

ANALYSIS OF LOCAL RESIDENTS' MOVEMENTS FOR DAILY LIFE IN URBAN AREAS IN JAPAN

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ABSTRACT: In recent years, as Japan's urban population and the birthrate have declined as the population has aged, the number of vacant houses in urban centers has increased. This increase in house vacancy is an urban problem that is difficult to solve using conventional town and transportation planning methods. In particular, about local transportation, the number of elderly people who have difficulty traveling is increasing as public transportation services are being cut due to profitability issues. The purpose of this study was to clarify the issues affecting local transportation in daily life. The analysis considered residents' evaluations of public transportation and an assessment of residents' movements in Moriguchi City, Osaka Prefecture. The results of the analysis showed that residents' satisfaction with transportation services was correlated with the distance to the nearest train or metro station, but not to the nearest bus stop. Also, the transportation network may need to be redeveloped in the future because of differences in daily activities, even within Moriguchi City.

Keywords: Residents, Daily life, Local transportation, Public transportation, Transportation network

1. INTRODUCTION

In recent years, as the Japanese population has declined and aged, vacant houses and other underused or unused land have randomly appeared inside cities, causing economic decline and public safety problems [1]-[2]. On the other hand, even in areas where the population is concentrated, it is becoming difficult to maintain public transportation, as buses are being discontinued due to a decrease in the number of users. In addition, as the number of elderly drivers increases, traffic accidents have also increased, and the number of elderly people surrendering their driver's licenses is increasing, despite public transportation services often being inadequate. As a result, there are concerns about an increase in the number of people with low mobility. Furthermore, the spread of the coronavirus is expected to bring about major changes in the transportation environment in daily life, including changes in work styles and lifestyles. To date, local governments have subsidized the operation of local community buses, and demand-based transportation services [3]. It is necessary to develop a transportation system that is tailored to the specific requirements of residents to ensure that they can maintain their daily activities.

2. RESEARCH SIGNIFICANCE

The significance of this study is that by analyzing residents' evaluations of the current public transport system and their travel histories in Moriguchi City, Osaka Prefecture, it will clarify the

problems faced by local transport and provide basic information for improving the existing transport system. Most of the existing studies and surveys have focused on the large movements of the population and few have focused on the small movements. By focusing on small movements, it is possible to identify more specific problems and to use this information effectively.

3. METHODOLOGY

3.1 Target Area of Case Study

The study area is Moriguchi City, Osaka Prefecture (See Fig. 1). The city, which has a population of approximately 140,000 people and an area of 12.71 km², has been experiencing a decline in both population and economic activity since 1975. The city is served by trains, subways, and monorails. It takes about 15 minutes to travel from Moriguchi City to the center of Osaka City and about 35 minutes to Osaka Airport. In addition, private buses and local community buses run at a frequency of about one bus every hour [4]-[5].

3.2 Questionnaire Survey on Local Residents' Movements

Table 1 shows an overview of a questionnaire survey on residents' movements. The questions assessed whether respondents had a driver's license, private car, evaluation of their movements in the city, and their movement history. Based on data published by Moriguchi City, the city was divided

into eastern, central, and southern regions [4]-[5]. The evaluation results for daily movement and movement history were analyzed.

Table 1 Overview of a questionnaire survey on of residents' movements

Purpose	To understand the evaluation of residents' movements and the history of movements to examine the means of transportation for the future aging population
Study Area	Moriguchi City, Osaka Prefecture
Period	September 26, 2020 - October 19, 2020
Method	By mail
Target People	1,000 residents, aged 16 or older, randomly selected from the Basic resident register network system in Moriguchi City
Collection Results	1000 distributed 244 responses. 24.4% valid response rate

