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健康ショックへの対応と配偶者の役割：日本家計パネル調査を用いた実証分析

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キーワード: 入院行動; 就業促進効果; 介護促進効果; 変量効果順序プロビット・モデル

【要旨】

入院は家計所得の減少を招く大きな健康ショックである。しかも所得の減少は家計の特性に大きく依存している。この研究では、2009 年から 2020 年までの慶應義塾大学パネルデータ設計・解析センタ提供による『日本家計パネル調査』を用いて、入院によってどの程度の所得減少が生じるのか、既婚世帯と未婚世帯を比較する定量的分析を行った。その結果、既婚世帯の場合には、夫が入院した際に妻の労働供給が増加するという「就業促進効果」が観察され、家計所得の減少が大幅に軽減されるが、女性単身世帯においては家計所得の減少が最も大きいことがわかった。

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Coping with Health Shocks and Role of Spouse: Evidence from Japanese Household Panel Survey*

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Abstract

Hospitalization is a serious health shock that reduces household income. However, income loss is not uniform across households. This study makes a quantitative comparison of income loss caused by hospitalization for two different types of households: married households and single households, using Japanese household panel survey from 2009 to 2020. We find that wife increases her labor supply when her husband is hospitalized and income loss of the household is substantially mitigated. We also find that income loss is largest when single female is hospitalized. Our evidence suggests that added worker effect by the wife of hospitalized husband is quantitatively important.

Keywords: hospitalization, income loss, added worker effect, caregiver effect, random-effects ordered probit model,
JEL Classification Number: I12, I14

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1. Introduction

Health shocks constitute a sudden deterioration in the state of an individual's health, caused by an illness and/or injury.[1] Health shocks and their associated costs have adverse effects on household welfare. When one is hit by health shock, one is forced to reallocate consumption expenditures among different items and increase medical spending. Moreover, when one falls sick, one has to stay away from work, which leads to income loss.

However, there are some social devices in Japan to mitigate the adverse effect of health shocks. It is mandatory for everyone to enter health insurance plan, which partially covers medical costs. If work absence is short, income loss might be fully covered by applying paid leave to the company. We also have important within-household informal device to mitigate health shocks. That is self-insurance by household members. When one falls sick, one's spouse might change his or her labor supply in two different ways. First, the spouse of the sick household member might increase his or her labor supply to make up for the income loss incurred by the sick member. This is added worker effect and has been documented after non-health related job losses. Secondly, the spouse might reduce his or her labor supply to care for sick spouse. This is caregiver effect and has been documented in situations where family member requires long-term care. However, loss of family income might be aggravated in this case since the spousal income also decreases.

This study makes a quantitative evaluation of the importance of self-insurance among family members in Japanese households. We pay special attention to the role played by the spouse when one is hit by health shock, using Japanese household panel survey. The health shock we focus on is hospitalization shock. Hospitalization shock is a severe adverse shock since the hospitalized person might incur large medical cost and income loss. When the hospitalized member has a spouse, it is important to take account of the response of spousal labor supply and change in household labor earnings to hospitalization of family member, as was discussed above. Our final goal is a quantitative comparison of the change in household labor income and employment status between married households and single households when a household member is hospitalized.[2] This comparison might

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[1] See Novignon et al. (2012)

[2] There are a number of Japanese studies, such as Ohishi (2000), Hamaaki and Noguchi (2010) and Kajitani (2011), that examined the relationship between one's health conditions and own labor supply, using household survey data. Our study differs from the previous studies in two points. First, we examine the impact of hospitalization shock on labor supply. Hospitalization is one realized state of health conditions that is most likely to affect labor supply. Secondly, we investigate the effects of hospitalization of family member not only on his or her own labor supply but also on spousal labor supply.

shed light on the spousal role in coping with hospitalization shock.

The household panel survey we use is *Japan Household Panel Survey* (JHPS/KHPS) collected by the Panel Data Research Center at Keio University. This survey covers not only married households but also single households. The survey questionnaires of this data set are very comprehensive in that it covers items such as household structure, individual member attributes, academic background and employment/education status. The data set also includes unique items indispensable for our research: self-rated health status and whether one is hospitalized or not for both household member and his or her spouse. The sample period covers 12 years from 2009 to 2020.

Let us preview our main findings. When single female is hospitalized, the adverse effect of hospitalization is largest. The probability that single female remains a regular worker decreases by 5.3 %. On the other hand, the probability that single female is a non-regular worker rises by 2.6% and the probability that single female is unemployed rises by 2.7%. Consequently, the earned income of single female decreases by 12.02 ten thousand yen per annum or 5.3% decrease of annual earned income. Moreover, even if there is no employment status, the annual labor income decreases by 11.9 ten thousand yen and 15.8 ten thousand yen, respectively, for non-regular female worker and regular female worker when single female is hospitalized.

In contrast, when the husband is hospitalized, the probability that his wife is a regular worker increases by 3.3% and the probability that his wife has no job decreases by 3.9%. Consequently, the labor income by his wife increases by 11.72 ten thousand yen per annum on average, which *exceeds* the loss of average labor income of the hospitalized husband by 8.24 ten thousand yen.[3] This shows that the added worker effect by the wife of hospitalized husband is quantitatively important.

The remainder of the paper is organized as follows. The next section reviews the past studies on the effects of adverse health on family labor supply, using micro data. Section 3 describes the dataset used for the analysis. In Section 4, we uncover the characteristics of hospitalization shocks. In Section 5, we investigate the change in employment status of the hospitalized member as well as his or her spouse and calculate the expected change in earned income. We then calculate the change in expected earned income when there is no employment status. Section 6 concludes this study.

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[3] When there is no employment status, the annual labor income decreases by 40.2 ten thousand yen and 8.3 ten thousand yen, respectively, for non-regular female worker and regular female worker, respectively, when her husband is hospitalized. However, note that the effect on total household income should be evaluated by combining change in wife's income with change in the hospitalized husband.

2. Literature survey on the effects of adverse health shocks on family labor supply

When one is hit by adverse health shock, a priori the impact of health shock on family labor supply, especially on spousal labor supply, is ambiguous. It depends on the extent to which the labor supplies of couples are *complements* (one may want to spend more time with or care for a sick spouse or *substitutes* (their spouse might need to work more to recover income for the household if someone is unable to work). The former is caretaker effect and the latter is added worker affect.[4]

Given theoretically ambiguous effects of adverse health shock on spousal labor supply, empirical evidence on this issue is also mixed. Jolly and Theodoropoulos (2022) make an excellent survey on why adverse health shocks lead to different responses of spousal labor supply. They point out four reasons why spousal effects are different. In this section we compare our study with the previous studies on these four points. This process makes clear the contribution of our study to the literature.

