



## Does poor spousal health negatively affect own health among elderly retired Japanese couples? A 1-year follow-up study

Yoko Muramatsu<sup>a,1</sup>, Kuniyasu Takagi<sup>b,1</sup>, Tomoko Suzuki<sup>c</sup>, Bibha Dhungel<sup>d,e</sup>,  
Akihiro Tsuchiya<sup>b</sup>, Koji Wada<sup>b,c,\*</sup>

<sup>a</sup> NLI Research Institute (A Member of the Nippon Life Insurance Company Group), 4-1-7 Kudankita, Chiyoda-ku, Tokyo, 102-0073, Japan

<sup>b</sup> Department of Social Medical Sciences, Graduate School of Medicine, International University of Health and Welfare, 4-1-26 Akasaka, Minato City, Tokyo, 107-8402, Japan

<sup>c</sup> Department of Public Health, School of Medicine, International University of Health and Welfare, 4-3 Kozunomori, Narita, Chiba, 286-8686, Japan

<sup>d</sup> Department of Public Health, Graduate School of Public Health, St. Luke's International University, 10-1 Akashicho, Chuo City, Tokyo, 104-0044, Japan

<sup>e</sup> Department of Health Policy, National Centre for Child Health and Development, 2-10-1 Okura, Setagaya City, Tokyo, 157-0074, Japan

### ARTICLE INFO

#### Keywords:

Spousal health  
Longitudinal study  
Worsening health  
Self-rated health  
Retirement  
Japan

### ABSTRACT

**Background:** We aimed to determine whether poor spousal health affected respondents' own self-rated health after 1 year among older retired Japanese couples.

**Methods:** Data were extracted from the nationwide population-based survey, the "Longitudinal Survey of Middle-aged and Elderly Persons", which has been conducted annually since 2005 by the Japanese Ministry of Health, Labour and Welfare. We used 2016 survey data as a baseline and 2017 data for 1-year follow-up. Baseline respondents comprised 21,916 individuals; of these, we focused on 4397 respondents who were retired, married, aged 65–70 years, and had good self-rated health. The survey included questions about respondents' own health and lifestyle, and their spouses' health status. Multivariate logistic regression analysis was used to explore the association between spousal health at baseline and respondents' own self-rated health after 1 year.

**Results:** We found that poor spousal health is associated with respondents' own self-rated poor health after 1 year. The odds ratio (OR) for worsening health was 1.67 (95% confidence interval (CI): 1.11–2.52) for men and 1.72 (95% CI: 1.25–2.37) for women when their spouse's health was "somewhat bad". The OR was 2.25 (95% CI: 1.40–3.62) for women when spousal health was "bad/very bad", compared with "somewhat good". Conversely, good spousal health was associated with a low risk of declining health for respondents after 1 year. The association for men was apparent when their spouse's health was "good" [OR: 0.69; 95% CI: 0.49–0.98], and the association for women was apparent when their spouse's health was "very good" [OR: 0.46; 95% CI: 0.24–0.90].

**Conclusions:** Poor spousal health is an independent factor that negatively affects own self-rated health after 1 year among retired couples in Japan aged 65–70 years.

### 1. Introduction

It is important for elderly couples in retirement to support one another's health. Among the indicators of health status, self-rated health is of particular interest because it is one of the predictors of mortality, chronic diseases, health behaviors, symptoms, and functional limitations (Dominick et al., 2002; Ganna & Ingelsson, 2015; Kawada, 2003; Stenholm et al., 2014). Despite aging and illness, elderly people may be able to maintain and improve their health through positive attitudes,

such as having realistic health expectations and rating their own health as good even if they have chronic diseases and functional disabilities (Ferraro, 1980; Liang et al., 2005; Stenholm et al., 2014).

Factors that improve self-rated health have long been studied. Many studies attribute these factors to individual factors such as medical history, health habits, employment status, neighborhood environments (Liu et al., 2018), and social contacts (Kang et al., 2019; Pinillos-Franco & García-Prieto, 2017). However, some studies have broadened the focus from the individual to analyze the effects of participation in social communities, communication in families (Kang et al., 2019), marital

\* Corresponding author. Department of Social Medical Sciences, Graduate School of Medicine, International University of Health and Welfare, 4-1-26 Akasaka, Minato City, Tokyo, 107-8402, Japan.

E-mail address: [kwada-sgy@umin.ac.jp](mailto:kwada-sgy@umin.ac.jp) (K. Wada).

<sup>1</sup> Equally contributed.

<https://doi.org/10.1016/j.ssmph.2021.100970>

Received 21 August 2021; Received in revised form 11 November 2021; Accepted 13 November 2021

Available online 16 November 2021

This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

### Abbreviations

<b>MHLW</b>	Ministry of Health, Labour and Welfare
<b>OR</b>	odds ratio
<b>CI</b>	confidence interval

status (Liu & Umberson, 2008), and the effect of serious spousal health events or death (Hagedoorn et al., 2001; Meyler et al., 2007; Valle et al., 2013). One systematic review of 103 articles found a strong association between marriage and health status; it showed that couples often have similar or concordant health statuses and health behaviors (Meyler et al., 2007). Many other studies have shown that when one spouse becomes seriously ill, the psychological or physical health of the other spouse is often affected (Hagedoorn et al., 2001; Valle et al., 2013).

