

# Trends of Health and Dietary Disparities by Economic Status among Elderly Individuals in Japan from 2004 to 2014: A Repeated Cross-Sectional Survey

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Received: July 31, 2023 Accepted: August 18, 2023 Online Published: September 7, 2023

doi:10.5539/gjhs.v15n10p1

URL: <https://doi.org/10.5539/gjhs.v15n10p1>

## Abstract

This study examines the changes in health and dietary disparities by economic status among elderly individuals in Japan from 2004 to 2014. The study design utilized a repeated cross-sectional approach, using data from the Survey of Attitudes among the Elderly toward Daily Life in 2004 and 2014. Logistic regression analysis was performed with subjective economic status, survey year, and their interactions as independent variables, and self-rated health, dietary satisfaction, and intake of balanced meals as dependent variables. The results revealed that disparities in self-rated health, dietary satisfaction, and intake of a balanced meal were present due to economic status. Furthermore, the disparities in self-rated health, dietary satisfaction, and balanced meal intake by economic status remained unchanged from 2004 to 2014 ( $P$  for interaction  $\geq 0.05$ ). The findings were consistent in sensitivity analyses conducted on those aged 75 and older, as well as on long-term care insurance recipients.

**Keywords:** economic status, health disparities, dietary disparities, elderly, Japan

## 1. Introduction

Economic inequality affects people's health and dietary behaviors. A meta-analysis of multilevel studies showed that economic inequality increases the relative risk for mortality (Kondo et al., 2009). Additionally, a review article concluded that a causal relationship exists between income inequality and health, based on a causal inference framework (Pickett & Wilkinson, 2015). Economic inequality affects health through unhealthy behaviors (Kondo, 2012), and unhealthy eating habits are one of them. In fact, good socioeconomic status is associated with high consumption of whole grains, vegetables and fruits, lean meats, and seafood; conversely, poor socioeconomic status is associated with high consumption of refined grains, potatoes, fatty meats, and fried foods (Darmon & Drewnowski, 2008). Moreover, poor socioeconomic status is associated with obesity (Drewnowski & Specter, 2004). These disparities can be partly explained by the fact that foods that cost little money or time have high energy density and low nutrient density (Darmon & Drewnowski, 2008, 2015; Drewnowski & Specter, 2004).

Health and dietary disparities by economic status are also known in Japan. The National Health and Nutrition Survey conducted by Japan's Ministry of Health, Labour and Welfare investigates disparities in health and diet by income among adults and the elderly every few years in the 2010s. Eating habits, physique, and health habits vary by income, and this has remained generally unchanged in the 2010s (Machida, 2022; Nishi, Horikawa, & Murayama, 2017). The National Health and Nutrition Survey began capturing data on health disparities by income in the 2010s, and changes from earlier years are unavailable. However, in Japan, trends in health inequalities by socioeconomic status have been captured since 1986 using data from the Comprehensive Survey of Living Conditions (Hiyoshi et al., 2013; Kachi et al., 2013; Kondo et al., 2008; Sugisawa et al., 2016; Tanaka et al., 2021). One study, which evaluated long-term trends from 1986 to 2013, found that health inequalities by income are cyclical (Sugisawa et al., 2016). This makes sense because Japan's economy fluctuated significantly from the 1990s through the 2010s. Following the collapse of Japan's bubble economy in the 1990s, the country experienced a prolonged period of economic stagnation. Despite some recovery in 2000, the economy was significantly impacted by the Lehman Shock in 2009 and the Great East Japan Earthquake in 2011. This fluctuation in Japan's

economic situation can be clearly seen in the unemployment rate (Sugisawa et al., 2016). The impact of each economic change on health and diet is also being analyzed. It includes dietary changes due to the Lehman shock (Jenkins et al., 2021), health outcomes during the employment ice age (Oshio, 2020), and changes in health disparities due to the collapse of the bubble economy (Kondo et al., 2008).