First, most studies find that wives' response to husband health shock is different from husbands' response to wife health shock.[5] The studies of Jeon and Pohl (2017), Shen et al. (2019) and Braakmann (2014) are three exceptions.[6] Our study is consistent with the previous studies in that females reduce their labor supply in response to spousal health shock, but males' labor supply is insensitive to spousal health shock.

Secondly, most studies examine the effects of adverse health shock on spousal labor supply for different countries. Each country has different social safety nets and social norms. Therefore, it is unsurprising that the previous studies report different results. The countries examined by the previous studies include the U.S., the Netherlands, Denmark, Canada, Germany, South Korea and China.[7] Jolly and Theodoropoulos (2022) provide an international comparison of the relationship between labor supply and spousal health shocks. To the best of the author's knowledge, this is the first study to examine the response of husbands' and wives' labor supply to spousal health shock, using Japanese

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[4] See Printz et al, (2018) for comprehensive survey on the relationship between spousal health shocks and labor supply.

[5] For example, see Parsons (1977), Charles (1999), Jiménez-Martín et al. (1999), Coile (2004), Nahum (2007), Van Houtven et al. (2010), Garcia-Gomez et al. (2013), Kim et al. (2018), Faldon and Nielsen (2021) and Jolly and Theodoropoulos (2022) for the evidence.

[6] Jeon and Pohl (2017) and Shen et al. (2019) find that males and females reduce their labor supply to a spousal health shock, while Braakmann (2014) finds insignificant labor supply response.

[7] See Parsons (1977), Berger and Fleisher (1984), Haurin (1989), McClellan (1998), Charles (1999), Johnson and Favreault (2001), Coile (2004), Siegel (2006), Van Houtven and Coe (2010), Hollenbeak et al. (2011), Dobkin et al. (2018), and Meyer and Mok (2019) for the U.S., Garcia-Gomez et al. (2013) for the Netherlands, Fadlon and Nielsen (2021) for Denmark, Braakmann (2014) for Germany, Gallipoli and Turner (2011) and Jeon and Pohl (2017) for Canada, Nahum (2007) for Sweden, Kim et al. (2018) for South Korea and Shen et al. (2019) for China.

household panel survey.

Thirdly, different response to spousal health shocks might reflect the type of health shocks examined. Most of the previous studies examine the effects of individual health shocks, such as heart attacks, strokes, lung disease, cardiovascular, cancer, respiratory diseases and diabetes, on spousal labor supply. The studies of Dobkin et al. (2018) and Garcia-Gomez et al. (2013) investigate the effects of hospitalization on spousal labor supply. The health shock we deal with is hospitalization. The household panel survey we use includes the question of whether the respondent was hospitalized in the previous year or not. We use this information of hospitalization and it is available not only for husbands and wives for the households with spouse but also for single male or female.[8]

Fourthly, the previous studies cover young households and old households. When the studies examine the data of old households, they mainly shed light on the retirement decision in response to health shocks. The time frame of labor supply decision includes both the short-run, medium-run and the long-run decisions. The former two decisions include a change in working hours and a change in working status, such as temporary job quit decision or switch from regular worker to non-regular worker. The retirement decision is considered as the long-run decision.[9] This study deals with young households. The age of household head in our sample is less than 60. Therefore our study focuses on the short-run or medium-run labor supply response to spousal health shocks.

3. Dataset and Characteristics

The household panel survey employed in this analysis is *Japan Household Panel Survey* (JHPS/KHPS) collected by the Panel Data Research Center at Keio University. The Keio Household Panel Survey (KHPS) has been implemented every year since 2004 on 4,000 households and 7,000 individuals nationwide. An additional survey on a cohort of about 1,400 households and 2,500 individuals started from 2007 to compensate for sample dropout. The Japan Household Panel Survey (JHPS) is a new survey targeting 4,000 male and female subjects nationwide in parallel with the KHPS. The survey questionnaires of this data set are very comprehensive in that it covers items such as household structure, individual attributes, educational background and employment status. The data set also includes unique items indispensable for our research: self-rated health status and whether one

[8] The survey does not provide any information about the reason why one was hospitalized and the days of hospitalization.

[9] For example, the effects of health shock on spousal retirement decision are examined in Jiménez-Martín et al. (1999), Johnson and Favreault (2001) and Van Houtven et al. (2010).

is hospitalized or not for both respondent and his or her spouse. Our sample households are divided into three types of households: married households, single females and single males. Our sample excludes the households whose employment status is self-employed, professional, worker at family business or consigned work or subcontractor. The age of the respondents is older than 14 and younger than 60 for female respondents and older than 17 and younger than 60 for male respondents. The sample period covers 12 years from 2009 to 2020.

The total number of observations is 23,109, 5,270 and 5,187, respectively, for married households, single females and single males. Table 1 shows descriptive statistics of household attributes by three types of households. There is no discernable difference in educational background for married males and single males. However, the proportion of high school graduates or junior college or technical college graduates is much higher for married females than single females, while the proportion of university graduates is much higher for single females than married females. There is no statistical difference in real liquid financial asset holding among three types of households, but real tangible asset excluding debt is statistically larger for single households than married households. This might reflect larger debt outstanding for households with spouse. In fact, the proportion of households with debt outstanding is 56.6%, 19.3% and 17.6%, respectively, for households with spouse, single males and single females.

As for the health conditions, the proportion of those in bad or not so good health condition is statistically higher for single households than married households. The proportion of the households in bad or not so good health condition is 15.8% for single males but it is 11.8% for married males. The proportion of the households in bad or not so good health condition is 16.2% for single females but it is 12 % for married females. In spite of poor health condition for single households, the proportion of hospitalization is statistically higher for married females (4.5%) than for single females (3.4%). This might suggest that single females cannot afford to get hospitalized even if her health condition deteriorated. There is no statistical difference in male hospitalization rate between married males and single males. We investigate the determinants of hospitalization in details in the next section.

Turning to the employment status, more than 90% of married males are regular employees, but the proportion of regular employees is only 63% for single males. The proportion of no work and non-regular employees is much higher for single males and it is 14.5% and 22.5%, respectively. The proportion of no work and non-regular employees is 30.7% and 48.3% for married females, but it is 11% and 40.3% for single females. In contrast, the proportion of regular employees is higher for single females (48.7%) than for married females (21%).

