STATUS-QUO AND CHARACTERISTICS OF SENIOR BICYCLE RIDERS

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ABSTRACT

Significant research has been conducted on senior vehicle drivers and traffic safety; however, there has been little research on senior bicycle riders and traffic safety. In this paper, a “senior rider” is defined as individual sixty years of age or older. The increasing number of seniors necessitates research on the topic. This research begins with an overview of the current situation and characteristics of senior bicycle riders. A survey questionnaire was administered in Morioka City, the capital of Iwate Prefecture, located in the northern part of mainland Japan.

This research shows that bicycles are an important mode of transportation for the senior members of society and that they are as active as younger riders (younger riders means individuals who is not senior riders), in terms of frequency of riding a bicycle and travel distance. Moreover, self-reports by senior riders indicate overconfidence in their riding abilities, despite their acceptance of declining physical conditions due to aging. This study intends is to improve the riding environment and safety for senior bicyclists. It is important to facilitate improved road lighting and to encourage electric-power-assisted bicycles for senior riders.

Keywords: senior bicycle rider, traffic safety

1. INTRODUCTION

A bicycle is a familiar means of transportation in Japan. After the Great East Japan disaster in 2011, transportation was paralyzed, triggering an increase in the use of bicycles by citizens of all ages.

According to police record, there were 628 bicycle-related traffic fatalities in 2011. In this study, “traffic fatality” is defined as death within twenty-four hours of a traffic accident. About 60% fatalities included seniors. While considerable research has been conducted on traffic safety and senior vehicle drivers, little research exists about senior bicycle riders and traffic safety. Therefore, this paper examined the current situation and characteristics of senior bicycle riders. The results can be applied to traffic safety measures for senior bicycle riders.
In this paper, a “senior rider” is defined as an individual sixty years of age or older.

2. RESEARCH REVIEW

As mentioned, several studies concerning senior vehicle drivers have been conducted. Okamura [1] found that for principal driving operations, such as steering wheel handling and braking, senior drivers were on par with younger drivers. However, cases in which the driver had to make complex judgment, such as maneuvering in traffic or stopping at stop signs, the ability of senior drivers was significantly inferior to that of younger drivers.

Suzuki [2] found that senior individuals experienced significant deterioration in physical abilities and faculties, such as eyesight, hearing, reflexes, general strength, mental judgment, and recovery from exhaustion that made them susceptible to potential accidents. From the psychological viewpoint, Suzuki also found that seniors had difficulties in simultaneously handling complex mental and physical operations, and they became “self-centered drivers”; that is, they expected others on the road to yield to them.

Katoh [3] found that self-evaluations of senior members were more favorable than their actual driving abilities. Motoda [4] conducted a survey of senior drivers and their families. He found that as the driver became older, their self-reported confidence in their driving abilities increased, whereas evaluations of their driving skills by their family members declined.

The limited research [5] on senior bicycle riders shows that senior riders' instability at the start of riding a bicycle, for example, weaving, was greater than that of younger riders. The same research showed that safety checks by senior riders at intersections or stop signs were less frequently done than younger riders. However, Motoda [6] found that senior riders obey trafiic rules more stringently than younger riders.

3. RESEARCH METHODOLOGY

With a population of about 300,000 people, Morioka city was selected for the field study. Morioka is the capital of Iwate Prefecture in northern Japan. Topographically, the city is small and flat, and the inhabitants frequently use bicycles. The transportation modal share for bicycles is 20%.

In December 2011, 2,500 questionnaire surveys and answer sheets were distributed to homes in Morioka through the newspaper delivery system. Target respondents were individuals who were sixteen years and older and who reported riding bicycles frequently. The number of answer sheets returned by mail was 348. The return rate was 13.7%.

The questionnaire queried on bicycle use, self-evaluation of bicycle riding skills, knowledge of traffic laws, actual riding behavior, traffic accident experience, and preferences for riding environments. The results for senior and younger riders were then compared to identify the characteristics of senior bicyclists.

4. RESULTS

(1) Age distribution

The respondents were 55% female and 45% male. More than half of the respondents were 40 years or older, and 38.4% respondents were 60 years or older (Figure 1). There were relatively few younger respondents (aged 39 years or younger). Respondents reported their primary occupation as company employees and housewives. Of all respondents, 78% reported a valid driver's license.

