

Enhancing Subjective Well-being in a Super-aging and Solitary Society: Insights from Household and Mobility Analysis

Yuji Takeguchi, Ayako Suzuki and Soushi Suzuki

Abstract

Phrases “increase in unmarried rate” and “high mortality society” have got attention in recent years in Japan. These trends mean that the number of older individuals living in single-person households will grow and will be increased vulnerability from the viewpoint of lose means of transportation in the future. These situations indicate that Japan is moving from a “super-aging society” to a “super-aging and solitary society”. Even under such difficult circumstances, it is necessary to implement sustainable regional development. Based on these backgrounds, this study especially focused on the issue of "means of transportation" which is already one of a major issue in the super-aging society among the issues predicted to arise in a super-aging and solitary society. This study clarifies the issues of “super-aging and solitary society” based on the analysis that subjective well-being (SWB) as an objective variable and focused on household structure and transportation attributes. The subject of this study set Abashiri city in Hokkaido prefecture where is a region with challenges related to aging and population decline. This study used datasets based on questionnaire survey for Abashiri city inhabitants in 2022. The analysis results revealed that the SWB of older individuals living in single-person households is statistically significantly lower than couple household and household with children. The analysis result also revealed that the SWB of lose means of transportation household is statistically significantly lower than other households. Moreover, this study utilized quantification theory type I to set SWB as the objective variable and to analyzed the category scores of household composition and transportation attributes. Based on these category scores, this study carried out a simulation analysis on SWB. In addition, this study conducted a future simulation analysis of total amount of SWB in Abashiri city based on the category scores as well as future estimated results of the lifetime unmarried rate and mortality rate. The simulation analysis result revealed that decline SWB overall Abashiri city caused by an increase in older individuals living in single-person households with poor means of transportation. On the other hand, it was suggested that in cases of public transportation and other services were increased, it may be possible to maintain or increase the SWB of overall Abashiri city.

Keywords: Subjective well-being (SWB), super-aging and solitary society, older individuals living in single-person households, transportation attributes

JEL: R20, R40, J14

Acknowledgment: This paper was previously presented in Japanese with the title “A study of subjective well-being focused on household and type of mobility in “super-aging and single society” in the 61st Annual Meeting of the JSRSAI (2024), and later modified for ERS2026.

1. Background and Aims of the Study

By 2030, Japan will transition to a “super-aging and solitary society.” This concept is newly defined in this study and refers to a society that satisfies the criteria of a super-aging society while exceeding a 21% ratio of older individuals living in single-person households within the older population. The threshold of 21% for older individuals in single-person households is set in accordance with the compositional requirements for individuals aged ≥ 65 years in a super-aging society. In this type of society, the proportion of older individuals with health and mobility concerns is expected to increase, and a significant number of these individuals will likely live alone without family support. Such a societal condition is not desirable from the perspective of welfare or regional sustainability. Older individuals who live alone primarily fall into two categories: those who reach the age of 65 without marrying and those who become single through divorce or the death of a partner. The former category of individuals is increasing due to the rise in lifetime unmarried rates, and the latter is increasing due to a “high mortality society.” Thus, Japan will inevitably transition into a “super-aging and solitary society.” Even under such difficult circumstances, implementing sustainable regional development and ensuring a happy life for individuals are necessary. Accordingly, this study aims to provide insights into the construction of regional systems that enable older individuals in single-person households to actively participate in social activities as community members and live happily without anxiety about the future. This study focused on the issue of “means of transportation,” which is a major challenge in super-aging societies and is expected to be a considerable problem in a super-aging and solitary society. This study clarifies the challenges of a super-aging and solitary society based on the analysis of subjective well-being (SWB) as an objective variable and focuses on household structure and transportation attributes. In summary, this research addresses the enhancement of SWB in a super-aging and solitary society while exploring transportation policy measures for sustainable regional development.

2. Review and Research Framework

To clarify the positioning of this study, we reviewed the literature on SWB. According to Ishii (1997), SWB has been widely investigated in Western countries since the 1960s. Ishii (1997) provides a comprehensive review of SWB, classifying the relevant literature into three main categories: studies on scales for measuring SWB, studies on the structure of SWB, and studies on the relationships between SWB and various independent variables or theoretical models. This study aims to extract the factors necessary to enhance SWB by exploring household composition and transportation attributes, corresponding to the third category of studies identified by Ishii (1997). This review will assess research on the relationships and theoretical models concerning SWB and various independent variables. Choe et al. (2021) examined the content of social participation among older individuals, demonstrating that community-based organizational activities, such as neighborhood associations, have statistically significant effects on SWB. Kinoshita et al. (2021) conducted a survey targeting older individuals and found that participation in activities (measured using the Self-completed

Occupational Performance Index) contributes to SWB for both early-stage older individuals (aged 65–74) and late-stage ones (aged 75–84). Hashimoto et al. (2022) identified the characteristics of individuals who possess a “third place” and found that those who have such places to visit from their workplaces exhibit higher SWB than those who do not. Yamashita et al. (1992) analyzed the morale scale scores of older individuals and showed that those living alone have significantly lower SWB than those living with others. Furthermore, Nagata et al. (1999) analyzed factors related to the SWB of late-stage older individuals. Keumi (2021) showed that many existing studies indicate a positive relationship between daily mobility and SWB. However, these studies often focus on hedonic SWB, which reflects momentary well-being such as comfort; the relationship between mobility and eudaimonic SWB, which reflects long-term well-being, remain underexplored. These reviews demonstrate that factors related to social participation, such as community-based organizational activities, activity participation, and third places, have established associations with SWB. However, research on the relationships between household structure or transportation attributes and SWB are relatively underdeveloped. Considering these gaps, this study focuses on household composition and transportation attributes to analyze eudaimonic SWB.

