

- Kawachi, I., Hirai, H., Shirai K., Ishikawa, Y., Suzuki, K., and The JAGES Group 2014. Social Participation and the Prevention of Functional Disability in older Japanese: the AGES Cohort Study. *PloS. One* 9 (6), e99638.
- Kondo, N., Kawachi, I., Hirai, H., Kondo, K., Subramanian, S. V., Hanibuchi, T., Yamagata, Z. 2009. Relative deprivation and incident functional disability among older Japanese women and men: prospective cohort study. *J. Epidemiol. Community Health* 63 (6), 461–467.
- Li, Y., Ferraro, K.F. 2005. Volunteering and depression in later life: social benefit or selection processes? *J. Health Soc. Beh.* 46 (1), 68–84.
- Liao WC, Li CR, Lin YC, Wang CC, Chen YJ, et al. 2011. Healthy behaviors and onset of functional disability in older adults: results of a national longitudinal study. *Journal of the American geriatrics society* 59: 200–206.
- Lum, TY, Lightfoot E. 2005. The effects of volunteering on the physical and mental health of older people. *Res. Aging* 27 (1), 31–55.
- Ministry of Health, Labour and Welfare 2000(a). Survey on the trend of medical care expenditures Available from, <http://www.mhlw.go.jp/topics/medias/s-med/00/1.html>(Date Accessed – 10/10/14). (in Japanese)
- Ministry of Health, Labour and Welfare 2012(b). Survey on the trend of medical care expenditures Available from, <http://www.mhlw.go.jp/topics/medias/year/12/index.html>(Date Accessed – 10/10/14). (in Japanese)
- Ministry of Health, Labour and Welfare (c). Trend in long term care benefit expenditure and insurance fee. Available from, <http://www.mhlw.go.jp/topics/kaigo/zaisei/sikumi.html> (Date Accessed – 10/10/14). (in Japanese)
- Moore, G. 1990. Structural determinants of men's and women's personal networks. *Am. Sociol. Rev.* 55 (5), 726–735.
- Musick, M.A., Wilson, J. 2003. Volunteering and depression: the role of psychological and social resources in different age groups. *Soc. Sci. Med.* 56 (2), 259–269.
- Nishi, A., Kondo, K., Hirai, H., Kawachi, I. 2011. Cohort profile: the AGES 2003 Cohort Study in Aichi, Japan. *J. Epidemiol.* 21 (2), 151–157.
- Sisson, K.L. Theoretical explanations for social inequalities in oral health. 2007. *Community Dent. Oral. Epidemiol.* 35 (2), 81–88.
- Socialist Health Association. 1980. The black report 1980. Available from, <http://www.sochealth.co.uk/resources/public-health-and-wellbeing/poverty-and-inequality/the-black-report-1980/> (Date Accessed – 10/10/14.).
- Takeda, T., Kondo, K., Hirai, H. 2010. Psychosocial risk factors involved in

- progressive dementia-associated senility among the elderly residing at home: AGES project—three year cohort longitudinal study. *Nihon Koshu Eisei Zasshi* 57 (12),1054-1065. (in Japanese)
- Väänänen, A., Murray, M., Koshinen, A., Vahtera, J., Kouvonen, A., Kivimäki, M. 2009. Engagement in cultural activities and cause-specific mortality: prospective cohort study. *Prev. Med.* 49 (2–3),142–147.
- Yoshida, H., Fujiwara, Y., Amano, H., Kumagai, S., Watanabe, N., Sangyoon, L., Mori, S., Shinkai S. 2007. Economic evaluation of disability prevention programs for community-dwelling elderly – secular trend analyses of medical and care expenses comparing participants and non-participants in the programs. *Nihon Koshu Eisei Zasshi* 54 (3), 156–167. (in Japanese)

**Table 1.** Incidence rates (1,000 person-years) of functional disability by subjects' characteristics based on data from the Japan Aichi Gerontological Evaluation Study (AGES)

	Men		Women	
	n (%)	Incidence rate (95% CI)	n (%)	Incidence rate (95% CI)
Age (years)				
65–69	2,472 (40.0)	9.7 (7.9,11.9)	2,273 (34.2)	8.4 (6.7,10.5)
70–74	1,938 (30.5)	16.6 (14.1,20.0)	1,860 (28.0)	20.7 (17.7,24.4)
75–79	1,237 (19.5)	40.9 (35.4,47.2)	1,474 (22.2)	49.1 (43.6,55.4)
80+	698 (11.0)	94.1 (82.5,107.4)	1,039 (15.6)	125.8 (114.2,138.5)
Marital status				
Married	5,287 (83.3)	43.7 (20.7,24.9)	3,401 (51.2)	22.4 (20.0,25.2)
Widowed/Divorced	589 (9.3)	53.3 (44.3,64.1)	2,603 (39.2)	54.1 (49.6,59.0)
Single	36 (0.57)	22.3 (7.2,69.2)	184 (2.8)	47.2 (33.6,66.7)

Other/Missing	433 (6.8)	33.0 (25.3,43.0)	458 (6.9)	41.5 (32.9,52.4)
Medical condition (3 major diseases <sup>a</sup> )				
Yes	1,348 (21.3)	34.9 (30.1,40.4)	948 (14.3)	59.6 (52.0,68.4)
No	4,997 (78.8)	23.7 (21.6,26.0)	5,698 (85.7)	32.7 (30.4,35.2)
Employment status				
Yes	2,048 (32.3)	12.0 (9.8,14.6)	1,169 (17.6)	16.5 (13.2,20.7)
No	4,188 (66.0)	32.9 (30.2,35.9)	5,325 (80.1)	40.5 (37.8,43.4)
Missing	109 (1.7)	34.2 (20.3,57.7)	152 (2.30)	51.9 (36.0,74.6)
Equivalized income (million yen)				
<1.99	2,192 (34.6)	26.4 (23.1,30.1)	2,115 (31.8)	35.7 (31.7,40.0)
2.00–3.99	2,725 (43.0)	22.2 (19.5,25.2)	1,992 (30.0)	25.3 (22.0,29.2)
4.00+	649 (10.2)	20.0 (15.2,26.4)	575 (8.7)	35.5 (28.3,44.4)
Missing	779 (12.3)	44.1 (37.1,52.5)	1,964 (30)	49.1 (44.2,54.5)
Educational attainment (years)				
Very low ( $\leq 5$ )	143 (2.3)	63.9 (45.2,90.3)	399 (6.0)	93.7 (78.7,111.7)
Low (6–9)	3,230 (50.9)	29.9 (27.0,33.1)	3,604 (54.2)	32.4 (29.5,35.5)
Middle (10–12)	1,709 (26.9)	20.3 (17.2,24.1)	1,921 (28.9)	31.7 (27.8,36.1)
High ( $\geq 13$ )	874 (13.8)	17.4 (13.5,22.5)	328 (4.9)	30.0 (21.7,41.3)
Other/Missing	389 (6.1)	26.3 (19.2,36.0)	394 (5.9)	50.5 (40.1,63.5)
Participation in group activities				
Sports group or club				
Yes	1,251 (22.3)	13.7 (10.8,17.4)	1,127 (19.9)	13.9 (10.8,17.8)
No	4,351 (77.7)	27.2 (24.8,29.9)	4,537 (80.1)	39.1 (36.2,42.2)
Hobby group				
Yes	1,549 (27.4)	16.3 (13.4,19.8)	2,016 (35.1)	19.9 (17.0,23.3)

