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Original Article

Factors Associated With Psychological Distress in a Community-Dwelling Japanese Population: The Ohsaki Cohort 2006 Study

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ABSTRACT

Background: In Asia, there has been no population-based epidemiological study using the K6, a 6-item instrument that assesses nonspecific psychological distress.

Methods: Using cross-sectional data from 2006, we studied 43 716 (20 168 men and 23 548 women) community-dwelling people aged 40 years or older living in Japan. We examined the association between psychological distress and demographic, medical, lifestyle, and social factors by using the K6, with psychological distress defined as 13 or more points out of a total of 24 points.

Results: The following variables were significantly associated with psychological distress among the population: female sex, young and old age, a history of serious disease (hypertension, diabetes mellitus, stroke, myocardial infarction, or cancer), current smoking, former alcohol drinking, low body mass index, shorter daily walking time, lack of social support (4 of 5 components), and lack of participation in community activities (4 of 5 components). Among men aged 40 to 64 years, only "lack of social support for consultation when in trouble" and a history of diabetes mellitus remained significant on multivariate analysis. Among men aged 65 years or older, age was not significantly associated with psychological distress, and the significant association with current smoking disappeared on multivariate analysis. Among women aged 40 to 64 years, a history of stroke was not associated with psychological distress. Among women aged 65 years or older, the significant association with current smoking disappeared on multivariate analysis.

Conclusions: A number of factors were significantly associated with psychological distress, as assessed by the K6. These factors differed between men and women, and also between middle-aged and elderly people.

Key words: cross-sectional; K6; population-based; psychological distress

INTRODUCTION

Mental health is an important component of overall well-being. About 14% of the global disease burden has been attributed to mental illness, mostly due to the chronically disabling nature of depression and other common mental disorders.[1,2] Although numerous studies have produced systematic evidence regarding the risk factors for physical health, the understanding of factors related to mental health, particularly in Asian countries, is still limited.[2]

In 2002, in an attempt to devise a method to easily assess mental health in general population surveys, Kessler and colleagues developed a scale of nonspecific psychological distress—the K6—that comprises only 6 questions.[3] The K6 was originally developed to identify persons with a high likelihood of developing mental conditions, such as depression and mood or anxiety disorders.[4] However, the K6 and the K10 (the K6 plus 4 additional questions related to symptoms of distress) have also been used to estimate the prevalence of nonspecific psychological distress in general population surveys,[5] and as part of the World Health Organization's World Mental Health Surveys.[6] Although it is brief enough to be added to lengthy general health questionnaires, a major limitation of the K6 is that it does not

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provide information on the particular psychiatric diagnosis or diagnoses a respondent may have. Nevertheless, researchers have begun to use the K6 for studies in clinical settings,[7] as well as in epidemiological studies[8,9] and large, nationally representative surveys. Despite the frequent use of the K6, no population-based epidemiological study has used this scale to clarify the factors associated with mental health in Asian countries.

The objective of the present study was to use the K6 to identify factors associated with psychological distress in a community-dwelling Japanese population. We also briefly describe the overall design of the study, as this is the first report from a new prospective cohort study, the Ohsaki Cohort 2006 Study.

METHODS

Study design, setting, and participants

The Ohsaki Cohort 2006 Study is a prospective cohort study, from which we analyzed cross-sectional data from a baseline survey. The source population for the baseline survey comprised community-dwelling individuals aged 40 years or older who were included in the Residential Registry for Ohsaki City, Miyagi Prefecture, northeastern Japan, as of December 1, 2006. The Residential Registry identified 78 101 persons (36 397 men; 41 704 women) living in the area.

The baseline survey was conducted from December 1 to December 15, 2006. A questionnaire was distributed by the heads of individual administrative districts to individual households, and returned by mail. Of the 78 101 persons, 866 were ineligible due to death, move-out, or hospitalization, yielding an eligible population of 77 235. The baseline questionnaires (described below) were collected from 50 210 persons, and valid responses were received from 49 855 (22 547 men and 27 308 women), who ultimately formed the study population of cohort participants. Among the study population, 26 512 persons (53.2%) were aged 40 to 64 years, and 23 343 (46.8%) were aged 65 years or older. The response rate was calculated by dividing the study population by the total eligible population, yielding 64.5%. The corresponding response rates, with respect to sex and age categories, were 54.9% and 60.4% among men and women aged 40 to 64 years, respectively, and 77.1% and 73.2% among men and women aged 65 years or older, respectively.

When analyzing the prevalence of psychological distress and its associations with demographic, medical, lifestyle, and social factors, we excluded participants for whom K6 data were missing ($n = 6139$). Consequently, the analyzed population comprised 43 716 participants (20 168 men and 23 548 women; 56.6% of the eligible population).

Baseline survey

The baseline questionnaires for persons aged 40 to 64 years consisted of the following details in sequence: (1) history of diseases, (2) family history of diseases, (3) health status during the preceding year, (4) smoking status, (5) alcohol drinking status, (6) dietary habits,[10] (7) job status and educational status, (8) present and past body weight and height, (9) health status in general, (10) sports and exercise,[11,12] (11) psychological distress (K6),[3,4] (12) social support,[13] (13) participation in community activities, (14) dental status, and (15) reproductive factors (among women).

The baseline questionnaires for persons aged 65 years or older consisted of the following details in sequence: (1) a frailty checklist (the Kihon checklist),[14] (2) history of diseases, (3) health status during the preceding year, (4) smoking status, (5) alcohol drinking status, (6) dietary habits,[10] (7) past body weight and height, (8) health status in general, (9) pain, (10) daily activities, (11) sports and exercise,[11,12] (12) psychological distress (K6),[3,4] (13) social support,[13] (14) participation in community activities, and (15) dental status.

Questionnaire items for persons aged 65 years or older were identical to those for persons aged 40 to 64 years, except that the former excluded family history of diseases, job status and educational status, present and past body weight and height, and reproductive factors in women, and included the frailty checklist, past body weight and height, pain, and daily activities.

Measurement of psychological distress

The K6 was used as an indicator of psychological distress.[3,4] The 6 questions were as follows: "Over the last month, how often did you feel: (1) nervous, (2) hopeless, (3) restless or fidgety, (4) so sad that nothing could cheer you up, (5) that everything was an effort, (6) worthless?" Participants were asked to respond by choosing "all of the time" (4 points), "most of the time" (3 points), "some of the time" (2 points), "a little of the time" (1 point), and "none of the time" (0 points). Total point score therefore ranged from 0 to 24. The K6 has been developed using modern psychometric theory and has been shown to be superior to some existing scales in brevity and psychometric properties.[3,4,15] The Japanese version of the K6 has been recently developed, using the standard back-translation method, and has been validated.[16] As suggested by Kessler and colleagues,[15] we classified participants with scores of 13 points or more as having psychological distress.

Measurement of other variables

The degree of social support available to each person was assessed by asking the following questions[13]: (1) Do you have someone with whom you can consult when you are in trouble?, (2) Do you have someone with whom you can consult when your physical condition is bad?, (3) Do you have someone who can help you with your daily housework?, (4) Do you have someone who can take you to a hospital when you do not feel well?, and (5) Do you have someone

who can take care of you when you are ill in bed? This social support questionnaire consisted of 5 questions, each requiring an answer of yes or no. This questionnaire was only available in Japanese, and its validity and reliability were not evaluated.

The frailty checklist is a tool developed by the Japanese Ministry of Health, Labour, and Welfare to screen for frail persons and is designed to measure actual task performance.[14] Researchers have also begun to use this tool in epidemiological surveys.[14]

Ethical issues

The return of questionnaires completed by the participants was regarded as consent to participate in the study, which involved cross-sectional analysis of the baseline survey data and the longitudinal study of subsequent mortality and immigration. The study protocol was reviewed and approved by the Ethics Committee of Tohoku University Graduate School of Medicine.

Statistical analysis

We used univariate and multivariate logistic regression analysis to calculate the odds ratios (ORs) for psychological distress (a K6 total score of ≥13 points) relative to demographic, medical, lifestyle, and social factors. In these analyses, we investigated the following factors: sex, age (40–44, 45–49, 50–54, 55–59, 60–64, 65–69, 70–74, 75–79, 80–84, ≥85 years), history of hypertension (yes, no), history of diabetes mellitus (yes, no), history of stroke (yes, no), history of myocardial infarction (yes, no), history of cancer (yes, no), smoking status (never, former, current), alcohol drinking (never, former, current), body mass index (kg/m^2) calculated with self-reported weight and height; <18.5, 18.5–24.9, ≥25.0), daily walking time (<30 min/day, 30 min–1 hour/day, ≥1 hour/day), social support (yes, none), participation in community activities (yes, none). In the multivariate models, the above variables were all adjusted for each other. Analyses were repeated by stratifying the population by sex and age categories (40–64 years, 65 years or older). When analyzing the data for men and women aged 40 to 64 years, we further added current employment status (yes, no) and duration of education (≤12 years, >12 years) as covariates. All statistical analyses were performed with SAS version 9.1 (SAS Inc., Cary, NC, USA), and all statistical tests were 2-sided. A P value less than 0.05 was considered to indicate statistical significance.

RESULTS

Prevalence proportion, and univariate and multivariate analysis of psychological distress among the total population

The crude prevalence proportion of psychological distress in the analyzed population was 6.7% (2921/43 716; 95% confidence interval [CI], 6.5 to 6.9). Univariate analysis showed that the following were significantly associated with a higher prevalence of psychological distress: female sex, young and old age, a history of serious disease, a current smoking habit, a former alcohol drinking habit, low BMI, shorter daily walking time, lack of social support, and lack of participation in community activities.

After mutual adjustment for the variables shown in Table 1, women had approximately 1.6 times the odds of psychological distress, relative to men. There was a U-shaped association between age category (5-year categories from 40–44 to ≥85 years) and the prevalence of psychological distress, with a nadir for those aged 65 to 69 years.

