Japanese Study of
Aging and Retirement

Chapter 2
Health and Health Care

2 Health and Health Care

2.1 Physical Health

2.1.1 Introduction

Aging is naturally accompanied by physical and functional deterioration and a higher likelihood of health problems. The aging of the population and subsequent burdens of medical and long-term care have become a common challenge to industrialized countries, including OECD member countries. In contrast to the US health care system's heavy reliance on the private sector, Japan and other OECD countries have basically adopted a public mandatory health care insurance system. Within this broad description, however, in OECD countries there is a wide variety of health care systems characterized by unique historical, cultural, and political backgrounds. We can also observe a wide variety within and across countries in terms of health achievement. A recent project to evaluate the efficiency, effectiveness, and equity of health care across OECD countries purported to learn lessons on issues related to health from other countries (OECD 2004). In this sense, Japan holds a very unique position of health and health care among OECD countries and promisingly offers important policy implications for other countries. The uniqueness of Japanese health and health care is summarized as follows.

First, Japan has the highest pace of aging in industrialized countries and the longest life expectancy in the world. According to OECD Health Data 2008, the life expectancy at birth for a Japanese male was 79.0 years in 2006, ranking third in the OECD circle following Iceland (79.4) and Switzerland (79.2). The number for a Japanese female was 85.8 years, the longest in the world (OECD 2008). Longevity of Japanese women is particularly remarkable when we compare Japan's number with those of Germany (82.4), France (84.4), and Sweden and Norway (82.9 for both). The increase in life expectancy is often attributed to a decreased infant mortality rate and improved elderly longevity which are further attributed to the improvement in economic living standards, public health interventions, medical technology innovations, and access to medical care. However, what made Japanese success possible in such a short period of just the past 50 years remains to be articulated.

Second, medical expenditure relative to economic size in Japan is very low for its excellent health achievement, compared to the OECD standard. While the total health expenditure of many major OECD countries is around 10% or more of GDP, the Japanese share was only 8.2% in 2005, a figure similar to those of the United Kingdom, Finland, and Ireland (OECD Health Data 2008).

This ambiguous combination of long life expectancy and low GDP ratio of medical expenditure poses a puzzle for both researchers and policymakers. One might argue that it reflects the fact that the Japanese people is extremely healthy. Another assertion might be that the Japanese health care delivery system is unusually efficient. Campbell and Ikegami argue that Japanese health policy has been successful in striking a balance between free access and cost containment, while it left quality control somewhat behind (Campbell & Ikegami 1999). Recent political debate over the skyrocketing health expenditure in the forthcoming super-aged society and threatened sustainability of the system requires empirical analysis of the main factors that enabled this unusual

combination of low cost and high health achievement. The analysis is critical not only for Japan, but for other countries who also suffer from a huge medical expenditure. In other words, the Japanese experience has great potential to provide useful lessons for other OECD countries.

In addition to the large difference in health and health care among countries, we should also pay attention to the substantial variation in health status among socio-economic groups within a country. Japan is not an exception which is described throughout this chapter. Despite the unique position of the Japanese population health and health care system, only limited socioeconomic and epidemiological research on the health disparity across socioeconomic positions has been conducted, mainly due to a lack of a comprehensive dataset.

Health disparity might be associated with genetic predisposition, individual attributes such as lifestyle behaviors, or environmental factors such as climate, toxic exposure, and accessibility to social, economic, and health resources. Thus, a comprehensive data collection is necessary to identify the socioeconomic, behavioral, and biological determinants of health. JSTAR is able to provide a large potential to study health problems related with aging, and to compare them with European countries in SHARE and HRS and ELSA in a consistent way. These surveys enable exploration of a variety of topics including prevalence of health problems, health care services (provision and utilization), and consequences of health issues on quality of life in an international perspective and jointly contribute to new scientific findings and evidence-based policymaking.

2.1.2 Overview of Health Domains in JSTAR

The questionnaire of health related variables used in JSTAR was originally based on the generic version of the SHARE questionnaire with modifications for the Japanese context. JSTAR has a wide range of indicators of physical health which have been grouped in four categories similar to SHARE: summary measures including self-reported health status, disease status, limitations in functioning, and limitations in activities of daily living. In addition, JSTAR performs a unique nutrition survey which provides background to health status. We will preview these variables in this subsection and provide more details in later subsections.

JSTAR has two measures for self-perceived health: a "North American" version with five answer categories ranging from "excellent" to "poor," and a "European" version with five answer categories ranging from "very good" to "very poor." Questions in the former version are asked in the interview, which employs the same scale used in existing domestic public surveys such as the Comprehensive Survey of Living Conditions of People. Questions in the latter, which is also employed in the Health and Retirement Study (HRS) as well as the English Longitudinal Survey on Aging (ELSA), are asked in the leave-behind (self administrative) questionnaire in JSTAR, though the translation of this European version has not been empirically tested beforehand. Thus, in this report, the results of the North American version are used unless otherwise specified. While there is no question on long-term health problems, we conducted a detailed history recording on disease conditions in JSTAR. JSTAR asked respondents to choose one of the four categories for activity limitations for the past 12 months,

which corresponds to the Global Activity Limitation Index (GALI) (Robine & Jagger 2003) asking respondents to choose one of the three categories for activity limitations over the past six months.

JSTAR has asked respondents whether they had a chronic disease diagnosed in their lifetime (20 named diseases). In the case of cancer, the location of the cancer (20 body parts) was also identified. Limitations in functioning were measured by self-report on mobility sensory functioning and other aspects of physical functioning. In addition to these responses, grip strength was measured using a handheld dynamometer (Smedley type, Hand Grip Meter, No. 6103, TANITA, Tokyo, 75 kg) in the dominant hand. Grip strength is a strong predictor of functional limitations and disability (Rantanen et al. 1999; Ishizaki et al. 2000).

The method of measurement of grip strength was different in Japan: subjects stood with the arm straight out, which is accordance with the instructions of the Japanese Ministry of Education, Sports, and Science for measurement with a Smedley type dynamometer. SHARE, HRS, and ELSA adopted a measurement with the subject seated and the elbow flexed at 90 degrees, which was originally a measurement style for the Jammer type dynamometer. Whether the use of different measurement methods and equipment influences results is a matter for further research.

While SHARE recorded walking speed for respondents aged 76 and over, JSTAR omits the measurement since the respondents surveyed in JSTAR were aged 75 or under. Finally, limitations in "activities of daily living" were measured by self-report in six types of daily activities (e.g. dressing, getting in/out bed, eating, etc.). Limitations in "instrumental activities of daily living" (IADL) were measured using the Tokyo Metropolitan Institute of Gerontology Index of Competence (TMIGIC), which has been a standard measurement of IADL in Japan, and includes items (e.g. preparing a meal, shopping, making telephone calls, etc.) compatible to the scale used in SHARE and ELSA (Nicholas, Huppert, McWilliams et al. 2003).

2.1.3 Prevalence of Physical Health Problems

Table 2-1-1 illustrates the prevalence of physical health problems. The numbers in the table correspond to the averages for males and females in each measure of health. The figures in parentheses are maximum and minimum figures within the averages by gender and municipality. We should note that the age range of the respondents differs between JSTAR and SHARE. JSTAR surveys persons aged between 50 and 75 while SHARE collects data from persons aged 50 and over including those in their 80s. We should keep in mind this difference in age range between JSTAR and SHARE throughout this chapter.

Table 2-1-1   General physical health measures among men and women in JSTAR sample

Health measure	Levels	Men		Women	
Summary measures					
Self-perceived health					
(US version)	Less than "very good"	50.9	(46.1-55.0)	53.8	(49.2-57.2)
Activity Limitations (GALI)	1 or 2	15.0	(12.4-19.4)	19.9	(17.0-23.5)
Diseases and symptoms					
Chronic diseases	2 or more diseases	36.0	(31.0-46.0)	34.7	(27.6-38.7)
Limitations in functioning					
Mobility and functioning	1 or more limitations	12.7	(9.1-16.0)	22.2	(19.3-27.6)
Grip strength	Mean grip strength	35.6	(33.4-36.8)	22.7	(21.5-23.3)
Limitations in activities of daily living					
ADL limitations	1 or more limitations	5.0	(3.8-8.6)	6.0	(3.9-9.9)
IADL limitations	1 or more limitations	44.4	(38.6-51.2)	35.2	(33.2-38.8)

SHARE found that 40% of male respondents and 48% of female respondents answered less than "good" in self perceived health status in the European version questionnaire. If we use the European version questionnaire in JSTAR, the corresponding number is 70.9% for males and 75.6% for females. Since Japanese respondents tend to choose the medium category (in this case "3. fair"), the proportion of "less than good" may understate actual health status among JSTAR respondents. Instead, the proportion of those who answered less than "very good" (or the second category) in the US version is shown in the table: it is 50.9% for males and 53.8% for females.

The results also showed a higher portion of subjects answering that they had activity limitations in the GALI scale, compared to SHARE results. Taking that the SHARE sample includes subjects older than in the JSTAR sample, it seems that the J-STAR sample has a larger portion of complaints of "poorer" health status compared to the sample subjects in SHARE. According to the Comprehensive Survey of Living Condition of People 2004, however, 57.9% of males and 60.2% of females aged 55-74 responded with a health perception less than "very good." Thus, compared to those in the national survey, the JSTAR sample gave rather better self-report health status. These puzzling numbers suggest that we have to be careful when we interpret the difference in perceived health status across countries, an aspect further discussed in Section 2.3.

In terms of self-reported chronic diseases, more than one-third of the JSTAR respondents had at least two chronic diseases diagnosed during their lifetimes. However, the numbers of self-reported health status by males are marginally smaller and those of females are substantially smaller compared to the ones in the SHARE sample.

The proportion of subjects with one or more limitations in mobility and sensoriphysical functions (eyesight, hearing, and chewing) was 39.8% for males and 44.2% for females in JSTAR. The corresponding figures in SHARE were still higher: 43% for males and 50% for females. The difference may be accounted for by the difference in the samples' age ranges as described above. Grip strength was measured by almost all respondents (which they seem to have enjoyed). The average grip strength was 36 kilograms for males and 23 kilograms for females, numbers that are lower than those in SHARE (43 kilograms and 26 kilograms, respectively). The variation might be due to an innate physical structural difference between Japanese and European Caucasians.

Lastly, JSTAR has a set of measures for ADL (Activities of Daily Living) and IADL (Instrumental Activities of Daily Living), similar to those in the SHARE questionnaire. Five percent of males and six percent of females reported that they had one or more limitations in six activities in daily life, e.g. dressing and using the toilet. The numbers were lower than those in SHARE (9.2% for males and 12.5% for females). In contrast, 44% of males and 35% of females in JSTAR reported that they had one or more limitations in IADL measured by the TMIGIC scale, which seems much higher than those in SHARE (11.8% for males and 21.1% for females). If we limit the questions to seven items of the TMIGIC scale to standardize the scale content to the SHARE questionnaire, the number drops to 10.6% for males and 7.6% for females, which is even lower than the SHARE results. Many of the subjects who complained of limitation in IADL in JSTAR answered that they did not engage in social engagements such as talking with younger people or visiting friends, which were included in TMIGIC but not in the SHARE questionnaire. Social engagement and participation will be further discussed in Chapter 3, Social and Family Context.

2.1.4 Variations by Age, Gender, and Municipality

Most physical health problems are strongly related with age and their prevalence is proportional or progressive with age. In this section, the prevalence of the self-reported disease status will be presented by age, gender, and municipality. It is important to mention two caveats beforehand. As mentioned in the SHARE report, JSTAR sampled residents living in the community and excluded institutionalized persons from its sampling frame. Since those persons are likely to have more health problems and occupy a larger portion of the older population, the disease prevalence reported in JSTAR and/ or SHARE may be underestimated. The other caveat is the cross-sectional character of the baseline observations. We should keep in mind that the results across different age cohorts are affected by the mixture of the age and cohort effects. For example, the older groups are not only older but also belong to a different generation and life course, factors that are likely to affect health and health care issues. We need to be careful that "age-gradient" includes cohort effects too. This limitation is common to all cross-sectional datasets and will be overcome when longitudinal data are constructed after the second wave of research.

Figures 2-1-1 and 2-1-2 illustrate the prevalence of chronic diseases by gender and municipality. The most common chronic diseases in the JSTAR sample are hypertension, followed by heart disease, hyperlipidemia, and diabetes.
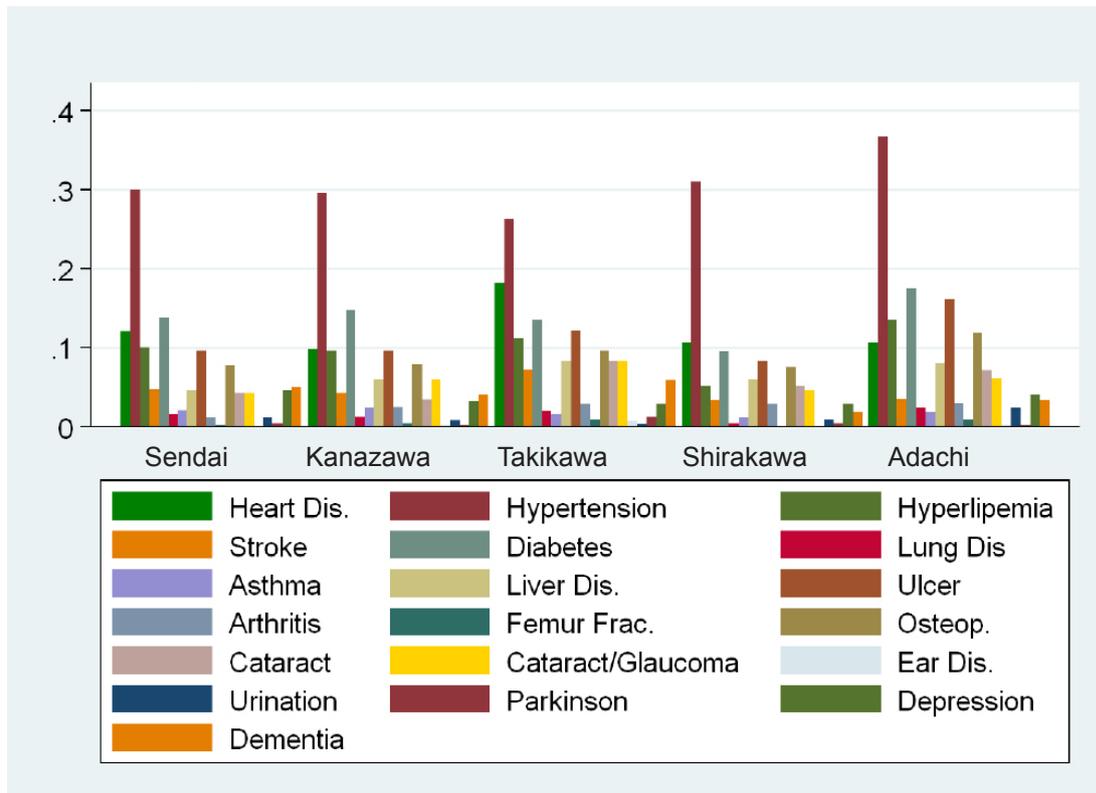
Figure 2-1-1 Prevalence of self-reported chronic diseases by municipality: males
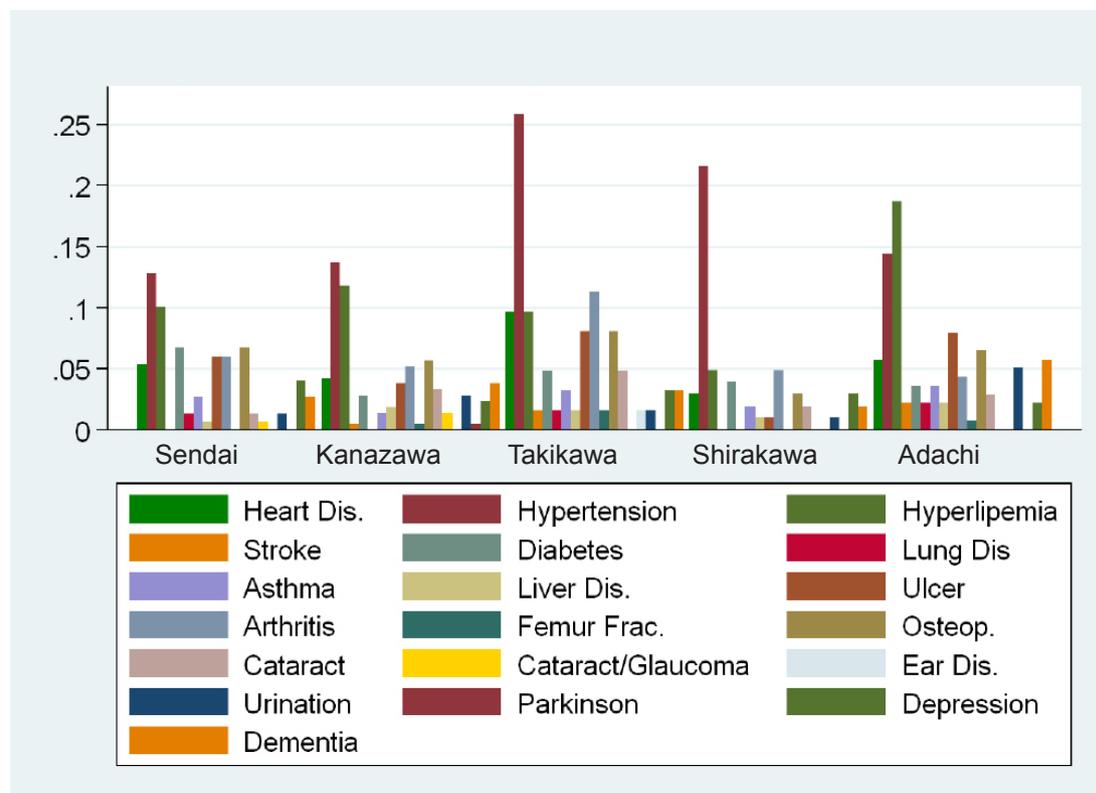

Figure 2-1-2 Prevalence of self-reported chronic diseases by municipality: females

Since disease prevalence is age-dependent, we should take a closer look at the numbers by stratifying by age. Figures 2-1-1-1~3 show the prevalence among males by age strata, the 50s, 60s, and 70s. The corresponding figures for females are Figures 2-1-2-1~3. The prevalence of hypertension increases with age. Compared to the numbers in the SHARE report, JSTAR respondents showed similar numbers and trends of hypertensive prevalence. In the 70s category, 40% to 50% of respondents answered they have been diagnosed as hypertensive. In the 50s category, males had a higher prevalence compared to females, and the sex difference in the hypertension prevalence was dissolved in the 70s. Females in their 50s in Takikawa city showed exceptionally higher prevalence of hypertension.

The prevalence of heart disease also increases proportionally to age. The sex difference was somewhat small in the 50s, but males in their 70s showed higher prevalence (21.5%) compared to females (15.4%). Again, Takikawa city showed the highest numbers in every age and sex category. The prevalence of heart disease in the JSTAR sample was almost as high as those in the SHARE sample, which was somewhat unexpected. We should be careful in interpreting this result because the prevalence in SHARE seems lower than expected from other previous reports.

The prevalence of hyperlipidemia was not age-dependent. In Sendai and Adachi, the prevalence among males decreased over age. The trend was the same even after limiting the sample to those who underwent annual health check-ups. Thus, the decreasing trend was not likely due to under-diagnosis, but was an actual trend among men in the urban areas. Female respondents in their 70s and over showed a higher prevalence (12.6%) than men in the same age category (8.8%). It is well known that menopausal women have a higher chance of hyperlipidemia and subsequent atherosclerotic diseases because estrogen has an effect to lower serum cholesterol, and women after menopause lose the protective effect by estrogen. It should be noted that those in Shirakawa had the lowest numbers in prevalence in any age and sex category, and younger males in urban areas showed the highest prevalence, suggesting that eating habits may be different in urban and rural areas, a result tested by nutrition data analysis in the following section.

The prevalence of diabetes in male respondents was twice as high as that in females, and increased proportionally with age. Again, Shirakawa has the lowest prevalence (7.0%) and Adachi the highest (12.2%), suggesting the urban lifestyle may be related to higher prevalence of diabetes.

The prevalence of stroke clearly increased over age (1.0% in the 50s and 5.8% in the 70s), and was higher among males than females (4.5 vs. 2.6%, respectively), which is on par with previous epidemiological observations. The number is almost compatible with that in the SHARE sample.

Cancer prevalence was also proportional to age (2.7% in the 50s and 5.8% in the 70s). It is interesting to note that after adjusting for age and sex, Shirakawa showed the significantly lowest prevalence of cancer (Odds ratio 0.38 [0.21-0.70]). Whether this is due to low incidence or due to a high mortality rate needs to be further investigated when the second wave data is prepared.
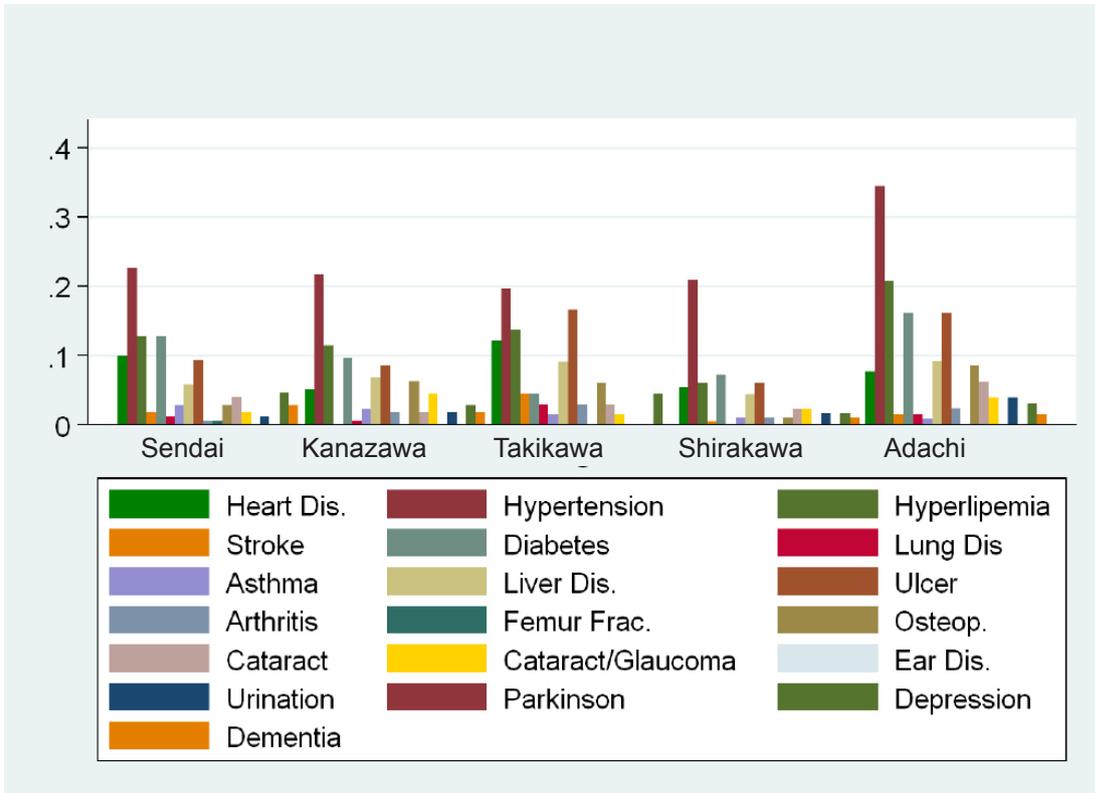
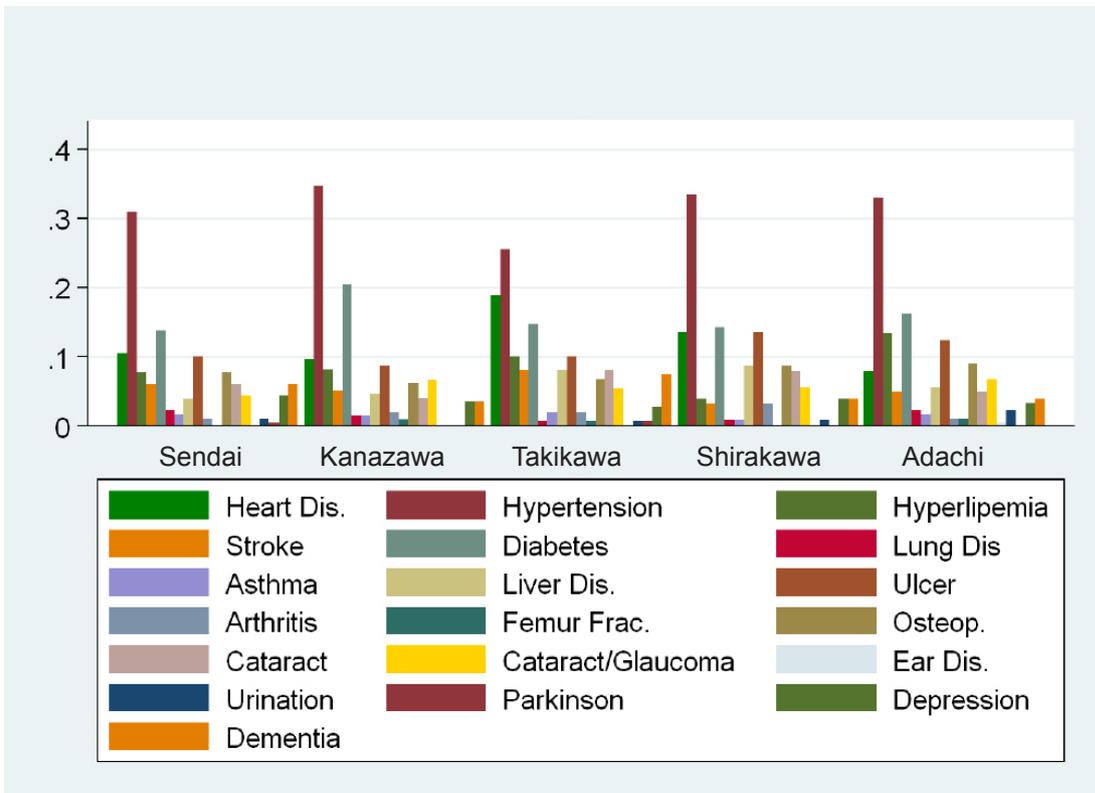Figure 2-1-1-1 Prevalence of self-reported chronic diseases by municipality: males in 50s

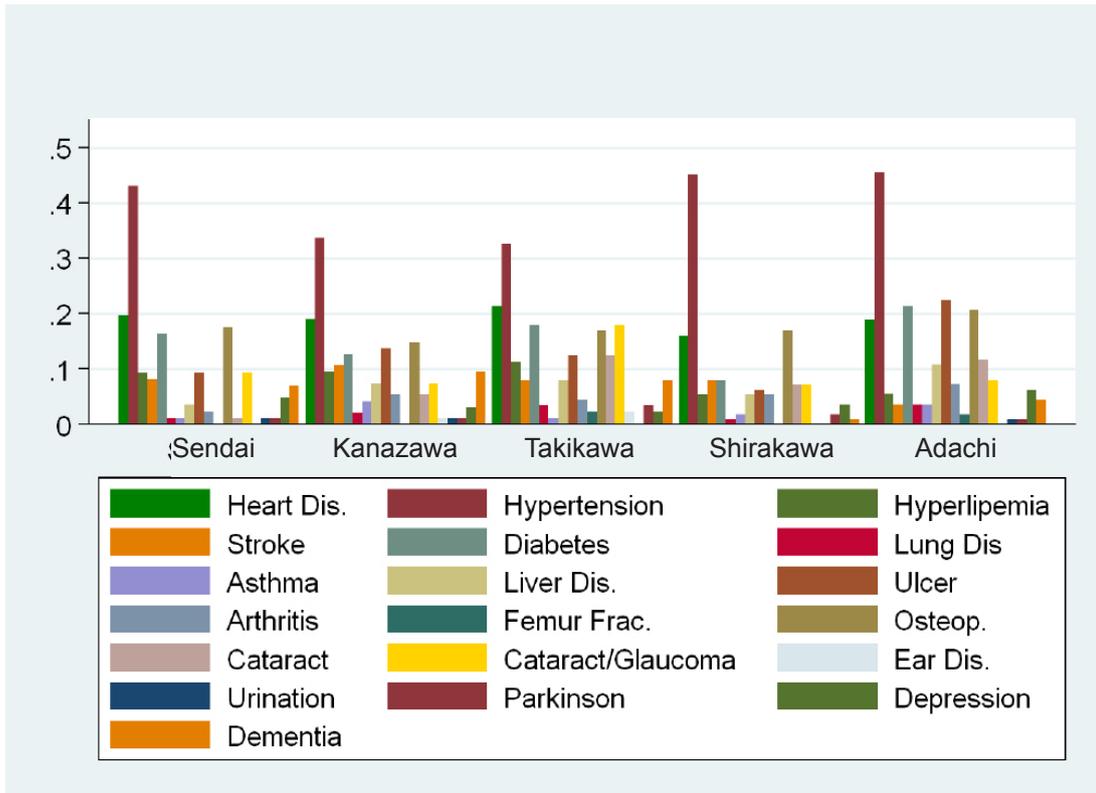Figure 2-1-1-2 Prevalence of self-reported chronic diseases by municipality: males in 60s

Figure 2-1-1-3 Prevalence of self-reported chronic diseases by municipality: males in 70s

Other age-related diseases such as cataract, arthritis, and hip fracture also showed increasing odds to age. Cataract was more frequently diagnosed in the 70s age group (22% for the 70s and 5% for the 50s) and in females (8.9% for males and 14.0% for females), but after adjusting for age and sex, there was no difference across municipalities. Arthritis and hip fracture was more often reported in those aged in their 70s, and among females. It is noteworthly that, even after adjusting for age and sex, Takikawa showed significantly higher prevalence of arthritis and hip fracture. Heavy snow in the winter months and related falling accidents may attribute to the difference, and further investigation in the following wave survey may be necessary.

The older respondents are not only likely to have a chronic condition, but also likely to have more numbers of chronic conditions. Those in their 50s had 0.9 disease conditions on average, while those in their 70s had 1.7 diseases per respondent on average. Due to physiological decline and high likelihood of multiple chronic conditions, older subjects are more likely to suffer functional decline in mobility, sensori-physical functioning, and IADL. Among respondents aged in their 70s, 32.6% had a limitation in more than one item of mobility, 15% in eyesight, 17% in hearing, 57% in chewing, and 15% in more than one item of IADL.

After adjusting for age and sex, Adachi and Takikawa showed significantly higher odds ratio for having more than two diseases (OR 1.47 (p<0.001) and 1.43 (p=0.002), respectively; Sendai as reference category), and having limitation in mobility and sensori-physical functioning (OR 1.52(p<0.001) and OR 1.33(p=0.009), respectively). Adachi also showed significantly higher odds ratio for having a limitation in IADL (OR 1.65 (p=0.003)).
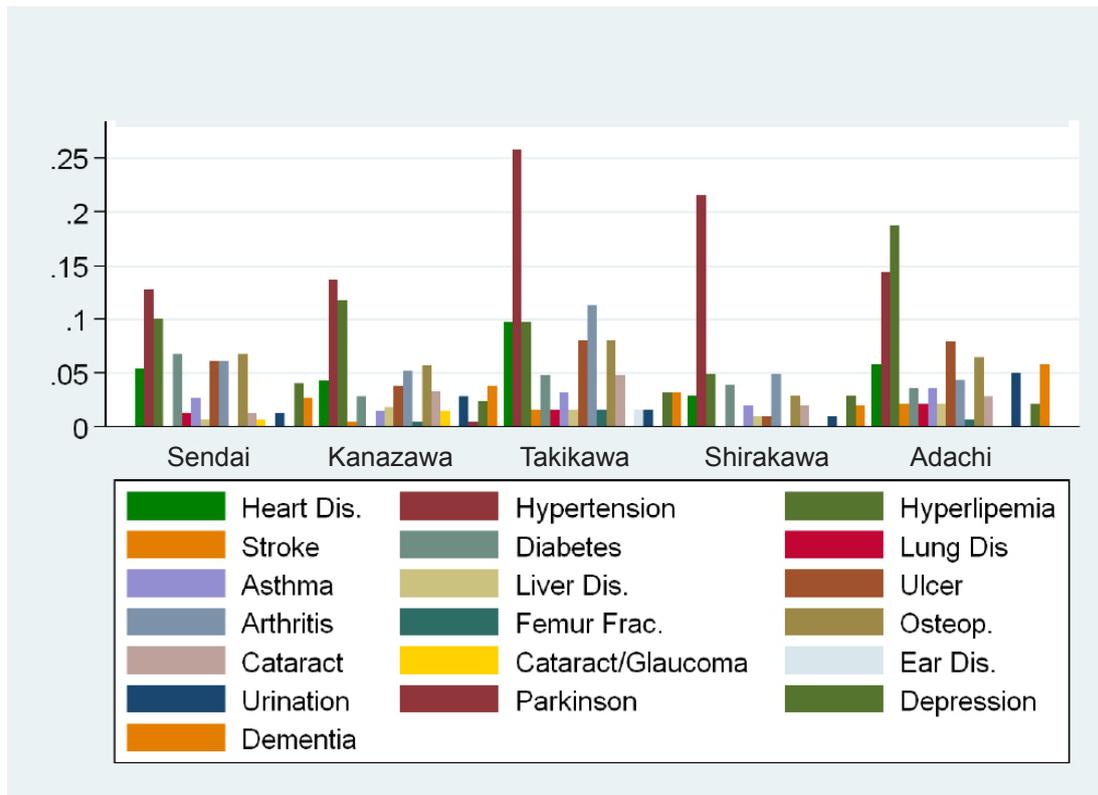
Figure 2-1-2-1 Prevalence of self-reported chronic diseases by municipality: females in 50s
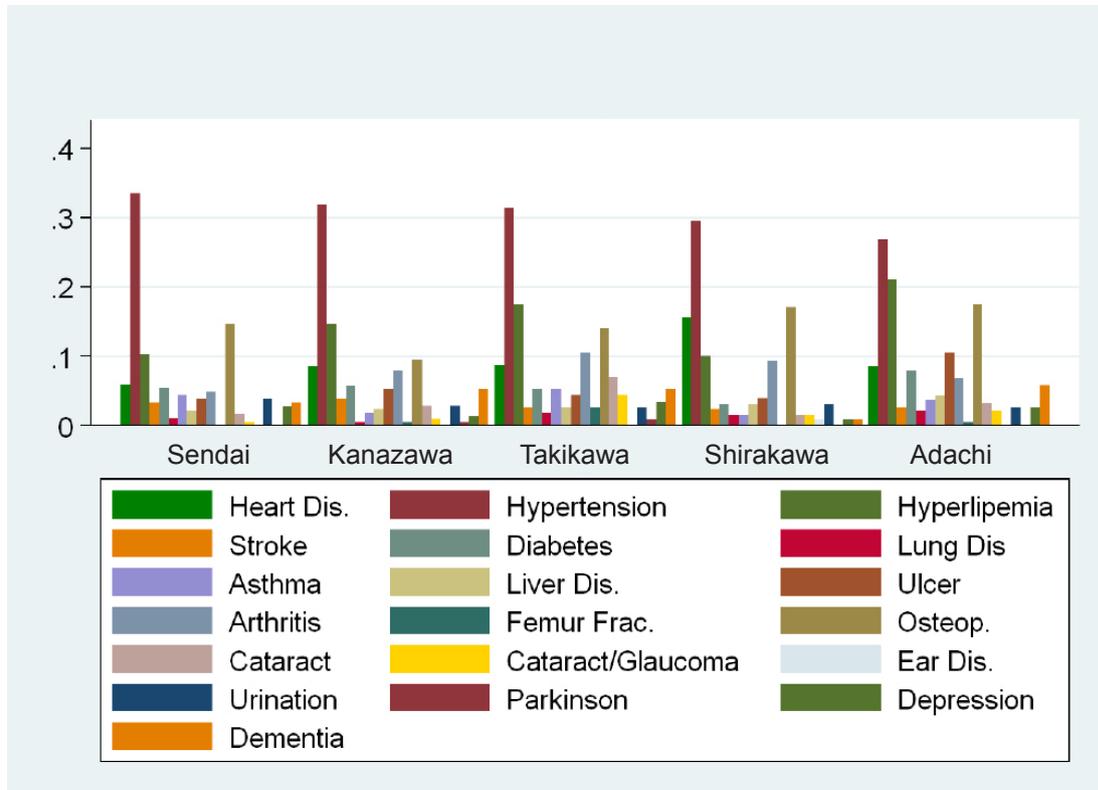

Figure 2-1-2-2 Prevalence of self-reported chronic diseases by municipality: females in 60s
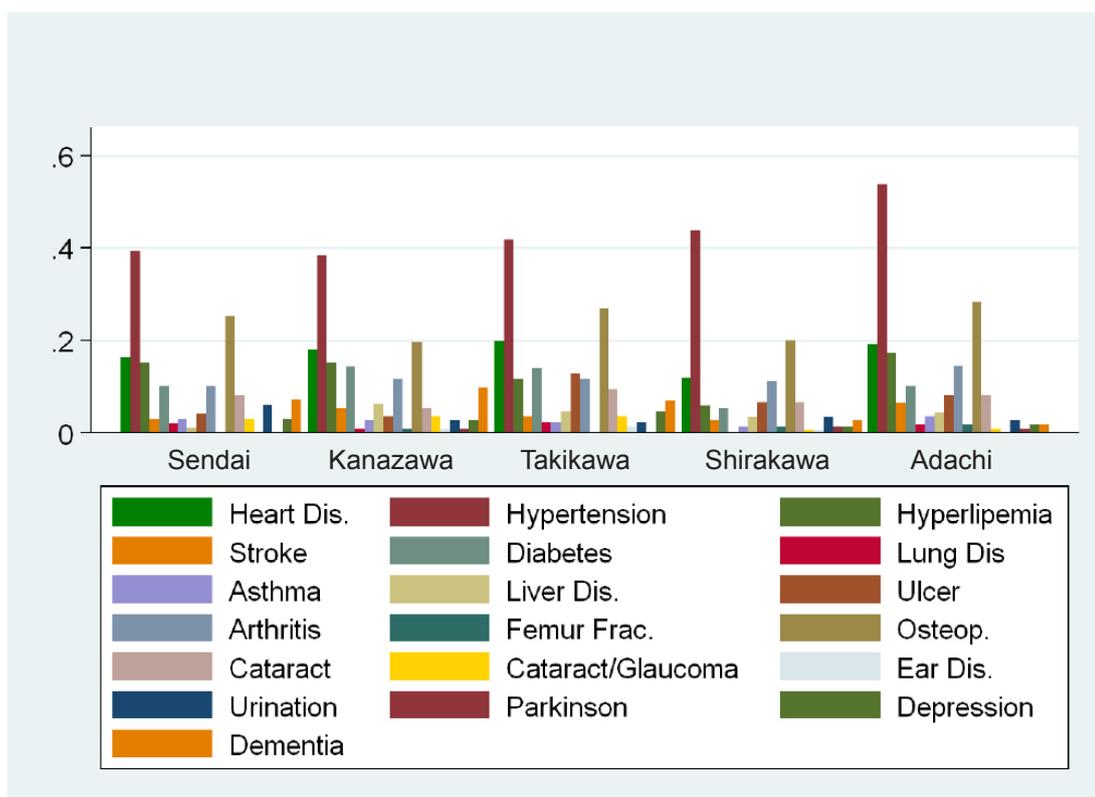
Figure 2-1-2-3 Prevalence of self-reported chronic diseases by municipality: females in 70s

Figure 2-1-3 shows the results for grip strength, which is often used as an objective measure of physical health and is known as a strong predictor of functional prognosis. The average measure was declined with age, and males showed higher measure than females in any age category. In the 50s, the average measure was close to 40 kilograms for males and 25 kilograms for females. There was not much difference in grip strength across municipalities, though the average for males in Adachi is somewhat lower. In the 70s, Adachi has the lowest average among all municipalities for both males and females. After adjusting for age and sex, Adachi showed significantly lower grip strength (-2.3kg compared to Sendai residents as reference). Whether these differences can be attributed to socioeconomic gradient of health across municipalities will be the topic in Section 2.3.