No	4,096 (72.6)	26.6 (24.1,29.3)	3,728 (64.9)	42.0 (38.7,45.6)
Volunteer group				
Yes	623 (11.1)	14.5 (10.4,20.2)	563 (9.9)	18.0 (13.1,24.6)
No	5,001 (88.9)	25.1 (22.9,27.4)	5,139 (90.1)	35.7 (33.1,38.5)
Facilitator role				
Yes	2,073 (46.0)	15.8 (13.3,18.8)	1,340 (30.7)	18.3 (15.0,22.4)
No	2,430 (54.0)	27.6 (24.4,31.2)	3,023 (69.3)	37.6 (34.2,41.3)
The number of participating groups (range:0-3)				
0	3,324 (60.9)	28.4 (25.6,31.4)	3,282 (60.3)	44.8 (41.2,48.8)
1	1,294 (23.7)	22.5 (18.7,27.1)	1,233 (22.7)	22.6 (18.7,27.3)
2	674 (12.3)	10.6 (7.3,15.3)	707 (13.0)	11.2 (7.9,15.9)
3	168 (3.1)	3.0 (0.7,12.0)	218 (4.0)	14.1 (8.0,24.8)

**Table 2.** Hazard ratios for incident functional disability (95% confidence intervals) by participation in sports group activities: results of Cox regression analysis

Men	Model 1	Model 2	Model 3
Participation in sports group activities	0.66 (0.51,0.85)	0.43 (0.19,1.02)	0.17 (0.17,0.93)
× Education very low		5.61 (1.59,19.82)	
× Education low		1.74 (0.70,4.35)	
× Education middle		0.93 (0.33,2.59)	
× Education high		1.00 (ref)	
× Income low			0.82 (0.82,5.59)
× Income middle			0.48 (0.48,3.31)
× Income high			1.00 (ref)
Income low (<1.99)	1.11 (0.79,1.56)	1.09 (0.78,1.54)	0.98 (0.68,1.42)
Income middle (2.00–3.99)	0.92 (0.66,1.28)	0.90 (0.65,1.26)	0.61 (0.61,1.24)
Income high (4.00+)	1.00 (ref)	1.00 (ref)	1.00 (ref)

Education very low ( $\leq 5$ )	1.89 (1.15,3.09)	1.49 (0.86,2.57)	1.13 (1.13,3.04)
Education low (6–9)	1.27 (0.94,1.71)	1.19 (0.87,1.63)	0.94 (0.94,1.70)
Education middle (10–12)	1.22 (0.89,1.69)	1.24 (0.88,1.74)	0.89 (0.89,1.69)
Education high ( $\geq 13$ )	1.00(ref)	1.00(ref)	1.00 (ref)
Women	Model 1	Model 2	Model 3
Participation in sports group activities	0.58 (0.44,0.76)	0.34 (0.10, 1.14)	0.12 (0.12,0.93)
× Education very low		0.98 (0.16,6.18)	
× Education low		1.47 (0.42,5.17)	
× Education middle		2.03 (0.57,7.2)	
× Education high		1.00 (ref)	
× Income low			0.57 (0.57,5.23)
× Income middle			0.33 (0.33,3.47)
× Income high			1.00 (ref)
Income low (<1.99)	1.24 (0.94,1.63)	1.24 (0.94,1.63)	0.90 (0.90,1.58)
Income middle (2.00–3.99)	1.02 (0.77,1.35)	1.02 (0.77,1.36)	0.76 (0.76,1.36)
Income high (4.00+)	1.00(ref)	1.00 (ref)	1.00 (ref)
Education very low ( $\leq 5$ )	0.95 (0.63,1.44)	0.90 (0.59,1.39)	0.62 (0.62,1.42)
Education low (6–9)	0.75 (0.52,1.10)	0.71 (0.48,1.06)	0.51 (0.51,1.07)
Education middle (10–12)	0.70 (0.48,1.03)	0.65 (0.43,0.97)	0.47 (0.47,1.01)
Education high ( $\geq 13$ )	1.00 (ref)	1.00 (ref)	1.00 (ref)
Adjusted for age, marital status, employment status, the three major diseases (cancer, heart disease, and stroke), and municipality.			
Income (million yen) denotes annual equivalized household income.			
Units: education = years, income = million yen			

**Table 3.** Hazard ratios for incident functional disability (95% confidence intervals) by participation in hobby group activities: results of Cox regression analysis

Men	Model 1	Model 2	Model 3
Participation in hobby group activities	0.69 (0.55,0.87)	0.56 (0.30,1.05)	0.62 (0.31,1.23)
× Education very low		3.97 (1.13,14.02)	
× Education low		1.41 (0.70,2.82)	
× Education middle		0.87 (0.40,1.90)	
× Education high		1.00(ref)	

× Income low			1.38 (0.63,3.02)
× Income middle			1.03 (0.47,2.22)
× Income high			1.00 (ref)
Income low (<1.99)	1.09 (0.77,1.54)	1.09 (0.77,1.54)	1.02 (0.69,1.51)
Income middle (2.00–3.99)	0.92 (0.65,1.29)	0.91 (0.65,1.27)	0.91 (0.61,1.34)
Income high (4.00+)	1.00(ref)	1.00(ref)	1.00(ref)
Education very low ( $\leq 5$ )	1.71 (1.02,2.84)	1.43 (0.81,2.50)	1.72 (1.03,2.87)
Education low (6–9)	1.29 (0.95,1.74)	1.19 (0.85,1.67)	1.28 (0.95,1.73)
Education middle (10–12)	1.19 (0.86,1.65)	1.21 (0.84,1.75)	1.19 (0.86,1.64)
Education high ( $\geq 13$ )	1.00 (ref)	1.00 (ref)	1.00 (ref)
Women	Model 1	Model 2	Model 3
Participation in hobby group activities	0.67 (0.55,0.80)	0.64 (0.31,1.33)	0.51 (0.28,0.92)
× Education very low		1.02 (0.35,2.95)	
× Education low		1.15 (0.53,2.49)	
× Education middle		0.89 (0.40,1.97)	
× Education high		1.00(ref)	
× Income low			1.16 (0.59,2.27)
× Income middle			1.08 (0.54,2.14)
× Income high			1.00(ref)
Income low (<1.99)	1.22 (0.93,1.61)	1.23 (0.94,1.61)	1.18 (0.87,1.59)
Income middle (2.00–3.99)	1.01 (0.77,1.34)	1.01 (0.77,1.34)	1.00 (0.73,1.36)
Income high (4.00+)	1.00(ref)	1.00(ref)	1.00(ref)
Education very low ( $\leq 5$ )	0.95 (0.63,1.45)	0.94 (0.56,1.56)	0.96 (0.63,1.46)
Education low (6–9)	0.77 (0.52,1.12)	0.74 (0.46,1.19)	0.76 (0.52,1.11)
Education middle (10–12)	0.76 (0.52,1.12)	0.78 (0.48,1.28)	0.75 (0.51,1.10)
Education high ( $\geq 13$ )	1.00(ref)	1.00(ref)	1.00(ref)

Adjusted for age, marital status, employment status, the three major diseases (cancer, heart disease, and stroke), and municipality.

Income (million yen) denotes annual equivalized household income.

