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Benefits of Knowing Own Health Status: Effects of Health Checkups on Health Behaviors and Labor Participation

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Abstract:

Lifestyle-related diseases account for a large proportion of mortality rates and healthcare expenses. These diseases are largely preventable with behavioral changes, but people often do not have adequate information to change their risky health behaviors. This study, for the first time, examines the extent to which health checkups, which provide relevant information, affect health behaviors and labor outcomes of people with lifestyle-related diseases. Using nationally representative data on health and socioeconomic status in Japan, this study employs propensity score matching to compare two samples with similar attributes who had or had not received health checkups. The results show that people who had health checkups exhibit healthier

behaviors and longer working hours than people who had not. Considering their cost and the benefits derived from resultant increases in annual income, health checkups can be regarded as cost-effective.

Keywords: health checkup; lifestyle-related diseases; health behaviors; labor participation; Japan

JEL Codes: I18; I10; I19

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1. Introduction

Risky health behaviors such as high cholesterol intake, physical inactivity, tobacco use, and excessive alcohol consumption are major causes of lifestyle-related diseases, including cancer, heart diseases, and diabetes (Danaei et al, 2009). These diseases cause high mortality and morbidity rates in high-income countries, and thus, their prevalence poses a considerable economic burden (World Economic Forum, 2011). In Japan, approximately 60% of deaths are attributed to lifestyle-related diseases, and they accounted for about 30% of total healthcare costs in 2014–2015 (Ministry of Health, Labor and Welfare (MHLW), 2017).

Lifestyle-related diseases are largely preventable with behavioral changes (Cawley and Ruhm, 2011). However, people do not always change their risky health behaviors. One of the key reasons for this, according to Kenkel (1991), is that people do not have adequate information about their own health. To address this, many developed countries have introduced mandatory health checkups to provide people with information on their health status (Dalton and Soljak, 2012; Kim et al, 2019; Hackl et al, 2015). In 2008, the MHLW in Japan introduced a health checkup system for people aged 40 to 74 years, called "Specific Health Checkup (*Tokutei Kenshin*)," focusing on metabolic syndrome.

Regarding the effects of health checkups, the literature has shown mixed results. Some studies have found no significant effects of health checkups on risky health behaviors and health outcomes (Kim et al., 2019), while others have shown that checkups significantly change the risky health behaviors of those who are diagnosed with diabetes (Oster, 2015) and hypertension (Zhao et al., 2013).

This study investigates how health checkups affect risky health behaviors and labor

outcomes among people with lifestyle-related diseases: diabetes, hyperpiesia, lipidemia, and obesity. This is the first known study focusing on the relationship between health checkups and labor outcomes. Based on the estimates of labor outcomes, a simple cost-effectiveness analysis for health checkups is performed at the end of this study. To avoid estimation bias caused by endogeneity in the relationship between health checkups and individual socioeconomic status and health status, propensity score matching is employed to compare people who received health checkups with people with similar attributes who did not.

2. Methods

2.1 Data

The data comes from the Comprehensive Survey of Living Conditions (CSLC), a nationally representative cross-sectional survey conducted every three years by the MHLW. The CSLC collects various information on the health and socioeconomic status of all household members of randomly selected households all over Japan.

This study uses data from the CSLCs conducted in 2013 and 2016, which are the latest available. Individuals ages 40 to 74, who are subject to “Specific Health Checkups” and who have also been diagnosed with diabetes, hyperpiesia, lipidemia, and/or obesity, have been extracted. The morbidity rate of these lifestyle-related diseases is 26.1% for males and 22.4% for females.

Table 1 summarizes the descriptive statistics of the outcome variables (i.e., health behaviors and labor outcomes) and a key variable (i.e., the rate of receiving health checkups) by gender. Panel A shows current health-related behaviors, Panel B reports labor outcomes, and Panel C indicates the rate of having a health checkup within one year before the date of survey.

2.2 Identification Strategy

Since the treatment group, those who received health checkups, and the control group, those who did not, are not allocated at random, it is important to address endogeneity for evaluating the effects of health checkup. People in the treatment group could be more health-conscious and have a different socioeconomic status than those in the control group. For example, people in the treatment group could have more education and earn higher incomes than those in the control group. Therefore, the selection bias would lead to the results being overestimated.