Three reasons are typically offered to explain health concordance within couples. First, couples tend to engage in similar or concordant health behaviors. That is, people with similar interests and orientations are more likely to marry; therefore, couples share social and economic resources that determine their health status. Second, couples monitor each other and try to keep each other healthy. Third, mental health concordance has been reported in families and couples (Meyler et al., 2007). Several studies have shown that health concordance increases with time spent together (Meyler et al., 2007; Ross et al., 1990). Additionally, evidence suggests that the health behaviors of husbands and wives affect each other: improvements in one spouse's health behavior positively affect their spouse's health behavior (Falba & Sindelar, 2008; Jackson et al., 2015). Moreover, an analysis of East Asian countries showed that self-rated health increases with marital satisfaction (Chung & Kim, 2014).

The effect of marital relationships on self-rated health may vary across countries and regions (Peek et al., 2006). Japan has one of the most aged populations in the world and maintaining self-rated health in old age is becoming increasingly important. There is evidence that the effect of spousal health on self-rated health increases by 11% every year (Sargent-Cox et al., 2010). Therefore, in this study, we aimed to determine whether poor spousal health affected respondents' own self-rated health after 1 year using data from Japanese retirees of both genders. We also analyzed the risk factors for poor self-rated health. To focus on our population of interest, we limited our analysis to married men and women aged 65 years or older who had retired from work and who reported good self-rated health at baseline.

## 2. Methods

### 2.1. Participants

This study used paneled data from a nationwide, population-based survey in Japan, the "Longitudinal Survey of Middle-aged and Elderly Persons", which has been conducted annually by the Japanese Ministry of Health, Labour and Welfare (MHLW) since 2005. This survey is conducted on middle-aged and older people of both genders across Japan to continuously monitor their attitudinal changes toward and actual changes in their health, employment, and social activities. The first to the fifth survey were administered by surveyors; all subsequent surveys have been administered by mail. Survey respondents were randomly selected using a two-stage sampling process. First, 2515 of the 5280 census areas listed in the 2004 population-based "Comprehensive Survey of Living Conditions", conducted by the MHLW, were randomly selected. At baseline, all men and women from these districts who were aged 50–59 years at the end of October 2005 were eligible for inclusion. Second, 40,877 residents aged 50–59 years were randomly chosen from each of the selected areas, in proportion to their population size. A total

of 34,240 respondents comprised the first survey wave (response rate 83.8%).

We used the latest data from the 12th (2016) and 13th (2017) waves of the survey, which contained 21,916 and 21,168 original respondents, respectively and contained all the key variables that were required for the analysis. The response rate for the 13th wave was 95.5% of that for the 12th wave. In this study, the 12th wave (2016) was used as the baseline and the 13th wave (2017) was used to provide 1-year follow-up data to allow time for spousal health to affect one's own health. To assess the effect of poor spousal health, we analyzed post-retirees that had very good, good, or somewhat good self-rated health at baseline (2016). We limited our analysis to post-retirees because work is strongly associated with health status (Oshio & Kan, 2017; Pietiläinen et al., 2011). We defined a person as retired if they did not have an income-generating job.

The flow chart in Fig. 1 shows the process of extracting the target population. First, from the 21,168 respondents who had participated in the study in two consecutive years (i.e., at the baseline and 1 year later), we extracted those who had a spouse and were aged 65–70 years at baseline, producing 11,668 respondents. We then excluded respondents who were still working at baseline ( $n = 5484$ ), and those who reported any negative self-rated health at baseline ( $n = 1561$ ). Finally, the exclusion of respondents with missing values resulted in 4397 participants (1664 men and 2733 women), who were included in the analysis. Of the participants, 99.6% of men and 99.1% of women lived with their spouses.