Units: education = years, income = million yen

**Table 4.** Hazard ratios for incident functional disability (95% confidence intervals) by having a facilitator role in a group: results of Cox regression analysis

Men	Model 1	Model 2	Model 3
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Have facilitator role	0.82 (0.66,1.02)	0.76 (0.41,1.44)	0.39 (0.18,0.87)
× Education very low		3.95 (1.30,12.05)	
× Education low		1.09 (0.54,2.17)	
× Education middle		0.60 (0.27,1.33)	
× Education high		1.00 (ref)	
× Income low			2.33 (0.97,5.63)
× Income middle			1.72 (0.72,4.10)
× Income high			1.00 (ref)
Income low (<1.99)	1.09 (0.73,1.62)	1.08 (0.72,1.60)	0.82 (0.52,1.31)
Income middle (2.00–3.99)	0.99 (0.68,1.46)	0.99 (0.67,1.46)	0.84 (0.54,1.31)
Income high (4.00+)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Education very low ( $\leq 5$ )	2.17 (1.22,3.84)	1.36 (0.64,2.91)	2.14 (1.21,3.78)
Education low (6–9)	1.40 (1.00,1.97)	1.36 (0.88,2.09)	1.39 (0.99,1.96)
Education middle (10–12)	1.16 (0.79,1.68)	1.37 (0.86,2.20)	1.15 (0.79,1.68)
Education high ( $\geq 13$ )	1.00 (ref)	1.00 (ref)	1.00 (ref)
Women	Model 1	Model 2	Model 3
Have facilitator role	0.70 (0.56,0.88)	0.30 (0.10,0.87)	0.45(0.20, 1.00)
× Education very low		3.13 (0.86,11.34)	
× Education low		2.22 (0.73,6.81)	
× Education middle		2.69 (0.86,8.42)	
× Education high		1.00 (ref)	
× Income low			1.56(0.64, 3.79)
× Income middle			1.46(0.59, 3.63)
× Income high			1.00(ref)
Income low (<1.99)	1.15 (0.84,1.58)	1.14 (0.83,1.57)	1.08(0.76, 1.52)
Income middle (2.00–3.99)	0.97(0.70,1.34)	0.96 (0.69,1.32)	0.92(0.65, 1.30)
Income high (4.00+)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Education very low ( $\leq 5$ )	0.66 (0.41,1.08)	0.52 (0.31,0.89)	0.65 (0.40,1.06)
Education low (6–9)	0.63 (0.41,0.96)	0.52 (0.33,0.83)	0.62 (0.41,0.95)
Education middle (10–12)	0.57 (0.37,0.87)	0.45 (0.28,0.73)	0.55 (0.36,0.85)
Education high ( $\geq 13$ )	1.00 (ref)	1.00(ref)	1.00 (ref)

Adjusted for age, marital status, employment status, the three major diseases (cancer, heart disease, and stroke), and municipality.

Income (million yen) denotes annual equivalized household income.

Units: education = years, income = million yen

**Table 5.** Hazard ratios for incident functional disability (95% confidence intervals) by participation in volunteer group activities: results of Cox regression analysis

Men	Model 1	Model 2	Model 3
Participation in volunteer group activities	0.81 (0.57,1.15)	0.88(0.38,2.07)	0.27 (0.07,1.13)
× Education very low		— <sup>a</sup>	
× Education low		1.09(0.41,2.88)	
× Education middle		0.55(0.18,1.68)	
× Education high		1.00 (ref)	
× Income low			3.74 (0.81,17.23)
× Income middle			2.47 (0.54,11.40)
× Income high			1.00 (ref)
Income low (<1.99)	1.12 (0.80,1.58)	1.13(0.80,1.58)	1.01 (0.72,1.43)
Income middle (2.00–3.99)	0.91 (0.65,1.27)	0.91(0.65,1.28)	0.85 (0.60,1.19)
Income high (4.00+)	1.00 (ref)	1.00(ref)	1.00(ref)
Education very low ( $\leq 5$ )	1.75 (1.06,2.91)	1.79(1.07,2.99)	1.76(1.06, 2.91)
Education low (6–9)	1.26 (0.94,1.69)	1.26(0.92,1.71)	1.25(0.93, 1.68)
Education middle (10–12)	1.17 (0.85,1.61)	1.23(0.88,1.72)	1.17(0.85, 1.61)
Education high ( $\geq 13$ )	1.00 (ref)	1.00 (ref)	1.00(ref)
Women	Model 1	Model 2	Model 3
Participation in volunteer group activities	0.86(0.62, 1.19)	0.94(0.36,2.44)	0.81(0.29,2.23)
× Education very low		0.57(0.06,5.17)	
× Education low		0.72(0.24,2.18)	
× Education middle		0.99(0.33,2.94)	
× Education high		1.00 (ref)	
× Income low			0.68 (0.20,2.31)
× Income middle			1.13 (0.35,3.65)
× Income high			1.00 (ref)
Income low (<1.99)	1.22(0.93, 1.59)	1.23(0.94,1.62)	1.24 (0.94,1.63)
Income middle (2.00–3.99)	0.99(0.75, 1.30)	1.00(0.75,1.32)	0.98 (0.73,1.30)
Income high (4.00+)	1.00(ref)	1.00 (ref)	1.00 (ref)
Education very low ( $\leq 5$ )	0.97(0.64, 1.46)	0.99(0.64,1.52)	0.98 (0.65,1.48)
Education low (6–9)	0.76(0.52, 1.10)	0.77(0.52,1.15)	0.76 (0.53,1.10)
Education middle (10–12)	0.71(0.49, 1.04)	0.72(0.48,1.08)	0.71 (0.49,1.05)
Education high ( $\geq 13$ )	1.00(ref)	1.00 (ref)	1.00 (ref)



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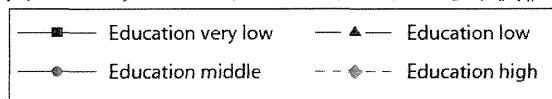
<sup>a</sup> Values could not be estimated because there were too few cases.

Adjusted for age, marital status, employment status, the three major diseases (cancer, heart disease, and stroke), and municipality.

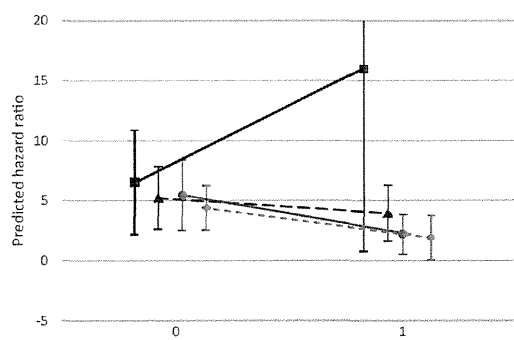
Income (million yen) denotes annual equivalized household income.

