Effect of social activities on health checkups and recommended doctor visits: a fixed-effects analysis in Japan

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Abstract: Health checkups are considered to promote occupational and public health. This study aimed to investigate the extent to which participation in social activities encourages middle-aged people to participate in health checkups and adhere to doctor-visit recommendations. We analyzed 337,024 longitudinal observational studies involving 33,420 individuals aged 50–59 yr in the baseline year (2005) derived from a nationwide, population-based, 14-wave survey. We estimated fixed-effects logistic models to elucidate how people's participation in health checkups and recommended doctor visits are affected by participation in social activities. Attending health checkups was positively associated with participation in social activities, with an odds ratio (OR) of 1.19 (95% confidence interval [CI]: 1.15–1.22) and a marginal effect of 3.3% (95% CI: 2.7%–3.9%). Adherence to doctor-visit recommendations was also positively associated with participation in social activities, with an OR of 1.15 (95% CI: 1.08–1.23) and a marginal effect of 3.3% (95% CI: 1.8%–4.8%), although the association was observed only among regular employees. These results provide new insights into the effectiveness of health checkups.

Key words: Doctor visit, Fixed-effects model, Health checkups, Middle-aged people, Social activities

Introduction

Health checkups, often designed as a set of periodic medical examinations, are considered to promote occupational and public health by detecting diseases and related risk factors¹⁻⁶⁾. Some health checkup participants are recommended to visit a doctor for further examination or medical treatment based on the results of these checkups. Periodic health checkups prevented health deterioration and mortality in many studies¹⁻⁶⁾ but not in others⁷⁻¹⁰⁾.

Factors affecting an individual's participation in health checkups and adherence to recommended doctor visits thereafter should be explored to determine the effectiveness of health checkups. They may be affected by institutional and individual characteristics, and an individual's job status may also affect such decisions^{11, 12)}. The Japa-

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nese Industrial Safety and Health Act obliges each firm to provide health checkups to its employees¹³⁾ but may sometimes exempt non-regular employees. Self-employed workers, family workers, and dependent spouses of employees are encouraged to undergo health checkups provided by municipalities; however, their participation is voluntary. If health outcomes differ between participants and non-participants because of their job status, health gaps exist, making jobs a major social determinant of health. Several factors, including an individual's socioeconomic status^{14–17)}, health literacy¹⁸⁾, lifestyle¹⁹⁾, and workplace^{20, 21)} affect participation in health checkups and adherence to doctor-visit recommendations.

The present study aimed to examine how participation in social activities was associated with an individual's decisions on health checkups and doctor visits, an issue that is rarely addressed. Social capital can promote a positive psychological inclination towards self-care and appropriate medical care utilization²²⁾. Community-level trust and social capital in the workplace reduce the probability of refraining from medical care^{23, 24)}. Considering that interpersonal interactions via social activities are closely related to the formation of social capital^{25, 26)}, participation in social activities (i.e., social participation) may promote health checkups and recommended doctor visits.

However, no consensus exists on a common definition of social activity²⁷⁾. In this study, we broadly defined social activities as an individual's activities that provide interaction with others in society or the community to capture the general and potential effects of social activities on health checkups and recommended doctor visits. As a supplementary analysis, we examined how the estimation results would change if we limited the definition of social activities to those performed with others.

We used large-scale data from 33,420 individuals from a nationwide, population-based survey, which enabled the comparison of determinants of participation in health checkups across all job types. This contrasts with most previous studies, which were based on data collected from limited study samples: employees (or excluding selfemployed workers and non-workers), selected firms, or certain communities.

Unlike most previous studies, this study estimated fixed-effects (FE) logistic regression models^{28, 29)}. The FE models, which focused on within-individual variations, allowed us to control for individual-level time-invariant attributes, which might affect an individual's participation in social activities, health checkups, and/or doctor visits, and possibly cause their overestimated associations.

Subjects and Methods

Study sample

We used data obtained from the nationwide 14-wave panel survey "Longitudinal Survey of Middle-Aged and Elderly Persons" (LSMAEP), which was conducted annually from 2005 to 2018 by the Japanese Ministry of Health, Labour and Welfare (MHLW). Japan's Statistics Law requires the survey to be reviewed from statistical, legal, ethical, and other perspectives. We obtained survey data from the MHLW with official permission; therefore, this study did not require ethical approval.