4. RESULTS & DISCUSSION

4.1 Results of Analysis of Residents' Movements

4.1.1 Evaluation of residents' movements in the city

As can be seen in Fig. 1, the questionnaire survey was conducted in Sep and Oct 2020. 1,000 questionnaires were distributed to residents of Moriguchi City in Osaka, Japan, and 244 responses were received. Figure 2 shows the personal attributes of respondents to the survey. A total of 59% of the respondents were "female," and 55% of the respondents were aged "60 or older". The percentage of respondents who "possessed a driving license" was 55%, and the percentage of those who owned a "private car" was 44%. A total of 39% of the respondents rated their movements in the city as "inconvenient" or "slightly inconvenient". As shown in Fig. 3, the number of respondents who rated transportation in the city as being "inconvenient" was 29% for "shopping", 19% for "going to the hospital", 18% for "getting from their home to the nearest station", and 16% for "entertainment/learning".

4.1.2 Attitudes of private car owners toward surrendering driver's license

Figure 4 shows the results of the questions on alternative means of transportation for private car

owners after they surrendered their license. Among the private car owners surveyed, 53% intended to return their license, of which 32% planned to do so "by the time they were 75 years old" and 64% "by the time they were 80 years old". After returning their license, their primary mode of transportation was to be "public transportation" for 37% of the respondents, followed by "cycling" for 19%, and "shuttle bus or lifts by family members" for 14%.

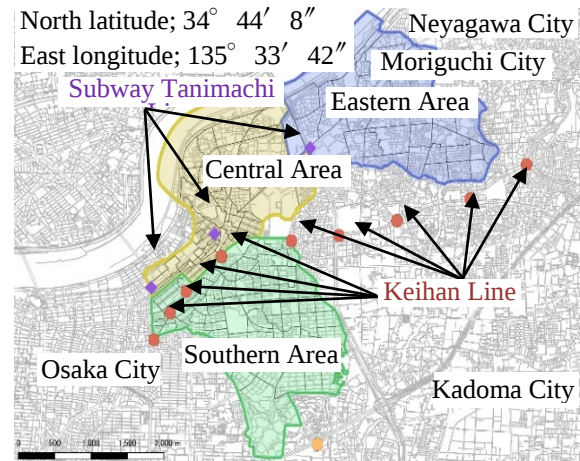


Fig. 1 The study area.

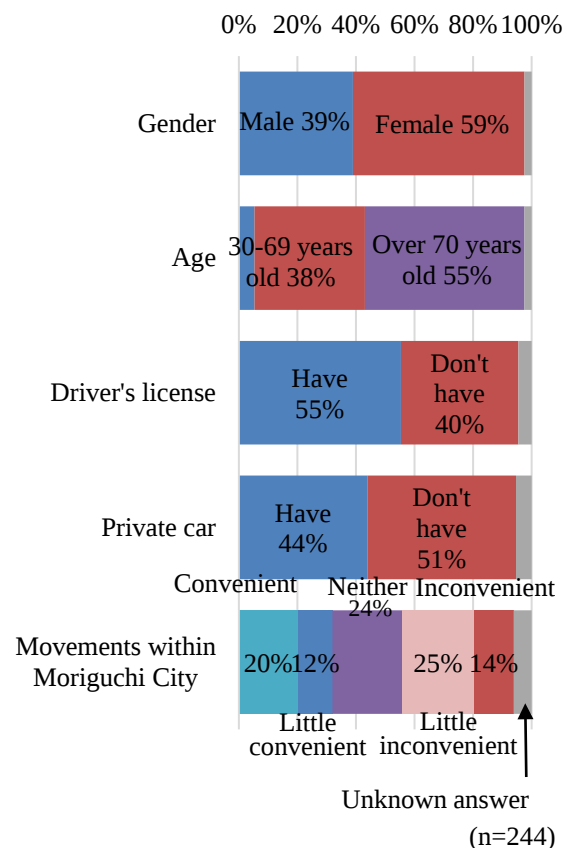


Fig. 2 The personal attributes of respondents.

