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Laughter and Subjective Health Among Community-Dwelling Older People in Japan

Cross-Sectional Analysis of the Japan Gerontological Evaluation Study Cohort Data

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Abstract: The aim of this study was to evaluate the association of laughter with subjective health independent of socioeconomic status and social participation among older people in Japan. We used the data of 26,368 individuals (men, 12,174; women, 14,194) 65 years or older who participated in the Japan Gerontological Evaluation Study (JAGES) in 2013. Participants provided information on laughter and self-rated health, depression, socioeconomic, and psychosocial factors. We evaluated laughter from three perspectives: frequency, opportunities, and interpersonal interactions. Even after adjustment for depression, sociodemographic factors, and social participation, the prevalence ratio for poor subjective health among women who never or almost never laugh was 1.78 (95% confidence interval, 1.48–2.15) compared with those who reported laughing every day. Similar associations were observed among men. Laughter may be an important factor for the promotion of general and mental health of older adults. The mechanisms linking laughter and health warrant further study.

Key Words: Laughter, subjective health, depression, social participation, Japan

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Previous studies have suggested that laughter has various health benefits, such as boosting immunity (Sakai et al., 2013), reducing depressive symptom (Hirsch et al., 2010), lowering blood pressure (Dolgoff-Kaspar et al., 2012), and preventing cognitive decline (Takeda et al., 2010). Laughter has been incorporated in complimentary medicine. Laughter yoga has been shown to be feasible in the hemodialysis context, and patients reported decreased fatigue, pain relief and improved communication (Bennett et al., 2014). The Smile-Sun technique, a set of positive verbal and nonverbal communication techniques using positive humor, has been applied in cancer patients to boost immunity (Sakai et al., 2013). Laughter also improves glycemic control among diabetes patients (Bennett et al., 2014). However, most of the previous studies did not generalize beyond the boundaries of the hospital and clinic, and very few were able to examine the impact of laughter on health in daily life or in the social context.

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Laughter has been found to occur most frequently during casual conversation (Provine, 1993), and laughter usually occurs when one encounters a meaningful interpretation of some stimulus or event that is different from which was initially assumed (Ramachandran, 1998). The frequency of laughter likely varies according to one's character and social background. That is, the frequency and opportunities for laughter can vary according to one's life situation, especially socioeconomic status and degree of social participation, and these factors could confound the effect of laughter on health, but this theory has yet to be examined.

Hasan and Hasan (2009) conducted a study among patients from India and Canada to characterize the frequency of laughter that was beneficial or detrimental to health. Among participants in India, a moderate level of laughter was found to be beneficial, whereas both low and high levels had no effect. Laughter was associated with emotional well-being and life satisfaction. In other words, frequency of laughing and the way of laughter influence health differently from environments.

To our knowledge, no studies have been conducted on the relationship between laughter and health, taking account of people's socioeconomic background and degree of social participation. Socioeconomic status and social participation can be considered common previous causes (*i.e.*, confounders) of the association between laughter and health. We therefore set out to examine the relationship between laughter and subjective health adjusting for socioeconomic factors and social participation, evaluating laughter from three perspectives: frequency, number of opportunities, and laughing in interpersonal interactions.

METHODS

Study Sample

The present study is based on the Japan Gerontological Evaluation Study (JAGES). The JAGES cohort was established in 2010 to investigate factors associated with subjective and objective health among noninstitutionalized individuals 65 years or older. The cohort covers 30 municipalities in Japan. We used the 2013 wave of JAGES, where self-reported questionnaires were mailed to 195,290 community-dwelling individuals 65 years or older. Of those, 138,294 individuals responded to the survey (response rate, 70.8%). Aside from basic questions, there were five modules of the survey covering different topics—module A: nursing care, medical care, and lifestyles; module B: oral hygiene, optimism, subjective health; module C: social capital, history of abuse; module D: subjective quality of life, sleep, cognitive function; module E: physical activity. We used module B, which includes questions about laughter. Respondents to module B were composed of 12,174 men and 14,194 women. We excluded 5968 subjects (men, 2202; women, 3766) with missing information on subjective health status, frequency