The analysis in this study is structured into four phases:

Phase 1: Categorization of Transportation Attributes.

The categorization method employs the concept of “combinations of available transportation modes” proposed by Takeguchi et al. (2023), which considers the availability and context of transportation choices. This method can effectively analyze the relationship between eudaimonic SWB and transportation attributes (Chapter 4).

Phase 2: Significance Testing for SWB between Each Category.

This study conducts significance tests to identify factors with significant impacts on SWB, employing household composition and transportation attributes as explanatory variables (Chapter 5).

Phase 3: Quantification of Category Scores

Next, we apply quantification theory type I with age, household composition, and transportation attributes as explanatory variables to quantify category scores for SWB (Chapter 6).

Phase 4: Simulation Analysis of Future SWB

Category scores calculated in Phase 3 are used to conduct simulation analyses of future SWB. These analyses include population dynamics-based simulations as well as sensitivity analyses using with-and-without approaches to assess the quantitative effects of transportation policy interventions (Chapter 7).

This study comprehensively analyzes eudaimonic SWB by focusing on household composition and transportation attributes; further, it conducts simulation analyses to quantify future SWB and assess policy impacts. Such an integrated approach addresses the gaps identified in the literature and highlights the novelty and utility of this research in the field of SWB. Additionally, the findings have practical implications for developing regional systems centered on transportation

policies to support a super-aging and solitary society.

3. Analytical Target and Dataset

3.1 Selection of the Analytical Target

This study selects Abashiri City in Hokkaido as the analytical target region (data collection area). Hokkaido is considered a pioneer in tackling population- and aging-related issues because its population decline and aging are progressing approximately 10 years ahead of Japan’s national average. Additionally, due to Hokkaido’s vast geographical area (22% of the total area of Japan) and snowy, cold climate, the region experiences significant transportation challenges, making it a leading area for addressing mobility issues (Takeguchi et al 2021).

Abashiri City—situated in the northeastern part of Hokkaido, in the Okhotsk region—serves as a central urban area with essential public services, including administrative offices, universities, and general hospitals. However, similar to other small and medium-sized cities, it is experiencing population decline and aging. An essential component of maintaining the settlement functions of Abashiri City and surrounding municipalities is developing a region where residents can live happily, which can be enhanced by addressing transportation and other basic needs.

Table 1 presents data on the population structure of Japan, Hokkaido, and Abashiri City based on the 2020 national census and statistics published by the National Institute of Population and Social Security Research (2023). Table 1 shows that as of 2020, all three regions fulfill the criteria for a super-aging society, with the proportion of older individuals exceeding 21%. Regarding the proportion of older individuals living in single-person households, the national average is 18.6%, whereas the proportions in Hokkaido and Abashiri City already exceed 21%. The national proportion of such households is projected to exceed 21% by 2030, indicating that Hokkaido and Abashiri City are 10 years ahead of the national trend in terms of both population and household structure. Given these characteristics, analysis of Hokkaido and Abashiri City can provide insights for investigating issues related to population, mobility, and household composition.

Table 1. Summary of Population Structure

Category	Total Population	Population Aged ≥65	Aging Rate (%)	Proportion of Older Individuals Living in Single-Person Households (%)		
Year	2020	2020	2020	2020	2025	2030
National Average	126,146,099	35,335,805	28.0%	18.6%	20.6%	21.5%
Hokkaido	5,224,614	1,663,023	31.8%	21.5%	23.0%	24.0%
Abashiri City	35,759	11,259	31.5%	21.1%	22.8%	24.4%

3.2 Dataset

This study analyzes data collected from a citizen survey conducted in Abashiri City in 2022 by the Hokkaido Tourism Organization. The survey primarily targeted residents in urban areas of Abashiri City, where public transportation is relatively well-developed. The city offers diverse transportation

options, including regular bus services operated by Abashiri Bus Co., Ltd., and shared mobility services using AI-based dispatch systems, such as the “Doko Bus.” Table 2 summarizes survey details.

Table 2. Overview of the Survey

Survey Period	October 2022	Distribution Area	Urban areas of Abashiri City
Distribution Method	Mail	Number of Households that Received Questionnaires	2,250 households
Number of Responses	762 (33.9%)	Responses Received from Older Individuals (%)	440 (19.6%)

3.3 Data Summary

3.3.1 Subjective Well-being

This study adopts SWB as the key performance indicator for analysis. To measure SWB, the survey employed a simple question: “Do you think you are happy?” Respondents rated their level of happiness on a 5-point Likert scale: 5 (*agree*) to 1 (*disagree*). Figure 1 illustrates the distribution of SWB scores among respondents who were older individuals, showing that 79.0% rated their happiness as high (scores of 4 and 5), with an average score of 4.19.

