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**Determining the status of older adults' well-being in Japan
using the Cabinet Office Survey on Satisfaction and Quality of Life
— A study using decision tree analysis —**

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— A study using decision tree analysis —**

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ABSTRACT

Japan is characterized as a “super-aged society.” Consequently, it is essential to comprehend the well-being of older adults. The objective of this study was to examine the factors associated with the elevated (high) and diminished (low) well-being of older adults through the implementation of a decision tree analysis, drawing upon the findings of the Cabinet Office’s Survey on Satisfaction and Quality of Life (2023). The QUEST node decision tree analysis was implemented to identify relevant items for the criterion variable, that is well-being, from the 291 questions (predictive variables). The values of the criterion variable were binary, either 0 or 1, corresponding to the “low” or “high” well-being group; the group that selected a well-being response of 9 or 10 was defined as the “high” group. Conversely, the “low” group was defined as the group of respondents who selected a well-being response of 0 to 4.

The older adult age group demonstrated a tendency to exhibit “high” levels of well-being in comparison with other age groups. The results of the decision tree analysis indicated that among the subset of individuals who reported no recent feelings of loneliness, who described their current health as good, and an absence of recent feelings of despair, 88.5% were classified as being in the “high” group of well-being among older adults. Conversely, 91.4% of those who reported recent feelings of loneliness and who described their current health as normal to poor were classified as being in the “low” well-being group. Furthermore, another decision tree analysis was conducted to identify the top 30 factors related to older-adult well-being from the 291 questions of the Survey. From the results, the frequent factors were identified as pessimism, loneliness, and health and subsequently, the other factors were money, work, and home.

1 Background

Economic indicators, most notably Gross Domestic Product (GDP), have historically been heavily relied upon to assess a nation's wealth and its populace's standard of living. However, there has been a mounting global concern that economic indicators alone are insufficient in capturing well-being and living standards (Stiglitz et al., 2015). Accordingly, endeavors have been initiated to appraise the affluence and well-being of individuals by evaluating diverse dimensions of their lives, extending beyond the conventional GDP metric. In this context, the significance of subjective indicators is being acknowledged, with an increasing emphasis on well-being, lifestyle satisfaction, and happiness levels. This paper will primarily focus on well-being.

The WHO (2021) defines well-being as "A positive state experienced by individuals and societies. Similar to health, it is a resource for daily life and is determined by social, economic, and environmental conditions." Well-being includes both objective and subjective indicators, but there is also the term subjective well-being, which focuses only on subjective indicators. According to the OECD (2013), subjective well-being is defined as "good mental states, including all of the various evaluations, positive and negative, that people make of their lives, and the affective reactions of people to their experiences." For the purposes of this paper, the term "well-being" will include subjective well-being.

The concept of well-being encompasses not only a state of physical and mental health but also a state of social and economic well-being and contentment. In nations such as Bhutan, the United Kingdom, South Korea, and the OECD, subjective and objective indicators are already being utilized as a component of measuring quality of life. Likewise, Japan has also initiated various initiatives, including the Cabinet Office's "Survey on Satisfaction and Quality of Life."

Moreover, as of October 2023, the proportion of the Japanese population aged 65 and over was 29.1%. Given that the proportion of older adults aged 65 and over has already exceeded 21% of the population, we believe that it is vital to comprehend the current state of well-being among older adults in Japan, which is currently experiencing a super-aging society.

To this end, we hereby present a report on our study of factors related to the well-being of older adults. This study was conducted using the Cabinet Office's "Survey on Satisfaction and Quality of Life."

2 Objective

The aim of this study is to investigate the factors related to high and low well-being among older adults using a decision tree analysis, based on the Cabinet Office's "Survey on Satisfaction and Quality of Life."

3 Methods

3-1 Target Data

This study employed the Cabinet Office's 2023 version of the "Survey on Satisfaction and Quality of Life" (hereinafter referred to as the "Well-Being Survey"). Conducted annually, the objective of this survey is to obtain a multifaceted understanding of the structure of Japan's economic society from the perspective of people's well-being, with the aim of applying this understanding to policy management.

The questions used in this study are described below:

(1) Current Overall Lifestyle Well-Being (hereinafter referred to as "well-being")

Respondents were asked, "How satisfied are you with your current life as a whole?" to which they were instructed to answer on a scale of 11, with "Not satisfied at all" being 0 and "Very satisfied" being 10 (Figure 1).