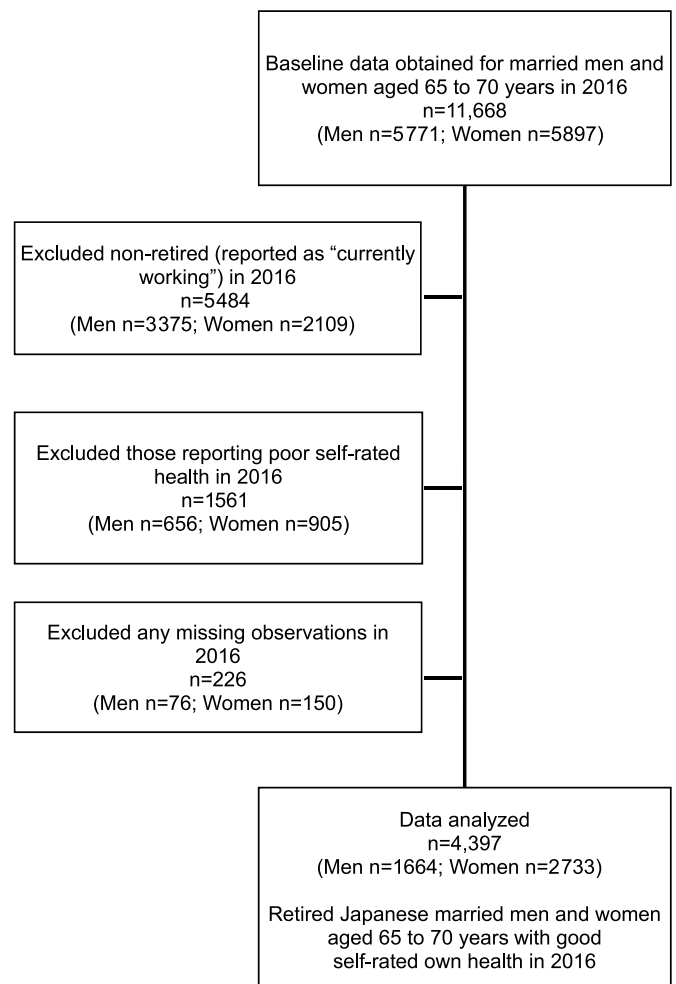


Fig. 1. Flow diagram of the extraction of the population analyzed.

## 2.2. Outcome variable

The outcome in the present study was respondent worsening self-rated health after 1 year (2017) despite good respondent self-rated health at baseline (2016). The following question was used to evaluate self-rated health: "How is your current health?". In response, participants rated their health on a six-level scale: "very good", "good", "somewhat good", "somewhat bad", "bad", and "very bad". The responses "very good", "good", and "somewhat good" were defined as good self-rated health. A change in self-rated health from "very good", "good", or "somewhat good" at baseline (2016) to "somewhat bad", "bad", or "very bad" after 1 year (2017) was defined as indicating worsening health.

## 2.3. Other variates

We also evaluated the health condition of respondents' spouses and the following behaviors: frequency of alcohol consumption, current smoking, and exercise. The following demographic variables were also assessed: gender, age, and educational attainment. To prevent reverse causality, we used the results at baseline (2016) as explanatory variables.

To assess spousal health status, respondents were asked, "How is your spouse's current health?". Each item was rated on a six-level scale: "very good", "good", "somewhat good", "somewhat bad", "bad", and "very bad". We further reduced these to five levels: "very good", "good", "somewhat good", "somewhat bad", and "bad/very bad".

The question, "How often do you usually drink alcohol?" was used to determine respondents' drinking frequency. Respondents chose from six possible categories: "rarely or never", "1–3 days a month", "1–2 days a week", "3–4 days a week", "5–6 days a week", and "daily". Current smoking habits were ascertained using the question, "Do you currently smoke?". Respondents who answered "yes" were categorized as current smokers; those who answered "no" were categorized as current non-smokers. Respondents chose one of the following five frequency categories to self-report their moderate-intensity exercise frequency: "never", "1 day a month to 1 day a week", "2–3 days a week", "4–5 days a week", and "almost every day".

Educational attainment comprised five category choices: "junior high school", "high school", "vocational school/junior college/technical college", "university or graduate school", and "other".

## 2.4. Statistical analysis

Using chi-square tests, we first estimated which variables affected declining self-rated health by comparing the composition of each variable for those whose self-rated health had worsened and for those whose health had not worsened after 1 year. Univariate logistic regression analysis was first used to evaluate the odds ratio (OR) and 95% confidence interval (95% CI) for worsening self-rated health of respondents after 1 year. Then, multivariate logistic regression analysis was performed, including variables for demographics and lifestyle habits (education, smoking, exercise, and alcohol consumption status, as well as gender and age) to identify the risk factors for poor self-rated health. The significance level was based on a two-tailed test of 0.05. Analyses were conducted using STATA 15.0 for Windows (Stata Corp LP, College Station, TX, USA).

## 3. Results

Table 1 summarizes the descriptive statistics of the analyzed sample. It shows that men and women had similar distributions of respondent self-rated health and spousal health. Approximately 14% of both men and women who were in good self-rated health at baseline reported worse health in the following year. Approximately half of men and women reported that their spouse's health condition at the baseline was

**Table 1**  
Participant characteristics.

Variables (at baseline)	Men (n = 1664)		Women (n = 2733)	
	N	(%)	N	(%)
Age				
65	208	(12.5)	413	(15.1)
66	245	(14.7)	408	(14.9)
67	327	(19.7)	534	(19.5)
68	300	(18.0)	532	(19.5)
69	343	(20.6)	496	(18.1)
70	241	(14.5)	350	(12.8)
Smoking habits				
Current non-smoker	1303	(78.3)	2624	(96.0)
Current smoker	361	(21.7)	109	(4.0)
Frequency of drinking				
Rarely or never	519	(31.2)	2023	(74.0)
1–3 days a month	92	(5.5)	157	(5.7)
1–2 days a week	107	(6.4)	135	(4.9)
3–4 days a week	136	(8.2)	122	(4.5)
5–6 days a week	180	(10.8)	101	(3.7)
Daily	630	(37.9)	195	(7.1)
Frequency of moderate-intensity exercise				
Not	661	(39.7)	1286	(47.1)
One day a month to one day a week	204	(12.3)	435	(15.9)
2–3 days a week	300	(18.0)	465	(17.0)
4–5 days a week	167	(10.0)	250	(9.1)
Almost every day	332	(20.0)	297	(10.9)
Educational attainment				
Junior high school	254	(15.3)	415	(15.2)
High school	798	(48.0)	1481	(54.2)
Vocational school, junior college/technical college	111	(6.7)	642	(23.5)
University or graduate school	501	(30.1)	189	(6.9)
Other	0	(0.0)	6	(0.2)
Spousal health condition				
Very good	98	(5.9)	161	(5.9)
Good	536	(32.2)	788	(28.8)
Somewhat good	805	(48.4)	1368	(50.1)
Somewhat bad	183	(11.0)	313	(11.5)
Bad/very bad	42	(2.5)	103	(3.8)
Respondent's own health condition at baseline				
Very good	87	(5.2)	121	(4.4)
Good	582	(35.0)	924	(33.8)
Somewhat good	995	(59.8)	1688	(61.8)
Respondent's own health condition after one year				
Very good	83	(5.0)	116	(4.2)
Good	517	(31.1)	766	(28.0)
Somewhat good	833	(50.1)	1478	(54.1)
Somewhat bad	203	(12.2)	348	(12.7)
Bad/very bad	28	(1.7)	25	(0.9)
Worsening self-rated health after one year				
Worsened	231	(13.9)	373	(13.6)
Not worsened	1433	(86.1)	2360	(86.4)