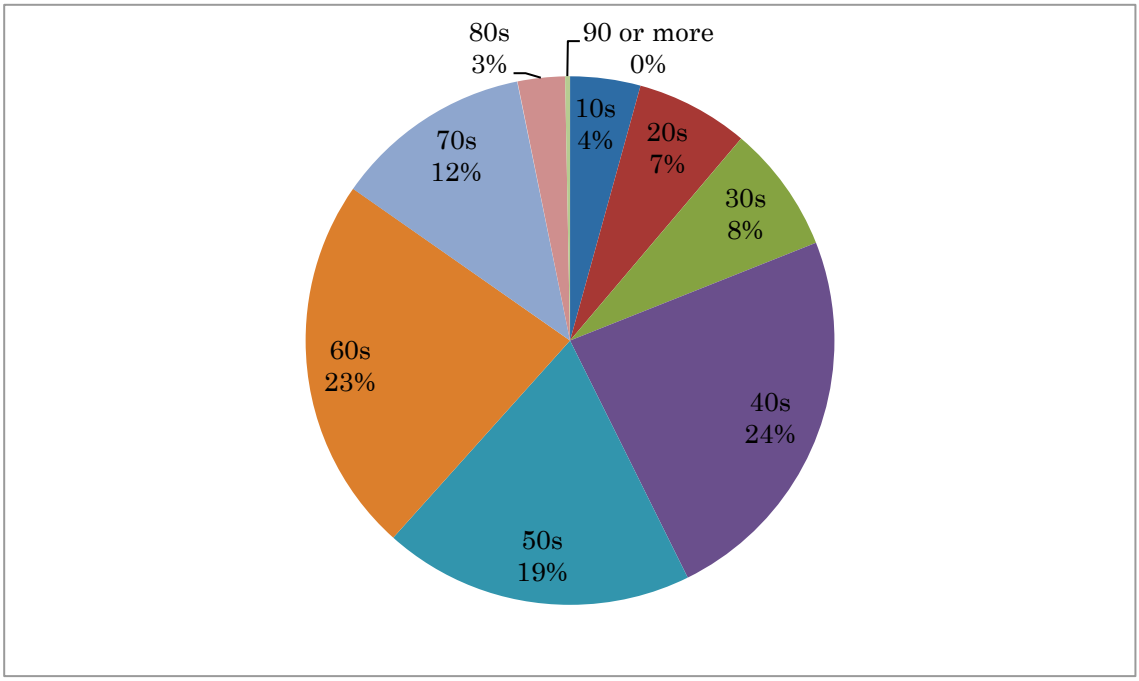

Figure 1 Age distribution

(2) Frequency of Riding

Table 1 shows the frequency of riding by riders' age groups. Of the total respondents, 37.6% reported riding a bicycle more than 5 days a week. However, as the respondent got older, this figure declined. This can probably be attributed to retirement and no longer commuting to work.

There was little difference between the age groups who reported riding bicycles more than 1–2 days a week, indicating that senior riders were generally as active as the others.

Table 1. Frequency of riding (%)

Age	5 days or more in a week	3-4 days a week	1-2 days a week	Few days a month	Few days a year
Total N=345	37.6	24.6	18.2	14.2	5.5
59 or less N=214	42.5	24.3	14.5	13.6	5.1
60 – 69 N=80	33.6	16.3	26.3	18.8	5.0
70 and above N=51	23.5	39.3	19.6	9.8	7.8

(3) Purpose of riding bicycles

The main purpose of riding bicycles by age groups is shown in Figure 2. For those 59 years and older, about 50% of respondents cited commuting to work as a purpose. However, this figure declined as the age increased because most senior riders were retirees.

The most common reason for riding a bicycle for all generations was to go shopping. Riders 70 years of age were more likely to use their bicycles for volunteer activities. By using bicycles, they also promoted good health more than the younger age groups, which may be attributed to life style changes by age. Only few respondents, including those in the senior age group, reported using a bicycle to go to hospital. This could be due to improved health conditions because of bicycle riding. In this questionnaire, 93% of respondents aged 60 years or older considered themselves healthy. On the other hand, it is unlikely that the health condition of respondents needing to visit a hospital would permit bicycle riding.

