DIFFERENCES OF THE ELDERLY TRAVEL CHARACTERISTICS BETWEEN SUMMER AND WINTER SEASONS

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1. INTRODUCTION

As of 1987, the Japanese have acquired an average life span to 75.6 for males and 81.3 for females, which are both the longest in the world. The population of sixty-five years and older constitutes 11.2 percent of the total population. This figure is expected to increase to 16.2 percent in the year 2000 and 23.5 in 2025, according to the research done by the Demographic Institute of the Ministry of Welfare.

In this regard, the transportation systems to meet the change in the Japanese social and demographic structure can be re-designed to this end so that the elderly and the society can better be served.

The problem of mobility among the elderly who live in the regions which experience cold and snowy climate is particularly manifested, because the climate can prevent them from easy access to public transportation, such as walking to a bus stop, which requires particular improvements for them in winter. As shown in Photo.1 snow on the roadway is removed and piled on the sidewalk, which causes not only the elderly but also non-elderly people in difficulty to approach to a bus stop and to get on or off a bus. In Japan, there are not a few of pedestrian bridges as shown in Photo.2. The slope is steep and the width of steps is narrow. These traffic environments can decrease out-of-home activities for the elderly in the winter season.

However, the information for the specialized transportation planning, which compares the travel characteristics in winter with in summer, has not been available. The goal of this study is to compare the travel behavior of the elderly in the winter season with that of summer. First, the differences of their travel characteristics between summer and winter are examined. Second, impediments to their travel are identified and some improvements are suggested.

2. SURVEY METHODS AND FIELD OF INVESTIGATION

The survey was carried out between September and October, 1987 among the elderly, who live in Akita city, Japan. The survey was conducted by visiting each subject's house, 983 questionnaire forms out of 1000 (98% collection rate) were collected, of which, 811 (over 50 years of age) were valid. 453 of those people were in the fifties, 295 of them were in the sixties, and the remainder were over 60 years of age. 382 were male, and 429 were female.

The "Elderly" is defined as persons who are sixty years of age or older. Akita City, Japan, is used as a case study site. The city is located on the western side of the North-Eastern (Tohoku) district of Honsyu island,

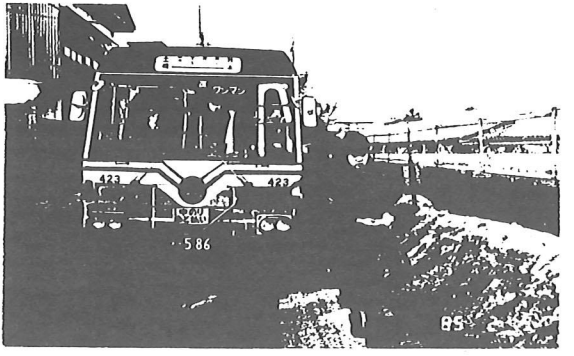

Photo.1

Photo.2

Table 1 Monthly Mean Temperature and Average Depth of Snow in Akita

(1985)

Month	Temperature (°C)	Average depth of snow (cm)
1	-1.8	30
2	-2.3	29
3	0.4	29
4	7.3	1
5	13.5	0
6	20.6	0
7	24.3	0
8	25.3	0
9	18.9	0
10	12.2	0
11	6.7	8
12	1.9	20

approximately 360 miles north of Tokyo. The city has the population of about 300,000 and is situated at lat. 40N. and long. 140E. The changing of seasons is clearly marked. It has definite four seasons. The average temperature of the Akita area from Nov.1st to the end of March is 1.1 C.(see Table 1)

3. TRAVEL CHARACTERISTICS OF THE ELDERLY IN COLD REGION

3.1 CHANGE OF TRAVEL PATTERN DURING A YEAR

It is generally known that human physical functions are weakened as one becomes aged, and the travel characteristics of the elderly are influenced by their physical disability and availability of travel modes. In the region which experiences cold and snowy climate, the elderly are much influenced by bad traffic conditions, such as muddy roads with snow, poor public transportation facilities, difficulty to understand to see traffic signs and signals, pedestrian bridges, etc. Therefore, in order to grasp the travel behavior of the elderly, the questionnaire was distributed to collect information on travel mode choice and frequency of travel in winter.

Table 2 summarizes the change of travel behavior of the elderly in winter season. In this paper, shopping, entertainment and visits to hospital or doctor's office were chosen as the subjects of the analysis.