Japan has one of the fastest-aging populations in the world (Ishibashi, 2018). As population aging is expected to continue in developed countries worldwide, conducting research on health promotion targeting Japan's elderly will provide valuable evidence for future health promotion in these countries. This also applies to the issue of disparities in health and diet. Several studies have examined health and diet disparities by economic status among Japan's elderly, confirming the existence of disparities in health and diet by economic status (Aida et al., 2011; Fukuda et al., 2017; Ichida et al., 2009; Sugisawa et al., 2015). Additionally, trends in health disparities by income among Japan's elderly have been examined (Sugisawa et al., 2018). However, trends over recent years in dietary disparities by economic status among the elderly in Japan have not been explored.

This study examines the changes in health and dietary disparities by economic status among elderly individuals in Japan from 2004 to 2014. This study determines whether health and dietary disparities have evolved during this period. It is hypothesized that changes in health disparities might have occurred during this timeframe, especially considering significant economic events, including the Lehman Shock and the Great East Japan Earthquake.

## 2. Method

### 2.1 Study Design and Data

This study used a repeated cross-sectional survey design. Data were derived from the Survey of Attitudes among the Elderly toward Daily Life 2004 and 2014 (Director General for Policies on Cohesive Society, Cabinet Office, The Government of Japan) and obtained from the Social Science Japan Data Archive, Center for Social Research and Data Archive (Cabinet Office, 2004, 2014). The survey was conducted to determine the actual conditions and attitudes of the elderly regarding their overall daily life. This includes information on their daily living conditions, life satisfaction, food, clothing, and housing, and satisfaction with household chores, going out, daily enjoyment, and information about daily life. The survey targeted persons aged 60 and over throughout Japan and has been conducted four times so far in 1998, 2004, 2009, and 2014. Data from the 2004 and 2014 surveys are available by applying to the Social Science Japan Data Archive, Center for Social Research and Data Archive, and were used in a secondary analysis. The survey was conducted from November to December and was conducted through interviews and mail in 2004 and 2014, respectively. In 2004, 4000 people were surveyed, with 2862 (71.6%) valid responses. In 2014, 6000 people were surveyed, with 3893 (64.9%) valid responses.

This study was conducted using anonymous information from a previously completed survey and according to the ethical guidelines for life science and medical research involving human subjects in Japan. This study was exempt from applying the ethical guidelines for life science and medical research involving human subjects in Japan because anonymous information was derived from a survey conducted prior to the study.

### 2.2 Variables

#### 2.2.1 Economic status

Subjective economic status measured by a single question was employed in this study. Participants were asked, "How would you describe your current economic situation?" The following five options were then given: "I have a comfortable household budget and am not worried at all," "I do not have a very comfortable budget, but I am not too worried," "I do not have a comfortable budget, and I am somewhat worried," "I have a very tight budget, and I am very worried," and "I don't know." The last option was excluded from the analyses. The options were divided into "no economic insecurity (reference [ref.]) (sum of the first two options)" and "have economic insecurity (sum of the latter two options)" and were used for the analyses.

In Japan, income declines as many people leave the workforce at ages 60–65. Although some income can be obtained from public pensions, this is often less than the salary income up to that point. In fact, the average income of elderly households is less than half the average income of nonelderly households (Ministry of Health, Labour and Welfare, 2021). Conversely, the amount of savings is higher among the elderly (Statistics Bureau, Ministry of Internal Affairs and Communications, 2022). Economic comfort in the lives of Japan's elderly largely depends on their savings funds. Therefore, income alone is insufficient for understanding the elderly's economic situation in Japan. Subjective economic status has also been shown to correlate with income among Japanese adults, making it an appropriate indicator of comprehensive economic status, including income (Hayashi, Takemi, & Murayama, 2015). For these reasons, this study adopted subjective economic status as an indicator.

### 2.2.2 Outcomes

Self-rated health, dietary satisfaction, and balanced meal intake work as outcomes.

The participants were asked to rate their self-rated health on a five-point scale: good, somewhat good, fair, somewhat poor, and poor. In this study, the categories “good/fair (ref.) (sum of good, somewhat good, and fair)” and “poor (sum of somewhat poor and poor)” were used for analyses. Self-rated health was used as an indicator in this study because it is commonly utilized in previous researches, making it easy to compare our findings with those of prior studies (Kondo et al., 2009; Hiyoshi et al., 2013; Kachi et al., 2013; Sugisawa et al., 2016; Tanaka et al., 2021).