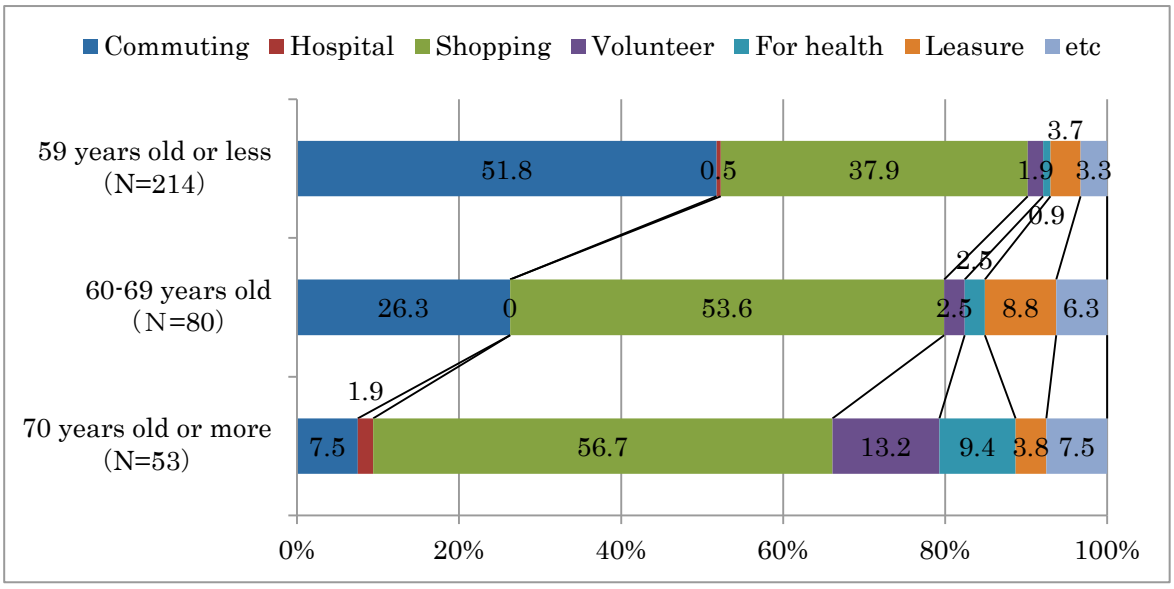

Figure 2 Purpose of riding bicycles

(4) Travel time to destination

Figure 3 shows the accumulated percentage of riding time to the most frequent destination by age group. About 80% of travel time to destination was less than 20 min. Assuming that the bicycle speed was 15 km/h, 80% of respondents' distance to their destination was about 5 km or less. Most bicycle trips were assumed to be less than 5 km. The questionnaire results agree with this assumption.

There was little difference in the results between the age group for distance traveled. According to research [7] by the National Institute for Land and Infrastructure Management, the average bicycle speed for senior riders was 11.4 km/h and for non-senior riders was 14.6 km/h. Therefore, senior riders' travel distance to their destination was about 20% lesser than that of young riders.