TABLE 1. Characteristics of the Subjects by Sex

	Men	Women
Poor subjective health	1892 (19.0)	1627 (15.6)
GDS score ≥ 5	1513 (15.2)	1623 (15.6)
Frequency of laughing in 4 wks (days)		
Almost every day	3762 (37.7)	5070 (48.6)
1–5 days per week	3754 (37.6)	3877 (37.2)
1–3 days per month	1463 (14.7)	935 (9.0)
Never or almost never	993 (10.0)	546 (5.2)
Number of opportunities of laughing		
Median [25%, 75%]	2 [1, 3]	3 [2, 4]
4+	2088 (20.9)	2892 (27.7)
2–3	5122 (51.4)	5508 (52.8)
0–1	2762 (27.7)	2028 (19.4)
Number of opportunities for laughing in interpersonal interactions (times)		
3	1734 (17.4)	1813 (17.4)
2	2825 (28.3)	3750 (36.0)
1	3610 (36.2)	3742 (35.9)
0	1803 (18.1)	1123 (10.8)
Frequency of social participation per 48 wks (times)		
Median [25%, 75%]	24 [0, 102]	24 [0, 138]
First quartile (men: 0 times, women: 0 times)	2270 (22.8)	2238 (21.5)
Second quartile (men: 1–24 times, women: 1–24 times)	2041 (20.5)	1581 (15.2)
Third quartile (men: 25–102 times, women: 24–138 times)	1739 (17.4)	1906 (18.3)
Fourth quartile (men: >102 times, women: >138 times)	2010 (20.2)	1859 (17.8)
Missing data	1912 (19.2)	2844 (27.3)
Age, yrs		
65–69	3124 (31.3)	3095 (29.7)
70–74	3024 (30.3)	3252 (31.2)
75–79	2137 (21.4)	2199 (21.1)
80+	1687 (16.9)	1882 (18.0)
Mean (SD)	73.36 (6.00)	73.62 (6.14)
Educational attainment		
≥10 yrs	6339 (63.6)	5979 (57.3)
<10 yrs	3633 (36.4)	4449 (42.7)
Missing data	55 (0.6)	94 (0.9)
Longest jobs		
Professionals, managers	3665 (36.8)	1091 (10.5)
Clerks, services, engineers	4103 (41.1)	5117 (49.1)
Agricultures, forestries, fisheries, self-employed, other	1623 (16.3)	2153 (20.6)
No jobs	50 (0.5)	935 (9.0)
Missing data	531 (5.3)	1132 (10.9)
Marital status		
Married	8586 (86.1)	6261 (60.0)
Bereaved	732 (7.3)	3275 (31.4)
Divorced	254 (2.5)	416 (4.0)
Never married	201 (2.0)	215 (2.1)
Other	95 (1.0)	74 (0.7)
Missing data	104 (1.0)	187 (1.8)
Equivalent family income (10,000 yen)		
Continuous (yen, log transformed), mean (SD)	14.54 (0.65)	14.41 (0.76)
First quintile (men: 8.84–129.90, women: 8.84–123.74)	1771 (17.8)	1666 (16.0)
Second quintile (men: 129.90–194.45, women: 123.74–175.00)	1687 (16.9)	1695 (16.3)
Third quintile (men: 194.45–247.49, women: 175.00–245.97)	1544 (15.5)	1746 (16.7)

(Continued on next page)

TABLE 1. *(Continued)*

	Men	Women
Fourth quintile (men: 247.49–318.20, women: 245.97–318.20)	1769 (17.7)	1476 (14.2)
Fifth quintile (men: >318.20, women: >318.20)	2229 (22.4)	1961 (18.8)
Missing data	972 (9.7)	1884 (18.1)

Data are presented as *n* (%), unless otherwise indicated.

Poor subjective health: measured by the question "How about your present health status? (responses: very good, good, bad, very bad). "Very bad" and "bad" were categorized as bad subjective health.

Number of opportunities of laughing: the number of opportunities when participants often laugh. Participants chose from eight opportunities (conversations with friends, conversations with your partner, conversations with your children and grandchildren, watching TV and videos, listening to radios, watching comic storytellings and plays, reading comics and magazines, other), and multiple answers were allowed.

Number of opportunities for laughing in interpersonal interactions: conversations with friends, conversations with you partner and conversations with children and grandchildren.

of laughing, depression (the short form of Geriatric Depression Scale [GDS]), number of opportunities of laughing, sex, or age.

Poor Subjective Health

Our outcome variable was poor self-rated health, assessed by the standard single-item question "How would you rate your present health status? (responses: very good, good, bad, very bad)"; "very bad" and "bad" were categorized as poor subjective health.

Laughter

We analyzed three types of variables related to laughter: frequency of laughing, number of opportunities for laughter, and laughing during interpersonal interactions. Respondents were asked to check up to eight different opportunities for laughing: during conversations with friends, conversations with a partner, conversations with children and grandchildren, watching TV and videos, listening to the radio, watching comic storytellings and plays, reading comics and magazines, and other. Three possible responses were given for laughing during interpersonal interactions: conversations with friends, conversations with a partner, and conversations with children and grandchildren.

Covariates

We controlled for age, sex, marital status, education, occupation, equivalized household income, depressive symptoms, and social participation. For the evaluation of depressive moods, the 15-item GDS (GDS-15) was used. The GDS-15 is a 15-item questionnaire, with a score range from 1 to 15. Higher scores indicate more depressive symptomatology. Following previous studies, we used 5 as the cutoff score for indicating moderate to severe psychological distress (Wongpakaran et al., 2013). For the evaluation of depressive moods, we measured frequency of social participations by summing up the number of opportunities per year one participated in social activities and groups. We divided them into four quartiles and used the first quartile as the reference category.