History of hypertension, diabetes mellitus, stroke, myocardial infarction, or cancer were all associated with a significantly higher prevalence of psychological distress in the multivariate models (Table 1). Among these diseases, a history of stroke was most strongly associated with psychological distress, and had more than 2 times the odds of psychological distress, relative to those who had no history of stroke.

A current smoking habit (vs never smoker), former smoking habit (vs never smoker), former alcohol drinking habit (vs never drinker), low BMI (vs normal BMI), and less daily walking time (vs time spent walking ≥1 hr) were associated with a higher odds for psychological distress, even in multivariate analysis (Table 1). In contrast, a moderate daily walking time (vs time spent walking ≥1 hr) was associated with a significantly lower odds.

Among the variables studied, lack of social support for consultation when in trouble was most strongly associated with a high prevalence of psychological distress in the multivariate models, although the association between other components of lack of social support and psychological distress was substantially attenuated in multivariate analysis (Table 1). The multivariate-adjusted OR (95% CI) for psychological distress associated with lack of social support for consultation when in trouble was 2.24 (1.97 to 2.56). The association of lack of participation in community activities with psychological distress was also attenuated, but lack of participation in neighborhood association activities, sports or exercise, volunteering, and community social gatherings were all associated with a higher prevalence of psychological distress, even in multivariate analysis.

Stratified analysis by sex and age categories (40 to 64 years, 65 years or older)

Stratified analysis by sex and age categories (40 to 64 years, 65 years or older) yielded results similar to those for the participants as a whole (Table 1), but the statistically significant associations that had been observed between several factors and psychological distress disappeared in each stratum.

Table 1. Univariate and multivariate analysis of the associations between psychological distress and demographic, medical, lifestyle, and social factors among the total study population[a]

Variables	No. of persons with psychological distress /No. of participants	Univariate OR (95% CI)	Multivariate OR (95% CI)[b]
Sex			
Male	1146/20 168	1.00 (referent)	1.00 (referent)
Female	1775/23 548	1.35 (1.25–1.46)	1.58 (1.41–1.76)
Age group (years)			
40–44	316/3702	1.00 (referent)	1.00 (referent)
45–49	380/4739	0.93 (0.80–1.09)	0.93 (0.79–1.09)
50–54	390/5712	0.79 (0.67–0.92)	0.79 (0.67–0.93)
55–59	398/6734	0.67 (0.58–0.79)	0.65 (0.56–0.77)
60–64	226/4461	0.57 (0.48–0.68)	0.54 (0.45–0.65)
65–69	240/5091	0.53 (0.45–0.63)	0.52 (0.43–0.63)
70–74	296/5242	0.64 (0.54–0.76)	0.57 (0.47–0.68)
75–79	281/4167	0.78 (0.66–0.92)	0.60 (0.50–0.72)
80–84	214/2347	1.08 (0.90–1.29)	0.74 (0.60–0.91)
≥85	180/1521	1.44 (1.19–1.75)	0.87 (0.69–1.08)
History of diseases			
Hypertension	907/12 658	1.11 (1.03–1.21)	1.17 (1.07–1.28)
Diabetes mellitus	319/3819	1.31 (1.16–1.48)	1.26 (1.11–1.44)
Stroke	156/1012	2.63 (2.21–3.14)	2.12 (1.76–2.57)
Myocardial infarction	122/1147	1.69 (1.40–2.05)	1.51 (1.23–1.86)
Cancer	225/2432	1.46 (1.27–1.68)	1.48 (1.28–1.73)
Smoking status			
Never	1443/22 219	1.00 (referent)	1.00 (referent)
Former	553/9030	0.94 (0.85–1.04)	1.15 (1.01–1.31)
Current	701/9699	1.12 (1.02–1.23)	1.32 (1.17–1.49)
Alcohol drinking status			
Never	1187/17 041	1.00 (referent)	1.00 (referent)
Former	407/3633	1.69 (1.50–1.90)	1.49 (1.31–1.70)
Current	1156/20 840	0.78 (0.72–0.85)	0.94 (0.84–1.04)
Body-mass index			
<18.5 kg/m^2	226/1803	2.12 (1.82–2.45)	1.59 (1.36–1.86)
18.5–24.9 kg/m^2	1689/26 610	1.00 (referent)	1.00 (referent)
≥25.0 kg/m^2	752/12 231	0.97 (0.89–1.06)	0.96 (0.87–1.05)
Time spent walking per day			
<30 min	1426/16 476	1.64 (1.49–1.80)	1.26 (1.14–1.40)
30 min–1 hr	710/14 190	0.91 (0.82–1.02)	0.89 (0.79–0.99)
≥1 hr	658/12 024	1.00 (referent)	1.00 (referent)
Lack of social support:			
(i) to consult when you are in trouble	873/5354	3.46 (3.18–3.77)	2.24 (1.97–2.56)
(ii) to consult when you are in bad physical condition	698/4167	3.39 (3.09–3.72)	1.24 (1.08–1.44)
(iii) to help with your daily housework	852/6701	2.47 (2.27–2.69)	1.12 (0.99–1.27)
(iv) to take you to a hospital	579/3834	2.86 (2.60–3.16)	1.27 (1.10–1.46)
(v) to take care of you	769/5563	2.71 (2.48–2.96)	1.42 (1.25–1.61)
No participation in community activities			
(i) Activities of neighborhood association	1952/22 109	2.26 (2.08–2.46)	1.27 (1.15–1.41)
(ii) Sports or exercise	2090/23 258	2.70 (2.47–2.95)	1.63 (1.47–1.81)
(iii) Volunteering	2307/28 871	2.48 (2.23–2.75)	1.17 (1.03–1.32)
(iv) Social gatherings	2016/22 568	2.48 (2.27–2.71)	1.31 (1.18–1.46)

Abbreviations: OR, odds ratio; CI, confidence interval.
[a]The K6 was used as an indicator of psychological distress,[3,4] with a cut-off point of ≥13 out of 24 points.[15]
[b]In the multivariate models, all variables shown in Table 1 were adjusted for each other.

The statistically significant association between history of hypertension and psychological distress disappeared in all strata. Among men aged 40 to 64 years, there was loss of significant associations with a history of myocardial infarction, history of cancer, being a former smoker, spending less than 30 min per day walking, lacking social support for consultation when in a bad physical condition, lacking social support for transport to a hospital, lacking social support for receiving care, lack of participation in community activities in a neighborhood association, and lack of participation in

Table 2. Multivariate analysis of the association between psychological distress and demographic, medical, lifestyle, and social factors among men aged 40 to 64 years[a]

Variables	No. of persons with psychological distress /No. of participants	Multivariate OR (95% CI)[b]
Age group (years)		
40–44	128/1802	1.00 (referent)
45–49	169/2299	0.99 (0.77–1.27)
50–54	173/2781	0.85 (0.67–1.09)
55–59	168/3269	0.65 (0.50–0.83)
60–64	98/2108	0.55 (0.41–0.73)
History of diseases		
Hypertension	164/2529	1.17 (0.96–1.42)
Diabetes mellitus	98/1030	1.65 (1.30–2.10)
Stroke	24/170	2.42 (1.51–3.89)
Myocardial infarction	18/173	1.62 (0.94–2.76)
Cancer	23/307	1.26 (0.80–1.99)
Smoking status		
Never	97/2099	1.00 (referent)
Former	218/3940	1.19 (0.92–1.54)
Current	405/6087	1.38 (1.09–1.75)
Alcohol drinking status		
Never	107/1622	1.00 (referent)
Former	89/775	1.52 (1.11–2.07)
Current	531/9746	0.89 (0.71–1.11)
Body-mass index		
<18.5 kg/m^2	39/266	2.20 (1.51–3.21)
18.5–24.9 kg/m^2	457/7749	1.00 (referent)
≥25.0 kg/m^2	235/4135	0.94 (0.79–1.12)
Time spent walking per day		
<30 min	330/4418	1.13 (0.94–1.37)
30 min–1 hr	177/3807	0.80 (0.64–0.98)
≥1 hr	217/3847	1.00 (referent)
Lack of social support:		
(i) to consult when you are in trouble	339/2269	2.87 (2.30–3.58)
(ii) to consult when you are in bad physical condition	258/1777	1.11 (0.87–1.41)
(iii) to help with your daily housework	274/2205	1.23 (0.98–1.53)
(iv) to take you to a hospital	185/1340	1.14 (0.86–1.50)
(v) to take care of you	176/1261	1.28 (0.97–1.69)
No participation in community activities		
(i) Activities of neighborhood association	425/5549	1.00 (0.83–1.21)
(ii) Sports or exercise	480/6078	1.35 (1.12–1.63)
(iii) Volunteering	545/7508	1.19 (0.95–1.48)
(iv) Social gatherings	476/5964	1.23 (1.02–1.50)

Abbreviations: OR, odds ratio; CI, confidence interval.
[a]The K6 was used as an indicator of psychological distress,[3,4] with a cut-off point of ≥13 out of 24 points.[15]
[b]In the multivariate models, all variables shown in Table 2 were adjusted for each other.