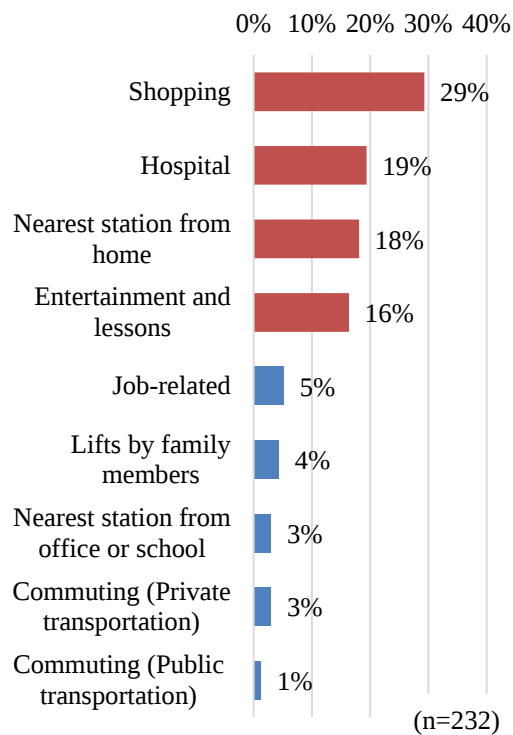


Fig. 3 The number of respondents who rated transportation in the city as being "inconvenient" / multiple answers.

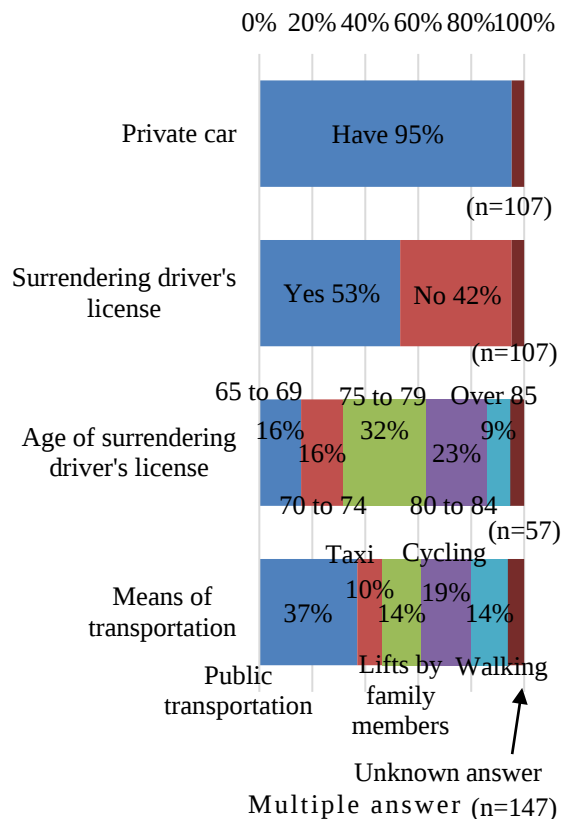


Fig. 4 alternative means of transportation for private car owners after they surrendered their license.

