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AN ANALYSIS ON MOBILITY OF PEOPLE WITH DISABILITIES IN A JAPANESE LOCAL CITY

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This is an abridged version of the paper presented at the conference. The full version is being submitted elsewhere. Details on the full paper can be obtained from the author.

ISBN: 978-85-285-0232-9

13th World Conference
on Transport Research

www.wctr2013rio.com

15-18
JULY
2013
Rio de Janeiro, Brazil

unicast

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ABSTRACT

In 2009, a large scale survey was conducted by TTRI on the mobility of people with disabilities in Toyota City. This study is to report the analysis results on the relations among mobility of the people with disabilities and the regional characteristics et al. The analysis related with the regional characteristics was based on three regions: centre, city, suburbs. The frequency, the travel purpose and other indicators of the mobility are used. It was clear that the level of the disabled people' mobility living in the suburbs area are lower than that who are living in the centre area or city area. Furthermore, as the factors having greatly influenced are the “regional characteristics” and “usability of private cars”. The analysis results implied that the detail infrastructure conditions such as the slope of roads and the service level of public transportation system like the distance to the nearest railway station/bus stop need to be further studied. Furthermore, our findings suggest the policies supporting the mobility of the people with disabilities should be studied in terms of the regional characteristics and the disability type instead of the current uniform policy.

Keywords: barrier-free transportation, people with disabilities, mobility, regional characteristics, Japanese local city, large scale survey

INTRODUCTION

In Japan, the Barrier-Free Transportation Act has come into force since 2006. However, we cannot really understand the mobility of the people with disabilities because the limited sample number when aggregating for the disabled people on the basis of the normal person trip surveys.

In 2009, a large scale survey was conducted by TTRI on the mobility of people with disabilities in Toyota City. This study is to report the analysis results on the relations among the mobility of the disabled people and the regional characteristics et al.

REVIEW OF PREVIOUS STUDIES

Regarding the mobility of the people with disabilities in Japan, there have been some studies up to now. For example, Akiyama (1983) tried to analyse the relations between the walking ability and the possibility making use of the different travel modes by considering the walking ability is closely related with the disability types and the influence levels. Furthermore, he had tried to understand the trip frequencies by the influence levels for the mobility through the questionnaire survey in that study. Then, Akiyama (1991) made the trip frequencies for the different purposes in the daily life being clear by focusing on the differences among the abled people and the different disabled people groups. Kimura et al. carried out a survey to understand the differences among the trips of the abled people and the disabled people. He discussed the problems and issues on the transportation facilities including the public transportation system after having confirmed that the trip frequency of the disabled people is extremely less than that of the abled people. All above studies told us that the trip frequency of the disabled people is less than that of the abled people, and the differences could be seen among the disabled people by the disability types and the influence levels. On the other hand, Hoshino et al. tried to model the intention structures of the physically disabled and the visually impaired people by using DEMATEL, which stands for DEcision MAKing Trial and Evaluation Laboratory (please refer to Falatoonitoosi el. for detail), and then made some proposals for the improvement of the transportation facilities in order to improve the mobility of the disabled people. Furthermore, in the studies on the working and living lives of the people with disabilities made by Suzuki et al. (1997a, 1997b, 1998), the travel activities between the home and the working place for the people with the mental disability, including the travel modes and so on, have been made clearly.

Summarizing the above review, regarding the mobility of the people with the disabilities in Japan, some research outputs have been published. The ability to travel by the disability types, the issues on the transportation facilities and the analysis in terms of the trip purpose and so on have been made understood step by step. However, because there are not enough large sample which is a common topic remained by the previous studies, there is few studies on the analysis in the viewpoint of the regional characteristics where the disabled people are living.

OUTLINE OF THE SURVEY IMPLEMENTED

As shown in Table I, all disabled people in Toyota City, who have been officially registered by the city government, had been considered being the objective group. It resulted that 2,511 persons were randomly selected from 11 thousands of disabled people according the disability types and the living areas but at least 20 samples should be selected respective with each category. The mail distribution and mail collection methods (including some

answers by emails) were adopted. Finally, 1,301 samples have been obtained and the effective collection rate was 52%.

Table I – Outline of the questionnaire survey implemented

Objectives	The persons with the disability (physically and mentally) who are living in Toyota City.
Sampling method	2,511 persons had been randomly selected from all 11 thousands of disabled people according to the disability types (7 in total) and the living areas (12 in total) but at least 20 samples should be selected respective with each category (84 in total). The final sampling rate is 24%.
Date of survey	March, 2009
Survey method	Mail distribution and mail collection including some emails
Collection result	The effective collection number is 1,301 and the final collection rate is 52%.

