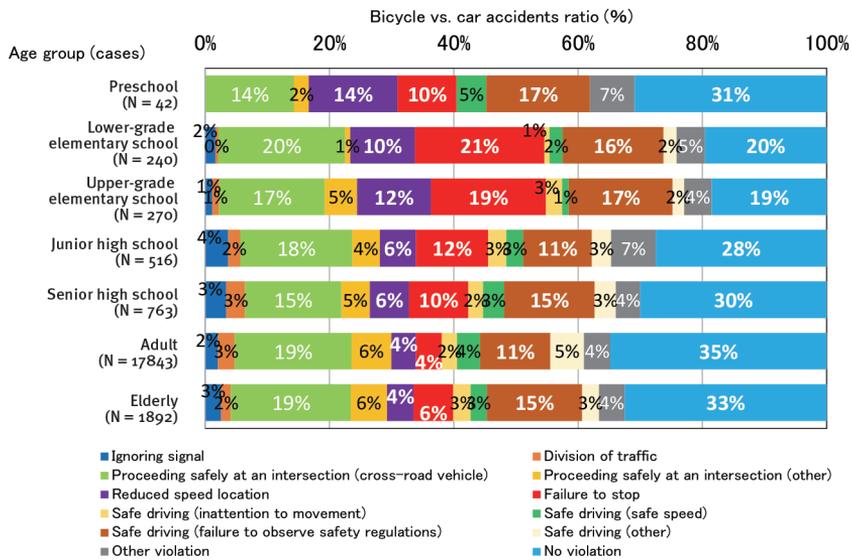


Figure 4 Breakdown of violations of laws and ordinances by age of bicyclist in bicycle vs. car accidents (intersections)

For junior and senior high school students, the rates of accidents in which there was no violation on the part of the bicyclist were higher for both junior and senior high school students than for elementary school students. For accidents in which violations of laws and ordinances occurred, “not proceeding safely at an intersection (cross-road vehicle)” was the most common violation, with a rate of approximately 18 % for junior high school students and approximately 15 % for senior high school students. For senior high school students, the rate of “unsafe driving violations (failure to observe safety regulations)” was also 15 %. These results are generally consistent with the patterns observed across all ages. On the other hand, for junior and senior high school students, the rates involving “reduced speed location” and “failure to stop” violations were higher than for adults and the elderly but lower than for elementary school students and those younger. This may be because junior high school students and those older have more opportunities to use bicycles for commuting to school and for personal use, and as they do, the distance they travel by bicycle increases. Hence, they may have acquired greater knowledge and understanding of traffic rules than elementary school students.

4.2 At non-intersections

Figure 5 presents the distribution of the violations of laws and ordinances by age of bicyclist in bicycle vs. car accidents that occurred at non-intersections in Ishikawa Prefecture between 2009 and 2019. The data for preschoolers are very sparse, corresponding to only 13 individuals, but are shown for reference. The results for adults and the elderly were similar, although the percentages of accidents involving unsafe driving violations vary. For junior and senior high school students, the results exhibit similar trend for adults and the elderly.