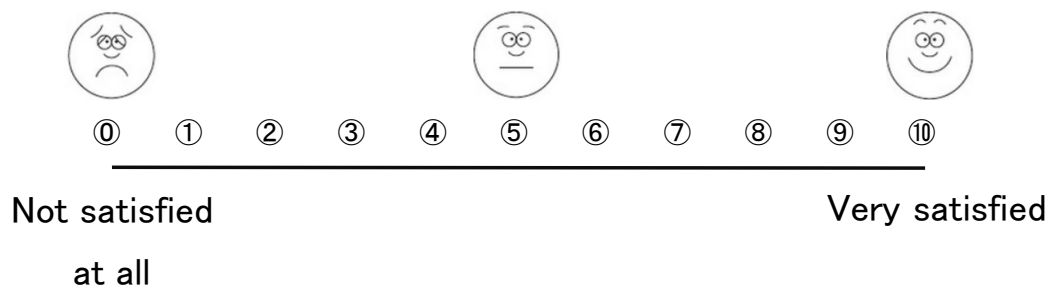


Figure 1: Response method to questions on well-being

(2) Candidate Items Related to Well-Being

As candidate items related to well-being, a question from the Well-Being Survey, "Which of the following factors have a significant impact on your current level of satisfaction or dissatisfaction?" was used. Respondents were instructed to select all of the items that had a significant impact on their level of satisfaction or dissatisfaction. There were total of 112 detailed questions, each of which falls under one of the following 13 categories:

[1] Household finances and assets, [2] Employment environment and wages, [3] Housing, [4] Work-life balance, [5] Health, [6] Educational environment and standards, [7] Personal relationships and social connectivity, [8] Confidence in politics, government, and the courts, [9] Natural environment surrounding daily life, [10] Personal safety, [11] Ease of child-rearing, [12] Ease of receiving/providing nursing care, and [13] Enjoyment of life.

(3) Items Concerning Actual Current Situations and Perspectives

Similarly to the above, these are also candidate items associated with well-being. There were total of 179 detailed questions, each of which falls into one of the following 20 categories:

[1] Members of the household, [2] Views on marriage, [3] Child-rearing, [4] Nursing care, [5] Those who have changed their employment status due to child-rearing or nursing care, [6] Employment status, [7] Recurrent education, [8] Health, [9] Frequency of interaction with friends, etc., [10] People you can rely on in times of need, [11] Volunteer activities, community activities, [12] Frequency of use of social media over the past year, [13] Voting, [14] Residence, [15] Highest level of education, [16] Household income, personal income, [17] Time, [18] Events in the past year, [19] Feelings about recent life, [20] Prefecture, ward, city, town, village of residence.

(4) Age and Gender

In the Well-Being Survey, age was divided into five-year increments; however, in this study, it was divided into four life stages: (1) Young (15-24 years old), (2) Young adult (25-44 years old), (3) Middle-aged adult (45-64 years old), and (4) Older adult (65 years old and over) (Health Japan 21 Planning Study Group, 2000; Tanaka & Osuka., 2021). Gender was divided into male and female.

3-2 Analysis Method

3-2-1 Descriptive Statistics and Statistical Inference

(1) Basic Attributes of Respondents by Life Stage

The number of people in each life stage, including older adults, was determined to understand the characteristics of each stage.

(2) Distribution of Well-Being

The frequency distribution of well-being responses from respondents at different life stages was shown as a histogram with 11 levels from 0 to 10, and the characteristics of the responses were identified.

(3) Comparison of Well-Being Between Life Stages

The mean and standard deviation of the level of well-being for each life stage were calculated, and the statistical significance was examined using a hypothesis test (Kruskal-Wallis test) for representative values.

3-2-2 Decision Tree Analysis

Decision tree analysis is a data mining method with a broad scope of application. One notable application of this method is the identification of predictive variables related to the criterion variable through the analysis of questionnaire results. This allows for the discovery of unanticipated latent knowledge from extensive data sets and the development of comprehensible rules. The analysis results are presented in a hierarchical structure, where the variables related to the criterion variable are selected sequentially. This arrangement facilitates the comprehension of the interrelationships between variables. While there are several proposed methods for decision tree analysis, for the purposes of this paper, the QUEST model was selected to identify items associated with the criterion variable, namely well-being.

The values of the criterion variable were 0 or 1, corresponding to the “low” or “high” well-being groups. To ensure a comparable number of respondents in the “low” and “high” groups, the “low” group was defined as individuals who selected a well-being score between 0 and 4, while the “high” group was defined as individuals who selected a well-being score of 9 or 10.

The decision tree was developed with a three-level hierarchy, focusing on terminal nodes with both the respondents of 100 or more and the proportion of either the high or low group of 85% or more. The number of hierarchical levels was determined based on Adachi & Ogawa (2021); Arai et al. (2011).

The Ranking of Factors Related to Well-Being in Older Adults

The node at the uppermost level of the decision tree is the node for the item that is most highly associated statistically with the criterion variable. Consequently, by deleting the top node and repeating the decision tree analysis, the subsequent item that is highly associated with the criterion variable becomes the top node. This iterative process of deleting and re-running the decision tree analysis enables the systematic extraction of items that are highly associated with the criterion variable. In this study, an attempt was made to extract the top 30 items.

3-2-3 Analysis Software

The software used for the analysis was IBMSPSS Statistics Ver. 30.

4 Results

4-1 Descriptive Statistics

(1) Basic Attributes of Respondents by Life Stage

The survey was conducted on 10,619 individuals (5,333 female, 5,286 male). The number of respondents by each age group is shown in Table 1.