One caveat must be mentioned here. We should keep in mind that the method for measuring grip strength differs between SHARE and JSTAR even though both surveys use the same Smedley type dynamometer. The effect of the difference in the mode of grip strength measurement will be examined in a small pilot study and as part of the second wave survey.

As we have observed, the prevalence of health problems varies substantially across municipalities even in the same country. The determinants of such cross-regional variance attract research interests: they might be demographic, behavioral, or socio-economic attributes; the policy implication is accordingly quite different. JSTAR provides interesting opportunities for looking at differences across municipalities in the prevalence of health problems because it contains comprehensive measure of lifestyle behaviors, dietary habits, socioeconomic resources and medical service utilization.
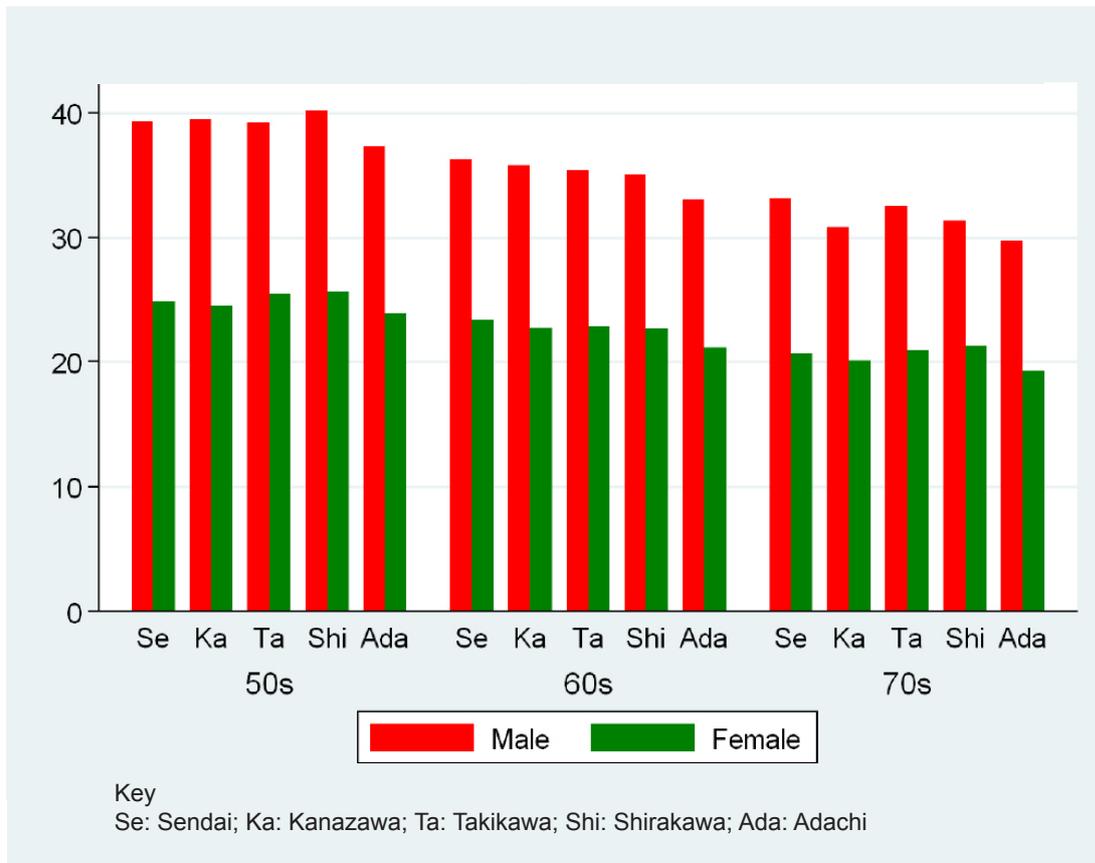
Figure 2-1-3 Grip strength by age and sex

However, JSTAR has just finished its first wave data collection, and it makes only cross-sectional data which limits the potential of the dataset for causal inference. The longitudinal data are critical for providing opportunities to better understand the interpersonal and cross-regional differences.

2.1.5 Conclusions

• Japan's unique characteristics of health and health care issues, especially the ambiguous combination of the longest average life expectancy and very low GDP ratio of medical expenditure, have considerable potential to formulate important lessons for health policy in other developed countries.

• As in European countries, in Japan the prevalence of physical health problems among the elderly is high, but there is substantial variation within the subjects. JSTAR has unusually rich variables on health and health care as well as social, economic, family and employment status, and allows us to explore a variety of issues related with health issues.

• Construction of longitudinal data after the second wave makes it possible to explore determinants of physical health problems among the elderly, especially to disentangle causal relationship between health and socioeconomic status, and to evaluate effectiveness of health policy.

2.2 Socioeconomic Disparities in Physical Health across Regions

2.2.1 Introduction

The disparity in health status across socioeconomic positions is considered as one of the "oldest" problems in modern societies. Japan is known as an egalitarian country compared to European countries, and some attribute the Japanese people's longest life expectancy to egalitarian social norms (Marmot & Smith 1989). However, even in Japan, the health gap between the rich and the poor is identified in various dimensions of health: e.g. self-reported health (Shibuya et al. 2002), all causes and disease specific mortality (Fukuda et al. 2005; Nakaya et al. 2005; Fujino et al. 2005), and physical and mental functions (Murata et al. 2008; Yamazaki et al. 2005). In Europe, the social gradient of health has been increasing in recent years (Mackenbach et al. 2003), though there is little empirical data in the Japanese case.

There has been a tremendous volume of policy debate on widening income inequality in Japan after the decade-long recession beginning in the early 1990s. Most of those debates focus only on economic disparity and often ignore health disparity. Although several epidemiological studies identifying socioeconomic disparity in health have been conducted, they do not adequately treat the endogenous problems between economic status and health status. Despite the importance to both academics and policymakers, a lack of data on both health and socioeconomic status has hampered the development of empirical research on socioeconomic positions and health.

Several factors contribute to difficulties in conducting studies of socioeconomic disparity in health. One is that income, educational attainment, and occupational class are inter-related yet have distinctive relationships with health status, health related behaviors, and access to economic and health resources. Thus, they should be concurrently measured and controlled. Previous epidemiological studies in Japan often failed to cover all of them. In the case of elderly population, especially, wealth and consumption rather than income are a better proxy for lifetime income, though no epidemiological studies have measured wealth and consumption so far. To the contrary, household economic studies measured income, consumption, and wealth, though they ignored health measurement. JSTAR includes household economic measurement in detail, and a set of various health measures as shown in the previous section.

Another major difficulty is that socioeconomic status and health are endogenous. Socioeconomic status discriminates in terms of access to health care and other health-supporting resources. Although the universal health insurance system covers all residents of Japan, it cannot be ignored that a portion of the lowest income group is not able to pay the insurance premium and thus loses eligibility to receive medical services at 10% co-payment. Socioeconomic status further discriminates in terms of the opportunity for social participation and social relationship, which affects mental health and functions among the elderly. (Murata et al. 2008) Inversely, health status affects the chance for social strata mobility. Such endogenous problems are not fully solved with panel data collection per se, as often claimed by epidemiological studies. Panel data with comprehensive measurements allows researchers to use adequate analytic techniques to overcome endogenous problems.

JSTAR enables us to perform in-depth examination of the nature and size of health disparities and of the relationship between health and socioeconomic status in a way comparable to SHARE. This subsection provides an overview of socioeconomic disparities in physical health in Japan. The main message is that Japan, which is often considered a relatively homogenous and egalitarian country, has serious health disparity across socioeconomic positions, and the size of the effect cannot be ignored. As in European countries, persons in the lower socioeconomic classes experience disproportionate burden of morbidity and disability. The government should pay close attention to these facts and reform public policies toward mitigating the disparities in health status across socioeconomic status.

In what follows, we use educational level as an indicator to represent socioeconomic status, as the SHARE report did. Educational attainment is a proxy for lifetime income while household income, another candidate to measure socioeconomic status, fluctuates and varies across life stages, especially for those at the time of retirement. Educational attainment may also be related to skills and knowledge for healthier lifestyles. In Japan, elementary and junior high school education (nine years) is compulsory. We divide the sample into those with compulsory education only (which corresponds to Levels 0-2 (pre-primary, primary and lower secondary education) defined by ISCED (international standard classification of education) (UNESCO 1997) and those with higher educational attainment.

The 2000 Census collected educational attainment of the Japanese population (note that the 2005 Census did not collect education data). We can estimate the proportion of those with compulsory education from the 2000 statistics, assuming that the attrition pattern since then would be equal regardless of the level of educational attainment. Thus, we simply regard here that those in age group 50-54 in 2000 would reach age 55-59 in 2005. Therefore, the proportion of those with compulsory education would be 21.2% in the 54-59 age group for both sexes, while the corresponding number in the JSTAR sample was 17.9% for males and 14.4% for females. The proportion in the 60s age group would be 32.7% for males and 36.8% for females in the Census, while it is 37.8% for males and 41.8% for females in the JSTAR sample. The proportion in age group 70-74 would be 42.3% for males and 46.3% for females in the Census, while it is 54.3% for males and 58.0% for females in JSTAR. Thus, compared to the national Census, the JSTAR sample includes a larger portion of those with primary education attainment. This is largely because the sample in Shirakawa had a dominantly large portion of those with primary education: 71% of males and 74% of females in their 60s were of primary education attainment.

Another indicator of socioeconomic status is household income, but caution must be paid. The unit of survey in JSTAR as well as in SHARE is the individual, not the household. And the household is defined as a couple (if married) and their economic dependents, if any. For example, if a woman is a homemaker and does not earn income, her individual income is measured as zero. In JSTAR and SHARE, the spouse's income is also measured. Therefore, household income is defined as the sum of the income of each individual member of the two-member household. To obtain equivalent household income adjusted for household size, we divided the value of income by the square root of the number that is the sum of the couple, their dependent children and parents living together, assuming these parents are economically dependent, which may not always be the case.

In order to illustrate socioeconomic disparities in health, we calculated age-adjusted odds ratios, as the SHARE report did, since age is the strongest predictor of health status, and age is also related to educational attainment. The odds ratio compares the risk of disease or disability between low vs. middle/high educational groups, and between lower vs. upper of median income groups. An odds ratio of 1 indicates that there are no differences between the two groups. And odds ratio larger than 1 indicates a higher risk of disease/disability among the lower socioeconomic group. For example, an odds ratio of 1.3 means that the lower socioeconomic group has a 30% higher chance of disease/disability status, compared to their higher socioeconomic counterpart. We also include municipalities as dummy variables to compare across municipalities.

2.2.2 Physical Health Problems across Socioeconomic Status

Figures 2-2-1, 2-2-2, and 2-2-3 illustrate odds ratios of educational attainment for perceived health status less than "very good" (in the US version questionnaire), ADL limitations, and IADL limitations, respectively. Figures 2-2-4, 2-2-5, and 2-2-6 illustrate odds ratios of equivalent household income for perceived health and ADL/IADL limitations.
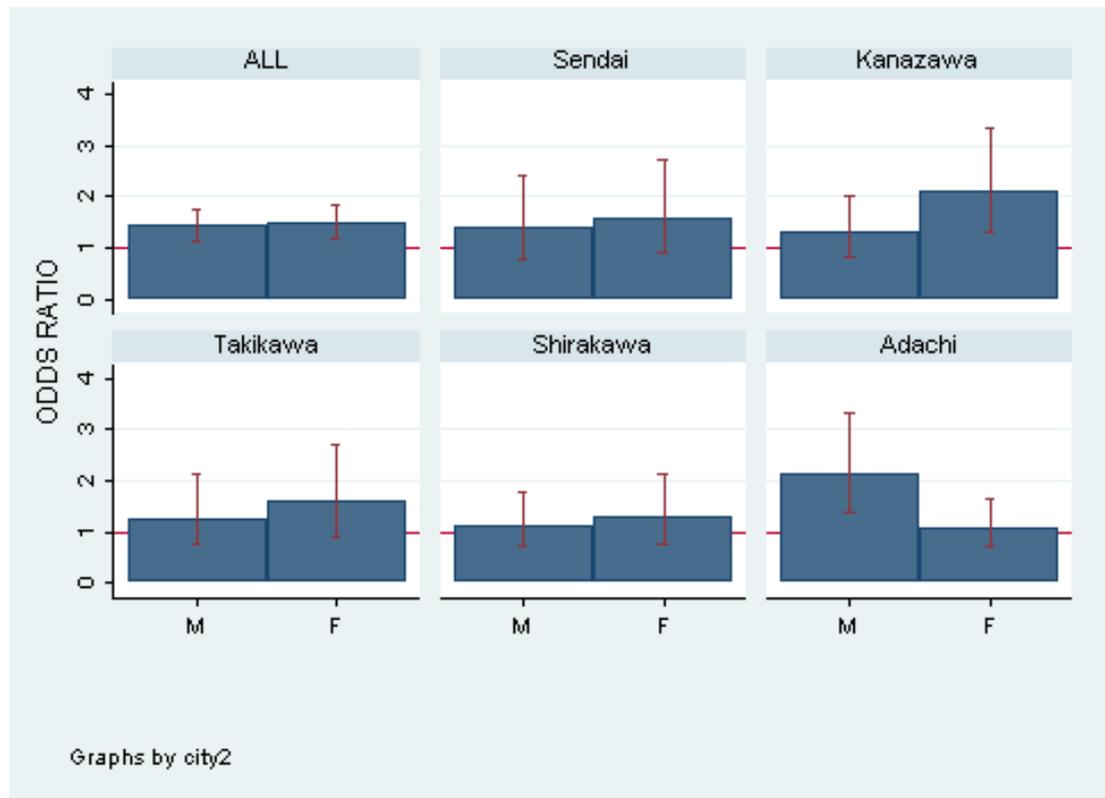

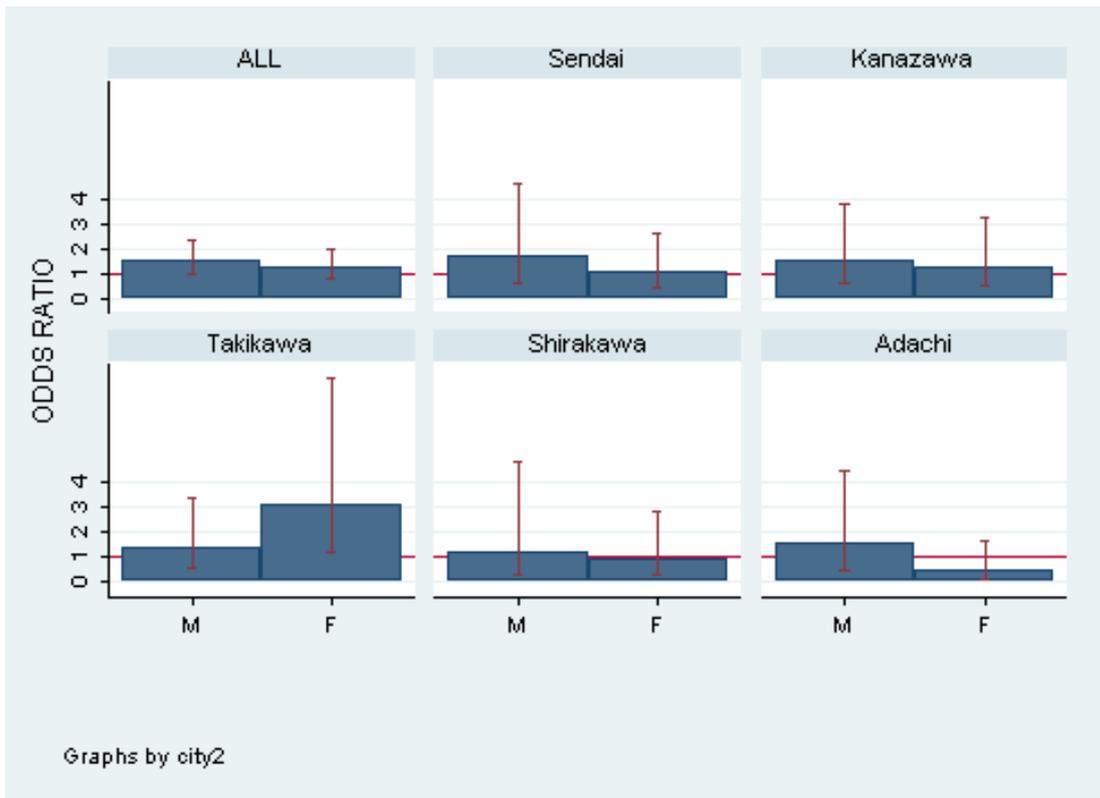Figure 2-2-1 Perceived health status vs. education
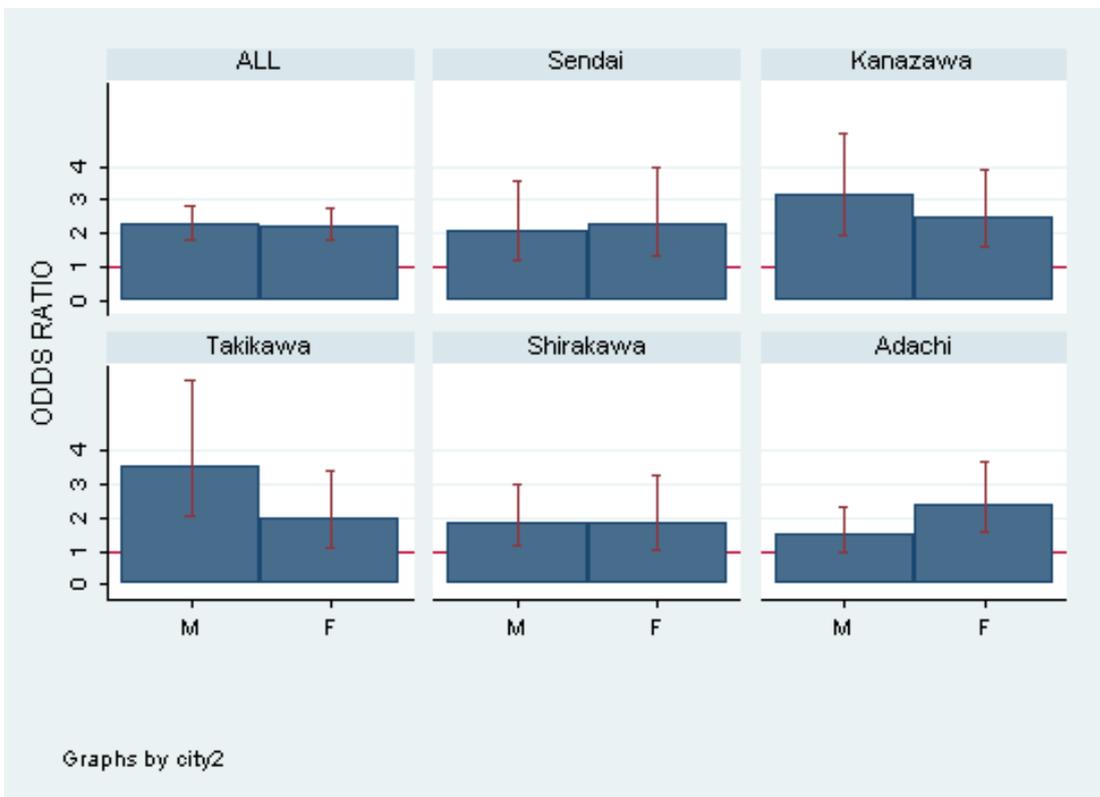
Figure 2-2-2 ADL limitations vs. education
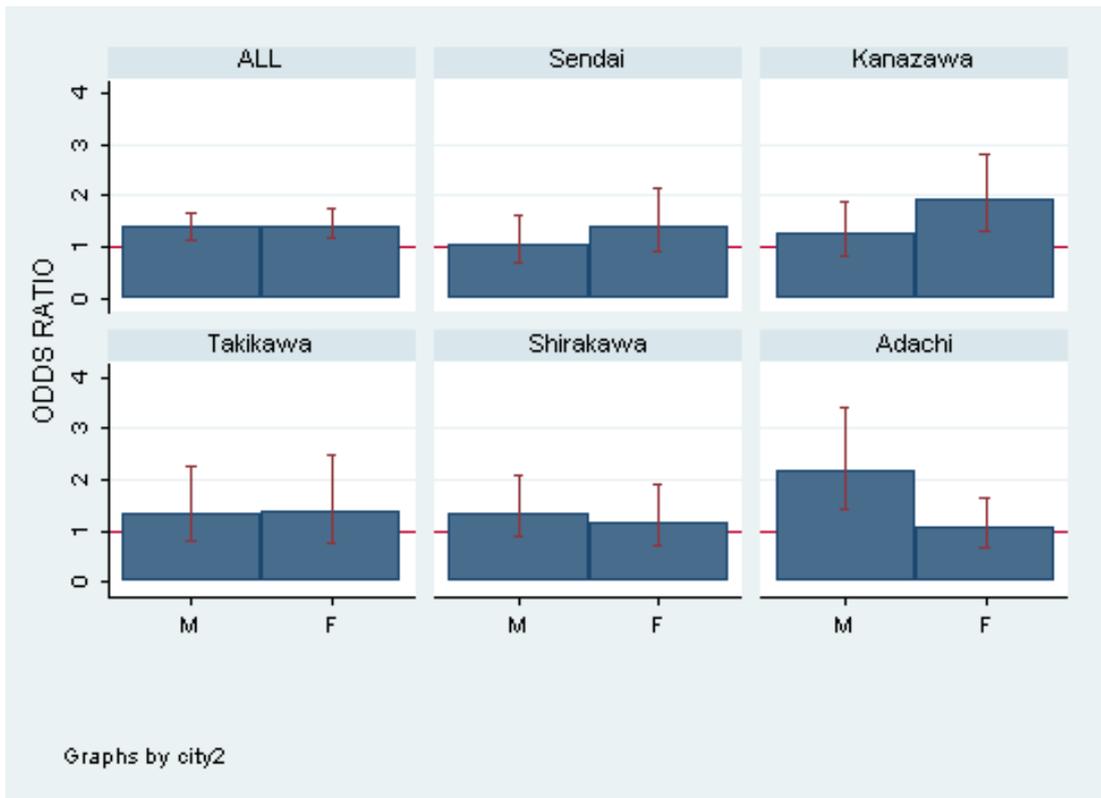

Figure 2-2-3 IADL limitations vs. education

Figure 2-2-4 Perceived health status vs. equivalent household income
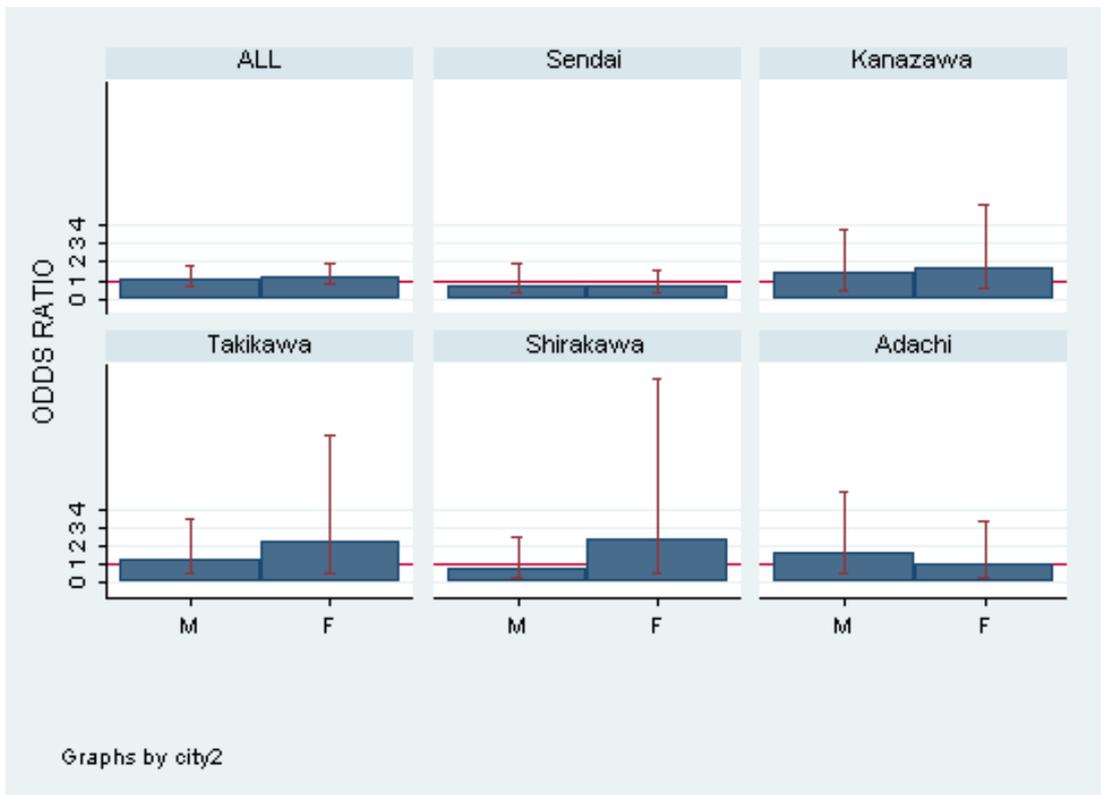

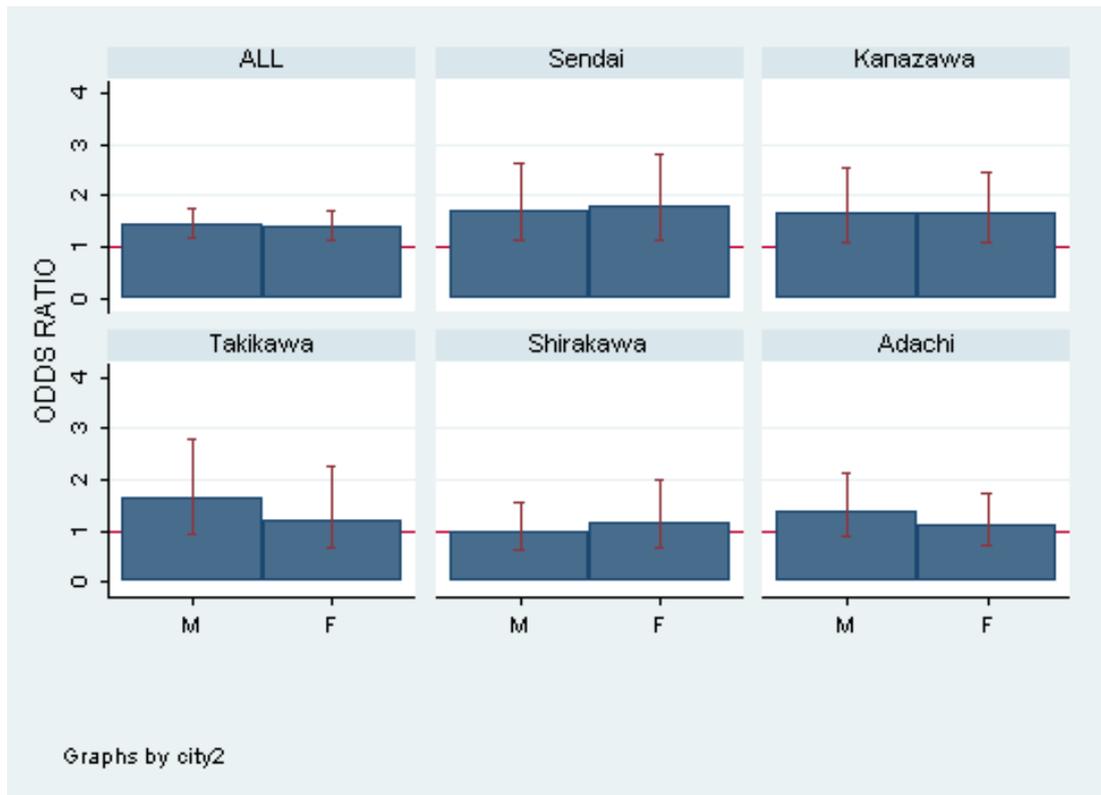Figure 2-2-5 ADL limitations vs. equivalent household income

Figure 2-2-6 IADL limitations vs. equivalent household income

As a whole, odds ratios of lower education attainment for reporting self-perceived health less than "very good" were 1.42 [1.15-1.75 for 95% confidence interval, or CI] for males and 1.46 [1.18-1.81] for females, after adjusting for age and municipalities (Figure 2-2-1, left upper graph). The impact of lower educational attainment was observed the most saliently among females in Kanazawa, and males in Adachi.

In the males category, the odds ratio of lower educational attainment for ADL limitation was marginally significant (OR 1.50 [0.96-2.33]) adjusting for age and municipalities, though the measure was not significant among females (OR 1.27 [0.83-1.95]) (Figure 2-2-2, left upper graph). There were no significant differences across municipalities for males, but there were higher odds for ADL limitation among females in Takikawa, compared to those in the other municipalities.

IADL limitation showed highly significant associations with educational attainment in both sexes. The odds ratio of lower education for IADL limitations after adjusting for age and municipalities was 2.24 [1.81-2.79] for males and 2.22 [1.78-2.78] for females (Figure 2-2-3, upper left graph).

Household equivalent income was also significantly related to self-perceived health status and IADL limitations. The odds ratio of health status less than "very good" in the lower income category was 1.37 [1.13-1.67] for males and 1.41 [1.16-1.73] for females, adjusting for age and municipalities (Figure 2-2-4, upper left graph). The odds ratio of ADL limitation was not significant in both genders (Figure 2-2-5). The odds ratio of IADL limitation was 1.44 [1.18-1.76] for males and 1.39 [1.12-1.72] for females (Figure 2-2-6).

We also tested interaction terms between socioeconomic dummies and demographic dummies (age and sex). None except for interaction between education and age on IADL limitation were significant (p=0.02, not shown in figures), The impact of lower educational attainment on IADL limitation was significantly lower among those in their 70s compared to younger categories. That is, since IADL limitation is strongly age-dependent, the impact of educational attainment is "diluted" by the effect of age in older strata.

Figures 2-2-7-1 to 2-2-7-6 report the odds ratios of having specific chronic diseases according to educational attainment. After adjusting for age, the prevalence of heart disease and hypertension were not related to educational attainment in either sex (Figures 2-2-7-1 and 2-2-7-2, respectively). The exception was females in Sendai, where the odds ratio of lower education for hypertension was 2.04 [1.16-3.58].

The odds ratios of the prevalence of hyperlipidemia was less than 1: that is, lower education was protective against hyperlipidemia; odds ratios adjusted for age were 0.63 [0.43-0.92] for males, and 0.69 [0.50-0.94] for females (Figure 2-2-7-3). The results are similar for equivalent household income (data not shown). Higher income was associated with higher odds of being diagnosed as hyperlipidemia. The negative association between socioeconomic status and hyperlipidemia was also found in males in the SHARE sample. It is speculated that economic accessibility to meat and other fat containing foods may be the culprit.

JSTAR includes a detailed food frequency questionnaire, which is not available in SHARE. Fat Calorie Ratio (FCR) is a ratio of fat energy intake to total energy intake, and the national recommendation in Japan is 25%. After adjusting for age and sex, middle/higher educational attainment compared to preliminary education attainment was related to increase in FCR by 1~1.4 % in the JSTAR sample (data not shown in figures). This finding may give some explanation to the association between hyperlipidemia and educational levels.

Unexpectedly, odds ratios for the prevalence of diabetes were not significant, and the point-estimate of the odds ratio of lower education was larger than 1 (1.25 [0.60-2.58] for males and 1.44 [0.96-2.16] for females) (Figure 2-2-7-4). Interestingly, the odds ratio of lower household income was less than 1 (0.88 [0.67-1.14] for males and 0.94 [0/65-1.34] for females) (not shown in figures). Why lower education was positively related to diabetes prevalence while it was negatively related to hyperlipidemia needs in-depth analysis, because lower FCR among the lower educational group appears contradictory to the higher prevalence of diabetes.

For other disease statuses, figures will be shown by sex, but they are combined across municipalities because the prevalence is low. The odds ratios are adjusted for age and municipalities.