The participants were given the question, “Are you satisfied with your overall diet?” a one-choice answer from the following five options: satisfied, somewhat satisfied, somewhat dissatisfied, dissatisfied, and don’t know. Dietary satisfaction is a representative construct of diet-related quality of life (Ainuki et al., 2012; Iwasa, Yoshida, & Suzukamo, 2019). In this study, the responses were divided into “satisfied (ref.) (sum of satisfied and somewhat satisfied)” and “dissatisfied (sum of somewhat dissatisfied and dissatisfied)” for analyses. Responses of “don't know” were treated as missing values.

To assess balanced meal intake, participants were asked, “What are your concerns regarding your daily diet?” The response option “lack of dietary balance” was included, and answers to this question were used. Participants who selected this option were considered to have said “no.” Those who did not select this option were considered to have said “yes (ref.)” A well-balanced meal intake is associated with lower mortality rates (Kurotani et al., 2016; Oba et al., 2009) and is, therefore, an appropriate indicator of a healthy diet.

### 2.2.3 Other

In addition to the above, was used the survey year (2004(ref.), 2014), gender (men, women), age (60–69, 70–79, ≥ 80), living arrangements (living together, living alone), and long-term care insurance recipient.

## 2.3 Analysis

The author used responses from 6587 individuals (2004y: 2832, 2014y: 3755) with no missing required items for the analyses. For analyses regarding dietary satisfaction, the author excluded responses containing an additional 107 missing values from the above in 2014.

First, the author described participant characteristics for each survey year and performed chi-square tests. The author then described the number and percentage of participants in each year for each economic status in terms of self-rated health, dietary satisfaction, and balanced diet intake. In addition, the change from 2004 to 2014 in the percentage of each outcome was calculated. This was not only captured for all participants but also for those aged 75 and older only for long-term care insurance recipients only. Then, the author used logistic regression analysis to determine the main effects of economic status and survey year and identify temporal changes in outcomes using the interaction of economic status and survey year. Logistic regression coefficients ( $\beta$ ), standard errors (SE), and probability values (P) were calculated. The statistical significance of this interaction means that the percentage of each outcome has increased or decreased in health and dietary disparities from 2004 to 2014. Conversely, if it is not statistically significant, it does not mean that health and dietary disparities have changed between 2004 and 2014. Economic status, survey year, and their interaction were used as independent variables in Model 1. In Model 2, the author adjusted for gender, age, and living arrangements. In addition to the overall analysis, the author conducted sensitivity analyses among those who are aged 75 and older, and those who are long-term care insurance recipients.

All analyses were conducted using IBM SPSS Statistics 28.0, with a 5% significance level (two-tailed test).

## 3. Results

### 3.1 Participants' Characteristics

Table 1 shows the participants' characteristics according to survey years. Age ( $P < 0.001$ ), living arrangements ( $P < 0.001$ ), economic status ( $P < 0.001$ ), and dietary satisfaction ( $P < 0.001$ ) were significantly different by survey years. Additionally, the ratios of people aged 75 or older ( $P < 0.001$ ) and long-term care insurance recipients ( $P < 0.001$ ) also differed by survey years.

Table 1. Participants' characteristics according to survey years

	survey year				P
	2004		2014		
	n	%	n	%	
	2832		3755		
Gender					
men	1318	46.5	1823	48.5	0.106
women	1514	53.5	1932	51.5	
Age					
60–69	1506	53.2	1697	45.2	<0.001
70–79	1044	36.9	1378	36.7	
≥80	282	10.0	680	18.1	
Living style					
living together	2587	91.3	3301	87.9	<0.001
living alone	245	8.7	454	12.1	
Economic status					
no economic insecurity	2068	73.0	2237	59.6	<0.001
have economic insecurity	764	27.0	1518	40.4	
Self-rated health					
good/fair	2247	79.3	3007	80.1	0.461
poor	585	20.7	748	19.9	
Dietary satisfaction					
satisfied	2654	93.7	3308	90.7	<0.001
dissatisfied	178	6.3	340	9.3	
(missing)	0		107		
Eat balanced meals					
yes	2287	80.8	3007	80.1	0.494
no	545	19.2	748	19.9	
aged 75 or more	664	23.4	1284	34.2	<0.001
long-term care insurance recipient	169	6.0	356	9.5	<0.001

Note. P: chi-square test.