Table 1: Number of Respondents by Age Group

Age groups	All (n)	Female(n)	Male (n)
Young	2,033	1,024	1,009
Young adult	4,188	2,059	2,059
Middle-aged adult	2,822	1,438	1,384
Older adult	1,646	812	834
All	10,619	5,333	5,286

Young (15–24 years old), Young adult (25–44 years old), Middle-aged adult (45–64 years old), and Older adult (65 years or older).

(2) Distribution of Well-Being

The overall and older adults' well-being was recorded.

In terms of overall results, when considering the responses on a scale of 0 to 10, the majority of respondents selected 5, 7, and 8, with two peaks (Figure 2-1). For older adults, there were significant peaks at 7 and 8, and a smaller peak at 5 (Figure 2-2).

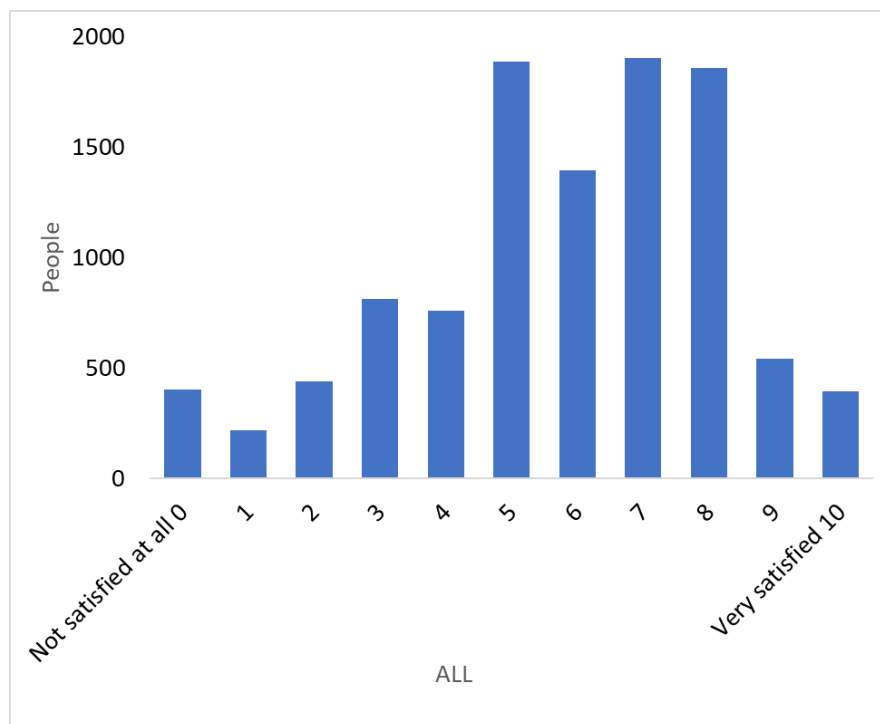


Figure 2-1: Well-being (All)