Table 3. Multivariate analysis of the association between psychological distress and demographic, medical, lifestyle, and social factors among women aged 40 to 64 years[a]

Variables	No. of persons with psychological distress /No. of participants	Multivariate OR (95% CI)[b]
Age group (years)		
40–44	188/1900	1.00 (referent)
45–49	211/2440	0.87 (0.70–1.08)
50–54	217/2931	0.75 (0.60–0.93)
55–59	230/3465	0.65 (0.52–0.81)
60–64	128/2353	0.51 (0.39–0.66)
History of diseases		
Hypertension	162/2225	1.10 (0.90–1.33)
Diabetes mellitus	49/567	1.19 (0.86–1.64)
Stroke	9/61	1.84 (0.87–3.91)
Myocardial infarction	8/48	3.00 (1.34–6.73)
Cancer	55/564	1.58 (1.17–2.13)
Smoking status		
Never	649/10 120	1.00 (referent)
Former	79/819	1.32 (1.02–1.71)
Current	181/1467	1.48 (1.22–1.79)
Alcohol drinking status		
Never	440/6637	1.00 (referent)
Former	104/800	1.55 (1.21–1.98)
Current	391/5197	1.04 (0.89–1.22)
Body-mass index		
<18.5 kg/m^2	79/641	1.49 (1.14–1.93)
18.5–24.9 kg/m^2	636/8876	1.00 (referent)
≥25.0 kg/m^2	248/3423	0.98 (0.84–1.16)
Time spent walking per day		
<30 min	389/5036	0.93 (0.79–1.10)
30 min–1 hr	277/4147	0.91 (0.76–1.09)
≥1 hr	275/3623	1.00 (referent)
Lack of social support:		
(i) to consult when you are in trouble	279/1349	2.20 (1.73–2.79)
(ii) to consult when you are in bad physical condition	256/1254	1.38 (1.07–1.78)
(iii) to help with your daily housework	310/2016	1.15 (0.93–1.42)
(iv) to take you to a hospital	218/1232	1.33 (1.05–1.67)
(v) to take care of you	305/2031	1.40 (1.13–1.74)
No participation in community activities		
(i) Activities of neighborhood association	618/6833	1.26 (1.07–1.48)
(ii) Sports or exercise	702/7344	1.70 (1.43–2.02)
(iii) Volunteering	763/9303	0.97 (0.79–1.19)
(iv) Social gatherings	664/7327	1.20 (1.02–1.42)

Abbreviations: OR, odds ratio; CI, confidence interval.
[a]The K6 was used as an indicator of psychological distress,[3,4] with a cut-off point of ≥13 out of 24 points.[15]
[b]In the multivariate models, all variables shown in Table 3 were adjusted for each other.

community volunteer activities (Table 2). Among women aged 40 to 64 years, there was loss of the significant associations with a history of diabetes mellitus, history of stroke, spending less than 30 min per day walking, and lack of participation in community volunteer activities (Table 3).

Among men aged 65 years or older, there was a loss of the significant associations with age, a history of diabetes mellitus, history of myocardial infarction, being a former smoker, being a current smoker, lacking social support for consultation when in bad physical condition, and lack of participation in community sports or exercise activities (Table 4). Among women aged 65 years or older, there was a loss of the significant associations with a history of diabetes mellitus, being a former smoker, being a current

Table 4. Multivariate analysis of the association between psychological distress and demographic, medical, lifestyle, and social factors among men aged 65 years or older[a]

Variables	No. of persons with psychological distress /No. of participants	Multivariate OR (95% CI)[b]
Age group (years)		
65–69	95/2323	1.00 (referent)
70–74	114/2379	1.01 (0.75–1.35)
75–79	105/1833	0.98 (0.72–1.33)
80–84	65/925	1.01 (0.71–1.43)
≥85	31/449	0.78 (0.49–1.22)
History of diseases		
Hypertension	194/3295	1.23 (0.99–1.53)
Diabetes mellitus	77/1128	1.25 (0.95–1.64)
Stroke	61/445	1.91 (1.39–2.62)
Myocardial infarction	44/544	1.33 (0.94–1.88)
Cancer	63/860	1.39 (1.03–1.87)
Smoking status		
Never	77/1862	1.00 (referent)
Former	222/3925	1.06 (0.80–1.40)
Current	90/1855	1.05 (0.76–1.47)
Alcohol drinking status		
Never	92/1646	1.00 (referent)
Former	149/1524	1.37 (1.03–1.83)
Current	154/4573	0.75 (0.57–1.00)
Body-mass index		
<18.5 kg/m^2	35/343	1.56 (1.04–2.34)
18.5–24.9 kg/m^2	209/4597	1.00 (referent)
≥25.0 kg/m^2	91/1878	1.13 (0.86–1.47)
Time spent walking per day		
<30 min	234/2687	2.14 (1.58–2.88)
30 min–1 hr	80/2767	0.95 (0.67–1.34)
≥1 hr	63/2255	1.00 (referent)
Lack of social support:		
(i) to consult when you are in trouble	112/1039	1.87 (1.35–2.58)
(ii) to consult when you are in bad physical condition	68/614	0.90 (0.59–1.36)
(iii) to help with your daily housework	100/1198	0.92 (0.66–1.28)
(iv) to take you to a hospital	70/572	1.77 (1.18–2.67)
(v) to take care of you	81/682	1.68 (1.16–2.43)
No participation in community activities		
(i) Activities of neighborhood association	299/3693	1.82 (1.32–2.51)
(ii) Sports or exercise	285/3886	1.23 (0.92–1.64)
(iii) Volunteering	326/4641	1.64 (1.11–2.41)
(iv) Social gatherings	278/3477	1.35 (1.00–1.82)

Abbreviations: OR, odds ratio; CI, confidence interval.
[a]The K6 was used as an indicator of psychological distress,[3,4] with a cut-off point of ≥13 out of 24 points.[15]
[b]In the multivariate models, all variables shown in Table 4 were adjusted for each other.

Table 5. Multivariate analysis of the association between psychological distress and demographic, medical, lifestyle, and social factors among women aged 65 years or older[a]

Variables	No. of persons with psychological distress /No. of participants	Multivariate OR (95% CI)[b]
Age group (years)		
65–69	145/2768	1.00 (referent)
70–74	182/2863	1.06 (0.84–1.34)
75–79	176/2334	1.08 (0.84–1.37)
80–84	149/1422	1.31 (1.01–1.69)
≥85	149/1072	1.49 (1.14–1.96)
History of diseases		
Hypertension	387/4609	1.14 (0.98–1.33)
Diabetes mellitus	95/1094	1.01 (0.80–1.28)
Stroke	62/336	1.86 (1.37–2.51)
Myocardial infarction	52/382	1.46 (1.06–2.00)
Cancer	84/701	1.61 (1.25–2.08)
Smoking status		
Never	620/8138	1.00 (referent)
Former	34/346	0.94 (0.64–1.39)
Current	25/290	0.92 (0.59–1.43)
Alcohol drinking status		
Never	548/7136	1.00 (referent)
Former	65/534	1.42 (1.06–1.91)
Current	80/1324	1.01 (0.78–1.31)
Body-mass index		
<18.5 kg/m^2	73/553	1.38 (1.04–1.83)
18.5–24.9 kg/m^2	387/5388	1.00 (referent)
≥25.0 kg/m^2	178/2795	0.84 (0.70–1.02)
Time spent walking per day		
<30 min	473/4335	1.73 (1.37–2.18)
30 min–1 hr	176/3469	1.05 (0.81–1.35)
≥1 hr	103/2299	1.00 (referent)
Lack of social support:		
(i) to consult when you are in trouble	143/697	1.75 (1.29–2.37)
(ii) to consult when you are in bad physical condition	116/522	1.63 (1.14–2.31)
(iii) to help with your daily housework	168/1282	1.13 (0.86–1.48)
(iv) to take you to a hospital	106/690	1.20 (0.88–1.63)
(v) to take care of you	207/1589	1.50 (1.18–1.90)
No participation in community activities		
(i) Activities of neighborhood association	610/6034	1.38 (1.09–1.75)
(ii) Sports or exercise	623/5950	2.22 (1.72–2.85)
(iii) Volunteering	673/7419	1.69 (1.18–2.43)
(iv) Social gatherings	598/5800	1.57 (1.24–1.99)

Abbreviations: OR, odds ratio; CI, confidence interval.
[a]The K6 was used as an indicator of psychological distress,[3,4] with a cut-off point of ≥13 out of 24 points.[15]
[b]In the multivariate models, all variables shown in Table 5 were adjusted for each other.

smoker, and lacking social support for help with daily housework (Table 5).

When we further added current employment status and the duration of education as covariates in the multivariate models, as shown in Table 2 and Table 3, the multivariate-adjusted OR (95% CI) for psychological distress associated with being currently employed was 1.65 (1.30 to 2.09) among men and 1.10 (0.84 to 1.28) among women, respectively, and 0.82 (0.68 to 0.98) among men and 0.93 (0.80 to 1.09) among women for longer duration of education.

In addition, we analyzed the data using different cut-off points (≥9/24, ≥11/24, and ≥15/24), but the results did not substantially change in an analysis of all participants or in stratified analyses (data not shown).

DISCUSSION

The use of general population surveys to measure the extent of mental illness presents many challenges because the diagnostic tools employed tend to be lengthy and cumbersome.[17,18] The results of the present study suggest that use of the K6 scale as a proxy indicator of mental health impairments contributes to the investigation of factors associated with mental health at the population level.

On the basis of baseline cross-sectional data from a new, large, population-based, prospective cohort study, we found that female sex, young and old age, history of hypertension, history of diabetes mellitus, history of stroke, history of myocardial infarction, history of cancer, current smoking, former alcohol drinking, low BMI, shorter daily walking time, lack of social support, and lack of participation in community activities were all associated with psychological distress, even in multivariate analysis. Nevertheless, stratified analysis by sex and age categories (40 to 64 years, 65 years or older) revealed some differences among strata. The present findings indicate that factors associated with psychological distress differ between men and women, and also between middle-aged and elderly people.