Table 2 shows the transition probabilities of employment status for males and females by households with or without spouse. Panel 1 shows the transition probabilities among three employment statuses of no jobs, non-regular jobs and regular jobs for males. The rows reflect the initial values and the columns reflect the final values. For married males, there is tendency to return to regular jobs whether they have no jobs or non-regular jobs in the initial year. Each year males with no jobs or non-regular jobs have 26.6 % and 19.9 % chance of having regular jobs in the next year. However, each year single male with no jobs or non-regular jobs has only 11.6 % and 14.4 % chance of having regular jobs in the next year.

Panel 2 shows the transition probabilities among three employment statuses for females. It is more likely that married females stay at the same employment status. Each year females with no job, non-regular jobs and regular jobs have 83.6 %, 90.7% and 92.2% chance of having the same jobs status in the next year, respectively. On the other hand, there is tendency to return to regular jobs whether they have no jobs or non-regular jobs for single females. Each year single females with no jobs, non-regular jobs or regular jobs have 10.3 %, 8.5% and 93.7 % chance of having regular jobs in the next year.

4. Quantitative evaluation of hospitalization as health shock

We focus on hospitalization shock in this study since hospitalization event is a severe adverse health shock hitting the households. When one gets hospitalized, one might incur large medical cost and income loss. Income loss for two reasons. First, as hospitalization gets longer, it is likely that one exhausts paid leave and ends up with losing job or being relocated to redundant divisions, which leads to a decrease in earned income. Secondly, even if one keeps the same employment status, working hours might be reduced and accordingly earned income will decrease.[10] In this section we make quantitative evaluation of the hospitalization shock across different household types. The effect of hospitalization on employment status and income loss will be discussed in the next section.

Figure 1 shows the time series path (2009 to 2020) of the proportion of hospitalization as well as the proportion of bad or not so good health condition for two types of households: married households and single households. The first panel compares the proportion of hospitalization and poor health conditions between married males and single males. The proportion of poor health condition is always

[10] The health insurance program in Japan provides two kinds of safety net against hospitalization. One is high-cost medical expense benefit where the amount of medical cost above the ceiling might be refunded to the patient. The other is allowance for the sick and wounded where the patient receives 67% of standard monthly remuneration for one year and half. Note that the hospitalized person still incurs income loss in spite of these safety net.

higher for singe males than married males. The difference varies to 6 percent points to 10 percent points during 2014 to 2018. The proportion of hospitalization is also slightly higher for singe males, reflecting poorer health conditions. The second panel compares the pattern of hospitalization and poor health conditions between married females and single females. The proportion of poor health condition is always higher for singe females, but the proportion of hospitalization is slightly higher for married females in most of the years. This might reflect the fact that singe females cannot afford to get hospitalized due to high hospitalization cost.

The panel survey also shows the annual medical cost for treatment of disease and/or injury paid by household. Figure 2 compares the impact of hospitalization on medical cost across different types of households. When no one is hospitalized, the average medical cost from 2013 to 2020 is 37.1 thousand yen for married males, 36.7 thousand yen for married females, 37.1 thousand yen for single males and 38.4 thousand yen for single females. There is no discernible difference in medical cost across the households with different attributes. However, the average medical cost during the same period for hospitalized household rises sharply. The corresponding figure is 194.2 thousand yen for married males, 178.2 thousand yen for marrier females, 163.6 thousand yen for single males and 193.0 thousand yen for single females. We find that the hospitalized households bear the substantial burden of medical cost. [11]

Another important characteristic of hospitalization is persistency of hospitalization. The households bear the heavy burden of hospitalization cost as hospitalization becomes persistent. Table 3 shows the transition probabilities of hospitalization for three types of households. Panel 1 shows the transition probabilities between non-hospitalization and hospitalization for males. The rows reflect the initial values and the columns reflect the final values. Each year hospitalized married male has 18.1 % chance of staying hospitalized in the next year, but hospitalized single male has 27.4 % chance of staying hospitalized in the next year. Panel 2 shows the transition probabilities between non-hospitalization and hospitalization for females. Each year hospitalized married female has 12.5 % chance of staying hospitalized in the next year, but hospitalized single female has 17.7 % chance of staying hospitalized in the next year. It is clear that hospitalization persists for single households, irrespective of sex.

[11] Note that the medical cost mentioned in the text includes the refund to the household under the high-cost medical expense benefit system.

5. Hospitalization, employment status and income loss

This section estimates the size of income loss created by hospitalization for three different types of households: married households, single males and single females. When one is hospitalized, one incurs income loss for the two reasons discussed in the previous section. If one has a spouse, income loss might be mitigated by an increase in spousal labor supply. However, income loss might be aggravated if spouse decreases labor supply to care for ill person. Therefore, the impact of hospitalization on household labor income is an empirical issue.

We calculate the income loss caused by a change in employment status quantitatively in random effects ordered probit model. The dependent variable is employment status (MESTATUS for males and FESTATUS for females) that takes 1 when one has no paid jobs, 2 when one is a non-regular worker and 3 when one is a regular worker. The basic explanatory variables are hospitalization dummy variable (MHOSPITAL for males and FHOSPITAL for females) that takes one if one is hospitalized and zero otherwise, number of children (CHILDREN), real net wealth (NWEALTH), dummy variable for debt outstanding (DEBT) that takes one if one has debt outstanding and zero otherwise, five educational background dummies (EDUCATION1 ~ EDUCATION5), age (AGE), squared age (SQAGE) and year dummies (DYEAR).[12,13]

The hospitalization dummy variable of spouse is added as an explanatory variable for married households. We also added real husband income (HUSINCOME), employment status of husband as explanatory variables.[14] Employment status of husband is measured by two variables. One is NONREGULAR variable that takes one if husband is a non-regular worker and zero otherwise. The other is REGULAR variable that takes one if husband is a regular worker and zero otherwise. The employment-status function for married females is specified as

[12] Education background dummies are defined as follows. EDUCATION1 takes one if one is a junior high graduate and zero otherwise. EDUCATION2 takes one if one is a two-year college graduate or a graduate of college of technology and zero otherwise. EDUCATION3 takes one if one is a university graduate and zero otherwise. EDUCATION4 takes one if one has a graduate degree and zero otherwise. EDUCATION5 takes one if one has other educational background and zero otherwise.