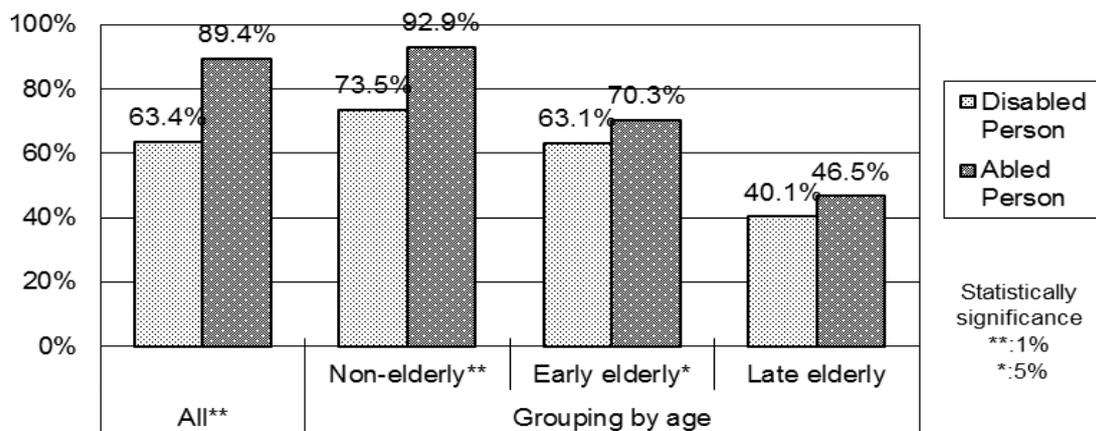


Figure 1 – Comparison of percentages for the disabled persons and the abled persons going out

To make the comparatively statistical analysis, the currently used person trip survey data, which is the Fourth Chukyo Metropolitan Person Trip Survey having been conducted in 1991, was used regarding the activities of the abled people. This comparison with the abled people was an introductory part. According to the MLIT (2010), there are big differences with the barrier-free or universal measures introduction among the three regions: city centre, city, and suburbs. Therefore, in this study, the analysis related with the regional characteristics was based on three regions. Here, because the above person trip survey did not cover all regions of Toyota City but only the centre and city regions, the data for the disabled people have been limited to the same two regions for the comparative analysis.

Figure 1 shows the percentages of going out, the mobility in another word. It means that the persons leave their home and have some activities outside. The average percentage for the disabled people is 63.4% that is about 80% of that (89.4%) for the abled people. To see in detail by the age, respective with all three age groups, those for the disabled people are lower than those for the abled people. Among them, the difference of the non-elderly persons is 1% statistically significant. And that of the early-stage elderly persons is 5% statistically significant. Here, the “first-stage elderly” is defined being between 65 and 74 years old, and the “second-stage elderly” is defined being 75 years old and over as usually defined in Japan.

Figure 2 give the travel modes when the people go to the hospital. It is difficult to make the statistical tests here because the travel modes for the disabled persons were the multiple answers but those for the abled persons were the main travel mode of the respective trip. However, generally, we can know that the share of the “private car self driving” for the disabled persons is less than half of that for the abled persons. Furthermore the shares of the “private car driven by someone else” and the “taxi” are quite higher than those for the abled persons.

All these results are quite similar with those in the previous studies. In a summary, the disabled persons have the lower mobility level comparing with the abled persons. Furthermore, the travel modes of the disabled persons tend to depend on the supports of the other persons.