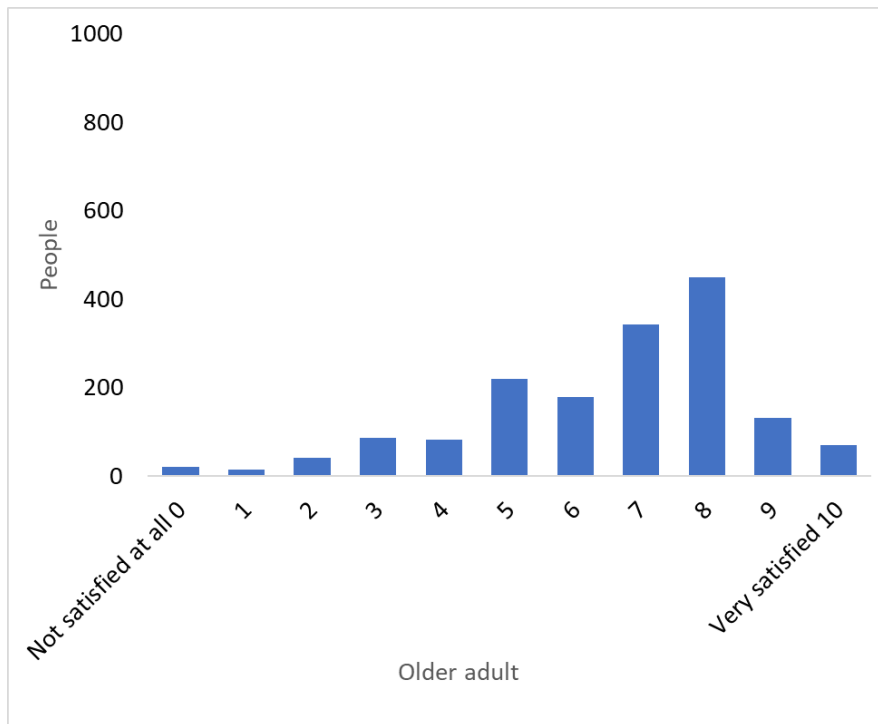
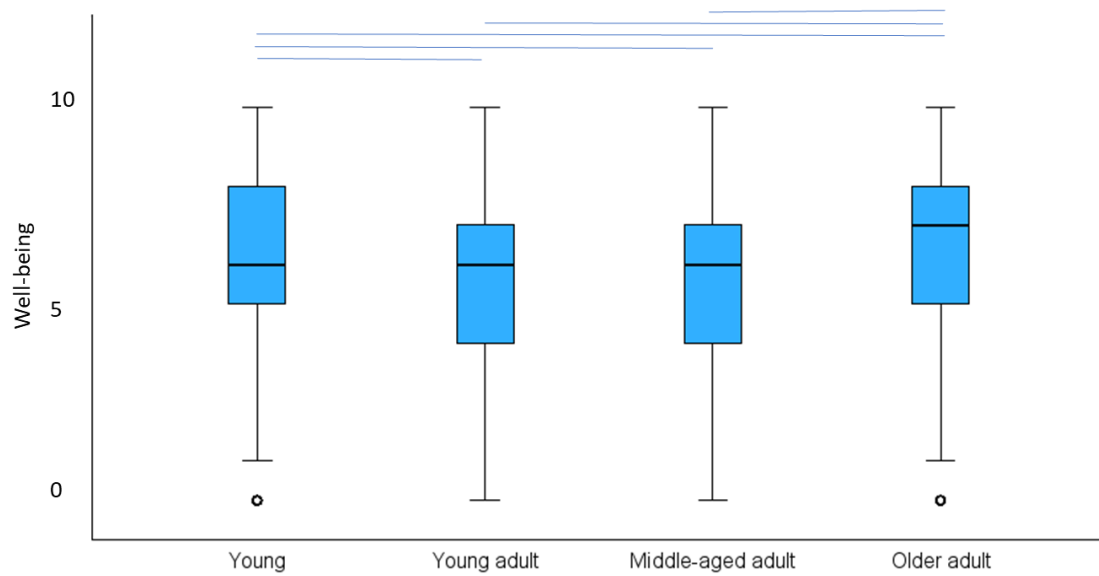


Figure 2-2: Well-being (Older adult)

(3) Comparison of Well-Being by Life Stage

The mean values of well-being for each age group were compared (Figure 3). The results indicated that well-being was significantly higher in older adults (7.55 ± 2.09) than in any of the other age groups ($p < 0.001$). In practice, well-being in young adults and middle-aged adults were 7.00 ± 2.27 and 6.53 ± 2.40 respectively.



	Ave.		SD
Young	7.00	±	2.27
Young adult	6.55	±	2.41
Middle-aged adult	6.53	±	2.40
Older adult	7.55	±	2.09

		Significance level
Young – Young adult	<	0.001
Young – Middle-aged adult	<	0.001
Young – Older adult	<	0.001
Young adult – Middle-aged adult	<	0.975
Young adult – Older adult	<	0.001
Middle-aged adult – Older adult	<	0.001

Figure 3: Average well-being score by age group

4-2 Decision Tree Analysis

(1) Formulation of Rules for High and Low Well-Being in Older Adults

The constructed decision tree is illustrated in Figure 4. Each square, designated as a node, corresponds to a specific item. The directionality of the branches is determined by the responses to the items. Nodes devoid of branches are designated as “terminal nodes,” a crucial component in the formulation of rules.

Initially, an examination of the top-level node revealed that 250 respondents were classified as “high” and 204 as “low” for the well-being evaluation, yielding a comparable ratio of 125:102, indicating an absence of a different order of magnitude. Subsequent analysis of the terminal nodes of the decision tree identified two nodes that satisfied the criteria for rule creation. One of these nodes was associated with the “high” group, while the other was associated with the “low” group. The nodes that extend from the top-level node to these terminal nodes specify the items involved in the process of rule creation.

First, a total of three nodes (items) were associated with the rules in the “high” group. The items are listed below in order.

- (i) For the item “Lately, I feel lonely,” the respondent selected “Not at all,”
- (ii) For the item “Current state of health,” the respondent selected “Normal, or Good,” and;
- (iii) For the item “Lately, I feel hopeless,” the respondent selected “No.”

The total number of individuals in this terminal node was 156, of which 138 (88.5%) were included in the group with a “high” well-being evaluation. Furthermore, 67.6% of all respondents in the group with a “high” well-being evaluation were included in this terminal node.

Secondly, a total of two nodes (items) were associated with the rules in the “low” group. The items are listed below in order.

- (i) For the item “Lately, I feel lonely,” the respondent selected “Sometimes, A little, Usually, or Always,” and;
- (ii) For the item “Current state of health,” the respondent selected “Normal or Poor.”

The total number of individuals in this terminal node was 187, of which 171 (91.4%) were included in the group with a “low” well-being evaluation. Furthermore, 68.4% of all respondents in the group with a “low” well-being evaluation were included in this terminal node.