[13] Net wealth is defined as the sum of liquid financial asset and tangible asset minus debt outstanding.

[14] Income and asset variables are adjusted by equivalence scale. Specifically, income and asset variables are divided by the square root of household size.

$$(FESTATUS)_{it} = \alpha_0 + \alpha_1(FHOSPITAL)_{it} + \alpha_2(MHOSPITAL)_{it} + \alpha_3(HUSINCOME)_{it} + \alpha_4(NONREGULAR)_{it} + \alpha_5(REGULAR)_{it} + \alpha_6(CHILDREN)_{it} + \alpha_7(NWEALTH)_{it} + \alpha_8(DEBT)_{it} + \alpha_9(AGE)_{it} + \alpha_{10}(SQAGE)_{it} + \sum_{j=1}^{5}\beta_j(EDUCATIONj)_{it} + \sum_{j=1}^{11}\gamma_j(DYEARj)_t + \varepsilon_{it} \quad (1)$$

where ε_{it}: disturbance term

Note that the variables of MHOSPITAL, HUSINCOME, NONREGULAR and REGULAR do not appear in the employment-status function of single females.

The employment-status function for married males is specified as

$$(MESTATUS)_{it} = \alpha_0 + \alpha_1(FHOSPITAL)_{it} + \alpha_2(MHOSPITAL)_{it} + \alpha_3(CHILDREN)_{it} + \alpha_4(DEBT)_{it} + \alpha_5(AGE)_{it} + \alpha_6(SQAGE)_{it} + \alpha_7(DEBT)_{it} + \sum_{j=1}^{5}\beta_j(EDUCATIONj)_{it} + \sum_{j=1}^{11}\gamma_j(DYEARj)_t + \varepsilon_{it} \quad (2)$$

The FHOSPITAL variable does not appear in the employment-status function of single males.

Table 4 shows the marginal effect of each explanatory variable on the probability of employment status.[15] The first panel shows the estimation results of employment status function of females. When married female is hospitalized, it significantly raises the probability of losing job, and significantly lowers the probability of working as non-regular worker or regular worker. When married female is hospitalized, the probability of no jobs rises by 3.4 percent points, and the probability of working as non-regular worker or regular worker decreases by 0.5 percent points and 2.9 percent points, respectively. When single female is hospitalized, it significantly raises the probability of no jobs and significantly lowers the probability of working as regular worker. However, it significantly raises that probability of working as non-regular worker. When single female is hospitalized, the probability of no jobs rises by 2.7 percent points and the probability of working as regular worker is lowered by 5.3 percent points. The probability of working as non-regular worker rises by 2.6 percent points. It should be noted that single females keep on working as non-regular worker even if she is hospitalized.

Number of children is also an important factor to determine employment status for females. However, the impact of number of children on employment status is completely different between married females and single females. For married females, when the number of children increases by

[15] The coefficient estimates of time dummies are suppressed to save space.

one, the probability of quitting job rises by 4.4 percent points and the probability of working as non-regular worker or regular worker is lowered by 0.7 percent points and 3.7 percent points, respectively. For single females, when the number of children increases by one, the probability of quitting job or working as non-regular worker is lowered by 1.5 percent points and 1.4 percent points, respectively, and the probability of working as regular worker rises by 2.9 percent points.

When husband is hospitalized, spousal labor supply changes significantly. The probability that his wife has no jobs decreases by 3.9 percent points and the probability of working as non-regular worker or regular worker rises by 0.6 percent points and 3.3 percent points, respectively. That is, when husband is hospitalized, his wife significantly increases her labor supply, supporting the added worker effect for married females.

Our estimation results also support for the Douglas-Arisawa's law that married woman increases her labor supply when her husband's income falls.[16] When husband income falls, it significantly lowers the probability of no jobs and significantly raises the probability of working as non-regular worker or regular worker. However, the effect of husband income on the wife's labor supply is not so large quantitatively. When the husband income falls by 10 ten thousand yen annually, the probability that his wife changes her employment status is at most 0.1 percent points.

Now we turn to the estimation results of male employment status function (the second panel of Table 4). When married male is hospitalized, the probability of quitting job or working as non-regular worker significantly rises by 0.9 percent points and 1.4 percent points, respectively, and the probability of working as regular worker is lowered significantly by 2.2 percent points. The effect of spousal hospitalization on husband labor supply is statistically insignificant. Therefore, we observe asymmetric effect of hospitalization on spousal labor supply between husbands and wives. Lastly, hospitalization does not have any significant effect on the probability of employment status for single males.

Given the above evidence on the effects of hospitalization on labor supply of family members, we calculate the expected income change caused by hospitalization. The expected income change is obtained by multiplying the probability of no paid jobs, non-regular worker and regular worker by the corresponding labor income. Table 5 shows the average labor income of no paid worker, non-regular worker, regular worker by household type and sex for the period of 2009 to 2020. Based on the probability of change in employment status caused by hospitalization and labor incomes given by

[16] See Douglas (1934) and Arisawa (1956) for the Douglas-Arisawa's law.

Table 5, we calculate a change in the expected labor income caused by hospitalization, which is shown in Table 6.

The expected income loss is largest for single females, which is 12.02 ten thousand yen annually and corresponds to 5.3% of annual labor income. The expected income loss is second largest for single males. It is 10.04 ten thousand yen annually and corresponds to 3.3% of annual labor income. When married female is hospitalized, the total expected income loss including husband's income loss is 12.77 ten thousand yen annually, but it corresponds to only 1.8% of joint annual income of husband and wife. When married male is hospitalized, the total expected household income *rises* by 3.48 ten thousand yen, reflecting the added worker effect of wives.

The discussion so far is concerned with the estimates of income loss caused by a change in employment status due to hospitalization. However, it should be notes that income loss still arises even if there is no change in employment status due to a change in working hours or job downgrading. Now we calculate the size of income loss when there is no change in employment status by estimating the earning function of non-regular workers and regular workers by household type and sex in random-effects panel model. The explanatory variables of earning function are hospitalization dummy variable that takes one if one is hospitalized and zero otherwise, five educational background dummies (EDUCATION1 ~ EDUCATION5), age (AGE), squared age (SQAGE), five dummies to represent firm size (FSIZE1 ~ FSIZE5) and year dummies (D2010~D2020).[17]

Table 7 shows a change in earnings of non-regular worker and regular worker by household type and sex when one is hospitalized. Hospitalization has a larger effect on earnings of single households. Labor income of non-regular worker and regular worker decreases by 37.28 ten thousand yen and 28.01 ten thousand yen, respectively, for single males. Labor income of non-regular worker and regular worker decreases by 11.95 ten thousand yen and 15.81 ten thousand yen, respectively, for single females.[18] To sum up, single households are most severely affected by health shock of hospitalization in terms of income loss with and without a change in employment status. The married households can

[17] FSIZE1 takes one when one works at the firm with 5 to 29 employees and zero otherwise. FSIZE2 takes one when one works at the firm with 30 to 99 employees and zero otherwise. FSIZE3 takes one when one works at the firm with 100 to 499 employees and zero otherwise. FSIZE4 takes one when one works at the firm with 500 employees or more and zero otherwise. FSIZE5 takes one when one works at government office and zero otherwise.