Units: education = years, income = million yen

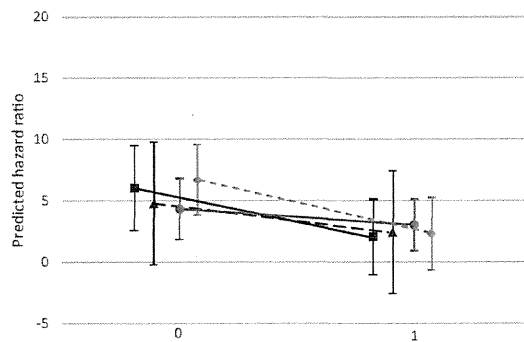
図 1. コックスハザードモデルによる予測値：教育年数と社会参加の有無との交互作用項



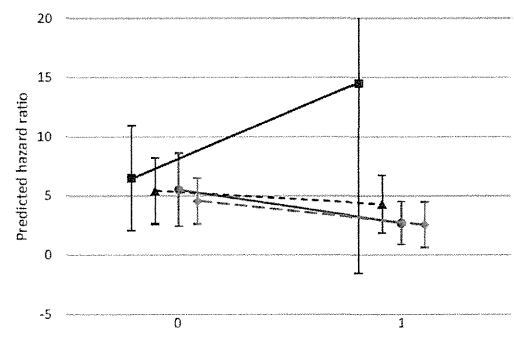
※  $\chi$  軸：0 = 参加経験なし，1 = 参加経験あり



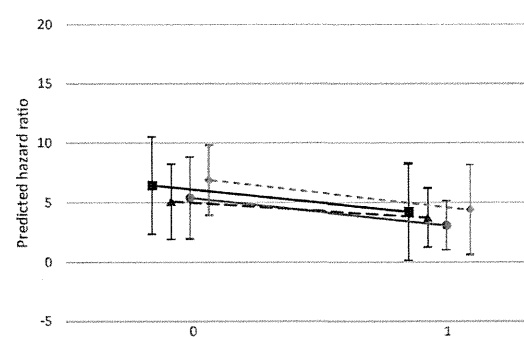
Panel A: For participation in sports club by education, Men



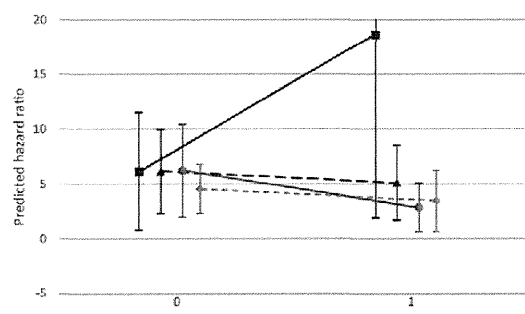
Panel B: For participation in sports club by education, Women



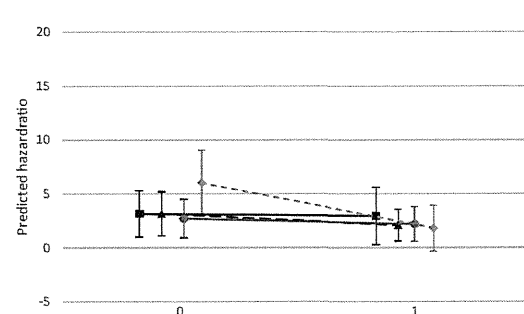
Panel C: For participation in hobby group by education, Men



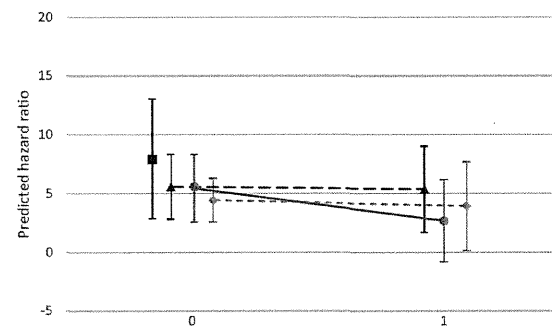
Panel D: For participation in hobby group by education, Women



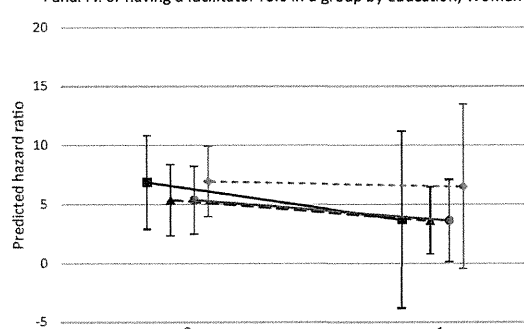
Panel E: For having a facilitator role in a group by education, Men



Panel F: For having a facilitator role in a group by education, Women



Panel G: For participation in volunteer group by education, Men



Panel H: For participation in volunteer group by education, Women

Volunteer group: Value and 95% confidence interval could not be estimated because there were too few cases.