Statistical Analysis

Poisson regression model was used to calculate the prevalence ratio (PR) for poor subjective health by frequency of laughing. In model 1, we controlled for the number of opportunities for laughter. In model 2, depressive symptoms was added as a potential confounder. In model 3, demographic variables (age, sex, marital status) were added to the variables in model 2. In model 4, socioeconomic variables (education, occupation, and equivalized household income) were added to the variables in model 3. In the final model 5, social participation (frequency of social participation per year) was added to the variables in model 4. In models 6 to 10, we repeated the same sequence of analyses as models 1 to 5, except we switched "number of opportunities for laughter" with "number of opportunities for laughter during interpersonal interactions" as a covariate. R 3.1.0 was used for statistical analysis, with a two-tailed significance level set at 5%.

RESULTS

Baseline characteristics are shown in Table 1. Women tend to laugh more frequently as well as to report a higher number of opportunities for laughter, compared with men. The prevalence of poor subjective health and depression according to participants' characteristics are shown in Table 2. We paid particular attention to statistically controlling for depressive symptoms, given the possibility that absence of laughter could be a symptom of depression.

The results of Poisson regression models linking laughter and poor subjective health are shown in Tables 3 and 4. Subjective health was associated with occupation, marital status, and household income in men. For women, in model 1, we found an association between frequency of laughter and poor self-rated health. The PR comparing the bottom to top category of frequency was 3.80 (95% confidence interval [CI], 3.24–4.46). With the successive addition of covariates (across models 2–5, as well as from models 6–10), the PR became more attenuated. Nonetheless, even in the fully adjusted models (models 5 and 10), we found significant associations between frequency of laughter and self-rated health. For women, in model 5, the PRs of poor self-rated health were 1.78 (1.48–2.15) for laughing never or almost never and 1.39 (1.17–1.66) for none to one opportunity of laughing. We found similar tendencies, albeit somewhat weaker associations, among men.

In a subanalysis, we did the same analysis, except we switched subjective health with depression as the objective variable. There were stronger relationships between laughing and depression in both men and women. For women, in model 4, where we controlled all the covariates, the PRs were 3.61 (3.02–4.31).

DISCUSSION

The purpose of the present study was to investigate the effects of laughter on self-rated health after carefully controlling for potential confounders. The results of the study showed that frequency of laughing is significantly related to subjective health. Although some categories

TABLE 2. Prevalence of Poor Subjective Health and Depression by Participants' Characteristics