3.3.2 Household Composition

Household composition is one of the analytical dimensions of this study, categorized into five types: “single-person,” “cohabitation with partner,” “cohabitation with children,” “cohabitation with parents,” and “three-generation households.” Figure 2 shows that “single-person” and “cohabitation with partner” households account for 75% of all households. This finding implies that as time progresses, widows/widowers in “cohabitation with partner” households will transition to “single-person” households, highlighting the increasing vulnerability of their living conditions.

3.3.3 Transportation Attributes

This study measures the availability and actual use of three transportation modes: “self-driving,” “vehicles driven by family members,” and “public transportation.” Table 3 compares the percentage of older individuals who can use each mode (availability rate) with those who actually use it (utilization rate). Although the availability rate of each mode is approximately 40%, only “self-driving” maintains a similar utilization rate (47.0%). In contrast, “vehicles driven by family members” and “public transportation” show significant gaps between availability and utilization, indicating that these modes, even when available, are less likely to be used.

Table 3. Availability and Utilization Rates of Transportation Modes

Transportation Mode	Availability Rate (%)	Utilization Rate (%)	Difference (%)
Self-driving	49.3%	47.0%	2.3%
Vehicles driven by family members	42.0%	31.4%	10.7%
Public transportation	45.9%	37.0%	8.9%

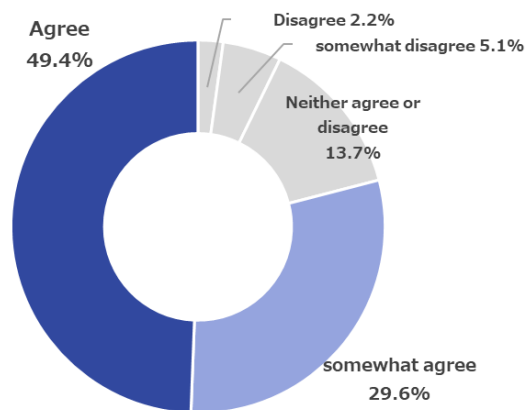


Figure 1. Subjective Well-being Scores of Older Individuals

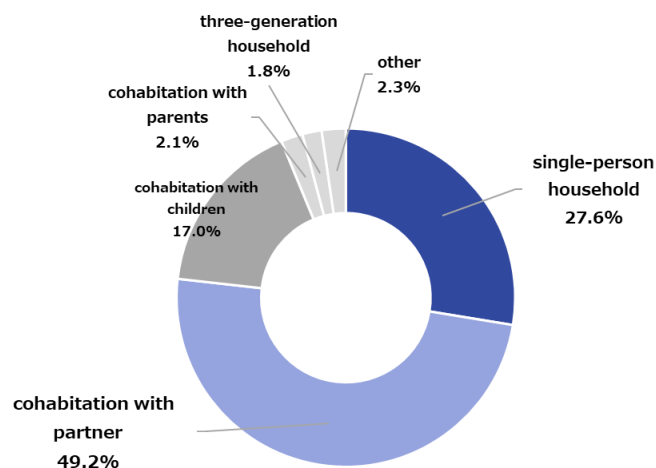


Figure 2. Categories of Older Individuals' Household Composition

4. Categorization of Transportation Attributes

4.1 Combination of Available Transportation Modes

This section, corresponding to Phase 1 of the analysis, presents the categorization of transportation attributes. Studies and surveys on this topic typically focus on the primary transportation mode or

modes frequently used in daily life. Such approaches often examine a snapshot of an individual's transportation behavior during specific outings and infer connections between the comfort or convenience of that mode and hedonic SWB. However, these methods do not distinguish between individuals who choose to drive when they have multiple transportation options and those who are forced to drive because no other options are available. Consequently, these methods do not account for the degree of freedom in transportation choices or the broader context of an individual's life.

To address these limitations, Takeguchi et al. (2023) proposed analyzing “combinations of available transportation modes” to examine the relationship between mobility and SWB. Their findings revealed significant connections between freedom of movement (an essential aspect of daily life) and eudaimonic SWB. This study adopts their concept of “combinations of available transportation modes” to categorize transportation attributes and use them for further analysis.

4.2 Construction of Transportation Categories

This study investigates the availability of three transportation modes: “self-driving,” “vehicles driven by family members,” and “public transportation.” Based on the availability of these modes, we constructed six categories of transportation attributes (Table 4).

Table 4. Combinations of Available Transportation Modes and Category Proportions (Older Respondents)

Category Name	Self-driving	Vehicles driven by family members	Public Transportation	Proportion (%)
All Modes Available Group	○	○	○	19.5%
Two Modes Available Group (Total: 21.6%)	○	○	×	12.2%
	○	×	○	2.6%
	×	○	○	6.8%
Self-driving Dependent Group	○	×	×	16.7%
Vehicles driven by family members Dependent Group	×	○	×	4.9%
Public Transportation Dependent Group	×	×	○	18.6%
No Modes Available Group	×	×	×	18.6%

The categorization results indicate the following:

- **Multiple Modes Available Group:** combined with the All Modes Available Group and Two Modes Available Group, this category accounts for 41.1% of older individuals who responded to the survey.
- **Dependency Groups:** Categories dependent on a single transportation mode (self-driving,

vehicles driven by family members, or public transportation) account for 40.2% of respondents.