図 2. コックスハザードモデルによる予測値：所得階層と社会参加の有無との交互作用項

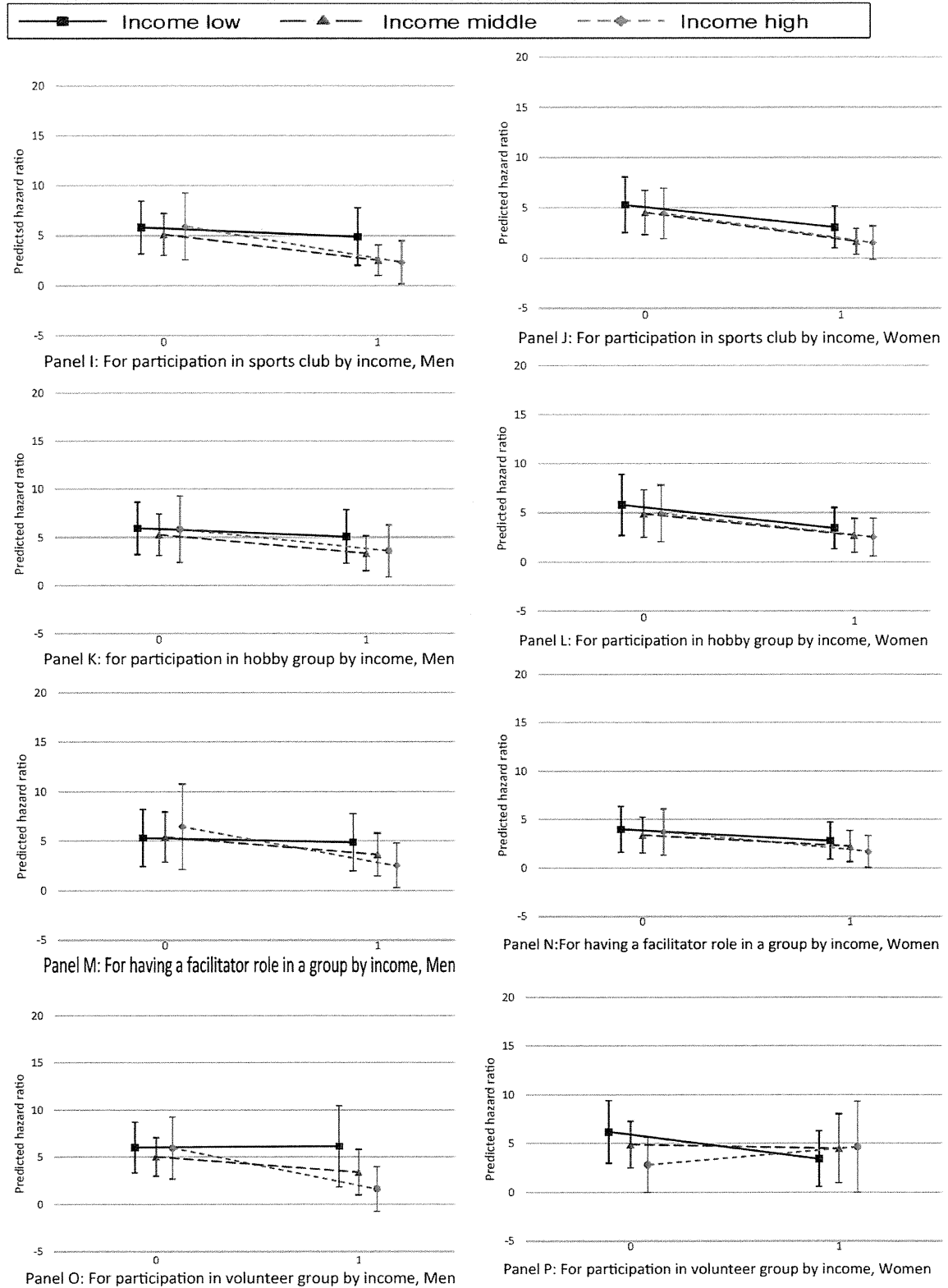
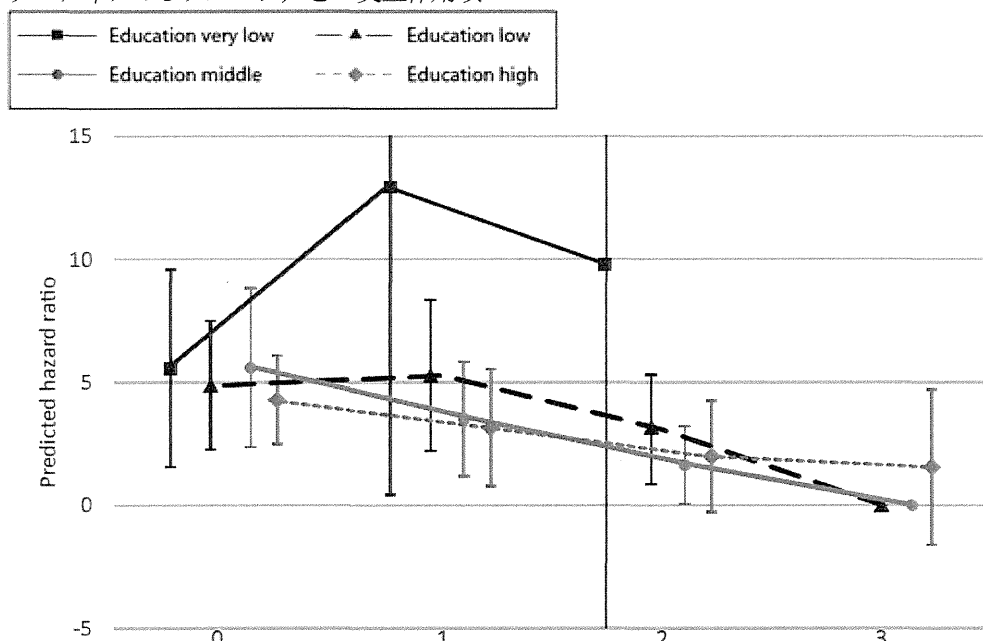
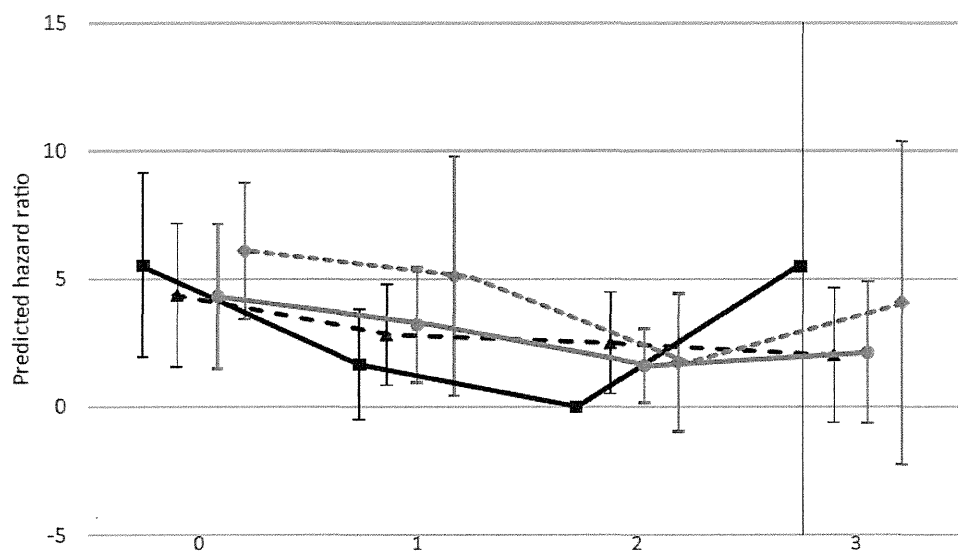


図 3. コックスハザードモデルによる予測値：教育年数とグループ参加合計数（スポーツ・趣味・ボランティアの3グループ）との交互作用項



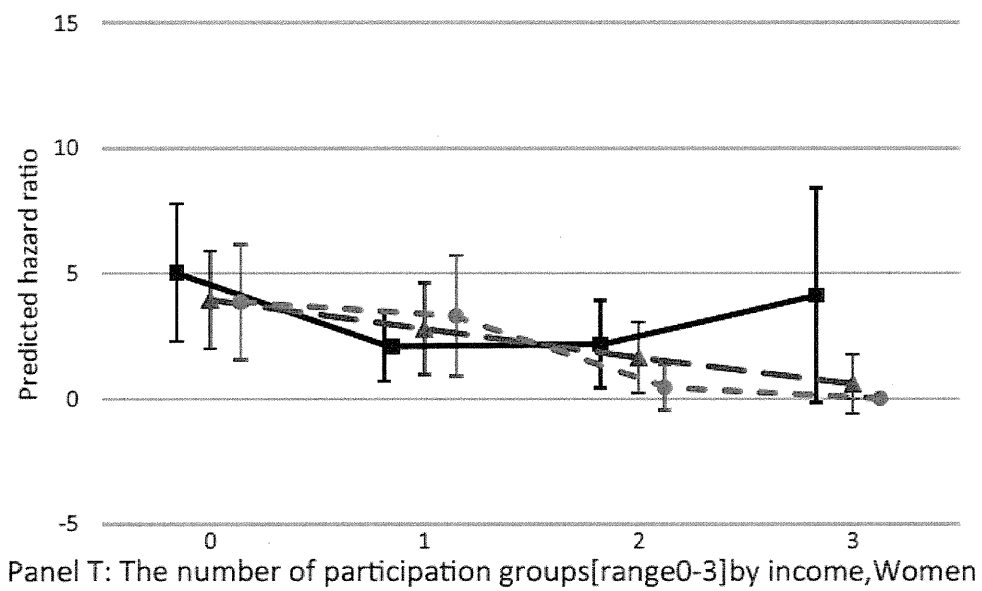
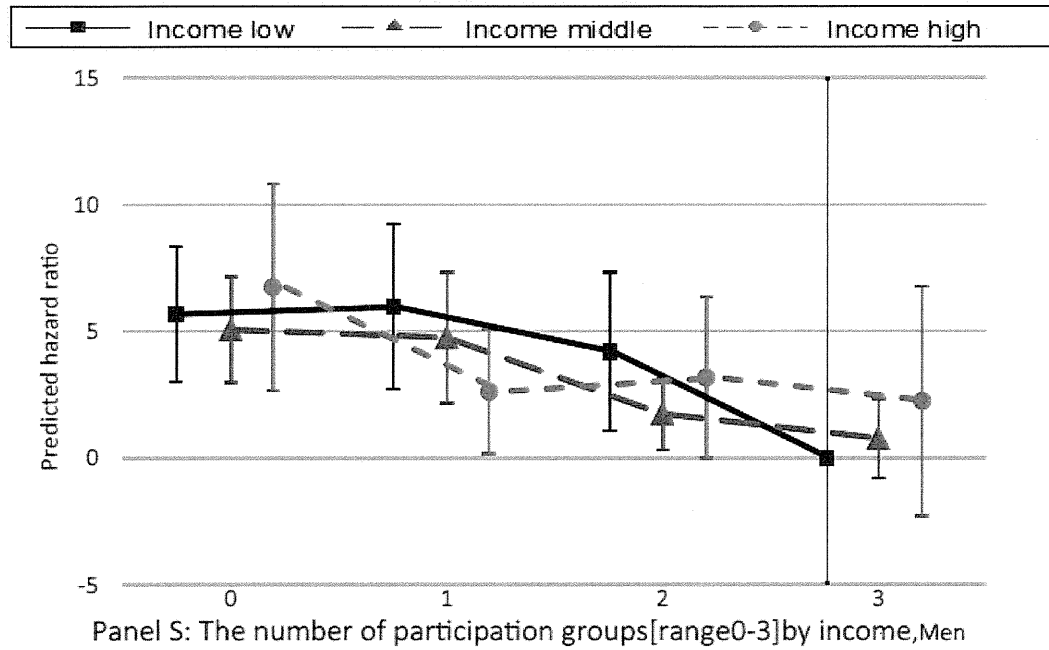
Panel Q: The number of participation groups[range0-3] by education,Men