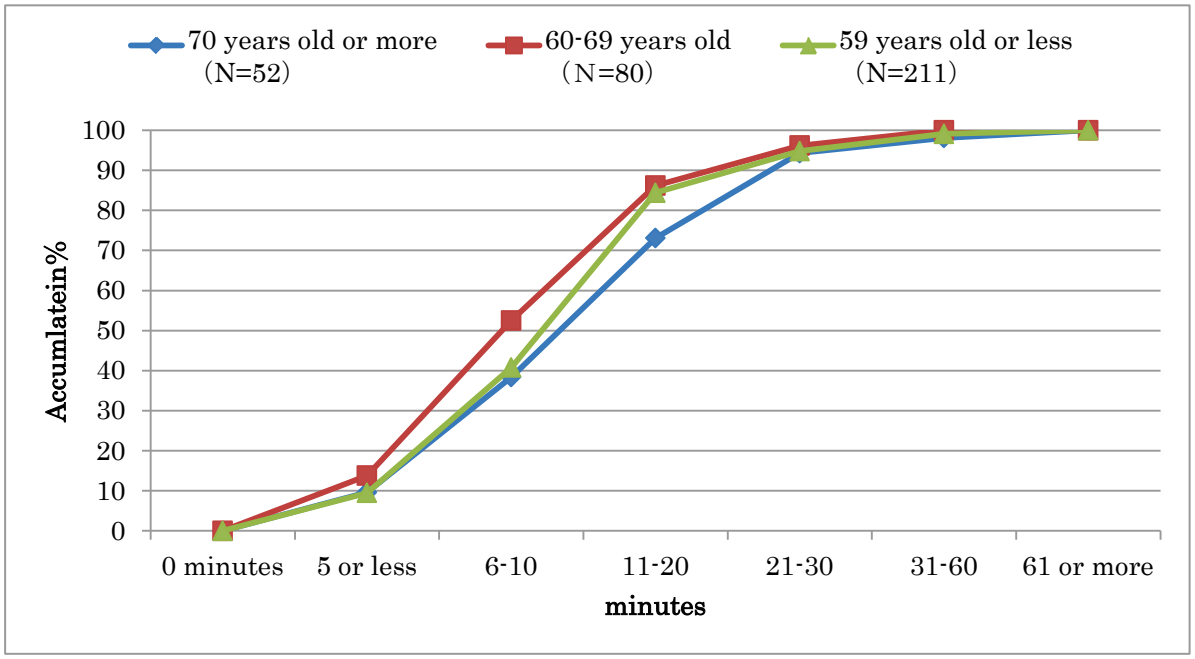

Figure 3 Travel time to destination

(5) Self evaluation of riding skills

Respondents 60 years or older were asked to evaluate their own health conditions and physical abilities: 58.3% answered that they were in very good health, and 34.4% stated that they were in good health. Thus, more than 90% of senior respondents reported that they were healthy, but this rate decreased as age increased. When asked if they had experienced a decline in physical abilities, 80.3% answered "yes." They complained of lacking quickness in motion (33%), declining physical strength (33%), and decreasing sense of balance (17%).

All respondents were asked to rate their confidence in their bicycle riding abilities (Figure 4). About 86% of respondents replied that they were confident. The level of confidence increased with respondents' age. This could be because only confident seniors attempt to ride bicycles. This phenomena is

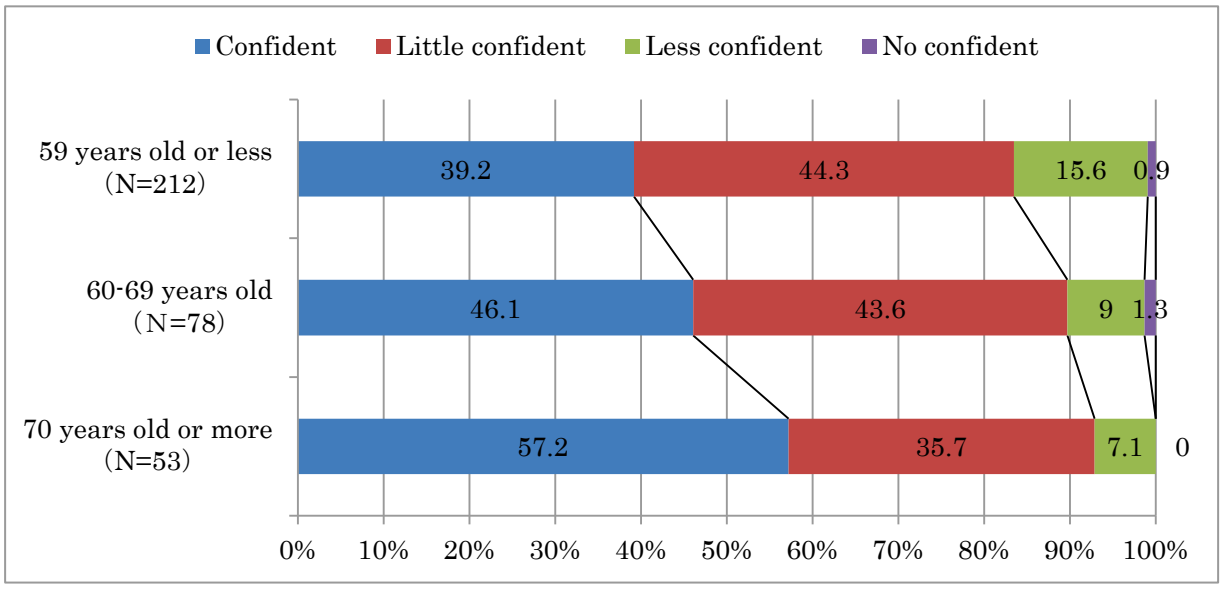

Figure 4　Confidence levels of riding bicycles

similar to research results about senior vehicle drivers. Research [4] showed that while senior drivers felt confident of their driving abilities, the evaluation of their driving skills by family members was low. Therefore, it is likely that senior bicyclist may be overconfident in their self-assessments.