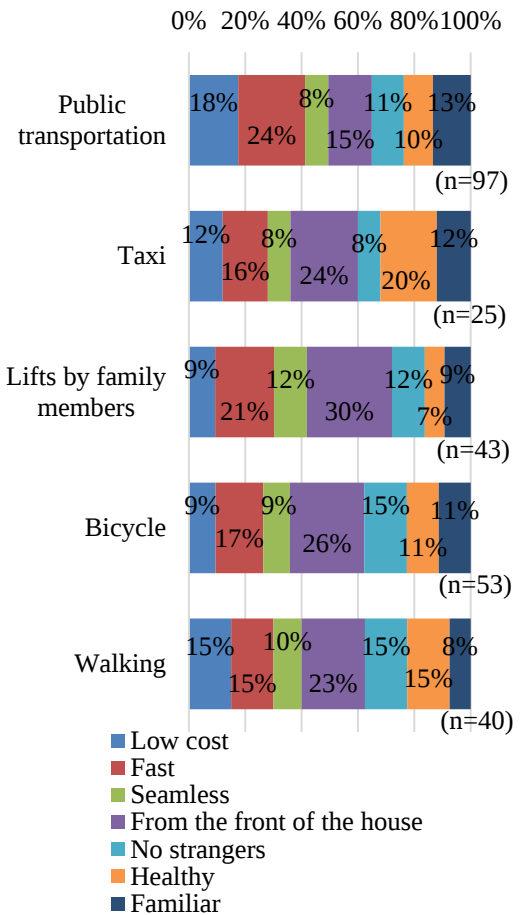


Fig. 5 Reasons why private car owners selected these alternative means of transportation after surrendering their license. (Multiple answers)

Figure 5 shows the reasons why private car owners selected these alternative means of transportation after surrendering their license. Most of the respondents emphasized "short travel time" and "catching transportation immediately in front of home". Those who selected public transportation placed more importance on "short travel time", while those who selected "taxi", "lift by family members", "cycling", and "walking" placed more importance on "being able to travel immediately from in front of the home".

4.1.3 Evaluation of travel within the city by distance to the nearest station

Figure 6 shows the ratings obtained for the "convenience" or "inconvenience" of travel in the city as a function of distance from home to the nearest train station. The number of people who rated the distance from their home to the nearest station as "inconvenient" exceeded the number of people who rated it as "convenient" when the distance was between 600 m and 800 m.

Figure 7 shows a map of the “inconvenient” or “convenient” responses to travel by area. In the Eastern Area, most respondents rated travel within the city as being “inconvenient”. This was because the average distance to the nearest station in the Eastern Area was more than 1000 m. Further, the only options available to residents in the Eastern Area are the subway located near the border with the Central Area, or the train station in Kadoma City, which lies outside Moriguchi City.

In the Eastern Area, only a few stations exist, and all stations are located near the boundary of the Central Area. Consequently, those residents who live near the stations tend to rate travel within the city as “convenient”, while many other people rate it as “inconvenient”.

In the Central Area, more respondents rated it as being “convenient” than “inconvenient”. This may be since there are many subway stations in the area, and the distance between the residential area and the train station is shorter than it is in other areas.

4.2 Analysis results of residents' movements

4.2.1 Purpose of travel in three areas of Moriguchi City

Figure 8 shows the purpose of travel for trips in Moriguchi City only. And a map of the purpose of travel for trips on weekdays and holidays is shown separately on the map in Fig. 9 and Fig. 10, respectively.

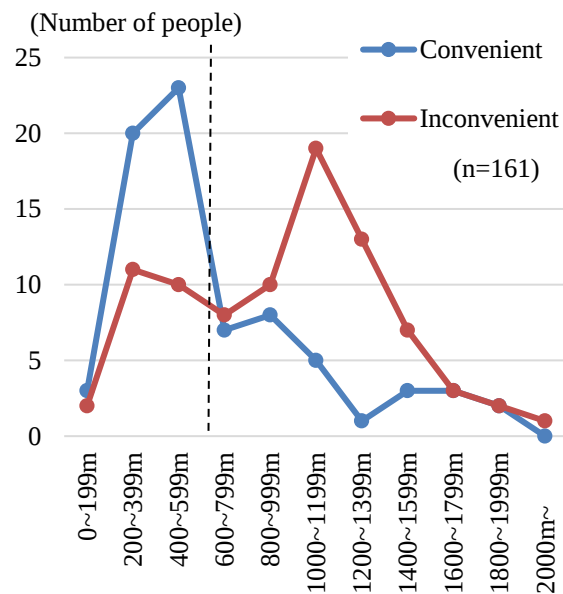


Fig. 6 The ratings obtained for the convenience or inconvenience of travel in the city as a function of distance from home to the nearest train station.