Stroke was significantly related with educational attainment among males. Odds ratios of lower education was 2.13 [1.34-3.39] for males after adjusting for age and municipalities. For females the association was only marginal (OR 1.76 [0.95-3.24]) (Figure 2-2-7-5). The interaction between sex and education was not significant. Thus, the difference would be mainly due to the sex difference in baseline prevalence of stroke.
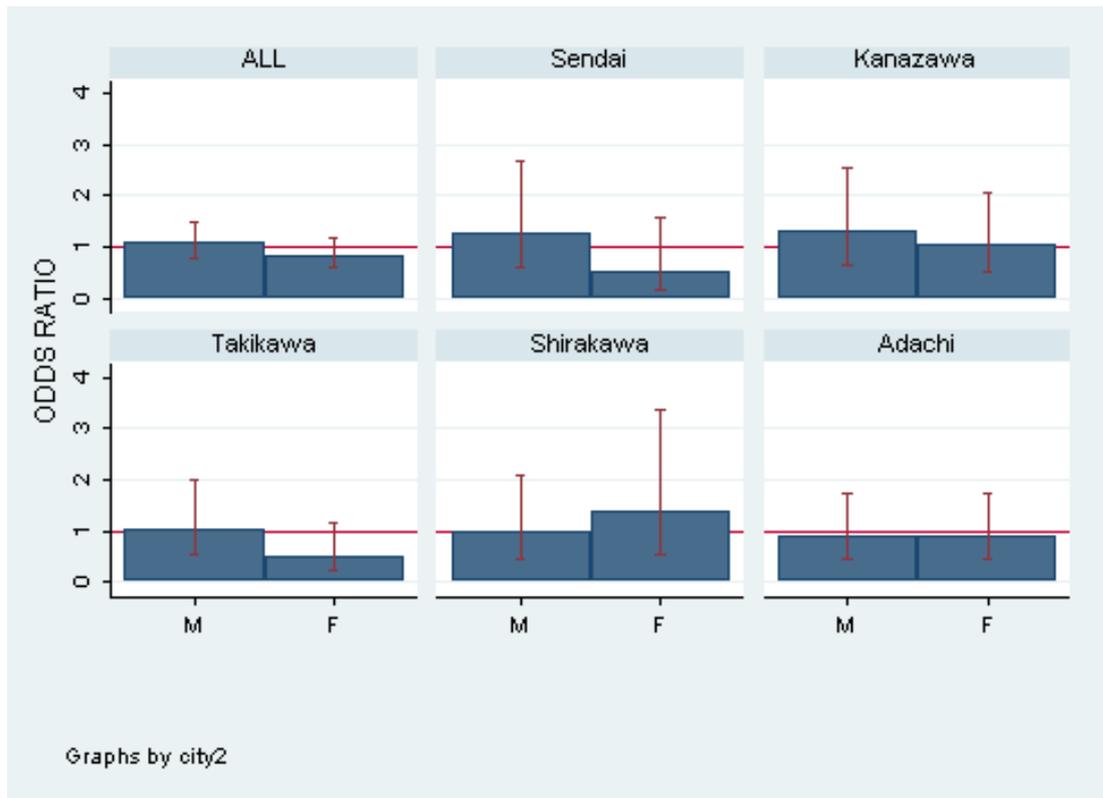
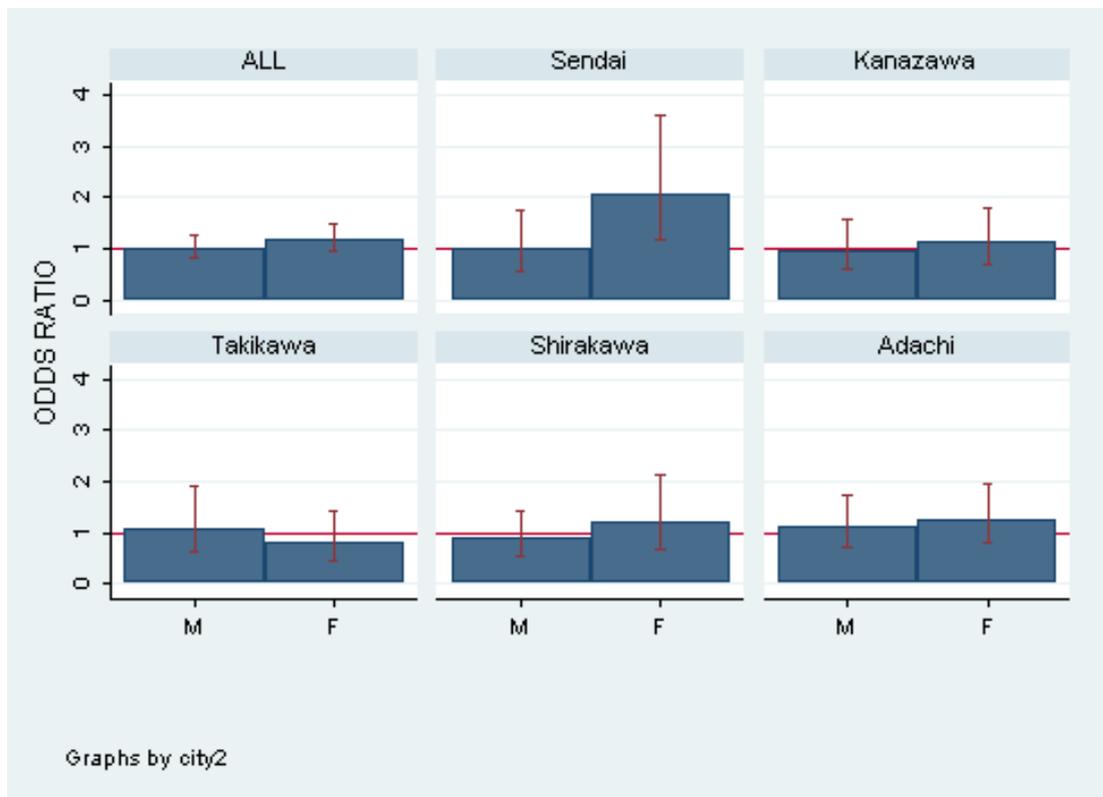Figure 2-2-7-1 Heart disease prevalence vs. education

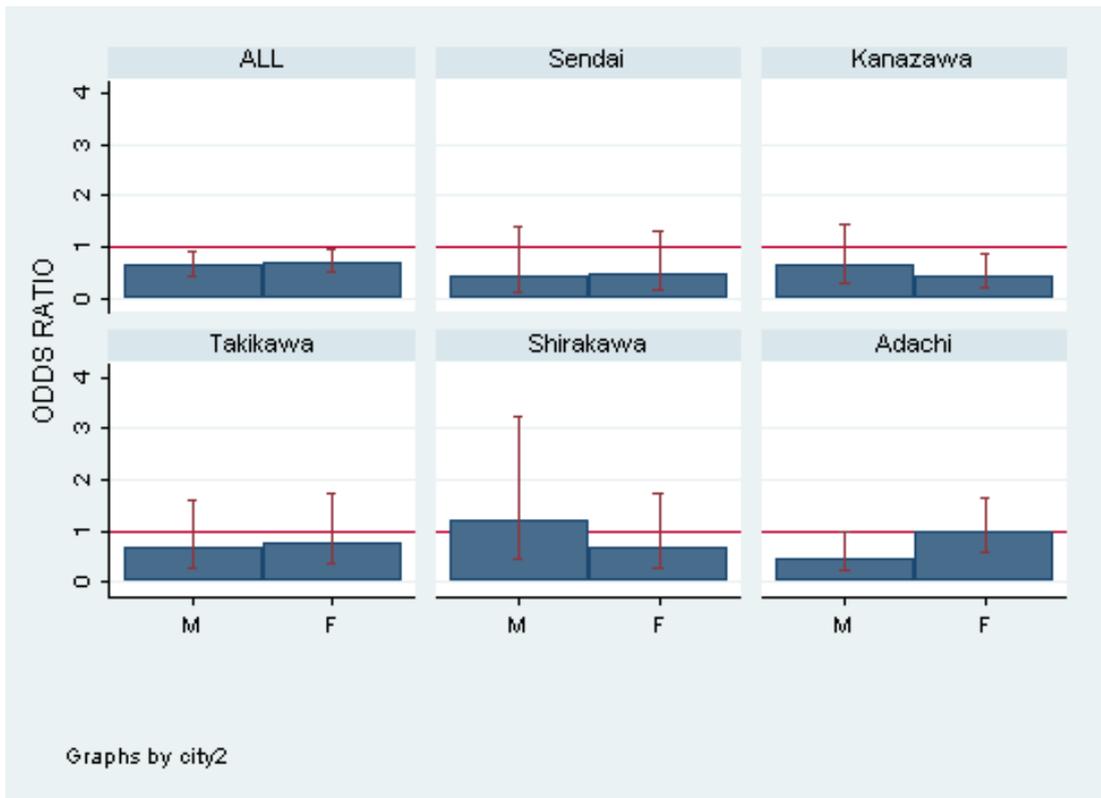Figure 2-2-7-2 Hypertension prevalence vs. education

Figure 2-2-7-3 Hyperlipidemia prevalence vs. education
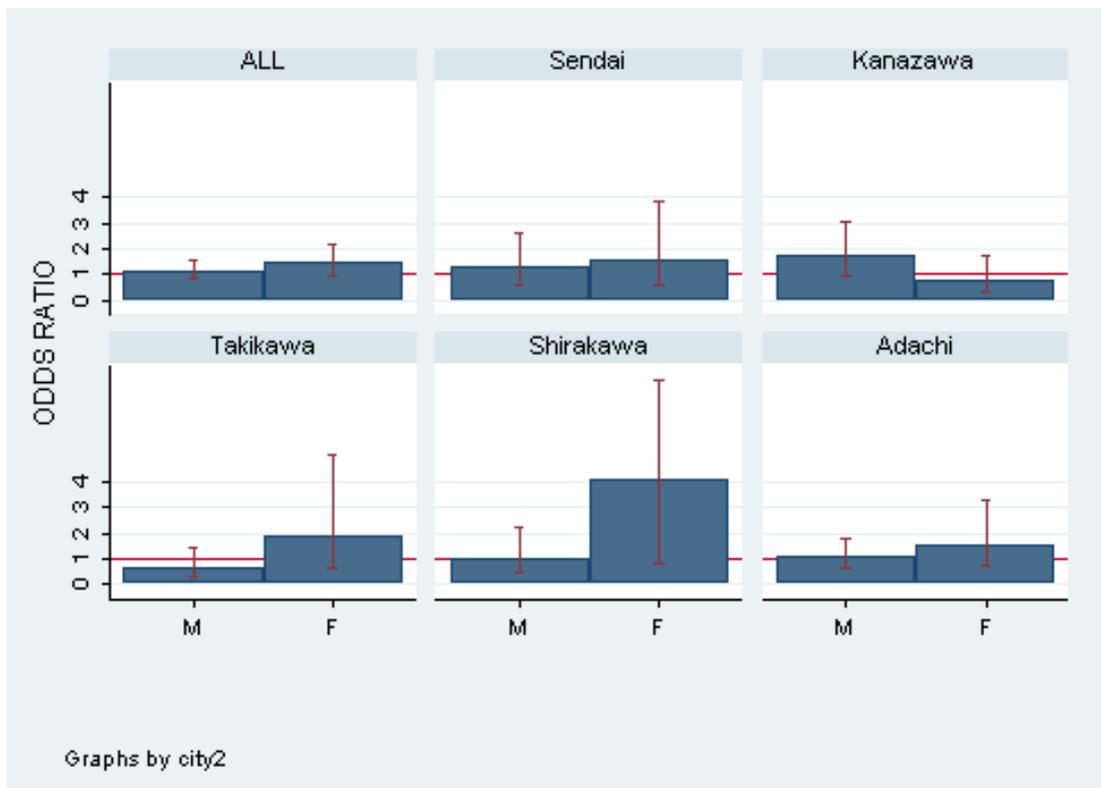

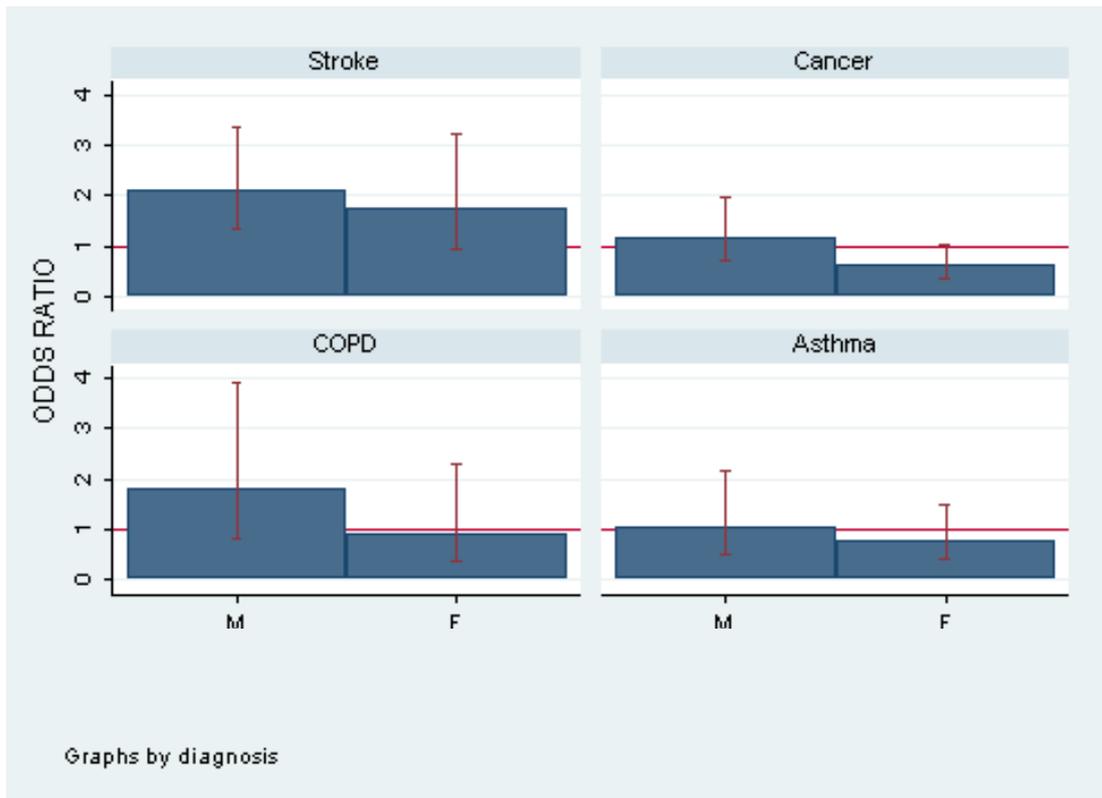Figure 2-2-7-4 Diabetes prevalence vs. education

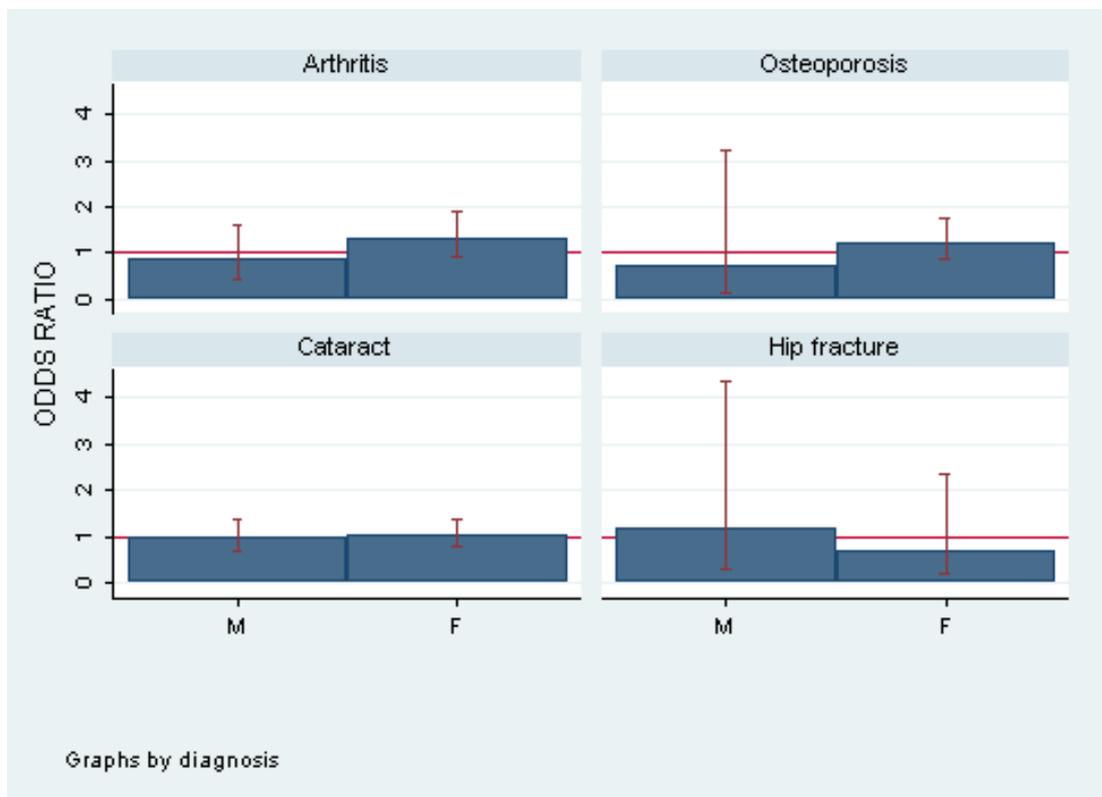Figure 2-2-7-5 Other disease prevalence vs. education

Figure 2-2-7-6 Other disease prevalence vs. education

Cancer was not associated with educational attainment or household income among males. Among females, prevalence of cancer was marginally associated with lower educational attainment: OR 0.61 [0.36-1.03] (Figure 2-2-7-5). The negative association between cancer prevalence and educational attainment was also found in the SHARE sample in both sexes. The SHARE researchers interpret the results in that those in lower socioeconomic groups suffer a higher cancer incidence and higher case fatality, which reduces the prevalence among those in lower class (Schrijvers et al. 1995). That is, the lower prevalence of cancer in lower educational attainment was not due to a lower chance of getting cancer, but a higher chance of dying earlier of cancer. Whether or not the argument holds true in the Japanese case has to wait for follow-up surveys in JSTAR. Fujino et al. reported in their longitudinal survey of community residents aged over 50 that educational attainment was positively and significantly related to mortality due to cancer among males, and a non-significant but positive gradient was observed among females, after adjusting for age, smoking habits, and occupational types (Fujino et al. 2005). However, they failed to control for income.

COPD seemed associated with lower educational attainment among males (OR: 1.80 [0.82-3.92]) but not among females. It may be related to smoking behavior which was more prevalent among younger males with lower educational attainment. Arthritis prevalence was only marginally associated with lower education among females (OR 1.31 [0.91-1.90]) (Figure 2-2-7-6). Otherwise, there was no remarkable association found in cataract, osteoporosis, or hip fracture.

We did notice the gender gap in the share of having diseases, especially stroke, diabetes, arthritis, or ulcer. What is more interesting is the variation across gender and municipalities. We see a very high prevalence of heart disease in Takikawa (males), hypertension in Sendai (females), stroke in Takikawa (males) and cancer in Takikawa (males). As discussed in a following subsection of health behavior, several factors such as smoking and dietary habits might be responsible for those differences.

2.2.3 Physical Functioning Limitations across Socioeconomic Status

Limitation in mobility was significantly associated with lower educational attainment. After adjusting for age and municipality, odds ratios of lower educational attainment for the limitation were 2.23 [1.66-3.03] for males and 1.56 [1.22-2.00] for females (Figure 2-2-8-1). A significant difference across municipalities was also found for females. Even after adjusting for age, females in Shirakawa had significantly lower odds for reporting limited mobility, whereas those in Takikawa showed significantly higher odds for mobility limitation. The difference remains even after adjusting for household income levels and educational attainment.

Limitation in sensori-physical functioning (e.g. eyesight and hearing) also showed an educational gradient. Adjusting for age, males with lower educational attainment had significantly higher odds of having eyesight limitation (OR 1.44 [1.05-1.98]) (Figure 2-2-8-2), and hearing limitation (OR 1.83 [1.35-2.49]) (Figure 2-2-8-3). Female counterparts showed a non-significant but positive relationship (OR 1.25 [0.92-1.78] for eyesight and 1.29[0.86-1.92] for hearing). Limitation in chewing function was significantly related to lower educational attainment in both sexes (1.37 [1.11-1.70] for males, and 1.36 [1.09-1.69] for females) (Figure 2-2-8-4). After adjusting for age and sex, there were no significant differences across municipalities.
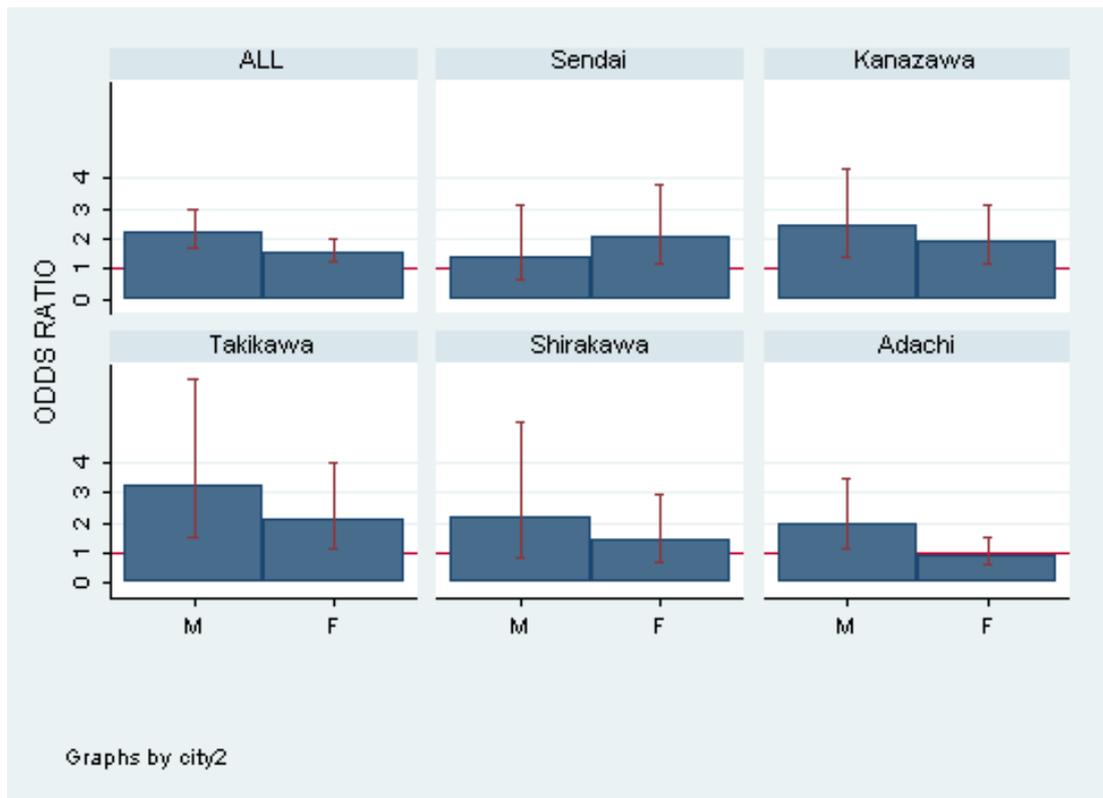
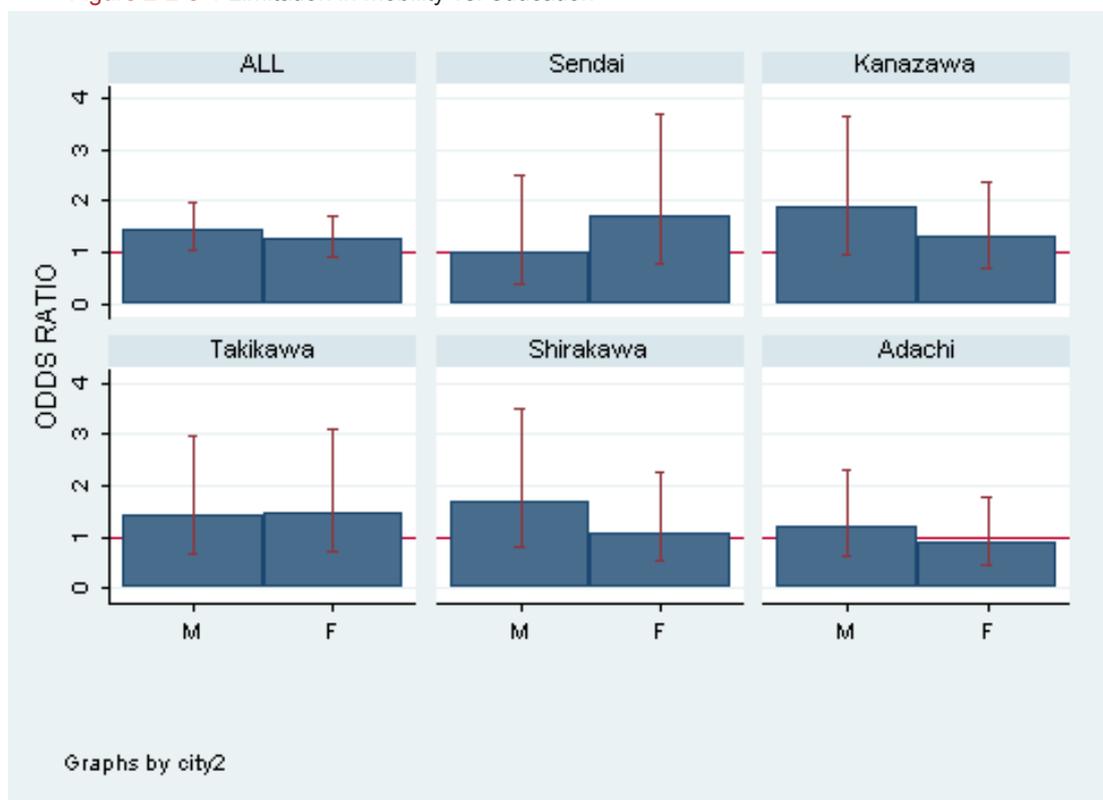Figure 2-2-8-1 Limitation in mobility vs. education

Figure 2-2-8-2 Limitation in eyesight vs. education

This pattern is confirmed even by grip strength, which is one of the objective physical health functioning and strength predictors of functional and life prognosis (Rantanen et al. 1999). After adjusting for age, sex, and municipalities, those belonging to the lower educational attainment category had significantly lower grip strength, and the effect was larger among males than among females (interaction between sex and education p<0.001) (data not shown in figures). Males with lower educational attainment showed lower grip strength by 1.69kg compared to those with high school or higher education. The female counterpart showed less grip strength by 0.77kg. The results remained significant even after adjusting for height.

Since the pattern of socioeconomic disparity was similar across different measurements of physical functioning, it would strongly suggest that those with a lower socioeconomic status suffer more from physical limitations and burdens in daily life. This finding is consistent with previous studies in Europe (Cambois et al. 2001; Huisman et al. 2003) and in Japan (Ishizaki et al. 2002).

SHARE provides further evidence on the relationship between health and socioeconomic disparities in all European Countries. That is, throughout Europe, the most disadvantaged socioeconomic groups have a higher prevalence of physical health problems than those in a higher socioeconomic status.

In general, we observe the same pattern in the relationship between health and socioeconomic status in Japan, and the magnitude of disparity varies across regions. The finding in this subsection poses a serious challenge for both Japan and European countries operating a universal health care system. Even under the universal health care system, we see a substantial disparity among people with different socioeconomic positions. The disparity is not random but is clearly concentrated on the disadvantageous group. This implies that a universal health care system is not enough to mitigate health disparities, and that policies should pay more attention to root causes of socioeconomic disparities in health. The finding also suggests that regional factors amplify or mitigate socioeconomic disparity in health even though they share the universal health care system. What constitutes regional difference invites further investigation.

Some studies have found that socioeconomic disparities in health are largely the result of socioeconomic disparities in adverse material circumstances (van Lenthe et al. 2004). Others found socioeconomic disparities in risk behaviors such as smoking, alcohol taking, or diet (we will explore these factors in later subsections). In either case, the current policy debates focusing simply on income inequality might be superficial, and policy reforms to equalize access to health care can be a partial remedy for the health disparity. Previous studies in Europe found higher health care utilization in the lower income group is due partly to lower labor participation. As such, non-health sector policy also affects people's health and related utilization. Thus, comprehensive and structural social policy debate, ranging across health care, education, health promotion, economic, and labor aspects may be required to achieve health equality (Marmot 2004; Kondo 2005). Large and comprehensive datasets that SHARE and JSTAR can provide in further follow-up surveys will be promising contributions to such empirical policy debates.
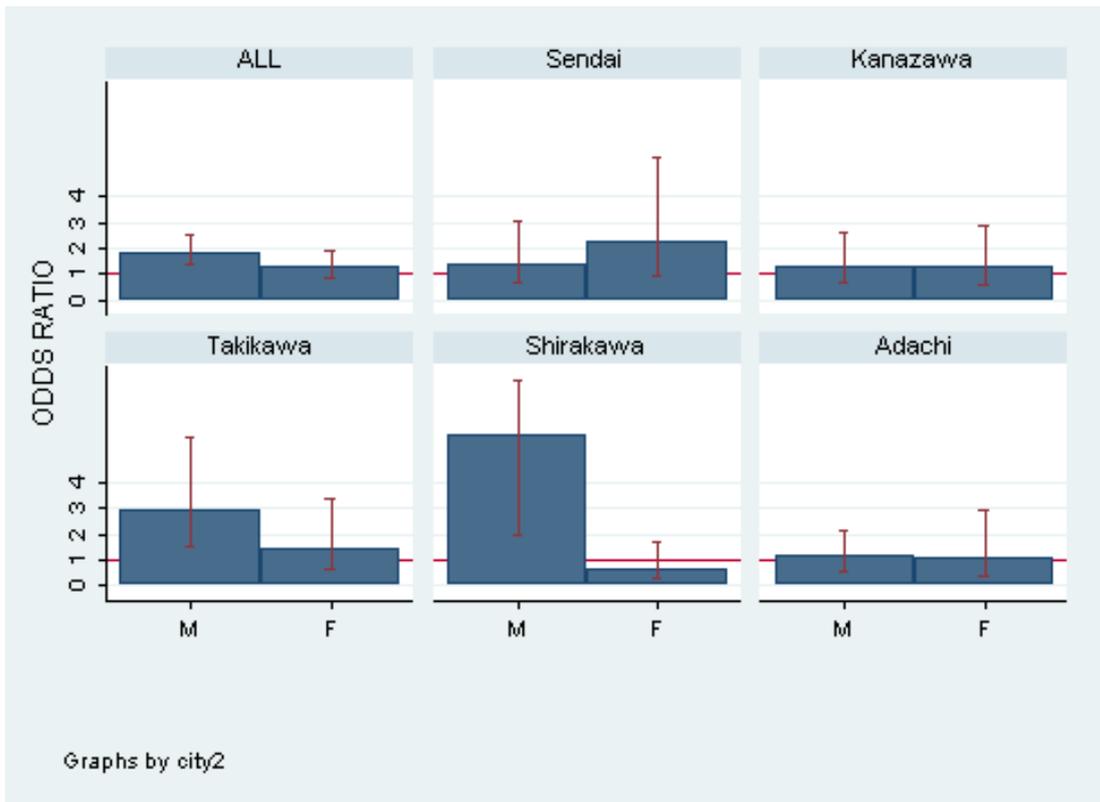
Figure 2-2-8-3 Limitation in hearing vs. education
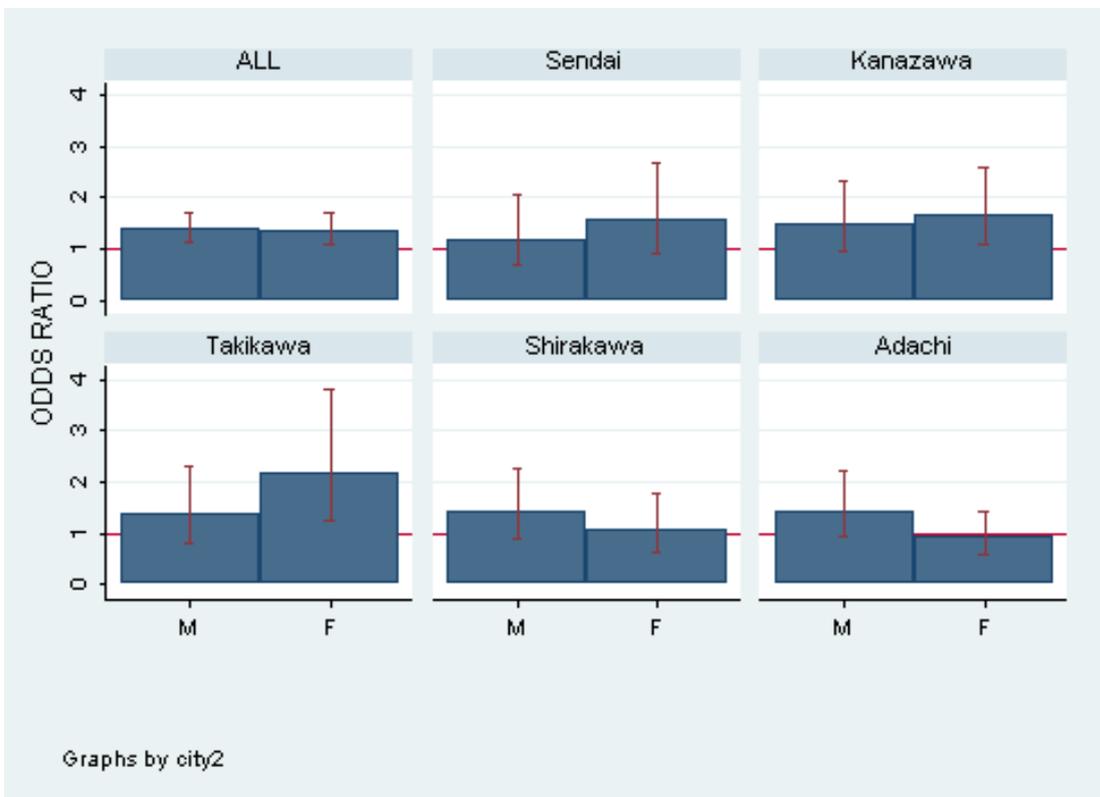
Figure 2-2-8-4 Limitation in chewing vs. education

2.2.4 Conclusions

• Within Japan, where universal health care insurance covers all residents, there are substantial variations in physical health and functioning depending on socioeconomic status.

• There is an endogenous relation between health and socioeconomic status. The health disparities seem not to be remedied by a universal health care program alone, and more fundamental social policies should be tailored towards disadvantaged groups.

• Longitudinal data are necessary to identify what policy measures can mitigate health disparities and socioeconomic disparities and how effective they are.

2.3 Cross-Regional Differences in General Health

2.3.1 Introduction

Self-reported health status is a useful indicator of individual health and serves as a predictor of mortality (Idler & Benyamini 1997). Due to the relative ease of obtaining the data, many studies have relied on self-perceived health status as the measure for the individual overall health condition and estimated relationship between health status and variables of interest. At the same time, a number of studies insisted that the self-reported perception of health status may not be comparable across countries or individuals (Kapteyn, Smith, & van Soest 2007) since some people are more likely, while others are less likely, to rate themselves as having a better health status, even when that status is objectively measured as identical. For example, Americans show a tendency to choose extreme answers while European and Japanese people tend to avoid extreme answers in general (Hayashi & Kuroda 1997).

Thus, while the self-reported health status is useful, we should be careful in comparing subjective health status across individuals, regions, and countries. Each respondent may have his or her own particular reference in evaluating the individual health condition. In Europe, Groot (2000) and Van Doorslaer and Gerdtham (2003) found that older persons are more likely to rate their status as better than otherwise comparable younger respondents. As a result, age-gradient of self-reported health may underestimate the decline in true health. In Japan to date, however, study on biases in self-reported health across different age strata has been scarce. Hayashi and Kuroda (1997) reported that Japanese have a tendency to choose the middle-response category in general, and younger rather than elderly respondents show the tendency at a higher rate.

While SHARE has to confront the issue of response differences derived from different habitual language use, JSTAR respondents share same language, and are less likely to be susceptible to bias in response due to different connotations. However, we should still keep in mind that the same word can be perceived and interpreted differently among individuals with different attributes, even in the same country.

Figure 2-3-1 shows the proportion of JSTAR respondents who reported being in "excellent" or "very good" health in a 5-response self-reported health question (US version), by gender and municipality. The proportion of the two healthiest categories was 47.6% for all, and in Shirakawa it was 52.4%, which was the highest number across municipalities. As we have already seen in Section 2.2, people in Shirakawa were least likely to have chronic conditions and functional limitations. The proportion of the two healthiest categories was around 45% in Kanazawa and Adachi, followed by 47–48% in Sendai and Takikawa.

What we observe in these figures is a variation in the self-reported health status across regions or gender even in the same country. The SHARE book also reported a wide variation in subjective health status across countries. Fifty percent of the Danish respondents and more than 40% of the Swedish and Swiss respondents report to be in very good or excellent health, figures that are similar to Japan. In contrast, the proportion of people in "very good heath" is around 20% in France, Germany, Italy, and
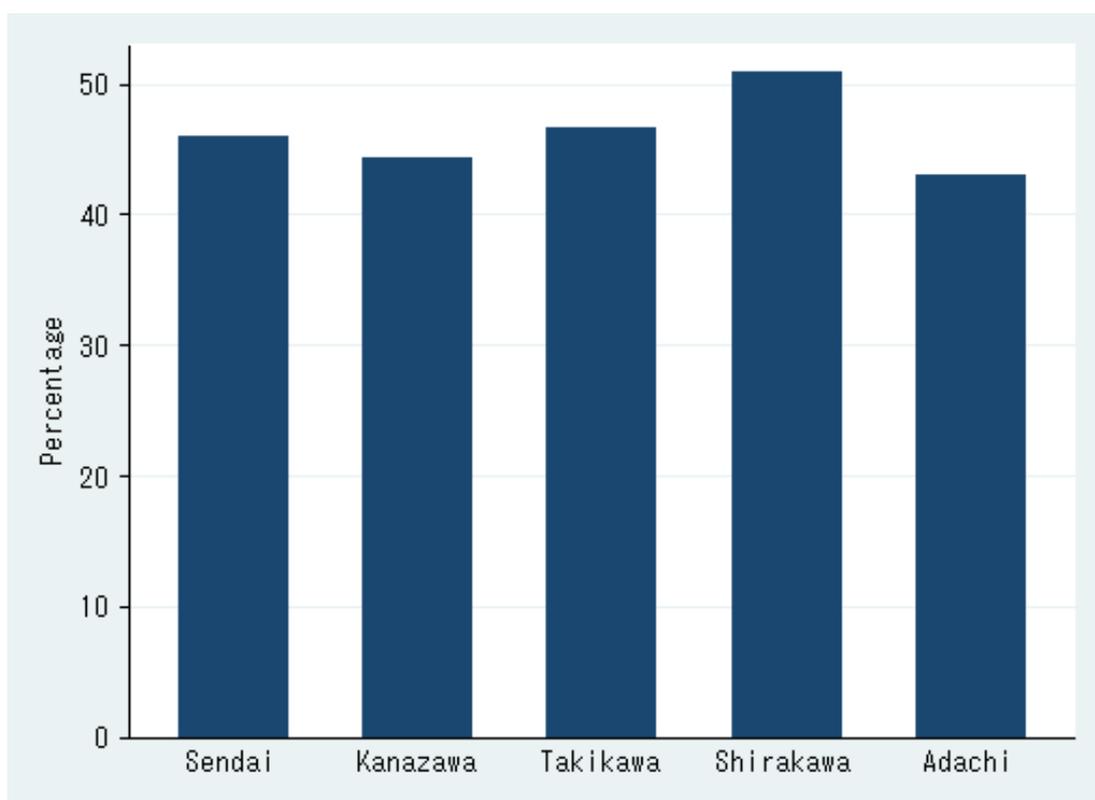
Figure 2-3-1 Proportion of respondents in "very good" or "excellent" health, by municipality

Spain. However, concluding that Danish people are healthier than Germans is unconvincing. Danish people may simply have a tendency to report excellent health, even if they have about the same true health status as Germans. The same is true in the JSTAR case. We have to carefully examine the information of self-reported health.