Riders were also asked to list their weaknesses in bicycle riding and to rate them accordingly (Figure 5). For all ages, riding in the winter season was the biggest weakness. Also, riding with heavy road and pedestrian traffic, bumpy roads, and rain were regarded as difficulties. Unlike in other countries, in Japan, it is legal to ride a bicycle on the sidewalks, which explains the effects of pedestrian traffic on Japanese bicyclists.

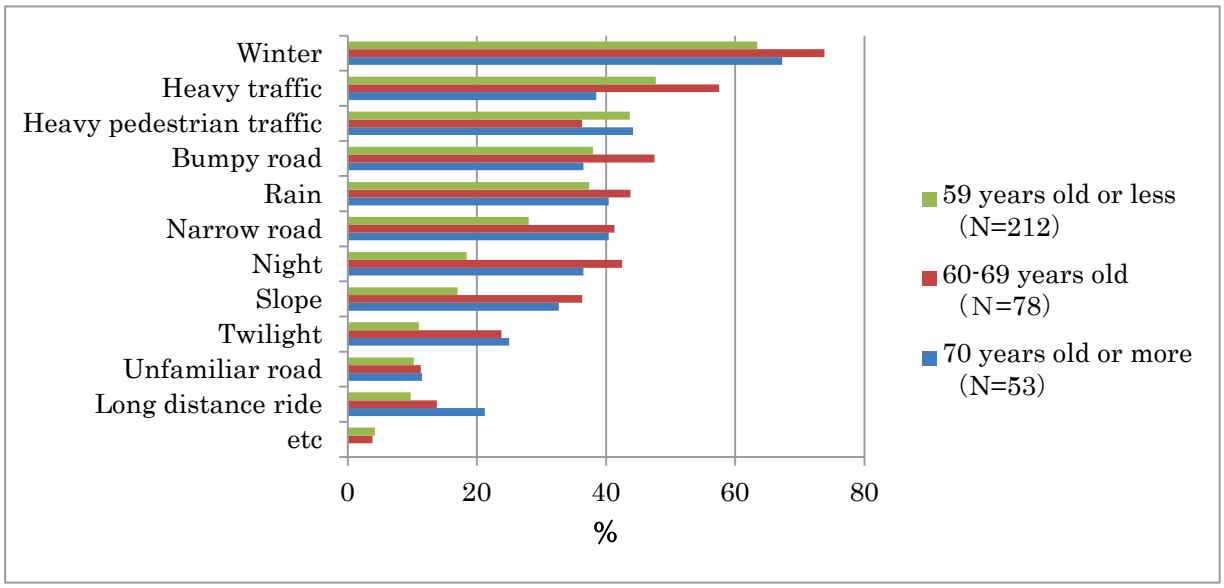

Figure 5　Weakness in riding

Table 2 Comparison of weaknesses between senior and younger riders

Items	Judgment
Riding in winter	-
Heavy traffic road	-
Heavy pedestrian traffic road	-
Bumpy road	-
Rain ride	-
Narrow road	*
Night ride	**
Slope road	*
Twilight ride	**
Unfamiliar road	-
Long distance ride	-
etc	-

- Note: "-"denotes not significant and * and ** imply 5 and 1% significance levels.

For almost all difficult riding situations reported, senior bicyclists were reported to have more problems with the conditions than younger riders. Table 2 shows comparisons of the rate of reported difficulty between senior and younger riders using Chi-square analysis. Results indicate that senior riders felt less confident than younger riders on narrow and sloped roads and during twilight and night. These differences result from the decline in seniors' physical abilities . Riding during twilight and night requires good eyesight. Riding on narrow and sloped roads requires physical strength to ride on an incline and braking skill to safely get down the hill.