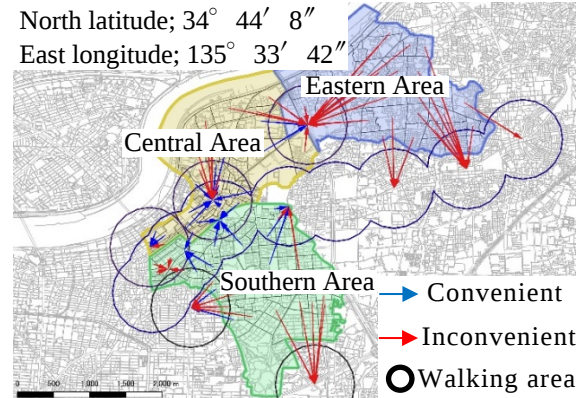


Fig. 7 Map of the inconvenient or convenient responses to travel by area.

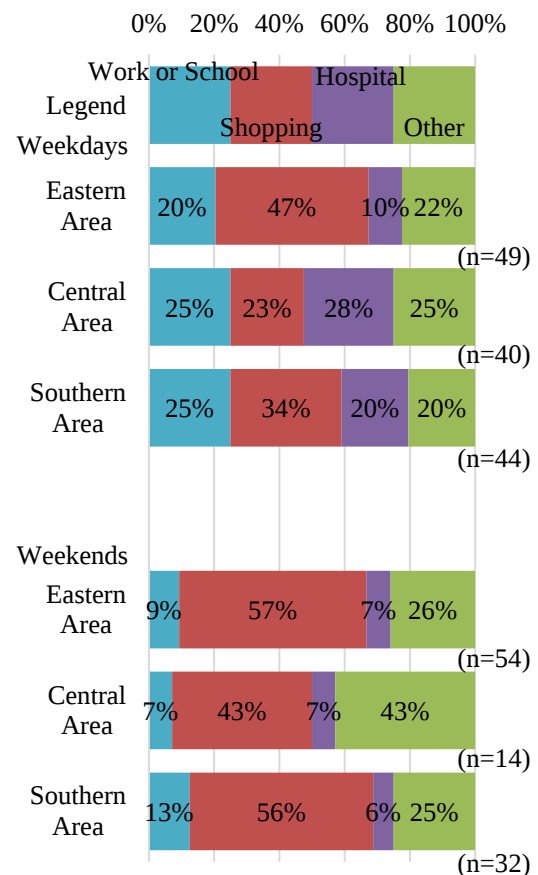


Fig. 8 Purpose of travels in Moriguchi City only.

As shown in Fig. 8, “shopping” was the most common reason for travel on weekdays in all areas, followed by “commuting to work/school” and “going to the hospital”. On weekends and holidays, “commuting to work/school” and “going to hospital” decrease, and “shopping” accounts for half of all trips. “Shopping” was the most common activity in the Eastern Area, where there is a large commercial district, and in the Southern Area, where there are

numerous department stores. "Hospital visits" was the most common activity in the Central Area, where there are several regional hospitals.

Figures 9 and 10 show the following trends in travel to particular areas. On weekdays, most of the residents in Moriguchi City went to the Central Area for "hospital visits", accounting for 44% of the total. Of these, more than 60% traveled to Matsushita Memorial Hospital. On weekdays, most "commuters" in respondents in Moriguchi City travel to the Southern Area around Moriguchi Station, accounting for 35% of all commuters in respondents. On weekends and holidays, most of the respondents went "shopping" at Dainichi Aeon Mall in the Eastern Area and Keihan Department Store in the Southern Area.

4.2.2 Representative means of transportation in Moriguchi City

Figure 11 shows the representative means of transportation in Moriguchi City by arrival point, and Fig. 12 and Fig. 13 shows that for travel by "train", "subway" and "private car" for weekdays and holidays.