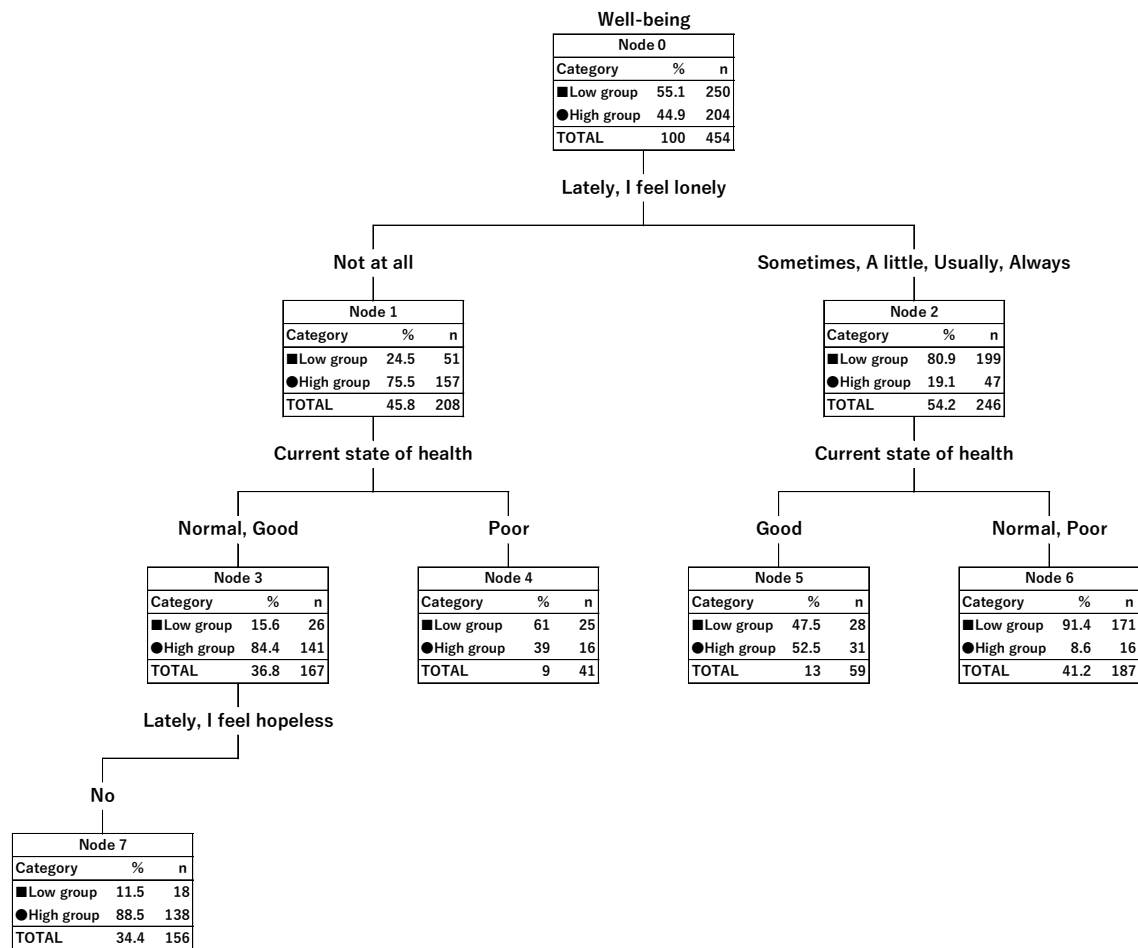


Figure 4: Decision Tree

(2) The Ranking of Factors Related to Well-Being in Older Adults

Table 2 shows the results of extracting the top 30 out of 291 items. The top 10 factors were predominantly characterized by “Pessimism,” followed by “Loneliness” and “Health.” Subsequent items included “Money,” “Work,” and “Home.”

Table 2: Top 30 items selected as parent nodes

No	Item	Category
1	Lately, I feel lonely	Loneliness
2	Lately, I feel depressed, and nothing cheers me up	Pessimism
3	Current state of health	Health
4	Lately, I feel hopeless	Pessimism
5	Lately, I have no one to enjoy things with	Loneliness
6	Lately, I feel that everything I do is a struggle	Pessimism
7	Lately, I feel restless and fidgety	Pessimism
8	Lately, I feel that I am worthless	Pessimism
9	Lately, I feel nervous and on edge	Pessimism
10	I have a hobby or a purpose in life	Health
11	I try not to let stress build up	Health
12	Future income (income, pension prospects, etc.)	Money
13	I have someone I can rely on	Loneliness
14	Frequency of interaction with friends, etc.	Loneliness
15	I feel joy and pleasure in my daily work	Work
16	Future burdens (taxes, medical expenses, insurance premium increases, etc.)	Money
17	I get enough sleep	Health
18	I eat a balanced diet	Health
19	I can rely on my acquaintances and friends in times of need	Loneliness
20	I feel a sense of fulfillment in my daily work	Work
21	Household financial assets	Money
22	I can rely on my household members and relatives in times of need	Loneliness
23	I am proud of my work	Work
24	Owned or rented home	Home
25	Anxiety about future health (dementia, shortage of doctors, etc.)	Health
26	Time allocation in daily life, such as sleep, rest, and sports	Health
27	Expenses for nursing care	Money
28	Total current household income (including pensions)	Money
29	I am in a position to choose my own work and working style from among many options	Work
30	I engage in exercise (including sports) or physical activity in moderation.	Health