"somewhat good", approximately 35% reported "very good" or "good", and approximately 15% reported "somewhat bad" to "very bad". Less than 5% of all respondents reported that their spouse's health was "bad/very bad".

Smoking was less common among women, with only 4% of women compared with 21.7% of men categorized as "current smokers" at baseline. The distributions of drinking frequency were completely different for men and women. Men most frequently reported "daily" or "rarely or never drinking" (approximately 30% in each category), whereas 74.0% of women reported "rarely or never drinking". Fewer men than women reported doing no moderate-intensity exercise: 39.7% and 47.1%, respectively. Of participants who engaged in moderate-intensity exercise, men were more likely to exercise "almost every day" and women were more likely to exercise "1 day a month" to "2–3 days a week", indicating that men were generally more likely to engage in moderate-intensity exercise more often. Regarding educational attainment, about half of both men (48.0%) and women (54.2%) had graduated from high school.

Table 2 shows the results of the chi-square tests comparing the distribution of spousal health and other variables between respondents whose own self-rated health worsened and for those whose self-rated health did not worsen after 1 year. When spousal health was “very good”, less than 10% of corresponding partners (respondents) reported worse health in the following year. However, when spousal health was “somewhat bad”, “bad”, or “very bad”, this proportion increased to approximately 20%. Both men and women who were “current smokers” at baseline, and who did not engage in moderate-intensity exercise, reported worsened self-rated health. Men who “rarely or never” consumed alcohol, who drank “1–2 days a week”, or who drank “every day” reported worsened self-rated health. Those with lower educational level also tended to report worsened self-rated health.

Table 3 shows the results of the univariate and multivariate logistic regression analysis on declining respondents’ self-rated health, spousal health condition, and other variables. The analysis showed that poor spousal health was positively associated with partner (respondent) declining self-rated health in the following year. The association with respondent self-rated health was particularly large for women whose spouse’s health condition was bad; for men, compared with “somewhat good” spousal health, the association was apparent when their spouse’s health was “somewhat bad” [OR: 1.67; 95% CI: 1.11–2.52], and when it was “bad/very bad” [OR: 1.26; CI: 0.56–2.85]. For women, the effect was strong when their spouse’s health was “somewhat bad” (compared with “somewhat good”) [OR: 1.72; CI: 1.25–2.37], and when it was “bad/very bad” [OR: 2.25; CI: 1.40–3.62].

Conversely, good spousal health was associated with a low risk of declining health for respondents after 1 year. For men, the effect was apparent when their spouse’s health was “good” [OR: 0.69; 95% CI: 0.49–0.98] compared with “somewhat good”. For women, the effect was apparent when their spouse’s health was “very good” [OR: 0.46; 95% CI: 0.24–0.90] compared with “somewhat good”.

Men and women who smoked tended to report worse self-rated

health after 1 year than those who did not [OR: 1.48; 95% CI: 1.06–2.05 for men and OR: 1.80; 95% CI: 1.11–2.92 for women]. Those who consumed alcohol regularly did not report worse self-rated health after 1 year than those who reported “rarely or never drinking”; this result was found only in men. Participants who engaged in moderate-intensity exercise did not report worse self-rated health after 1 year than those who did not exercise, and the OR was lowest for those who exercised almost daily. Participants with less education tended to have worse self-rated health after 1 year.

#### 4. Discussion

We aimed to determine whether poor spousal health affected respondents’ own self-rated health after 1 year among retired Japanese couples. Our findings showed that respondents’ self-rated health worsened after 1 year if spousal health was poor at baseline, even after adjusting for age, educational attainment, and health behaviors. Conversely, when spousal health was good at baseline, respondents’ self-rated health did not tend to worsen, and respondents maintained good self-rated health after 1 year. This indicates that spousal health is associated with partners health both positively and negatively. For women, the effect of their husbands’ health condition was greater than that of their own age, education, and health behaviors. This finding aligns with previous studies showing that respondents’ self-rated health declined when their spouses’ health status worsened in cases of hospitalization (Saito et al., 2016), onset of serious illness (Valle et al., 2013), and chronic illness (Hagedoorn et al., 2001).