The baseline LSMAEP survey was conducted in 2005 with 34,240 participants aged 50–59 yr (born between 1946 and 1955) using a two-stage random sampling procedure (response rate: 83.8%). The second to fourteenth waves were conducted annually, from 2006 to 2018. We used incomplete panel data consisting of 337,024 longitudinal observations of 33,420 individuals (98.8% of the original sample) after removing respondents with missing key variables related to health checkups and social activities. Overall, 17,957 individuals remained in the survey during the fourteenth wave. Figure 1 illustrates the construction of the study sample for the statistical analysis.

Health checkups and recommended doctor visits

The survey asked respondents whether they had participated in health checkups, including the "Ningen Dock" (comprehensive health checkup system) in the previous year. We constructed a binary variable for health checkups, allocating "1" to respondents who participated in health checkups and "0" to those who did not. Respondents who had been recommended to undergo medical care, guidance, or further examinations after the checkups were further asked whether they visited a doctor in response to such recommended doctor visits by allocating "1" to respondents who did and "0" to others.

Social activities

Regarding social activities, the survey asked respondents if they participated in the following six types of social activities (multiple answers permitted): (1) hobbies or entertainment, (2) sports or physical exercises, (3) community activities, (4) childcare support or educational or cultural activities, (5) support for the elderly, and (6) others. If the respondents answered "yes", they were asked to indicate with whom they participated in each activity by choosing (a) alone, (b) family members or friends, (c)



337,024 observations over 14 waves

Fig. 1. Constructing the study sample.

workplace colleagues, (d) members of a neighborhood association, or (e) members of a nonprofit organization or public service corporation (multiple answers permitted). We collected data pertaining to social activities broadly and constructed a binary variable for an individual's participation in social activities by allocating "1" to respondents who chose at least one item from (a)–(e) in at least one of the six social activities, and "0" otherwise. We additionally considered a narrower definition of social activities, limiting it to activities performed with others (and excluded those performed alone), to emphasize the effect of interaction with others²⁷).

Covariates

As covariates, we considered job status, self-rated health (SRH), smoking, heavy alcohol consumption, household spending, and marital status, following previous studies^{14–17)}. We considered five types of job status: (1) regular employees (including managers), (2) non-regular employees (i.e., part-time, temporary, dispatched, and contract), (3) self-employed workers, (4) family workers and others, and (5) non-workers. As mentioned, each firm was obliged to provide periodic health checkups to its employees, but non-regular employees were sometimes exempt from this practice. Self-employed workers, family workers, and non-workers were encouraged to undergo health checkups provided by municipalities, but their participation was voluntary. Regarding SRH, the survey asked the respondents about their current health status to choose from among "very good", "good", "somewhat good", "somewhat poor", "poor", and "very poor", We constructed a binary variable for poor SRH by allocating "1" to respondents who chose "poor" or "very poor", and "0" otherwise. Concerning health behavior, we constructed binary variables for smoking and heavy drinking, defined as an intake of more than three "go" (540 ml) of Japanese sake or an equivalent amount of alcohol every day, which corresponds to approximately 60 g of pure alcohol for men and 30 g for women. These thresholds were based on a study³⁰⁾ in which maintaining alcohol consumption below 46 g/d for men and 23 g/d for women appeared to minimize the risk of mortality in a Japanese population. We adjusted household spending for the household size by dividing it by the square root of the number of household members³¹⁾. We categorized it into quartiles and constructed binary variables for each quartile. For respondents who did not answer questions on household spending, we allocated a binary variable to the unanswered questions. In addition to these individual factors, we controlled for wave-specific factors using binary variables for each wave.

Analytic strategy

Following descriptive analyses to paint a general picture of health checkups, doctor-visit recommendations, and adherence to them, we estimated a set of FE logistic models using the longitudinal dataset. First, we estimated models to explain the probability of attending health checkups by participating in one or more social activities, job status, and other covariates. Second, we estimated the models to explain the probability of adherence to doctor-visit recommendations by limiting the sample to those who had received such recommendations after the latest health checkup. Third, as a supplementary analysis, we separated the sample into the six aforementioned types of job statuses and conducted two analyses for each. The Stata software package (version 17) was used for all statistical analyses.