- **No Modes Available Group:** Comprising 18.6% of respondents, this group has no available transportation options.

By including respondents who depend solely on self-driving (35.4% when combined with the No Modes Available Group), the study highlights a significant proportion of older individuals who are vulnerable to mobility issues. Even in Abashiri City, where public transportation services are relatively well-developed, a notable percentage of the older population experiences mobility challenges. This study analyzes the effects of these transportation categories on older individuals' SWB.

5. Significance Testing for Subjective Well-being across Categories

5.1 Overview of the Analysis

This chapter corresponds to Phase 2 of the analysis, focusing on the significance testing of SWB across the categories of household composition and transportation attributes.

- **Household Composition Categories** (five categories): single-person, cohabitation with partner, cohabitation with children, cohabitation with parents, and three-generation households.
- **Transportation Attribute Categories** (six categories): All Modes Available, Two Modes Available, Self-driving Dependent, Vehicles driven by family members Dependent, Public Transportation Dependent, and No Modes Available.
- For this analysis, one-way analysis of variance and a multiple comparison test (Tukey–Kramer method) were applied. Additionally, two analysis groups were used: “elderly only” and “all generations.” The results for significance testing are presented in subsequent sections, where statistical significance is denoted as follows: ***, 1% significance level; **, 5% significance level; *, 10% significance level; and n.s., not significant.

5.2 Significance Testing across Household Composition Categories

Figure 3 shows the SWB scores for different household composition categories among older respondents. The SWB score is highest for cohabitation with parents, followed by cohabitation with partner households and three-generation households, with single-person households showing the lowest SWB score. Table 5 shows the significance of differences in SWB across household composition categories for older individuals only. Results indicate that SWB scores for cohabitation with partner households are significantly higher than those for single-person households and cohabitation with children.

Figure 4 shows the SWB scores across household composition categories for all generations. The SWB score is highest for cohabitation with partner households, followed by three-generation households and cohabitation with children. SWB scores of all generations are similar to those of older respondents in the case of single-person households, with the lowest scores recorded for this household composition category. Table 6 shows that significance of differences in SWB across

household composition categories for all generations). Results demonstrate that cohabitation with partner households have significantly higher SWB scores than single-person households, cohabitation with parents, and cohabitation with children.

The two analyses show that cohabitation with partner households consistently show higher SWB scores across age groups and that single-person households exhibit lower scores.

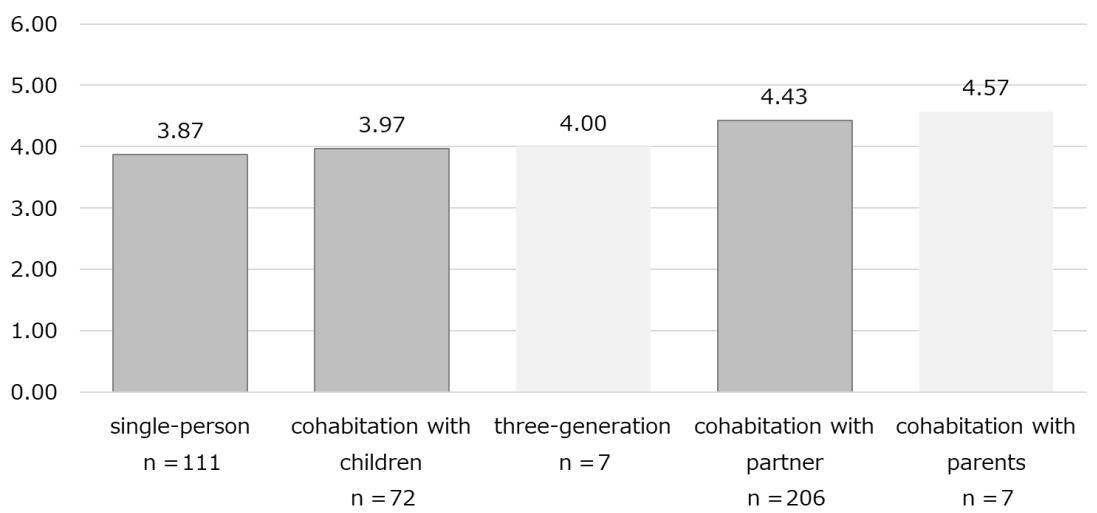


Figure 3. Subjective Well-being Scores by Household Composition Categories (Older Individuals Only)

Table 5. Significance of Differences in Subjective Well-being across Household Composition Categories (Older Individuals Only)

	single-person	cohabitation with partner	cohabitation with children	cohabitation with parents	three-generation
single-person		***	n.s.	n.s.	n.s.
cohabitation with partner			***	n.s.	n.s.
cohabitation with children				n.s.	n.s.
cohabitation with parents					n.s.
three-generation					