2.3.2 Two Measures to Adjust for Reporting Bias

For this purpose, SHARE adopted two popular measures to adjust for bias in self-reported health status. The first approach is to construct "true" measures which stand for objective health condition and employ the objective measure to correct reporting bias. We will turn to this measure below. The second approach is to use anchoring vignettes. An anchoring vignette is a methodology to ask a respondent to report his health status and then rate the health status of hypothetical persons with a different health status after hearing short descriptions. This method asks respondents to rate other individuals on the same scale used for themselves (King et al. 2004). Thus, self-reported health status is adjusted by the responses to vignette questions, which facilitate an interpersonal comparison. In other words, this method uses a comparison of health status for one's own and hypothetical persons to adjust for reporting biases. SHARE collects the vignettes from a sub-sample of respondents. JSTAR has not yet tried it, but a pilot study on anchoring vignettes using the questionnaire is underway in Japan in an independent study ("COMPARE" project).

In this subsection, we take the first approach. As the SHARE book takes, we compute an objective health index that is composed of disease status and measured functions, which are less susceptible to individual difference in perception, and allows us to examine how self-reported health status is biased across demographic, socioeconomic, and regional conditions.

As in SHARE, JSTAR has two different versions of the self-reported health question with five choices: the "European" version provides choices from "very good" to "very poor" and is used in the WHO survey. The "North American Version" ranges from "excellent" to "poor," and is used in the Japanese Comprehensive Survey of Living Conditions of People. This section uses the latter version to maintain comparability with the SHARE book.

2.3.3 Computing a Single Health Index

The idea of a health index is to calculate a comparable health measure based on objective information on a respondent's health, assuming that there is a "true" and comparable health condition across persons or countries. The index is a continuous and latent variable to employ an ordered probit model to regress the response to subjective health status (5 choices) on a variety of variables related with objective measures in the questionnaire (Cutler and Richardson 1997). The health index is then computed as a linear prediction from this regression (the latent variable). Then the index is scaled to 0 for the respondent with the worst observed health state and a value of 1 for respondents without any conditions or limitations (excellent health).

The health index is estimated based on the prevalence of a variety of health conditions and functional limitations of each respondent. The independent variables include diagnosed chronic conditions (named 20 diseases), ADL and IADL limitations, depression measured in CES-D, mobility limitations, height, weight, grip strength and cognitive ability as well as demographic variables such as gender and age. In this procedure, the estimated coefficients capture a specific amount that the presence of a certain condition or limitation reduces the value of the latent "health" index, which reflects their effect on health. While the weights are assumed to be the same for each respondent (and hence the same across municipalities) within JSTAR, the thresholds of the latent variables was compared across municipality so that "fixed municipality effects" are examined.

Although we used a similar estimation model for health index to that adopted in SHARE, we should be clear that we cannot make a simple comparison between our results and those in SHARE even with estimated index, because we used a pool of the JSTAR sample for our estimation, while SHARE used their own risk pool. Once we confirm that similar estimations are available in SHARE and JSTAR, we can make a comparable analysis with micro level data from both surveys that is compiled in the future.

2.3.4 Differences in Response Styles by Region and Individual Attributes

Figure 2-3-2 shows the distribution of the health index by municipality. Note that we pooled both sexes to estimate the health index. The box located in the middle of each bar refers to the median and the 25th and 75th percentiles, and the upper and lower bars indicate the adjacent values of the health distribution, respectively. First, we notice that the disparity across municipalities is smaller in the standardized health index than in a simple subjective report. The medium of the index is 0.704 in all regions. The result shows that we should be careful in comparing self-reported health status and that the simple comparison is in fact misleading.
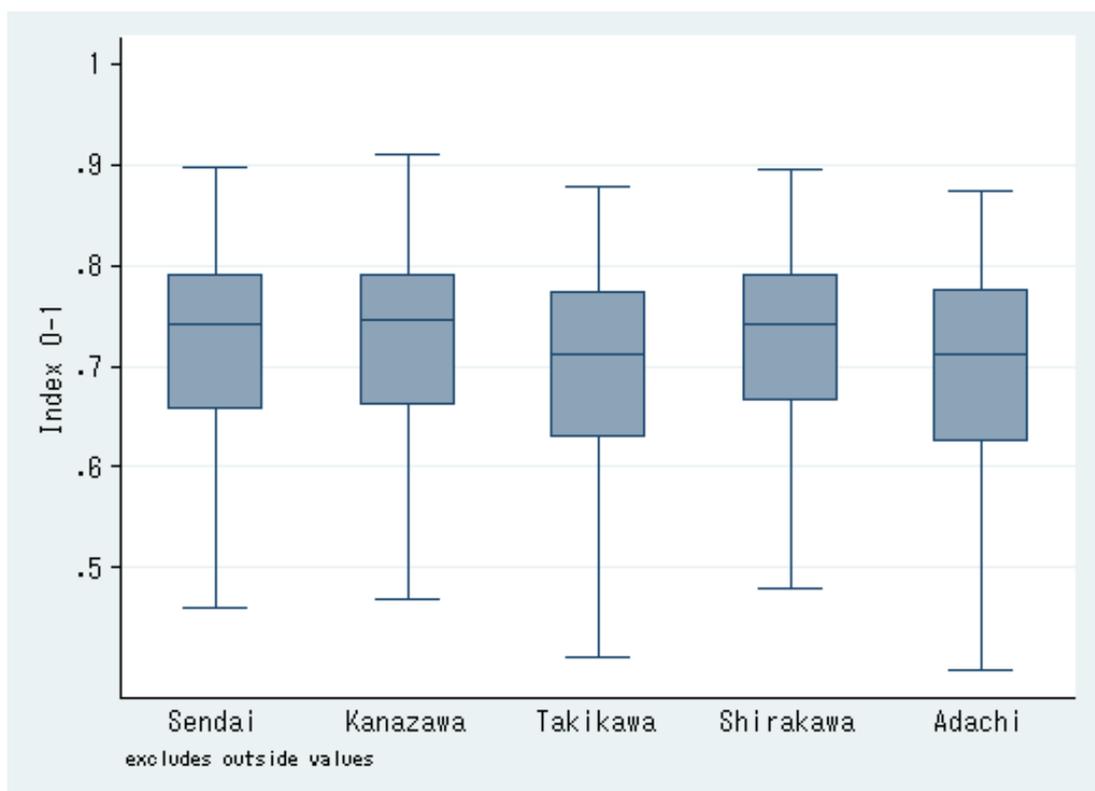
Figure 2-3-2 Distribution of standardized health index, by municipality

We turn to relate the health index values with the respondent's self assessment of health. Following the SHARE method, we assume that each individual would report "very good" or "excellent" health only if his or her health index value surpasses a specific threshold value. Concretely, we compute region-specific thresholds as the exact percentiles of the municipality-specific health index distribution that correspond to the proportion of respondents that report "very good" or "excellent" health. For example, since 47.6% of all JSTAR respondents reported to be in "very good" or "excellent" health, we take the 47.6 percentile of health index value as the threshold, which is 0.726.

The estimated thresholds of "very good" and "excellent" health for each municipality are shown in Figure 2-3-3. As we can observe, there was little difference in the thresholds across municipality. Sendai, Kanazawa, and Shirakawa have a higher

Figure 2-3-3 Health index cut-off points to "very good/excellent" health, by municipality

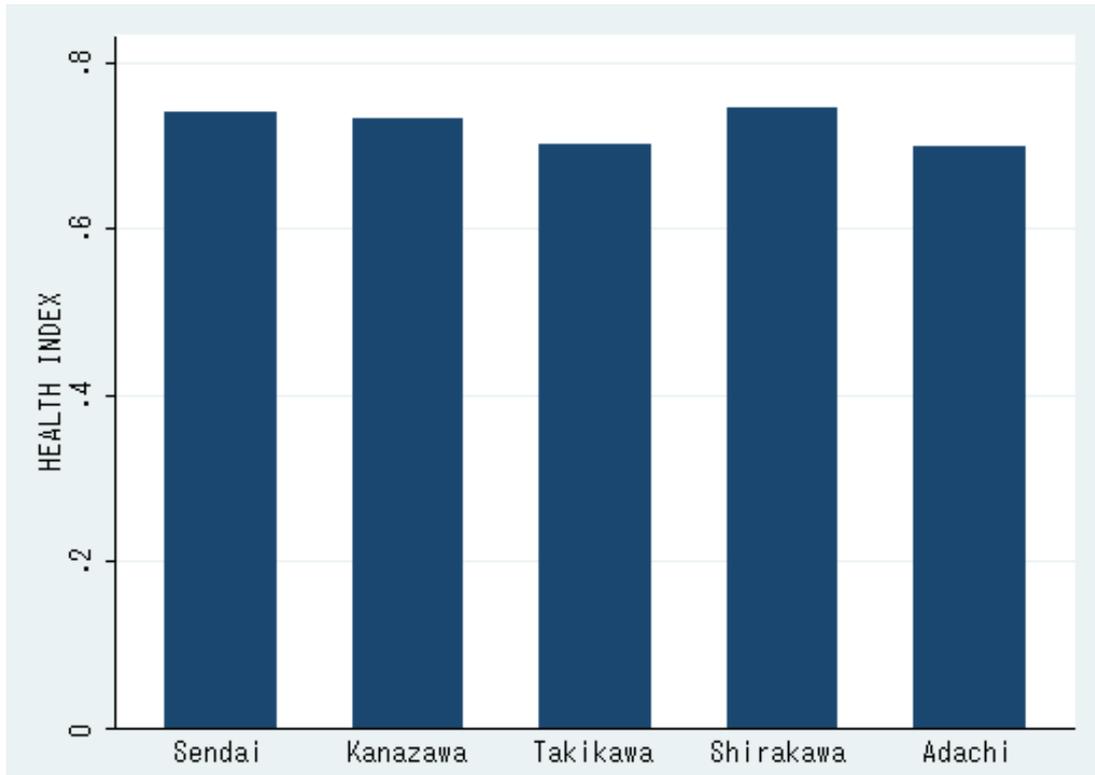threshold than Takikawa and Adachi, but the difference is quite small. This means that bias in self reporting of perceived health status across regions will not largely account for the differences in self-reported health status.

Lastly, Figure 2-3-4 compares self-reported health levels with adjusted health levels. The horizontal line shows the proportion of those who answered "very good" or "excellent" to self-reported health questions, and the vertical line shows the proportion of those who should have answered "very good" or "excellent" according to the objectively estimated health index score. For this analysis, we adopted a standard cut-off point of 0.7264 for all the respondents, not region-specific thresholds. The red line is a 45 degree line. If the subjective report and the estimated report pattern converge, the dot should be on this 45 degree line. If the dot comes to the right to the line, it means that self-reported status tends to be better than objective health conditions, or the respondents tend to over-report their health status. As the figure shows, respondents in Adachi and Takikawa tend to over-report their health status, though the deviation is quite a bit smaller compared to the cross-country difference observed in the SHARE results. Thus, response bias in self-perceived health questions across regions seems trivial in JSTAR, as we have already confirmed in Figure 2-3-3.

Taking the difference between estimated and actual response of "very good" or "excellent" health, we conducted ordered logistic analysis to test whether age, gender, socioeconomic position, and region may contribute to any tendency to over- or under-report the perceived health status. The results showed that older age significantly leads
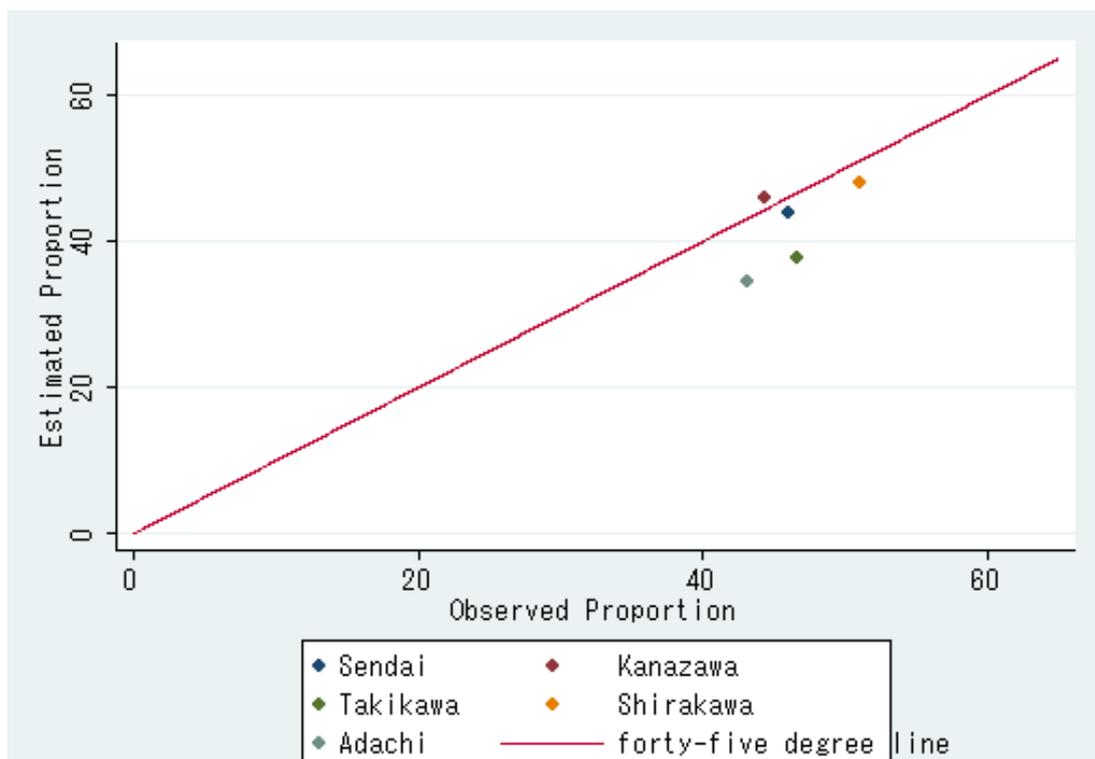
Figure 2-3-4 Estimated vs. observed proportion of those in "very good/excellent" health, by municipality

to over-report (these respondents tend to report "very good" or "excellent" even though actual health conditions are not as good). Gender, educational attainment, household income, and region were not significantly related to biased response. These results elicit caution when we interpret the impact of aging on self-reported health, because relying on self-reported health may under-estimate the actual gradient of health across different age strata.

2.3.4 Conclusions

• Self-reported health is not directly comparable across persons or regions. One approach to correct reporting bias is to measure a single health index which is based on objective health measures.

• Self-reported general health shows large cross-municipality variations. Comparison of self-report and objectively estimated health index shows that cross regional difference is less likely to be due to biased response across regions, but rather to actual difference in health conditions.

• Self-reported health is over-reported among older people, which raises caution when we interpret the impact of demographic conditions on self-reported health.

2.4 Health Behavior

2.4.1 Introduction

This subsection examines several behavioral health factors which are closely related to functional capacity and mortality: smoking, alcohol consumption, physical activity, and weight control. In Europe, these behaviors have been proved to be related to lower mortality and improved functional capacity among elderly and health benefits (Adams et al. (1990); Davis et al. (1994); and Johansson & Sundqvist 1999). In Japan, large population-based epidemiological cohort studies, such as the Japanese Public Health Center Study (JPHC) (Inoue et al. 2004; Iso et al. 2004; Mannnami et al. 2004) and Japan Collaborative Cohort Study (JACC) (Fujino et al. 2005; Iso et al. 2005; Lin et al. 2005; Lin et al. 2007), were conducted in the 1990s to identify the impact of lifestyle behaviors on the incidence and mortality due to cancer, stroke, and cardiovascular disease among middle-aged community residents. These studies followed a large-sized sample (70,000 to 100,000) for 5-10 years, which allowed them to investigate diseases with rare mortality. Further, JPHC conducted a detailed dietary questionnaire, and JSTAR has adopted the same. However, these epidemiological studies failed to measure individual-level socioeconomic variables such as household income. JPHC did ask occupational types at baseline, but not occupational history and educational attainment. Neither did they have information regarding consumption and utilization of medical care. Besides, their measurements were not compatible to research in other countries, which prevents cross-country comparison. JSTAR provides an unusual chance for researchers to examine the prevalence of these behaviors and their effects on health care utilization and subsequent health outcomes among Japanese elderly.

First, we preview the prevalence of smoking, alcohol consumption, physical activity, and body-mass-index (BMI). Then, we examine these behaviors in different age and socioeconomic groups. The JSTAR questionnaire regarding these behaviors is comparable with that of SHARE. The leave-behind-question asked a respondent whether he/she (1) currently smokes on a daily basis or (2) previously smoked on a daily basis but has quit, or (3) has never smoked on a daily basis. There are two small differences between JSTAR and SHARE. One is that since most smokers in Japan smoke cigarettes, JSTAR does not distinguish within smoking types (while cigarettes, cigars, cigarillos and pipes are distinct in SHARE). The other is that SHARE asked whether a respondent has ever smoked for at least for one year but JSTAR asked regarding smoking on daily basis. If a respondent is smoking or has smoked, he/she is asked when he/she began to smoke and, if not currently smoking, when he/she quit, which allows us to estimate years of smoking for individuals. Then a respondent is asked the number of cigarettes smoked per day. Alcohol consumption was also inquired in the leave-behind-question. The respondent was asked about the frequency of consuming alcoholic beverages (beer, spirits, whisky, sake, or wine) in the last six months and about the amount of consumption for each kind of alcohol if he/she drinks at least once or twice a week. JSTAR does not ask respondents whether they drink more than two glasses since the definition of "two glasses" in SHARE is not necessarily clear. The questions on physical activities differ between JSTAR and SHARE.

Following ELSA, SHARE asked respondents about frequency of moderate physical activity (gardening, cleaning the car, walking) and vigorous physical activity (sports, heavy housework, a job involving physical labor). JSTAR does not have the corresponding questions but asks the number of minutes of walking per day. Lastly, the interview questions in JSTAR have self-reported height and weight so that we calculate the body mass index (BMI, weight (kg) divided by the square of height (m2). According to the World Health Organization (2000), BMI equal to or higher than 30 was used as a cutoff point for obesity and that between 25 and 29.9 as overweight.

2.4.2 Health Behavior by Gender and Age

Table 2-4-1 reports summary statistics of those measurements on health behavior. We should keep in mind that the age range is different between JSTAR and SHARE. While SHARE includes respondents aged 80 and over, JSTAR respondents are aged between 50 and 75.

Table 2-4-1   Prevalence of behavioral risk factors among men and women in JSTAR subjects

Health related behaviors	Men		Women	
Smoking habit				
Ever smoking 1+ years	78.6	(74.0–80.7)	17.6	(7.2–25.0)
Current smoking	35.2	(34.0–39.1)	10.3	(4.7–15.8)
Average number of years smoking	27.4	(26.2–29.5)	23.4	(21–34.4)
(among the total population)				
Drinking habit				
Daily/5–6 times per week	51.8	(48.6–55.0)	12.6	(8.0–16.1)
Never in the last six months	23.2	(22.2–25.0)	60.0	(55.4–66.0)
Physical activity				
Neither vigorous nor moderate physical activity	7.3	(4.8–12.5)	6.5	(4.4–13.5)
Overweight/obesity				
Overweight (BMI 25–29.9)	25.1	(21.1–33.1)	19.3	(15.5–27.0)
Obesity (BMI 30+)	2.4	(0.5–3.3)	2.2	(1.3–3.5)
Overweight or obesity (BMI 25+)	27.5	(22.9–36.4)	21.5	(16.8–29.3)

First, we observe that nearly 80% of males have smoked on a daily basis during their lifetime. The corresponding figure for females is less than 20%. The figure for males is higher in JSTAR than that in SHARE (64%) while that for females is lower in JSTAR than that in SHARE (27%). When confining results to current smokers, 35% of male respondents were current smokers, and the number is still higher than the 23.9% in SHARE. For females, 10% percent of JSTAR respondents were current smokers, and the number is a little lower than 13.2% in SHARE female respondents.

We also notice a disparity among municipalities in smoker prevalence (the numbers in parentheses are the maximum and minimum among five municipalities). Compared to SHARE female respondents, JSTAR female respondents showed a wide range of smoking prevalence across regions: the lowest was 4.7% in Shirakawa and the highest was 15.8% in Adachi. Since smoking prevalence was significantly different by age category, however, we should compare the prevalence by age strata (Figures 2-4-1-1 for males and 2-4-1-2 for females). If we focus on female respondents in their 50s, 25.2% in Adachi and 9.9% in Shirakawa were current smokers. In the cases of Takikawa and Adachi, smoker prevalence was drastically different across age strata (Figure 2-4-1-2). The difference between female smoking prevalence in the 50s and that in the 70s counted about 16 points in both cities, while it was about 7 points in other cities. A further difference is observed in the average years of smoking: that exceeds 27 years for males and 23 years for females, both of which are higher than in Europe (Table 2-4-1). This means that while the share of female smokers is lower, their experience is comparable with male smokers.

Second, we look at alcohol consumption. More than a half of males and 12% of females consumed alcohol beverages daily or 5–6 times per week during the last six months (Table 2-4-1). Similar to cigarette consumption, the share of male drinkers is higher while that of female drinkers is lower in JSTAR compared to the numbers in SHARE. The shares of the respondents who did not drink during the last six months were 23% for males and 60% for females. Again, as discussed below, those numbers range across gender and municipalities.
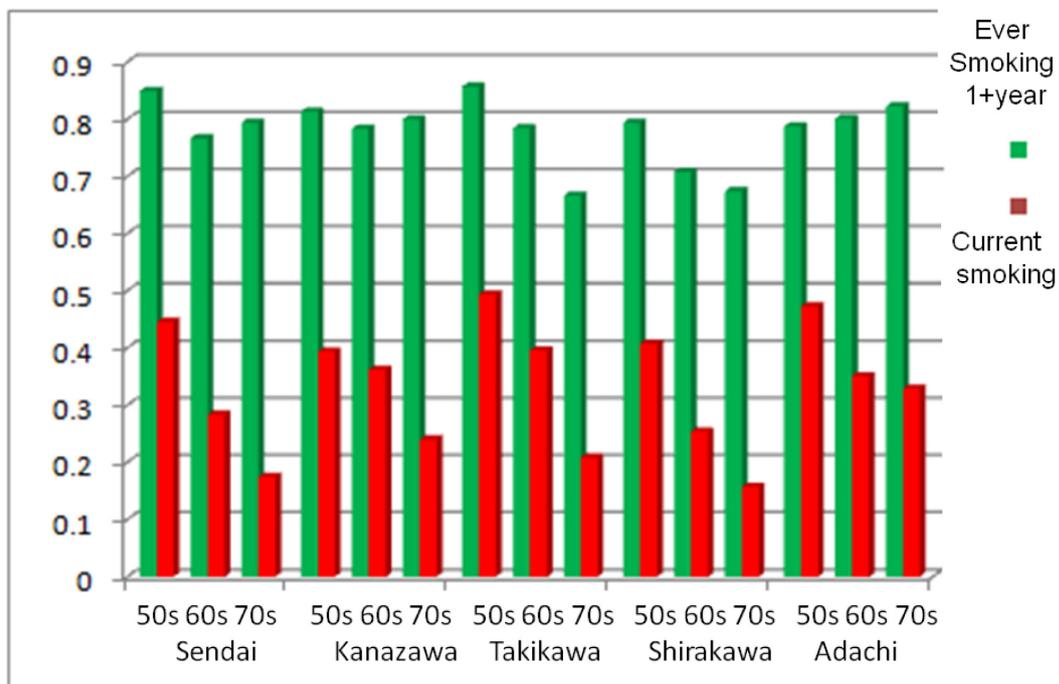

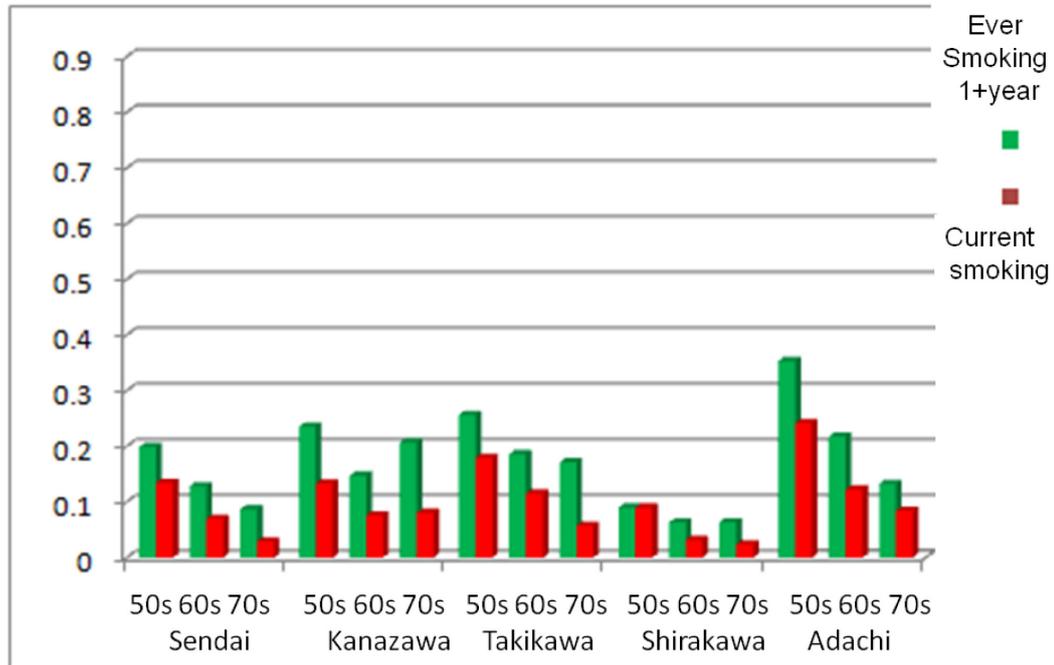Figure 2-4-1-1 Smoking behavior by municipality, males

Figure 2-4-1-2 Smoking behavior by municipality, females

The share of the respondents who do not walk (or are not able to walk), which is a surrogate to physical inaction (do not do any moderate or vigorous physical activity), in the SHARE questionnaire was about 7% for both males and females. While the definition and the age range differ between JSTAR and SHARE, the proportion seems lower in JSTAR than in SHARE and this is especially the case for females.

According to the National Health and Nutrition Survey 2005, about 30% of males in their 50s to 60s, 24% of females in their 50s, and 29% of females in their 60s had a BMI over 25. Overweight respondents whose BMI ranges between 25 and 29.9 were seen in about a quarter of males and close to 20% in females in JSTAR. Those figures are much lower than those in SHARE (50% for males and 36% for females in SHARE) as expected. Obese respondents whose BMI is equal to or greater than 30 is also as low as 2% both for males and females in JSTAR respondents, which is again much lower than the corresponding numbers in SHARE results (16% for males and 18% for females). The SHARE report warns readers that overweight is on an increasing trend, especially for males. In Japan, according to the National Health and Nutrition Survey, overweight among middle aged males is also increasing over past decades.

Obesity, especially central obesity, is related to metabolic syndrome with increased risk of Type-II diabetes, cardiovascular disease, and consequent functional disabilities and mortality in Europe where obesity has become epidemic, and it is true in Japan too, where the prevalence of obesity was still moderate (Tsugane et al. 2002).

2.4.3 Variations by Age, Socioeconomic Status, and Municipality
(1)   Smoking behavior

The upper left graph in Figure 2-4-2-1 reports the odds ratio of lower educational attainment on being a current smoker by gender, adjusted for age and municipality. Those with lower educational attainment showed the odds ratio of 1.37 [1.09-1.71] for males and 1.63 [1.14-2.34] for females to be a current smoker. That is, those with lower educational attainment are more likely to be smokers. The interaction between sex and educational attainment was not significant, that is, the impact of education on the likeliness to be a smoker is about the same in both genders. However, as we can see in Figure 2-4-2-1, the impact of lower educational attainment on being a smoker was somewhat larger in females than in males, except for those in Shirakawa.

If we look at the impact of household equivalent income, those with less than median income showed significantly higher odds to be a current smoker. (OR 1.52 [1.27-1.82]) (not shown in the figures). The association of household income with likelihood of being a current smoker was observed independently of those with educational attainment.
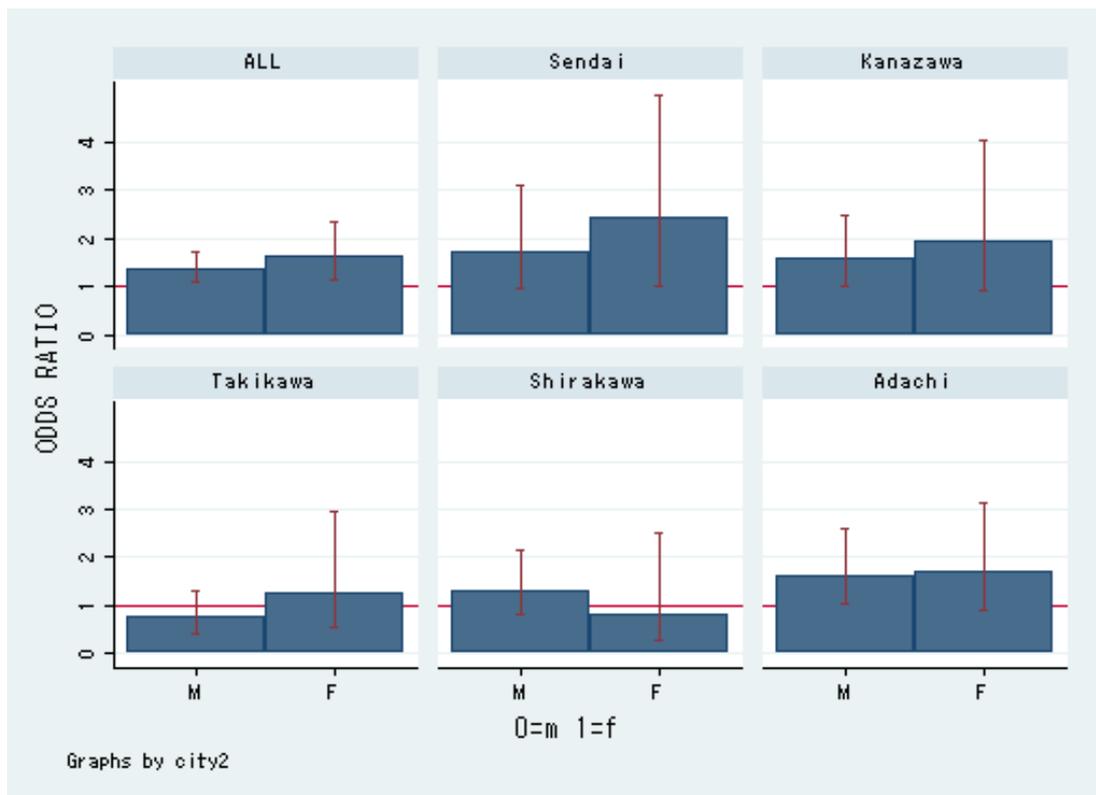

Figure 2-4-2-1 Odds ratio of lower education on being a current smoker, by sex and region, adjusted for age

(2)   Drinking behavior

Figure 2-4-2-2 shows the odds ratio of education attainment for being a daily/5-6 times-a-week drinker. Adjusting for age and municipality, those with lower educational attainment showed slightly lower odds to be a daily drinker (OR 0.86 [0.70-1.06] for males, 0.99 [0.70-1.40]). We did not find any significant interaction between sex and educational attainment, or between sex and household income. Those patterns seem not to be coincident with those in Europe which see that higher educated persons are more likely to consume more alcohol, especially in the case of females. When we compare municipalities, those in Kanazawa city were significantly more likely to be daily drinkers, which might be due to a unique social engagement pattern there.
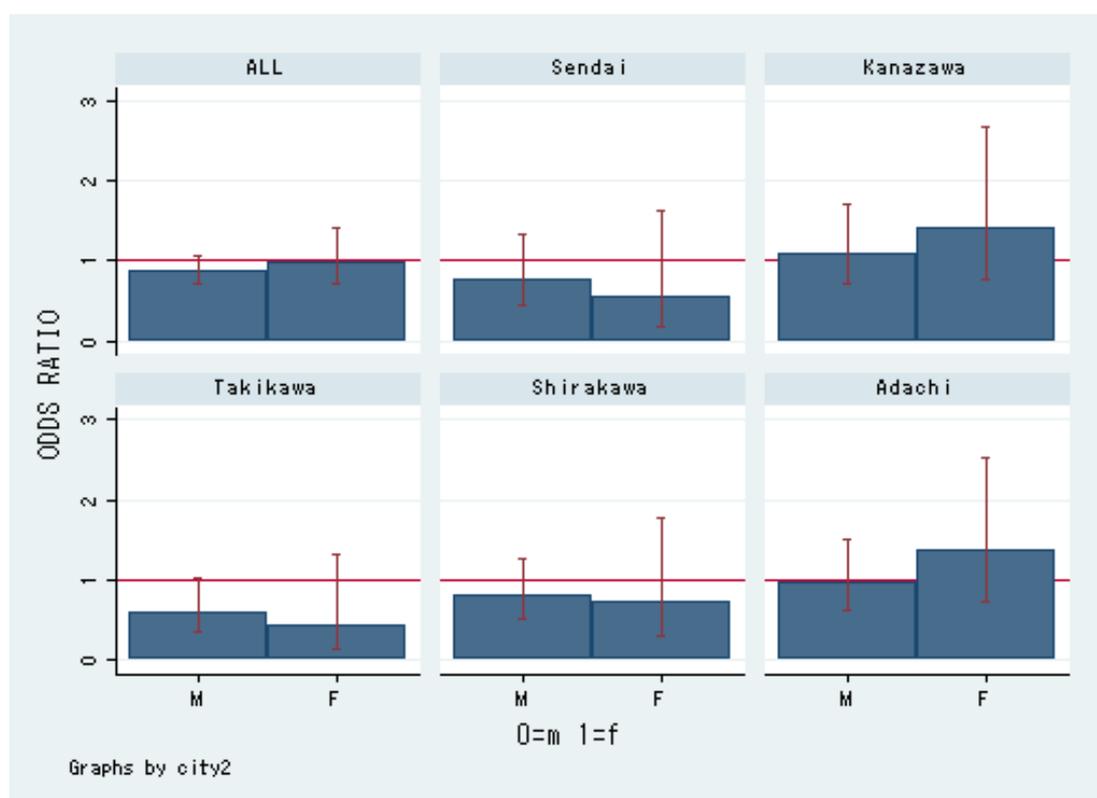

Figure 2-4-2-2 Odds ratio of lower education on daily/frequent drink, by sex and region, adjusted for age

Excessive alcohol consumption is known to be harmful to health, but lately there has been a lot of discussion of the potential health benefits of moderate alcohol consumption. Recently Sulander et al. (2004) have shown among elderly men evidence for the U-shaped association between alcohol consumption and functional ability. The same U-shaped association between alcohol consumption and mortality has also been identified among Japanese middle-aged men and women (Lin et al. 2005). Previous epidemiological studies identified that alcohol intake <20g/day ethanol equivalent is associated with the lowest mortality due to cancer and heart disease, and that no consumption and consumption > 20g/day lead to higher risks. In JSTAR, we have a detailed estimation of alcohol intake (ethanol g/day) through the food frequency questionnaire, which is not available in SHARE. We preliminarily conducted a multi-

nominal logit model using 3 levels of alcohol consumption (none, less than 20g/day, and over) as a dependent variable to find influential factors of the alcohol consumption pattern. Lower educational attainment was negatively associated similarly with moderate (<20g/day) and heavy (>20g/day) alcohol consumption. Income effect was positive and stronger in heavy consumption (data not shown).

The share of Japanese male daily drinkers is higher than the average in Europe and is comparable with France, Italy, and Spain whose share is greater than 30%. The share of female drinkers, which is lower than that of the male counterpart both in Japan and Europe, is also comparable with countries with the highest shares like France, Italy, the Netherlands, and Denmark. Consumption was highest in three southern European countries of France, Italy and Spain, but was clearly lower in Greece. SHARE asked the frequency and rough quantification of alcohol consumption by simply asking the number of glasses per consumption. Since drinking habits vary across countries, the precision of alcohol consumption is quite limited in the SHARE questionnaire. On the other hand, JSTAR uses a detailed consumption survey by asking frequency, type, and quantity of alcohol beverages, and an additional food frequency questionnaire, which gives a better opportunity to analyze the association of alcohol consumption with socioeconomic status and consequent health problems.

(3) Physical inactivity and obesity

The odds ratio of lower educational attainment on physical inactivity (those who don't walk or walk less than 30min per day), adjusting for age, limitation in ADL, and municipality was 2.11 [1.42-3.12] for males and 1.03 [0.67-1.59] for females. (Figure 2-4-2-3) Interaction between education and gender was significant (p=0.027). The impact of lower educational attainment on physical inactivity was more salient among males than among females, even after taking into consideration age, ADL limitation, and region. We also found that people in Takikawa were significantly less likely to walk compared to those in other cities (OR: 2.67 [1.76-4.05]). We speculate that this was due to snow in the winter time, and the tendency to use a car for daily transportation in a region with a less extensive public transportation system.