※ Participation three groups in education very low group: Not estimated because there were few people.



Panel R: The number of participation group [range0-3]by education,Women

図 4. コックスハザードモデルによる予測値：所得階層とグループ参加合計数（スポーツ・趣味・ボランティアの3グループ）との交互作用項



Appendix 1. Hazard ratios (95% confidence intervals) for incident functional disability by one point increase in the number of participating groups (ranger: 0-8) among men of the very low educational background.

Men	Model 1	Model 2	Model 3
Participation in group activities	0.92 (0.85,0.99)	0.93 (0.75,1.14)	0.77 (0.61,0.96)
× Education very low		1.47 (1.02,2.14)	
× Education low		1.02 (0.81,1.27)	
× Education middle		0.86 (0.67,1.10)	
× Education high		1.00 (ref)	
× Income low			1.26 (0.97,1.62)
× Income middle			1.15 (0.89,1.48)
× Income high			1.00 (ref)
Income low (<1.99)	1.06 (0.75,1.50)	1.03 (0.73,1.46)	0.76 (0.47,1.23)
Income middle (2.00–3.99)	0.88 (0.63,1.23)	0.85 (0.61,1.20)	0.71 (0.44,1.14)
Income high (4.00+)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Education very low ( $\leq 5$ )	1.70 (1.00,2.87)	1.19 (0.59,2.43)	1.69 (1.00,2.85)
Education low (6–9)	1.33 (0.98,1.81)	1.31 (0.84,2.05)	1.32 (0.97,1.80)
Education middle (10–12)	1.26 (0.90,1.76)	1.54 (0.95,2.50)	1.26 (0.90,1.75)
Education high ( $\geq 13$ )	1.00 (ref)	1.00 (ref)	1.00 (ref)
Women	Model 1	Model 2	Model 3
Participation in group activities	0.83 (0.77,0.90)	0.92 (0.71,1.19)	0.80 (0.64,1.00)
× Education very low		0.87 (0.61,1.25)	
× Education low		0.91 (0.69,1.21)	
× Education middle		0.86 (0.64,1.15)	
× Education high		1.00 (ref)	
× Income low			0.96 (0.74,1.25)
× Income middle			0.99 (0.76,1.30)
× Income high			1.00 (ref)
Income low (<1.99)	1.22 (0.92,1.61)	1.22 (0.92,1.61)	1.24 (0.84,1.84)
Income middle (2.00–3.99)	1.00 (0.75,1.33)	1.00 (0.75,1.34)	1.00 (0.66,1.51)
Income high (4.00+)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Education very low ( $\leq 5$ )	0.92 (0.60,1.40)	1.06 (0.60,1.87)	0.92 (0.61,1.41)
Education low (6–9)	0.75 (0.51,1.10)	0.84 (0.50,1.42)	0.75 (0.51,1.10)
Education middle (10–12)	0.72 (0.49,1.07)	0.87 (0.50,1.50)	0.72 (0.49,1.06)
Education high ( $\geq 13$ )	1.00 (ref)	1.00 (ref)	1.00 (ref)

Adjusted for age, marital status, employment status, the three major diseases (cancer, heart disease, and stroke), and six municipalities.

Income (million yen) denotes annual equivalized household income.

Groups : sports, hobby, volunteer group, citizen/consumer, religious, political, local community group and industry or trade associations.

Appendix 2. Hazard ratios (95% confidence intervals) for incident functional disability by one point increase in the number of participating groups (sports, hobby, and volunteer groups only; range: 0-3) among men of the very low educational background. .

Men	Model 1	Model 2	Model 3
Participation in group activities	0.75(0.66,0.87)	0.71(0.49,1.03)	0.62(0.41,0.95)
× Education very low		2.39(1.11,5.16)	
× Education low		1.18(0.78,1.80)	
× Education middle		0.77(0.48,1.25)	
× Education high		1.00 (ref)	
× Income low			1.40(0.87,2.25)
× Income middle			1.10(0.69,1.75)
× Income high			1.00 (ref)
Income low (<1.99)	1.07(0.75,1.51)	1.06(0.75,1.49)	0.92(0.62,1.38)
Income middle (2.00–3.99)	0.89(0.63,1.25)	0.88(0.62,1.23)	0.84(0.56,1.24)
Income high (4.00+)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Education very low ( $\leq 5$ )	1.66(1.00,2.77)	1.34(0.75,2.41)	1.68(1.01,2.79)
Education low (6–9)	1.24(0.92,1.68)	1.17(0.82,1.66)	1.24(0.92,1.67)
Education middle (10–12)	1.20(0.87,1.67)	1.33(0.90,1.94)	1.20(0.87,1.66)
Education high ( $\geq 13$ )	1.00 (ref)	1.00 (ref)	1.00 (ref)
Women	Model 1	Model 2	Model 3
Participation in group activities	0.72(0.64,0.82)	0.73(0.48,1.12)	0.56(0.37,0.87)
× Education very low		0.66(0.29,1.55)	
× Education low		0.99(0.62,1.56)	
× Education middle		0.94(0.59,1.52)	
× Education high		1.00 (ref)	
× Income low			1.16(0.71,1.88)
× Income middle			1.14(0.70,1.86)
× Income high			1.00 (ref)
Income low (<1.99)	1.25(0.95,1.65)	1.26(0.96,1.67)	1.19(0.88,1.62)
Income middle (2.00–3.99)	1.02(0.77,1.36)	1.03(0.77,1.37)	0.98(0.72,1.35)
Income high (4.00+)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Education very low ( $\leq 5$ )	0.86(0.56,1.31)	0.89(0.54,1.46)	0.85(0.56,1.30)
Education low (6–9)	0.70(0.48,1.03)	0.70(0.44,1.12)	0.69(0.47,1.01)
Education middle (10–12)	0.69(0.47,1.02)	0.71(0.44,1.15)	0.68(0.46,1.00)
Education high ( $\geq 13$ )	1.00 (ref)	1.00 (ref)	1.00 (ref)

Adjusted for age, marital status, employment status, the three major diseases (cancer, heart disease, and stroke), and six municipalities.