5 Discussion

5-1 Comparison of Well-Being by Age Group

In comparison with other age groups, the older adult group demonstrated a tendency to exhibit “high” levels of well-being. Moreover, the present finding is consistent with the results of a study that employed the same Well-Being Survey as this study (Tsuru, 2022). The results of said study also indicate that the well-being of younger and older age groups is high. This suggests that the results of this study are highly credible.

5-2 Decision Tree Analysis

The total number of individuals in this terminal node was 156, of which 138 (88.5%) were included in the group with a “high” well-being evaluation. Furthermore, 67.6% of all respondents in the group with a “high” well-being evaluation were included in this terminal node. The individuals who simultaneously responded that they did not feel “lonely lately,” that their “current state of health” was good and that they did not feel “hopeless lately” were in the “high” well-being group for older adults. Conversely, the total number of individuals in this terminal node was 187, of which 171 (91.4%) were included in the group with a “low” well-being evaluation. Furthermore, 68.4% of all respondents in the group with a “low” well-being evaluation were included in this terminal node. The individuals who reported both feelings of “lonely lately” and a “current state of health” that was “normal to poor” were in the “low” well-being group. The keywords that distinguished both the “high” and “low” well-being groups were “loneliness” and “health.”

The results of the analysis of the factors that may be relevant are shown below. 84.2% of the respondents in the “high” group for well-being lived with others, compared to 72.4% of the respondents in the “low” group for well-being. A statistically significant difference between the two groups was observed in terms of whether or not they lived with others (chi-square test $p = 0.008$) (Figure 5).

Furthermore, 99.0% of the respondents in the “high” group for well-being had someone they could rely on, compared to 78.4% of the respondents in the “low” group for well-being. A statistically significant difference was observed between the two groups with regard to the presence or absence of someone they could rely on (chi-square test $p < 0.001$) (Figure 6).

A subsequent breakdown of the results by the presence or absence of a support system (separated by family/relatives inside the household, family/relatives outside the household, friends/acquaintances) (Figure 7) revealed that only 1% of individuals in the “high” well-being group reported having no one to rely on, compared to 21.6% of those in the “low” well-being group. When friends/acquaintances were included as a potential source of support, 54.4% of those

in the “high” well-being group and 26.0% of those in the “low” well-being group indicated that they had someone to rely on.

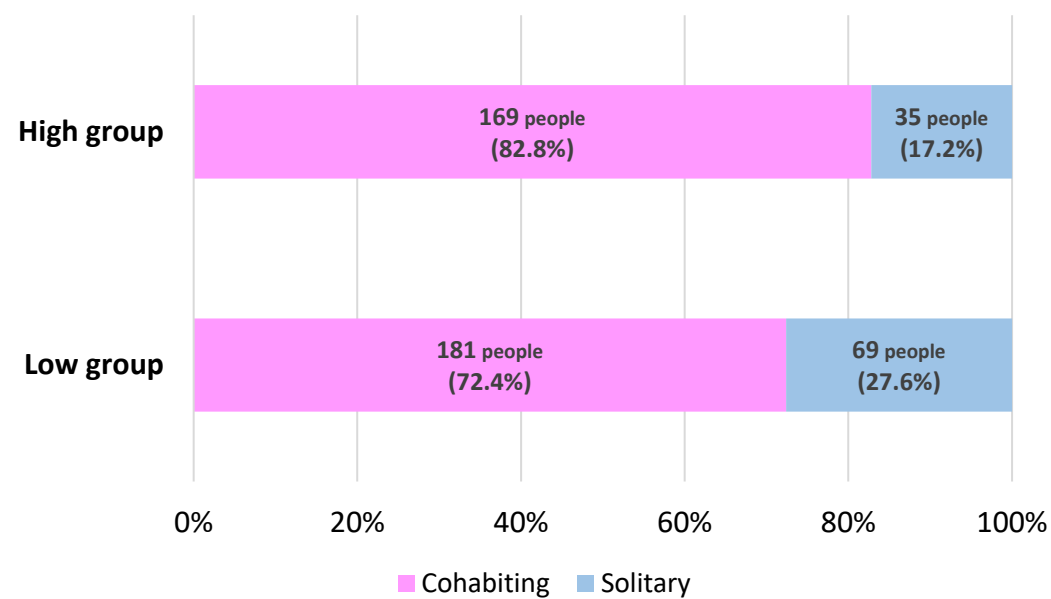


Figure 5: Differences in the presence or absence of cohabitation between the “high” and “low” groups in terms of well-being