Results

Descriptive analysis

Table 1 summarizes the key features of the study sample at the baseline (Wave 1). The proportion of regular employees was much higher among men (63.9%) than it was among women (20.1%). Table 2 reports the proportion of individuals in the entire sample who participated in health checkups, received doctor-visit recommendations, and adhered to them (individual × wave). The proportion of individuals who participated in health checkups was higher among regular employees (85.8%) than among those with other job statuses (56.6%–74.6%). The finding

 Table 1.
 Key features of the study sample at the baseline

Proportion (%)	All	Men	Women
Job status			
Regular employees	41.4	63.9	20.1
Non-regular employees	19.6	6.8	31.7
Self-employed workers	12.4	20.1	5.2
Family workers and others	7.3	2.7	11.6
Non-workers	19.3	6.5	31.5
Education level			
Junior high school	17.3	17.8	16.9
High school	53.2	48.0	58.1
Junior college	6.7	2.3	10.9
College or above	8.2	8.4	7.9
Unanswered	14.7	23.6	6.3
Poor self-rated health	4.5	4.7	4.4
Smoking	30.4	48.9	13.0
Heavy alcohol consumption	4.7	8.7	0.8
Married	83.3	84.5	82.2
Age (yr)			
Mean	54.7	54.7	54.7
Standard deviation	(2.7)	(2.7)	(2.7)
Household spending (monthly, household-size-adjusted, 1,000 JPY)			
Mean	187.7	193.9	181.7
Standard deviation	(191.3)	(215.5)	(164.6)
N	33,420	16,249	17,171

	All		Underwent a health checkup		Doctor visit recommended		Visited a doctor	
	n _A	(%)	n _B	$n_{\rm B}/n_{\rm A}~(\%)$	n _C	$n_{\rm C}/n_{\rm B}~(\%)$	n _D	$n_{\rm D}/n_{\rm C}~(\%)$
Regular employees	83,975	100	72,040	85.8	38,743	53.8	23,242	60.0
Non-regular employees	80,682	100	60,182	74.6	30,223	50.2	20,562	68.0
Self-employed workers	39,024	100	22,091	56.6	11,132	50.4	7,716	69.3
Family workers and others	23,404	100	14,224	60.8	6,888	48.4	4,638	67.3
Non-workers	109,939	100	63,857	58.1	33,256	52.1	25,265	76.0
Total	337,024	100	232,394	69.0	120,242	51.7	81,423	67.7

Table 2. Health checkups, doctor-visit recommendations, and doctor visits

that the participation rate among regular employees was below 100% suggests that their mandatory requirement was not perfect, in line with the official data of health checkup participation³²⁾. This may reflect the fact that non-participation in health check-ups did not invite any legal penalty under the Japanese Industrial Safety and Health Act¹³⁾. The proportion of individuals recommended to visit a doctor after undergoing health checkups was approximately 50% across all job statuses. The proportion of individuals who adhered to doctor-visit recommendations was slightly lower among regular employees (60.0%) than among other statuses (63.7%–76.0%).

The top panel of Table 3 summarizes the prevalence of participation in each social activity. The prevalence ranged from 49.0% for childcare support or educational or cultural activities to 60.4% for hobbies or entertainment, with 78.3% of the sample participating in one or more social activities. The bottom panel of the table reveals no significant difference in the prevalence of participation in social activities (76.4%–80.0%) across job statuses.

Table 4 compares the proportions of participants in health checkups (top panel) and recommended doctor visits (bottom panel) between participants and non-participants of social activities for each job status. The *p*-values for the Welch's *t*-test of the hypothesis that the proportions between the two groups were equal were reported. Participants in social activities were more inclined to undertake health checkups adhering to doctor-visit recommendations across all job statuses. However, the observed differences between participants and non-participants of social activities were likely affected by institutional settings especially the coverage of regular employees by firms' obliged provisions of periodic health checkups—as well as personality traits and other individual attributes.

Regression analysis

Table 5 summarizes the estimation results of the FE

Table 3. Prevalence of participation in social activities

Prevalence (%) of each social activity	
Hobbies or entertainment	60.4
Sports or physical exercises	58.3
Community activities	49.7
Childcare support, or educational or cultural activities	49.0
Support for the elderly	49.7
Others	49.5
One or more activities	78.3
Proportion (%) of those participating in one or more social actives	
Regular employees	78.8
Non-regular employees	76.8
Self-employed workers	76.4
Other workers	77.1
Non-workers	80.0
Total	78.3

logistic models explaining the probabilities of participating in health checkups (left) and adherence to doctorvisit recommendations (right). Participation in social activities positively correlated with participation in health checkups, with an OR of 1.19 (95% CI: 1.15-1.22) and a marginal effect of 3.3% (95% CI: 2.7%-3.9%). The table also shows that the probability of participation in health checkups was much lower among job statuses other than regular employees. Participation in social activities was also positively associated with doctor visits, with an OR of 1.15 (95% CI: 1.08-1.12) and a marginal effect of 3.3% (95% CI: 1.8%-4.8%). Consistent with participation in health checkups, there was no difference in job status. The table also shows that health checkups were positively associated with poorer SRH and higher household spending, and negatively associated with smoking. Recommended health checkups were positively associated with poor SRH and negatively associated with smoking and heavy alcohol consumption.