	Sum of Each		Poor Subjective Health		Depression	
	Men	Women	Men	Women	Men	Women
Depression						
GDS score ≥ 5	1513	1623	715 (47.3%)	648 (39.9%)		
GDS score < 5	8459	8805	1177 (13.9%)	979 (11.1%)		
Frequency of laughing in 4 wks (days)						
Almost every day	3762	5070	482 (12.8%)	518 (10.2%)	281 (7.5%)	391 (7.7%)
1–5 days per week	3754	3877	679 (18.1%)	658 (17.0%)	494 (13.2%)	665 (17.2%)
1–3 days per month	1463	935	349 (23.9%)	239 (25.6%)	319 (21.8%)	295 (31.6%)
Never or almost never	993	546	382 (38.5%)	212 (38.8%)	419 (42.2%)	272 (49.8%)
Number of opportunities of laughing						
≥4	2088	2892	266 (12.7%)	249 (8.6%)	136 (6.5%)	204 (7.1%)
2–3	5122	5508	856 (16.7%)	877 (15.9%)	672 (13.1%)	810 (14.7%)
0–1	2762	2028	770 (27.9%)	501 (24.7%)	705 (25.5%)	609 (30.0%)
Number of opportunities for laughing in interpersonal interactions						
3	1734	1813	206 (11.9%)	140 (7.7%)	110 (6.3%)	101 (5.6%)
2	2825	3750	440 (15.6%)	455 (12.1%)	274 (9.7%)	413 (11.0%)
1	3610	3742	686 (19.0%)	700 (18.7%)	584 (16.2%)	696 (18.6%)
0	1803	1123	560 (31.1%)	332 (29.6%)	545 (30.2%)	413 (36.8%)
Social participation per year						
First quartile (men: 0 times, women: 0 times)	2270	2238	649 (28.6%)	571 (25.5%)	571 (25.2%)	589 (26.3%)
Second quartile (men: 1–24 times, women: 1–24 times)	2041	1581	386 (18.9%)	257 (16.3%)	327 (16.0%)	280 (17.7%)
Third quartile (men: 25–102 times, women: 24–138 times)	1739	1906	269 (15.5%)	235 (12.3%)	186 (10.7%)	212 (11.1%)
Fourth quartile (men: >102 times, women: >138 times)	2010	1859	228 (11.3%)	150 (8.1%)	154 (7.7%)	153 (8.2%)
Missing data	1912	2844	360 (18.8%)	414 (14.6%)	275 (14.4%)	389 (13.7%)
Age, yrs						
65–69	3124	3095	455 (14.6%)	331 (10.7%)	414 (13.3%)	404 (13.1%)
70–74	3024	3252	493 (16.3%)	438 (13.5%)	420 (13.9%)	458 (14.1%)
75–79	2137	2199	519 (24.3%)	408 (18.6%)	353 (16.5%)	362 (16.5%)
≥80	1687	1882	425 (25.2%)	450 (23.9%)	326 (19.3%)	399 (21.2%)
Educational attainment						
≥10 yrs	6339	5979	1042 (16.4%)	763 (12.8%)	779 (12.3%)	755 (12.6%)
<10 yrs	3633	4449	850 (23.4%)	864 (19.4%)	734 (20.2%)	868 (19.5%)
Missing data	55	94	11 (20.0%)	16 (17.0%)	13 (23.6%)	23 (24.5%)
Longest jobs						
Professionals, managers	3665	1091	579 (15.8%)	138 (12.6%)	440 (12.0%)	129 (11.8%)
Clerks, services, engineers	4103	5117	830 (20.2%)	710 (13.9%)	637 (15.5%)	751 (14.7%)
Agricultures, forestries, fisheries, self-employed, other	1623	2153	345 (21.3%)	417 (19.4%)	314 (19.3%)	393 (18.3%)
No jobs	50	935	15 (30.0%)	175 (18.7%)	17 (34.0%)	151 (16.1%)
Missing data	531	1132	123 (23.2%)	187 (16.5%)	105 (19.8%)	199 (17.6%)
Marital status						
Married	8586	6261	1562 (18.2%)	873 (13.9%)	1161 (13.5%)	780 (12.5%)
Bereaved	732	3275	159 (21.7%)	577 (17.6%)	161 (22.0%)	634 (19.4%)
Divorced	254	416	65 (25.6%)	66 (15.9%)	70 (27.6%)	94 (22.6%)
Never married	201	215	50 (24.9%)	39 (18.1%)	63 (31.3%)	51 (23.7%)
Other	95	74	29 (30.5%)	20 (27.0%)	32 (33.7%)	23 (31.1%)
Missing data	104	187	27 (26.0%)	52 (27.8%)	26 (25.0%)	41 (21.9%)
Equivalent family income (10,000 yen)						
First quintile (men: 8.84–129.90, women: 8.84–123.74)	1771	1666	472 (26.7%)	334 (20.0%)	476 (26.9%)	398 (23.9%)
Second quintile (men: 129.90–194.45, women: 123.74–175.00)	1687	1695	344 (20.4%)	310 (18.3%)	299 (17.7%)	331 (19.5%)
Third quintile (men: 194.45–247.49, women: 175.00–245.97)	1544	1746	264 (17.1%)	227 (13.0%)	212 (13.7%)	254 (14.5%)
Fourth quintile (men: 247.49–318.20, women: 245.97–318.20)	1769	1476	282 (15.9%)	185 (12.5%)	164 (9.3%)	164 (11.1%)
Fifth quintile (men: >318.20, women: >318.20)	2229	1961	322 (14.4%)	248 (12.6%)	167 (7.5%)	161 (8.2%)
Missing data	972	1884	208 (21.4%)	323 (17.1%)	195 (20.1%)	315 (16.7%)