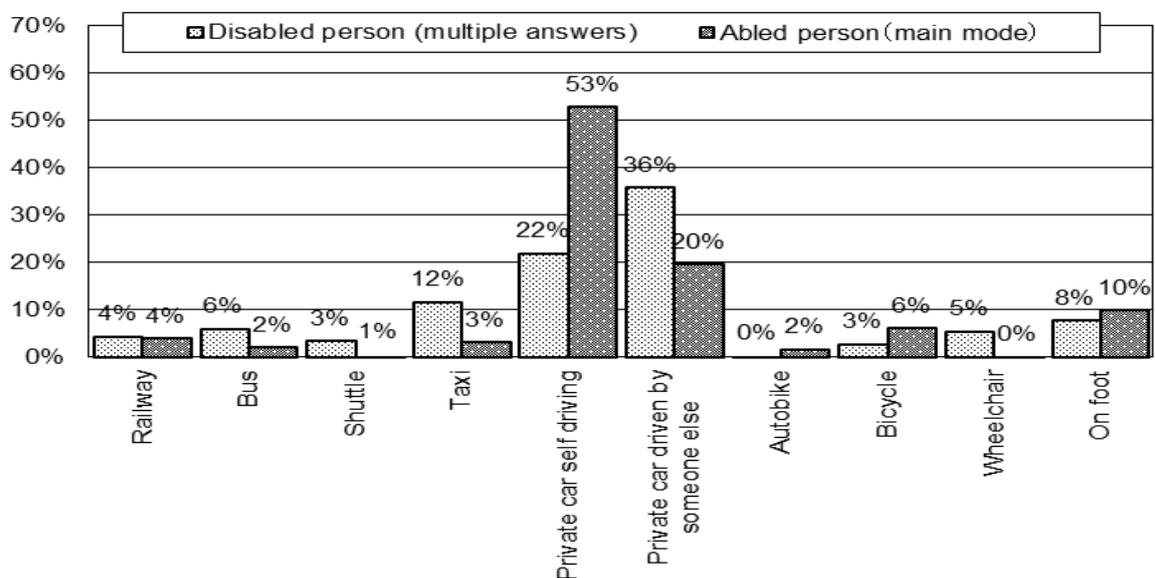


Figure 2 – Comparison of travel modes for the disabled persons and the abled persons when going to hospital

UNDERSTANDING OF THE DISABLED PEOPLE BY REGIONS

Classification of regions

As we mentioned in the above chapter, Toyota City mainly includes three regions: centre, city and suburbs as described in Table II. By using this classification, the detail analysis on the frequency, the travel purpose and other indicators of the mobility are carried out in the followings for the disabled persons.

Table III summarizes the outline of the disabled persons and the comparison with the abled persons regarding the aged people. The distributions of the disabled persons by the region are almost as same as the abled persons those are 27% versus 31% in the centre region, 63% in the city region and 9% versus 6% in the suburbs region. However, the percentages of the elderly people for the disabled persons are double or more than those of the abled

persons. The issues for the disabled persons regarding the elderly people are much more important than the abled persons.

Table II – Classification of objective regions

Classification	Geographic characteristics	Other characteristics
Centre	<ul style="list-style-type: none"> Area where the representative city facilities, such as main railway stations, city hall and central hospital et al, are located. 	<ul style="list-style-type: none"> Population density is high. There are two barrier-free model zones.
City area except centre	<ul style="list-style-type: none"> Near centre area but less city facilities and functions. Somewhere land use are mixed by residence, plants and farm fields. 	<ul style="list-style-type: none"> The population density is relatively lower but the percentage of the elderly is almost same with that in the centre. Belong to the urban planning area defined in terms of the Urban Planning Act.
Suburbs	<ul style="list-style-type: none"> Far from the centre with the higher percentage of the forest area. Population distributes in the wider area. 	<ul style="list-style-type: none"> The population density is low and the percentage of the elderly is high. Merged in 2005, only several years ago.

Table III – Number and the elderly people rate of the disabled persons by region

		Centre	City	Suburbs	All
Disability type	Visually impaired (person,%)	150 (1%)	330 (3%)	50 (1%)	530 (5%)
	Hearing impaired (person,%)	210 (2%)	430 (4%)	50 (1%)	690 (6%)
	Speaking impaired (person,%)	30 (0%)	30 (0%)	10 (0%)	70 (1%)
	Physically disabled (person,%)	1,090 (10%)	2,590 (24%)	410 (4%)	4,090 (38%)
	Internal breakdown (person,%)	700 (7%)	1,660 (16%)	240 (2%)	2,610 (24%)
	Intellectually disabled (person,%)	400 (4%)	1,030 (10%)	140 (1%)	1,560 (15%)
	Mentally disabled (person,%)	350 (3%)	660 (6%)	100 (1%)	1,110 (10%)
	Total (person,%)	2,920 (27%)	6,740 (63%)	1,010 (9%)	10,660 (100%)
Percentage of No. of the elderly people (%)		47%	46%	64%	48%
Population	Population (1,000 persons,%)	130 (31%)	268 (63%)	25 (6%)	423 (100%)
	Percentage of No. of the elderly people (%)	14%	15%	32%	16%
	Density (persons/ha)	33.1	8.5	0.4	4.6

Note: Numbers of the disabled persons are rounded at the ten's position. Population is about all citizens. () are the shares.

Situation of the mobility of the disabled people by region

In order to understand the mobility of the disabled persons, the average frequency of going out per week is used as the indicator. As shown in Figure 3, it is clear that the level of the disabled people' mobility living in the suburbs region are lower than that who are living in the centre region and the city region. The disabled persons are at the lower level and less about one day per week. And this difference is 1% statistically significant.

Regarding the car usages having the highest share in the above chapter, Figure 4 shows the percentages of the detail car usages situation by the region. On the basis of the chi-square test, there is no significant difference among the regions. Generally, about 30% of the disabled persons are able to drive and have the cars for their personal usages. In addition, about 30-40% disabled persons may make use the private cars driven by someone without limitation. Of all disabled persons, only about 10% cannot make use of the private cars.