To deal with endogeneity, propensity score matching is utilized to compare groups with similar attributes. To this end, the probability of receiving a health checkup for each group is first estimated, then regressed on various attributes by using a logit model. The estimation model is as follow:

$$\text{logit}(HC_{ipt}) = \alpha + \boldsymbol{X}_{it}\boldsymbol{\beta} + \gamma_p + \delta_t + \pi_{pt} + \varepsilon_{ipt} \quad (1)$$

The predicted value, $\widehat{HC}_{ipt}$, is the propensity score for an individual i living in prefecture p at survey year t, X_{it} are attributes for individual i at survey year t, and γ_p and δ_t are the prefecture and survey year fixed effects. The variable π_{pt} is the interaction term of the prefecture and survey year fixed effects. A one-to-one nearest -neighbor matching is then employed such that each individual in the control group is matched with a nearest individual in the treatment group within a caliper of 25% of the standard deviation of the propensity score (Guo and Fraser, 2015).

Figure 1 plots the standardized differences in the means of all covariates between the treatment and control groups before and after matching. For example, people in the treatment

group tend to be more health-conscious with more education and higher incomes, than those in the control group, most of which are statistically significant at the 10% level. After matching, however, all covariates seem to be well balanced, and standardized differences in their means are statistically insignificant.

Figure 2 plots the distribution of the propensity score before and after matching. The figure shows that the distribution of the score for the treatment group is skewed to the right-hand side compared to the control group before matching, suggesting that those in the treated population are more likely to receive health checkups. However, the distribution becomes much more similar after matching.

Using only matched samples, the average treatment effect of receiving a health checkup is estimated. There are 19,290 matched samples of men and 22,109 matched samples of women. The bootstrapping method is then used with 200 counts of replications based on 47 clusters in prefectures.

4. Results

Table 2 reports the estimated differences in healthy behaviors between the treatment and control groups. The results suggest that those in the treated population are more likely to have healthier behaviors than those in the control group. The proportion of males (females) who are having regular and balanced meals in the treatment group are higher than in the control group by 8.0% (8.2%) and 6.1% (6.5%). Further, those in the control group tend to make healthier choices about exercising, smoking, and drinking than those in the control group. Regardless of gender, the proportion of people who are not performing any healthy behaviors is smaller in the control group.

Regarding labor outcomes, Table 3 shows that males (females) in the treatment group

are more likely to be currently working than those in the control group by 0.3% (1.0%), but these differences are not statistically significant. Significant effects on weekly working hours are observed but only for females. Females in the treatment group work 0.64 hours longer per week than those in the control group. Likewise, males (females) in the treatment group work 0.17 (0.15) hours longer per day than those in the control group.

5. Discussion and conclusion

This study examines the effects of health checkups on health behaviors and labor outcomes among people with lifestyle-related diseases. The results show that people who received health checkups make healthier lifestyle choices and work longer hours compared to people who did not.

Based on the estimates on the increase in weekly working hours, the cost-benefit of health checkups is evaluated. To prevent overestimation of the cost-effectiveness of health checkups, the cost is calculated to be higher and the benefit is calculated to be lower than that of average value in Japan. For costs, the maximum cost per person of a health checkup is JPY 18,522 while the costs actually vary across medical institutions and municipalities (Japan Health Insurance Association, 2019). Table 4 shows how benefits from receiving health checkups by gender are calculated. First, increases in daily working hours are multiplied by health checkups by 244 days in 2016 for a total increase of approximately 41 and 36 hours for males and females, respectively. Second, increases in yearly working hours are multiplied by JPY 823 per hour, the minimum wage in 2016. Then, the benefit from health checkups, equivalent to the increase in annual income for those who have a health checkup, is JPY 33,937 per male and JPY 29,720 per female. In conclusion, the results suggest that health checkups would be effective in terms of cost and benefits for both males and females.

Thus, we can infer that providing information on health status through health checkups is an effective way to motivate people with lifestyle-related diseases to make healthier choices. Further, health checkups have positive effects on labor outcomes. Finally, considering the cost of health checkups and the benefits from increased annual income, health checkups would be cost-effective.

This study is subject to a few limitations that create avenues for future research. Our estimation strategy, propensity score matching, cannot address unobserved and time-variant individual attributes. If there are unobserved attributes correlated with health checkups behaviors and labor outcomes, results would be biased. Panel data that includes both health checkup status and labor outcomes could address this. To the best of our knowledge, Japanese panel data does not exist.