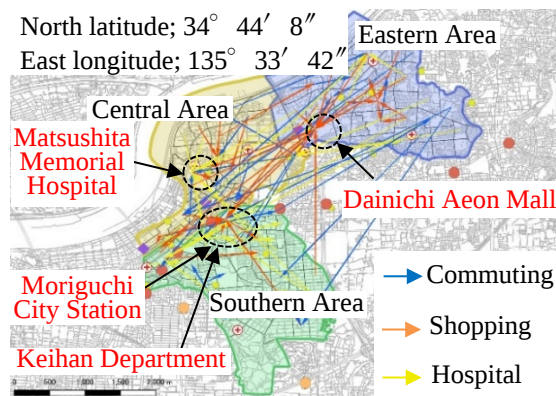


Fig. 9 Map of the purpose of travels on weekdays.

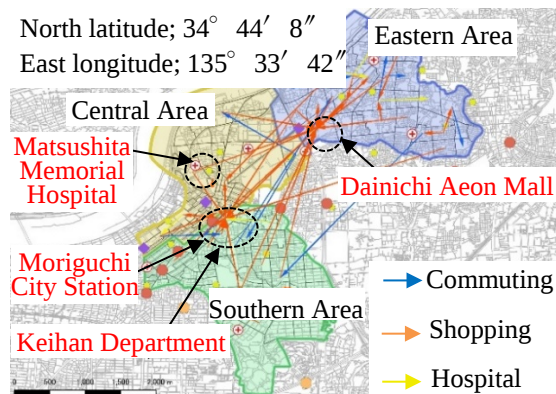


Fig. 10 Map of the purpose of travels on weekends.

As shown in Fig. 11, "cycling" and "walking"

account for about 60% to 70% of the means of transportation in all areas on weekdays and holidays. In addition, for both weekdays and holidays, there were more trips by "private car" to the Eastern and Central Areas than to the Southern Areas. The combined usage rate of "train" and "subway" was about 10% on weekdays and about 5% on weekends.

Figures 12 and 13 show that on weekdays, travel by "private car" was more likely to arrive at Matsushita Memorial Hospital in the Central Area and Dainichi Aeon Mall in the Eastern Area in respondents. On weekends, travel by "private car" was more likely to visit Dainichi Aeon Mall in the Eastern Area and Keihan Department Store in the Southern Area in respondents.

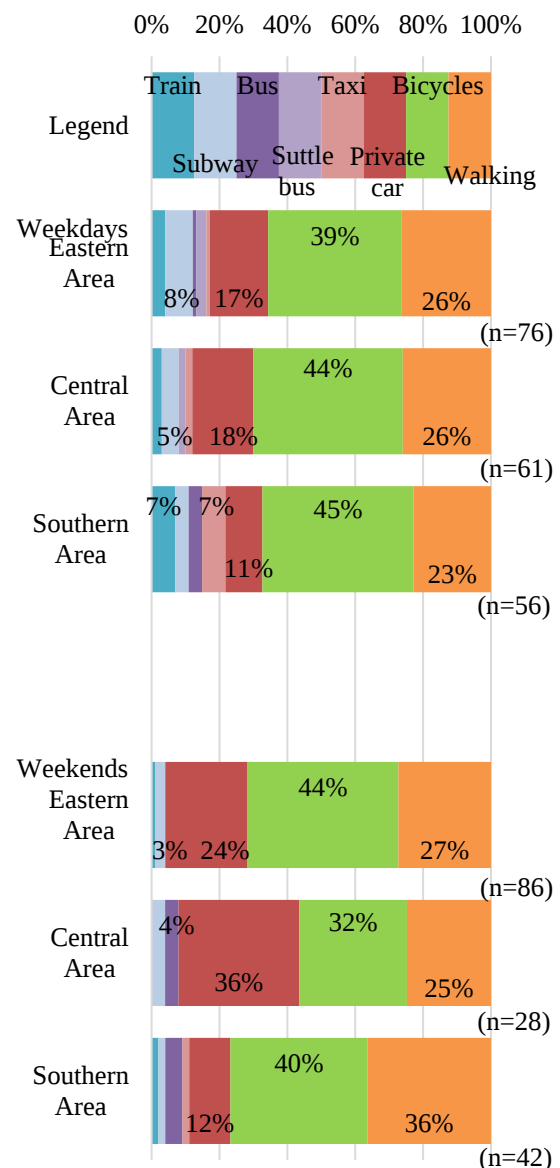


Fig. 11 The representative means of transportation in Moriguchi City by arrival point.