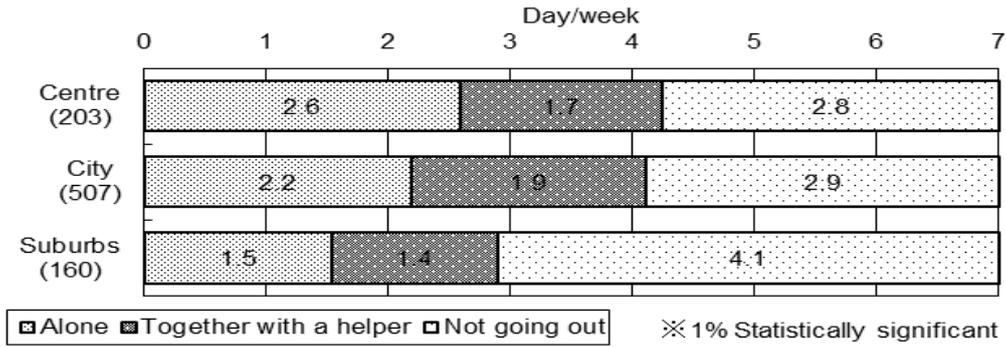


Figure 3 – Comparison of number to go out by the region

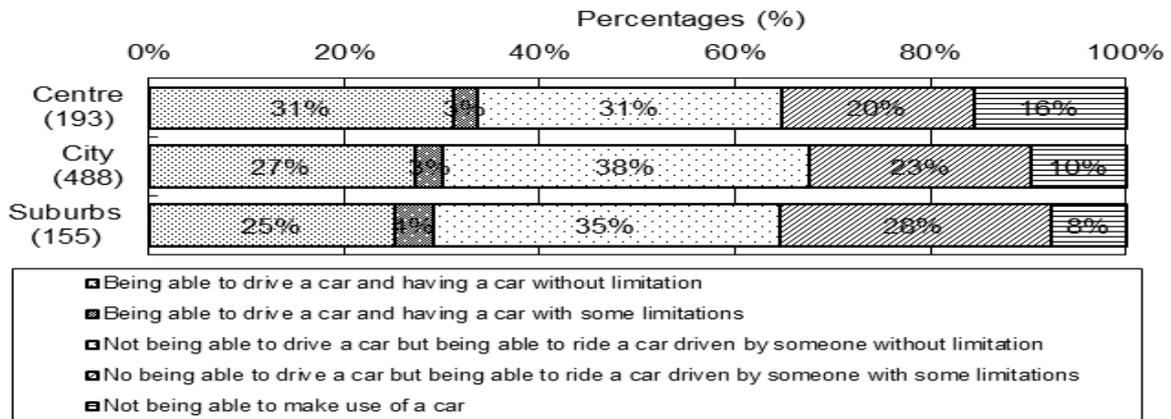


Figure 4 – Situation of possibilities to make use of the private cars

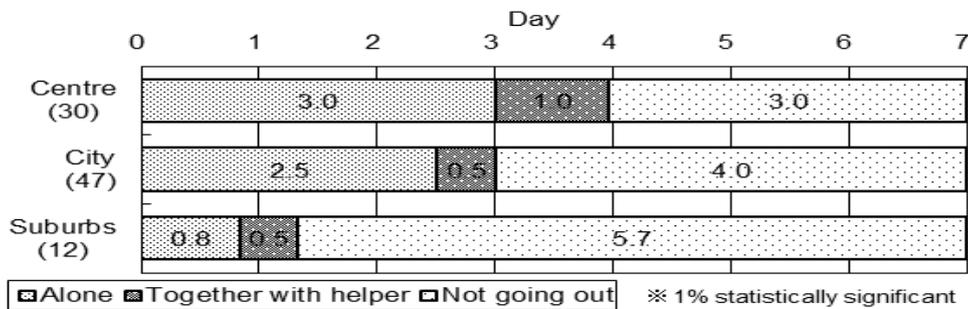


Figure 5 – Situation of going out for the people not being able to make use of a car