As seen in the table, about 43 percent of the elderly people changed their travel behavior in winter season. Among them, 18 percent changed their travel modes but unchanged travel frequency. "Travel mode changed and travel frequency decreased", "Travel mode unchanged and travel frequency decreased" and "Did not travel in winter season" account for 7, 10 and 8 percent, respectively, of all the trips. The elderly changed their travel behavior in winter, were 52 percent for shopping, 33 percent for entertainment and 32 percent for visits to hospital or doctor's office. Approximately, 24 percent of all trips for visits to hospital or doctor's office and 22 percent of all trips for entertainment made by the elderly, changed their trip modes but unchanged travel frequency in winter season. In shopping trips, 12 percent was "Travel mode changed and travel frequency decreased", 16 percent was "Travel mode unchanged and travel frequency decreased", 14 percent was "Travel modes changed but travel frequency unchanged" and 10 percent is "Did not travel in winter season".

We can see distinctly that there are great differences in travel behavior between the summer and the winter seasons. That is, in entertainment and visits to hospital or doctor's office in winter, the elderly people cope by a change of their travel modes. In shopping trips, they cope by means of a decrease in the frequency of out-of-home activities.

3.2 ANALYSIS OF TRAVEL CHARACTERISTICS BY AGE GROUPS

To understand the difference of mobility between the summer and the winter seasons, the rate of decrease in out-of-home activities by age groups is shown in Fig.1. As is evident from Fig.1, the elderly who decrease travel frequency, decrease their shopping and entertainment trips, as age increases. In visits to hospital or doctor's office trips, the frequency of these have small differences between age groups. Shopping trips are calculated a correlation coefficient of 0.737 between the rate of decrease in out-of-home activities and

Table 2 Travel Behavior in Winter when Compared with Summer Time

	Shopping	Enter-tainment	Visit hospital or doctor's office	Total sample size
No change	348 (48.2)	287 (66.6)	171 (68.1)	806 (57.4)
Change	374 (51.8)	144 (33.4)	80 (31.9)	598 (42.6)
Travel mode changed but travel frequency unchanged	101 (14.0)	96 (22.4)	61 (24.3)	258 (18.4)
Travel mode changed and travel frequency decreased	86 (11.9)	15 (3.5)	1 (0.4)	102 (7.2)
Travel mode unchanged but travel frequency decreased	112 (15.5)	15 (3.5)	6 (2.4)	133 (9.5)
Did not travel in winter season	75 (10.4)	18 (4.2)	12 (4.8)	105 (7.5)
Total sample size	722 (100)	431 (100)	251 (100)	1404 (100)

Note: The figure in parenthesis represents the percentage of trips

Table 3 The Frequency of Travel per Week by Age Groups

purpose	shopping		entertainment		visit hospital or doctor's office	
age	summer	winter	summer	winter	summer	winter
50～54	2.6	2.0 (0.77)	1.5	1.4 (0.93)	1.2	1.2 (1.00)
55～59	3.1	2.5 (0.81)	1.7	1.7 (1.00)	1.1	1.0 (0.91)
60～64	2.9	2.4 (0.83)	1.7	1.6 (0.94)	1.0	1.0 (1.00)
65～69	3.0	2.4 (0.80)	2.4	2.1 (0.88)	1.5	1.5 (1.00)
70～74	2.8	2.1 (0.75)	2.2	1.8 (0.82)	1.9	1.7 (0.89)
over 75	3.1	2.3 (0.74)	2.8	1.6 (0.57)	1.2	1.2 (1.00)
Total	2.9	2.3 (0.79)	1.8	1.6 (0.89)	1.3	1.2 (0.92)

Note: The figure of parenthesis is the ratio of the winter to summer season

age groups, and group activity trips is 0.856. These are large enough to confirm the presence of such correlation.

The frequency of travel per week is shown in table 3. In winter, the frequency of travel per week of the elderly have a tendency to decrease in shopping trips and in group activity trips, as age increases. In shopping trip made by elderly persons, there is a small difference between the fifties and over 60 years of age. On the other hand, the frequency of entertainment trip by over 65 years of age are larger than those in the fifties. The frequency of visits to hospital or doctor's office is no different between age groups in both seasons.