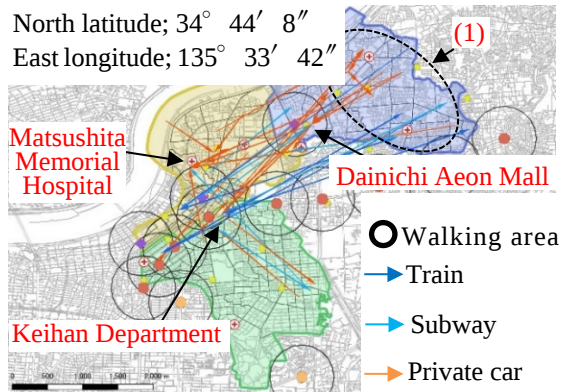


Fig. 12 Map of travels by train/subway and private car in Moriguchi City on weekdays.

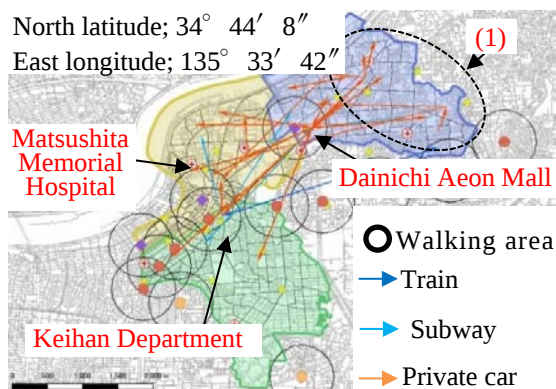


Fig. 13 Map of travels by train/subway and private car in Moriguchi city on weekends.

On weekdays, respondents that used the “train” tended to visit the areas between the Eastern and Southern Areas of the city, while respondents that used “private car” tended to move along the main street. 50 percent of the respondents that used the “train and subway” in the Eastern Area traveled from areas outside a 500 m radius of the train and subway stations, and about 60% of the respondents that used “private car” also traveled from areas outside a 500 m radius of the train and subway stations. Based on this result and the fact that the majority of the respondents will surrender their driver's license in the future, as shown in Fig. 4, it is necessary to secure a new means of transportation for the zone (1) in the Eastern Area, because it will be difficult for these residents to move around in the future.

4.2.3 Transportation to the nearest station to get to Osaka City

We then examined “traveling from Moriguchi City to Osaka City”, which is the most popular destination for commuters “going to work or school” on weekdays. Most travels on holidays were for

“entertainment” or “sightseeing”. Figure 14 shows the results for “travel to Osaka City” on weekdays and weekends and the means of transportation used. Figure 15 shows the mode of travel used to get to the nearest station to travel to Osaka City on weekdays and weekends combined, and the percentage of elderly people in 2035 by area.

Figure 14 shows that the most used mode of transport in all areas are “the train and subway”. In the Eastern Area, the percentage of respondents who used “the subway” to travel to Osaka City was the highest, at 52%. On the other hand, in the Southern Area, which is relatively close to Osaka City, more people use “cycling” than in any other area, at 26%.

Figure 15 shows that in the Eastern Area, most people used Dainichi Station on the Osaka Metro; in the Central Area, most people used stations on the Osaka Metro; and in the Southern Area, most people used stations on the Keihan Line.

For the Eastern Area, in particular, accessibility to both stations will need to be improved in the future because the future percentage of elderly people in the entire Eastern Area is estimated to be 42% and 52% of subway and rail users, respectively [6].