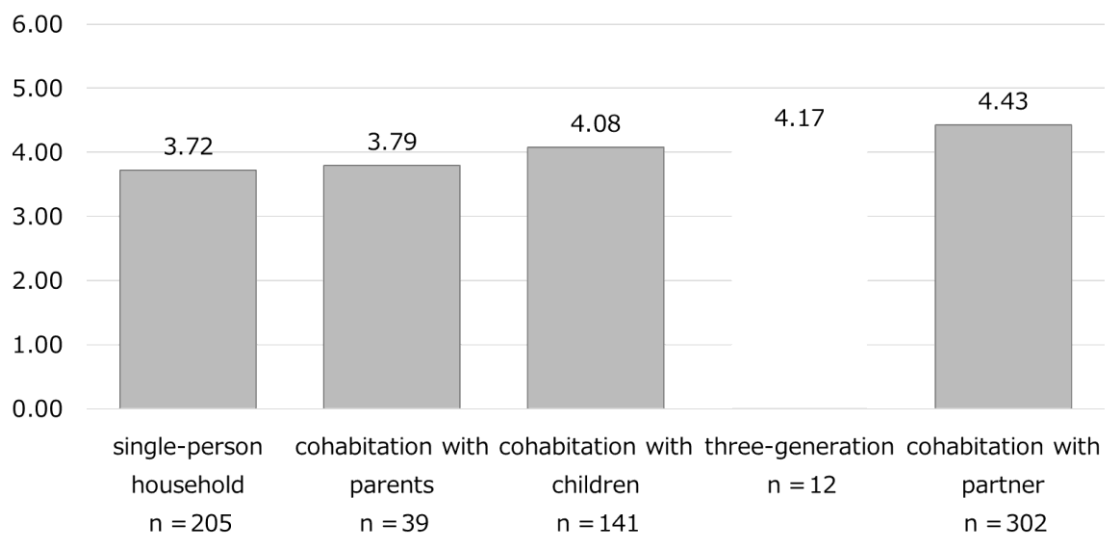


Figure 4. Subjective Well-being Scores by Household Composition Categories (All Generations)

Table 6. Significance of Differences in Subjective Well-being across Household Composition Categories (All Generations)

	single-person	cohabitation with partner	cohabitation with children	cohabitation with parents	three-generation
single-person		***	***	n.s.	n.s.
cohabitation with partner			***	***	n.s.
cohabitation with children				n.s.	n.s.
cohabitation with parents					n.s.
three-generation					

5.3 Significance Testing across Transportation Attribute Categories

Figure 5 shows the SWB scores for different transportation categories among older respondents. SWB scores are highest for the All Modes Available Group, followed by the Two Modes Available Group and Self-driving Dependent Group; the No Modes Available Group has the lowest score. Table 7 shows that SWB scores for the All Modes Available Group, Two Modes Available Group, Self-driving Dependent Group, and Public Transportation Dependent Group are significantly higher than those for the No Modes Available Group.

Figure 6 shows the SWB scores across transportation categories for all generations. These results are similar to those obtained for older respondents: the SWB scores are highest for the All Modes Available Group, followed by the Two Modes Available Group and Self-driving Dependent Group,

with the No Modes Available Group consistently exhibiting the lowest scores. Table 8 shows that SWB scores for the All Modes Available Group and Two Modes Available Group are significantly higher than those for the No Modes Available Group.

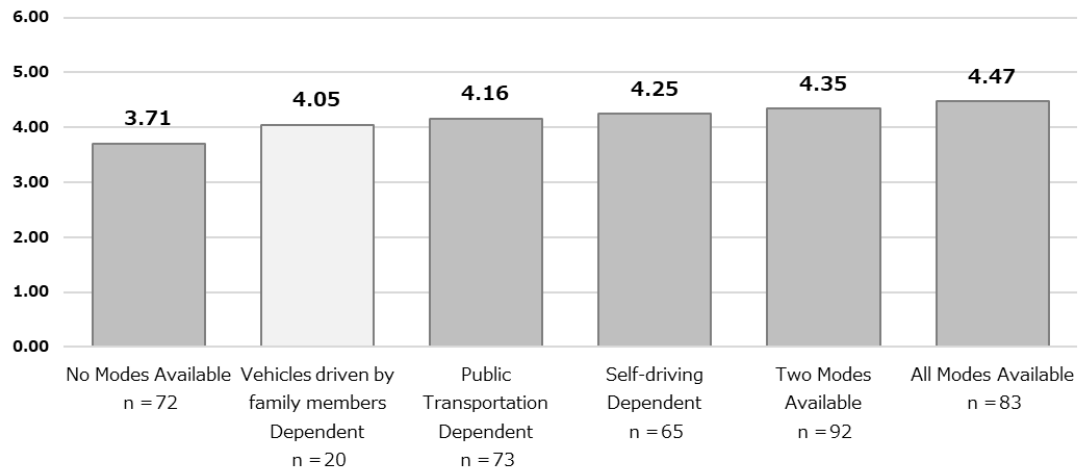


Figure 5. Subjective Well-being Scores by Transportation Categories (Older Individuals Only)

Table 7. Significance of Differences in Subjective Well-being across Transportation Categories (Older Individuals Only)