The differences of the frequency of the travel among the three trip purposes may be explained by travel distance. Fig.2 shows the relation between travel distance by trip purpose and by age group. Travel distance becomes shorter for all three trip purposes as age increases. In short the elderly try to complete their travel demands by shortening travel distance. This means that the elderly people alter their trip destination closer to their home, such as entertainment trips, which is how they may cope with the frequency of travel in winter season as age increases.

3.3 TRAVEL MODES OF THE ELDERLY ON A COLD DAY

Travel modes of the elderly are examined both in summer and winter. The percent of trips according to modes of travel is shown in Fig.3 and 4. The authors divided them into three age groups (50's, 60's and 70's).

First, the travel modes are analyzed in the summer season (Fig.3). In the fifties age group 25.9 percent is done by bicycle, 25.0 percent by car (driver), 16.6 percent by bus, 13.7 percent by walking, with a remainder of 19.4 percent for other,such as car passenger, motorbike. About 30.3 percent of all trips made by the sixties age group are done by bicycle, 22.2 percent by walking, 21.5 percent by bus, 16.4 percent by car (driver). In the group over 70 years of age, bicycle trips have a majority of 30.4 percent, walking is 29.7 percent, bus is 21.0 percent. It can be seen that there is an increase in walking trips and a decrease in motorized trips as age increases. Bicycle and bus trips show little change between age groups.

Second, Fig.4 summarizes travel modes in the winter season. We can see that there are great differences in travel modes between both seasons. 24.5 percent of all trips of the fifties age group are by walking, 28.8 percent are by bus, 23.7 percent are by car (driver). In the sixties group 31.9 percent is done by bus, 31.6 percent by walking. Walking and bus by the group over 70 years of age account for 44.8 and 31.5 percent, respectively, of all modes. These two are very important modes for the elderly in the winter season. Bicycles, which are a principal mode during summer, is found changed to walking and replaced with bus in winter.

In the sixties and fifties groups, the rate of trip generation of the elderly who drive their own cars show little change: 0.7 percent of all trips of three groups between summer and winter season. But the rate of the group of over 70 years drops markedly from 2.9 percent to 1.6 percent, and it decreases about one-half between both seasons. In the winter season, we also can see distinctly that there are many bicycle trips by the elderly and they expose themselves to dangers of traffic accident. Therefore, it is necessary to improve the walking and bus system environments and so on.