[18] Fall in labor earning of regular married female worker and non-regular married male worker is also large. It is 44.54 ten thousand yen and 40.22 ten thousand yen, respectively. However, its impact of fall in labor income on household as a whole should be viewed by looking at the proportion of income loss in joint income of husband and wife.

mitigate the impact of male hospitalization by added worker effect by his wife.

6. Concluding remarks

This study is an empirical attempt to make a quantitative comparison of income loss across households with and without spouse when household member is hospitalized. We find that single household is vulnerable to large income loss, while the married household can mitigate hospitalization shock of husband by an increase of spousal labor supply (added worker effect).

However, note that our evidence refers to the *average* income loss incurred by the hospitalized households. We cannot tell the whole picture of the relationship between hospitalization shock and income loss The distributional knowledge of income loss across the hospitalized households is indispensable to discuss the distributional aspect of income loss across the hospitalized households. The 2020 patient survey conducted by the Ministry of Health, Labour and Welfare reports that the average day of hospitalization is 33.3 days. But there is a wide variation of hospitalization days, depending on the disease. When the hospitalization day is short enough to be fully covered by paid leave, there will be no income loss. However, when one suffers from psychiatric disorder, one will be hospitalized for 294.2 days on average and thus income loss will be substantial. Therefore it is important to identify the households affected by serious disease and estimate income loss for those households. This kind of information helps the social planner to design welfare policy that improves the quality of life of the hospitalized households by preventing the hospitalized households from falling poverty.

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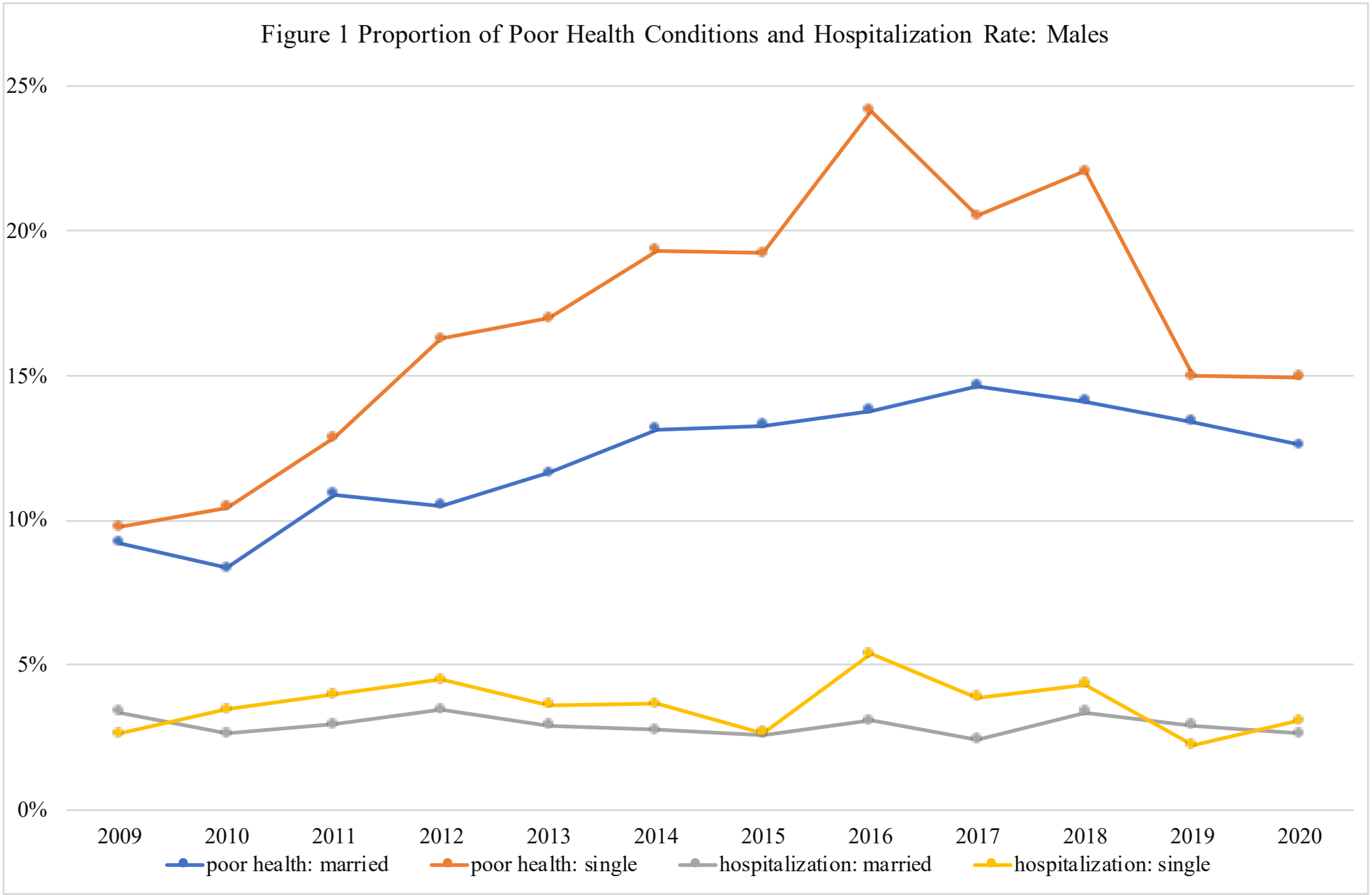
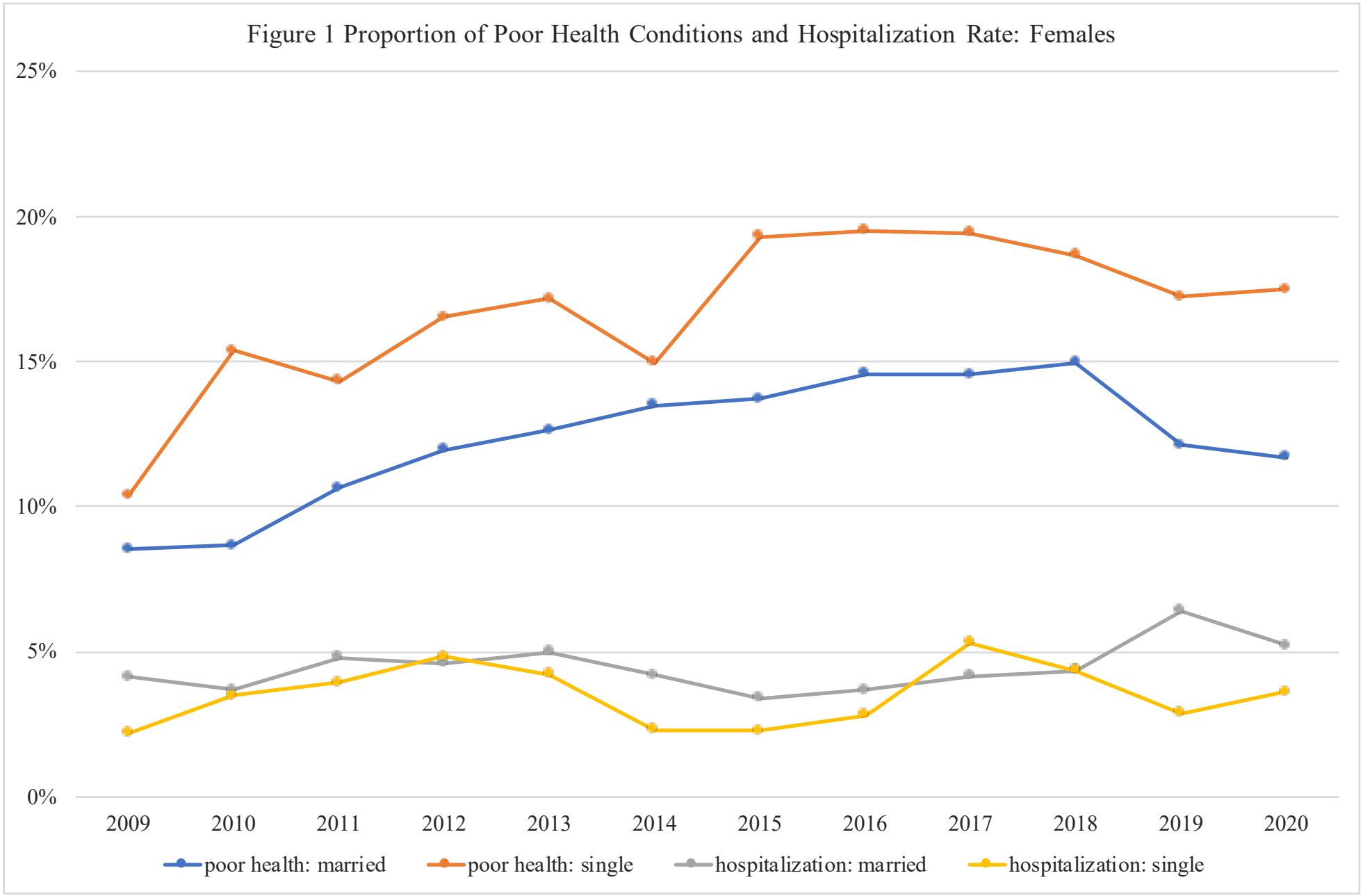
Figure 1 Proportion of Poor Health Conditions and Hospitalization Rate: Males