Previous studies have suggested two main reasons why poor spousal health affects partners’ self-rated health. One, married couples have the same lifestyles and have shared risks of health deterioration (Meyler et al., 2007). Thus, if a couple has an unhealthy lifestyle and problems in their marital relationship, it is likely that they will both experience a decline in health. Two, if one partner becomes seriously ill, the daily life

**Table 2**

Associations between worsened respondent self-rated health after 1 year and other variables at baseline (men n = 1,664, women n = 2733).

Respondents’ self-rated health after one year (At the baseline)	Men			p-value <sup>a</sup>	Women			p-value <sup>a</sup>		
	Worsened (n = 231)		Not worsened (n = 1433)		Worsened (n = 373)		Not worsened (n = 2360)			
	n	(%)	n		(%)	n	(%)		n	(%)
Spousal health condition										
Very good	8	(8.2)	90	(91.8)	0.001	10	(6.2)	151	(93.8)	<0.001
Good	55	(10.3)	481	(89.7)		99	(12.6)	689	(87.4)	
Somewhat good	120	(14.9)	685	(85.1)		175	(12.8)	1193	(87.2)	
Somewhat bad	40	(21.9)	143	(78.1)		63	(20.1)	250	(79.9)	
Bad/very bad	8	(19.0)	34	(81.0)		26	(25.2)	77	(74.8)	
Smoking habit										
Current non-smoker	165	(12.7)	1138	(87.3)	0.006	349	(13.3)	2275	(86.7)	0.009
Current smoker	66	(18.3)	295	(81.7)		24	(22.0)	85	(78.0)	
Frequency of drinking										
Rarely or never	91	(17.5)	428	(82.5)	0.040	289	(14.3)	1734	(85.7)	0.507
1–3 days a month	10	(10.9)	82	(89.1)		23	(14.6)	134	(85.4)	
1–2 days a week	17	(15.9)	90	(84.1)		16	(11.9)	119	(88.1)	
3–4 days a week	14	(10.3)	122	(89.7)		13	(10.7)	109	(89.3)	
5–6 days a week	17	(9.4)	163	(90.6)		12	(11.9)	89	(88.1)	
Every day	82	(13.0)	548	(87.0)		20	(10.3)	175	(89.7)	
Frequency of moderate-intensity exercise										
Never	113	(17.1)	548	(82.9)	0.023	206	(16.0)	1080	(84.0)	0.010
One day a month to one day a week	30	(14.7)	174	(85.3)		50	(11.5)	385	(88.5)	
2–3 days a week	34	(11.3)	266	(88.7)		54	(11.6)	411	(88.4)	
4–5 days a week	18	(10.8)	149	(89.2)		34	(13.6)	216	(86.4)	
Almost every day	36	(10.8)	296	(89.2)		29	(9.8)	268	(90.2)	
Educational attainment										
Junior high school	53	(20.9)	201	(79.1)	<0.001	69	(16.6)	346	(83.4)	0.154
High school	121	(15.2)	677	(84.8)		201	(13.6)	1280	(86.4)	
Vocational school/junior college/technical college	17	(15.3)	94	(84.7)		78	(12.1)	564	(87.9)	
University or graduate school	40	(8.0)	461	(92.0)		23	(12.2)	166	(87.8)	
Other	0	(0.0)	0	(0.0)		2	(33.3)	4	(66.7)	

<sup>a</sup> Chi-square test.

**Table 3**  
Logistic regression analysis of worsening self-rated health of respondents after 1 year (men n = 1,664, women n = 2733).

	Men				Women			
	Univariate		Multivariable <sup>a</sup>		Univariate		Multivariable <sup>a</sup>	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Spouse's health condition								
Very good	0.51	(0.24–1.07)	0.54	(0.25–1.16)	0.45	(0.23–0.87)	0.46	(0.24–0.90)
Good	0.65	(0.46–0.92)	0.69	(0.49–0.98)	0.98	(0.75–1.28)	1.03	(0.79–1.34)
Somewhat good	Ref		Ref		Ref		ref	
Somewhat bad	1.60	(1.07–2.38)	1.67	(1.11–2.52)	1.72	(1.25–2.36)	1.72	(1.25–2.37)
Bad/very bad	1.34	(0.61–2.97)	1.26	(0.56–2.85)	2.30	(1.44–3.69)	2.25	(1.40–3.62)
Smoking habit								
Current non-smoker	Ref		Ref		Ref		Ref	
Current smoker	1.54	(1.13–2.11)	1.48	(1.06–2.05)	1.84	(1.15–2.94)	1.80	(1.11–2.92)
Frequency of drinking								
Rarely or never	Ref		Ref		Ref		Ref	
1–3 days a month	0.57	(0.29–1.15)	0.61	(0.30–1.25)	1.03	(0.65–1.63)	1.16	(0.73–1.85)
1–2 days a week	0.89	(0.50–1.56)	1.01	(0.56–1.80)	0.81	(0.47–1.38)	0.87	(0.51–1.51)
3–4 days a week	0.54	(0.30–0.98)	0.60	(0.32–1.11)	0.72	(0.40–1.29)	0.73	(0.40–1.32)
5–6 days a week	0.49	(0.28–0.85)	0.54	(0.31–0.94)	0.81	(0.44–1.50)	0.90	(0.49–1.69)
Daily	0.70	(0.51–0.97)	0.69	(0.49–0.97)	0.69	(0.42–1.11)	0.66	(0.40–1.07)
Frequency of moderate-intensity exercise								
Never	Ref		Ref		Ref		Ref	
One day a month to one day a week	0.84	(0.54–1.29)	1.04	(0.66–1.64)	0.68	(0.49–0.95)	0.70	(0.50–0.98)
2–3 days a week	0.62	(0.41–0.93)	0.79	(0.52–1.20)	0.69	(0.50–0.95)	0.73	(0.52–1.01)
4–5 days a week	0.59	(0.35–0.99)	0.68	(0.39–1.16)	0.83	(0.56–1.22)	0.82	(0.55–1.22)
Almost every day	0.59	(0.40–0.88)	0.68	(0.45–1.03)	0.57	(0.38–0.86)	0.60	(0.40–0.91)
Educational attainment								
Junior high school	1.48	(1.03–2.11)	1.30	(0.90–1.88)	1.27	(0.94–1.71)	1.21	(0.89–1.63)
High school	Ref		Ref		Ref		Ref	
Vocational school, junior college/technical college	1.01	(0.58–1.76)	0.97	(0.55–1.71)	0.88	(0.67–1.16)	0.90	(0.68–1.20)
University or graduate school	0.49	(0.33–0.71)	0.52	(0.36–0.77)	0.88	(0.56–1.40)	0.86	(0.54–1.37)
Others	–		–		3.18	(0.58–17.5)	3.41	(0.62–18.9)