TABLE 3. PR and CI for Poor Subjective Health in Men

	Crude		Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7		Model 8		Model 9		Model 10	
	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI
Frequency of laughing																						
Almost every day	Ref	–	Ref	–	Ref	–	Ref	–	Ref	–	Ref	–	Ref	–	Ref	–	Ref	–	Ref	–	Ref	–
1–5 days per week	1.41	1.26–1.59	1.34	1.19–1.51	1.24	1.10–1.40	1.25	1.11–1.40	1.24	1.10–1.40	1.25	1.11–1.40	1.32	1.17–1.49	1.24	1.10–1.39	1.24	1.10–1.39	1.24	1.10–1.39	1.24	1.10–1.40
1–3 days per month	1.86	1.62–2.14	1.65	1.43–1.91	1.39	1.20–1.61	1.38	1.20–1.60	1.38	1.19–1.59	1.37	1.19–1.59	1.62	1.40–1.87	1.38	1.19–1.60	1.37	1.19–1.59	1.37	1.18–1.59	1.37	1.19–1.59
Never or almost never	3.00	2.63–3.43	2.39	2.05–2.79	1.63	1.39–1.91	1.62	1.38–1.90	1.60	1.36–1.87	1.54	1.31–1.80	2.30	1.97–2.69	1.62	1.38–1.90	1.59	1.36–1.87	1.58	1.35–1.86	1.54	1.31–1.81
Number of opportunities of laughing																						
≥4	Ref	–	Ref	–	Ref	–	Ref	–	Ref	–	Ref	–										
2–3	1.31	1.14–1.51	1.16	1.01–1.33	1.08	0.94–1.25	1.09	0.95–1.26	1.09	0.95–1.26	1.06	0.92–1.22										
0–1	2.19	1.90–2.52	1.53	1.31–1.78	1.34	1.15–1.57	1.33	1.13–1.55	1.32	1.13–1.54	1.25	1.07–1.46										
Number of opportunities for laughing in interpersonal interactions (times)																						
3	Ref	–											Ref	–	Ref	–	Ref	–	Ref	–	Ref	–
2	1.31	1.11–1.55											1.22	1.03–1.44	1.18	1.00–1.40	1.19	1.01–1.40	1.20	1.01–1.42	1.17	0.99–1.38
1	1.60	1.37–1.87											1.35	1.15–1.59	1.23	1.05–1.44	1.23	1.04–1.44	1.23	1.04–1.44	1.16	0.99–1.37
0	2.61	2.23–3.07											1.76	1.47–2.10	1.48	1.24–1.77	1.48	1.23–1.77	1.45	1.21–1.74	1.35	1.12–1.61
Depression																						
GDS ≥ 5	3.40	3.09–3.73			2.84	2.57–3.14	2.79	2.52–3.08	2.69	2.43–2.98	2.56	2.31–2.84			2.82	2.55–3.12	2.77	2.50–3.06	2.67	2.41–2.96	2.55	2.30–2.83
GDS < 5	Ref	–			Ref	–	Ref	–	Ref	–	Ref	–			Ref	–	Ref	–	Ref	–	Ref	–
Age, yrs																						
65–69	Ref	–					Ref	–	Ref	–	Ref	–					Ref	–	Ref	–	Ref	–
70–74	1.12	0.99–1.27					1.13	0.99–1.28	1.11	0.98–1.26	1.13	0.99–1.29					1.13	0.99–1.28	1.11	0.97–1.26	1.13	0.99–1.28
75–79	1.67	1.47–1.89					1.57	1.38–1.78	1.53	1.35–1.74	1.56	1.37–1.77					1.56	1.38–1.78	1.53	1.35–1.74	1.55	1.37–1.77
≥80	1.73	1.52–1.97					1.55	1.35–1.78	1.51	1.32–1.74	1.51	1.31–1.73					1.56	1.36–1.79	1.52	1.33–1.75	1.52	1.32–1.74
Marital status																						
Married	Ref	–					Ref	–	Ref	–	Ref	–					Ref	–	Ref	–	Ref	–
Bereaved	1.19	1.01–1.41					0.84	0.71–0.99	0.84	0.71–0.99	0.84	0.71–1.00					0.83	0.70–0.99	0.83	0.70–0.98	0.84	0.71–0.99
Divorced	1.41	1.10–1.80					1.05	0.81–1.35	1.03	0.80–1.32	1.00	0.78–1.29					1.04	0.81–1.34	1.02	0.79–1.32	1.00	0.78–1.29
Never married	1.37	1.03–1.81					1.00	0.75–1.34	0.95	0.71–1.27	0.92	0.69–1.23					0.98	0.73–1.31	0.93	0.70–1.25	0.91	0.68–1.21
Other	1.68	1.16–2.42					1.14	0.79–1.65	1.09	0.75–1.58	1.08	0.74–1.56					1.13	0.78–1.64	1.09	0.75–1.57	1.08	0.74–1.56
Missing data	1.43	0.98–2.09					1.02	0.70–1.50	0.97	0.66–1.43	1.00	0.67–1.47					1.01	0.69–1.48	0.95	0.65–1.41	0.98	0.67–1.45
Educational attainment																						
≥10 yrs	Ref	–							Ref	–	Ref	–							Ref	–	Ref	–
<10 yrs	1.43	1.30–1.56							1.15	1.04–1.27	1.12	1.02–1.24							1.14	1.04–1.26	1.12	1.01–1.23
Missing data	1.22	0.67–2.21							0.93	0.51–1.68	0.93	0.51–1.68							0.91	0.50–1.66	0.91	0.50–1.66
Longest jobs																						
Professionals, managers	Ref	–							Ref	–	Ref	–							Ref	–	Ref	–
Clerks, services, engineers	1.28	1.15–1.42							1.13	1.02–1.26	1.11	0.99–1.24							1.13	1.01–1.26	1.11	0.99–1.23
Agricultures, forestries, fisheries, self-employed, other	1.35	1.18–1.54							1.06	0.92–1.22	1.03	0.90–1.19							1.06	0.93–1.22	1.04	0.90–1.19
No jobs	1.90	1.14–3.17							1.06	0.63–1.78	1.03	0.61–1.73							1.07	0.64–1.80	1.04	0.62–1.75
Missing data	1.47	1.21–1.78							1.14	0.93–1.39	1.13	0.93–1.38							1.15	0.94–1.40	1.14	0.93–1.39
Equivalent family income (10,000 yen)																						
First quintile (men: 8.84–129.90, women: 8.84–123.74)	1.84	1.60–2.13							1.13	0.97–1.31	1.12	0.96–1.30							1.13	0.97–1.31	1.12	0.96–1.30
Second quintile (men: 129.90–194.45, women: 123.74–175.00)	1.41	1.21–1.64							1.07	0.92–1.25	1.07	0.91–1.25							1.07	0.91–1.25	1.06	0.91–1.24