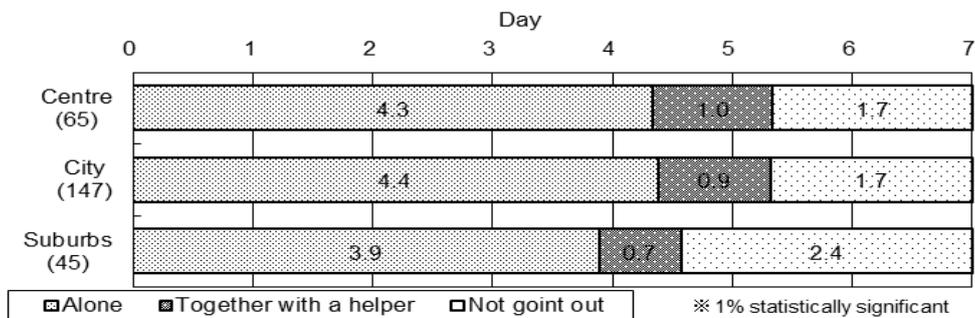


Figure 6 – Situation of going out for the people being able to drive a car

Furthermore, the detail analysis by grouping the disabled persons into two groups: the persons who are not able to make use of the private cars and the persons who are able to drive and have the private cars. On the group who are not able to make use of the private cars, the mobility is given in Figure 5. In terms of the chi-square test, there are statistically significant differences at the 1% significance level. Comparing with the suburbs region, the disabled persons living in the centre and the city regions have higher mobility level with a double number of days per week. As for the group who are able to drive and have the private cars, the aggregate results are shown in Figure 6. There are also statistically significant differences at the 1% significance level among the disabled persons living the different areas on the basis of the chi-square test. However, the differences are not as big as those of the first group shown in Figure 5.

Intentions of the disabled people for their mobility

To understand the mobility of the disabled persons deeply, the questions of the intentions about the different purposes were asked in the questionnaire. The answers are summarized in Figure 7. As the statistical analysis result, there are significant differences at 1% significance level. The results tell us that the disabled persons want to increase their number of times to go shopping and go to amusement facilities.

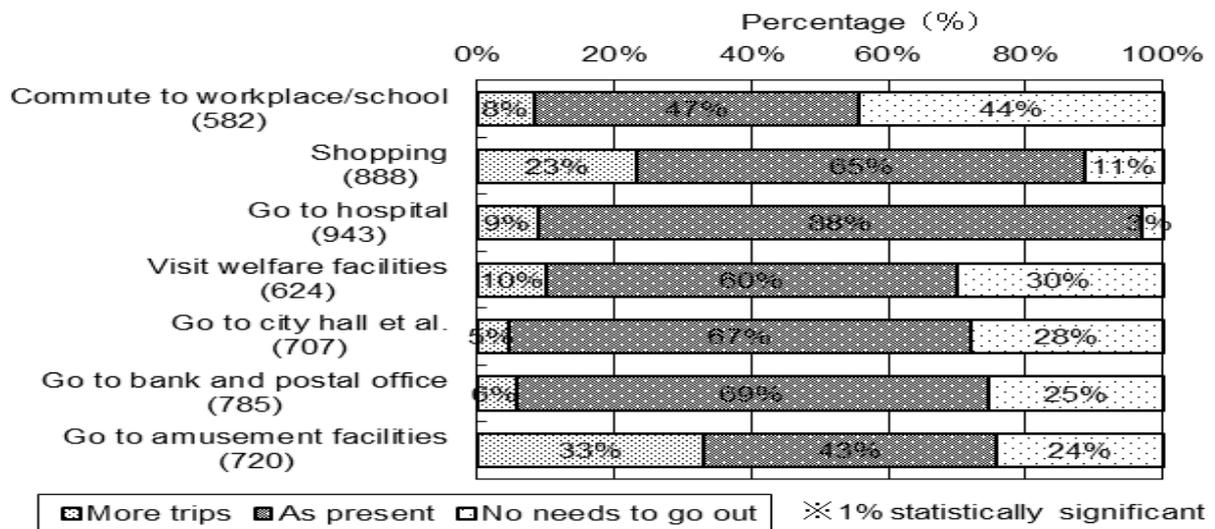


Figure 7 – Demand by the trip purpose

Surely the mobility to go the amusement facilities is also very important because it may bring the QOL (Quality of Life) level up for the disabled people. However, the mobility to go shopping is much more important because it is the necessary activity for the daily lives of the disabled people. So that the further detail analysis has been made and the results are shown in Figure 8 and Figure 9.

Figure 8 shows the intentions for go shopping and the average number of times as the reference. There are not statistically significant differences among the different regions when the chi-square test was conducted. However, there are statistically significant differences

with the average numbers of times per month at the 1% significance level when the analysis of variance was carried out. The number of the disabled persons in the centre region is the biggest (9.2times/month) and the number of those in the suburbs region is the smallest (6.0times/month). On the other hand, the satisfactions by the region to go shopping, depicted by Figure 9, tell us there are not statistically significant differences based on the chi-square test. The most disabled persons gave the neutral answers in the questionnaire.

