

1. Title of the Paper

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

2. Author(s) Information

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3. Introduction

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.

4. Literature Review

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.

5. Methodology

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%)

Data Summary

[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*). 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.

[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.” “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.

[Transportation Attributes]

This study measures the availability and actual use of three transportation modes: “self-driving,” “vehicles driven by family members,” and “public transportation.” 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.

Data Analysis Methods

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.

6. Results and Discussion

Table 1 presents the corresponding model accuracy (1% statistical significance), and Figure 2 illustrates the category scores calculated using quantification theory type I.

Table 1. 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

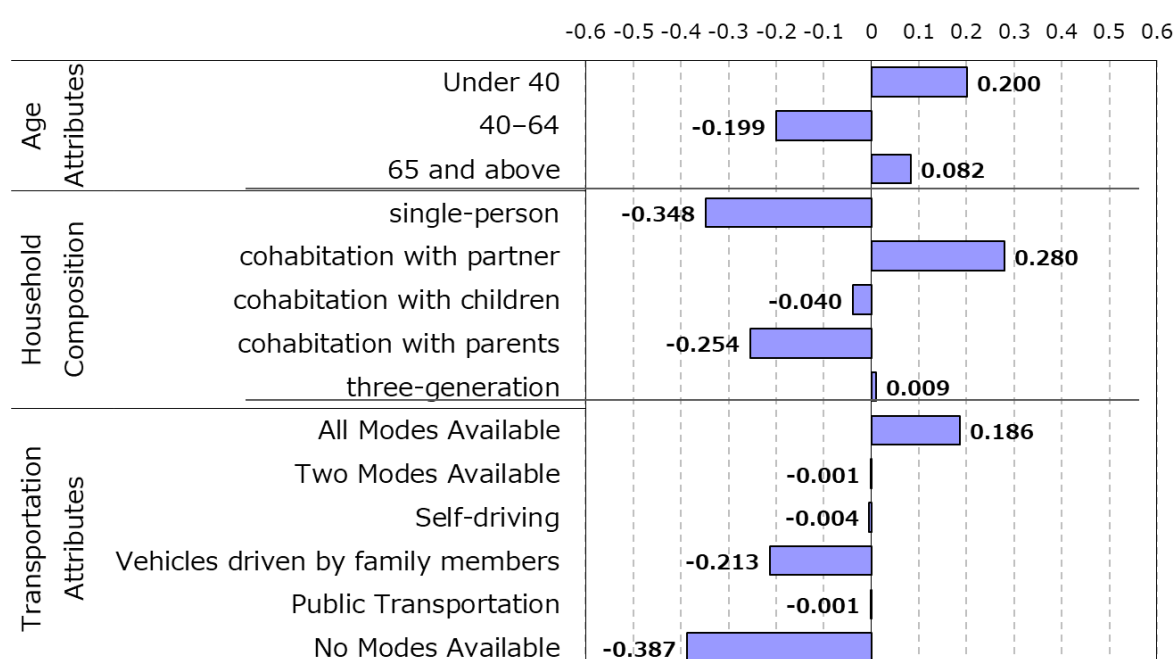


Figure 1. Category Scores for SWB Based on Quantification Theory Type I

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.

7. Conclusion

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.

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.

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