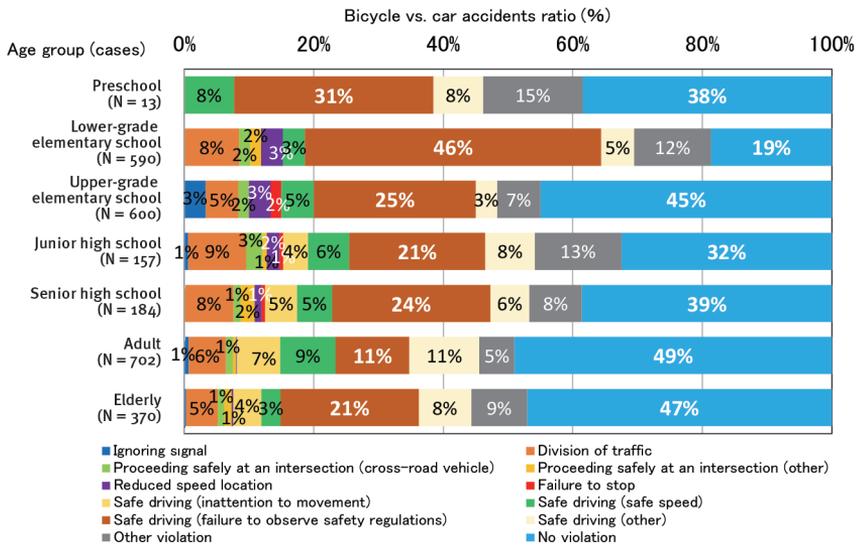


Figure 5 Breakdown of violations of laws and ordinances by age of bicyclist in bicycle vs. car accidents (non-intersections)

For elementary school students involved in accidents in which there was no violation on the part of the bicyclist, elementary school students in the lower grades had the lowest rate among all age categories, at approximately 19 %, whereas the figure was approximately 45 % for those in the upper grades. For accidents in which violations of laws or ordinances occurred, the results were similar to those for the other age groups, with “unsafe driving violations (failure to observe safety regulations)” being the most common type of accident, particularly for the lower grades, for which the figure was approximately 46 %. These results suggest that bicycle traffic safety education is important, beginning early with students in the lower grades of elementary school, to make young bicycle riders understand the importance of observing safety regulations.

5 Conclusions

The purpose of this study was to identify the causes of traffic accidents among children riding bicycles. Utilizing traffic accident statistics maintained by the Ishikawa Prefectural Police Headquarters, we analyzed the relationships between the ages of children riding bicycles and violations of traffic laws and ordinances.

We analyzed accidents at intersections and non-intersections separately to clarify the patterns related to violations of laws and ordinances with respect to the age of the bicyclist in bicycle vs. car accidents. Among the age groups considered, elementary school students had the lowest rate of accidents without violations at intersections. Since elementary school students are generally considered to have received traffic safety education at least once while in school, it is possible that the knowledge of traffic rules learned through this education is not retained or that their understanding of the rules is insufficient. For accidents in which violations occurred, “not proceeding safely at an intersection (cross-road vehicle)” was the most common violation for accidents involving bicyclists who were junior high school students or older, while “failure to stop” violations were the most common type for accidents involving elementary school students. These results suggest that it is important for elementary school students who ride bicycles to understand the necessity of stopping at intersections. For junior and senior high school students, there were lower rates of “failure to stop” violations

than for elementary school students. This may be because junior high school students and those older than them have more opportunities to use bicycles for commuting to school and for personal use and thus travel greater distances by bicycle. Hence, they may have acquired greater knowledge and understanding of traffic rules than elementary school students.

Among all the age categories, lower-grade elementary school students had the lowest rates of accidents at non-intersection locations in which there was no violation on the part of the bicyclist. Involvement in accidents associated with unsafe driving violations (failure to observe safety regulations) was particularly common among lower-grade elementary school students compared to other age groups. These results suggest that it is important to conduct bicycle traffic safety education early on—in the lower grades of elementary school—to make young riders understand the importance of observing safety regulations.

In this study, we conducted a macroscopic analysis of the relationships between the ages of bicyclists involved in traffic accidents and the occurrence of violations of traffic laws and ordinances. However, it is reasonable to expect that children and adults will tend to ride bicycles in different road traffic environments with different levels of bicycle traffic. Therefore, in the future, it will be necessary to analyze the relationship between age and violations of laws and ordinances in bicycle accidents that occur in more limited road traffic environments (e.g., narrow street intersections with no signal control) and to further clarify the traffic violations that are most common in accidents involving children who ride bicycles.

We found that more than 20 % of the accidents involving bicycle-riding children did not involve any traffic violations. As the reduction of these types of traffic accidents is important, detailed analysis is needed to understand the specific violations of laws and ordinances committed by other parties in such accidents and to ascertain the most common locations of accidents in which there is no violation on the part of the bicyclist.

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