Table 6 summarizes the association of social activities

	Socia			activities	
	All	Yes (A)	No (B)	(A) – (B)	<i>p</i> -value
Health checkup					
Regular employees	85.8	88.0	81.4	6.6	< 0.001
Non-regular employees	74.6	77.9	68.0	9.9	< 0.001
Self-employees	56.6	60.3	50.5	9.8	< 0.001
Other workers	60.8	64.7	53.7	10.9	< 0.001
Non-workers	58.1	62.5	47.7	14.8	< 0.001
Total	69.0	72.4	62.0	10.4	< 0.001
Recommended doctor visit					
Regular employees	70.6	73.0	64.8	8.2	< 0.001
Non-regular employees	72.7	74.6	68.1	6.5	< 0.001
Self-employees	76.5	78.3	72.5	5.8	< 0.001
Other workers	74.0	75.1	71.5	3.6	0.002
Non-workers	80.3	80.6	79.5	1.1	0.024
Total	74.5	76.2	70.4	5.8	< 0.001

Table 4. Proportions of health checkups and recommended doctor visits by job status

Table 5.	Results of fixed-effects logistic models assessing	g health checkups and recommended doctor visits

	Health checkups		Doctor	r visits
	OR	95% CI	OR	95% CI
Social activities	1.19	(1.15–1.22)	1.15	(1.08–1.23)
Job status (ref.=regular employees)				
Non-regular employees	0.47	(0.45 - 0.49)	1.03	(0.96–1.10)
Self-employed workers	0.31	(0.29–0.33)	1.12	(0.98 - 1.28)
Family workers and others	0.30	(0.28–0.32)	0.98	(0.86–1.11)
Non-workers	0.20	(0.19–0.21)	1.05	(0.97 - 1.14)
Poor self-rated health	1.14	(1.08–1.21)	1.68	(1.51 - 1.87)
Smoking	0.91	(0.86-0.96)	0.61	(0.55-0.68)
Heavy alcohol consumption	0.96	(0.89–1.04)	0.86	(0.76–0.97)
Married	0.96	(0.89–1.03)	0.98	(0.85–1.14)
Household spending (ref.=1st quartile)				
Second quartile	1.01	(0.98–1.05)	1.00	(0.94–1.07)
Third quartile	1.06	(1.02–1.10)	0.98	(0.91-1.05)
Fourth quartile	1.07	(1.02–1.11)	0.97	(0.90-1.05)
Not answered	1.02	(0.97 - 1.07)	0.83	(0.76–0.92)
Social activities	Marginal effect	95% CI	Marginal effect	95% CI
	0.033	(0.027–0.039)	0.033	(0.018-0.048)
Observations	232	,615	67,578	
Individuals	19,999		10,203	

Further controlled for individual- and wave-level fixed effects, and used individual-level clustered standard errors. OR: Odds ratio; CI: Confidence interval.

with participation in health checkups and recommended doctor visits obtained from the regression models for each job status. We controlled for the same covariates as those used in the regression models shown in Table 5. Participation in health checkups was positively associated with social activities across all job statuses except for family workers and others. Adherence to doctor-visit recommendations was positively associated with social activities only among regular employees, and the similar result for all workers was mainly derived from it.

For both Tables 5 and 6, the results for regular employees should be cautiously interpreted, because their partici-

Job status	OR	95% CI	Marginal effect	95% CI
Health checkups				
Regular employees	1.25	(1.14–1.36)	0.053	(0.032–0.073)
Non-regular employees	1.17	(1.10–1.26)	0.040	(0.023–0.057)
Self-employed workers	1.14	(1.04–1.25)	0.032	(0.010-0.055)
Family workers and others	1.01	(0.88–1.15)	0.002	(-0.031-0.034)
Non-workers	1.24	(1.17–1.32)	0.054	(0.039–0.068)
Total	1.19	(1.15–1.22)	0.033	(0.027–0.039)
Doctor visits				
Regular employees	1.23	(1.10–1.37)	0.043	(0.018–0.069)
Non-regular employees	0.94	(0.83 - 1.08)	-0.012	(-0.041-0.016)
Self-employees	1.08	(0.86–1.36)	0.018	(-0.036-0.072)
Family workers and others	0.99	(0.73–1.35)	-0.001	(-0.053 - 0.050)
Non-workers	1.13	(0.97–1.33)	0.031	(-0.008 - 0.070)
Total	1.15	(1.08–1.23)	0.033	(0.018-0.048)

Table 6. Estimated associations of health checkups and doctor visits with social activities

Controlled for covariates (see Table 5), individual- and wave-level fixed effects, and used individuallevel clustered standard errors. Used subsamples for each job status.