(6) Knowledge and Violation of Traffic Laws

Respondents were asked about their knowledge and violation of traffic law. Ten scenarios of bicycle behavior were provided, and respondents were asked to state if the case was legal or illegal. Of the 10 cases, three were legal and seven were illegal. The legal cases involved keeping to the left, stopping at stop signs, and riding by a carriageway on the sidewalk. Illegal cases were tandem riding, side-by-side riding, riding without a headlamp at night, using a cell phone while riding, using umbrellas while riding, drinking and riding, and ringing the bicycle bell at pedestrians.

Figure 6 shows the results of these questions. It is clear that in most cases, more than 90% of respondents picked the right answer. Only "ringing the bicycle bell at pedestrians" showed a low rate of understanding and compliance. Although riding on the sidewalk is permitted in Japan, pedestrians have the right-of-way on the sidewalk; thus, bicycle riders are required to yield to

pedestrians by traffic law. Thus, “ringing the bicycle bell at pedestrians” on the sidewalk is deemed illegal. In general, traffic laws about riding on the sidewalk can be difficult to comprehend, because it contains many exceptions and are often changed. This figure also shows that there was little difference between senior and young riders’ knowledge of traffic laws.

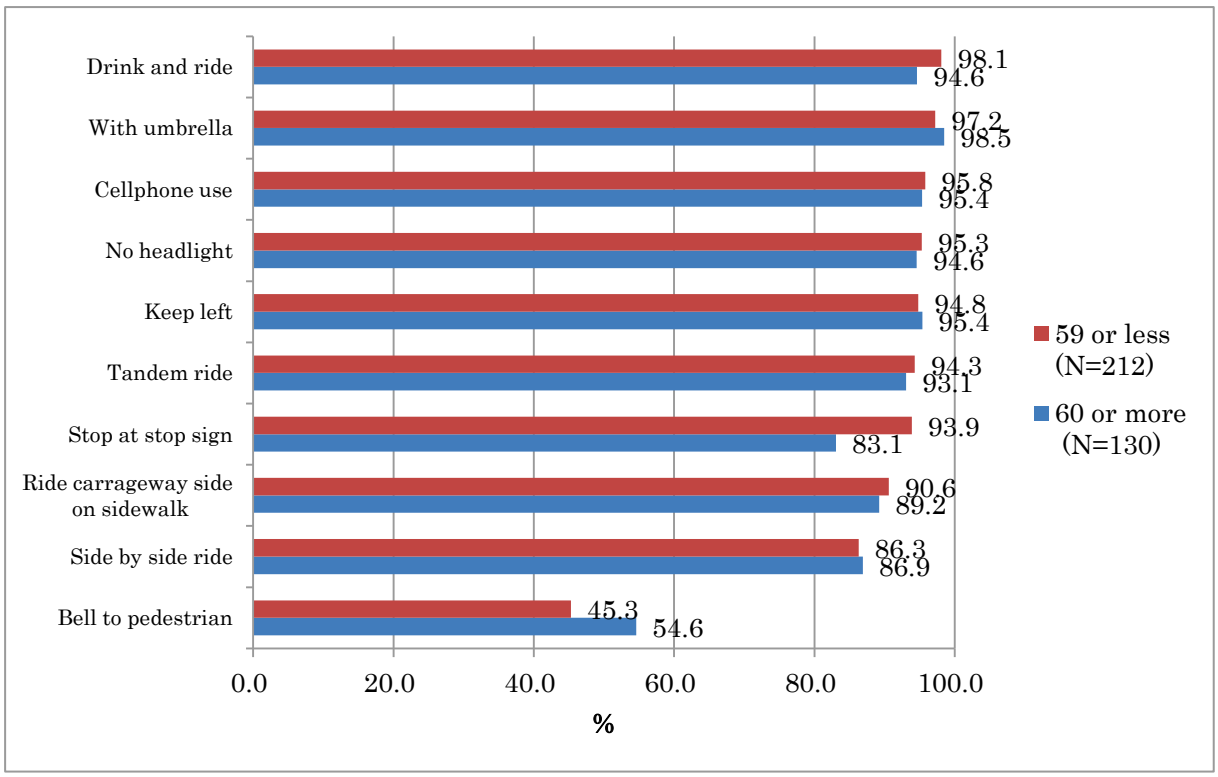

Figure 6 Rates of correct answers about traffic laws

Respondents were also asked whether they actually comply with the rules (Figure 7). Apart from the results in Figure 6, there was evidence of actual behavioral differences between senior and younger riders. Except for “ringing the bicycle bell at pedestrians,” senior riders were more likely to obey traffic laws than younger riders.