Ref: Reference; OR: Odds ratio; CI: Confidence interval.

<sup>a</sup> Multivariable: model adjusted for all independent variables.

of the other partner may substantially change (e.g., if they have to make hospital visits or do more housework); if homecare is needed, there is a greater burden on the carer. Poor communication owing to a spouse's illness is another factor that may reduce self-rated health (Kang et al., 2019). We consider both factors to be influential. A partner's life changes when their spouse has a serious illness; however, even non-serious spousal illness can have a negative effect on a partner's feelings, resulting in anxiety or depression. However, respondents in this study tended to maintain good self-rated health when their spouse's health condition was good. As with wellbeing or happiness, the self-rated health of a married couple increases when they are satisfied with their marriage (Hoppmann et al., 2011; Park & Lee, 2013). Therefore, if the self-rated health of one partner is good, the other partner may also be able to maintain good self-rated health (Chung & Kim, 2014).

The effects of spousal health deterioration differ between men and women. For example, one study that analyzed the short- and long-term effects of a spouse's severe health problem, disability, or death on their partner's physical and mental health reported that women's mental health and men's self-rated health worsened (Valle et al., 2013). Another study demonstrated that there was a link between women's psychological distress in relation to their own health and that of their spouses, whereas psychological distress in men was only associated with their own health (Hagedoorn et al., 2001). This suggests that men and women have different attitudes to spousal illness (Hagedoorn et al., 2001).

Previous studies have analyzed cases in which a spouse became seriously ill. Here, we evaluated spousal health using partners' (respondents') questionnaire responses, rather than a doctor's diagnosis (e.g., of severe illness). Studies on both self-ratings and spousal ratings of health show that self-rated health can be a predictor of death or the onset of serious illness (Ayalon & Covinsky, 2009). Therefore, our findings suggest that for elderly couples, the deterioration of one spouse's health may affect the other's self-rated health, even if the health problem is not a serious illness diagnosed in a hospital. Taking into account the fact that many of our participants lived with their spouses, it is also possible that worrying about one's spouse, changing one's daily life to accommodate one's spouse's health problems, and being negatively affected by their psychological distress, may contribute to the decline of one's own self-rated health, as well as adding to the burden of nursing and providing care.

In the present study, smoking was associated with worsening self-rated health, whereas drinking in men and exercising in women were associated with maintaining good self-rated health. Although no significant difference was observed, self-rated health in men also tended to improve if they exercised regularly and in women, if they drank regularly. The harmful effects of smoking are well recognized (Kang et al., 2019) and are reflected in the present findings. Because it is well recognized that drinking too much alcohol can be harmful to health, we presume that participants in the present study who reported drinking were either confident about their health or were drinking amounts that did not adversely affect their health. Similar results can be found in the literature (Kang et al., 2019; Park & Lee, 2013). Exercise is generally considered to have a positive effect on physical and mental health (Kang et al., 2019). The present findings also showed that regular exercise, especially among women, tended to help respondents maintain a sense of subjective health over the 1-year study period.

Lower education was positively associated with declining self-rated health for men and women, and higher education was associated with a low risk of declining self-rated health for men. Educational attainment generally improves cognitive abilities. Some studies have shown that the effect of educational attainment on self-rated health is greater for men than for women (Brown et al., 2013; Pinillos-Franco & García-Prieto, 2017). This is interpreted as indicating that compared with men, women have fewer socioeconomic resources (e.g., women have less economic independence and fewer opportunities for full-time work) and thus are

less affected by low access to education-related social resources (Brown et al., 2013; Pinillos-Franco & García-Prieto, 2017). An analysis of middle-aged Japanese men confirmed that self-rated health was worse among less-educated workers, even after adjusting for occupation and employment contract (Wada et al., 2015). The present analysis also shows that educational attainment can be a factor that worsens self-rated health for men, not only in working-age populations but also in retired populations. Healthcare providers should focus on the health of retired patients and their spouses providing interventions to improve health and wellbeing as their health are correlated. A positive environment with a flexible care-leave system should be established for adult employed children of middle-aged couples to better support their parents at the time of family crisis.