Income (million yen) denotes annual equivalized household income.

Three groups activity: sports, hobby, volunteer group

Appendix 3. Estimates (95% confidence intervals) of Cox proportional hazard models for political group/organizations participation

Men	Model 1	Model 2	Model 3
Participation in political group activities	1.06 (0.80,1.40)	1.15 (0.52,2.54)	0.53 (0.19,1.49)
× Education very low		1.29 (0.30,5.56)	
× Education low		1.07 (0.45,2.57)	
× Education middle		0.59 (0.21,1.61)	
× Education high		1.00 (ref)	
× Income low			2.38 (0.78,7.27)
× Income middle			1.67 (0.54,5.18)
× Income high			1.00 (ref)
Income low (<1.99)	1.11 (0.79,1.55)	1.09 (0.78,1.53)	1.00 (0.70,1.42)
Income middle (2.00–3.99)	0.94 (0.67,1.30)	0.92 (0.66,1.28)	0.88 (0.62,1.24)
Income high (4.00+)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Education very low ( $\leq 5$ )	1.77 (1.07,2.94)	1.72 (1.00,2.95)	1.76 (1.06,2.92)
Education low (6–9)	1.30 (0.97,1.75)	1.30 (0.95,1.77)	1.29 (0.96,1.74)
Education middle (10–12)	1.18 (0.86,1.63)	1.26 (0.89,1.77)	1.18 (0.85,1.62)
Education high ( $\geq 13$ )	1.00 (ref)	1.00 (ref)	1.00 (ref)
Women	Model 1	Model 2	Model 3
Participation in political group activities	1.16 (0.82,1.65)	0.81 (0.11,5.92)	0.96 (0.30,3.07)
× Education very low		1.53 (0.18,12.96)	
× Education low		1.22 (0.15,9.81)	
× Education middle		1.41 (0.17,11.47)	
× Education high		1.00 (ref)	
× Income low			1.29 (0.35,4.71)
× Income middle			0.56 (0.12,2.57)
× Income high			1.00 (ref)
Income low (<1.99)	1.22 (0.94,1.60)	1.22 (0.93,1.60)	1.21 (0.92,1.59)
Income middle (2.00–3.99)	1.00 (0.76,1.32)	1.00 (0.76,1.31)	1.02 (0.77,1.35)
Income high (4.00+)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Education very low ( $\leq 5$ )	1.03 (0.68,1.56)	1.02 (0.67,1.54)	1.02 (0.67,1.54)
Education low (6–9)	0.80 (0.55,1.16)	0.79 (0.54,1.15)	0.79 (0.55,1.15)
Education middle (10–12)	0.75 (0.51,1.09)	0.74 (0.50,1.09)	0.74 (0.51,1.09)
Education high ( $\geq 13$ )	1.00 (ref)	1.00 (ref)	1.00 (ref)

Adjusted for age, marital status, employment status, the three major diseases (cancer, heart disease, and stroke), and six municipalities.

Income (million yen) denotes annual equivalized household income.



Appendix 4. Estimates (95% confidence intervals) of Cox proportional hazard models for industry or trade associations participation

Men	Model 1	Model 2	Model 3
Participation in industry or trade associations group activities	1.20 (0.92,1.56)	1.73 (0.94,3.17)	0.87(0.43,1.79)
× Education very low		1.78 (0.37,8.63)	
× Education low		0.73 (0.37,1.45)	
× Education middle		0.44 (0.20,0.98)	
× Education high		1.00 (ref)	
× Income low			1.34 (0.58,3.06)
× Income middle			1.45 (0.64,3.25)
× Income high			1.00 (ref)
Income low (<1.99)	1.14 (0.81,1.60)	1.14 (0.81,1.60)	1.06 (0.73,1.54)
Income middle (2.00–3.99)	0.95 (0.68,1.32)	0.94 (0.68,1.31)	0.87 (0.60,1.26)
Income high (4.00+)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Education very low ( $\leq 5$ )	1.82 (1.09,3.02)	1.87 (1.09,3.23)	1.80 (1.08,2.99)
Education low (6–9)	1.28 (0.95,1.72)	1.38 (0.99,1.94)	1.27 (0.95,1.70)
Education middle (10–12)	1.14 (0.83,1.57)	1.34 (0.93,1.92)	1.14 (0.83,1.56)
Education high ( $\geq 13$ )	1.00 (ref)	1.00 (ref)	1.00 (ref)
Women	Model 1	Model 2	Model 3
Participation in industry or trade associations group activities	0.99 (0.64,1.54)	2.68 (0.63,11.37)	1.38 (0.43,4.42)
× Education very low		0.89 (0.12,6.77)	
× Education low		0.26 (0.05,1.27)	
× Education middle		0.32 (0.06,1.68)	
× Education high		1.00 (ref)	
× Income low			0.58 (0.14,2.30)
× Income middle			0.41 (0.08,2.07)
× Income high			1.00 (ref)
Income low (<1.99)	1.21 (0.92,1.58)	1.21 (0.92,1.58)	1.23 (0.94,1.62)
Income middle (2.00–3.99)	0.99 (0.75,1.31)	1.00 (0.75,1.32)	1.02 (0.77,1.35)
Income high (4.00+)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Education very low ( $\leq 5$ )	0.99 (0.66,1.49)	1.02 (0.67,1.55)	0.99 (0.66,1.49)
Education low (6–9)	0.78 (0.54,1.12)	0.82 (0.56,1.19)	0.78 (0.54,1.12)
Education middle (10–12)	0.70 (0.48,1.03)	0.74 (0.50,1.09)	0.70 (0.48,1.03)
Education high ( $\geq 13$ )	1.00 (ref)	1.00 (ref)	1.00 (ref)

Adjusted for age, marital status, employment status, the three major diseases (cancer, heart disease, and stroke), and six municipalities.

Income (million yen) denotes annual equivalized household income.

Appendix 5. Estimates (95% confidence intervals) of Cox proportional hazard models for citizen/consumer groups participation