We found that, as compared to men, women were more likely to have psychological distress, even in multivariate analysis, which was consistent with 2 previous US studies that used the K6.[5,8] Several studies have also shown that women have a higher risk of anxiety and mood disorders, suggesting that many factors, such as female hormones, personality, coping skills, and sociocultural roles, play a direct role in anxiety and mood disorders, as do socioeconomic status and comorbid conditions.[19–21]

The association of advanced age with psychological distress was substantially attenuated in multivariate analysis, suggesting that the high OR in the univariate model might be due to other variables shown in Table 1. Nevertheless, there was still a U-shaped association between age category (5-year categories from 40 to 44 years to ≥85 years) and the prevalence of psychological distress, with a nadir for those aged 65 to 69 years. This pattern of association is consistent with that of a previous study.[5] In contrast, stratified analysis revealed no apparent association between age and psychological distress among men aged 65 years or older, which suggests that age alone was not associated with psychological distress among men in this age category.

The associations of psychological distress with a history of serious disease were as unsurprising. Similar associations were also reported in a survey conducted in the United States.[5] The strong association between a history of stroke and psychological distress may be due to post-stroke depression.[22] Nevertheless, stratified analyses revealed some differences among sex and age categories. A history of hypertension was not significantly associated with psychological distress in any stratum. Although not significant, point estimates for history of hypertension were all above unity, which is suggestive of relatively small differences among strata. A history of diabetes mellitus was significantly associated with psychological distress only among men aged 40 to 64 years, indicating the potential burden of this disease among middle-aged men. A history of stroke was not significantly associated with psychological distress among women aged 40 to 64 years, but the point estimate was similar to that among women aged 65 years or older, suggesting that the disease burden was similar for women in these 2 age groups. The significant association between a history of myocardial infarction and psychological distress disappeared among men aged 40 to 64 years and 65 years or older, suggesting a potential sex difference in disease burden. A history of cancer was not significantly associated with psychological distress among men aged 40 to 64 years, although the reason for this was unclear.

We also found that former smoking, current smoking, former alcohol drinking, being underweight, and shorter daily walking time were associated with a higher prevalence of psychological distress. In contrast, we observed a lower prevalence among participants with a moderate daily walking time. The results for former smoking,[8] current smoking,[5,8] and being underweight[5] were consistent with previous studies. Stratified analyses yielded reduced point estimates for current smoking among men aged 65 years or older and women aged 65 years or older, suggesting that the smoking habit itself, as well as related factors, was not strongly associated with psychological distress among persons aged 65 years or older, in contrast to those aged 40 to 64 years.

Among the variables studied, lack of social support was most strongly associated with a high prevalence of psychological distress, even in multivariate analysis. Although this is the first large population-based epidemiological study using the K6 in an Asian country, previous studies[23,24] have used other mental health scales, such as the Geriatric Depression Scale (GDS)[25] among Japanese populations. Koizumi et al reported that negative responses to the questions "Do you have someone with whom you can consult when you are in trouble?" and "Do you have someone who can take care of you when you are ill in bed?" were significantly associated with an increase in the risk of depression.[23,24] The finding is consistent with, and supports, the present results for persons aged 65 years or older. The depressive symptoms detected by the GDS and the psychological distress detected by the K6 reflect common underlying factors.

Although lack of social support was strongly associated with a high prevalence of psychological distress, the significant association that had been found with 3 components of deficient social support disappeared on multivariate analysis among men aged 40 to 64 years (Table 2). However, lack of social support for consultation when in trouble remained strongly associated with psychological distress. These results appear to underline the importance of such support among men aged 40 to 64 years.

The association of lack of participation in community activities with psychological distress was substantially attenuated in multivariate analysis, indicating that the high OR in the univariate models could be largely explained by other variables shown in Table 1. Nevertheless, the significant increases in OR in the multivariate model indicate that lack of participation in community activities may also be associated with mental health. Stratified analysis revealed that the significant association between lack of participation in community activities in a neighborhood association disappeared among men aged 40 to 64 years, indicating the relatively low influence of neighborhood community on middle-aged men. Also, the significant association with lack of participation in volunteer activities disappeared among men and women aged 40 to 64 years, but the point estimate among men was similar to that among the total population. However, the lower point estimate on multivariate analysis suggests a relatively weak association with participation in volunteer activities among women aged 40 to 64 years.

Our data showed that being currently employed was associated with a high odds of psychological distress, and that a longer duration of education was associated with a lower odds of psychological distress, among men aged 40 to 64 years. Although the reason is unclear, our data suggest that some socioeconomic factors, such as employment and education, are important among men aged 40 to 64 years.

Our study did have some limitations. First, because of the cross-sectional design, the direction of causation for the associations observed in this report cannot be inferred from the data. Prospective studies that measure the K6 in respondents at baseline, follow the respondents over time, and measure the K6 at the end of follow-up, are needed to clarify these causal relationships.

Second, because the response rate was not high (64.5%), the respondents may not be a representative sample of the source population of Ohsaki City residents. The response rates among men and women aged 40 to 64 years were lower (54.9% and 60.4%, respectively) than those among men and women aged 65 years or older (77.1% and 73.2%, respectively). These relatively low response rates, especially among participants aged 40 to 64 years, should be kept in mind when interpreting the results from prospective, as well as cross-sectional, analyses.

Third, because the K6 does not provide information about the specific psychiatric conditions of respondents, it is difficult to identify what is being measured. However, the particular symptoms included in the K6 make it likely that severe, disabling, mood and anxiety disorders are being identified.[3,4,15,16] Although the K6 focuses on nonspecific psychological distress, the majority of cases detected by this instrument would meet the criteria for certain mental health disorders specified in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition.[3,15]

Finally, no scales, including the present one, have been adequately validated for use as social support questionnaires in the Japanese population. Also, the first question in the questionnaire, "Do you have someone with whom you can consult when you are in trouble?", might be construed to include the participant's family, which may not qualify as social support.

In conclusion, the findings of this cross-sectional study demonstrate that the factors associated with psychological distress differ between men and women, and also between middle-aged and elderly people. These findings underline the importance of considering sex and age categories when attempting to minimize psychological distress in community-dwelling populations. To our knowledge, this is the first large population-based epidemiological study to use the K6 in an Asian country.

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No conflicts of interest are declared.

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Green tea consumption is associated with lower psychological distress in a general population: the Ohsaki Cohort 2006 Study[1–3]

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ABSTRACT

Background: Although green tea or its constituents might reduce psychological stress, the relation between green tea consumption and psychological distress has not been investigated in a large-scale study.

Objective: Our aim was to clarify whether green tea consumption is associated with lower psychological distress.

Design: We analyzed cross-sectional data for 42,093 Japanese individuals aged ≥40 y from the general population. Information on daily green tea consumption, psychological distress as assessed by the Kessler 6-item psychological distress scale, and other lifestyle factors was collected by using a questionnaire. We used multiple logistic regression analyses adjusted for age, sex, history of disease, body mass index, cigarette smoking, alcohol consumption, time spent walking, dietary factors, social support, and participation in community activities to investigate the relation between green tea consumption and psychological distress.

Results: We classified 2774 (6.6%) of the respondents as having psychological distress (Kessler 6-item psychological distress scale ≥13/24). There was an inverse association between green tea consumption and psychological distress in a model adjusted for age and sex. Although the relation was largely attenuated when possible confounding factors were adjusted for, a statistically significant inverse association remained. The odds ratio (with 95% CI) of developing psychological distress among respondents who consumed ≥5 cups of green tea/d was 0.80 (0.70, 0.91) compared with those who consumed <1 cup/d. These relations persisted when respondents were stratified by social support subgroups or by activities in communities.

Conclusion: Green tea consumption was inversely associated with psychological distress even after adjustment for possible confounding factors. *Am J Clin Nutr* 2009;90:1390–6.

INTRODUCTION

Mental health is an important component of overall well-being (1). Thus, to determine risk factors for impaired mental health or psychological distress is an important task.

Kessler et al (2) recently compared the projected lifetime risk of any mental disorder as assessed by the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV) in 17 countries. The risk was the lowest in metropolitan areas in China (18.0%), Nigeria (19.5%), and Japan (24.4%). These values were lower than other countries, such as the United States (55.3%), France (47.2%), and Germany (33.0%). This suggests that some cultural or lifestyle-related features of Japan, such as dietary habit, personality, or social capital, might have a positive effect on mental disorders.

Among these features, green tea consumption is a traditional part of the Japanese lifestyle (3–5), and it has long been considered that drinking green tea is associated with stress relief (6). Actually, recent trials suggest that tea consumption (6) or supplementation with L-theanine (7), which is a constituent of green tea, reduces responses to acute psychological stress when assessed as post-task cortisol (6), heart rate, and salivary immunoglobulin-A (7). Therefore, green tea consumption might be able to reduce psychological distress. However, large-scale studies have not investigated the relation between green tea and psychological distress in the general population. One reason for this might be the difficulties with assessing psychological distress in a general population. However, Kessler et al (8, 9) have developed a short form of screening scales to monitor the prevalence of psychological distress in populations [the Kessler 6-item psychological distress scale (K6)], which we applied in the present study to investigate whether green tea consumption is associated with a lower psychological distress.

SUBJECTS AND METHODS

Study design, setting, and participants

The design of the Ohsaki Cohort 2006 Study has been described in detail (10). In brief, the source population for the

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baseline survey comprised all men and women aged ≥40 y living in Ohsaki City, northeastern Japan, on 1 December 2006.

The baseline survey was conducted between 1 December and 15 December 2006. A questionnaire was distributed by the heads of individual administrative districts to individual households and collected by mail. Of the eligible 77,235 respondents, the 49,855 (26,512 men and 23,343 women; 64.5%) who provided valid responses formed the study cohort. Of the 49,855 respondents, 43,716 (87.7%) completed the K6. We excluded 1623 persons who did not complete the questionnaire regarding green tea consumption. Thus, 42,093 responses were analyzed in this study.