OR: Odds ratio; CI: Confidence interval.

pation in health checkups was supposed to be mandatory. Institutional factors that could influence the association between their social activities and health checkups were not examined, as mentioned in the Discussion section.

In Supplementary Tables 1 and 2, as adjuncts to Tables 5 and 6, respectively, present the estimation results obtained when we limited social activities to those performed with others. The results demonstrated similar patterns and confirmed the robustness of the main findings, although the magnitude of association was slightly lower compared to the broader definition.

Discussion

We examined the extent to which participation in social activities encouraged middle-aged Japanese people to attend health checkups and adhere to doctor-visit recommendations. Compared to previous studies, our study utilized larger-scale data obtained from a nationwide, populationbased longitudinal survey, which enabled us to cover all types of job statuses, including self-employed workers and non-workers, and control for individual factors.

Participation in health checkups was positively associated with participation in social activities across all job types and, albeit limited to regular employees, with adherence to doctor-visit recommendations. These results are generally consistent with those of previous observations^{21, 26)} that social capital, which is likely enhanced by interactions with others through social activities, tends to promote medical care utilization. Social activities were closely associated with health checkups, even after controlling for individuallevel attributes potentially affecting both, underscoring the independent impact of social activities on health checkups. In comparison, the relevance of social activities was more limited to adherence to doctor-visit recommendations; social activities encouraged only regular employees. This result suggests that participation in social activities affects health-oriented behavior, particularly with limited work flexibility, which may impede it.

Moreover, social activities were positively associated with participation in health checkups and adherence to doctor-visit recommendations, even if social activities were limited to those performed with others. However, the magnitude of the association was slightly lower than that for the broader definition, suggesting that engagement in any social activity mattered more effectively than did the actual interaction with others during health checkups and doctor visits.

It cannot be unequivocally concluded that participation in health checkups was positively associated with participation in social activities among regular employees, considering that these employees were compulsorily supposed to undergo health checkups¹³⁾. Our interpretation is that participation in social activities encouraged them to undergo a health checkup just like other categories of workers, in line with a view that social participation can promote a positive psychological inclination towards selfcare and appropriate medical care utilization^{21, 23)}. This interpretation was confirmed by the results of the FE analysis, which took into account individuals' fixed effects.

However, we cannot exclude another interpretation of the results, besides potential errors in reporting health check participation. For example, regular employees who have more flexibility in allocating hours and other resources between work and non-work domains can easily engage in social activities as well as undergo a health checkup; this flexibility gives them an advantage over non-regular employees and other workers. This interpretation would require us to be cautious in evaluating the positive effect of social activities on health checkups.

The observed positive association between social activities, participation in health checkups, and adherence to doctor-visit recommendations may have two alternative and conflicting implications. First, from the perspective of health promotion, policy measures to support social activities are welcome to encourage people to participate in health checkups and thereby improve public health. This seems to be particularly true at the local community level, considering that health checkups for the self-employed and family workers and non-workers are usually voluntary and provided by local authorities.

An alternative implication is that caution should be exercised when evaluating the effectiveness of health checkups. The fact that participants in social activities were more likely to participate in health checkups may imply that the health-promoting effect of health checkups, if any, may at least partly reflect the favorable impact of social activities on health.

This study had several limitations. First, our sample was limited to middle-aged Japanese people, and statistical analyses were based on repeated observations over waves, requiring caution in any generalization of the obtained results. The association between social activities and health checkups may change with age; in particular, job status and opportunities to participate in social activities are likely to change after retirement from primary jobs, a mechanism not discussed in this study.

Second, we ignored the density, frequency, multiplicity, and satisfaction associated with social activities, all of which can affect the impact of social activities on health checkups and doctor visits. Another unaddressed issue was the type of social activity that mattered the most, as hobbies or entertainment were the most popular in the current dataset.

Third, a more detailed analysis is required to identify the effectiveness of health checkups by controlling for the effects of participation in social activities on health. We cannot exclude the possibility that health checkups and recommended doctor visits may act as mediators of social activities on health outcomes.

Fourth, we did not consider potential autocorrelations. The experience of health checkups and recommended doctor visits may affect an individual's current behavior, and if this is the case, the estimated effect of participation in social activities could have been overestimated.

Within the limitations of this study, the results highlight the importance of participation in social activities for an individual's decision to participate in health checkups and recommended doctor visits. Although the effectiveness of health checkups remains debatable, participation in social activities should be considered when designing and managing health checkups at both organizational and community levels.

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