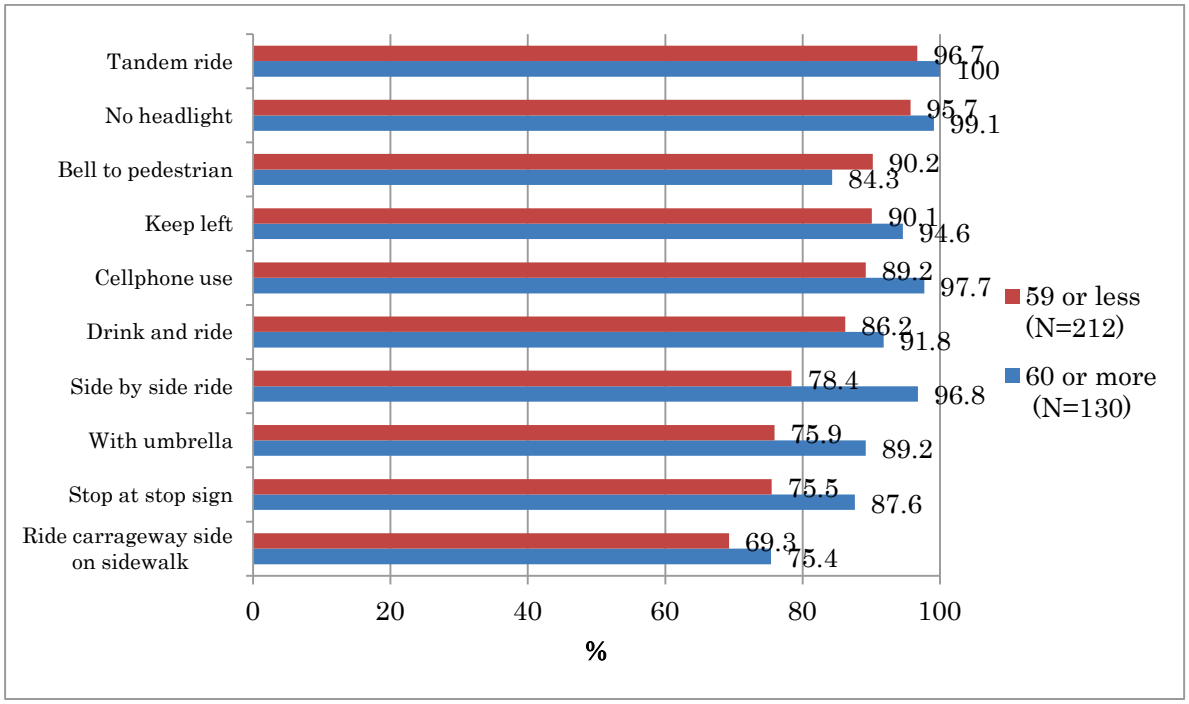

Figure 7 Rate of obedience to traffic laws

Table 3 Comparison of obedience rate between senior and younger riders

Items	Judgment
Tandem ride	-
No headlight	-
Bell to pedestrian	-
Keep left	-
Ride with cell phone use	**
Drink and ride	*
Ride side by side	**
Ride with umbrella	-
Stop at stop sign	**
Ride on carriageway side on sidewalk	*

- Note: "-"denotes not significant and * and ** imply 5 and 1% significance levels.

Table 3 shows a comparison of the rates of obedience to traffic law between senior and younger riders. Chi-square analysis was applied. Five out of 10 items showed significantly different levels of compliance. Therefore, senior riders are more likely to obey to traffic laws than younger bicyclists. This result agrees with that of Motoda [6].

There are two possible reasons why senior riders are more compliant to traffic rules. First is that senior riders have weaker physical conditions, and thus, they follow the rules more closely to protect themselves. The other possible reason is generation based. In recent research, Gotoh [8] found that riding on the sidewalk

deteriorates moral compliance to bicycle traffic rules. In 1970, Japan permitted the use of bicycles on the sidewalk to cope with increasing traffic accidents. Therefore, those who began riding after 1970 are possibly more accustomed to riding on sidewalk, and this younger generation may feel entitled to the right of way there. This is an area left for future research.