Men	Model 1	Model 2	Model 3
Participation in citizen/consumer group activities	0.93(0.57,1.51)	0.59(0.08,4.30)	— <sup>a</sup>
× Education very low		9.09(0.78,106.59)	
× Education low		1.47(0.18,11.9)	
× Education middle		0.97(0.10,9.57)	
× Education high		1.00 (ref)	
× Income low			— <sup>a</sup>
× Income middle			— <sup>a</sup>
× Income high			1.00 (ref)
Income low (<1.99)	1.10 (0.78,1.55)	1.10 (0.78,1.55)	1.05 (0.74,1.48)
Income middle (2.00–3.99)	0.91 (0.65,1.27)	0.90 (0.65,1.26)	0.88 (0.63,1.23)
Income high (4.00+)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Education very low ( $\leq 5$ )	1.80 (1.08,2.99)	1.64 (0.97,2.77)	1.81 (1.09,3.01)
Education low (6–9)	1.27 (0.95,1.71)	1.26 (0.93,1.70)	1.27 (0.95,1.72)
Education middle (10–12)	1.18 (0.85,1.63)	1.18 (0.85,1.64)	1.18 (0.86,1.63)
Education high ( $\geq 13$ )	1.00 (ref)	1.00 (ref)	1.00 (ref)
Women	Model 1	Model 2	Model 3
Participation in citizen/consumer group activities	1.08 (0.73,1.58)	3.60 (1.25,10.34)	0.45 (0.06,3.25)
× Education very low		0.78 (0.16,3.71)	
× Education low		0.20 (0.06,0.68)	
× Education middle		0.19 (0.05,0.76)	
× Education high		1.00 (ref)	
× Income low			1.00 (0.11,8.76)
× Income middle			2.06 (0.24,17.49)
× Income high			1.00 (ref)
Income low (<1.99)	1.16 (0.89,1.52)	1.18 (0.90,1.54)	1.18 (0.89,1.54)
Income middle (2.00–3.99)	0.98 (0.74,1.29)	1.00 (0.75,1.32)	0.97 (0.73,1.28)
Income high (4.00+)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Education very low ( $\leq 5$ )	1.02 (0.67,1.54)	1.01 (0.71,1.69)	1.02 (0.67,1.54)
Education low (6–9)	0.79 (0.55,1.15)	0.88 (0.59,1.31)	0.79 (0.54,1.15)
Education middle (10–12)	0.72 (0.49,1.06)	0.80 (0.53,1.20)	0.71 (0.48,1.04)
Education high ( $\geq 13$ )	1.00 (ref)	1.00 (ref)	1.00 (ref)

Adjusted for age, marital status, employment status, the three major diseases (cancer, heart disease, and stroke), and six municipalities.

Income (million yen) denotes annual equivalized household income.

a. Values could not be estimated because there were too few cases.

Appendix 6. Estimates (95% confidence intervals) of Cox proportional hazard models for religious organization participation

Men	Model 1	Model 2	Model 3
Participation in group activities	1.15 (0.90,1.45)	1.67 (0.89,3.13)	0.54 (0.19,1.52)
× Education very low		0.45 (0.11,1.78)	
× Education low		0.64 (0.32,1.30)	
× Education middle		0.53 (0.23,1.20)	
× Education high		1.00 (ref)	
× Income low			1.88 (0.62,5.70)
× Income middle			2.45 (0.82,7.31)
× Income high			1.00 (ref)
Income low (<1.99)	1.11 (0.79,1.56)	1.11 (0.79,1.56)	1.02 (0.71,1.46)
Income middle (2.00–3.99)	0.93 (0.66,1.29)	0.93 (0.67,1.30)	0.82 (0.57,1.16)
Income high (4.00+)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Education very low ( $\leq 5$ )	1.73 (1.04,2.88)	1.99 (1.14,3.47)	1.75 (1.05,2.92)
Education low (6–9)	1.31 (0.97,1.76)	1.43 (1.02,2.01)	1.31 (0.97,1.76)
Education middle (10–12)	1.21 (0.88,1.67)	1.36 (0.95,1.95)	1.21 (0.88,1.67)
Education high ( $\geq 13$ )	1.00 (ref)	1.00 (ref)	1.00 (ref)
Women	Model 1	Model 2	Model 3
Participation in group activities	1.03 (0.83,1.28)	1.55 (0.60,4.04)	0.78 (0.36,1.70)
× Education very low		0.47 (0.15,1.47)	
× Education low		0.67 (0.24,1.82)	
× Education middle		0.72 (0.25,2.04)	
× Education high		1.00 (ref)	
× Income low			1.18 (0.49,2.82)
× Income middle			1.40 (0.57,3.43)
× Income high			1.00 (ref)
Income low (<1.99)	1.22 (0.93,1.59)	1.22 (0.93,1.60)	1.20 (0.90,1.59)
Income middle (2.00–3.99)	0.98 (0.74,1.29)	0.97 (0.74,1.29)	0.94 (0.70,1.26)
Income high (4.00+)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Education very low ( $\leq 5$ )	0.99 (0.66,1.49)	1.09 (0.70,1.69)	1.00 (0.66,1.50)
Education low (6–9)	0.77 (0.53,1.11)	0.81 (0.54,1.20)	0.77 (0.53,1.11)
Education middle (10–12)	0.73 (0.50,1.06)	0.76 (0.50,1.14)	0.73 (0.50,1.06)
Education high ( $\geq 13$ )	1.00 (ref)	1.00 (ref)	1.00 (ref)

Adjusted for age, marital status, employment status, the three major diseases (cancer, heart disease, and stroke), and six municipalities.

Income (million yen) denotes annual equivalized household income.

Appendix 7. Estimates (95% confidence intervals) of Cox proportional hazard models for local community participation

Men	Model 1	Model 2	Model 3
Participation in local community activities	0.80 (0.70,0.99)	0.96 (0.56,1.65)	0.66 (0.37,1.17)
× Education very low		1.47 (0.56,3.81)	
× Education low		0.82 (0.46,1.46)	
× Education middle		0.78 (0.41,1.49)	
× Education high		1.00 (ref)	
× Income low			1.19 (0.63,2.26)
× Income middle			1.32 (0.70,2.51)
× Income high			1.00 (ref)
Income low (<1.99)	1.03 (0.74,1.43)	1.02 (0.74,1.42)	0.93 (0.58,1.49)
Income middle (2.00–3.99)	0.88 (0.64,1.21)	0.87 (0.63,1.21)	0.75 (0.47,1.2)
Income high (4.00+)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Education very low ( $\leq 5$ )	1.84 (1.12,3.02)	1.57 (0.77,3.20)	1.83 (1.12,3.00)
Education low (6–9)	1.33 (1.00,1.79)	1.49 (0.96,2.33)	1.34 (1.00,1.79)
Education middle (10–12)	1.18 (0.86,1.62)	1.35 (0.83,2.19)	1.18 (0.86,1.63)
Education high ( $\geq 13$ )	1.00 (ref)	1.00 (ref)	1.00 (ref)
Women	Model 1	Model 2	Model 3
Participation in local community activities	0.78 (0.67,0.90)	0.86 (0.43,1.74)	0.84 (0.51,1.37)
× Education very low		0.98 (0.44,2.18)	
× Education low		0.87 (0.42,1.80)	
× Education middle		0.96 (0.45,2.04)	
× Education high		1.00 (ref)	
× Income low			0.86 (0.49,1.48)
× Income middle			0.89 (0.50,1.57)
× Income high			1.00 (ref)
Income low (<1.99)	1.27 (0.97,1.67)	1.28 (0.98,1.68)	1.39 (0.90,2.14)
Income middle (2.00–3.99)	1.04 (0.79,1.38)	1.05 (0.79,1.38)	1.12 (0.71,1.77)
Income high (4.00+)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Education very low ( $\leq 5$ )	1.00 (0.66,1.50)	1.00 (0.59,1.71)	1.00 (0.67,1.51)
Education low (6–9)	0.81 (0.56,1.17)	0.87 (0.53,1.42)	0.82 (0.56,1.18)
Education middle (10–12)	0.77 (0.53,1.13)	0.78 (0.46,1.30)	0.77 (0.53,1.13)
Education high ( $\geq 13$ )	1.00 (ref)	1.00 (ref)	1.00 (ref)

Adjusted for age, marital status, employment status, the three major diseases (cancer, heart disease, and stroke), and six municipalities.

Income (million yen) denotes annual equivalized household income.