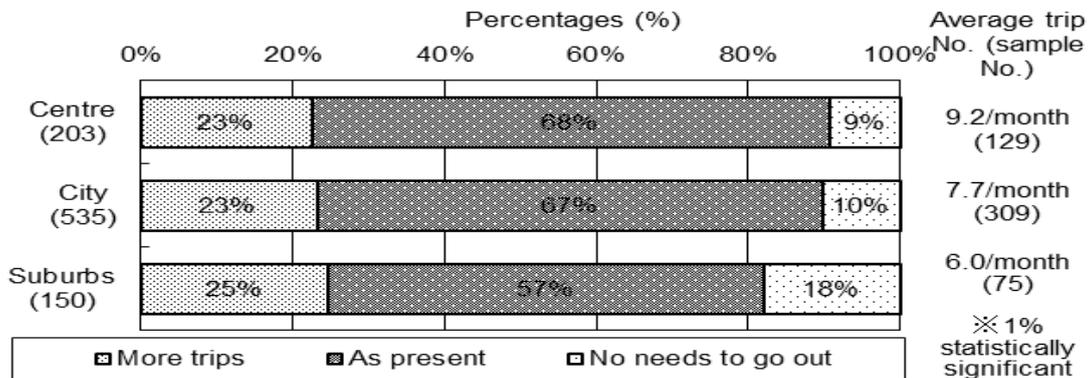


Figure 8 – Demand and the present situation by the region for shopping

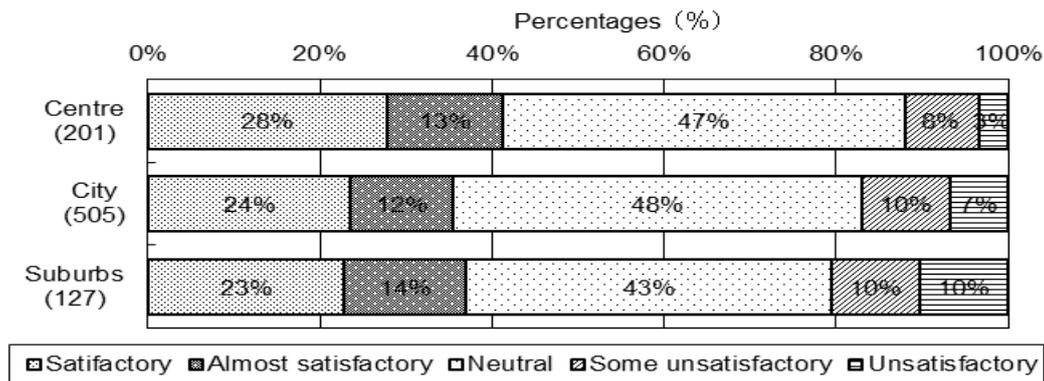


Figure 9 – Satisfactions by the region to go out for shopping

FACTORS AFFECTING THE MOBILITY OF THE PEOPLE WITH DISABILITY OF LEGS

In the prior chapter, the present situation of the mobility on the disabled persons was described and the analysis results by the living region et al have been summarized. One clear result is that living in the suburbs area has affected the mobility of the disabled persons. The further detail analysis is expected here. However, considering the disability type may make the impact factors be quite different, the further analysis is expected by the disability type. On the other hand, in order to make the analysis be statistically significant, the quite large samples are needed. Taking into the considerations of the relatively more samples of the disabled persons with the legs disability, this chapter is focusing on the mobility of the people with the disability of legs.

Outline of the disabled persons with the legs disability

There are 85 persons who answered having the legs disability. The outline is given in Table IV. The elderly rates are much higher than the average levels of the disabled persons. Especially, in the suburbs, this rate has been 90%. Another feature is that the percentage of the disabled persons who have the jobs is very low.

Table IV – Outline of the objective people with the leg disability

	No. of objective persons (person)	No. of the elderly persons (%)	No. of the persons being able of driving (%)	No. of the persons who are working (%)	No. of the persons who need tool to assist them (%)
Centre	24	63%	46%	21%	75%
City	40	65%	25%	15%	80%
Suburbs	21	90%	29%	5%	76%
Total	85	71%	32%	14%	78%

As what we did in the prior chapter, the intensions to go shopping and the present number of times are summarized in Figure 10. There are not the statistical significances among the regions because of too few samples. The disabled persons living in the suburbs region tend to increase the number of times to go shopping. This result is different with what we knew from Figure 8. One reason may be considered that the disability of legs had limited the mobility so that they had stronger demand intension. On the other hand, regarding the average trip numbers at present, as same as what we knew from Figure 8, the disabled persons living in the suburbs have smaller number.