(7) Desire to improve bicycleing environments

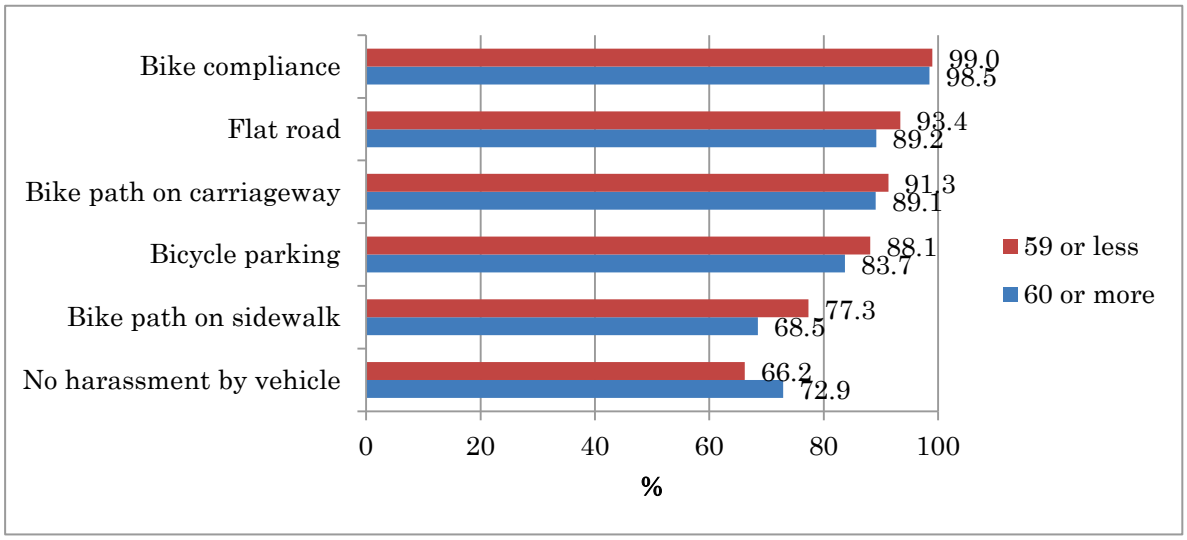

Figure 8 Desire to improve bicycling environments

Figure 8 shows respondents' desire to improve the bicycling environment. Interestingly enough, better compliance to the rules by other bicyclists was the most requested improvement, followed by flatter roads and bicycle paths on carriageways. For these improvements, there was no significant difference between senior and younger riders.

5. CONCLUSION

This research indicated that senior riders are more than "guests" that are given special treatment in bicycle traffic. Following are the results from the surveys.

(1) For frequency of bicycle use, daily use was lesser for senior riders than for younger riders; however, the overall difference in frequency between senior and younger riders was not extreme and showed that senior riders were still active bicycle users.
(2) Senior riders no longer used bicycles to commute to work, but regularly used bicycles for shopping and volunteer activities.
(3) There was no significant difference in travel time and distance to destination among different age groups. However, the difference of average speed between

senior and younger riders meant that the travel distance for senior bicyclists to their destination was about 20% shorter than that for younger bicyclists.
(4) The older the riders, the greater their confidence in their bicycling abilities. This result correlates with the reported confidence levels of senior vehicle drivers.
(5) Seniors expressed weaknesses in riding on narrow and sloped roads, and difficulties with riding during twilight and night. They acknowledged that these deficiencies are caused by the age-related deterioration of physical abilities and strengths.
(6) There was no significant difference in knowledge of traffic laws between senior and younger riders. However, in actual traffic behavior, seniors were found to be more obedient to traffic law than younger riders.
(7) All riders agreed that the best way to improve the bicycle riding environments was for all bicycle riders to comply with the laws. There was no significant difference between senior and younger riders on this point.

Moreover, senior riders exhibited good compliance with traffic rules. However, it may be necessary to provide them with some assistance to offset decreased abilities. For example, improved lighting on roads may increase safety not just for senior bicyclists but for all bicycle riders. Electric-power-assisted bicycles could help senior riders climb slopes. Over confident senior bicyclists may need objective assessments to make them aware of their real abilities and encourage them to engage in exercises to increase those abilities. Since this research is based on questionnaire survey data, future works must consider research based on accident data.

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