Measurement of psychological distress

The K6 was used as an indicator of psychological distress (8, 9). Respondents were asked about their mental status over the last month by using 6 questions to which they responded by choosing "all of the time" (4 points), "most of the time" (3 points), "some of the time" (2 points), "a little of the time" (1 point), and "none of the time" (0 points). Total point scores ranged from 0 to 24. The questions were as follows: "Over the last month, how often have you felt the following? *1*) nervous, *2*) hopeless, *3*) restless or fidgety, *4*) so sad that nothing could cheer you up, *5*) that everything was an effort, and *6*) worthless. The K6 is based on modern psychometric theory and has already outperformed some existing scales (8, 9). The Japanese version of the K6 was recently developed by using the standard back-translation method and has been validated (11). As suggested by Kessler et al (9), we classified individuals with scores of ≥13/24 as having psychological distress (10). Furukawa et al (12) investigated whether K6 was able to predict 30-d disorders of the DSM-IV as assessed by the World Health Organization Composite International Diagnostic Interview in the Australian National Survey. They showed that K6 was able to detect Composite International Diagnostic Interview/DSM-IV mood and anxiety disorders (area under the receiver operating curve: 0.89; 95% CI: 0.88, 0.90) better than the General Health Questionnaire 12 (AUC: 0.80; 95% CI: 0.78, 0.82).

Measurements of other types of exposure

The survey included questions about the frequency of recent average consumption of green tea, oolong tea, black tea, coffee, and 36 food items, as well as questions regarding alcohol and tobacco consumption, history of disease, body weight, height, and time spent walking per day. The food-frequency questionnaire did not cover a specific period of time but asked about "daily diet." The frequency of green tea consumption was categorized as never, occasionally, or 1–2, 3–4, and >5 cups/d. Within the study region, the volume of a typical cup of green tea is 100 mL.

We conducted a validation study of the food-frequency questionnaire, in which 113 respondents provided four 3-d food records within a period of 1 y and subsequently responded to the questionnaire. The Spearman rank coefficient for the correlation between amounts of consumed green tea according to the questionnaire and amounts consumed according to the food records was 0.71 for men and 0.53 for women; the correlation between consumption measured by the 2 questionnaires administered 1 y apart was 0.63 for men and 0.64 for women (13). Body mass index was calculated as the self-reported body weight (kg) divided by the square of the self-reported body height (m).

The degree of social support available to each individual was assessed by asking the following (14): Do you have someone *1*) whom you can talk to when you are in trouble? *2*) whom you can consult when you do not feel well? *3*) who can help you with your daily housework? *4*) who can take you to a hospital when you feel ill? and *5*) who can take care of you if you become bedridden? This social support questionnaire consisted of 5 questions, each requiring a "yes" or "no" answer. This questionnaire was available only in Japanese. The validity and reliability of the questionnaire were not evaluated.

We also assessed participation in community activities. We asked about how often the respondent participates in the following activities: *1*) neighborhood associations; *2*) sports, exercise, or a hobby; *3*) volunteering for nonprofit organizations; and *4*) participation in other social gatherings. The frequency of these activities was assessed as never, a few times each year, monthly, 2–3 times/month, 1 time/wk, 2–3 times/wk, and ≥4 d/wk.

Ethical issues

We considered the return of completed questionnaires to imply the consent to participate in the study involving a cross-sectional analysis of the baseline survey data and subsequent follow-up of mortality and emigration. The Ethics Committee of Tohoku University Graduate School of Medicine reviewed and approved the study protocol.

Statistical analysis

Baseline characteristics were evaluated by using the analysis of variance for continuous variables and the chi-square test for categorical variables. We also used age-sex-adjusted logistic regression analyses to clarify the age-sex-adjusted relation between green tea consumption and history of diseases. We used multivariate logistic regression analysis to calculate the odds ratios (ORs) and 95% CIs for having psychological distress (a K6 total score of ≥13/24) according to categories of green tea consumption. We established respondents who consumed <1 cup/d green tea as the reference category and examined the relation between green tea consumption and psychological distress by using the following models. Model 1 was age-sex adjusted. Model 2 was adjusted for the following physical risk factors: sex; age (40–44, 45–49, 50–54, 55–59, 60–64, 65–69, 70–74, 75–79, 80–84, and ≥85 y); history of hypertension ("yes," "no"), diabetes mellitus ("yes," "no"), stroke ("yes," "no"), myocardial infarction ("yes," "no"), and cancer ("yes," "no"); smoking status ("never," "former," "current," "missing"); alcohol consumption ("never," "former," "current," "missing"); body mass index (in kg/m^2: <18.5, 18.5–24.9, ≥25.0, missing); and time spent walking (<30 min/d, 30 min to 1 h/d, ≥1 h/d, missing). Model 3 was further adjusted for dietary factors, namely volume of rice intake and frequency of consumption of miso soup, red meat, chicken, fish, green or yellow vegetable, soy products, fruit, coffee, black tea, and oolong tea. Model 4 was fully adjusted and included the answers to the questions about social support ("yes," "no support," "missing") and participation in community activities ("yes," "never," "missing").

TABLE 1
Relation between green tea consumption and the characteristics of the participants of the Ohsaki Cohort 2006 Study[1]

	Green tea consumption (cups/d)				
	<1 (n = 10,770)	1–2 (n = 12,007)	3–4 (n = 10,364)	>5 (n = 8952)	P
Age (y)	58.5 ± 12.5[2]	59.9 ± 12.5	64.6 ± 12.0	67.5 ± 10.8	<0.01
Women [n (%)]	5090 (47)	6093 (51)	5954 (57)	5742 (64)	<0.01
Smoking [n (%)]					
Current	3249 (30)	2829 (24)	1787 (17)	1323 (15)	<0.01
Former	2319 (22)	2589 (22)	2126 (21)	1633 (18)	
Never	4749 (44)	5991 (50)	5721 (55)	5202 (58)	
Alcohol drinking [n (%)]					
Current	5797 (54)	6415 (53)	4573 (44)	3266 (36)	<0.01
Former	1020 (9)	886 (7)	802 (8)	749 (8)	
Never	3603 (33)	4244 (35)	4404 (42)	4311 (48)	
BMI [n (%)]					
18.5 kg/m^2	506 (5)	455 (4)	405 (4)	375 (4)	<0.01
18.5–24.9 kg/m^2	6517 (61)	7454 (62)	6322 (61)	5376 (60)	
≥25 kg/m^2	3077 (29)	3420 (28)	2875 (28)	2466 (28)	
Time spent walking >1 h [n (%)]	3074 (29)	3209 (27)	2717 (26)	2539 (28)	<0.01
History of diseases [n (%)]					
Hypertension	2610 (24)	3191 (27)	3296 (32)	3139 (35)	<0.01
Diabetes mellitus	850 (8)	966 (8)	981 (9)	867 (10)	<0.01
Stroke	278 (3)	269 (2)	233 (2)	183 (2)	<0.01
Myocardial infarction	243 (2)	261 (2)	307 (3)	267 (3)	<0.01
Cancer	483 (4)	571 (5)	656 (6)	643 (7)	<0.01
Volume of rice intake [n (%)]					
>3 bowls/d	1107 (10)	1135 (9)	882 (9)	687 (8)	<0.01
Consumed miso soup almost every day [n (%)]	7790 (72)	9585 (80)	8756 (84)	7715 (86)	<0.01
Frequency of food intake [n (%)]					
Red meat (at least once/wk)	8910 (83)	10225 (85)	8901 (86)	7579 (85)	<0.01
Chicken (at least once/wk)	6163 (57)	7266 (61)	6387 (62)	5432 (61)	<0.01
Fish (almost every day)	1867 (17)	2470 (21)	2814 (27)	3211 (36)	<0.01
Green yellow vegetable (almost every day)	3097 (29)	4176 (35)	4526 (44)	4795 (54)	<0.01
Soy products (almost every day)	4314 (40)	5750 (48)	5971 (58)	5859 (65)	<0.01
Fruit (almost every day)	2509 (17)	3673 (31)	4210 (41)	4626 (52)	<0.01
Frequency of beverage intake [n (%)]					
Coffee ≥1 cup/d	7749 (72)	8843 (74)	6586 (64)	4796 (54)	<0.01
Black tea ≥1 cup/d	937 (9)	2173 (18)	1875 (18)	1677 (19)	<0.01
Oolong tea ≥1 cup/d	1507 (14)	2304 (19)	1845 (18)	1714 (19)	<0.01
Social support [n (%)]					
To consult when you are in trouble (no)	1690 (16)	1567 (13)	1061 (10)	764 (9)	<0.01
To consult when you are in bad physical condition (no)	1335 (12)	1214 (10)	812 (8)	594 (7)	<0.01
To help with your daily housework (no)	1903 (18)	1834 (15)	1476 (14)	1163 (13)	<0.01
To take you to a hospital (no)	1188 (11)	1057 (9)	782 (8)	637 (7)	<0.01
To take care of you (no)	1498 (14)	1460 (12)	1259 (12)	1096 (12)	<0.01
Participation in community activities [n (%)]					
Activities in neighborhood association (any yes)	4659 (43)	5681 (47)	5120 (49)	4352 (49)	<0.01
Sports or exercise (any yes)	4140 (38)	5283 (44)	4707 (45)	4005 (45)	<0.01
Volunteers (any yes)	2854 (27)	3588 (30)	3189 (31)	2736 (22)	<0.01
Social gathering (any yes)	4061 (38)	5271 (44)	4698 (45)	4081 (46)	<0.01

[1] For smoking, alcohol drinking, and BMI, the sum of the number of participants did not match all numbers of participants due to missing information.
[2] Mean ± SD (all such values).

We used several dummy variables to adjust for the aforementioned factors.

Because we considered that social support or community activities might modify the relation between green tea and psychological distress, we further stratified the responses by social support (support in all 5 social support categories and perception of not being supported in ≥1 of 5 social support categories) and community activity (participation in at least one community activity or none) to confirm the relation between green tea consumption and psychological distress. Those who did not answer any questions about social support or participation in community activities were excluded when stratified by social support and participation in communities, respectively. In an analysis of social support and participation in community activities, neither of these was used as the respective covariate. When we calculated the interaction of green tea with social support and participation in community activities, we used cross-product terms of green tea and social support or participation in community activities.