### 3.2 Self-Rated Health, Dietary Satisfaction, and Balanced Meals Intake for Each Year by Economic Status

Table 2 shows self-rated health, dietary satisfaction, and balanced meal intake for each year by economic status. For economically insecure participants, the percentage of those dissatisfied with the general diet was 13.9% and 16.8% in 2004 and 2014, respectively (changes from 2004 to 2014: +2.9%). In contrast, for the participants who did not have economic insecurity, the percentage of those dissatisfied with their general diet was 3.5% and 4.3% in 2004 and 2014, respectively (changes from 2004 to 2014: +0.8%). For economically insecure participants, the percentage of people not eating balanced meals was 23.7% and 24.8% in 2004 and 2014, respectively (changes from 2004 to 2014: +1.1%). Among the participants who did not have economic insecurity, the percentage of people not eating balanced meals was 17.6% and 16.6% in 2004 and 2014, respectively (changes from 2004 to 2014: -1.0%). For economically insecure participants, the percentage of those poor with self-rated health was 30.1% and 28.4% in 2004 and 2014, respectively (changes from 2004 to 2014: -1.7%). In contrast, for the participants who did not have economic insecurity, the percentage of poor with self-rated health was 17.2% and 14.2% in 2004 and 2014, respectively (changes from 2004 to 2014: -3.0%). The only significant decrease was in self-rated poor

health among those without economic insecurity. No other significant differences were found. When the analysis was limited to those “aged 75 or more” or “long-term care insurance recipients”, no significant differences were found in any of the items.

Table 2. Self-rated health, dietary satisfaction, and balanced meals intake for each year by economic status

	Survey year				%changes from 2004 to 2014	P
	2004		2014			
	n	%	n	%	%	
<i>Overall</i>						
dietary satisfaction (n and % of “not satisfied”)						
have economic insecurity	106	13.9	245	16.8	+2.9	0.073
no economic insecurity	72	3.5	95	4.3	+0.8	0.149
Eat balanced meals (n and % of “no”)						
have economic insecurity	181	23.7	376	24.8	+1.1	0.571
no economic insecurity	364	17.6	372	16.6	-1.0	0.397
Self-rated health (n and % of “poor”)						
have economic insecurity	230	30.1	431	28.4	-1.7	0.395
no economic insecurity	355	17.2	317	14.2	-3.0	0.007
<i>Aged 75 or more</i>						
dietary satisfaction (n and % of “not satisfied”)						
have economic insecurity	18	14.3	88	19.8	+5.5	0.159
no economic insecurity	22	4.1	46	5.9	+1.8	0.149
Eat balanced meals (n and % of “no”)						
have economic insecurity	28	22.2	104	21.8	-0.4	0.928
no economic insecurity	80	14.9	120	14.9	+0.0	0.993
Self-rated health (n and % of “poor”)						
have economic insecurity	53	42.1	213	44.7	+2.6	0.590
no economic insecurity	148	27.5	189	23.4	-4.1	0.088
<i>Long-term care insurance recipient</i>						
dietary satisfaction (n and % of “not satisfied”)						
have economic insecurity	12	25.5	45	28.1	+2.6	0.726
no economic insecurity	14	11.5	18	10.5	-1.0	0.797
Eat balanced meals (n and % of “no”)						
have economic insecurity	12	25.5	35	20.1	-5.4	0.421
no economic insecurity	20	16.4	22	12.1	-4.3	0.286
Self-rated health (n and % of “poor”)						
have economic insecurity	36	76.6	127	73.0	-3.6	0.618
no economic insecurity	61	50.0	95	52.2	+2.2	0.707

Note. P: chi-square test.