Our study has a few limitations. First, for simplicity, we only examined changes in respondents' self-rated health over a 1-year period; however, longer-term analysis is needed, as the spousal health status and health habits may have longer-lasting effects. Second, although self-rated health tends to worsen with age in Japan, some people experience improvements in health in their later years. In the present data, the number of respondents with poor self-rated health at baseline was very small, so we could not analyze factors that improved self-rated health. Additionally, various other factors that may affect self-rated health, such as medical history, length of marital relationship, and social networks, could not be adjusted for because we had no data on these factors. Third, we did not consider whether poor respondent self-rated health affected spousal health after 1 year, although we found that poor spousal health negatively affected respondents' self-rated health after 1 year. Similarly, as the responses on own self-rated health as well as spousal health were obtained from the respondent, the reported associations between spouse's and own health may be inflated due to shared methods variance. Hence, there is a need to replicate this study using dyadic data. There is a possibility of selection bias as we included only 4397 retired respondents with good health out of a total of 11,668 respondents in the baseline survey.

## 5. Conclusion

In both men and women, poor spousal health is an independent factor that is associated with poor self-rated health after 1 year among retired couples in Japan aged 65–70 years. Spousal health is independently associated with self-rated health even after controlling for lifestyle factors (smoking, drinking, and exercise) and social factors (educational background).

## Funding

This work was supported by the Japan Society for the Promotion of Science (JSPS) Kakenhi [grant number JP 17K09184].

## Declarations of interest

None.

## Availability of data and materials

Data are available from the Ministry of Health, Labour and Welfare, Japan, for researchers who meet the criteria for access to confidential data.

## Author contributions

Conceptualization: KW, KT, YM, TS; Data curation: YM, KT, KW; Formal Analysis: YM, KT, KW, TS; Funding acquisition: KW; Investigation: YM, KT, BD, Methodology: YM, KT, BD; Project Administration: YM, KT, TS, AT, KW; Resources: YM, KW; Supervision: TS, AT, KW; Validation: YM, KT, KW; Writing – original draft: YM, KW, KT, TS, AT;

Writing – review & editing: YM, KW, KT, TS, BD, AT. All authors have read and approved the final manuscript.

### Ethics statement

Ethical approval for this study was not required as the data were extracted from a national dataset that had been obtained by the Ministry of Health Labour and Welfare of Japan and did not contain any personally identifiable information.

### Acknowledgments

We thank Anita Harman and Diane Williams from Edanz Group for editing a draft of this manuscript.