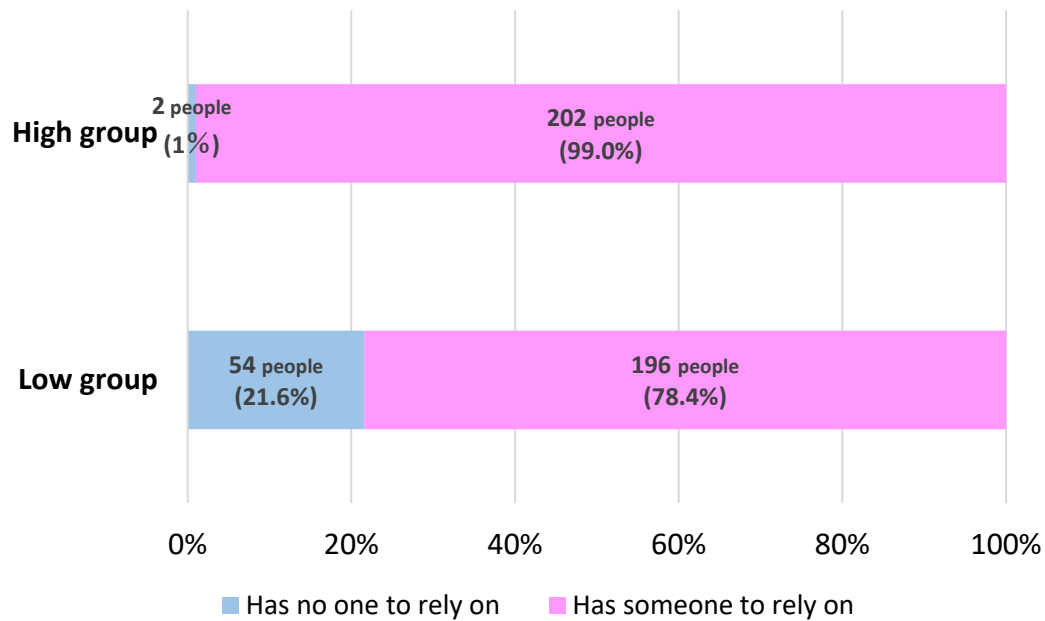


Figure 6: Differences in the presence or absence of someone to rely on between the “high” and “low” well-being groups