### 3.3 Logistic Regression Analyses

Table 3 shows the results of the logistic regression analyses for all participants. The main effect of economic status was significant, and the main effect of the year was not significant, for both self-rated health, dietary satisfaction, and balanced meal intake. The p-values for interaction in dietary satisfaction were 0.985 and 0.831 for Models 1

and 2, respectively. The p-values for interaction in balanced meal intake were 0.334 and 0.255 for Models 1 and 2, respectively. The p-values for interaction in self-rated health were 0.261 and 0.300 for Models 1 and 2, respectively. Thus, the interaction between economic status and the year was not significant for any of the outcomes.

Table 4 shows the results of sensitivity analyses or the logistic regression analyses for the participants “aged 75 or more” and “long-term care insurance recipient.” Both were similar to those analyzed in all participants. All P-values for the interaction were  $\geq 0.05$ .

Table 3. Logistic regression analysis of all participants

	Model 1			Model 2		
	$\beta$	SE	P	$\beta$	SE	P
Dietary satisfaction (ref. “satisfied”)						
economic insecurity (ref. “no”)	1.496	0.159	<0.001	1.463	0.161	<0.001
year (ref. 2004)	0.229	0.159	0.150	0.132	0.161	0.412
interaction (economic insecurity*year)	-0.004	0.203	0.985	0.044	0.205	0.831
intercept	-3.322	0.120	<0.001	-3.366	0.139	<0.001
Eat balanced meals (ref. “yes”)						
economic insecurity (ref. “no”)	0.374	0.103	<0.001	0.302	0.104	0.004
year (ref. 2004)	-0.069	0.081	0.397	-0.060	0.082	0.466
interaction (economic insecurity*year)	0.127	0.132	0.334	0.151	0.133	0.255
intercept	-1.544	0.058	<0.001	-1.617	0.075	<0.001
Self-rated health (ref. “good/fair”)						
economic insecurity (ref. “no”)	0.732	0.098	<0.001	0.851	0.101	<0.001
year (ref. 2004)	-0.227	0.084	0.007	-0.384	0.087	<0.001
interaction (economic insecurity*year)	0.145	0.129	0.261	0.137	0.132	0.300
intercept	-1.574	0.058	<0.001	-2.123	0.081	<0.001

Note.  $\beta$ : logistic regression coefficient, SE: standard error.

Model 1: economic status, year, and interaction were used as independent variables.

Model 2: Model 1 + gender, age, and living style were adjusted.

Table 4. Logistic regression analysis of “aged 75 or more” and “long-term care insurance recipient”

	<i>aged 75 or more</i>			<i>long-term care insurance recipient</i>		
	$\beta$	SE	P	$\beta$	SE	P
Dietary satisfaction (ref. “satisfied”)						
economic insecurity (ref. “no”)	0.941	0.450	0.036	1.244	0.338	<0.001
year (ref. 2004)	0.009	0.393	0.981	0.334	0.267	0.210
interaction (economic insecurity*year)	0.210	0.543	0.698	0.130	0.391	0.739
intercept	-2.153	0.418	<0.001	-3.194	0.235	<0.001
Eat balanced meals (ref. “yes”)						
economic insecurity (ref. “no”)	0.397	0.431	0.357	0.381	0.250	0.128
year (ref. 2004)	-0.144	0.356	0.686	-0.048	0.158	0.762
interaction (economic insecurity*year)	0.096	0.524	0.854	0.083	0.292	0.776

intercept	-1.326	0.361	<0.001	-1.965	0.142	<0.001
Self-rated health (ref. “good/fair”)						
economic insecurity (ref. “no”)	1.296	0.398	0.001	0.639	0.206	0.002
year (ref. 2004)	-0.003	0.248	0.991	-0.228	0.128	0.074
interaction (economic insecurity*year)	-0.345	0.455	0.449	0.342	0.240	0.155
intercept	-0.340	0.299	0.255	-1.111	0.112	<0.001

Note.  $\beta$ , logistic regression coefficient; SE, standard error.

Gender, age, and living style were adjusted.