Third quintile (men: 194.45–247.49, women: 175.00–245.97)	1.18	1.01–1.39						1.00	0.85–1.18	0.99	0.84–1.17
Fourth quintile (men: 247.49–318.20, women: 245.97–318.20)	1.10	0.94–1.29						1.02	0.87–1.19	1.02	0.87–1.20
Fifth quintile (men: >318.20, women: >318.20)	Ref	–						Ref	–	Ref	–
Missing data	1.48	1.24–1.76						0.96	0.80–1.16	0.95	0.80–1.15
Frequency of social participation per year (times)											
First quartile (men: 0 times, women: 0 times)	Ref	–								Ref	–
Second quartile (men: 1–24 times, women: 1–24 times)	0.66	0.58–0.75								0.82	0.72–0.93
Third quartile (men: 25–102 times, women: 24–138 times)	0.54	0.47–0.62								0.76	0.66–0.88
Fourth quartile (men: >102 times, women: >138 times)	0.40	0.34–0.46								0.59	0.51–0.70
Missing data	0.66	0.58–0.75								0.79	0.69–0.90
			1.01	0.86–1.19	1.00	0.85–1.18					
			1.02	0.87–1.20	1.03	0.87–1.21					
			Ref	–	Ref	–					
			0.96	0.80–1.15	0.95	0.79–1.14					
					Ref	–					
					0.82	0.72–0.94					
					0.75	0.65–0.87					
					0.59	0.50–0.69					
					0.78	0.69–0.90					

of laughter were not significant in men, the results still suggested a protective effect of laughter, both in terms of frequency as well as number of different occasions for laughter. Statistical adjustment for depression, sociodemographic factors, and social participation resulted in an attenuation of the relation. Depression and social participation were especially important confounders to consider. Nonetheless, our findings suggest that encouraging laughter may be a potential avenue for health promotion.

The relationship between laughter and subjective health may be underpinned by at least four distinct mechanisms (Martin, 2002). First, laughter may have direct psycho-neuro-immunological benefits such as lowering markers of inflammation. Second, laughter may be a marker of positive emotions, which can promote resilience against disease (Kubzansky, 2011). Third, laughing can buffer the effects of stress (Berk et al., 1989). Finally, people who laugh often can make a good impression on others and make others more likely to help them, for example, by providing them with social support.

The simple frequency of laughter seems to be more predictive of subjective health than the number of different occasions/contexts for laughter. This finding is consistent with previous studies that have found that laughing frequently is related to emotional well-being and life satisfaction (Hasan and Hasan, 2009). According to Schimmack et al. (2002), life satisfaction is correlated with emotional well-being, and the association is stronger in individualistic societies. The current study shows that there are stronger relationships between laughter and subjective health in older people. Alpass and Neville (2003) reported in their study that the most significant predictor of depression in older men was loneliness and that age-related losses (such as decline in mobility) may weaken their ability to maintain relationships with others. The current study also shows that women laugh more frequently than men do and laughter is more strongly related to subjective health among women. LaFrance et al. (2003) reported that women smile and laugh more than men do. These findings suggest that laughter is especially important for old people and women.

However, the present study had limitations. First and foremost, we are unable to establish a causal relationship between laughter and poor subjective health owing to the cross-sectional nature of the data. Longitudinal analyses of our cohort data will clarify how laughing can prevent poor subjective health. In addition, we cannot completely exclude the possibility of reverse causation, even though the study controlled for depression and other covariates. The third limitation is that all the answers to questionnaire were self-reported. The perceived frequency of laughter may be at variance from the actual frequency, but we lacked objective data on laughing frequency. Moreover, we did not consider the types of laughter. There are many types of laughing, for example, smiling is an indication of fondness and appeasement, whereas laughter expresses playfulness (Hooff, 1972), and Duchenne laughter is coming from positive emotion, whereas non-Duchenne laughter is fake laughter (Gervais and Wilson, 2005). Further studies are needed to examine these differences among various types of laughter. There is missing information for 882 subjects with missing in subjective health status, 1306 in laughter, and 4692 in depression. It may be plausible that less healthy people are more likely not to report their health status, possibly making the association between laughter and health underestimated. Finally, it is unclear whether laughter can prevent disease onset. Although previous research has indicated that laughter can improve the biomarkers of immune function (Bennett and Lengacher, 2009; Donkor et al., 2014), there were very few studies that examined actual disease outcomes. Martin (2002) even reported that many studies regarding the health benefits of humor and laughter are less conclusive than commonly believed. However, Donkor et al. (2014) showed that health-related quality of life among stroke survivors was significantly related to laughter, and this is consistent with our subanalysis. Future study needs to investigate further this point.