	All Modes Available	Two Modes Available	Self-driving Dependent	Vehicles driven by family members Dependent	Public Transportation Dependent	No Modes Available
All Modes Available		n.s.	n.s.	n.s.	n.s.	***
Two Modes Available			n.s.	n.s.	n.s.	***
Self-driving Dependent				n.s.	n.s.	**
Vehicles driven by family members Dependent					n.s.	n.s.
Public Transportation Dependent						*
No Modes Available						

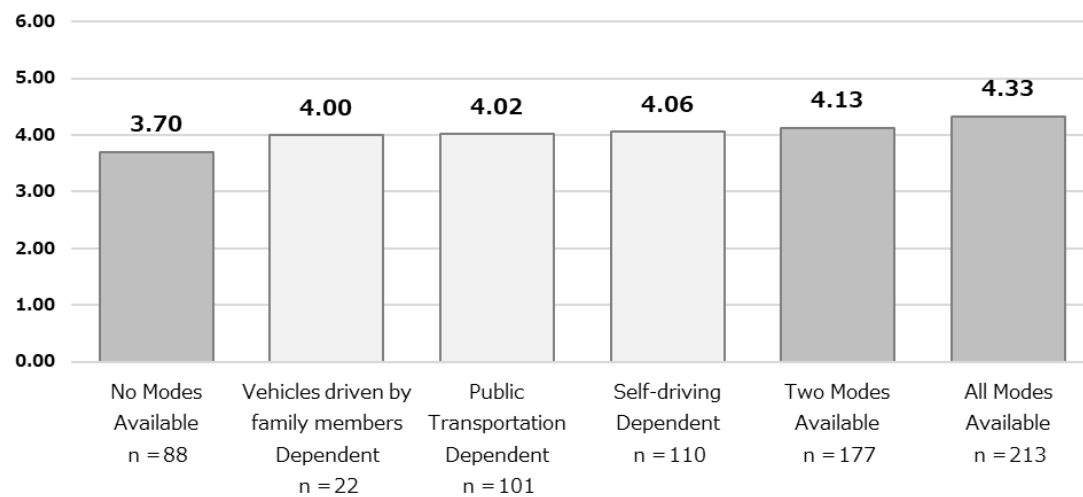


Figure 6. Subjective Well-being Scores by Transportation Categories (All Generations)

Table 8. Significance of Differences in Subjective Well-being across Transportation Categories (All Generations)

	All Modes Available	Two Modes Available	Self-driving	Vehicles driven by family members	Public Transportation	No Modes Available
All Modes Available		n.s.	n.s.	n.s.	n.s.	***
Two Modes Available			n.s.	n.s.	n.s.	**
Self-driving				n.s.	n.s.	n.s.
Vehicles driven by family members					n.s.	n.s.
Public Transportation						n.s.
No Modes Available						

The two analyses demonstrate that for older individuals and all generations, access to multiple transportation modes correlates with higher SWB scores and lack of access (e.g., No Modes Available Group) significantly lowers these scores. Older individuals living in single-person households are particularly negatively affected by transportation limitations, as shown by the larger gap in these scores. These results emphasize the importance of transportation availability for improving SWB, especially among aging populations.

6. Analysis of Category Scores for Subjective Well-being

6.1 Overview of the Analysis

In this section, corresponding to Phase 3 of the analytical framework, we analyze the category scores that influence SWB based on household composition and transportation attributes. Quantification theory type I is employed for this analysis.

Explanatory variables in the analysis comprise age, household composition, and transportation attributes. These variables are categorized as follows:

- **Age Attribute Categories** (three categories): under 40, 40–64, and 65 and above.
- **Household Composition Categories** (five categories): single-person household, cohabitation with partner household, cohabitation with children, cohabitation with parents, and three-generation household.
- **Transportation Attribute Categories** (six categories): All Modes Available Group, Two Modes Available Group, Self-driving Dependent Group, Vehicles Driven by Family Members Dependent Group, Public Transportation Dependent Group, and No Modes Available Group.

Table 9 presents the corresponding model accuracy (1% statistical significance), and Figure 7 illustrates the category scores calculated using quantification theory type I.

The key results are as follows:

- The highest SWB score is associated with age under 40, cohabitation with partner households, and access to all transportation modes. This combination indicates a group with high freedom in mobility and supportive household composition.
- The lowest scores are observed in single-person households with no modes of transportation available, highlighting the significant negative impact of transportation vulnerability and isolated living conditions.
- For 40-60 years individuals, cohabitation with parents and dependency on vehicles driven by family members negatively affect SWB, suggesting reduced autonomy in living and mobility conditions.
- For older individuals, ensuring access to diverse transportation options can significantly mitigate the negative effects of living alone or lack of mobility.

The category scores calculated in this analysis are used as input for the simulation analysis in the next section. These scores provide a quantitative basis for predicting future trends in SWB and

evaluating the impact of transportation policy measures.