### References

- Ayalon, L., & Covinsky, K. E. (2009). Spouse-rated vs self-rated health as predictors of mortality. *Archives of Internal Medicine*, 169(22), 2156–2161. <https://doi.org/10.1001/ARCHINTERNMED.2009.386>
- Brown, D. C., Hummer, R. A., & Hayward, M. D. (2013). The importance of spousal education for the self-rated health of married adults in the United States. *Population Research and Policy Review*, 33(1), 127–151. <https://doi.org/10.1007/S11113-013-9305-6>
- Chung, W., & Kim, R. (2014). Does marriage really matter to health? Intra- and inter-country evidence from China, Japan, taiwan, and the Republic of Korea. *PLoS One*, 9(8), Article e104868. <https://doi.org/10.1371/JOURNAL.PONE.0104868>
- Dominick, K. L., Ah\ern, F. M., Gold, C. H., & Heller, D. A. (2002). Relationship of health-related quality of life to health care utilization and mortality among older adults. *Aging Clinical and Experimental Research*, 14(6), 499–508. <https://doi.org/10.1007/BF03327351>
- Falba, T. A., & Sindelar, J. L. (2008). Spousal concordance in health behavior change. *Health Services Research*, 43(1 Pt 1), 96–116. <https://doi.org/10.1111/J.1475-6773.2007.00754.X>
- Ferraro, K. F. (1980). Self-ratings of health among the old and the old-old. *Journal of Health and Social Behavior*, 21(4), 377–383. <https://doi.org/10.2307/2136414>
- Ganna, A., & Ingelsson, E. (2015). 5 year mortality predictors in 498 103 UK biobank participants: A prospective population-based study. *The Lancet*, 386(9993), 533–540. [https://doi.org/10.1016/S0140-6736\(15\)60175-1/ATTACHMENT/6ECF1CA7-A91E-4339-9737-5F478762701A/MMC1.PDF](https://doi.org/10.1016/S0140-6736(15)60175-1/ATTACHMENT/6ECF1CA7-A91E-4339-9737-5F478762701A/MMC1.PDF)
- Hagedoorn, M., Sanderman, R., Ranchor, A.v., Brilman, E. I., Kempen, G. I. J. M., & Ormel, J. (2001). Chronic disease in elderly couples: Are women more responsive to their spouses' health condition than men? *Journal of Psychosomatic Research*, 51(5), 693–696. [https://doi.org/10.1016/S0022-3999\(01\)00279-3](https://doi.org/10.1016/S0022-3999(01)00279-3)
- Hoppmann, C. A., Gerstorf, D., Willis, S. L., & Schaie, K. W. (2011). Spousal interrelations in happiness in the seattle longitudinal study: Considerable similarities in levels and change over time. *Developmental Psychology*, 47(1), 1–8. <https://doi.org/10.1037/A0020788>
- Jackson, S. E., Steptoe, A., & Wardle, J. (2015). The influence of partner's behavior on health behavior change: The English longitudinal study of ageing. *JAMA Internal Medicine*, 175(3), 385–392. <https://doi.org/10.1001/JAMAINTERNMED.2014.7554>
- Kang, S. Y., Lee, J. A., & Kim, Y. S. (2019). Impact of family communication on self-rated health of couples who visited primary care physicians: A cross-sectional analysis of family cohort study in primary care. *PLoS One*, 14(3), Article e0213427. <https://doi.org/10.1371/JOURNAL.PONE.0213427>
- Kawada, T. (2003). Self-rated health and life prognosis. *Archives of Medical Research*, 34(4), 343–347. [https://doi.org/10.1016/S0188-4409\(03\)00052-3](https://doi.org/10.1016/S0188-4409(03)00052-3)
- Liang, J., Shaw, B. A., Krause, N., Bennett, J. M., Kobayashi, E., Fukaya, T., & Sugihara, Y. (2005). How does self-assessed health change with age? A study of older adults in Japan. *Journal of Gerontology: Serie Bibliographique*, 60(4), S224–S232. <https://doi.org/10.1093/GERONB/60.4.S224>
- Liu, H., & Umberson, D. J. (2008). The times they are a changin': Marital status and health differentials from 1972 to 2003. *Journal of Health and Social Behavior*, 49(3), 239–253. <https://doi.org/10.1177/002214650804900301>
- Liu, J., Luo, Y., Haller, W., Vander Mey, B., & Granberg, E. (2018). Neighborhood environments and self-rated health in Mainland China, Japan and South Korea. *PLoS One*, 13(9), Article e0204910. <https://doi.org/10.1371/JOURNAL.PONE.0204910>
- Meyler, D., Stimpson, J. P., & Peek, M. K. (2007). Health concordance within couples: A systematic review. *Social Science & Medicine*, 64(11), 2297–2310. <https://doi.org/10.1016/J.SOCSCIMED.2007.02.007>
- Oshio, T., & Kan, M. (2017). The dynamic impact of retirement on health: Evidence from a nationwide ten-year panel survey in Japan. *Preventive Medicine*, 100, 287–293. <https://doi.org/10.1016/J.YPMED.2017.04.007>
- Park, J. H., & Lee, K. S. (2013). Self-rated health and its determinants in Japan and South Korea. *Public Health*, 127(9), 834–843. <https://doi.org/10.1016/J.PUHE.2012.12.012>
- Peek, M. K., Stimpson, J. P., Townsend, A. L., & Markides, K. S. (2006). Well-being in older Mexican American spouses. *The Gerontologist*, 46(2), 258–265. <https://doi.org/10.1093/GERONT/46.2.258>
- Pietiläinen, O., Laaksonen, M., Rahkonen, O., & Lahelma, E. (2011). Self-rated health as a predictor of disability retirement – the contribution of ill-health and working conditions. *PLoS One*, 6(9), Article e25004. <https://doi.org/10.1371/JOURNAL.PONE.0025004>
- Pinillos-Franco, S., & García-Prieto, C. (2017). The gender gap in self-rated health and education in Spain. A multilevel analysis. *PLoS One*, 12(12), Article e0187823. <https://doi.org/10.1371/JOURNAL.PONE.0187823>
- Ross, C. E., Mirowsky, J., & Goldstein, K. (1990). The impact of the family on health: The decade in review. *Journal of Marriage and Family*, 52(4), 1059. <https://doi.org/10.2307/353319>
- Saito, T., Wakui, T., & Kai, I. (2016). Effects of spousal illness on self-rated health in older couples: Role of sex and proximity to adult children. *Geriatrics and Gerontology International*, 16(12), 1332–1338. <https://doi.org/10.1111/GGI.12646>
- Sargent-Cox, K. A., Anstey, K. J., & Luszcz, M. A. (2010). Patterns of longitudinal change in older adults' self-rated health: the effect of the point of reference. *Health Psychology*, 29(2), 143–152. <https://doi.org/10.1037/A0017652>
- Stenholm, S., Pentti, J., Kawachi, I., Westerlund, H., Kivimäki, M., & Vahtera, J. (2014). Self-rated health in the last 12 Years of life compared to matched surviving controls: The health and retirement study. *PLoS One*, 9(9), Article e107879. <https://doi.org/10.1371/JOURNAL.PONE.0107879>
- Valle, G., Weeks, J. A., Taylor, M. G., & Eberstein, I. W. (2013). Mental and physical health consequences of spousal health shocks among older adults. *Journal of Aging and Health*, 25(7), 1121–1142. <https://doi.org/10.1177/0898264313494800>
- Wada, K., Higuchi, Y., & Smith, D. R. (2015). Socioeconomic status and self-reported health among middle-aged Japanese men: Results from a nationwide longitudinal study. *BMJ Open*, 5(6), Article e008178. <https://doi.org/10.1136/BMJOPEN-2015-008178>