Figure 2-4-2-4 shows the odds ratio of education on being overweight, or BMI >= 25, a criterion for overweight. Adjusting for age and municipality, the odds ratio of lower educational attainment on being overweight were 1.11 [0.89-1.41] for males and 1.40 [1.09-1.81] for females. Interaction between gender and education was marginally significant (p=0.12). Lower educational attainment was related to obesity among females, but less among males. Thus, educational attainment was a risk factor of obesity especially among females.

It is interesting to note that people in Takikawa have the highest odds ratio of being obese (OR 1.48[1.17-1.88]) while those in Shirakawa have the lowest odds ratio (OR 0.70 [0.55-0.90]) (data not shown in the figures). This is in line with the municipal difference in walking habits. We refer to the data in the food frequency questionnaire to assess whether the difference in BMI across municipalities was due to the difference in the food intake pattern. We focused on Fat Calorie Ratio (FCR) again, and corrected Total Energy Intake (cTEI) which was the estimated total energy intake divided by standard body weight. Standard body weight was calculated as body weight for
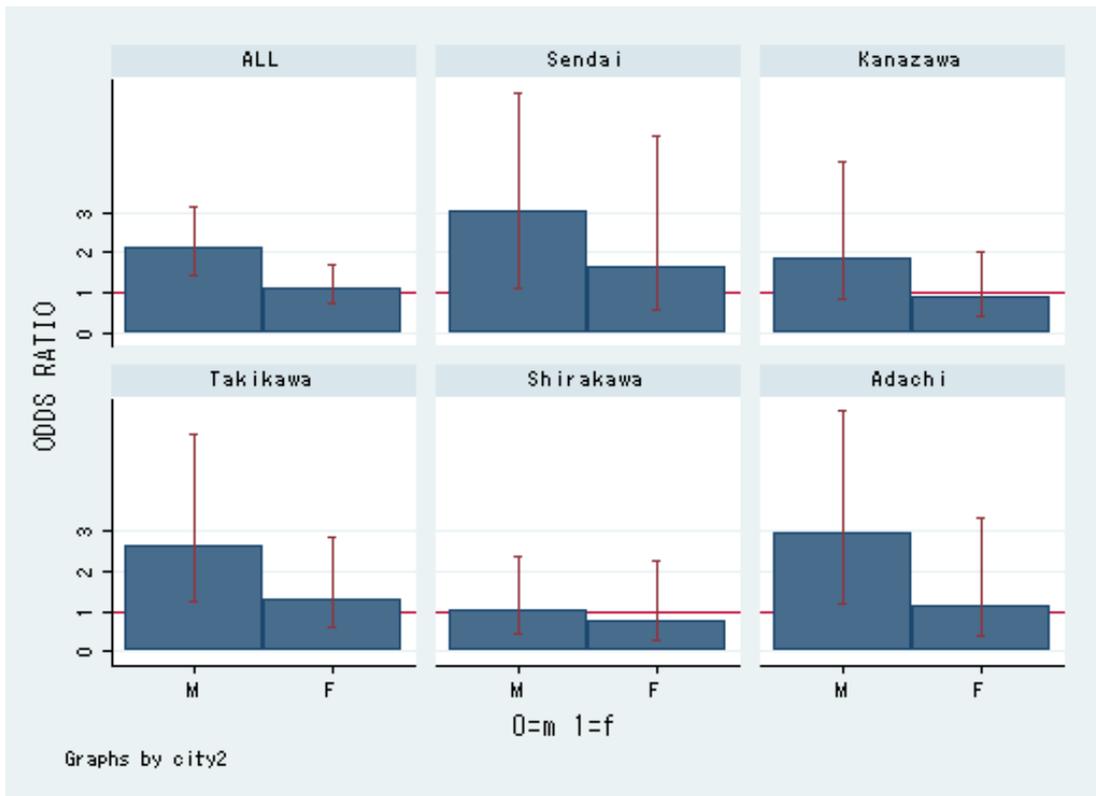
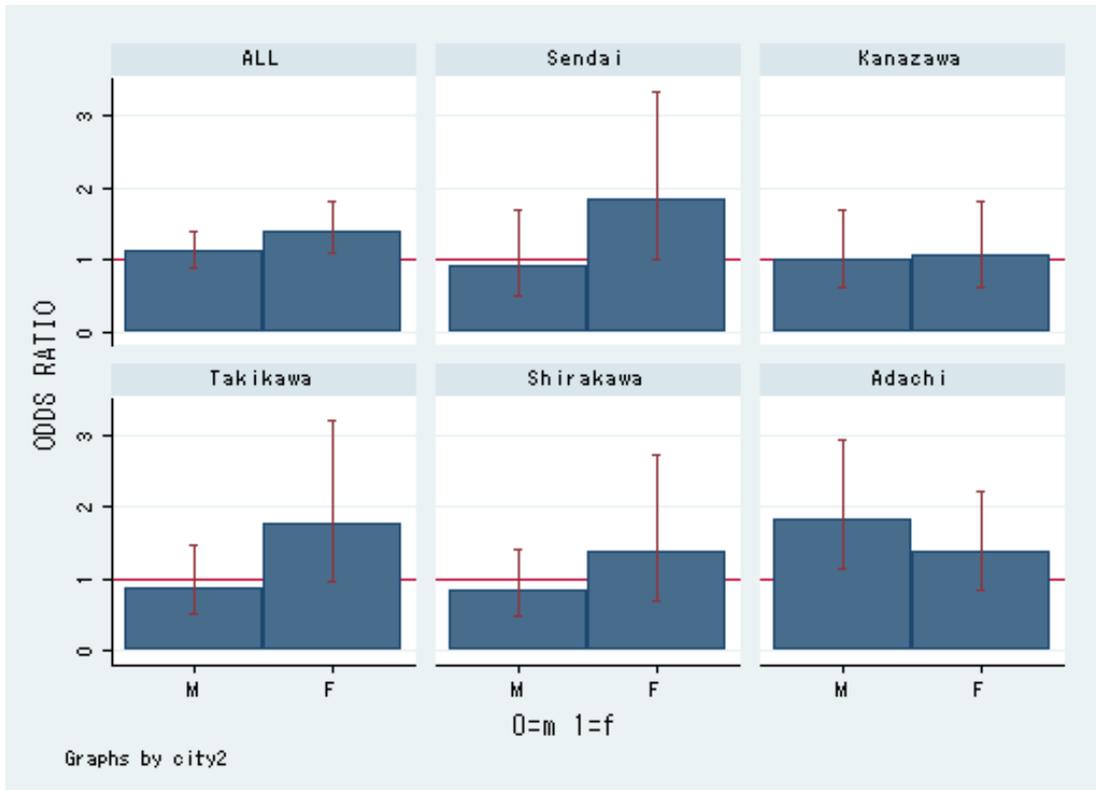Figure 2-4-2-3 Odds ratio of lower education on physical inactivity, by sex and region, adjusted for age

Figure 2-4-2-4 Odds ratio of lower education on overweight, by sex and region, adjusted for age

BMI=22 for the given body height (22 X (body height(m))2). ANOVA regressed on FCR or cTEI as a dependent variable, and with age and sex as covariates, shows that people in Takikawa did not have significantly higher FCR or cTEI. Thus, it is most likely that the highest prevalence of obesity in Takikawa was due to physical inactivity rather than over-intake.

The results on behavioral risk factors in this subsection are preliminary in that this is based on cross-sectional observation. Further research with a follow-up panel survey is required to better address the relationship between risky health behaviors on health outcomes, i.e. the effect of overweight on the prevalence of heart disease. In Europe, overweight is more problematic than in Japan and the SHARE book calls for health promotion for mitigating metabolic syndrome, diabetes and cardiovascular disease, premature mortality, and decline in functional capacity so as to decrease socioeconomic inequalities. In addition, the book discusses the different actions that are needed in different countries based on cross country differences. It seems that cross-municipality disparity in risky health behavior is smaller than cross-country difference in Europe but we still observe substantial disparities even within Japan across gender, age, municipality and social status. More targeted policies might be needed even within a country to address ways to discourage those behaviors.

2.4.4 Conclusions

• There is a disparity in risky health behavior (smoking, drinking, physical inactivity, and overweight) across gender, age, and municipality within Japan. Overweight and obesity are health threats in this JSTAR population 50+. This can have enormous effect on the incidence of chronic disease, and consequent health care resource use in future decades.

• As in Europe, in Japan, socioeconomic and gender disparities are observed in health behaviors; smoking was more prevalent among those with lower educational attainment. Physical inactivity was more prevalent among males with lower education, but not among females. Overweight was more prevalent among females with lower education, but less evident among males.

• Further research should examine the relationship between risky health behavior and health outcomes to contribute to more effective health policymaking by targeting specific groups.

2.5 Mental Health

2.5.1 Introduction

One of the most serious social issues in Japan is suicide. After the rate suddenly rose at end of the 1990s, more than 30,000 persons have committed suicide every year. Among the OECD countries, Japan's suicide rate (the number of persons who committed suicide per 100,000 people) is ranked as one of the highest since 1998. Actually, in 2004 the rate was the highest for males and the second highest for females. By age and gender group, males aged 65 and over had the largest share (48.1%), which is double that of those aged 25-45 (25.2%). The increase of suicide among middle-aged males in the second half of the 1990s is often attributed to the economic turndown (Chen, Choi, and Sawada 2008). The gap across age groups is even larger for females: 35.5% for those aged 65 and over, versus 9.9% for those aged 25-45. The high suicide rate among elderly females in this country is often attributed to women's deprived status under the traditional agnate family system.

Psychiatric studies identified that mental depression is a strong predictor and risk factor for committing suicide. It is a matter of debate, however, whether depression causes social isolation and economic difficulties, or economic and social difficulties lead to depression and subsequent suicide.

In Europe, late-life depression, when defined according to the broad criterion of clinical significance, is a common disorder affecting 10% to 15% of the over-65-year-old population (Beekman et al. 1999). In Japan, a recent community-based cross-sectional survey of psychiatric disorders did not detect any difference in the prevalence of psychiatric disorder including depression across socio-demographic attributes, though the severity of psychiatric disorder was significantly greater among older and unmarried residents (Kawakami et al. 2005). Another cross-sectional survey found that a higher prevalence of depression was found among the unmarried, females, and with lower household income (Inaba et al. 2005). However, longitudinal population-based studies of the elderly population have not been conducted so far in this country.

The JSTAR leave-behind-questionnaire includes the CES-D scale (Center for Epidemiological Studies Depression Scale) which also has been used in previous domestic studies as well as in the Health and Retirement Study (HRS) of the US. In contrast, SHARE adopts EURO-D scale which has been validated in an earlier cross-European study of depression prevalence, EURODEP (Prince et al. 1999a; Prince et al. 1999b). EURO-D was developed to link the data measured in different scales across EU countries, including CES-D, Zung Depression Scale, and other already validated scales. Thus, the EURO-D score can be estimated based on items in CES-D we measured in the JSTAR sample for comparative purpose. However, we judged that including this estimation is not appropriate in this JSTAR report since the adjusted depression measure has not been validated in Japan. Rather, we chose to proceed with the discussion using the original scoring algorithm of the CES-D scale below.

The CES-D scale includes 20 items to measure mental status, specifically in terms of depression and anxiety disorders. Each item lists a specific symptom of the disorder, and the respondent is asked to choose the frequency of each symptom during the past

one week by a 4 level response: not at all, 1-2 days, 3-4 days and more than 5 days per week. The scale ranges from 0-60, and 16 is the worldwide recommended cut-off point for screening depression status. We emphasize again that different depression scales are employed between Japan and Europe. In the SHARE book, the threshold of clinically significant depression in the EURO-D scale is 3, which was validated by the EURODEP for comparative analysis within the EU, but whether mental status of 3 in the EURO-D score is the same as that of 16 in CES-D is not confirmed.

In JSTAR, we also asked present and past history. About 0.6% of respondents had a past history of diagnosed depression, and about 1.4% were currently under treatment.

We will examine in this chapter the prevalence of current depression, measured in CES-D, by age, gender, and region. We also follow the analysis conducted in the SHARE report to identify the association of depression status with living accommodations, household income, and social support exchange, using logistic regression. In these analyses we always control for age, gender, and marital status. We will provide the odds ratio and other estimates for a whole sample, and by municipality. Sampling weights were not applied. In the graphs we present the estimates from the models and a 95% confidence interval.

2.5.2 Variations across Gender, Age, and Municipality

Figure 2-5-1 illustrates the prevalence of depression (defined as CES-D score>=16) by age and gender. First, we observe that the overall share of people who are currently suspected of suffering from depression is around 17%. Second, the prevalence was somewhat lower for people in their 60s compared to the 50s and 70s, a trend seen in both sexes. Lastly, females showed a higher prevalence than male respondents, which was on par with previous population-based surveys in Japan and internationally. This trend was confirmed when we use logistic regression analysis; the female gender (OR 1.24[1.06-1.48]) and age in the 60s (OR 0.68 [0.68-0.99]) were significant predictors of depression prevalence. Otherwise, there was no significant difference across municipalities, after adjusting for age and sex.

We did not observe a clear gradient increase of depression prevalence over age, as the SHARE report has found. We need to be careful in comparing the results with those in Europe because of different scales to measure depression. The Euro-D scale in SHARE measures mood disorder and motivation deficit, which may often be observed in the case of a cognitive disorder among the elderly. As Prince et al. (1999b) already acknowledged, the Euro-D may over-diagnose depression disorder because the score is contaminated with the effect of motivation deficit, and the age gradient that was reported in the SHARE report may be artifact due to the effect of motivation deficit in the elderly.

In spite of this difference, it is of interest that we observed a similarity between JSTAR and SHARE in that females have a higher prevalence of depression than males. In Europe, the excess in depression prevalence among females is clearly evident in the EURODEP consortium study. (Prince et al. 1999b) The degree of excess varies across the life course (Jorm 1987), though it is also associated with marital status. However, SHARE failed to find a significant interaction between gender and marital
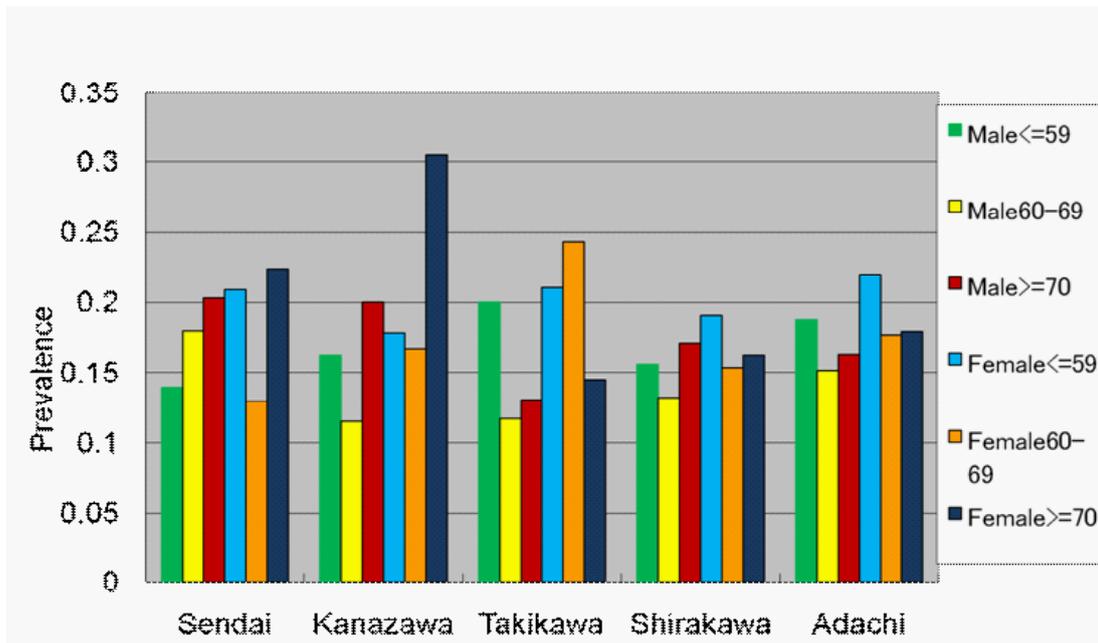
Figure 2-5-1 Prevalence of depression

status (specifically the protective effect of marital status among males but not among females), which has been consistently found in previous studies. In JSTAR, we found a significant main effect of gender difference in depression prevalence. Even after we controlled for age, municipality, education, marital status, and interaction between gender and marital status, the female gender was significantly related to higher chance of having depression (OR: 1.26 [1.04-1.52]). Furthermore, gender showed a significant interaction with marital status; divorce was related to higher odds of having depression among males, but not among females (data not shown). We shall take a closer look at the relationship of depression with marital and income status in the next section.

2.5.3 Variations across Marital and Income Status

SHARE reports that not being married and living alone were consistently associated with depression. Figure 2-5-2 presents the association of current depression with living arrangement and marital status. Current depression is associated with the single living arrangement and unmarried status, and the association was similarly observed across municipalities. Living alone showed a highly significant association with depression status (OR 1.90 [1.47-2.46], adjusting for age, sex, and municipality). Unmarried status also showed a highly significant association with depression status (OR 1.87 [1.43-2.43] adjusting for age, sex, and municipality).

Whether depression leads to single residence and un-married status, or the reverse is true remains to be studied in a future follow-up survey. Some might argue that living alone is a risk factor for depression since the person is less likely to contact and communicate with other people and family members. Social isolation and lack of social interaction is a well known risk factor of functional decline and mortality (Ishizaki et al. 2000). Others might discuss that living with other persons is stressful and is a risk factor for depression. This would be especially true among females who were bound
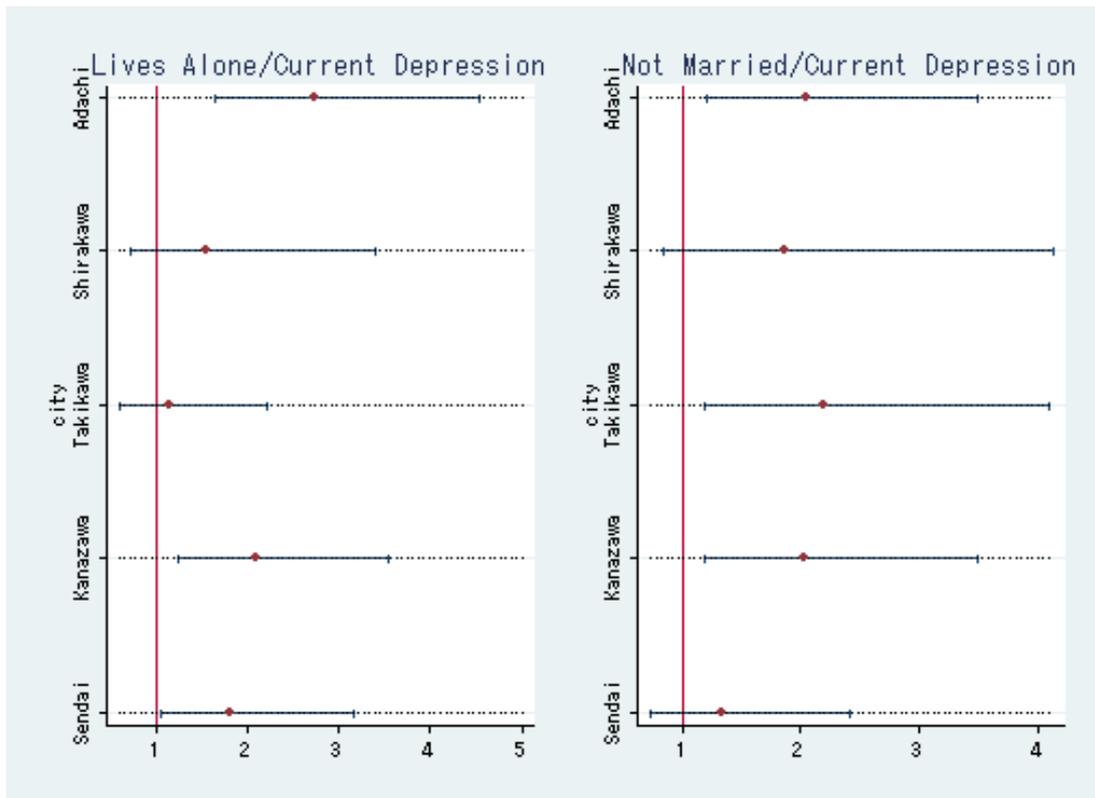
Figure 2-5-2 Odds ratio relative to non-depressed on living alone and not married

in the gender role and lack of power in the traditional large family system (Takeda et al. 2004). In fact, the mortality among elderly females was the lowest among those living alone (Murata et al. 2005). Further investigation is needed to figure out what causes the difference in the pattern across living arrangement and marital status, especially paying attention to the role of family members.

Following the analysis in the SHARE report, we modeled household equivalent income as log-normally distributed outcomes. We controlled for age, sex and marital status. Figure 2-5-3 shows the effects. The x-axis indicates the predicted income of a person with depression as proportion of that of a non-depressive case. Although depression was not consistently associated with income in SHARE, our results show an overall tendency that depression is associated with lower household equivalent income. Those with depression had 0.89 times less household income compared to non-cases (p=0.003 when all cities are combined). Interestingly, the finding in JSTAR was similar to those in Denmark and Sweden, the countries with high welfare regimes. Another finding to be noted was that the income-depression association was not significant in Sendai. What makes differential relationships between income and depression across regions deserves detailed analysis that includes other influential factors such as family structure, social support, and regional variables such as welfare system and the level of social capital.
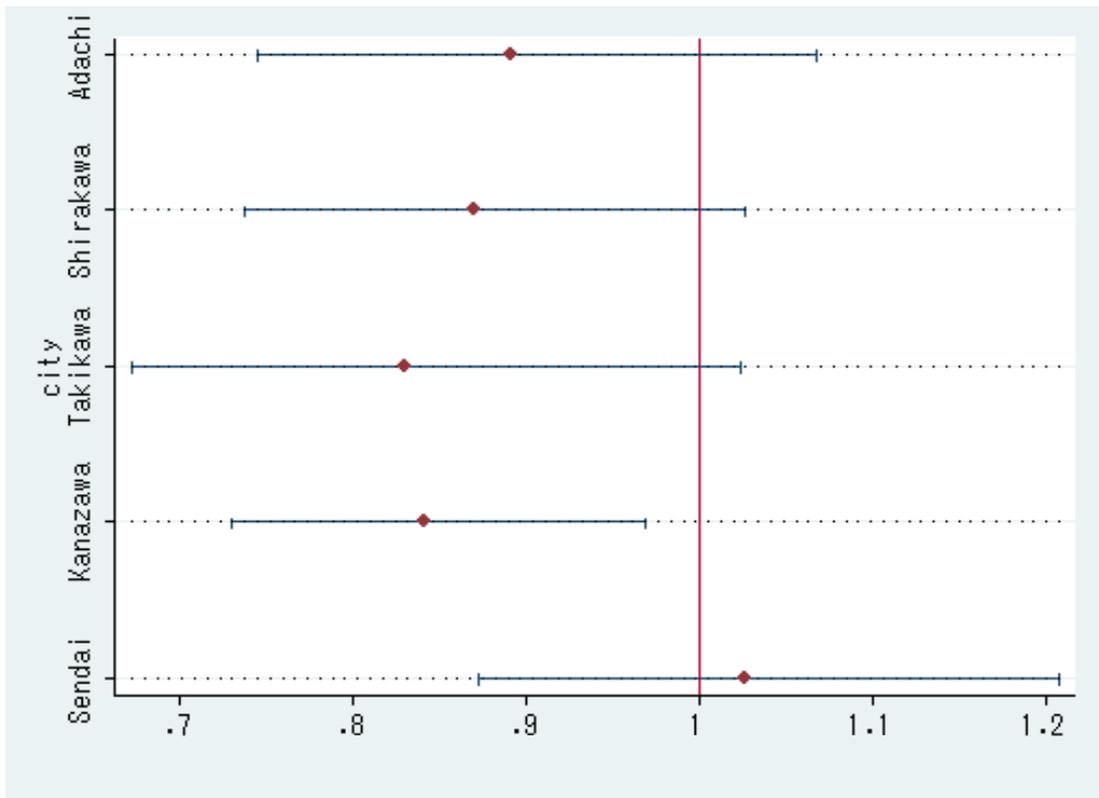
Figure 2-5-3 Equivalent income as proportion of that of non-depressed

In the SHARE analysis, depression was associated with wealth, rather than income. This was, moreover, only apparent in northern European countries. Since wealth is a better proxy to lifetime income and belonging to social class than is current income, the association between depression and wealth may suggest the causal direction of economic disadvantage on mental health, rather than the reverse relationship. A detailed analysis using wealth in JSTAR data is being prepared. Preliminary analysis shows that the disparity between the depressed and non-cases was much larger in relation to wealth compared to that of household income, which would be on par with SHARE findings (data not shown).

2.5.4 Depression and Support

The associations between depression and giving/receiving emotional, practical or financial support were modeled using logistic regression, controlling for age, sex and marital status, following SHARE. Figure 2-5-4 shows that depressed people are in general less likely to give support and more likely to receive it, results quite similar to those in SHARE. The association between depression and receiving support is stronger in Takikawa and Adachi cities.

2.5.5 Variations across Functioning and Physical Health

Many studies have commented on the strength of the cross-sectional relationship between physical health variables and depression in older age. Several longitudinal studies have shown a strong association between disablement at baseline and the
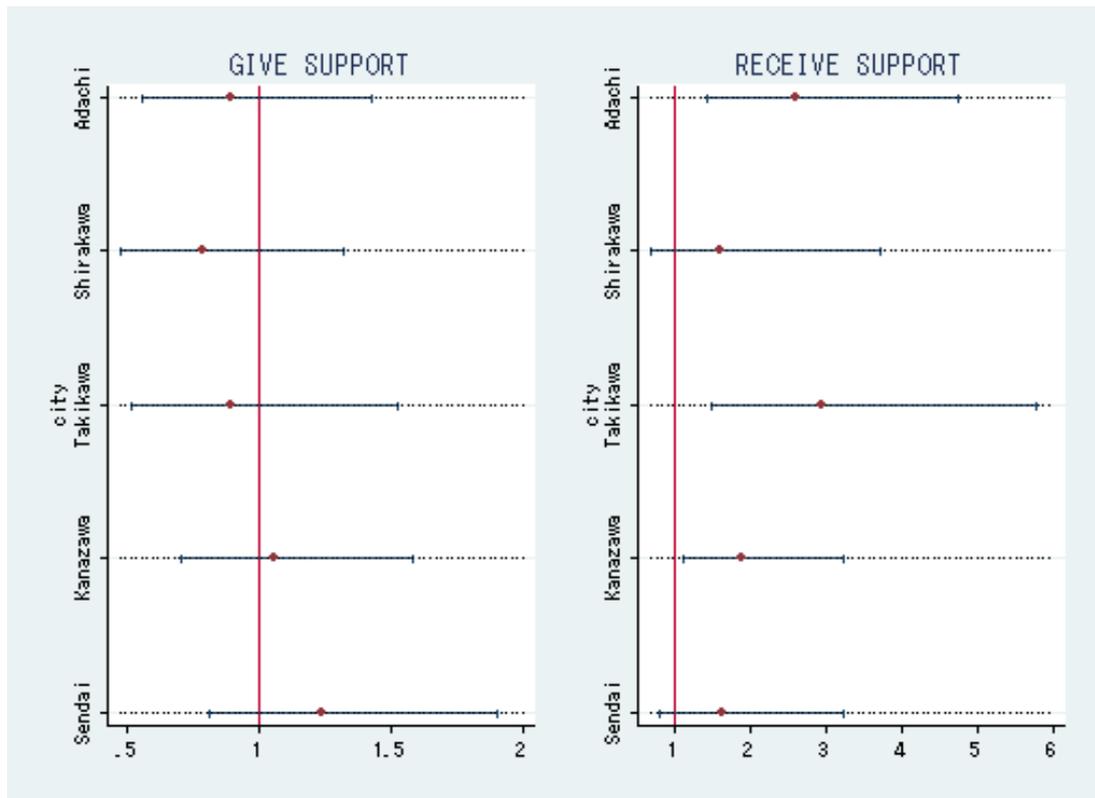
Figure 2-5-4 Odds ratio relative to non-depressed on giving and receiving support

subsequent onset of depression, and the impact was most manifest among those with the least social support (Prince et al. 1998; Schoevers et al. 2000). In Japan, a longitudinal study also identified that the decline in physical function was parallel with the loss of social interaction and the increased risk of depression (Asakawa et al. 2000).

Figure 2-5-5 illustrates the relationship between depression and the limitation in activities of daily living (ADL), instrumental activities of daily living (IADL), and mobility. It is clear that depression status was consistently and significantly related to higher odds of physical limitations, even after adjusting for age, sex, and marital status. Those with depression were two to three times more likely to report functional limitations, as was also shown in SHARE results. It is also manifest that the observed association varied in magnitude across regions: those in Sendai showed a significant association between depression and functional limitations, but those odds were the smallest among the five cities.

Figure 2-5-6 illustrates the associations between depression, and self-perceived health and chronic conditions, with the use of logistic regression to control for age, sex, and marital status. Those with depression had 1.5 to 2 times increased odds of reporting two or more chronic illnesses, and two to three times increased odds of reporting perceived health less than "very good" in the US version questionnaire. Again the findings are quite similar to those in SHARE.
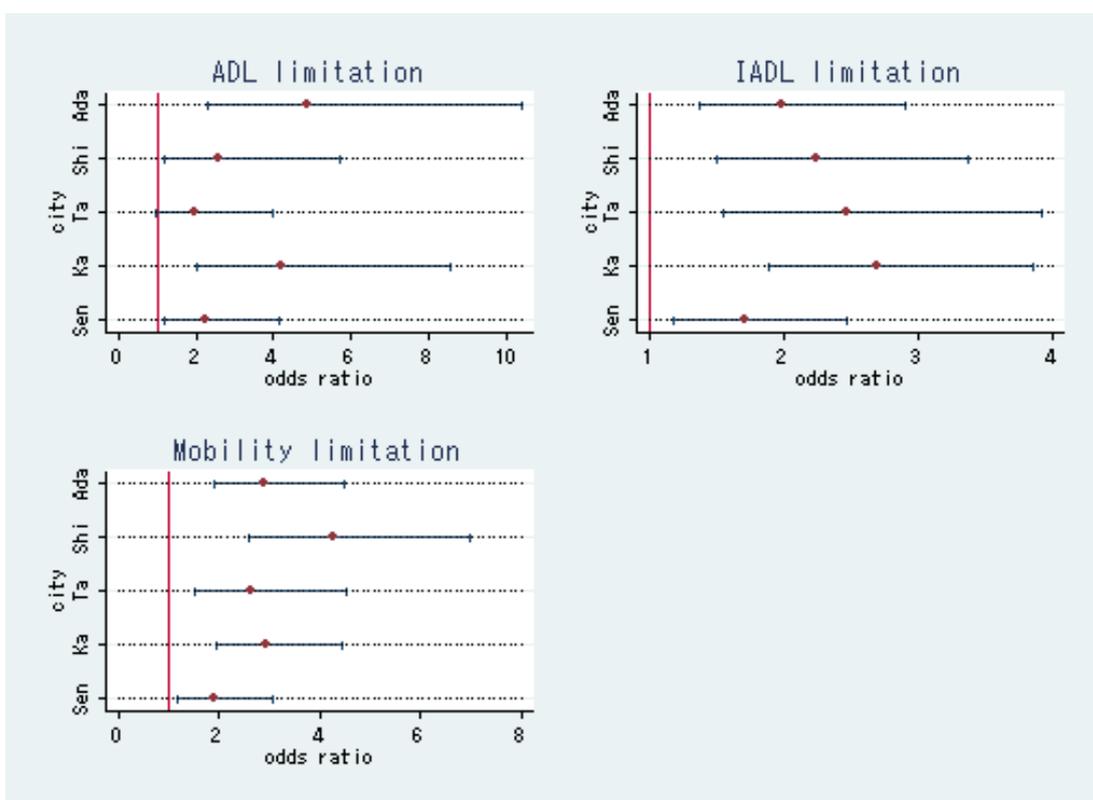
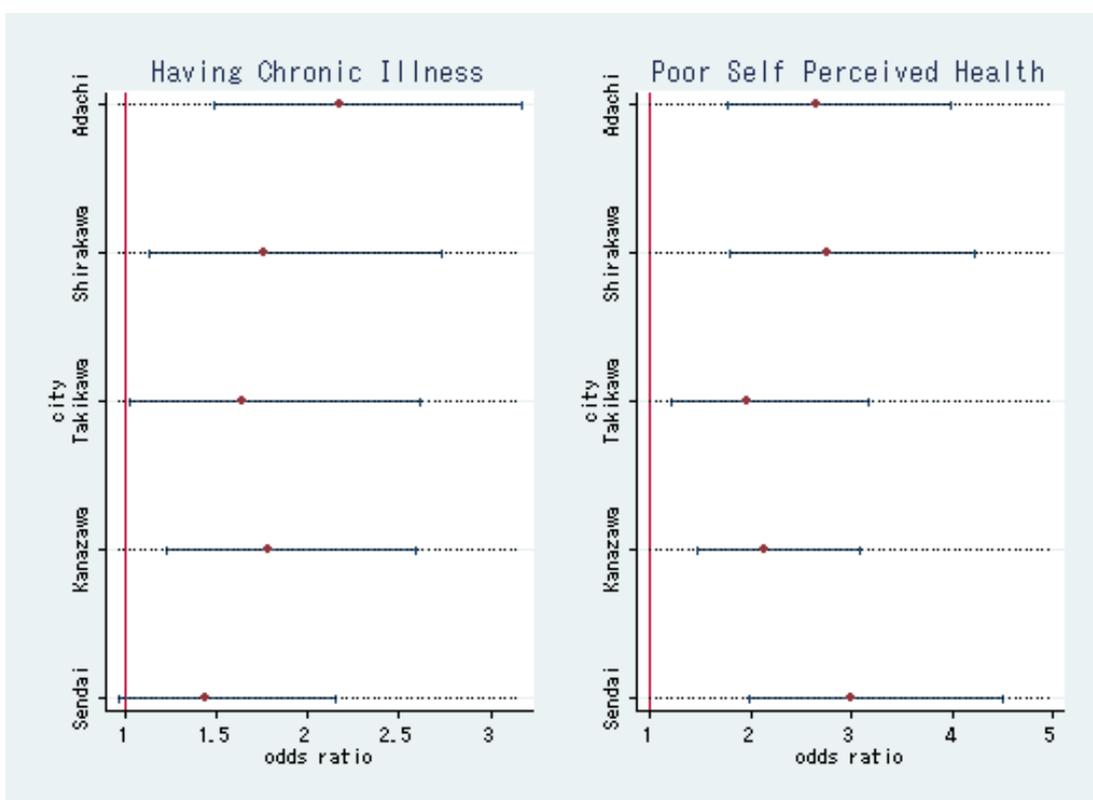Figure 2-5-5 Odds ratio relative to non-depressed on limitations in ADL, IADL, and mobility

Figure 2-5-6 Odds ratio relative to non-depressed on having chronic illness/poor self-perceived health

In sum, we observe a large disparity in variations of the depression across attributes, most of which are consistent with those in what the SHARE book found. The negative impact of depression upon quality of life is underlined by the very strong associations between depression status, impaired functioning, and self-perceived health. Depression is a very disabling condition, of which burden of disease has become substantial both in industrialized and developing countries (Murray et al. 1997). Understanding the causal relationship between depression and salient life events and socio-economic conditions in late-life is crucial for SHARE and JSTAR.

We should be patient, however, and not induce any conclusive causal inference at this stage. Since late-life depression and relative disadvantage in income, living arrangement, education, and social support are highly correlated with each other, it will always be difficult to determine the effect of one, independent of the others. Whether depression is the result of economic disadvantage, or vice versa, should be discussed when the panel data becomes available in the future JSTAR report.

2.5.6 Conclusions

• The prevalence of depression in Japan has a similar pattern to that in the SHARE report. The rich information in JSTAR provides opportunities to investigate determinants of depression within and across regions.

• While the prevalence of depression does not differ much across age or municipality in Japan, it does depend on gender, marital status, socioeconomic conditions, and physical functions.

• Longitudinal data will allow us to disentangle the causality of depression and other related factors described in this subsection, which will contribute to determining how to mitigate depression in old age.

2.6 Cognitive Function

2.6.1 Introduction

An expanding prevalence of dementia is a common challenge for industrialized countries. A research group funded by the Ministry of Health, Labour and Welfare of Japan recently reported that the number of those who are suffering from cognitive dysfunction is estimated at 2 million in 2005 and is expected to increase to 4.5 million in 2035 (Asahi Shimbun newspaper, 2008). However, this estimate was based on the prevalence data obtained in the 1980s and projected demographic data at that time.

In Europe, the prevalence of dementia is around 2% for those aged 65-70, and it doubles with every five year increase in age, reaching around 25-30% for the demographic aged 85 years and over (Lobo et al. 2000). In Japan, the municipal government often refers to the estimate released from the then Ministry of Health and Welfare in 1992. According to the official circular notice, the prevalence was 1.5% for those aged 65-70, and doubles with every five years until it reaches 27% in those aged 85 and over (Ministry of Health and Welfare, 1992). There has been no published reference cited for this number. We have to recognize that current policy for cognitive dysfunction among the elderly in this country has not been based on firm scientific evidence.