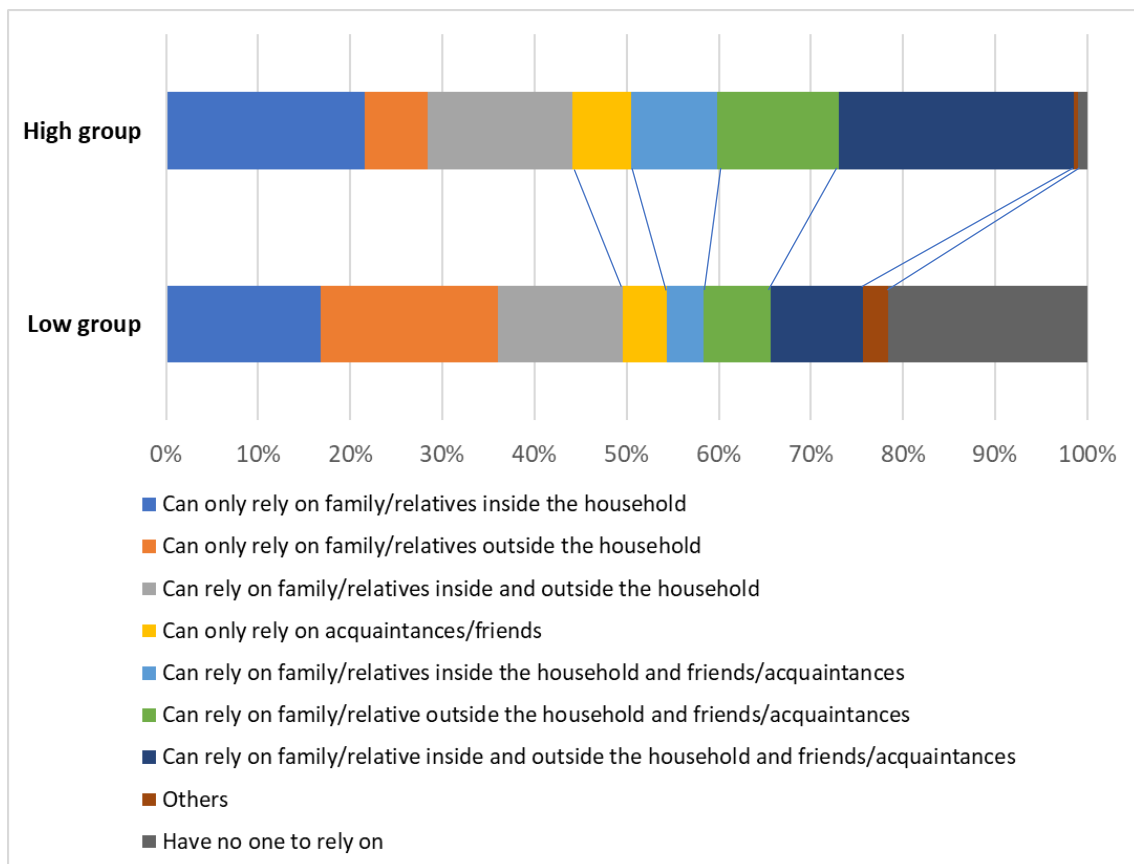


Figure 7: Relationship between the presence or absence of someone to rely on (classified by family members/relatives inside the household, family members/relatives outside the household, and friends/acquaintances) and well-being

For individuals who reported having family members (inside and outside the household) and friends/acquaintances that they can rely on, the proportion of those with “high” well-being was 25.5%, and the proportion of those with “low” well-being was 10.0%. The proportion of individuals who can only rely on family members of “inside the household,” “outside the household,” or “inside and outside the household” was 44.1% for those with “high” well-being and 49.6% for those with “low” well-being. In the context of “loneliness” and “health,” the National Institute on Aging reports that as individuals age, they tend to spend more time in solitude. Moreover, when in solitude, older adults are more prone to experience feelings of loneliness or social isolation, which can have adverse effects on their physical and mental well-being. Research has demonstrated that loneliness and social isolation have been identified as significant health risks, including but not limited to heart disease, depression, and cognitive decline. Furthermore, it has been suggested that poor health can also result in social isolation and loneliness (National Institute on Aging, 2024).

Similarly, in accordance with the findings of this study, the “high” and “low” groups in the decision tree analysis for “loneliness” and “health” were both ranked high, thereby suggesting that these factors may potentially affect the well-being of older adults. Moreover, it has been previously established that feelings of “loneliness” in older adults can have a detrimental effect on their well-being (Endo, 1998). In Japan, in response to the growing population of older adults, social systems and measures have been promoted since the enactment of the Act on Social Welfare for the Elderly in 1963 (Health, Labour and Welfare Statistics Association, 2022). Such measures include projects to promote the improvement of quality of life, as well as measures related to “loneliness.”

Individuals living with others were observed to demonstrate higher levels of well-being, while those with someone to rely on also demonstrated higher levels of well-being. Consistent with these findings, a previous study reported that increased interaction frequency with family and friends, along with increased dialogue, positively influenced subjective well-being in both men and women (Kawakubo & Oguchi, 2015; Ohashi, 2018). These observations suggest a potential impact of relationships with family and friends on the experience of loneliness among older adults.

As illustrated by the ranking of factors related to well-being in older adults, “pessimism” emerges as a significant contributor. Despite this, the well-being of older adults has been observed to exceed that of other age groups. In recent years, the phenomenon known as the “aging paradox” has garnered significant attention. This term refers to the observation that, despite the prevalence of adverse conditions associated with aging, the sense of well-being among older adults is not low (Gondo, 2024). This aging paradox is theorized to occur when coping strategies for the loss of resources that accompany aging function effectively. In the context of maintaining happiness,

it has been suggested that a psychological change known as gerontological transcendence may occur, which involves the ability to accept the loss of resources as a natural aspect of the aging process rather than relying on coping strategies for the loss of resources (Gondo, 2024).

Furthermore, an experimental study has demonstrated that older adults tend to prioritize positive emotional stimuli, such as smiling faces, while disregarding negative emotional stimuli, such as angry faces. Additionally, older adults have been found to retain positive information more effectively than negative information (Reed & Carstensen, 2012). As such, while it has been indicated that the loss of various resources that support happiness becomes more pronounced in old age, making it difficult to maintain happiness, it is also known that there is no decline in happiness. Likewise in this study, the well-being of older adults was found to be greatly related to “pessimism”; however, the well-being of older adults was found to be higher than that of other age groups.

5-3 Limitations

This study did not evaluate well-being by gender. Research has demonstrated that women are more prone to experience negative emotions compared to men (OECD, 2020). A global examination of “happiness” by gender and country reveals that, in most countries, including developed and emerging economies, women consistently attain lower scores than their male counterparts. However, in Japan, the reverse is observed, with men demonstrating lower levels of well-being (Honkawa, 2021).

Furthermore, this study does not differentiate between the early and late stages of old age. Compared to the early stage of old age, the late stage of old age is associated with a decline in physiological and immune functions, leading to a higher risk of developing diseases and chronic conditions (Honkawa, 2021). Additionally, there is a decline in the ability to perform basic daily activities (Ouchi, 2005), which may have a detrimental effect on well-being. Furthermore, the factors associated with the well-being of late-stage old age were fewer than those of early-stage old age, and the factors that increased well-being were subjective health perception and financial comfort (Taniguchi et al., 2013).

Given the possibility that happiness and well-being may differ depending on gender and age, it is recommended that this be investigated in future research.

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