TABLE 4. PR and CI for Poor Subjective Health in Women

	Crude		Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7		Model 8		Model 9		Model 10	
	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI
Frequency of laughing																						
Almost every day	Ref	–	Ref	–	Ref	–	Ref	–	Ref	–	Ref	–	Ref	–	Ref	–	Ref	–	Ref	–	Ref	–
1–5 days per week	1.66	1.48–1.86	1.51	1.34–1.70	1.33	1.18–1.50	1.33	1.18–1.49	1.33	1.18–1.50	1.33	1.18–1.50	1.48	1.31–1.66	1.32	1.17–1.48	1.31	1.16–1.48	1.31	1.17–1.48	1.32	1.17–1.49
1–3 days per month	2.50	2.15–2.92	2.09	1.78–2.45	1.59	1.35–1.87	1.59	1.35–1.87	1.58	1.34–1.86	1.55	1.32–1.83	1.97	1.68–2.32	1.53	1.30–1.80	1.53	1.30–1.80	1.52	1.29–1.80	1.50	1.28–1.77
Never or almost never	3.80	3.24–4.46	2.90	2.42–3.47	1.89	1.57–2.28	1.86	1.54–2.25	1.85	1.54–2.24	1.78	1.48–2.15	2.61	2.17–3.14	1.76	1.46–2.13	1.74	1.44–2.10	1.73	1.43–2.10	1.68	1.39–2.04
Number of opportunities of laughing																						
≥4	Ref	–	Ref	–	Ref	–	Ref	–	Ref	–	Ref	–										
2–3	1.85	1.61–2.13	1.60	1.38–1.84	1.48	1.28–1.71	1.46	1.26–1.69	1.44	1.25–1.67	1.39	1.20–1.61										
0–1	2.87	2.46–3.34	1.89	1.59–2.24	1.60	1.35–1.89	1.51	1.27–1.80	1.47	1.24–1.75	1.39	1.17–1.66										
Number of opportunities for laughing in interpersonal interactions (times)																						
3	Ref	–											Ref	–	Ref	–	Ref	–	Ref	–	Ref	–
2	1.57	1.30–1.90											1.42	1.17–1.71	1.34	1.11–1.62	1.35	1.11–1.65	1.34	1.10–1.63	1.33	1.09–1.61
1	2.42	2.02–2.90											1.94	1.61–2.34	1.71	1.42–2.07	1.70	1.40–2.07	1.67	1.37–2.03	1.60	1.32–1.95
0	3.83	3.14–4.66											2.37	1.91–2.95	1.89	1.51–2.35	1.83	1.46–2.30	1.78	1.41–2.23	1.66	1.32–2.08
Depression																						
GDS ≥ 5	3.59	3.25–3.97			2.84	2.55–3.17	2.79	2.50–3.10	2.72	2.44–3.04	2.58	2.31–2.88			2.79	2.51–3.11	2.75	2.46–3.06	2.69	2.41–3.00	2.56	2.29–2.86
GDS < 5	Ref	–			Ref	–	Ref	–	Ref	–	Ref	–			Ref	–	Ref	–	Ref	–	Ref	–
Age, yrs																						
65–69	Ref	–					Ref	–	Ref	–	Ref	–					Ref	–	Ref	–	Ref	–
70–74	1.26	1.09–1.45					1.24	1.07–1.43	1.21	1.04–1.39	1.21	1.05–1.40					1.23	1.06–1.42	1.20	1.04–1.38	1.20	1.04–1.39
75–79	1.73	1.50–2.01					1.61	1.39–1.87	1.55	1.33–1.80	1.53	1.31–1.78					1.58	1.37–1.83	1.53	1.31–1.77	1.51	1.30–1.75
≥80	2.24	1.94–2.58					1.91	1.64–2.23	1.82	1.55–2.13	1.72	1.47–2.01					1.88	1.62–2.20	1.80	1.54–2.10	1.70	1.45–1.99
Marital status																						
Married	Ref	–					Ref	–	Ref	–	Ref	–					Ref	–	Ref	–	Ref	–
Bereaved	1.26	1.14–1.40					0.84	0.75–0.94	0.83	0.74–0.94	0.84	0.75–0.95					0.80	0.71–0.90	0.80	0.71–0.90	0.81	0.72–0.91
Divorced	1.14	0.89–1.46					0.85	0.66–1.10	0.86	0.67–1.10	0.83	0.64–1.06					0.80	0.62–1.03	0.81	0.63–1.04	0.78	0.61–1.01
Never married	1.30	0.94–1.79					0.86	0.62–1.19	0.90	0.65–1.25	0.87	0.63–1.20					0.79	0.57–1.10	0.84	0.60–1.16	0.81	0.59–1.13
Other	1.94	1.24–3.02					1.09	0.70–1.71	1.06	0.68–1.66	1.01	0.64–1.58					1.05	0.67–1.64	1.02	0.65–1.60	0.98	0.62–1.53
Missing data	1.99	1.51–2.64					1.32	0.99–1.75	1.32	0.99–1.76	1.32	0.98–1.76					1.27	0.96–1.68	1.27	0.95–1.70	1.28	0.95–1.71
Educational attainment																						
≥10 yrs	Ref	–							Ref	–	Ref	–							Ref	–	Ref	–
<10 yrs	1.53	1.39–1.69							1.17	1.05–1.30	1.13	1.02–1.26							1.17	1.05–1.29	1.13	1.02–1.25
Missing data	1.34	0.82–2.20							0.90	0.55–1.49	0.87	0.53–1.44							0.89	0.54–1.47	0.87	0.52–1.43
Longest jobs																						
Professionals, managers	Ref	–							Ref	–	Ref	–							Ref	–	Ref	–
Clerks, services, engineers	1.10	0.91–1.32							1.02	0.84–1.22	0.99	0.83–1.19							1.01	0.84–1.22	0.99	0.82–1.19
Agricultures, forestries, fisheries, self-employed, other	1.53	1.26–1.86							1.18	0.96–1.43	1.12	0.92–1.36							1.17	0.96–1.43	1.11	0.91–1.36
No jobs	1.48	1.18–1.85							1.13	0.90–1.42	1.07	0.86–1.35							1.13	0.90–1.41	1.07	0.85–1.34
Missing data	1.31	1.05–1.63							0.93	0.74–1.17	0.91	0.73–1.15							0.93	0.74–1.17	0.91	0.72–1.15
Equivalent family income (10,000 yen)																						
First quintile (men: 8.84–129.90, women: 8.84–123.74)	1.59	1.35–1.87							1.00	0.84–1.19	0.99	0.84–1.18							0.99	0.83–1.17	0.98	0.83–1.17
Second quintile (men: 129.90–194.45, women: 123.74–175.00)	1.45	1.22–1.71							1.07	0.90–1.27	1.05	0.89–1.25							1.06	0.89–1.25	1.04	0.88–1.24
Third quintile (men: 194.45–247.49, women: 175.00–245.97)	1.03	0.86–1.23							0.86	0.71–1.03	0.87	0.72–1.04							0.85	0.71–1.02	0.86	0.72–1.03