Other statistics on the prevalence of cognitive dysfunction were derived from claim bill data of Long-term Care Insurance, and it may be more reliable. A working group in the Ministry reported that based on the data, the estimate was 1.5 million in 2002, and the number was projected at 3.2 million in 2025 (Ministry of Health, Labour and Welfare 2006). A limited yet scientifically sound measurement of the prevalence in the community was provided by Ishizaki et al. (1998). They conducted a Mini-Mental State Examination, a validated measurement of cognitive function, on 90% of the residents aged 65 and over in a rural city in northern Japan (N=2,266). Mild cognitive impairment (MMSE score<24) was identified in 21.8% of the population, and severe impairment (MMSE<18) was found in 6.0%.

Surprisingly, there has been no scientifically reliable nationwide data on the prevalence of cognitive function in this country, and the recent working group in the Ministry cited the necessity of such statistics as soon as possible. Although studies using a sophisticated measurement of cognitive function are available in the clinical setting, a previous study conducted by a research team in the Tokyo Metropolitan Gerontology Institute has been the only nationwide population-based survey. However, MMSE is not sensitive enough to detect early stages of cognitive dysfunction.

Cognition can be divided into different domains of ability, which should be tested separately. Memory is often affected first, and most prominently. It is very difficult to distinguish between physiological and pathological decline of cognitive function in the early and mild stages of the impairment. Higher cognitive functions such as numeracy and word recall are believed to be more sensitive to mild and early impairment. Most aspects of cognitive ability have been shown to be relatively stable across the early life course, reflecting the strong influences of heredity, early environment, and education (Richards et al. 2004).

SHARE, HRS, and JSTAR had a common set of measurements on orientation, word recall, and numeracy. In SHARE and HRS, verbal fluency was also measured. JSTAR and her sister surveys provide a unique opportunity in a community setting to compare cognitive function in aging populations across OECD countries.

Cognitive function in midlife is known to be influenced by many factors—including but not limited to genes, educational attainment, occupation, physical functions, and depression (Lee et al. 2005; Liang et al. 1996). Cognitive function also affects the prognosis of functional decline (Ishizaki et al. 2006). Thus, if results vary between countries, they may be linked to a variety of underlying mechanisms. Of particular interest here is the impact of education.

Age-related cognitive impairment is generally considered to be an organic process, linked to neuro-degeneration. We would therefore anticipate that the effect of age upon cognitive ability would be similar across countries after adjusting for conventional risk factors such as diabetes, hyperlipidemia, and smoking. The effect of gender may vary particularly if confounded by educational opportunity and other social engagement. The core cognitive abilities assessed in JSTAR and SHARE are expected to have an impact upon the socioeconomic success of participants, indexed by income and/or wealth. Of interest here would be 1) whether any independent effect of cognitive function was discernible, having controlled for education and occupational status, and 2) the extent to which any such effects were seen in Japan as are seen in European countries.

We report each cognitive test score and examine the effect of poor cognitive performance on a number of economic, health, and social functioning measures. To simplify the presentation we focused on three key cognitive domains: memory (recall), disorientation, and numeracy. We did not include verbal fluency in JSTAR because standard measurement of the ability across different languages was not available, and a validated measure for verbal fluency with a short questionnaire was not available in Japanese.

Measurement of "disorientation of time and place" is a part of Mini-Mental Status Exam, and has been adopted in common by JSTAR, HRS, and SHARE. Memory was measured by asking the respondents to recall 10 words that are presented beforehand. Due to cultural and linguistic difference, purely comparable measurement of word recall was not validated across countries (e.g. HRS version includes the word "church" which may not be similarly familiar to Japanese elderly). After discussion with HRS researchers who are in charge of cognitive function assessment (personal e-mail communication with Prof. H. Dodge at Oregon State University), we decided to adopt a 10-word test from a part of Alzheimer's Disease Assessment Scale J-COG, which has been used in clinical trials for evaluating the efficacy of anti-dementia medicine (Mohs et al. 1983; Homma et al. 1992; Kawano et al. 2007). Finally, numeracy tests are completely comparable among JSTAR, SHARE, and HRS. The questionnaire asks the respondents to conduct a simple arithmetic calculation only in his/her head.

For these analyses SHARE has re-coded each of the cognitive measures to a binary variable with as near as possible to 7% scoring as impaired. In JSTAR, we adopted the same strategy to dichotomize each measure as follows: disorientation (if any failed answer=6.6%), word recall (initial recall less than or equal to 2 = 4.1%, late recall less than 1 = 8.3%), and numeracy (failed in the first two questions = 2.2%).

In these analyses we always adjust for the effects of age, sex, and education, and stratify for region. Additional variables are included as appropriate and are mentioned as each set of results is presented and discussed. Sampling weights were not applied. We present the estimates from the models and a 95% confidence interval.

2.6.2 Prevalence of Cognitive Impairment

Figures 2-6-1-1, 2-6-1-2, and 2-6-1-3 summarize the prevalence of cognitive impairment in disorientation, memory (initial word recall) and numeracy by age, sex, and region. For each domain, the overall trend shows that the prevalence of impairment rises with age. Exceptional was the case of males in Takikawa for disorientation and recall, where overall prevalence of dysfunction was higher than those in other cities, and the prevalence was higher among those in their 50s rather than among those in their 60s.

When we conducted a logistic model to predict the impairment with explanatory variables including age, gender, education, household income, marital status, and municipality,

• Even after controlling for covariates, age still shows the increasing gradient for all the domains of cognitive dysfunction, which supports the patho-physiological basis of cognitive impairment.

• Education was the strongest and most consistent socioeconomic predictor of cognitive impairment as expected.

• Age, gender, educational attainment and marital status did not explain all of the differences across municipalities in memory and disorientation.
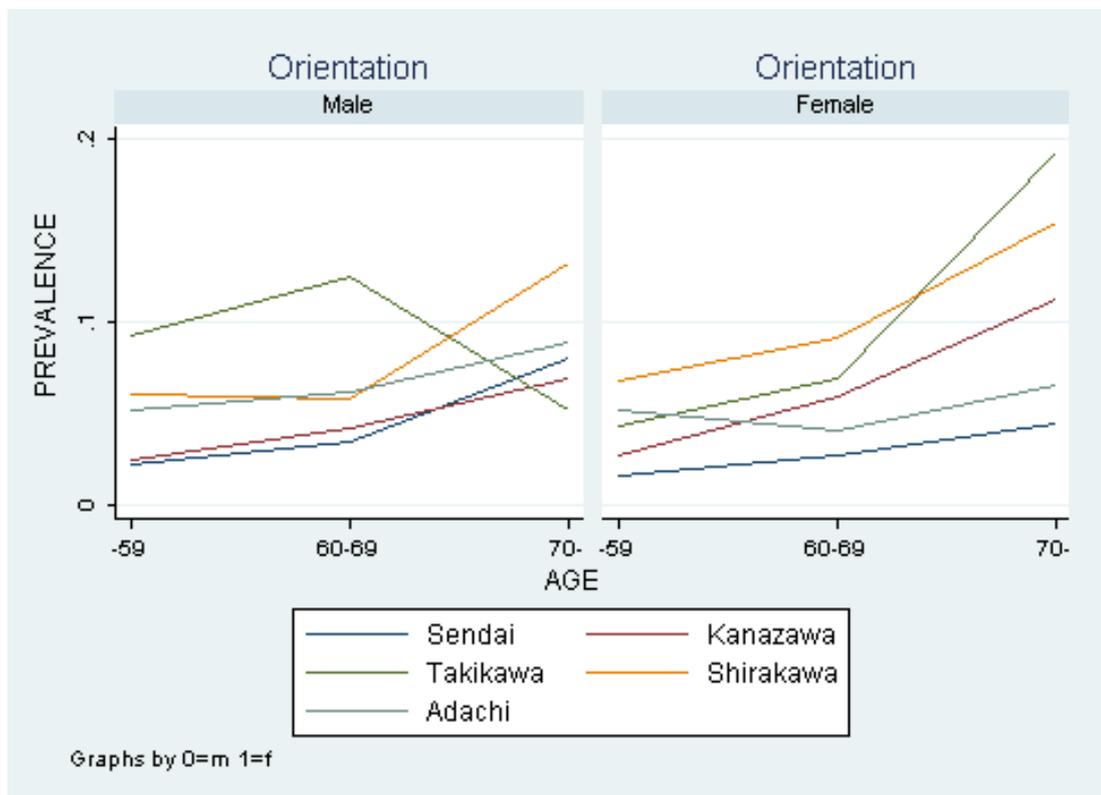

Figure 2-6-1-1 Cognitive impairment in orientation, by age, sex, and region
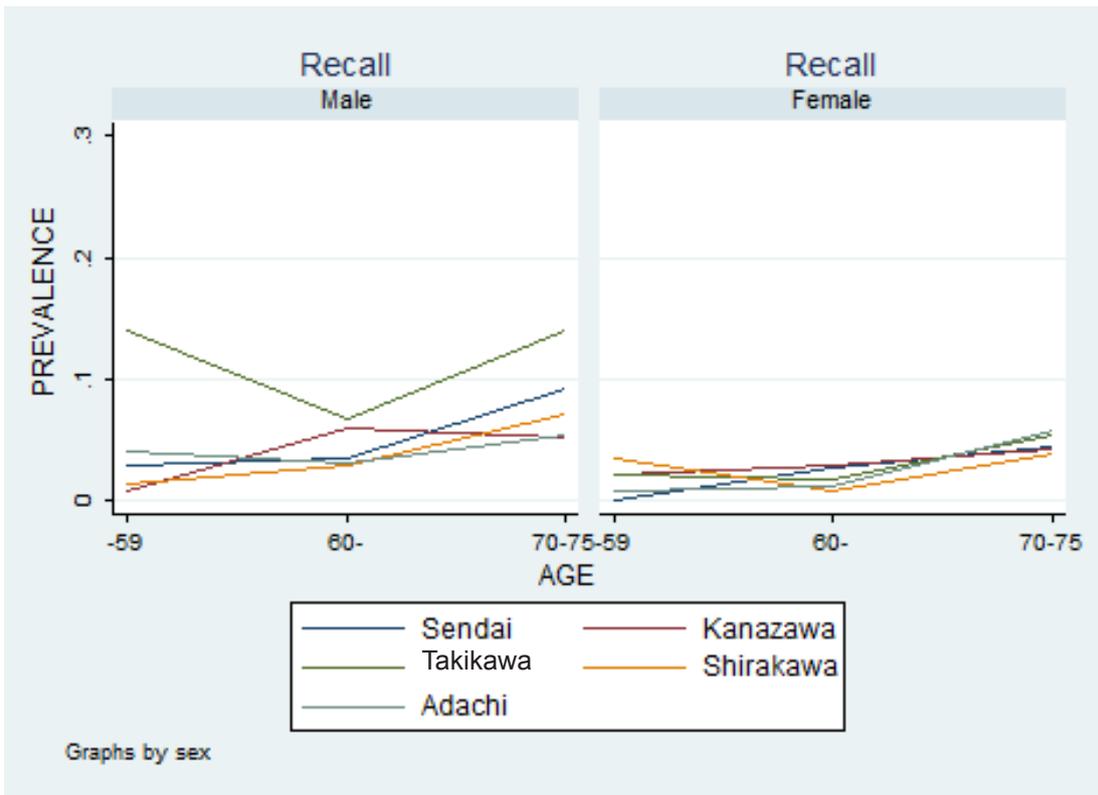
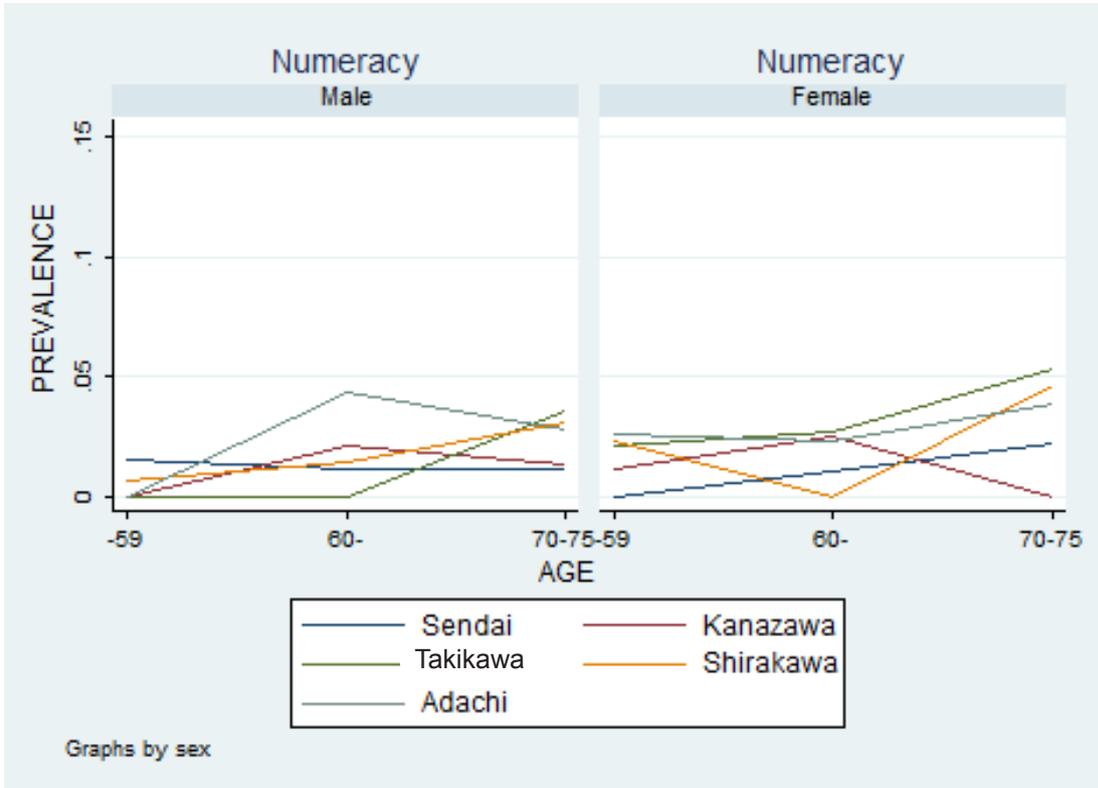Figure 2-6-1-2 Cognitive impairment in word recall, by age, sex, and region

Figure 2-6-1-3 Cognitive impairment in numeracy, by age, sex, and region

These findings are in accord with the findings in SHARE. When we put all cities together and conduct logistic regression to control for age, gender, educational attainment, and marital status, those in Takikawa and Shirakawa, rural farming and forestry cities, showed higher odds of impairment in orientation, compared to those in the cities (ORs 2.05[1.20-3.50] and 2.36[1.43-3.91], respectively). As for word recall, those in Shirakawa had significantly lower odds of impairment (OR 0.44 [0.23-0.86]). This finding strongly suggests the association of social environment with the prevalence of cognitive function in different domains. However, their causal direction is, again, a matter of scientific debate. One could argue that a rural life with less intensity of social interaction may cause a higher chance of cognitive impairment. Others could counter-argue that those with moderate impairment were selectively excluded in the urban area due to higher access to institutionalization, which relatively raised the prevalence in rural areas. Again, follow-up JSTAR surveys in the future will provide us opportunities to answer which argument is the truth.

2.6.3 Cognitive Impairment and Education

In this section, we treat cognitive impairment as a predictor variable to lower education attainment, as the SHARE report did, for comparative purpose. However, we believe that the supposed causal direction of education on cognitive function in later life may be the reverse, and education should have been treated as a covariate rather than a target variable in this case.

Figure 2-6-2 presents the odds ratio of cognitive impairment on lower educational attainment, after adjusting for age, sex, and marital status. When data from the five cities was compiled, the odds of cognitive impairment to lower education was 1.50 (1.11-2.01) for orientation, 2.04 (1.42-2.95) for word recall, and 2.28 (1.37-3.81) for numeracy. The figure shows the results stratified by municipality, and all point estimates of odds ratios suggest the association between lower educational attainment and cognitive impairment, though many of the estimates were not statistically significant, due to a relatively smaller sample size to detect the impact of cognitive dysfunction for each city. There was no significant interaction between municipalities and cognitive dysfunction.

As such, cognitive function, however measured, was strongly and consistently associated with education. The effects of cognitive dysfunction were broadly similar across regions. When compared to SHARE data, Japanese elderly in JSTAR showed a similar pattern to those in Nordic countries, compared to southern European countries and Switzerland, where the relationship between education and numeracy was observed quite strongly. Although the SHARE report did not discuss this cross-country difference in the relationship between educational attainment and numeracy ability, that JSTAR results were similar to Nordic countries may suggest that the high quality of primary education in Japan and Nordic countries may contribute to the less remarkable association between cognitive function and educational attainment.
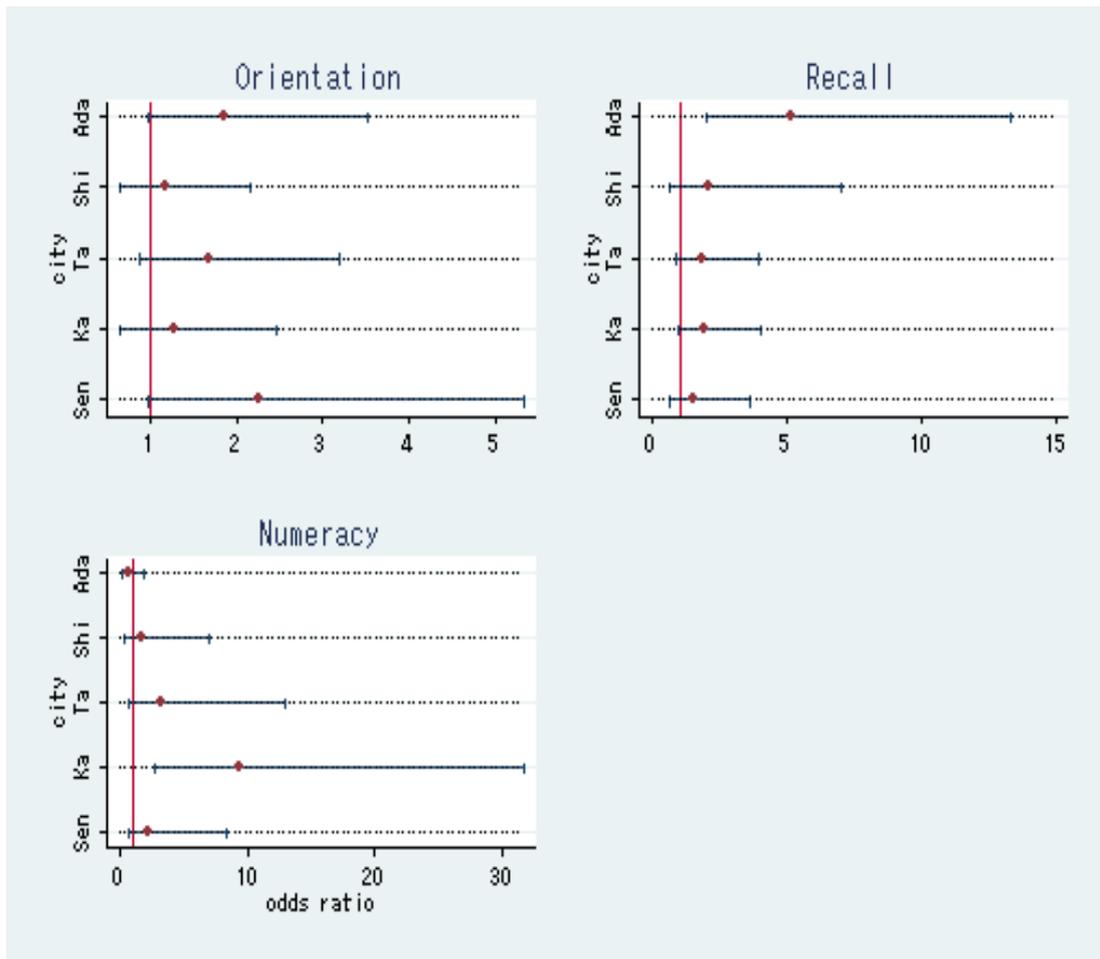
Figure 2-6-2 Adjusted odds ratio of cognitive impairment on low educational attainment, by region

2.6.4 Cognitive Impairment and Income

In Figure 2-6-3, we modeled equivalent household income as log-normally distributed outcomes with upper 1 percentile outliers excluded. The effect of cognitive impairment was estimated, controlling for age, gender, education and employment status. The association of impairment in the numeracy function with equivalent income was marginally significant when combined across regions. The point estimate of the proportion of equivalent income to that of non-impaired subjects was 0.84. (p=0.08). Disorientation and impaired word recall were negatively associated with equivalent household income, but were not significant (p=0.15, p=0.56, respectively). Exceptional was the case in Sendai where those with disorientation had 1.32 times more household income (p=0.108). Those in Takikawa with recall impairment have 0.74 times less income than their counterparts with intact recall (p=0.08).
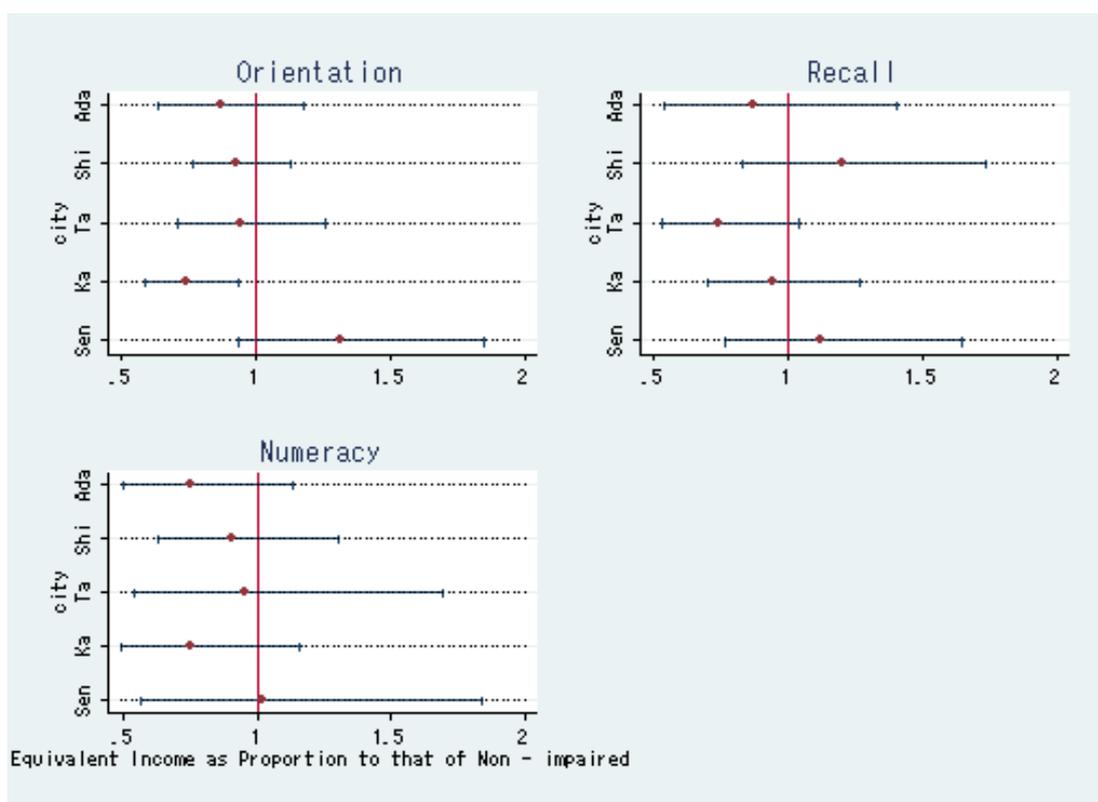
Figure 2-6-3 Equivalent income as proportion to that of non-impaired, by region

2.6.5 Cognition and Support

The effect of relative cognitive impairment upon giving and receiving emotional, practical or financial support was modeled using logistic regression, controlling for age, sex and education, following the SHARE analysis. Overall findings shown in Figure 2-6-4-1 (giving support) and Figure 2-6-4-2 (receiving support) were as expected in that those with cognitive impairment were generally less likely to give, and more likely to receive support than non-impaired subjects.

To be more specific, if we put the five cities together, those with disorientation (OR 0.67[0.47-0.95]) were significantly less likely to give support. Numeracy and recall impairment did not show a significant association with the likelihood of giving support. Being young, female, and with higher education were characteristics significantly related to higher odds of giving support.

As with receiving support, when the five cities are put together, those with impaired numeracy (OR 2.51 [1.32-4.77]) and memory impairment (OR 2.09 [1.24-3.52]) were significantly more likely to receive support compared to non-impaired subjects, while disorientation was not related to the likelihood of receiving support. Interestingly, the female gender was significantly related to higher likelihood of receiving support. Educational attainment and age were not related to likelihood of receiving support.
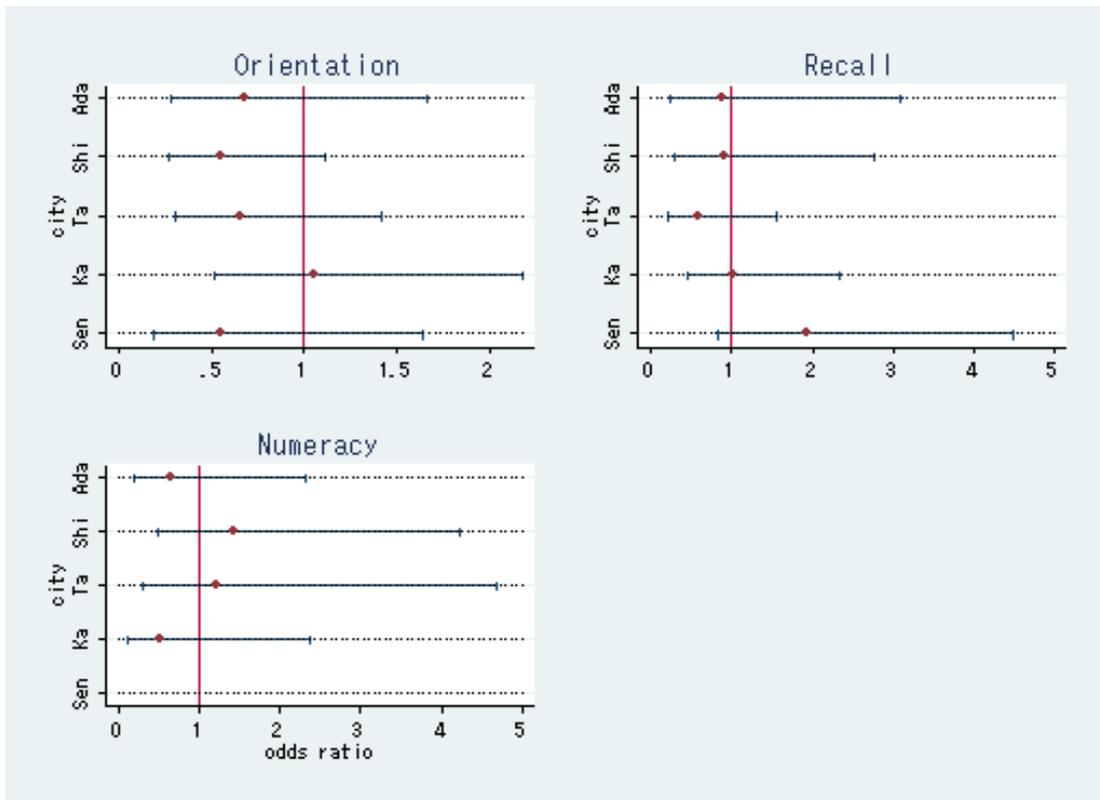
Figure 2-6-4-1 Adjusted odds ratio of cognitive impairment on giving support, by region
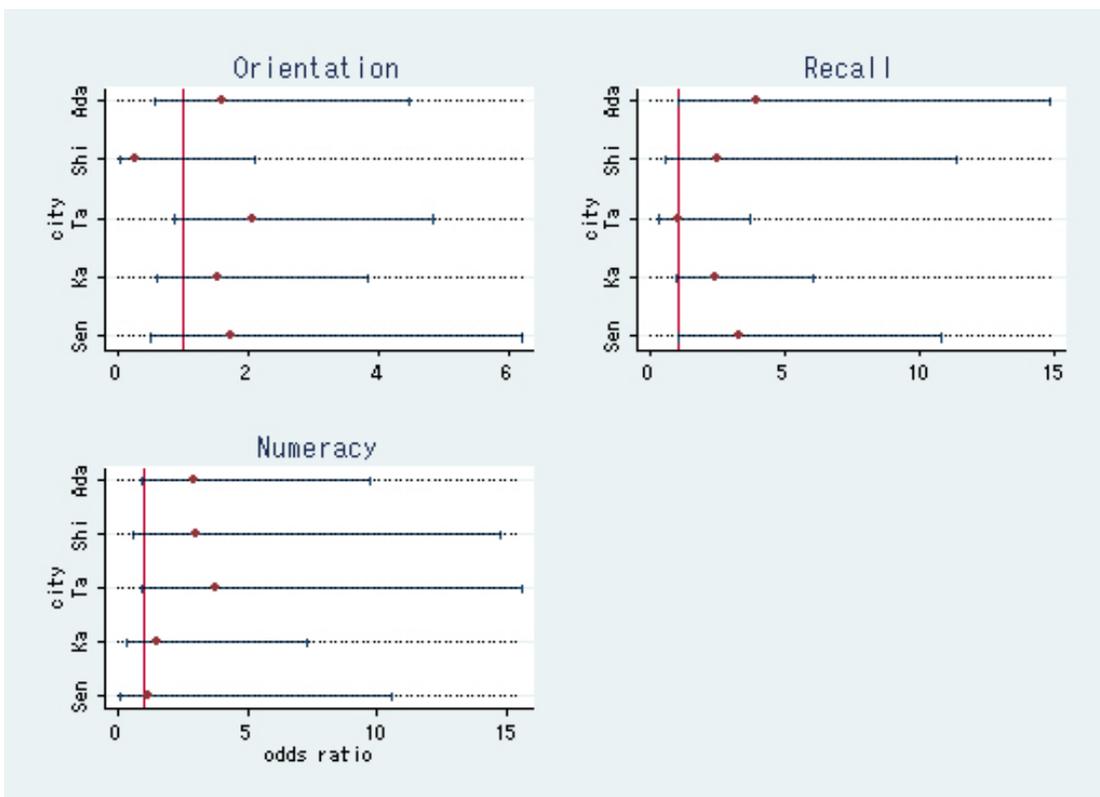

Figure 2-6-4-2 Adjusted odds ratio of cognitive impairment on receiving support, by region

There was no significant interaction between municipalities and cognitive function. Thus, there seems to be no regional variance in the association between cognitive function and likelihood of support exchange. However, those in Shirakawa were less likely to receive support, compared to respondents in other cities. We do not have a plausible explanation for this regional difference in the pattern of support exchange. Further analysis including the availability of formal and informal care for those in need in regional areas may be helpful.

2.6.6 Cognition and Functioning

The effect of relative cognitive impairment upon the mobility function, activities of daily living (ADL), and performance of instrumental activities of daily living (IADL) was modeled using logistic regression, controlling for age, sex and education. Again, we can see the overall trend that impairment in orientation, memory recall, and numeracy were all significantly related to limitations in mobility, ADL, and IADL, which is again the same as SHARE findings. When we stratify the analysis by municipality as shown in Figure 2-6-5-1 (mobility vs. cognitive functions), Figure 2-6-5-2 (ADL vs. cognitive functions), and Figure 2-6-5-3 (IADL vs. cognitive functions), however, the magnitude and direction of the associations were somewhat varied across regions and types of cognitive function, supposedly due to smaller sample size for each city to detect a robust association between functioning and cognition.

The association of numeracy and limitations in mobility and ADL was less salient compared to those of disorientation and recall. The effect of impaired numeracy was most salient in IADL limitation. Since IADL includes the function to manage money and payment, numeracy would be a necessary capacity.

Disorientation was less associated with functional limitations in Sendai and Shirakawa, compared to those in other cities, which may be related to regional difference in the patterns of social engagement and transfer. Memory impairment was inconsistently associated with ADL/IADL limitation across cities.

2.6.7 Cognition and Physical Health

The effect of cognitive impairment upon self-perceived health and chronic illness was modeled using logistic regression, controlling for sex, age, and education. There were clear and consistent negative effects of relative cognitive impairment (each domain) upon self-perceived health. There was no clear pattern of association with having two or more chronic physical illnesses. These findings are quite similar to those in SHARE.
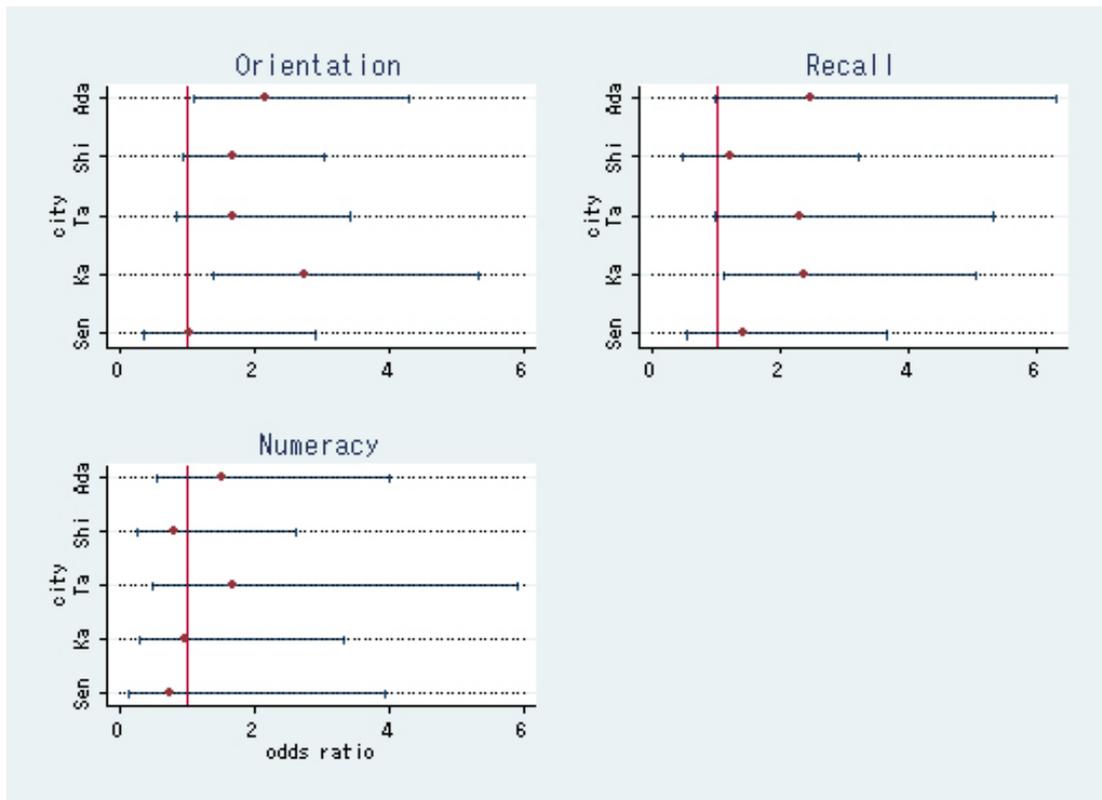
Figure 2-6-5-1 Adjusted odds ratio of cognitive impairment on mobility limitation, by region
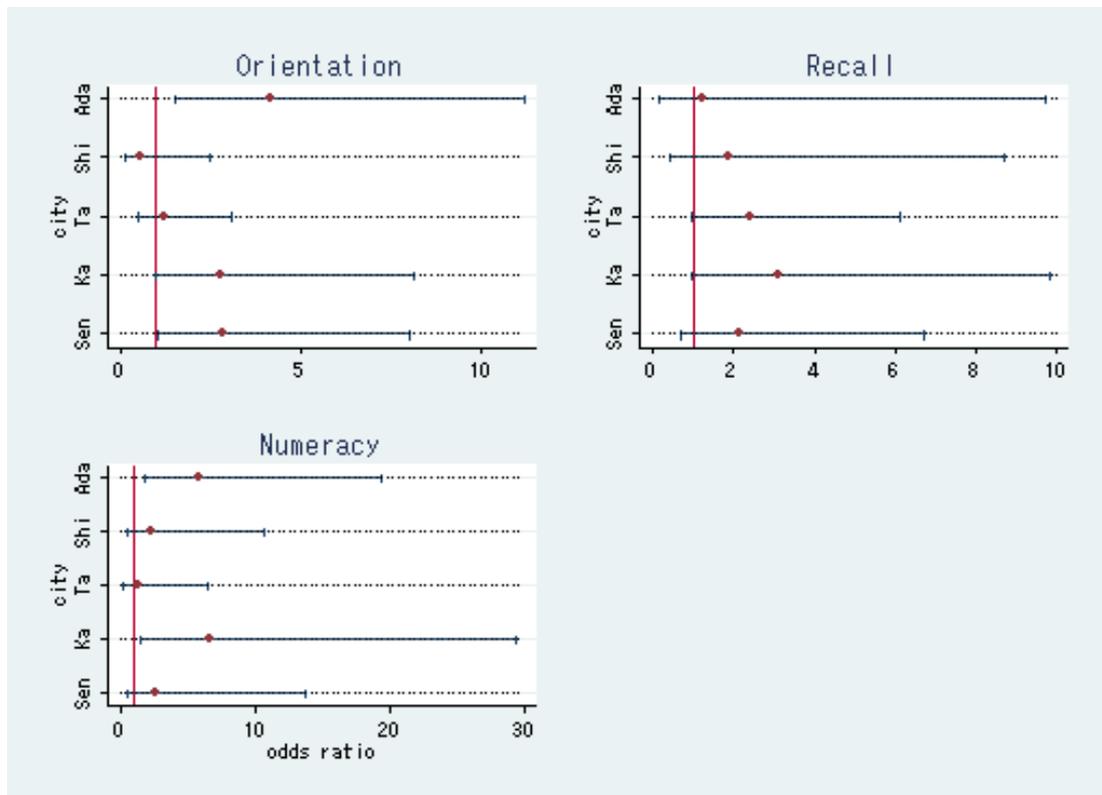