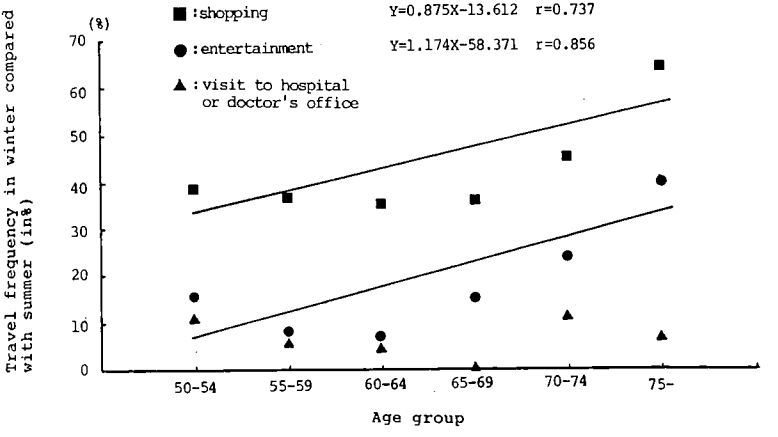

Fig.1 Out-of-home activities in summer and in winter

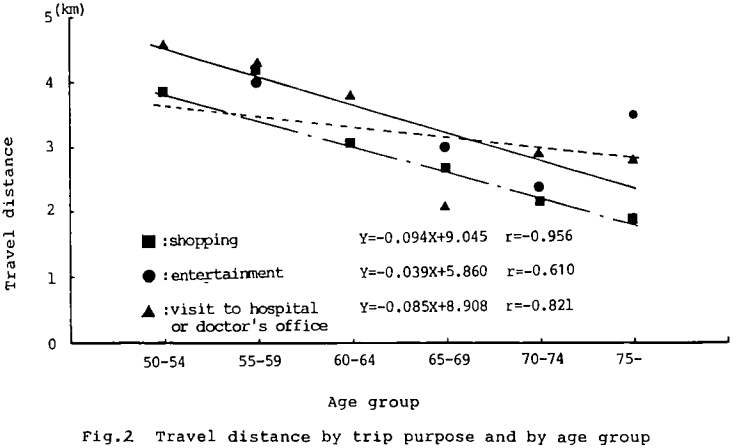

Fig.2 Travel distance by trip purpose and by age group

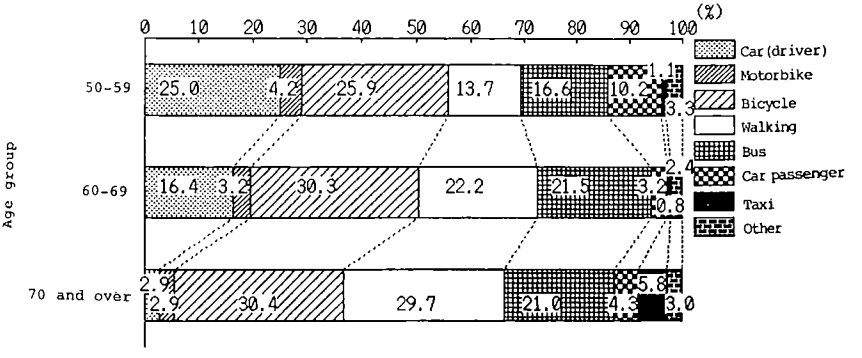

Fig.3 Travel modes by age group in summer season

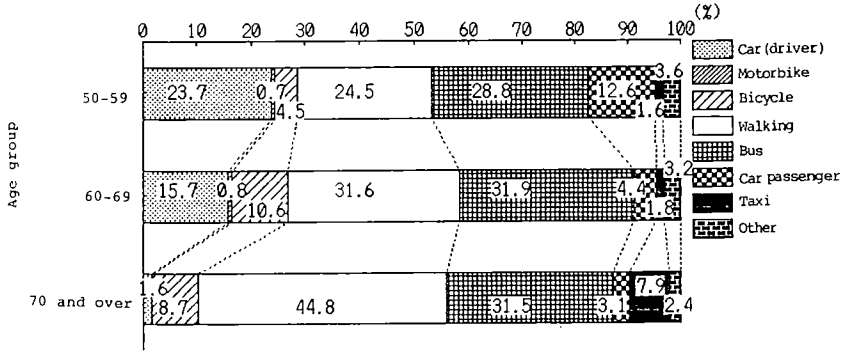

Fig.4 Travel modes by age group in winter season

4.TRAVEL PERCEPTION OF THE ELDERLY IN WINTER

In the preceding chapter, we analyzed travel characteristics of the elderly in winter, and decrease of the frequency of out-of-home activities and travel modes of the elderly was clarified. Therefore, in order to understand the differences of mobility between both seasons, traffic perception of the elderly in winter season was analyzed. Walking and bus trips, which are principal during winter, and car trips which will increase in the near future are also chosen as the subject of this analysis.

Traffic perception of the elderly in winter is evaluated by the method of following D-value.

$$Di = (Si-Bi)/(Si+Bi) \times 100$$

where Di :satisfied index of i-th factor.
Si :percentage of the elderly who express their satisfaction at i-th factor to the whole.
Bi :percentage of the elderly who express their dissatisfaction at i-th factor to the whole.

If Di value is negative, the degree of dissatisfaction of i-th factor is larger in comparison to others. That is Di value takes a numerical value of -100 when satisfaction of i-th factor is zero.

Table 4 shows factors which affect difficulty of walking in the winter season. The influencing factors are "snow on the sidewalk", "Frozen slippery sidewalk" and "Undistinguished level between sidewalk and roadway by snowfall". These factors point out that the elderly want to have sidewalks shoveled. About 63 percent of the elderly were affected difficulty of walking trips in winter and only 6 percent of them were not affected.

In the "bus trips" category, the most affected factors were "Lack of sheltered bus stop", "Schedule delay due to snow". The elderly have much affection with the lack of equipment and delays of bus services. The least affected factors were "Reduced frequency", "Congestion on a bus" (see Table 5). The "Strongly affected with bus ride in winter season" was 28 percent, "Not affected" was about 30 percent. It is very important for bus trips in winter to operate punctually.