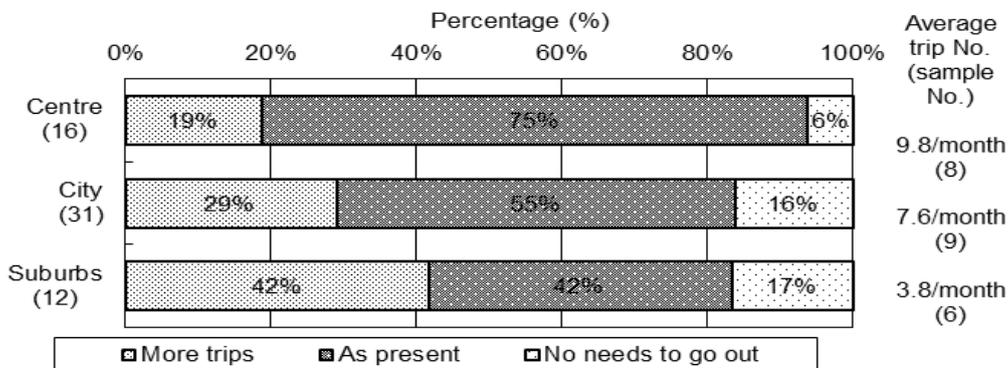


Figure 10 – Demand intension and present situation by region for the persons with leg disability

In order to understand what the people with the legs disability think about the limitations for their mobility, 10 limitations or so called barriers have been asked in detail by relating with their real lives.

Figure 11 shows the results by region on the causes not going out. On the basis of the chi-square test, there are not statistically significant differences among the regions because of the few samples. However, regarding the causes of “can't go out because no helper” and “can't go out because nobody drive the car”, there are quite large differences among the regions. This means that these two limitations of “no helper” and “nobody drive the car” have caused the persons with the legs disability who are living in the suburbs region not tend to go

out although these differences are not statistically significant. Furthermore, as the specialities of the persons with the legs disability, the barriers of “can’t go out because the environment is so bad that the wheelchair can’t be used”, “can’t make use of the public transport because the access environment is so bad that the wheelchair can’t be used” and “can’t make use of the public transport because the facilities” may be listed up. The more special results cannot be observed from Figure 11.