We also analyzed the relation between black tea consumption and psychological distress by using a fully adjusted model (model 4). All data were statistically analyzed by using SAS version 9.1 (SAS Inc, Cary, NC). All statistical tests described here were 2-sided, and $P < 0.05$ was accepted as statistically significant.

RESULTS

The association between green tea consumption and other lifestyle factors is shown in **Table 1**. The mean age, the proportion of women, the proportion of those who had never smoked or never consumed alcohol, as well as the frequency of a history of hypertension and cancer were higher among those who more frequently consumed green tea. This group also consumed more fish, soy products, green and yellow vegetables, and fruit and participated more often in community activities. Conversely, fewer respondents who consumed more green tea felt a lack of social support. Because the relation between green tea consumption and a history of diseases might be strongly confounded by age, we conducted age-sex-adjusted logistic regression analyses. The relation of green tea consumption to hypertension, diabetes, and myocardial infarction was no longer statistically significant when adjusted for age and sex (P for trends ≥ 0.13). However, the inverse association between green tea consumption and history of stroke ($P < 0.001$) and the positive relation between green tea consumption and history of cancer ($P = 0.007$) remained statistically significant.

Overall, 2774 (6.6%) respondents were considered to have psychological distress (K6 $\geq$ 13). The prevalence was the highest (8.4%) and lowest (5.1%) among those who consumed <1 and $\geq$5 cups green tea/d, respectively (*see* **Table 2**). The age-sex-adjusted model (model 1) revealed a close inverse relation between green tea consumption and having psychological distress. In comparison with individuals who consumed <1 cup/d, the ORs (95% CI) of having psychological distress for those who consumed 1–2, 3–4, and $\geq$5 cups/d were 0.79 (0.71, 0.87), 0.68 (0.61, 0.76), and 0.59 (0.52, 0.67), respectively. Although these associations were attenuated when adjusted for other lifestyle factors or a history of disease (model 2), the significant inverse association persisted (P for trend < 0.001). Although adjustment for dietary factors (model 3) and for social support or participation in community activities (model 4) also attenuated the relation, the inverse association between green tea consumption and psychological distress persisted (both P's for trend were <0.001). The adjusted ORs (95% CI) for psychological distress in subjects who consumed 1–2, 3–4, and $\geq$5 cups of green tea/d were 0.95 (0.86, 1.06), 0.89 (0.79, 1.00), and 0.80 (0.70, 0.91), respectively, in model 4, compared with the reference group.

To confirm whether the relation between green tea consumption and psychological distress persisted irrespective of social support or participation in community activities, we also investigated the association stratified in a subgroup by these 2 factors (**Table 3**). Neither an interaction between green tea consumption and social support for psychological distress ($P = 0.91$) nor an interaction between green tea consumption and participation in community activities for psychological distress ($P = 0.08$) was statistically significant.

We also analyzed the relation between the consumption of black tea and psychological distress. Compared with participants who consumed <1 cup black tea/d ($n = 35,431$), the ORs (95% CI) for those who consumed 1–2 cups black tea/d ($n = 2161$), and $\geq$3 cups black tea/d ($n = 516$) were 1.14 (0.95, 1.36) and 1.11 (0.78, 1.58), respectively.

TABLE 2
Relation between green tea consumption and psychological distress, as assessed by the Kessler 6-item psychological distress scale (K6), in the Ohsaki Cohort 2006 Study[1]

	Green tea consumption (cups/d)				
	<1 (n = 10,770)	1–2 (n = 12,007)	3–4 (n = 10,364)	>5 (n = 8952)	P for trend
No. of participants with psychological distress (K6 $\geq$13)	902	808	604	460	—
Prevalence of psychological distress (%)	8.4	6.7	5.8	5.1	—
Model 1[2]	Ref	0.79 (0.71, 0.87)[3]	0.68 (0.61, 0.76)	0.59 (0.52, 0.67)	<0.001
Model 2[4]	Ref	0.83 (0.75, 0.92)	0.73 (0.65, 0.81)	0.64 (0.57, 0.72)	<0.001
Model 3[5]	Ref	0.91 (0.82, 1.01)	0.83 (0.74, 0.93)	0.73 (0.64, 0.83)	<0.001
Model 4[6]	Ref	0.95 (0.86, 1.06)	0.89 (0.79, 1.00)	0.80 (0.70, 0.91)	<0.001

[1] Ref, referent.

[2] Adjusted for age categories (40–44, 45–49, 50–54, 55–59, 60–64, 65–69, 70–74, 75–79, 80–84, and $\geq$85 y) and for sex.

[3] Odds ratio; 95% CI in parentheses (all such values).

[4] Same as model 1 + history of hypertension (yes, no), history of diabetes mellitus (yes, no), history of stroke (yes, no), history of myocardial infarction (yes, no), history of cancer (yes, no), smoking status (never, former, current, missing), alcohol consumption (never, former, current, missing), BMI (in kg/m^2; <18.5, 18.5–24.9, $\geq$25.0, missing), and time spent walking (<30 min/d, 30 min–1 h/d, $\geq$1 h/d, missing).

[5] Same as model 2 + volume of rice intake, frequency of consumption of miso soup, red meat, chicken, fish, green and yellow vegetable, soy product, fruit, coffee, black tea, and oolong tea.

[6] Same as model 3 + social support [ie, *1*) Do you have someone with whom you can consult when you are in trouble? (yes, no, missing), *2*) Do you have someone with whom you can consult when your physical condition is not good? (yes, no, missing), *3*) Do you have someone who can help you with your daily housework? (yes, no, missing), *4*) Do you have someone who can take you to a hospital when you do not feel well? (yes, no, missing), and *5*) Do you have someone who can take care of you when you are ill in bed? (yes, no, missing)] and participation in community activities [ie, How often do you participate in the following activities? *1*) activities in neighborhood association (any yes, never, missing), *2*) sports, exercise, or hobby (any yes, never, missing), *3*) volunteer for a nonprofit organization (any yes, never, missing), and *4*) other social gatherings (any yes, never, missing)].

TABLE 3
Relation between green tea consumption and psychological distress, as assessed by the Kessler 6-item psychological distress scale (K6), stratified by social support and community activity subgroup in the Ohsaki Cohort 2006 Study[1]

	Green tea consumption (cups/d)				
	<1	1–2	3–4	>5	*P* for trend
Social support[2]					
No lack					
No. of participants	7466	8723	7799	6839	
No. of participants with psychological distress (K6 ≥ 13)	414	422	312	259	
Prevalence of psychological distress (%)	5.5	4.8	4.0	3.8	
Multiple adjusted OR (95% CI)[3]	Ref	0.99 (0.86, 1.15)	0.86 (0.73, 1.01)	0.81 (0.68, 0.96)	0.005
Any lack					
No. of participants	3283	3255	2544	2098	
No. of participants with psychological distress (K6 ≥ 13)	484	383	291	201	
Prevalence of psychological distress (%)	14.7	11.8	11.4	9.6	
Multiple adjusted OR (95% CI)[3]	Ref	0.89 (0.77, 1.04)	0.94 (0.80, 1.11)	0.77 (0.64, 0.94)	0.02
Participation in community activities[2]					
Participated					
No. of participants	6830	8281	7285	6246	
No. of participants with psychological distress (K6 ≥ 13)	370	383	288	197	
Prevalence of psychological distress (%)	5.4	4.6	4.0	3.2	
Multiple adjusted OR (95% CI)[3]	Ref	0.99 (0.85, 1.15)	0.98 (0.83, 1.16)	0.82 (0.67, 0.998)	0.08
Did not participate					
No. of participants	3759	3499	2876	2491	
No. of participants with psychological distress (K6 ≥ 13)	500	387	297	245	
Prevalence of psychological distress (%)	13.3	11.1	10.3	9.8	
Multiple adjusted OR (95% CI)[3]	Ref	0.93 (0.80, 1.08)	0.87 (0.73, 1.02)	0.82 (0.69, 0.98)	0.02

[1] OR, odds ratio; Ref, referent; "No lack," participants who perceived that they were supported for all 5 social support categories; "Any lack," participants who perceived that they were not supported for at least one social support category; "Participated," participants who participated in at least one community activity; "Did not participate," participants who did not participate in any community activities.

[2] Social support and participation in community activities were not used as covariates in analyses. *P* values for interaction for social support and participation in community activities were 0.91 and 0.08, respectively.

[3] Model 4 in Table 2 was used for adjustment.

DISCUSSION

We identified an inverse relation between green tea consumption and psychological distress as assessed by K6 in a large-sample cross-sectional study of a Japanese population. We considered that green tea consumption might contribute, at least in part, to a low lifetime risk of any mental disorder in Japan (2).

The main strength of our study is that we investigated a large sample of the general population, which allowed the consideration of many confounding factors, including social support and participation in community activities. Another strength is that we used a practical and tested questionnaire to assess psychological distress (8, 9). Of the 49,855 respondents, 88% completed the K6 [the 6-item scale developed by Kessler et al (8, 9)], which enabled an assessment of risk factors for psychological distress in a general population.

To understand whether green tea was inversely and independently related to psychological distress, we attempted several approaches to control confounding. First, we tested the effects of comorbidities or lifestyle factors on the relation. Both green tea consumption and psychological distress are inversely related with a history of cardiovascular diseases (CVDs) (10) and risk factors for CVD (10, 15, 16). Furthermore, we already reported that green tea consumption is inversely related with CVD mortality (4). Thus, CVD or risk factors for CVD can be confounding factors of the relation between green tea and psychological distress. However, the association persisted although adjustment for these factors attenuated the inverse relation between green tea consumption and psychological distress. Therefore, we considered that the relation was independent of CVD or these risk factors.