Source: *Japan Household Panel Survey* , The Panel Data Research Center at Keio University

Figure 1 Proportion of Poor Health Conditions and Hospitalization Rate: Females



Source: *Japan Household Panel Survey* , The Panel Data Research Center at Keio University

Figure 2 Medical Expenditure by Household Type: 2013-2020

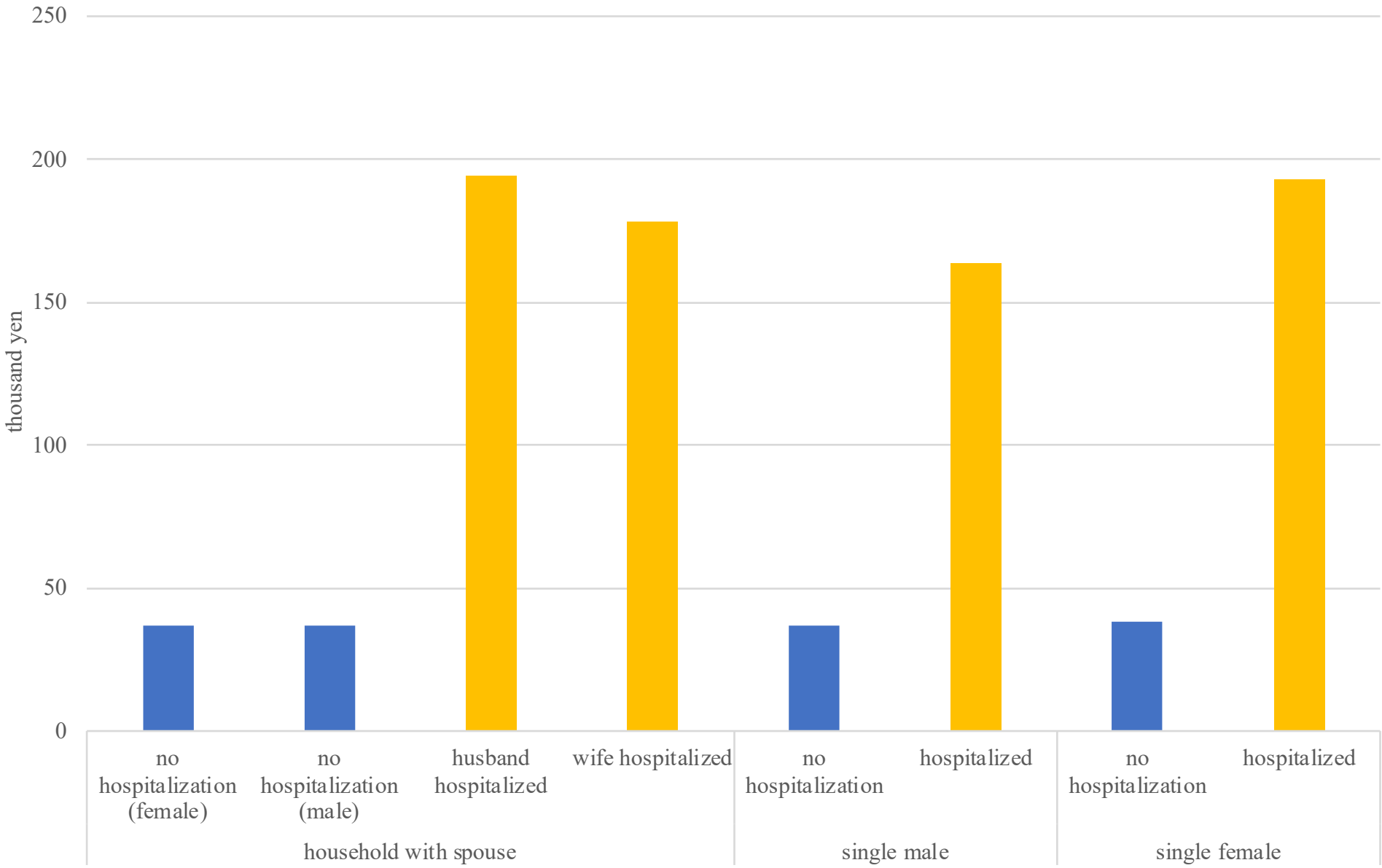


Table 1 Descriptive Statistics of Household Attributes by Household Type

		married households	single males	single females
basic statistics				
age	male	45.8	37.9	
	female	44.1		38.7
number of children		1.8	0.0	0.2
health-related statistics				
Bad or not so good health condition (%)	male	11.8	15.8	
	female	12.0		16.2
proportion of hospitalization (%)	male	2.9	3.5	
	female	4.5		3.4
educational background				
junior high (%)	male	2.1	2.1	
high school (%)		39.9	37.6	
junior college or technical college (%)		8.0	7.1	
university (%)		39.6	39.2	
graduate school (%)		5.1	4.1	
other (%)		5.3	9.8	
junior high (%)	female	1.3		2.0
high school (%)		40.4		35.1
junior college or trechnical college (%)		30.6		23.4
university (%)		18.4		26.8
graduate school (%)		0.9		1.0
other (%)		8.5		11.6
income and wealth-related statistics				
real before-tax annual income (ten thousand yen) [1)]		811.8	634.3	608.0
real liquid financial asset (ten thousand yen) [1), 2)]		661.0	640.5	665.2
real tangible asset (land and housing) minus debt outstanding (ten thousand yen) [1)]		537.6	759.6	692.8
proportion of households with debt (%)		56.6	19.3	17.6
working status				
no paid work (%)	male	1.6	14.5	
non-regular employee (%)		5.2	22.5	
regular employee (%)		93.3	63.0	
no paid work (%)	female	30.7		11.0
non-regular employee (%)		48.3		40.3
regular employee (%)		21.0		48.7

1) real values in 2020 price, deflated by CPI.

2) liquid financial asset includes deposits and securities.

Source: *Japan Household Panel Survey,* The Panel Data Research Center at Keio University

Table 2
Transition Probabilities of Employment Status

Panel 1: males

married (%)

initial status	final status			
	no jobs	non-regular jobs	regular jobs	total
no jobs	49.3	24.0	26.6	100.0
non-regular job	2.6	77.5	19.9	100.0
regular job	0.6	0.9	98.5	100.0

single (%)

initial status	final status			
	no jobs	non-regular jobs	regular jobs	total
no jobs	74.2	14.2	11.6	100.0
non-regular job	8.8	76.8	14.4	100.0
regular job	2.1	2.9	95.1	100.0

Panel 2: females

married (%)

initial status	final status			
	no jobs	non-regular jobs	regular jobs	total
no jobs	83.6	15.4	1.1	100.0
non-regular jobs	6.2	90.7	3.1	100.0
regular jobs	2.8	5.0	92.2	100.0

single (%)

initial status	final status			
	no jobs	non-regular jobs	regular jobs	total
no jobs	69.5	20.1	10.3	100.0
non-regular jobs	4.5	86.9	8.5	100.0
regular jobs	1.4	4.9	93.7	100.0

Table 3
Transition Probabilities of Hospitalization

Panel 1: males

married (%)

initial status	final status		
	no hospitalization	hospitalization	total
no hospitalization	97.5	2.5	100.0
hospitalization	81.9	18.1	100.0

single (%)

initial status	final status		
	no hospitalization	hospitalization	total
no hospitalization	97.0	3.0	100.0
hospitalization	72.6	27.4	100.0

Panel 2: females

married (%)

initial status	final status		
	no hospitalization	hospitalization	total
no hospitalization	96.4	3.6	100.0
hospitalization	87.5	12.5	100.0

single (%)

initial status	final status		
	no hospitalization	hospitalization	total
no hospitalization	96.8	3.2	100.0
hospitalization	82.4	17.7	100.0