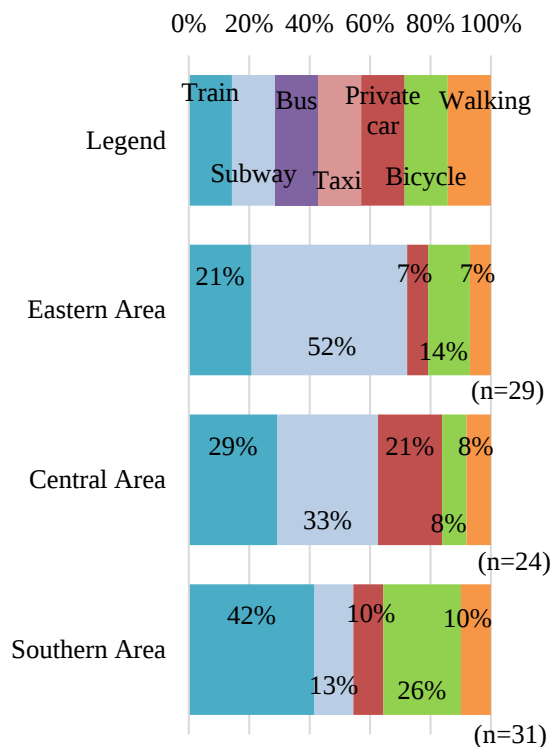


Fig. 14 The means of transportation used for “travel to Osaka City” on weekdays and weekends combined.

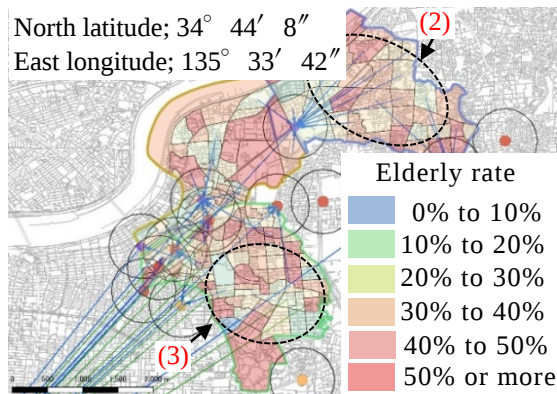


Fig. 15 The means of transportation used for “travel to Osaka City” on weekdays and weekends combined, and the percentage of elderly people in 2035 by area.

These people travel from areas outside a radius of 500 m from Osaka Metro Dainichi Station and Keihan Line Owada Station (See Fig. 15 (2)). On the other hand, in the Southern Area, the percentage of people traveling to the nearest station from areas outside a 500 m radius of the train or subway station is 29%, which is less than that in other areas. However, since the future aging rate for the entire Southern Area is estimated to be 40%, those respondents who currently travel to Osaka City by cycling from areas outside a 500 m radius of a train or subway station may have difficulty in doing so due to aging or other reasons (See Fig. 15 (3)). Therefore, it is considered that accessibility to train and subway stations will need to be improved in the Southern Area in the future.

5. CONCLUSION

In this study, we were able to clarify the following by analyzing the current movements of residents in Moriguchi city.

- The number of people who rated the distance from their home to the nearest station as “inconvenient” exceeded the number of people who rated it as “convenient” when the distance was between 600 m and 800 m.
- On weekdays, “shopping” was the most common reason for travel in all areas, followed by “commuting to work/school” and “going to the hospital”. On weekends and holidays, “commuting to work/school” and “going to hospital” decrease, and “shopping” accounts for half of all trips. On weekdays, most of the residents in Moriguchi City went to the Central

Area for “hospital visits”, accounting for 44% of the total. Of these, more than 60% traveled to Matsushita Memorial Hospital.

- In the Eastern and Southern Areas, accessibility to stations and subways will need to be improved in the future, as the aging of the population and other reasons may make it difficult to get around.

In the future, we would like to accumulate data on actual travel conditions and analyze changes in the number of trips and the residents’ movements to consider the most sustainable means of transportation for Moriguchi City. In doing so, we hope to ensure that the transportation needs of the transportation-weak are met in an aging society.

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