We also considered confounding by other dietary factors. Adjustments for other foods were required because the consumption of green tea might be associated with that of other Japanese foods, such as fish or soy products (5). Furthermore, the effect of other beverages on psychological distress also should be adjusted. However, adjustment for dietary factors and beverages did not fully explain the inverse relation between green tea and psychological distress. Therefore, we considered that the relation was independent of other dietary factors or beverages.

Third, we considered the effect of social support or community activities. Because green tea is the most likely beverage to be served during social activities in Japan, its consumption might be merely a marker of social support or community activity (3). In fact, our cross-sectional analyses have already shown a close inverse relation between psychological distress and social support or activities in the community (10). Thus, consideration of these factors is also important to understanding the relation between green tea consumption and psychological distress. However, we show that the inverse association between green tea consumption and psychological distress persisted even after further adjustment for social support and participation in community activities, irrespective of social support subgroup or

ubgroup of community activities. Therefore, although other esidual confounding factors might exist, we considered that ;reen tea consumption was inversely and independently related to)sychological distress.

Only one study has described a relation between green tea :onsumption and mental illness (17). Shimbo et al (17) in-vestigated 380 Japanese individuals aged 20–69 y and assessed :he relation between green tea consumption and a Japanese version of the General Health Questionnaire 12. Although they show that brewed green tea consumption was inversely associated with mental illness (OR: 0.78 for males and 0.77 for females), the relation was not statistically significant. Because the point estimate was large, Shimbo et al (17) might have detected a significant association if a sufficiently large sample had been investigated. Thus, although the assessment methods were different, we considered that our results agreed with their findings.

Some clinical trials have examined the effect of tea (6), L-theanine (7), or high doses of ascorbic acid (18) on responses to psychological stress. Both L-theanine and ascorbic acid are constituents of green tea (16). An investigation of the influence of black tea compared with a caffeine-matched placebo on both acute biological responses and the rate of poststress recovery by using double-blind methodology (6) discovered that 6 wk of tea consumption leads to lower poststress cortisol and greater subjective relaxation. Kimura et al (7) examined whether L-theanine influences the physiologic response under stress by using a mental arithmetic task as an acute stressor. They show that L-theanine intake resulted in a reduction in heart rate and salivary immunoglobulin A responses to an acute stress task relative to a placebo control. Brody et al (18) reported that high-dose ascorbic acid palliates blood pressure, cortisol, and subjective responses to acute psychological stress. These studies consistently show that the acute response to psychological stress was reduced in a group provided with tea or tea constituents. Because reducing physiologic stress might result in reduced psychological distress, these data could be considered as evidence that supports our findings.

These results from clinical trials also suggested that not only green tea but also black tea might have a beneficial effect on psychological distress because the constituents of the 2 types of tea are similar (16). In fact, Hintikka et al (19) have reported an inverse relation between the daily consumption of black tea and the risk of depression, as assessed by a postal questionnaire and the Beck Depression Inventory in a relatively large general Finnish population sample. In our study, however, we did not find any relation between consumption of black tea and psychological distress. We considered that the lack of such an association was due to the less-frequent consumption of black tea in Japan. Any relation between black tea and psychological distress might be masked by frequent consumption of green tea.

This study has some limitations. The first was the cross-sectional design. We could not conclude whether green tea reduces psychological distress or whether individuals without psychological distress are more likely to consume green tea. However, because we clarified an inverse relation between green tea consumption and psychological distress irrespective of social support and participation in community activities, we considered that green tea has a beneficial effect on psychological distress. A prospective study or a clinical trial is required to confirm this notion. Second, the correlation between the amounts of green tea consumed according to the questionnaire and the amounts consumed according to the 3-d food records was not very high (men: 0.71; women: 0.53), especially in women. Because green tea consumption varied day by day, we considered that a certain difference could be acceptable for green tea consumption. However, in any case, questionnaire surveys have some misclassifications regarding green tea consumption. Due to this limitation, we might have underestimated the inverse relation between green tea consumption and psychological distress in this study. Third, although we claimed that social support is an important confounding factor and we stratified according to this variable, the variable is not validated. However, the questionnaire comprised simple questions, and therefore we considered that it could be used for the assessment of social support. In conclusion, we showed that green tea consumption was inversely associated with psychological distress in a cross-sectional study of a large Japanese population.

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The authors' responsibilities were as follows—AH, SK, NN, and IT: conception and design; SK, NN, KO-M, MK, and TS: acquisition of data; AH, SK, NN, and KN: analysis and interpretation of data; AH: drafting of the manuscript; SK, NN, KO-M, MK, TS, MN, YS, AN, YT, KN, and IT: critical revision of the manuscript for intellectual content; AH: statistical analysis; and IT: obtaining funding and supervision. None of the authors had a conflict of interest.

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Difference in lifetime medical expenditures between male smokers and non-smokers

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ABSTRACT

Objectives: It is controversial whether smokers have higher lifetime medical expenditures than non-smokers, because smokers have high annual medical expenditures but comparatively short lives. We examined differences in lifetime medical expenditures between them.
Methods: We constructed life tables for male smokers and non-smokers from 40 years of age. We calculated average annual medical expenditures of them categorized by survivors and deceased, which were used to examine differences in lifetime medical expenditures between them and perform sensitivity analyses.
Results: Smokers had a higher mortality rate, shorter life expectancy, and generally higher annual medical expenditures than non-smokers. We also observed tendencies for smokers to have higher inpatient expenditures, but non-smokers to have higher outpatient expenditures. Although non-smokers had lower long-term cumulative medical expenditures between 64 and 81 years of age, their lifetime medical expenditures were higher by a minimal amount. Sensitivity analyses did not change this result.
Conclusions: Smoking may not cause increases in lifetime medical expenditures because smokers had lower lifetime medical expenditures than non-smokers. However, it was clear that smokers, especially survivors, often had higher annual medical expenditures than non-smokers. The importance of tobacco control is still relevant.

1. Introduction

Smoking has a major impact on both health status and medical expenditures. It is widely accepted that smoking is closely associated with morbidity and mortality from lifestyle diseases such as cancer, heart disease, cerebrovascular disease, diabetes (type 2), hypertension, and other diseases [1–4]. Therefore, many national and local governments have launched a variety of tobacco control activities [5,6], with the common understanding that smoking is one of the biggest preventable causes of disease and loss of life. On the other hand, even though tobacco-related deaths occur in Japan as well as in other countries, the Japanese tobacco control program remains significantly backward in comparison. In addition to the impact on health status, smoking has also been associated with an increase in the utilization of medical services. Previous research suggests that smokers have higher short-term medical expenditures than non-smokers [7].

Due to the increasing problem of rising medical expenditures, it has been proposed that disease prevention and health promotion may be effective approaches for

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reducing medical expenditures [8]. It is controversial whether smokers have higher lifetime medical expenditures than non-smokers, because smokers have high annual medical expenditures but comparatively short lives [9–15]. Some previous studies suggest that smokers have higher lifetime medical expenditures than non-smokers [10,13–15], while others show that smokers have lower cumulative expenditures [9,11,12]. However, most of this research estimated lifetime medical expenditures by applying economic models for mixed results from multiple databases, such as macro-data at the national level. Thus, there are limitations in the accuracy of the calculations because it is impossible to evaluate the annual medical expenditures of survivors and deceased separately while also accounting for differences in smoking status. Therefore, this study aims both to examine directly the life expectancy and the annual medical expenditures of smokers and non-smokers, and to clarify the difference in lifetime medical expenditures between them by using a simple calculation model based on a single cohort database.

2. Materials and methods

2.1. Dataset selection

We used data derived from the Ohsaki cohort study to calculate the lifetime medical expenditures of both smokers and non-smokers. Details of the Ohsaki cohort study have been described previously [16]. In brief, this study started in 1994, and this database includes the data regarding National Health Insurance (NHI) beneficiaries who lived in the catchment area of Ohsaki Public Health Center, Miyagi Prefecture, Japan. From October to December 1994, a survey was conducted of NHI beneficiaries aged 40–79 years. This survey used a self-administered questionnaire regarding various health-related lifestyle factors. Response rate for this questionnaire was very high, and 94.6% (N = 52,029) responded. Since then, utilization of medical services (medical expenditure and utilization duration per month categorized by inpatient and outpatient) and survival status have also been included.

For this study, we selected 11 years of data (January 1995 to December 2005) for males aged 40–79 years in 1995 (N = 24,573). Thus, the complete dataset included data for individuals between 40 and 90 years of age.

2.2. Calculation methods

We first constructed life tables for 100,000 male smokers (including former smokers) and 100,000 male non-smokers from 40 years of age by using mortality rates calculated from the Ohsaki cohort database and the latest published complete life tables [17]. First, we used a logistic regression model to estimate mortality rate for males at each age grouped by smokers and non-smokers. Strictly speaking, we divided each individual's multi-year data into multiple, separate single-year categories, and performed logistic regression analysis using age and smoking status as independent variables and survivor status as the dependent variable. Therefore, the 11-year survival data of an individual were divided into 11 separate single-year categories (11 survivors' data). In the case of a person who died after 4 years, data were divided into 4 separate single-year data categories (three survivors' and one deceased's data). For example, data of a person who was 40 years old in 1994 and became 51 years of age after 11 years were divided into 11 separate single-year data categories of ages 40, 41, 42, 43, 44, 45, 46, 47, 48, 49 and 50. These were treated as 11 separate single-year data points for 11 individuals. After that, we constructed life tables for both male smokers and non-smokers from 40 years of age by using the mortality rates derived from the logistic regression analysis. We used a single mortality rate (for both smokers and non-smokers) derived from the complete life tables to adjust the data after 90 years of age because we did not have data from anyone more than 90 years old in our dataset.