Table 4
Determinants of Employment Status in Ordered Probit Model

Panel 1: females

	married			single		
	no paid jobs	non-regular jobs	regular jobs	no paid jobs	non-regular jobs	regular jobs
MHOSPITAL	-0.0393***	0.0063***	0.0330***			
	(-3.18)	(2.83)	(3.16)			
FHOSPITAL	0.0341**	-0.0055**	-0.0286**	0.0271**	0.0263**	-0.0534**
	(2.35)	(-2.17)	(-2.35)	(1.99)	(1.98)	(-1.99)
HUSINCOME	0.0002***	-0.0001***	-0.0001***			
	(4.20)	(-3.51)	(-4.17)			
NONREGULAR	-0.0127	0.0020	0.0011			
	(-0.41)	(0.41)	(0.41)			
REGULAR	-0.0363	0.0058	0.0304			
	(-1.20)	(1.18)	(1.20)			
NWEALTH	2.17×10^{-06}	-3.48×10^{-07}	-1.82×10^{-06}	-4.28×10^{-06}	-4.15×10^{-06}	8.43×10^{-06}
	(0.52)	(-0.52)	(-0.52)	(-1.49)	(-1.45)	(1.47)
CHIDLREN	0.0441***	-0.0071***	-0.0370***	-0.0148***	-0.0148***	0.0292***
	(5.82)	(-4.40)	(-5.68)	(-2.71)	(-2.69)	(2.73)
DEBT	-0.0258**	0.0042**	0.0217**	-0.0052	-0.0050	0.0102
	(-2.22)	(2.07)	(2.22)	(-0.37)	(-0.37)	(0.37)
AGE	-0.0361***	0.0058***	0.0303***	-0.0140***	-0.0135***	0.0275***
	(-4.80)	(4.01)	(4.69)	(-3.01)	(-2.95)	(3.01)
SQAGE	0.0004***	-0.0001***	-0.0003***	0.0002***	0.0002***	-0.0004***
	(4.39)	(-3.79)	(-4.30)	(3.18)	(3.12)	(-3.19)
EDUCATION1	-0.0269	0.0043	0.0023	0.0536	0.0520	-0.1056
	(-0.53)	(0.52)	(0.53)	(1.12)	(1.12)	(-1.12)
EDUCATION2	-0.0373**	0.0060**	0.0313**	-0.0655***	-0.0634***	0.1289***
	(-2.20)	(2.17)	(2.18)	(-3.22)	(-3.17)	(3.24)
EDUCATION3	-0.0888***	0.0143***	0.0746***	-0.0771***	-0.0747***	0.1517***
	(-4.08)	(3.68)	(3.98)	(-3.84)	(-3.74)	(3.86)
EDUCATION4	-0.3694***	0.0594***	0.3100***	0.0145	0.0141	-0.0286
	(-4.00)	(3.32)	(3.99)	(0.19)	(0.19)	(-0.19)
EDUCATION5	-0.0667**	0.0107**	0.0559**	-0.0772***	-0.0748***	0.1520***
	(-2.35)	(2.28)	(2.33)	(-3.01)	(-2.97)	(3.03)
σ_v^2		6.3760			6.6898	
number of observations		10,959			3,406	

Panel 2: males

	married			single		
	no paid jobs	non-regular jobs	regular jobs	no paid jobs	non-regular jobs	regular jobs
MHOSPITAL	0.0085***	0.0136***	-0.0221***	0.0197	0.0136	-0.0333
	(3.02)	(3.08)	(-3.07)	(1.55)	(1.55)	(-1.55)
FHOSPITAL	0.0027	0.0043	-0.0070			
	(0.99)	(0.99)	(-0.99)			
NWEALTH	-1.26×10^{-06}	-2.01×10^{-06}	3.27×10^{-06}	1.28×10^{-06}	8.86×10^{-07}	-2.17×10^{-06}
	(-1.46)	(-1.44)	(1.45)	(0.32)	(0.33)	(-0.33)
CHIDLREN	-0.0012	-0.0019	0.0031	-0.0172	-0.0119	0.0291
	(-1.43)	(-1.44)	(1.44)	(-1.30)	(-1.29)	(1.30)
DEBT	-0.0129***	-0.0204***	0.0333***	-0.0037	-0.0254	0.0062
	(-6.33)	(-7.54)	(7.27)	(-0.18)	(-0.18)	(0.18)
AGE	-0.0069***	-0.0110***	0.0179***	-0.0285***	-0.0197***	0.0482***
	(-6.15)	(-6.93)	(6.83)	(-5.69)	(-6.61)	(6.21)
SQAGE	0.0001***	0.0001***	-0.0002***	0.0003***	0.0002***	-0.0006***
	(6.85)	(7.95)	(-7.81)	(5.51)	(6.45)	(-6.02)
EDUCATION1	0.0318***	0.0505***	-0.0822***	0.1361*	0.0940*	-0.2302*
	(6.15)	(5.74)	(-6.05)	(1.70)	(1.72)	(-1.71)
EDUCATION2	-0.0015	-0.0023	0.0038	-0.0297	-0.0205	0.0501
	(-0.55)	(-0.55)	(0.55)	(-0.90)	(-0.90)	(0.90)
EDUCATION3	-0.0128***	-0.0203***	0.0330***	-0.0004	-0.0003	0.0007
	(-6.33)	(-7.02)	(6.97)	(-0.02)	(-0.02)	(0.02)
EDUCATION4	-0.0097**	-0.0154**	0.0251**	-0.0235	-0.0162	0.0397
	(-2.27)	(-2.31)	(2.30)	(-0.61)	(-0.61)	(0.61)
EDUCATION5	-0.0040	-0.0063	0.0102	0.0438	0.0303	-0.0741
	(-1.11)	(-1.10)	(1.11)	(1.54)	(1.57)	(-1.55)
σ_v^2		9.9131			6.5625	
number of observations		16,568			3,396	

Notes: The value in parenthesis is t-value.

*, ** and ***: significant at 10%, 5% and 1% level, respectively

σ_v^2: variance of i.i.d. panel-level error component

Table 5

Average Labor Income by Household Type: 2009-2020

(ten thousand yen)

male					
no jobs		non-regular worker		regular worker	
married	single	married	single	married	single
143.5	44.6	276.2	181.6	597.9	402.1

female					
no jobs		non-regular worker		regular worker	
married	single	married	single	married	single
7.4	35.1	106.9	159.1	343.6	321.3

Source: *Japan Household Panel Survey*, The Panel Data Research Center at Keio University.

Table 6

Effects of Hospitalization on Labor Income When Employment Status Changes

(ten thousand yen)

	hospitalized person	
	married male	single male
change in labor income of males	-8.24	-10.04
change in labor income of females	11.72	--------

(ten thousand yen)

	hospitalized person	
	married female	single female
change in labor income of males	-2.61	--------
change in labor income of females	-10.16	-12.02

Table 7

Effects of Hospitalization on Labor Income

When There Is No Change in Employment Status

(ten thousand yen)

	hospitalized person	
	married male	single male
change in labor income of males		
non-regular income	-40.22*	-37.28*
	(-1.82)	(-1.67)
regular income	-8.35	-28.01***
	(-1.40)	(-2.82)
change in labor income of females		
non-regular income	-2.94	-------
	(-0.83)	
regular income	0.36	--------
	(0.03)	

(ten thousand yen)

	hospitalized person	
	married female	single female
change in labor income of males		
non-regular income	-16.35	--------
	(-1.07)	
regular income	-1.98	--------
	(-0.48)	
change in labor income of females		
non-regular income	2.24	-11.95
	(0.43)	(-1.40)
regular income	-44.54***	-15.81*
	(-3.24)	(-1.66)

Notes: The number within parathesis is t-value.

*,*** significant at 10% and 1% level, respectively.