Fourth quintile (men: 247.49–318.20, women: 245.97–318.20)	0.99	0.82–1.20							0.92	0.76–1.11	0.91	0.75–1.11
Fifth quintile (men: >318.20, women: >318.20)	Ref	–							Ref	–	Ref	–
Missing data	1.36	1.15–1.60							0.97	0.81–1.15	0.97	0.81–1.15
Frequency of social participation per year (times)												
First quartile (men: 0 times, women: 0 times)	Ref	–									Ref	–
Second quartile (men: 1–24 times, women: 1–24 times)	0.64	0.55–0.74									0.82	0.71–0.96
Third quartile (men: 25–102 times, women: 24–138 times)	0.48	0.42–0.56									0.75	0.64–0.87
Fourth quartile (men: >102 times, women: >138 times)	0.32	0.26–0.38									0.55	0.45–0.66
Missing data	0.57	0.50–0.65									0.76	0.66–0.86

Fourth quintile (men: 247.49–318.20, women: 245.97–318.20)									0.92	0.76–1.11	0.92	0.76–1.11
Fifth quintile (men: >318.20, women: >318.20)									Ref	–	Ref	–
Missing data									0.98	0.82–1.16	0.97	0.82–1.16
Frequency of social participation per year (times)												
First quartile (men: 0 times, women: 0 times)											Ref	–
Second quartile (men: 1–24 times, women: 1–24 times)											0.82	0.71–0.95
Third quartile (men: 25–102 times, women: 24–138 times)											0.74	0.63–0.86
Fourth quartile (men: >102 times, women: >138 times)											0.54	0.45–0.65
Missing data											0.75	0.66–0.86

In conclusion, laughter may lower the risk of poor subjective health of older people, and this effect was observed even after adjusting for depression, socioeconomic status, and social participation. Moreover, laughing frequently regardless of situations may be effective for decreasing the risk. The mechanisms and determinants of laughter warrant further study to use laughter effectively to improve the physical and psychological health of old people.

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DISCLOSURE

The authors declare no conflict of interest.

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