Figure 2-6-5-2 Adjusted odds ratio of cognitive impairment on ADL limitation, by region
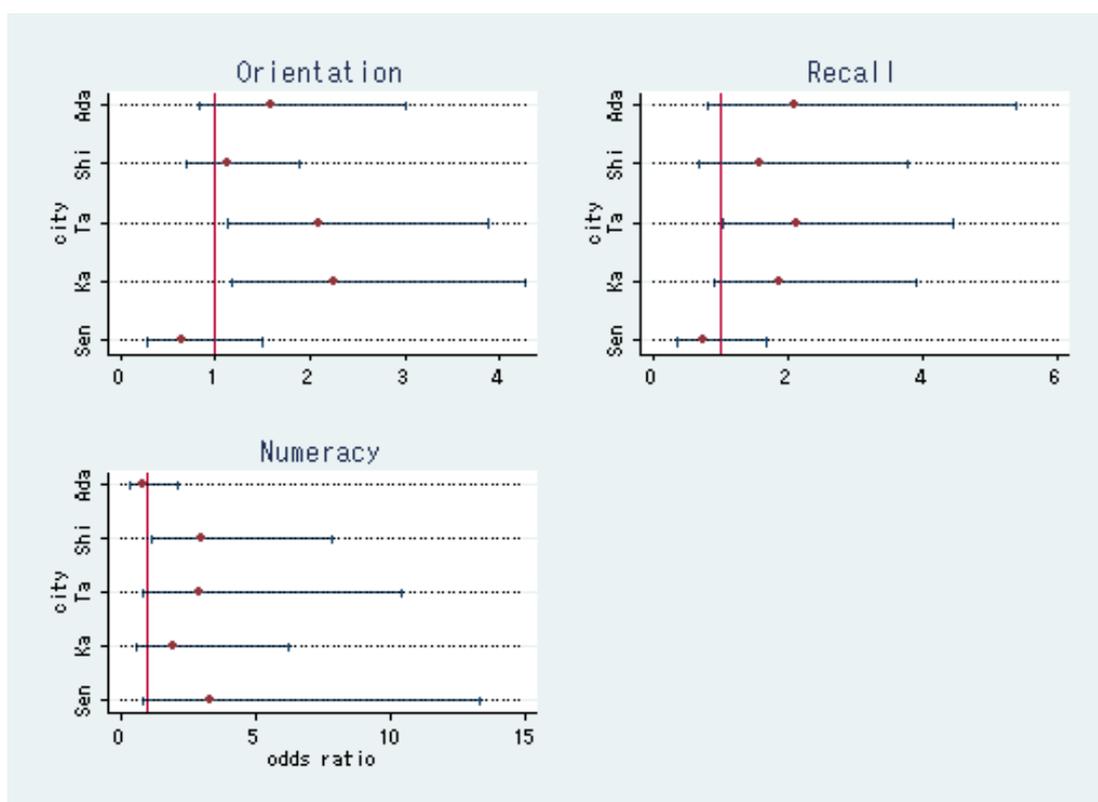
Figure 2-6-5-3 Adjusted odds ratio of cognitive impairment on IADL limitation, by region
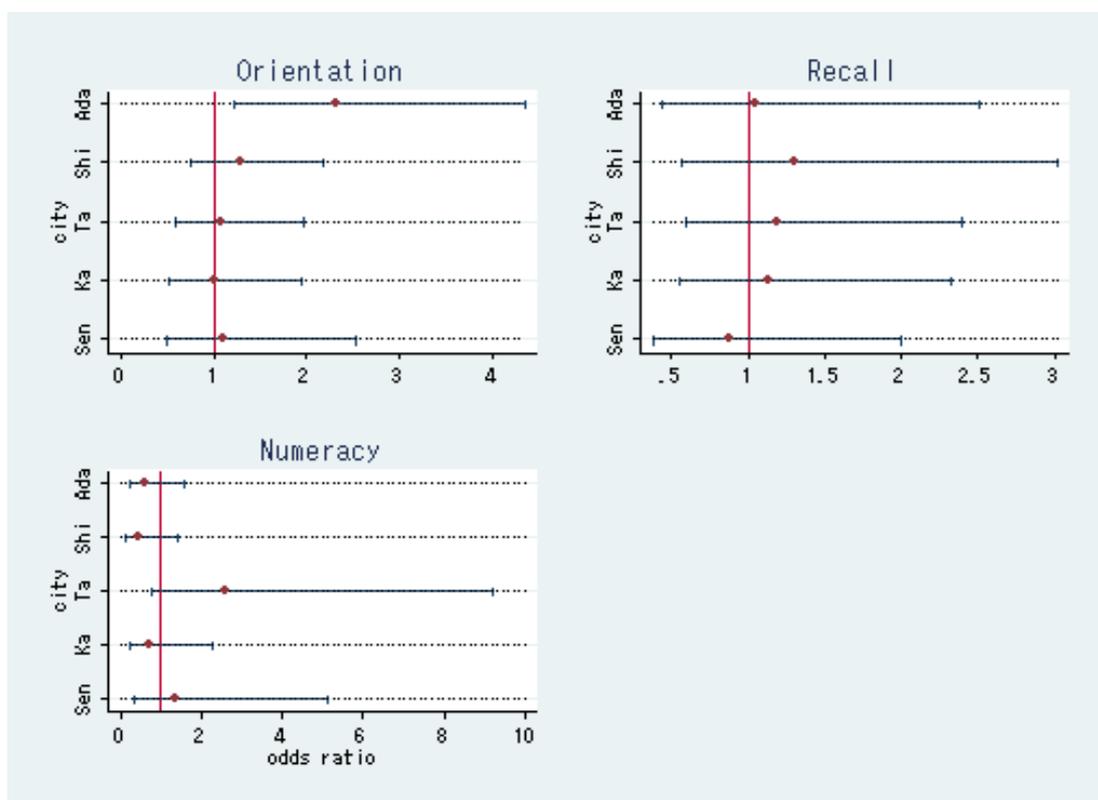

Figure 2-6-6-1 Adjusted odds ratio of cognitive impairment on having chronic diseases, by region
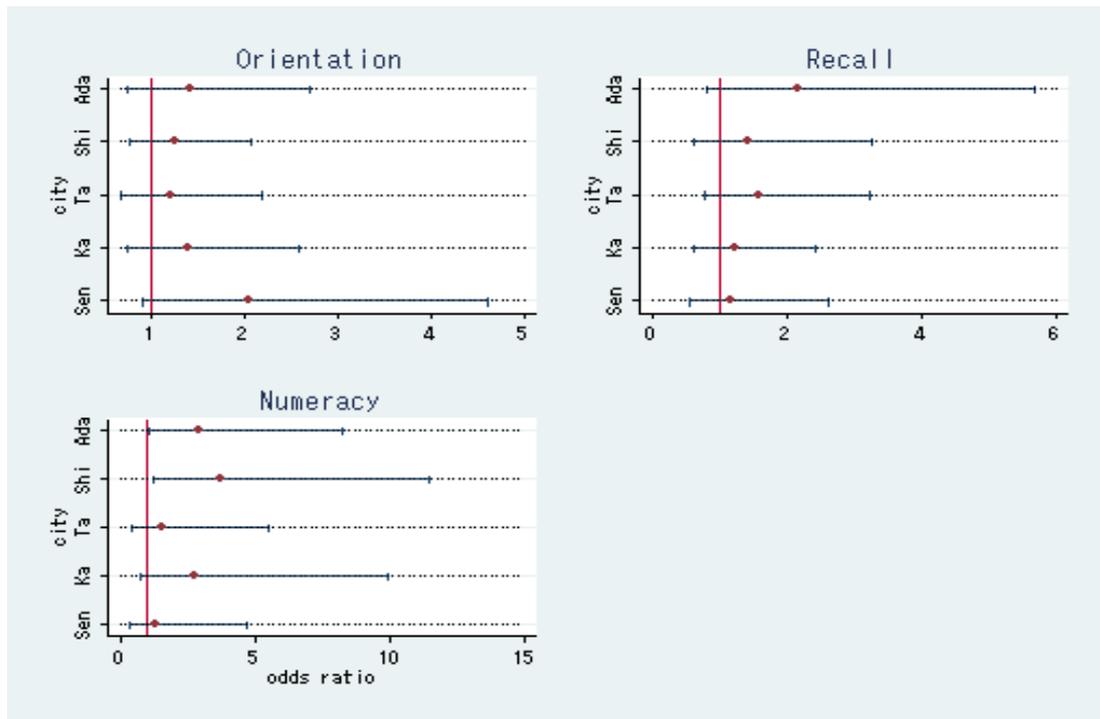
Figure 2-6-6-2 Adjusted odds ratio of cognitive impairment on poor self-perceived health, by region

2.6.8 Conclusions

• Even after controlling for covariates, age still shows the increasing gradient for all the items of cognitive dysfunction, which supports the patho-physiological basis of cognitive impairment.

• Education was the strongest and most consistent predictor of cognitive impairment as expected.

• Age, gender, educational attainment, and marital status did not explain all of the differences in the prevalence of cognitive impairment across municipalities, suggesting the association of social environment with the prevalence of cognitive function.

• Japanese elderly in JSTAR showed a similar pattern to those in Germany and Nordic countries, compared to Southern European countries, where the impact of education on numeracy was far stronger.

• Consistently across regions, people with numeracy impairment had lower incomes than those who were not impaired, which was comparable to the findings in SHARE. The associations were independent of education and current occupational status. The causal relationship between cognitive impairment and income disadvantage deserves further follow-up study and comparable analysis with SHARE and HRS.

• An interesting contrast emerged between rural towns and urban cities. While the risk of over-generalizing is conceded, a pattern emerges in which relative cognitive impairment is more prevalently seen in rural towns, and more robustly associated in urban cities with receiving support. Availability of informal care in rural areas and accessibility of formal institutionalized care in urban areas may cause this urban-rural difference, which provides an important policy implication in long-term care for those with cognitive impairment in the community. It also gives a research focus on comparative analysis with SHARE findings where a similar contrast was seen between northern and southern countries.

2.7 Out-of-Pocket Payments for Health Care Expenditures

2.7.1 Introduction

Beginning in 1961, the Japanese national health care program has mandated universal medical coverage. In the case of company-based health plans, employers are required to have a non-profit insurance organization or to join the government-driven plan to provide their employees with health insurance. Civilian office workers, teachers in private schools, and workers in some specialties are covered by a non-profit insurance organization for each worker type. In these employment-based health plans, the premium is set proportionally to annual income. At that time, half of the premium was paid by employers and the other half by employees.

In the case of community-based plans, which cover the self-employed, the retired, and those who are not covered by employment-based programs, municipalities become public insurers to provide mandatory health care coverage. The premiums of community-based plans are set by a combination of the community rate and income-proportional rate, and are levied on household heads. Since the community-based plans include high-risk beneficiaries with low income, premium revenue covers only half of the cost, and the remaining half is compensated by tax revenue.

At the beginning of the mandatory coverage, household heads were not required any copayment, while the dependent family member had to pay 50% of copayment. Gradually, the copayment rate was decreased to 30% for dependent family members in the 1980s. Due to financial pressure on national health insurance, however, 10% copayment for household heads was instead introduced in 1984 for the first time; it was raised to 20% in 1997 and since 2003 it has been 30%.

There are no deductibles in Japanese public insurance scheme to date, though the debate to introduce one has been made as a measure to control the extreme rise in medical expenditure. The upper limit of monthly contribution was set according to income levels, and the personal contribution over the limit is reimbursed by the insurers. For those who cannot afford premium payment and copayment, a means-tested subsidy is possibly available through welfare programs.

After 1973, the elderly aged 70 and over were entitled to free medical services both for outpatient and hospitalized services, which quickly raised national medical expenditure due to the expected moral hazard and subsequent over-utilization. In 1983, free medical services were abolished and the new Elderly Health Care Law was established. The law stipulated that the elderly were required to make a fixed amount monthly contribution, e.g. 400 yen per month for outpatient and 300 yen per diem for inpatient. The contribution amount has been amended and increased since then, until 20% coinsurance was introduced in 2002, with a monthly limit of 3,000 yen for outpatients and 37,200 yen for inpatients. From April 2008, a medical care program for the elderly aged 75 and over has begun to be operated as an independent program, though it needs some time to stabilize because political debate over an increased economic burden on low-income elderly households has been raised.

In 2000, another mandatory public insurance program was initiated to cover long-term care. Long-term Care Insurance (LTCI) is a non-selective mandated insurance

payable by all Japanese residents aged 40 and above, driven by municipal government insurers. The LTCI is a single and dominant insurer for providing formal elderly care services in this country. Until the introduction of LTCI, elderly care relied on informal care in a traditional family setting in which the burden of care was the selective obligation of female family members. Besides that, long-term care was often offered in medical facilities, even for those without a need for medical attention. The introduction of LTCI originally purported to alleviate the burden of informal care and to efficiently use resources so as to reduce a large medical expenditure (Mitchell, Piggott and Shimizutani 2008). Elderly in need of long-term care must apply to the Local Care Needs Assignment Committee that decides whether the applicants meet the care eligibility criteria. Once approved, the beneficiaries are entitled to use formal care of any mix, under a monthly upper limit and with 10% copayment.

These programs in the Japanese health care system are evidenced by comparing the figures appearing in Table 2-7-1. Out-of-pocket (OOP) payments vary substantially across countries with different mixes of health insurance programs: public and private, or tax financing and social contribution. The proportion of OOP to total health expenditure ranges from 11% in Greece to 42% in Italy, and the rate of 18% in Japan is positioned in the middle of the range.

The major component of the Japanese health care program is the national mandatory health insurance operated as social insurance. The population covered by public/mandatory insurance is 100% in Japan which is the same as cases in most of the SHARE countries, except for Germany and Denmark where public insurance is not mandated.

According to OECD Health Data 2005, the share of the public social insurance program in the total health expenditure has been about 66% in Japan, which was about the same or a little lower than the programs in France and Germany (data not shown in the table). The supplemental insurance is not mandated in Japan, and the government does not hold a reliable statistic on the magnitude and prevalence of private supplementary insurance, though it would be estimated negligible as is the case in Sweden.

The data in Table 2-7-1 and what we have observed in previous sections poses an important theme. Apparently, non-selective availability of health insurance does not guarantee the achievement of health equity in the nation. Although the public mandated coverage of medical care does seem to close the health gap across socioeconomic class, a social gradient of health can be observed even in Japan and Sweden, where health care insurance is covered exclusively by the public domain. The remaining health gap in these countries may deserve close attention. One might argue that, even with mandatory public health insurance emphasizing equity, actual usage of medical recourse varies across gender, age, region or socioeconomic status. Babazono et al. reported that a rise in the copayment rate resulted in decreased access to primary care among those economically deprived (Babazono et al. 2005). Or, it may be due to a higher chance of ill-health and disability among those in lower social class, and even equal access to medical care does not solve the problem.

In what follows, we will explore possibilities of the former case, by looking over some variations in OOP, which may discriminate care access by socioeconomic position. In particular, we will assess the proportion and characteristics (age, gender,

Table 2-7-1 Comparison of Health Care Systems across OECD countries

Countries	Out-of-Pocket (as % of health expenditure)	% population covered by public/mandatory	% population covered by supplementary insurance	Financing scheme of public health system
Germany	11	91	9	Social insurance
Denmark	16	100	28	Tax financed
Netherland	17	75.6	64	Social insurance
France	20	99.9	86	Social insurance
Spain	20	99.8	10	Tax financed
Sweden	22	100	negligible	Tax financed
Austria	24	99	32	Social insurance
Switzerland	30	100	30	Social insurance
Greece	32	100	10	Tax financed
Italy	42	100	16	Tax financed
Japan	17	100	negligible	Social insurance

Source OECD data with Swiss Federal Office Public Health (2002)

educational attainment, and health status) of those who paid out-of-pocket over the past twelve months. Then, we will explore how OOP is related to ability to pay as expressed by household income.

2.7.2 Payments across Municipality, Gender, and Age

SHARE reports OOP for drugs, outpatient, inpatient, and daycare services. In JSTAR, OOP for drugs is not fully separable from outpatient expense because some outpatient clinics still sell drugs at their counter, rather than just issue a prescription for drugs at pharmacies. We also exclude daycare expense because very few respondents used the service in this wave of the survey.

Figure 2-7-1 presents the proportion of people who used any outpatient, inpatient, or dental services in the past 12 months. About 70% of the respondents used outpatient services, and about 50% used dental care services, and about 10% used in-patient services. We could see a variance across regions: Kanazawa (74%) and Adachi (72%) showed the highest proportion of outpatient service use, and Takikawa showed the lowest (61%). For dental service use, Sendai (50%) was followed by Kanazawa (47%) and Adachi (46%), and the least was Shirakawa (42%). For outpatient and dental care service, cities were more likely to use services compared to rural towns, suggesting that physical access to these services may be better in urban settings. For inpatient services, however, Takikawa, Kanazawa, and Sendai were the same (11%), followed by Adachi (9%), and Shirakawa (6%). Since Hokkaido, the northern prefecture where Takikawa is located, has the second largest number of hospital beds per population in Japan, a higher proportion of in-hospital service use there may be explained by this.
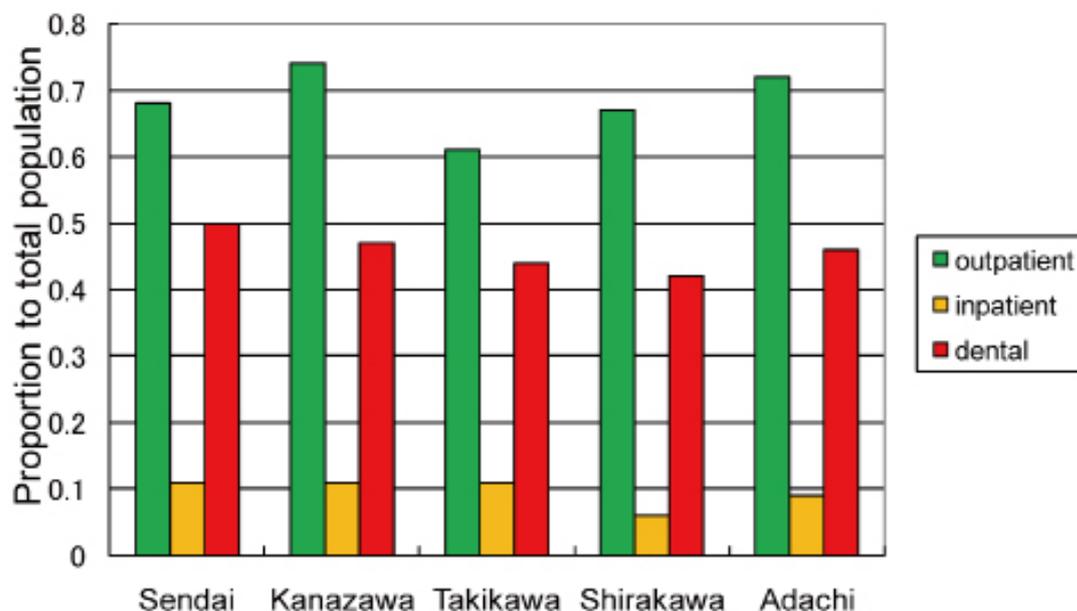
Figure 2-7-1 Proportion of people who used outpatient, inpatient, and dental services in the past 12 months, by region

Figure 2-7-2 shows average OOP payments among those who used the service. The largest average OOP expense was JPY125,000 in Adachi, followed by Kanazawa (JPY97,000), Sendai (JPY87,000), Takikawa (JPY84,000), and Shirakawa (JPY58,000). Patients in Adachi spent 2.1 times as much as those in Shirakawa. Adachi and Kanazawa spent JPY250,000 for inpatient service on average, while Takikawa spent as much as JPY157,000. Adachi also had the largest expenditures for outpatient and dental care services. In contrast, people in Shirakawa were least likely to use medical and dental services, and when they did use them, they spent the least.

Figure 2-7-3 shows the proportion of OOP spent in each type of service. About 45%-60% of OOP was shared by outpatient services. Inpatient services shared 19%-31%, and dental service shared 19%-26% of total OOP. We can observe a variance across regions: Shirakawa paid OOP mainly for outpatient services, and least likely used in-hospital and dental services, whereas Kanazawa spent the largest portion on inpatient services, and the least for outpatient services.

In SHARE, payments for outpatient care and medicines contribute to more than 80% of the expenditures across the countries with various health care systems. In contrast, payments for inpatient and day care represent very small parts of the financial burden related to medical expenditures. We should keep in mind, however, that the OOP payment scheme differs across insurance systems. Per diem payment is required in Austria, Germany, France, Spain, Sweden, and Greece. In Japan, fixed rate co-insurance with an upper monthly limit is required for hospitalization. In all countries, prescribed pharmaceuticals are submitted to OOP payments through various mechanisms, either a fixed fee per drug (Austria, Germany, Italy, Sweden, and Denmark with a cost ceiling in the two last cases) or a co-insurance rate (France, Spain, Greece, and Japan). In Switzerland, the OOP payments take the form of a fixed amount deductible and a co-insurance rate of 10% on all health care services up to a cost ceiling per year.
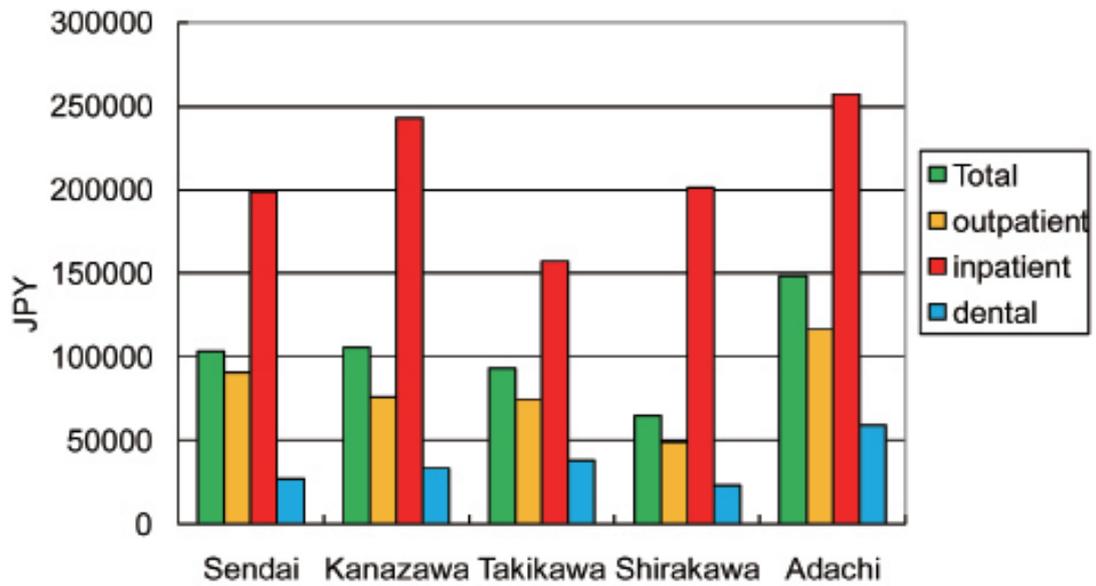
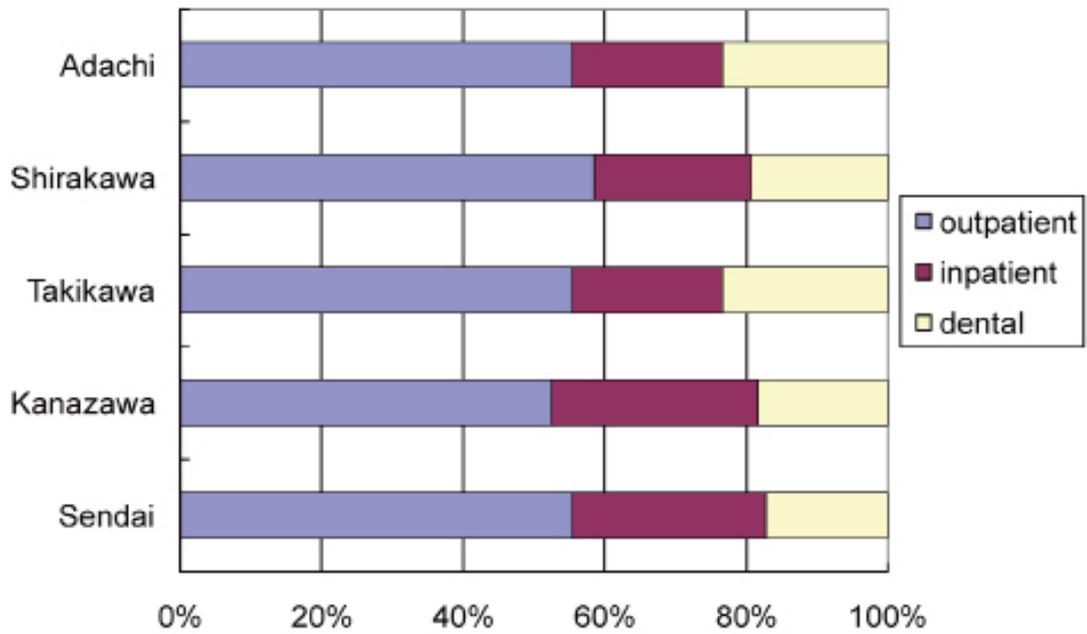Figure 2-7-2 Average OOP payment in the past 12 months, by region

Figure 2-7-3 Proportion of OOP spent in each type of service, by region

2.7.3 Factors Associated with OOP Payments

Table 2-7-2 reports the share of the respondents who met positive OOP. In most of the SHARE countries, around 80% of the respondents paid out-of-pocket with large variations: it was lower in the Netherlands, France, and Spain (around 40%) and especially low for those aged 65 and over in Spain (less than 30%) where Spanish national health insurance exempts elderly patients from copayment. In JSTAR, 69% of the respondents answered positive out-of-pocket in the past 12 months, and the proportion was comparable across regions. The number is close to that in Switzerland. It is mainly because a larger portion of JSTAR respondents reported they had no visit to outpatient, inpatient, or dental services in the past 12 months, as we will see in Section 2.8. Among those who did use any outpatient, inpatient, and/or dental services, 98-99% reported positive out-of-pocket payment, which is not surprising since Japanese public health insurance asks for copayment for all citizens, except for those covered by welfare assistance and exempted from copayment.

Table 2-7-2 Percentage of People Being faced with Positive Out-of-Pocket Payment

	All (%)	By age groups (%)			By gender (%)	
		50–59	60–69	70+	Female	Male
Sendai	68.4	59.5	74.3	76.1	71.6	65.2
Kanazawa	69.3	58.6	76.9	78.7	69.8	68.7
Takikawa	65.5	59.5	62.5	77.8	68.1	63.4
Shirakawa	68.0	60.7	70.4	75.1	69.9	66.3
Adachi	68.0	64.0	67.2	77.1	68.3	67.7

Table2(cont.)

	By subjective health (%)		By educational levels (%)	
	Good	Less than good	Secondary	Mandatory
Sendai	60.8	76.0	68.2	69.9
Kanazawa	63.6	74.1	68.3	72.7
Takikawa	56.6	73.6	65.0	66.3
Shirakawa	62.0	74.6	64.9	69.6
Adachi	62.2	73.0	68.9	67.0

As was true in the SHARE report, JSTAR respondents also showed increasing proportion of meeting positive out-of-pocket payment as the respondent's age went up. Female respondents were more likely to meet OOP, though gender difference in the chance of having positive PPO was somewhat smaller compared to those in SHARE countries. Those with poorer subjective health also had a higher chance of meeting positive PPO, and it is simply due to their higher chance of using medical services. Simple comparison did not show a clear relationship between the chance of positive PPO and educational attainment, though multivariate analysis adjusting for health status leads to a different conclusion as we will discuss later.

The SHARE report concludes that there was no clear relationship between OOP and educational level. However, the table gives a different picture. In the Netherlands, Spain, and France, where the percentage of subjects facing positive OOP is generally low, the likelihood of meeting positive PPO gradually rises as educational attainment goes up. In contrast, other SHARE countries where around 70%-80% of subjects meet positive OOP, the difference in educational level is not clear. JSTAR shows that Japan further marks a unique position: lower educational attainment was associated with a lower chance to meet OOP, and this is significant after adjusting for age, sex, household income, subjective health, and region (OR; 0.81 [0.68-0.98], " high school education or higher" as reference category). Further analysis found that the chance to use outpatient and/or in-hospital service in the past 12 months was not significantly related to educational attainment, but the chance to use dental service was significantly related to education (see Chapter 2 section 8), which may contribute to lower chance to meet OOP among those with lower educational attainment. In the same line, lower household income was significantly associated with lower probability to meet OOP, after adjusting for age, sex, education, subjective health, and regions (OR; 0.80 [0.68-0.93], as "more than median income" as reference category), and lower income was also significantly associated with lower chance to visit dentists. Although Japanese public health does cover dental services, fee charges out of public health insurance scheme was allowed in the system, and copayment for dental services tended to be costly, which may hinder access to the service among those in low income households.

In JSTAR, those who paid OOP with supplemental private insurance were virtually zero: none for outpatient and dental care services, and only 0.9% (3 out of 325) for inpatient service. Supplemental private insurance in Japan plays only a limited role. There are virtually no insurance plans in this country that cover OOP for co-insurance payment. As is discussed in the SHARE report, in France and the Netherlands where supplemental insurance is prevalent and mandated, it is more common among those with higher household income, and is significantly related to higher OOP and higher utilization of medical resources.

2.7.4 Equity Issues in OOP Payments

The SHARE book examined the share of OOP in total household income to discuss the vertical equity across income levels. This is relevant and even more important in our Japanese case, because we would want to know whether current Japanese policy of "health care for all" is successful to achieve it or not. Figure 2-7-4 reports the mean of OOP if OOP is positive, and the ratio of OOP to equivalent household income.

As is the case in the SHARE results, JSTAR results also showed a regressive nature of OOP to income levels: the share of OOP to equivalent household income was the largest among those in the lowest quartile of income. Another point to be noted was that the share was the highest among those in their 60s, followed by those in their 50s, and the least among those in their 70s. The OOP share across age categories is somewhat similar to that of Spain where the national health insurance exempts copayment to those above 65. The same is true in the Japanese system. At the time of the first wave survey of JSTAR, those above the 70s were treated in the Elderly Health Care system in which the service recipient was required to pay a lower coinsurance rate with a lower upper limit in monthly expense, compared to those under age 70. Thus, those in their 60s and with lower household income faced the highest share of OOP to their household income (7.8%). Since this group of respondents was likely to have a limited financial liquidity due to retirement, we could say that the current Japanese system seems quite regressive to those with most difficulties in their financial status.
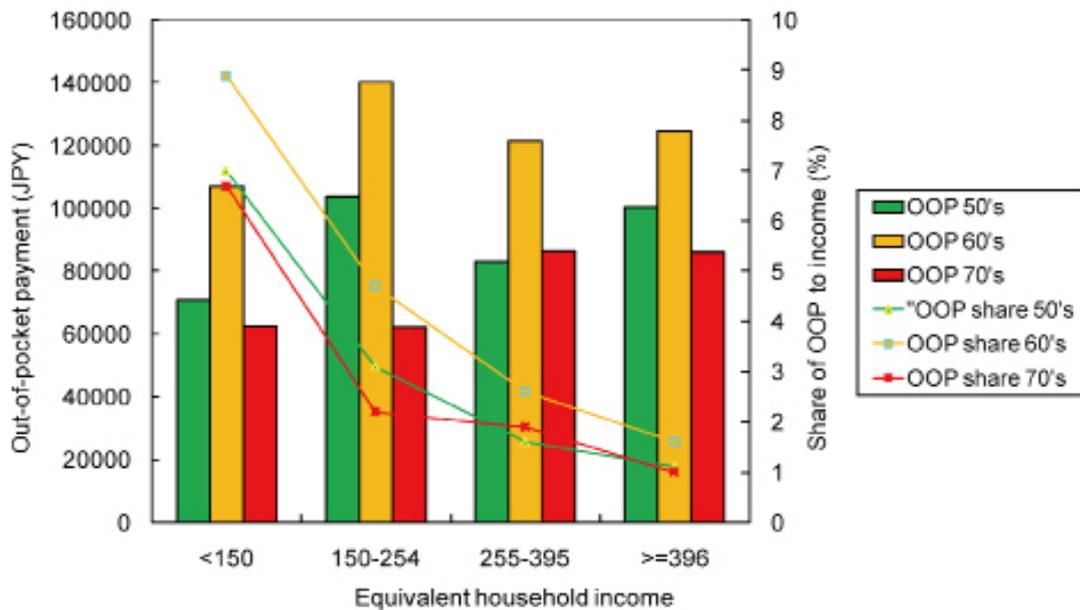

Figure 2-7-4 Amount of OOP and its share of equivalent household income by income level and age

The large share of OOP to household income showed a variance among municipalities: the share in the poorest quartile was 8.3% in Sendai, 8.2% in Kanazawa, and 7.9% in Adachi, while the corresponding number was 5.7% in Takikawa and 4.8% in Shirakawa.

For the poorest respondent, the share of OOP payment varies a lot between countries in the SHARE report. In Denmark, Austria, Germany, Sweden, and Switzerland, OOP share was about 6% of total income in the poorest group, which is about the same as the JSTAR finding above. In southern European countries (Spain, Greece, Italy), this share was much higher and comprised between 10% and 12%. The financing issue related to OOP is particularly crucial to the extent that out-of-pocket may present a barrier to health care utilization, and in particular to outpatient care for primary and preventive services.

In sum, we explored some determinants of OOP payments including gender, age, and municipality as well as health status and education/income level. While Japan has a long history of more than 40 years of a mandatory public health insurance program, we see a substantial variation in OOP payments across those factors. When longitudinal data is constructed, we will be able to perform more in-depth analysis on determinants of OOP expenditures among the elderly over time.

2.7.5 Conclusions

• OOP payments depend on a share of health insurance programs in each country. Under the mandatory health insurance system which guarantees equity and free access to medical resources, we see a larger share of people owing OOP under 20%-30% coinsurance.

• Even under the non-selective public health program, we see variations in OOP payment across educational attainment, age, and municipality. Lower education was associated with lower probability to meet OOP. Those in their 60s were most likely to meet positive OOP.

• As regards the association between OOP payments and ability to pay, the poorest group faced the largest share of OOP to equivalent household income, suggesting that the Japanese public health system is as regressive as several SHARE member countries such as Denmark, Austria, Germany, Sweden, and Switzerland. Among municipalities, those with poorest households in cities showed the higher share of OOP to household income compared to their counterparts in rural areas.

2.8 Health Services Utilization in Older Japanese

2.8.1 Introduction

While the GDP share of medical expenditure in Japan is the lowest among OECD countries (see Subsection 2-1), there is a large gap in medical costs between the young and the old. According to the national health expenditure estimate by the Ministry of Health, Labour and Welfare (MHLW 2006), of the JPY24.4 trillion (or US$24.4 billion) of total medical expenditure in 2004, JPY12.9 trillion was used for those aged 65 and over. That is, while JPY190 thousand was spent per capita for the whole population, if we limit to those aged 65+, the per capita spent was JPY520 thousand. The Japanese Government started a new health care insurance program specifically for those aged 75 and over since 2008 April, aiming at controlling the medical cost rise among the most elderly demographic, though political concerns with the traditional seniority culture and failed system management fuel a political debate, and the leading political Liberal Democratic Party has already announced an amendment to the policy.

It is commonly seen in every developed country today that the aging population spends a relatively larger expense for health care, and there has been a debate whether population aging per se is a major driving force increasing health expenditure among developed countries (Zweifel et al. 1999). Although a larger proportion of aged people are in general more likely to suffer from chronic or acute diseases and multiple morbidities, we need to pay attention to the fact that health care utilization of people, especially of the old, is very heterogeneous, depending not only on health status but also socioeconomic conditions. This subsection decomposes health care service utilization in Japan to uncover some important factors to account for utilization patterns among the middle-aged and elderly population in this country, with some comparative analysis with the SHARE countries. Disentangling the patterns of health care utilization in Japan may provide some important policy implications for other countries that also suffer from the elevation of health care expenditures.

To date, internationally comparable datasets to explore different utilization patterns across countries with different health care systems have been scarce even among OECD countries (van Doorslaer & Masseria 2004). Moreover, no available data allowed an examination of the effect of socioeconomic status on health care utilization in a cross-country comparative perspective (van Doorslaer et al. 2004). SHARE and JSTAR allow us to examine health utilization patterns across socioeconomic status and health condition in Japan and OECD countries in a consistent way.

In this subsection, we follow the SHARE analysis again, and explore cross-sectional relationships between a variety of factors such as age, gender, subjective health or education, and the utilization of health services. JSTAR has rich information on self-reported health care utilization of outpatient and inpatient services including surgery. The frequency of outpatient visits was asked because many Japanese elderly make visits to clinics on a regular basis by week or by month. The use of hospitalization and surgical services were measured based on a twelve-month recall.

Analyses of bivariate relationships between age, gender, subjective health or level of education with health services utilization were performed on non-weighted data.