Next, we calculated the average annual medical expenditures (total, inpatient, and outpatient) of both smokers and non-smokers categorized by survivors and deceased. We also calculated the annual medical expenditures from data of the Ohsaki cohort study after transforming multiple-year data into multiple single-year data. In general, we calculated the annual medical expenditures in 5-year age groups, but calculated that of those who died in their 40s as a 10-year age group because data were sparse. We used the purchasing power parity rate of US$ 1.00 = JPN¥120 (2007) [18] as the exchange rate.

Finally, we examined the difference in lifetime medical expenditures between smokers and non-smokers by using the above life tables and annual medical expenditures. For both smokers and non-smokers, we multiplied the number of survivors and deceased of each age by survivor's or deceased's annual medical expenditures, respectively. We calculated long-term cumulative medical expenditure per smoker or non-smoker after summing expenditures of all ages. Moreover, we performed sensitivity analyses by using discount rates of 0%, 1%, and 5% to verify the accuracy of the results.

These analyses were performed using SPSS 15.0J for Windows (SPSS Inc., Chicago, IL, USA) and EXCEL2003 for Windows (Microsoft, Redmond, WA, USA). All reported P-values were two-tailed, and P-values <0.05 were considered significant. This study was approved by the Institutional Review Board of the Faculty of Medicine at the Graduate School of Medicine of Kyoto University, Tohoku University School of Medicine, and Nara Women's University.

3. Results

Table 1 shows the logistic regression coefficients and odds ratios with 95% confidence intervals (CIs) for the effects of age and smoking status on mortality in males. Smoking status and age were both statistically significant, and the odds ratio of smokers to non-smokers and age was 1.52 (95% CI: 1.38–1.67) and 1.10 (95% CI: 1.09–1.10), respectively. The C-index of our model was 0.74 (95% CI: 0.74–0.75), which was relatively high. When we constructed life tables for both male smokers and non-smokers from 40 years old based on the regression coefficients and information from the published complete life table, life expectancy of smokers at 40 was 39.6 years and that of

Table 1
Logistic regression coefficients and odds ratios with 95% confidence intervals for effects of age and smoking status on mortality in males.

Independent variables	Coefficient	Odds ratio	95% Confidence interval	*P*-value
Age	0.0915	1.10	(1.09–1.10)	0.000
Smoking status				
Non-smokers		1.00		
Smokers	0.417	1.52	(1.38–1.67)	0.000
Intercept	−10.6			
Hosmer-Lemeshow test		Chi-square = 7.126		0.52
C-index		0.74	(0.74–0.75)	

non-smokers was 43.1 years, suggesting that non-smokers live approximately 3.5 years longer than smokers.

Table 2 shows average annual medical expenditures (total, inpatient, and outpatient) of both smokers and non-smokers categorized by survivors and deceased. In general, smokers had higher annual medical expenditures than non-smokers, but we observed some other trends when evaluating survivors vs. deceased and inpatient vs. outpatient expenditures. Smokers tended to have higher expenditures, except in the survivors of the younger generation, although there was not a clear-cut trend in the deceased. We also observed that smokers tended to have higher inpatient expenditures, but non-smokers tended to have higher outpatient expenditures.

Table 3 shows long-term average cumulative medical expenditures per capita of smokers and non-smokers beginning from 40 years old until a specific age. Although non-smokers had lower long-term cumulative medical expenditures between 64 and 81 years of age (24–41 years beginning from 40 years of age) (data not shown), their lifetime medical expenditures were higher. The lifetime medical expenditure per capita of smokers and non-smokers was $49,980 and $51,771, respectively, and that of non-smokers was about 3.5% higher than non-smokers. Therefore, an increase of lifetime medical expenditure of less than $1800 was equivalent to a return of 3.5 years of extended life, or approximately $500 per year.

Fig. 1 shows the effect of discount rate on the difference in long-term cumulative medical expenditures between smokers and non-smokers. As discount rate increased, the difference in long-term cumulative medical expenditures between smokers and non-smokers decreased. There was little difference between smokers and non-smokers in their long-term cumulative medical expenditures at the discount rate of 5%. Changing the discount rate did not reverse the order of the two lifetime medical expenditures.

4. Discussion

In this study, we directly examined life expectancies and annual medical expenditures of smokers and non-smokers, and clarified the difference in lifetime medical expenditures between them using a single cohort database. The results suggested that: (1) smokers had a higher mortality rate than non-smokers, resulting in shortened life expectancy; (2) in general, smokers have higher annual

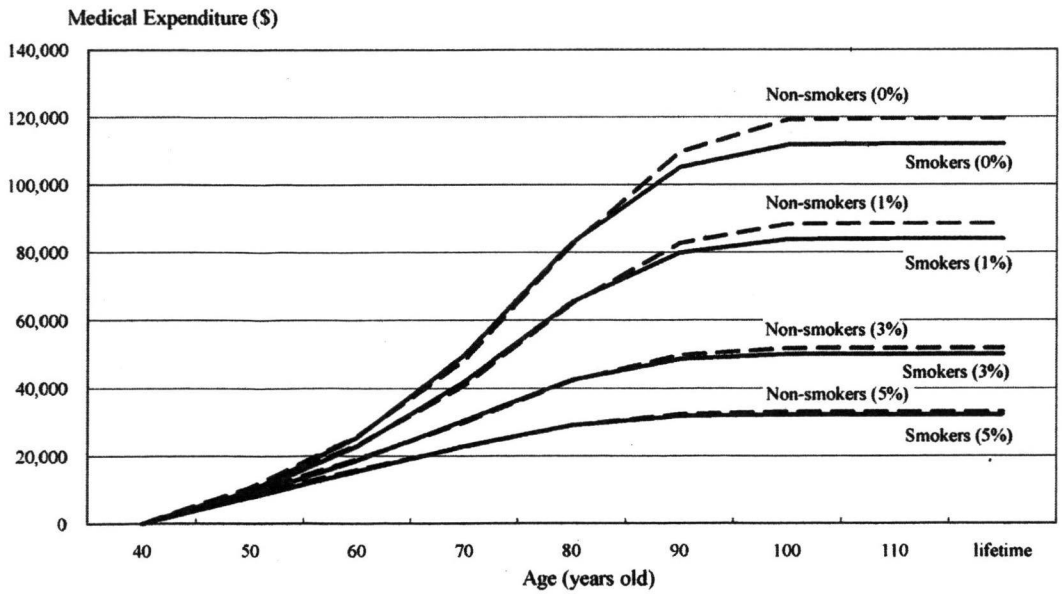

Fig. 1. Long-term average cumulative medical expenditure per capita of smokers and non-smokers by each discount rate.

Table 2
Average annual medical expenditures (total, inpatient, and outpatient) of smokers and non-smokers categorized by survivors and deceased.

Age	Total		Survivors		Deceased	
	Smokers	Non-smokers	Smokers	Non-smokers	Smokers	Non-smokers
40–44						
N	4,692	729	4,680	728	58	11
Total AME* ($)	860	869	848	869	10,238	10,558
Inpatient ($)	276	437	264	437	8,950	8,171
Outpatient ($)	584	432	584	432	1,288	2,387
45–49						
N	15,314	2,888	15,268	2,878		
Total AME	1,086	1,288	1,055	1,253		
Inpatient	396	480	367	450		
Outpatient	690	809	688	803		
50–54						
N	18,770	4,033	18,678	4,018	92	15
Total AME	1,484	1,440	1,423	1,378	14,017	18,024
Inpatient	571	546	518	498	11,205	13,421
Outpatient	914	894	904	880	2,811	4,603
55–59						
N	16,545	4,375	16,436	4,355	109	20
Total AME	1,821	1,665	1,743	1,601	13,620	15,630
Inpatient	740	539	666	486	11,974	11,983
Outpatient	1,081	1,126	1,077	1,115	1,645	3,647
60–64						
N	20,685	6,097	20,453	6,067	232	30
Total AME	2,454	2,104	2,334	2,011	13,026	20,825
Inpatient	1,089	648	977	571	10,974	16,260
Outpatient	1,365	1,455	1,358	1,440	2,052	4,565
65–69						
N	28,006	7,188	27,532	7,130	474	58
Total AME	3,138	2,753	2,940	2,665	14,599	13,601
Inpatient	1,374	959	1,183	870	12,515	11,851
Outpatient	1,763	1,794	1,758	1,795	2,085	1,750
70–74						
N	28,762	5,881	28,024	5,801	738	80
Total AME	4,331	3,886	4,049	3,722	15,037	15,752
Inpatient	1,914	1,434	1,626	1,283	12,835	12,356
Outpatient	2,417	2,452	2,423	2,439	2,202	3,396
75–79						
N	20,099	3,918	19,301	3,799	798	119
Total AME	5,043	4,703	4,632	4,450	14,987	12,778
Inpatient	2,274	1,947	1,842	1,686	12,723	10,252
Outpatient	2,769	2,757	2,790	2,764	2,264	2,526
80–84						
N	9,088	2,132	8,524	2,022	564	110
Total AME	5,355	5,078	4,907	4,577	12,131	14,281
Inpatient	2,637	2,221	2,133	1,678	10,260	12,209
Outpatient	2,718	2,857	2,774	2,899	1,871	2,071
85+						
N	2,298	667	2,098	612	200	55
Total AME	5,252	4,896	4,643	4,542	11,643	8,838
Inpatient	2,863	2,064	2,180	1,634	10,020	6,851
Outpatient	2,390	2,832	2,463	2,908	1,623	1,987
Total						
N	164,259	37,908	160,994	37,410	3,265	498
Total AME	3,068	2,781	2,847	2,633	13,947	13,957
Inpatient	1,355	1,036	1,142	899	11,868	11,314
Outpatient	1,713	1,745	1,705	1,733	2,079	2,643

*AME: average medical expenditures.