References

Cawley, J., & Ruhm, C.J. (2011). The economics of risky health behaviors. in M. Pauly, T. McGuire, & P. Barros (Eds.) *Handbook of Health Economics*, 2, 95–199.

Dalton A.R. & Soljak M. (2012). The nationwide systematic prevention of cardiovascular disease: the UK's Health Check programme. *Journal of Ambulatory Care Management*, 35(3), 206–215

Danaei, G., Ding, E., Mozaffarian, D., Taylor, B., Rehm, J., Murray, C., & Ezzati, M. (2009). The preventable causes of death in the United States: Comparative risk assessment of dietary, lifestyle, and metabolic risk factors. *PLoS Medicine*, 6(4): e1000058. doi: 10.1371/journal.pmed.1000058.

Guo, S., & Fraser, M. (2015). *Propensity score analysis*. Thousand Oaks, California: SAGE Publications.

Hackl F., Halla M., Hummer M. & Pruckner G.J. (2015). The effectiveness of health screening. *Health Economics*, 24(8), 913–935.

Kenkel, D. (1991). Health behavior, health knowledge, and schooling. *Journal of Political Economy*, 99(2), 287–305.

Japan Health Insurance Association (2019, September 10). https://www.kyoukaikenpo.or.jp (last accessed on December 25, 2019)

Kim, H., Lee, S., & Lim, W. (2019). Knowing is not half the battle: Impacts of information from the National Health Screening Program in Korea. *Journal of Health Economics*, 65(1), 1–14.

Ministry of Health, Labour and Welfare. (2017). Latest trends on lifestyle-related disease. https://www.niph.go.jp/soshiki/jinzai/koroshoshiryo/tokutei29/keikaku/program/K1-1.pdf (last accessed on December 25, 2019)

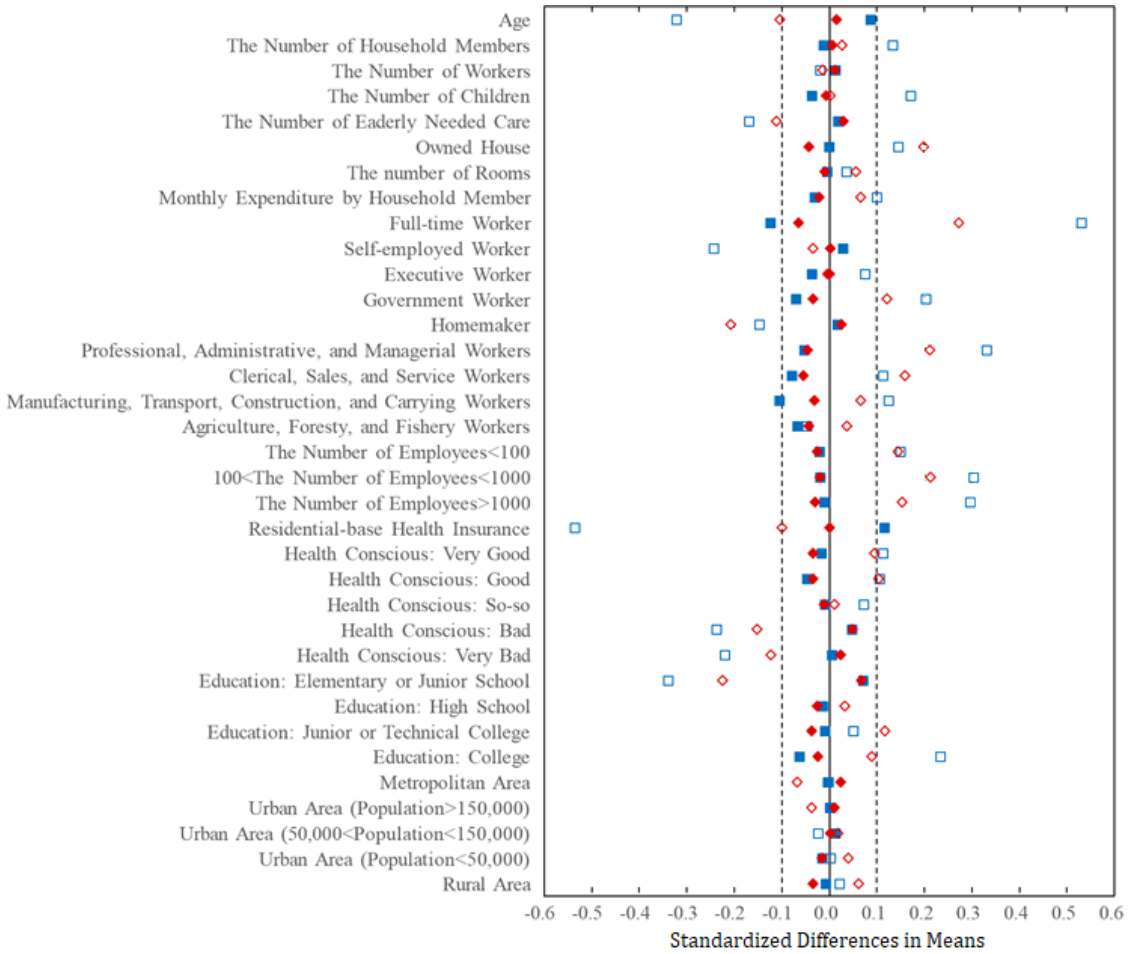
Oster, E. (2015). Diabetes and diet: Purchasing behavior response to health information. *American Economic Journal: Applied Economics*, 10(4), 308–348.