The effect of education and household income was then studied after adjustment for age, gender, and subjective health status in unweighted multivariate regression models (logistic regression for dichotomous response variables, ordered logistic regression in case of response variables showing more than two levels); subjective health was finally introduced in our multivariate models beside age, gender, and education. Analyses were essentially conducted on the whole dataset.

2.8.2 Variation across Age, Gender, Municipality and Health/Socioeconomic Status

(1) Outpatient service

Figure 2-8-1 shows the distribution of outpatient visits to clinics in the past twelve months. The number of reported medical consultations in the past year is strongly related to age, which is similar to what SHARE found. What seems strikingly different from the SHARE report is that a larger portion of respondents did not make any visit in the past year in the JSTAR sample: 40% of those in their 50s did not contact a physician. Even among those in their 70s, 20% of them had no contact with a physician. In SHARE, the numbers were only 18% of those in their 50s and 7%-8% of those in in their 70s. Another difference was found in the frequency of visit: those who did make a visit to a physician made far more frequent contact with a physician compared to SHARE samples. For those in their 70s, 40%-50% of them made more than six contacts in the past year in the SHARE sample, while nearly 70% of their counterparts in JSTAR made more than six contacts. The difference between JSTAR and SHARE respondents may be attributed to the legally-mandated health check-up system in Japan that is the focus of section 2.9. The health check-up system provides a substitution to a consultation visit with a physician.
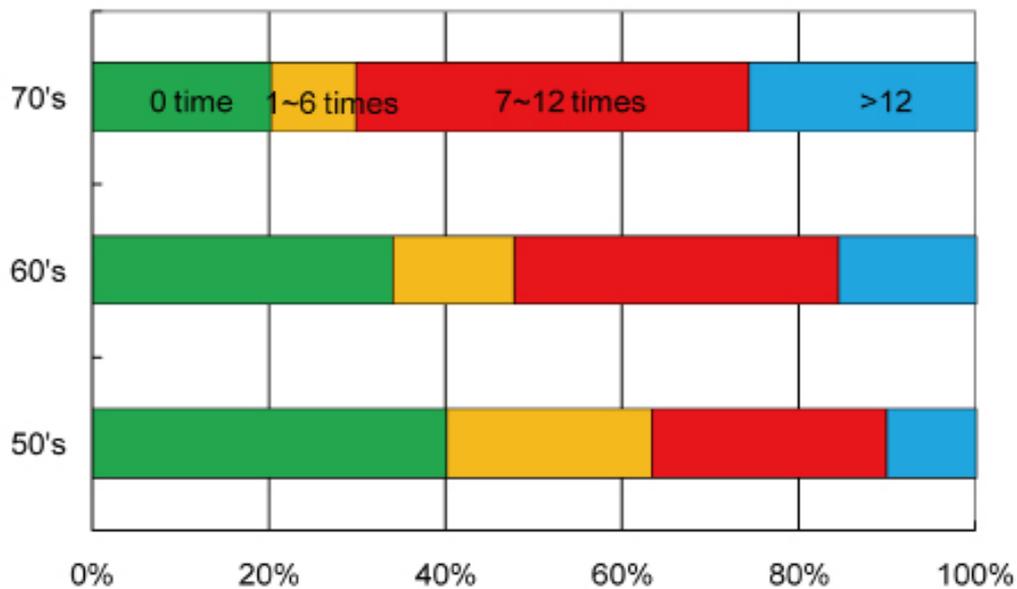

Figure 2-8-1 Distribution of the number of outpatient visits in the past 12 months, by age

We conducted logistic regression on the use of services, adjusting for age, sex, educational attainment, household equivalent income, subjective health status, and region. The odds of outpatient service use linearly increased over age: those in their 70s were 2.8 times more likely to use the outpatient service compared to those in their 50s (OR 2.76 [2.16-3.52]). Females were 1.5 times more likely to use the service (OR 1.46 [1.25-1.70]). Educational attainment and household equivalent income were not related to the odds of service use. As expected, poor subjective health status was related to higher odds to use outpatient services (OR 2.31 [1.98-2.70]). Among regions, Takikawa was the least likely to use outpatient service, even after adjusting for age, sex, income, education, and subjective health status, suggesting least access to the service among the five municipalities (OR 0.63 [0.48-0.81], Sendai as reference municipality).

The results were basically similar if we use ordered probit regression to account for the number of contacts as a categorical variable. Exceptional was that lower educational attainment was marginally significant in the frequency of visit made in the past year (p=0.08), even after adjusting for age, sex, subjective health status, and household income. As Figure 2-8-2 shows, the proportion of those who did not make any visit was similar across education statuses, but those with none or primary education were more likely to make a visit more than 6 times, compared to those with higher educational attainment.
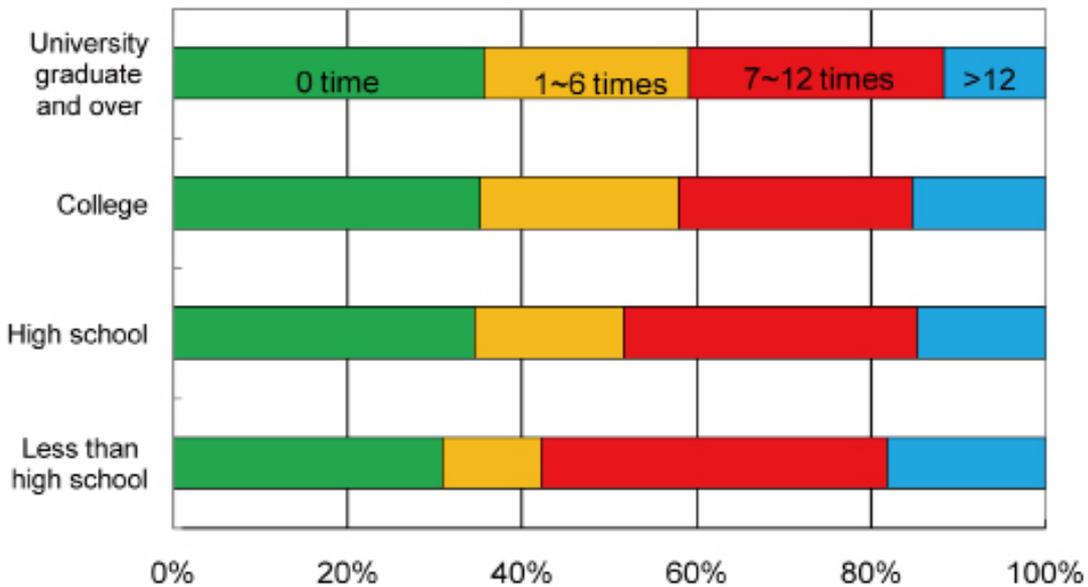

Figure 2-8-2 Distribution of the number of outpatient visits in the past 12 months, by educational attainment

Interestingly, what we found in this figure is quite similar to the corresponding figure in SHARE: once a visit is made, those with lower education tend to make more frequent visits to a physician. However, in the SHARE report, the effect of education was lost after adjustment for subjective health status, and the authors attributed this to poorer health status among those belonging to lower educational categories. In JSTAR, the effect of education remained even after adjusting for subjective health status, which strongly suggests that low educational attainment may be related to frequent visits through lower health literacy and less ability for self-care.

(2) Dental service

For dental care services, the highest odds of service use was seen in the age category of the 60s, and the odds was lower among the 70s. Females were 1.3 times more likely to use dental care service (OR 1.34 [1.10-1.63]). Lower educational attainment (OR 0.79 [0.67-0.93]) and lower household equivalent income (OR 0.86 [0.75-0.99]) were significantly related to less likelihood of dental care service use, suggesting that access to dental care was somewhat regressive to socioeconomic status. SHARE also found that lower education was significantly related to less likelihood of dental care visit after adjusting for demographic and health status. It is not surprising because in many EU countries dental care was out of the coverage in the public mandatory package (Doorslare et al. 2004). In the Japanese case, dental care is covered by the public insurance; however, the utilization pattern was significantly different according to education and income status, suggesting that higher copayment and out-of-pocket coverage in dental care may preclude access to the service among those in a lower socioeconomic status, even under public insurance coverage. Among regions, Takikawa was less likely to use dental care service (OR 0.80 [0.63-1.02], Sendai as reference municipality).

(3) Inpatient service

For inpatient service, age was also related to linearly increased odds of service use. Interestingly, females were significantly less likely to use inpatient service (OR 0.71 [0.56-0.90]). This discrepancy between outpatient and inpatient service use between genders suggests that women tend to take better care of their own health by seeking preventive services to avoid the risk of hospitalization. This hypothesis should be tested in the follow-up stage in a later JSTAR survey. In the SHARE case, however, there was no gender difference in the chance of hospitalization. Income and education were not significantly related to inpatient service use. Finally, among regions, Shirakawa was the least likely to use inpatient service (OR 0.58 [0.38-0.88], Sendai as reference municipality). The results were basically similar when we used ordered probit regression to account for the frequency of hospitalization. Although SHARE found that lower education was related to less likelihood of hospitalization after adjusting for subjective health, we did not find such association.

A comparative study of health care systems across EU countries (van Doorslaer et al. 2004) found that several countries have a vertical inequality in the access to specialty care and inpatient care. What we found in JSTAR suggests that the Japanese health care system was somewhat successful in achieving vertical equality in access to outpatient and inpatient services, but not to dental service. In outpatient service, lower education attainment may be associated with overuse of the service.

(4) Surgery

In JSTAR, we asked regarding inpatient and outpatient surgery in the past year. We also asked about invasive exams such as cardiac catheterization, gastroenterology endoscope, and arthroscopy. In this analysis, we include these invasive procedures as a part of surgery services. In SHARE, the inpatient or outpatient surgery was related to age, but not to gender. In JSTAR, the chance of undergoing surgery in the past year increased linearly with age, and females showed significantly lower likelihood of surgery (OR: 0.71 [0.58-0.86]), even after adjusting for age, education, income, subjective health, and region. Income was not associated with surgery. Lower education was marginally associated with less chance to undergo surgery (OR: 0.82 [0.65-1.03]).

2.8.3 Conclusions

• JSTAR successfully provides an opportunity to investigate the factors influential on the utilization pattern of medical care across different layers of socioeconomic conditions and regions in a comparable way with European findings in SHARE. Such detailed analysis has been made possible for the first time in Japan because JSTAR measured a comprehensive set of medical utilization, health status, and socioeconomic conditions among elderly households.

• Japanese respondents in the JSTAR sample were less likely to make a visit to physicians in the past year, compared to those in SHARE, but among those who did make a visit, they made more frequent visits compared to those in SHARE. There are few in SHARE who visited a physician 1-5 times a year. Japanese elderly, once they made contact with physicians are more likely to make regular visits each month. Such regular use was more often seen among those with lower educational attainment.

• Women reported significantly more outpatient service use, but less inpatient service and surgical services than men in JSTAR, which deviates from SHARE findings.

• Educational attainment showed various associations with medical service use. Lower education was related to more frequent visits in outpatient services, less use of dental care, and surgery, and no significant relationship was found with inpatient service, which is similar to SHARE. However, it is crucial to investigate the effect of education on utilization in light of other factors that may act as confounding. Although SHARE results suggested that the association of lower education and frequent visits were due to poorer health status among those with lower education, our JSTAR results suggest that lower health literacy and consequent lack of skills for self-care among those with lower education may be the culprit for overuse of outpatient service and less use of dental care.

• Regional differences in medical service use, lower in rural areas, and higher in cities, may require further in-depth analysis using a multivariable technique taking into consideration region-specific statistics such as the number of clinics and beds per population and other regional resource data. Further work will be based on the behavioral model of health services utilization which would be affected by health literacy, socioeconomic resources, and regional resource availability in order to provide a better insight on policy implications and comparative discussion with European countries, which should better serve as a basis for health policy decisions.

2.9 Health Check-up

2.9.1 Introduction

The annual health check-up program is a unique characteristic of the Japanese health care system. Several laws offer all the citizens in this country a chance to get health check-up on an annual basis. The Elderly Health Care Law mandates regional municipalities to offer citizens aged 40 and over a free or low-cost health check-up. The Hygiene and Safety at Worksites Law mandates every employer with more than 50 employees to offer free annual health check-up to employees. Finally, the School Law mandates the school agency to offer check-up to school employees and students. Since August 2008, a new national health check-up program has been launched, and every municipality and employer who is in charge of providing health check-up is required to report to the government the results of health check-up and subsequent health education program to prevent metabolic syndrome and consequent medical care cost rise (Ministry of Health, Labour and Welfare, 2008). However, the program has been criticized as it is less supported by scientific evidence of program efficacy and theoretical basis of health education program.

JSTAR asked the respondent citizens whether they had a health check-up in the past 12 months, and if not, what prevented them from getting one. In this subsection, we will present descriptive statistics on health check-up, and what determines the chance of getting it.

2.9.2 Variation across Age, Gender, Municipality and Health/Socioeconomic Status

(1) Demographic factors

The lower portion of Figure 2-9-1 presents the association of health check-up and demographic factors. The likelihood of having a health check-up in the past year linearly decreased over age: 73% of those in their 50s had had a check-up, while the number falls to 51% among those in their 70s (p<0.001). Females had less chance of having a health check-up compared to males (60% vs. 67%, p<0.001). These figures are presumably confounded by working status and insurance type.

(2) Insurance types

Japanese national insurance in general is comprised of two types: community-based insurance and employment-based insurance. Community-based insurance is for those self-employed and retired. For both types, dependent family members are covered by the insurance plan of their household head. Thus, we describe four categories of insurance type: "employed-based and self-insured, "community-based and self-insured," "employed-based and dependent family," and "community-based and dependent family."

The middle portion of Figure 2-9-1 depicted that those with "employed-based and self-insured" showed a distinctively higher proportion of health check-up (84%) compared to other types (54%-59%). Since health check-up at the worksite can easily get compliance from employees to participate in the check-up, this is not surprising. Those

who are self-employed and dependent on the insured household head suffer more from psychological and economic barriers because the health check-up is provided only in a limited time and place, even though they are entitled to have health check-up. JSTAR clearly revealed the disparity in the opportunity of health check-up according to health insurance type.
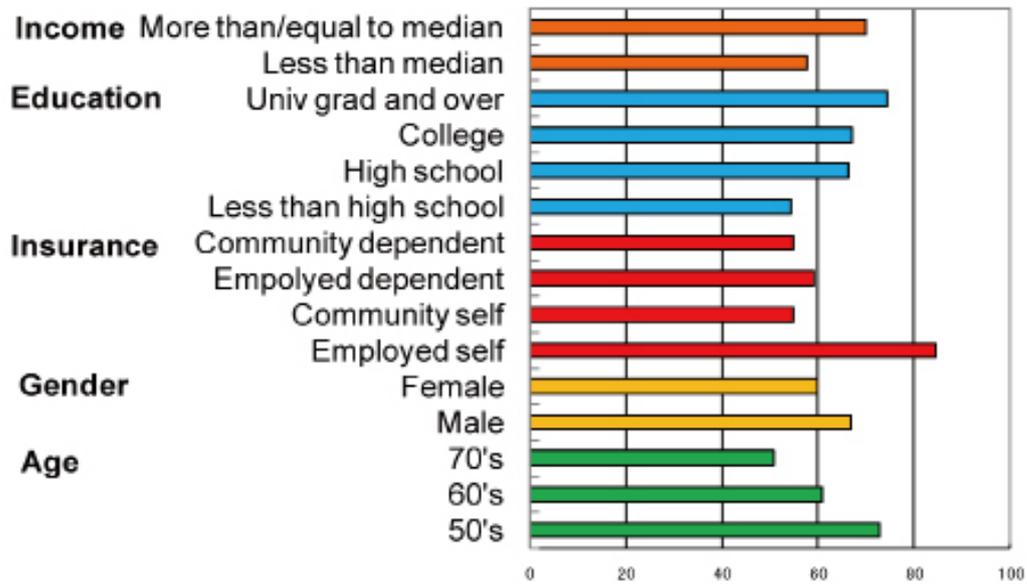

Figure 2-9-1 Proportion of those who had a health check-up in the past year, by age, gender, insurance type, income, and educational attainment

(3) Socioeconomic status

The upper portion of Figure 2-9-1 presents the likelihood of having health check-up in the past year by different layers of socioeconomic conditions. Higher educational attainment was linearly and significantly related to higher likelihood of having a health check-up: 54% of those with less than a high school education had a health check-up, while 74% of university graduates had a check-up in the past year. Higher household income was also significantly related to the higher chance to have a health-checkup. Again, income and education was tightly confounded by age, sex, and occupational status, which in turn related to insurance type. Thus, we need to conduct a multivariate analysis.

Logistic regression on having a health check-up in the past year was conducted adjusting for age, gender, insurance type, education, and household income. Not surprisingly, all of the factors except for sex showed significant associations with the chance of having check-up, even after adjusting for each other. The significance of gender was lost after insurance types were included in the model. Older age, lower education, lower household income, and insurance type other than "employment-based and self-insured," were significantly and independently related to less odds of having a check-up.

(4) Region

Even after adjusting for these variables, those in Sendai city had remarkably and significantly higher odds of having a health check-up. Sendai city is known to have a unique health check-up system across community and work places, especially for cancer screening. Such a unique policy history would promote Sendai as a champion city in health check-up.

2.9.3 Reasons for Not Having Health Check-up

Next, we focused on those who did not have a health check-up in the past year. For these respondents, JSTAR asked the reasons they did not have one: being busy, no need felt without any symptoms, concerns with cost payment, fear of learning bad news, and others.

Those who answered "being busy" tended to be in a group that was younger, was "employed-based and self-insured," with higher educational attainment and higher household income.

Those who answered "no need felt without any symptoms" tended to be younger. Otherwise, sex, insurance type, education, and income level were not related to this answer type. However, as expected, the response pattern was significantly more prevalent among those who reported better than good subjective health, current smokers, and those without depression status. Those who answered "cost concerns" were only 16 respondents, and tended to be with lower household income. Finally, those who answered "fear of learning bad news" tend to be female and dependent family members to household heads, suggesting those with less control over the household economy. Further analysis may be deserved in family dynamics and household economy with the results obtained in Chapter 3 in this book.

2.9.4 Conclusions

• Japan has a unique national health check-up program that offers all citizens an annual health check-up.

• JSTAR found, however, that there is considerable variation across demographic, socioeconomic, and insurance conditions in the probability of having a health check-up in the past year.

• Multivariable analysis confirmed that older age, lower education, lower household income, and insurance type other than "employment-based and self-insured," were significantly related to less odds of having a check-up in the past year.

• Sendai city, which is famous for its unique heath check-up policy, showed distinctively higher compliance to annual health check-up.

• Reasons not to have a health check-up depend on age, sex, working status, and socioeconomic condition. The results suggest that better information provision and health education in the community would enhance compliance to the program. Those who answered "fear of learning bad news" may suffer less economic discretion in the household.

2.10 Nutrition Intake

2.10.1 Introduction

JSTAR has incorporated a detailed food frequency questionnaire in the survey. The Brief Dietary Habit Questionnaire was developed and validated by Sasaki et al. (2003a, b). This self-administered questionnaire asks the respondents to recall the frequency of taking a specific type of food. The results were analyzed with a pre-determined and validated algorithm which could provide a detailed estimation on nutrition intake with relatively high precision, compared to other modes of nutrition intake measurement, as well as to biomarkers obtained from urinary and blood sample. The analysis using the results of the nutrition survey is still ongoing, and this subsection provides a limited portion of preliminary results to present the potential of the nutrition dataset to reveal the mechanism of health impact by socioeconomic conditions and consumptions.

2.10.2 Variations in Nutrition Intake by Age, Sex, and Region

Figures 2-10-1~5 depict the average estimated amount of nutrition intake per day by age, sex, and region. Figure 2-10-1 shows the intake of salt. Recommended amount of salt intake per day by the Ministry of Health, Labour and Welfare is less than 12g per day. As the table shows, all of the age, sex, and region cells exceed the recommended amount. Specifically, males over 60 in cities tend to exceed 14g per day, and may need an intensive educational intervention.
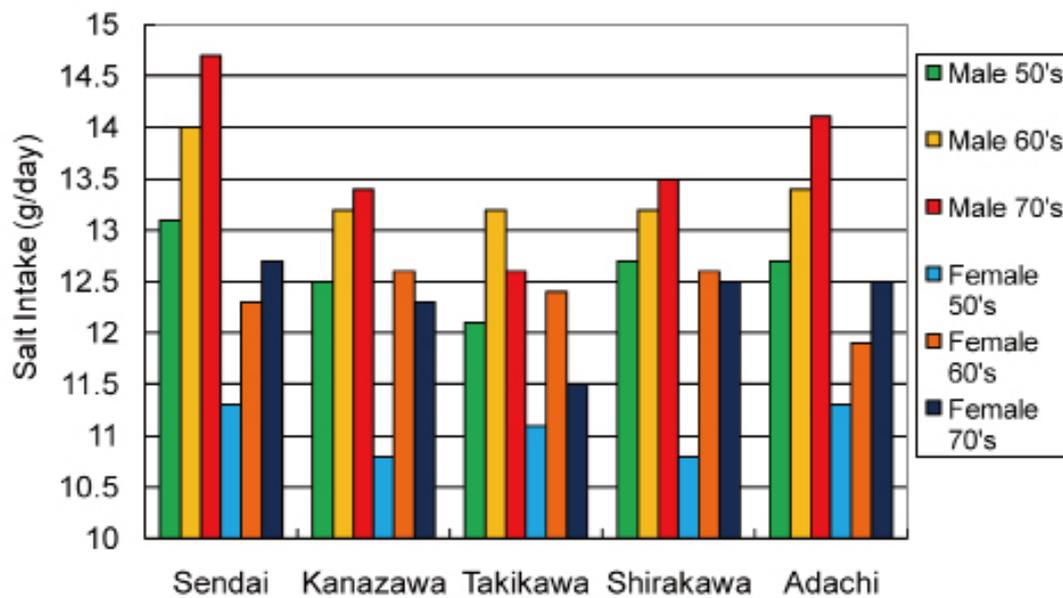

Figure 2-10-1 Estimated salt intake (gram) per day, by age, gender, and region

Figure 2-10-2 shows the average amount of estimated alcohol intake, in grams per day equivalent to ethanol. Daily intake less than 20g is recommended for preventing cardiovascular disease and cancer. Alcohol is known to be associated with the risk of cardiovascular disease and cancer in the U-shape manner: those without any alcohol intake may suffer higher odds of getting the diseases compared to those with moderate intake. Males in their 50s, excepting those in Shirakawa, showed an average amount of alcohol intake exceeding 20g per day.
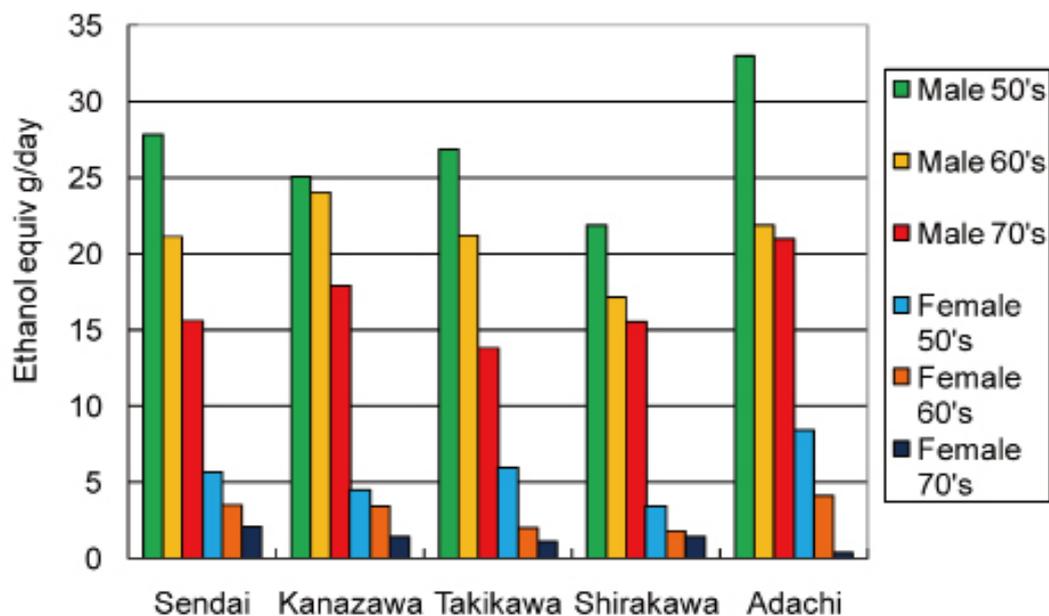

Figure 2-10-2 Estimated alcohol intake (ethanol equivalent, gram) per day, by age, gender, and region

Figure 2-10-3 shows cholesterol intake in miligrams per day; 300mg is the recommended intake. Those in Shirakawa in both sexes tend to have a higher intake of cholesterol, which may require close attention. We suspect local delicacies (e.g. grilled eel, perhaps) may be the reason. Figure 2-10-4 shows fat calorie ratio, or the proportion of fat intake to total energy intake, for which less than 26% is the recommendation. Females in cities tend to exceed the recommended proportion. Finally, Figure 2-10-5 shows intake of fruit and vegetables in grams per 1,000 Kcal energy intake. As we can observe, females and older ages are related to a healthier style of intake of fruit and vegetables.

2.10.3 Variations in Socioeconomic Status

Since nutrition intake would be affected by individual preference, economic resources, and regional culture, we conducted a multivariable regression to consider the socioeconomic difference in nutrition intake patterns. Following that we briefly report the obtained results for each nutrition item. The regression model included age, sex, educational attainment (less than high school vs. higher), monthly expense (less than median vs. higher), current smoking status, and region.
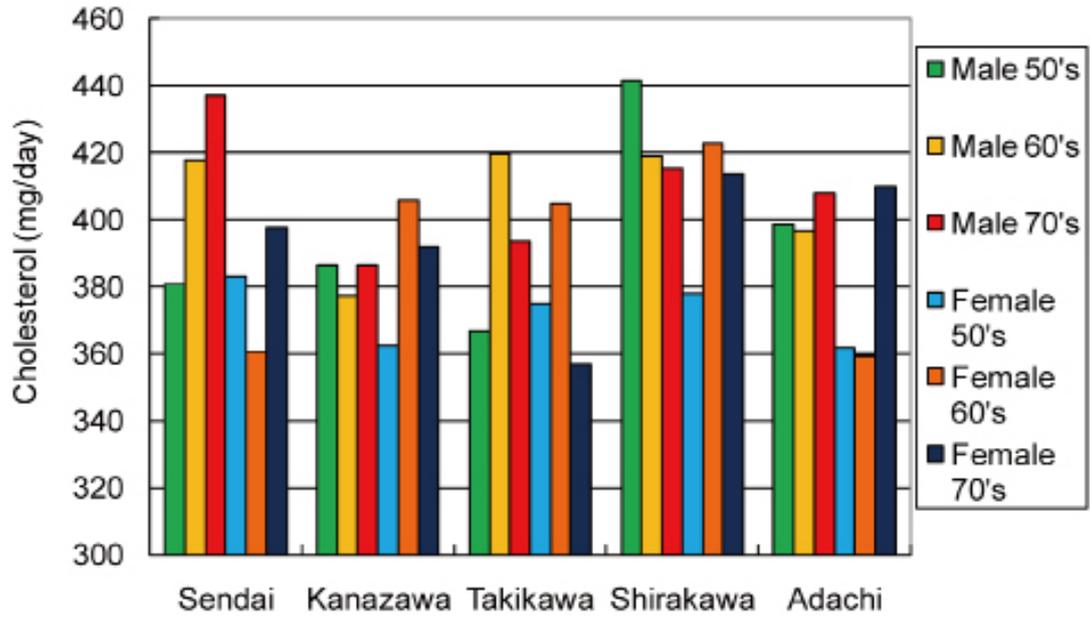
Figure 2-10-3 Estimated cholesterol intake (milligram) per day, by age, gender, and region
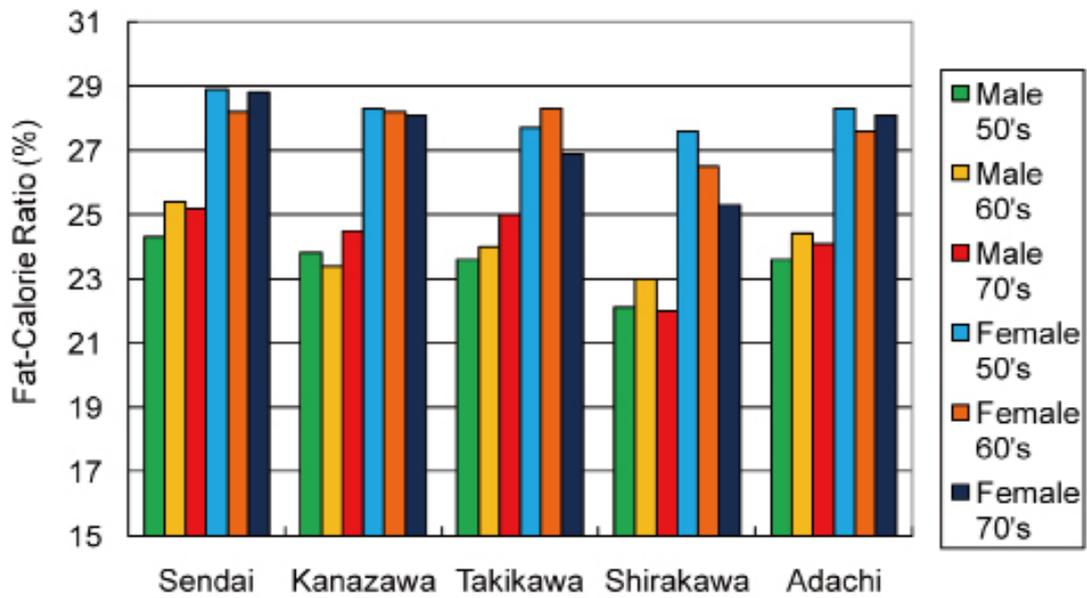

Figure 2-10-4 Estimated fat calorie ratio (%), by age, gender, and region
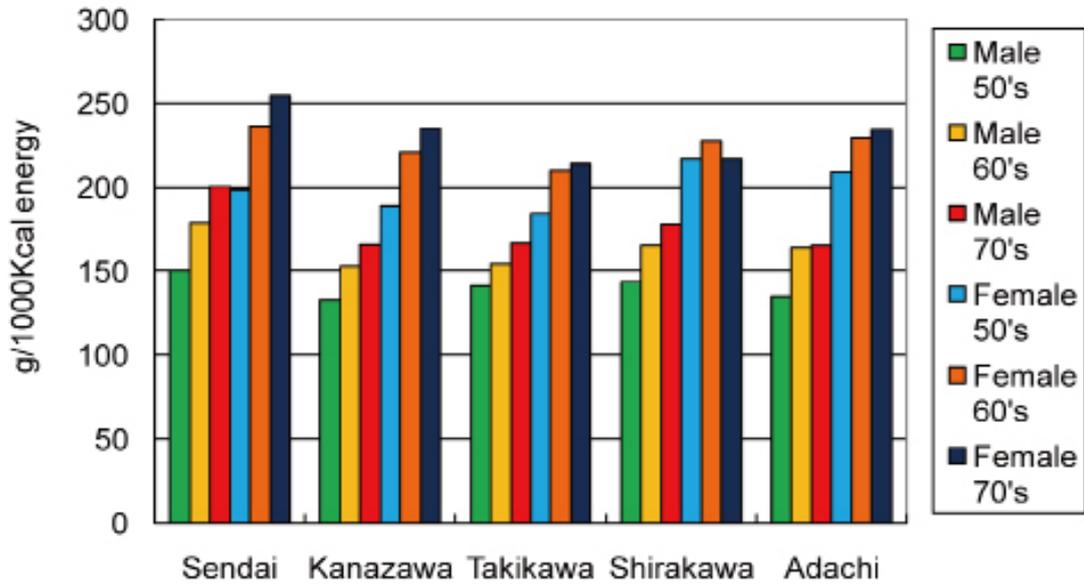
Figure 2-10-5 Estimated fruit and vegetable intake (gram) per day, by age, gender, and region
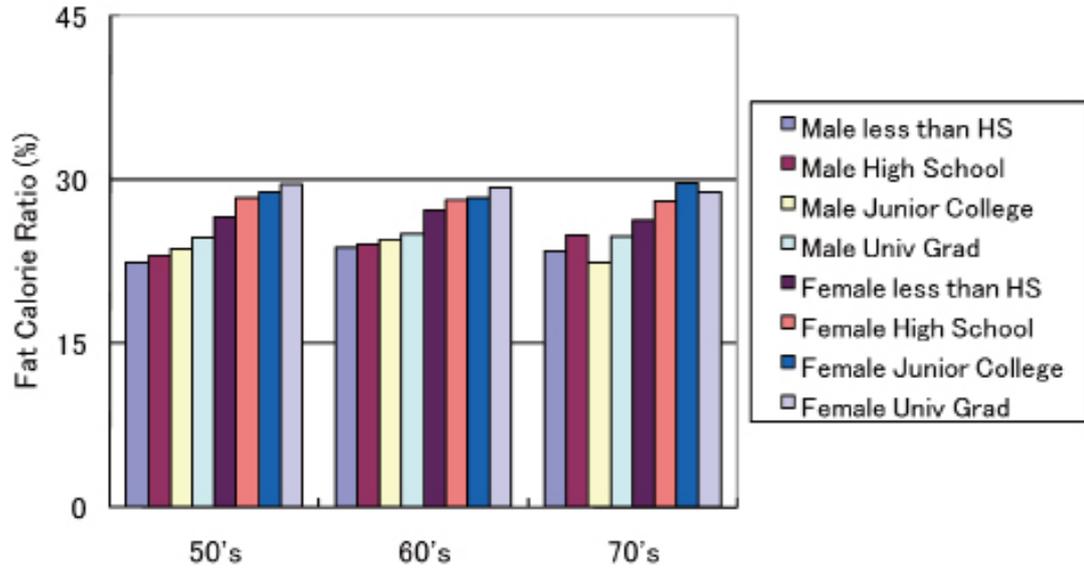

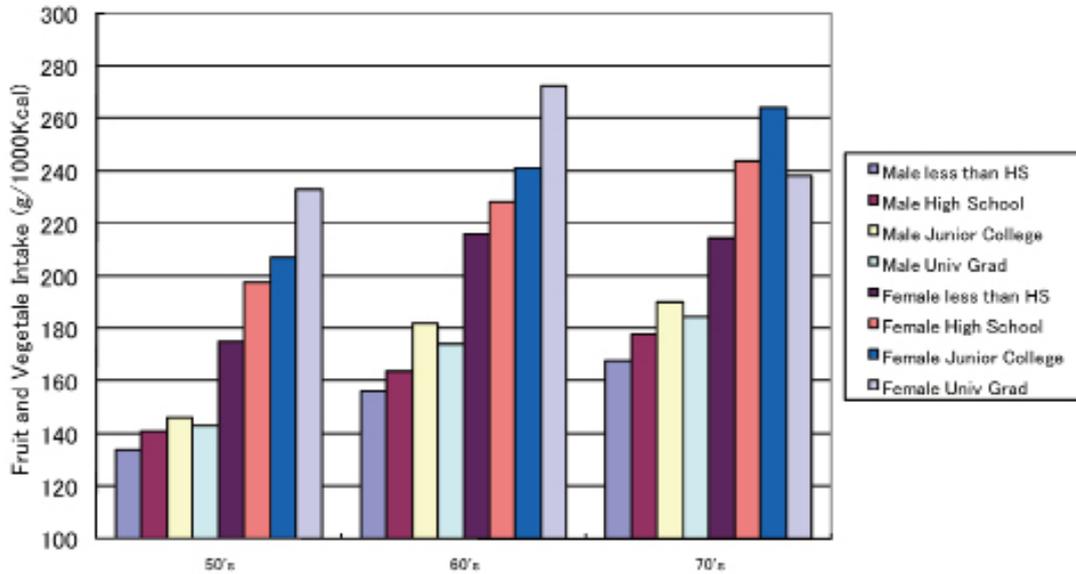Figure 2-10-6 Fat calorie ratio by age, gender, and education

Figure 2-10-7 Fruit and vegetable intake by age, gender, and education

Salt intake was larger among the older demographic, males, and those with higher monthly expense. Those in Kanazawa and Takikawa had significantly less intake of salt compared to those in Sendai.

Alcohol intake was larger among the younger group, males, current smokers, those with higher education and higher monthly expense. Among cities, those in Adachi had significantly higher intake of alcohol.

Cholesterol intake was larger among the older group, and those with higher education. Even after adjusting for age, sex, education, monthly expense, and smoking status, those in Shirakawa had a significantly higher amount of cholesterol.

Fat calorie ratio was higher among females, non-smokers, and those with higher education. Those in Sendai had a significantly higher ratio compared to those in Kanazawa, Shirakawa, and Adachi.

Fruit and vegetable intake was larger among the older group, females, non-smokers, and those with higher education and monthly expense. Those in Kanazawa and Takikawa had significantly lower amount of fruit and vegetables compared to those in other cities.

These findings in the first wave should give a basis to investigate the impact of healthy diet on health outcomes, and the association of socioeconomic conditions through dietary habits with health outcomes in future follow-up surveys.

2.10.4 Conclusions

• JSTAR provides a unique opportunity to test how lifestyle and preference affect the health conditions among elderly through dietary patterns.

• Dietary patterns are strongly affected by demographic, socioeconomic, and regional environmental conditions. Further analysis will offer policy implications on the segment of population who needs close attention and intensive health education in new health promotion programs.

2.1 References

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