Table 4 Factors which affect difficulty of walking in winter season

(sample:811)

Factors	Strongly affected (%)	Somewhat affected (%)	Not affected (%)	D-Values
Snow on the sidewalk	56.36	34.64	9.00	-72.5 (1)
Undistingnished level between sidewalk and roadway by snowfall	44.64	39.58	15.78	-47.7 (3)
Frozen slippery sidewalk	48.71	42.54	8.75	-69.4 (2)
On the whole, level of satisfaction for walking in winter	63.18	30.40	6.42	-81.6

Table 5 Factors which reduce the use of transit in winter season

(sample:811)

Factors	Strongly affected (%)	Somewhat affected (%)	Not affected (%)	D-Values
Schedule delay due to snow	42.83	44.9	12.22	-55.6 (2)
Lack of sheltered bus stop	58.41	26.0	15.55	-57.8 (1)
Frozen slippery foot steps on the bus	22.68	51.9	25.40	5.6
Longer tavel time	37.97	42.4	19.60	-31.9 (3)
Reduced frequency	16.89	36.3	46.74	46.9
Congestion on a bus	24.78	43.2	31.93	12.5
On the whole, level of satisfaction for bus ride in winter	27.62	42.3	30.08	4.3

Table 6 Factors which reduce the driving opportunities in winter season

(sample:252)

Factors	Strongly affected (%)	Somewhat affected (%)	Not affected (%)	D-Values
Narrowed roadway caused by piled snow	55.68	36.66	7.66	-75.7 (1)
Frozen slippery roadway	42.00	47.67	10.33	-60.6
Longer travel time	51.21	37.11	11.68	-62.8 (3)
Higher fuel consumption	54.34	33.00	12.66	-62.1
Narrowed parking lots caused by piled snow	48.67	38.00	13.33	-57.1
Rutted roadway caused by compaction of snow	50.68	40.66	8.66	-70.7 (2)
On the whole, level of satisfaction for driving cars in winter	66.68	25.66	7.66	-79.3

The factors of affection when the elderly drive a car are "Narrowed roadway caused by piled snow", "Rutted roadway caused by compaction of snow" and "Longer travel time". From these replies, we found that the elderly were discontented with driving cars in the winter season (see Table 6). 67 percent of the elderly drivers were affected with driving their cars in winter. High-careful driving techniques are required for driving their car on narrowed and rutted roadway with snow. It may strain their nerves for the elderly to drive in winter.

5.CONCLUSION

In this research we have found travel characteristics of the elderly in the cold region which have hardly been investigated prior to this study in terms of the correlation between the aged and the hazardous factors in winter. The findings may be summarized as follows:

(1) Decrease of the Frequency of Out-of-home Activities, Increases with the Age

As they get aged, they are found to travel for shopping and entertainment less frequently. That is, the elderly try to complete their travel demands by shortening travel distance. It means that the elderly people alter their trip destination closer to their homes. This is how they may cope with the frequency of travel in winter season as age increases. For visits to hospital or doctor's office trips, the rate have rather small differences between age groups.

(2) Travel Modes of the Elderly on a Cold Day

A bicycle, which is the principal mode of travel during summer, is found changed to walking and is replaced by bus in winter. Therefore, in the region which experiences cold and snowy climate in the winter season, it is necessary to improve the walking and bus system environments and so on.

(3) Travel Perception of the Elderly in Winter

As one of the things found troublesome and needed to be improved through this study, we found that the elderly seek to have sidewalks shoveled. There are narrowed pedestrians' spaces due to removed and piled snow. In addition to these, the elderly walkers are troubled by the frozen slippery sidewalks. On the other hand, the perception of bus services to the elderly is the longer wait longer and discomfort at bus stop without a good protection from inclement weather in winter. On the narrowed and rutted roadway owing to snowfall, the elderly strain their nerves to drive their cars and have much affection to drive cars in the winter season. Such affection are common problems not only for elderly persons but also non-elderly persons.

As we have seen in this study, how to solve the snow problem to maintain normal traffic condition in winter is one of the principal questions in a cold region like Akita. According to the way they do in Akita, snow on the roadway is removed first, which causes pedestrians to walk in difficulty, which suggests sidewalks should be first instead.

After this, it may be necessary to examine the possible improvements of

traffic environments in the winter season for the elderly, such as the improvements of handrail or steps of the pedestrian bridge, the sheltered bus stop. Moreover, snow-melting and road surface heating devices will be helpful to walk for the elderly people. In fact, at selected location they are in place and greatly improve the walking environment.

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