Table 9. Model Accuracy of Quantification Theory Type I

Adjusted R-squared	0.108
AIC	1914.001
ANOVA P value	0.000 (***)

AIC, Akaike information criterion; ANOVA, analysis of variance

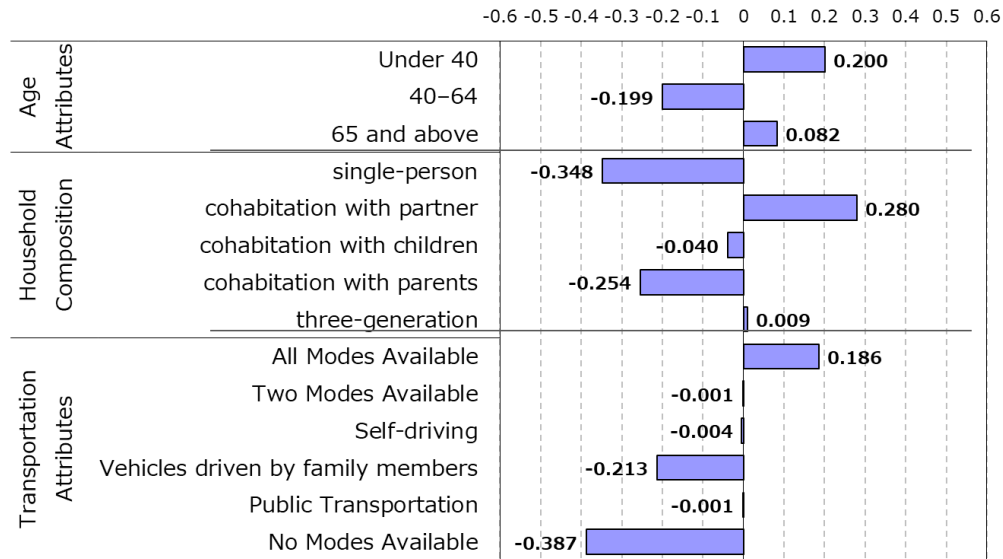


Figure 7. Category Scores for Subjective Well-being Based on Quantification Theory Type I

7. Simulation Analysis of Subjective Well-being

7.1 Overview of the Analysis

In this section, we use the findings from our previous analyses to conduct a simulation analysis that assesses the impact of policy interventions aimed at mitigating transportation vulnerability on SWB. The results of this analysis will help us visualize the importance of transportation policies and recommend appropriate directions for regional policy planning.

7.2 Simulation Scenarios and Estimation Procedures

The basic simulation framework calculates SWB scores by summing category scores across all 90 combinations of age, household composition, and transportation attributes. These scores are then weighted based on the projected population data for Abashiri City in the target year to estimate the total SWB score. The base year for the analysis is set as 2020, and projections are generated for the year 2030. For the 2030 analysis, three scenarios are considered:

- **No Policy Implementation Case**
- **Public Transportation Enhancement Case**
- **Community-based Shared Transport Introduction Case**

In the latter two cases, the proportion of transportation categories is modified to indicate the

impact of transportation policy interventions; thereafter, the change in the overall SWB score is analyzed. Additionally, sensitivity analysis is conducted in the **Public Transportation Enhancement Case** and the **Community-based Shared Transport Introduction Case** at multiple levels to determine whether the findings are robust.

7.3 Results and Discussion

The simulation analysis results for SWB are shown in Figure 8. In this figure, the total SWB score represents the aggregated SWB scores, indexed to 100 for the baseline year 2020. In all cases, the total SWB score decreases by 2030 owing to population decline.

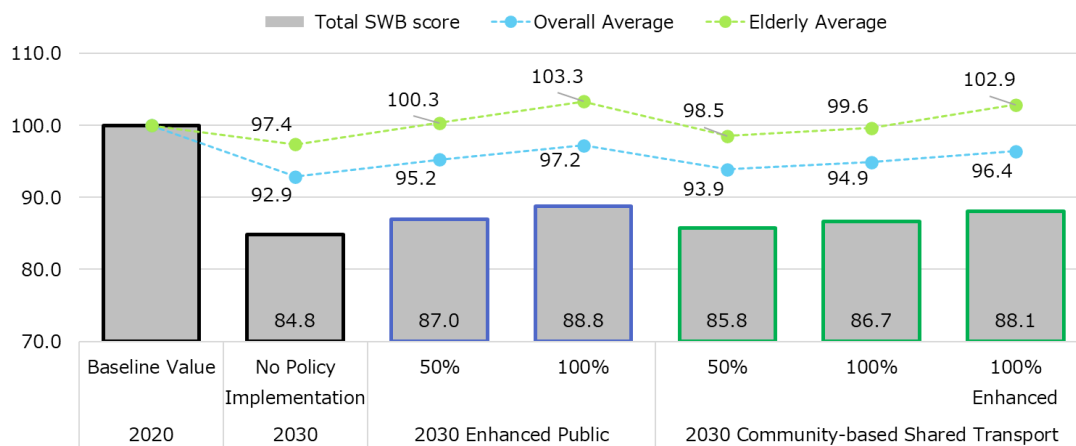


Figure 8. Simulation Results

Additionally, under the **No Policy Implementation Case**, the overall average and the older individual average decline in comparison with those in 2020. This decline is not solely attributable to population decrease; it also reflects changes in age distribution, household composition, and transportation attributes. Specifically, the increase in older individuals in single-person households leads to a decrease in SWB scores at the individual level.