World Health Organization (2009). Global health risks: Mortality and burden of disease attributable to selected major risks. *WHO Press*.

World Economic Forum (2011). The Global Economic Burden of Non-communicable Diseases. Harvard School of Public Health. http://www3.weforum.org/docs/WEF_Harvard_HE_GlobalEconomicBurdenNonCommunicableDiseases_2011.pdf (last accessed on December 25, 2019)

Zhao, M., Konishi, Y., & Glewwe, P. (2013). Does information on health status lead to a healthier lifestyle? Evidence from China on the effect of hypertension diagnosis on food consumption. *Journal of Health Economics*, 32(2), 367–385.

Figure 1. Covariates Balance

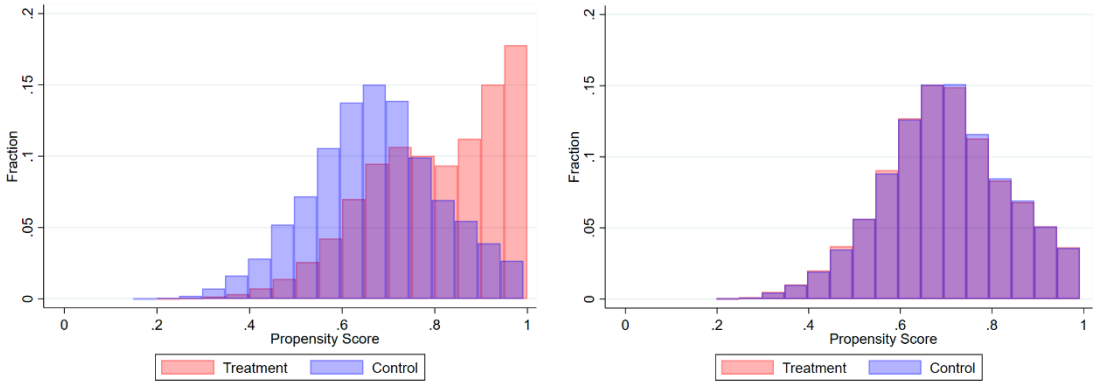


Notes: This figure plots standardized differences in means, average differences in means between the treatment and the control group expressed in standard deviation units, of all covariates. Dotted lines represent the 10% significance level.