#### 4. Discussion

This study described the changes in health and dietary disparities by economic status among elderly individuals in Japan from 2004 to 2014. As a result, it should be argued that health and dietary disparities by economic status in both 2004 and 2014, but the trends were largely parallel. Comparing 2004 and 2014, the health dietary disparities had not widened, but neither had they narrowed. It is no doubtful that the results will contribute to future research on health disparities in Japan.

The results of this study show that dietary disparities by economic status remained unchanged from 2004 to 2014. A previous study examined trends in health disparities by economic status among Japan’s elderly from 2004 to 2013 (Sugisawa et al., 2018). The results of the previous study remained unchanged as in this study (Sugisawa et al., 2018). In another previous study of Japanese adults and the elderly, health disparities by economic status widened slightly in 2007 and 2010 compared to 2004, but they were at the same level in 2013 as in 2004 (Sugisawa et al., 2016). The results of this study are consistent with those of previous studies (Sugisawa et al., 2016; Sugisawa et al., 2018). This study did not have data for the years between 2004 and 2014 and, thus, could not capture trends in those intermediate years. Additionally, in Japan, the Law for Supporting the Independence of the Indigent was enacted in 2013, and the Independence Support System for the Indigent began operating in 2015. The support provided by this system may contribute to the improvement of disparities in health and diet. Therefore, analyzing data from 2014 onward in the future is needed.

Additionally, unlike previous studies, this study did not observe a crossover of disparity by age (Sugisawa et al., 2016; Sugisawa et al., 2018). Prior studies observed a crossover of health disparities by income around age 80 (Sugisawa et al., 2016; Sugisawa et al., 2018). Essentially, the health disparity by income disappears around age 80, after which an inverse association appears: the lower the income, the healthier the individual. This crossover was not observed for dietary inequalities in the present sensitivity analysis of those aged 75 and older. However, as this study has a small sample size, conducting a more detailed examination of the crossover in dietary disparities by economic status using other data in the future will be necessary.

This study has several limitations. First, this study’s outcomes were subjective items for which validity and reliability were not verified. Validating dietary satisfaction with a validated diet-related quality of life scale, for instance, would be a better option. Dietary balance with nutrient intakes could be calculated based on actual dietary surveys. However, when examining past trends, as in this case, using the best method is often impossible. Therefore, verifying the trend using an indicator such as that used in this study is worthwhile. Moreover, data used in this study were obtained using different survey methods in 2004 and 2014, and the existence of bias due to this difference cannot be denied. Finally, as this is a repeated cross-sectional survey, the same individuals were not followed. While I statistically adjusted for gender, age, and family structure, I cannot eliminate the possibility that I am comparing potentially slightly heterogeneous groups.

This study recommends that proactive measures be implemented to address the prevailing health and dietary disparities among Japan’s elderly population. There is a clear presence of health and dietary disparities linked to economic conditions in Japan, which require intervention. Moreover, ongoing monitoring is essential to ensure that these disparities are being adequately addressed.

#### 5. Conclusions

This study examined the changes in health and dietary disparities by economic status among elderly individuals in Japan from 2004 to 2014. The results showed disparities in self-rated health, dietary satisfaction, and intake of a balanced meal due to economic status. Moreover, these disparities remained unchanged from 2004 to 2014. However, this study used data from only two periods, 2004 and 2014. Longer-term trends need to be identified in

the future.

### Acknowledgments

Data for this secondary analysis, “Survey of Attitudes among the Elderly toward Daily Life” 2004 and 2014, was provided by the Social Science Japan Data Archive, Center for Social Research and Data Archives, Institute of Social Science, University of Tokyo.

### Funding

D.M. was funded by JSPS KAKENHI; grant number JP21K13503.

### Informed Consent

Not applicable.

### Provenance and Peer Review

Not commissioned; externally double-blind peer reviewed.

### Data Availability Statement

It is available by applying to the Social Science Japan Data Archive, Center for Social Research and Data Archive, which is affiliated with the Institute of Social Sciences, University of Tokyo.

### Competing Interests Statement

The author declares that there are no competing or potential conflicts of interest.

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