In the **Public Transportation Enhancement Case**, two levels of intervention are examined: a scenario in which 50% of individuals who currently lack access to public transportation gain access (**50% Enhancement**) and a scenario in which all individuals gain access (**100% Enhancement**). In both cases, the overall average remains lower than the 2020 baseline. However, the decline is less pronounced in this case than that in the No Policy Implementation Case, demonstrating the mitigating effects of transportation interventions. Furthermore, the average for older individuals exceeds the 2020 baseline under the **50% enhancement** and **100% Enhancement** scenarios, implying that universal access to public transportation can have a significant positive impact on the well-being of older individuals.

Similarly, in the **Community-based Shared Transport Introduction Case**, three levels of intervention are examined: a **50% Introduction** scenario, a **100% Introduction** scenario, and a **100% Enhanced Version** scenario in which the convenience of the shared transport system is assumed to be comparable to that of private vehicles. In all cases, the overall average is higher than

that in the No Policy Implementation Case. Notably, in the **100% Enhanced Version** scenario, the average score of older individuals exceeds the 2020 baseline, indicating that high-quality shared mobility services can significantly improve the well-being of older individuals.

8. Conclusions and Future Challenges

8.1 Conclusions

This study analyzed SWB as a key performance indicator to address the challenges posed by Japan's transition to a "super-aging and solitary society." By focusing on household composition and transportation attributes, the study quantitatively demonstrated that these factors significantly influence SWB.

The results also indicated that without policy interventions, the overall SWB score in Abashiri City is projected to decline by 2030 owing to the increasing proportion of older individuals in single-person households and worsening transportation accessibility.

Furthermore, the simulation analysis revealed that while SWB scores are expected to decline due to demographic changes, transportation policy interventions can mitigate this decline. In particular, implementing measures to enhance public transportation and introducing community-based shared transport services can help maintain or improve SWB scores, especially among older individuals.

8.2 Limitations and Directions for Future Research

This study focused on Abashiri City, where public transportation services are well-developed compared with other small and medium-sized cities. Therefore, the impact of public transportation policies in this area may be relatively modest. However, in regions where public transportation is less accessible, the potential benefits of such interventions are expected to be greater. The analytical framework developed in this study can be applied to other municipalities to examine appropriate policy directions based on their specific conditions.

Although this study provides important insights, several limitations should be addressed in future studies. One limitation lies in the measurement of SWB. This study used a simple five-point Likert scale to evaluate SWB; however, this approach may not fully capture the complexity of individual happiness. Further research should consider more nuanced and comprehensive indicators to improve the assessment of SWB. Another limitation is the sample size. The number of respondents in some household composition and transportation categories was relatively small, possibly affecting the robustness of the analysis. Expanding the dataset in further research will be essential for improving the reliability of the findings.

References

Choe, H., et.al (2021) Social participation, social capital, and subjective well-being among older adults, Japanese Journal of Gerontology, Vol.43(1), pp.5-14.

HASHIMOTO, S. et al. (2022) A STUDY OF THIRD PLACE AND SUBJECTIVE WELL-BEING, Journal of Japan Society of Civil Engineers, Ser. D3 (Infrastructure Planning and Management), Vol.77, No.5, I_375-I_383. https://doi.org/10.2208/jscejipm.77.5_I_375

Ishii, R., (1997) Recent Research Trend of Subjective Well-Being Studies, Japanese journal of community psychology, Vol.1(1), 94-107.

Keumi, C., (2021) Understanding the relationship between daily travel and subjective well-being, The Doshisha Business Review Vol.73(2): 593-623. <https://doi.org/10.14988/00028544>

Kinoshita, R., et al. (2021) The relationship between subjective well-Being, activity participation status, and basic attributes in community-dwelling older adults, Asian Journal of Occupational Therapy, Vol. 40(1): 34-41.

Nagata, A. et al. (1999) Sex Differences in Subjective Well-Being and Related Factors in Elderly People in the Community Aged 75 and Over, Japanese Journal of Gerontology, Vol. 36: 868-873.

National Institute of Population and Social Security Research (2023) Estimated future population of Japan by region (estimated for 2023) <https://www.ipss.go.jp/pp-shicyoson/j/shicyoson23/t-page.asp>

Yamashita, K., et al. (1992) Depressed Mood and Subjective Sensation Well-being in the Elderly Living Alone on Oki Island in Shimane Prefecture, Japanese Journal of Geriatrics, Vol.29(3): 179-184.

Takeguchi, Y et al. (2021) A proposal of support method for rural settlement in depopulating and aging society ~Clustering and Development of daily life convenience index based on all settlement data of Hokkaido prefecture~, Studies in Regional Science, Vol.50(1). <https://doi.org/10.2457/srs.51.15>

Takeguchi, Y et al. (2023) Feature Analysis in living Standards evaluation of Elderly Focused on Selectable Transportation, Journal of Japan Society of Civil Engineers, Ser. D3 (Infrastructure Planning and Management), Vol.79, No.6, 22-00074. <https://doi.org/10.2208/jscej.22-00074>