Figure 2. The Distribution of Propensity Scores

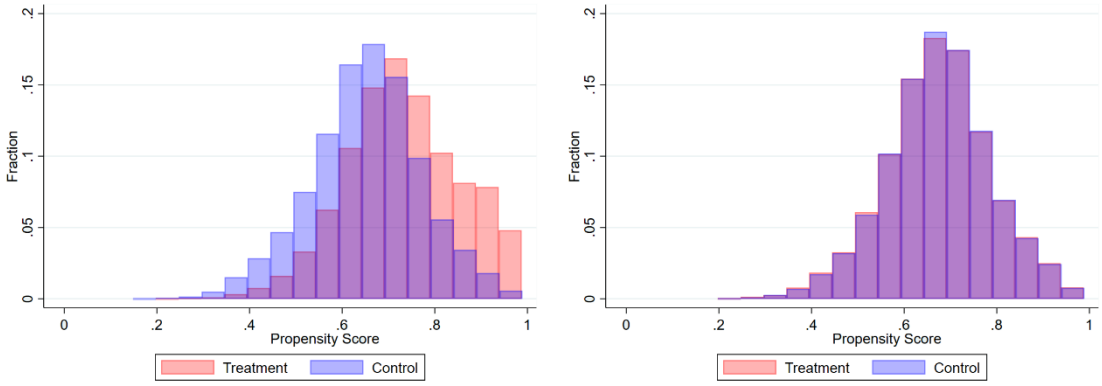
Panel A. Male

(i) Before Matching (ii) After Matching



Panel B. Female

(i) Before Matching (ii) After Matching



Notes: These figures plot histograms of the propensity score, which represents the probability of receiving a health checkup based on individual attributes, by gender, before and after matching.

Table 1. Descriptive Statistics

	Male (N=57,455)		Female (N=52,968)	
	Mean	S.D.	Mean	S.D.
Panel A: Health Behaviors				
Regular Meals	0.628	(0.483)	0.696	(0.460)
Balanced Meals	0.377	(0.485)	0.455	(0.498)
Do Not Overeat	0.448	(0.497)	0.508	(0.500)
Exercise Moderately	0.416	(0.493)	0.422	(0.494)
Do Not Smoke	0.465	(0.499)	0.462	(0.499)
Do Not Overdrink Alcohol	0.385	(0.487)	0.404	(0.491)
No Healthy Behavior	0.092	(0.289)	0.067	(0.250)
Panel B: Labor Outcomes				
Working	0.656	(0.475)	0.407	(0.491)
Weekly Working Hours	42.124	(15.296)	32.724	(15.714)
Daily Working Hours	8.154	(2.321)	6.580	(2.361)
Panel C: Health Checkup				
Received Health Checkup within one year	0.770	(0.421)	0.708	(0.455)

Notes: This table shows mean values and standard deviations of the outcome variables and a key variable. All samples before matching are used

Table 2. The Effect of Health Checkups on Health Behaviors

	Regular Meals	Balanced Meals	Do Not Overeat	Exercise Moderately	Do Not Smoke	Do Not Overdrink	No Healthy Behaviors
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Male							
Health Checkup	0.080***	0.061***	0.026***	0.078***	0.078***	0.047***	-0.031***
	(0.009)	(0.007)	(0.008)	(0.007)	(0.008)	(0.010)	(0.005)
Sample Size	19,290	19,290	19,290	19,290	19,290	12,129	19,290
Panel B: Female							
Health Checkup	0.082***	0.065***	0.039***	0.100***	0.066***	0.024**	-0.025***
	(0.008)	(0.005)	(0.007)	(0.006)	(0.006)	(0.012)	(0.003)
Sample Size	22,109	22,109	22,109	22,109	22,109	4,890	22,109

Notes: This table shows estimated differences in health behaviors between the treatment and the control group. Standard errors are clustered at the prefectural level. *** p< 0.01, ** p< 0.05, and * p< 0.1

Table 3. The Effect of Health Checkup on Labor Outcomes

	Working	Weekly Working Hours	Daily Working Hours
	(1)	(2)	(3)
Panel A: Male			
Health Checkup	0.003	0.264	0.169***
	(0.008)	(0.328)	(0.047)
Sample Size	19,290	9,857	9,857
Panel B: Female			
Health Checkup	0.010	0.641*	0.148***
	(0.007)	(0.341)	(0.052)
Sample Size	22,109	7,294	7,294

Notes: This table shows estimated differences in labor outcomes between the treatment and the control group. Standard errors are clustered at the prefectural level. *** $p< 0.01$, ** $p< 0.05$, and * $p< 0.1$.

Table 4. Benefits from Receiving Health Checkups

	Male	Female
Increase in Daily Working Hours	0.169	0.148
Weekdays in 2016	× 244	× 244
Increase in Yearly Working Hours	= 41.24	= 36.11
Minimum Wage in 2016 (in JPY)	× 823	× 823
Increase in Annual Income (in JPY)	= 33,937	= 29,720

Notes: This table shows benefits increased income from receiving health checkups. Increase in daily working hours come from the main results on labor outcomes, column 3 of Table 3.