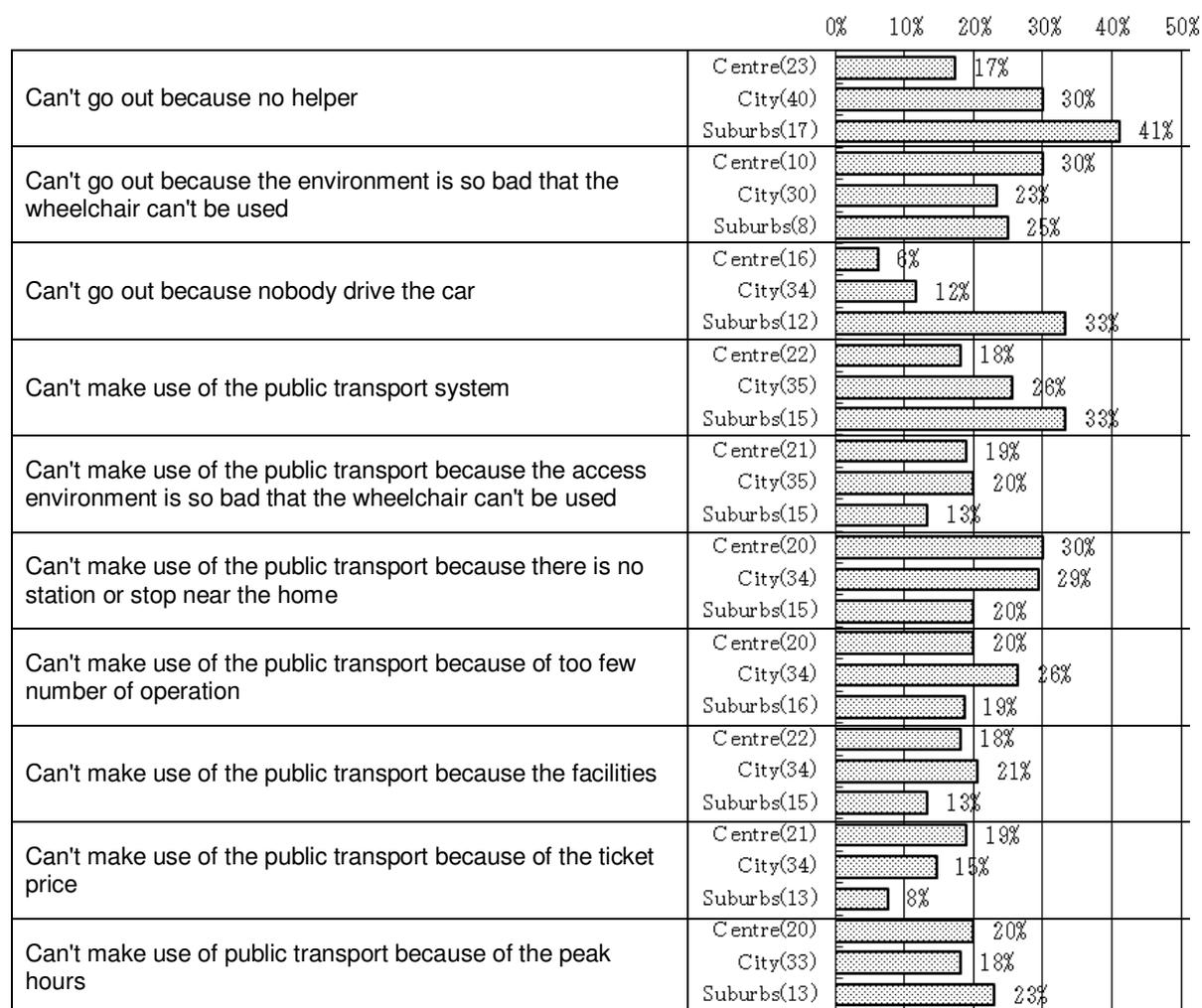


Figure 11 – Percentages not being out because of the barriers

Factor analysis affecting the mobility

As the results in the prior section show, the reasons/limitations/barriers have been made clearly to a certain degree. Meanwhile, it is very significant for the improvement of the transportation environment focusing on the mobility of the disabled persons to know what degree the factor may influence their behaviour.

To make the analysis more deeply on the impacts of the influence factors, the Quantification Method II, that is a method of multivariate discrimination analysis expanded to manipulate

attribute data as predictor variables or to analyse the relationship between several qualitative explanatory variables and a qualitative criterion variable (please refer to Hayashi for detail), has been applied here, where the. The external standard is defined as the frequency of going out by two categories: 3 days/week or less and 4 days/week or more on the basis of the nearly equal sample numbers. The explanatory variables are the region classification, “need a help or not when going out” and “whether can make use of private cars” in terms of the analysis results in the above. The analysis result of the Quantification Method II is given in the Table V. The Hit-ratio which expresses the precision of the mathematical model is 80% so that this result can be considered as a satisfactory analysis result.

In terms of the range, the explanatory variables of the “region” and “whether being able to make use of cars” show the same impacts for the mobility of the disabled people. Focusing on the category, the suburbs region makes the disabled people with the lower frequency mostly. Consequently, the “not being able to make us of cars” makes the negative impact for the mobility of the disabled people. That is, the factor of living in the suburbs region is the strongest impact for the mobility of the disabled people with the negative effect.

Table V – Factors affecting the mobility of the disabled people

Factors	Category	Low er frequency of outing	Higher frequency of outing	Range	Correlation coefficient
Region	Center(n=16)	-0.06		1.696	0.486
	City(n=26)		0.62		
	Suburbs(n=14)	-1.08			
Need help when outing?	Necesary(n=29)	-0.38		0.787	0.244
	Unnecesary(n=27)		0.41		
Whether being able to make use of cars	Being able to drive(n=16)		0.80	1.709	0.323
	Being able to ride(n=36)	-0.26			
	Not being able to make us of cars(n=4)	-0.91			
		Relation Rate	0.400	Hit-ratio	80.4%

SUMMARY AND CONCLUSIONS

In this paper, some analysis results are summarized on the basis of the survey implemented in Toyota City, a representative local city in Japan. This survey has been evaluated as the largest scale regarding the mobility of the disabled people in Japan although there are not still enough sample numbers.

As the similar results with the previous studied in Japan, it is confirmed that the mobility of the disabled people is quite lower than the abled people. Furthermore, as same as what happened with the abled people in the local cities, the private car using shares the most of the travel modes.

Regarding the mobility of the disabled people, the region being living has the strong impact. The disabled persons who are living in the suburbs region have given up some trips comparing with the disabled persons living the centre and city regions. Especially, the disabled persons expect to have more trips for shopping and going to the amusement facilities.

Focusing on the persons with the legs disability, both factors of the “region” and “whether being able to make use of the cars” have affected their mobility greatly. At a more detail sense, the “suburbs region” influences the mobility more negatively than the “not being able to make use of the cars”. It means that the regional characteristic has become the most impacted factor.

Our findings suggest the policies supporting the mobility of the disabled people should be studied in terms of the regional characteristics and the disability type instead of the current uniform policy that has been introduced in Japan.

ACKNOWLEDGEMENT

We gratefully appreciate the financial support of Foundation for Promoting Personal Mobility and Ecological Transportation that made it possible to complete this paper.

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