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Purpose in life and tobacco use among community-dwelling mothers of early adolescents

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Dr. Trish Groves
Editor-in-Chief
BMJ Open

Dear Dr. Groves,

I wish to submit an original research article for publication in ***BMJ Open***, titled "Purpose in life and tobacco use among community-dwelling mothers of early adolescents." The paper was co-authored by Yuko Morimoto, Syudo Yamasaki, Shuntaro Ando, Shinsuke Koike, Shinya Fujikawa, Sho Kanata, Kaori Endo, Miharu Nakanishi, Stephani L. Hatch, Marcus Richards, Kiyoto Kasai, Mariko Hiraiwa-Hasegawa, and Atsushi Nishida.

This study utilizes the results of questionnaires administered as part of the Tokyo Early Adolescence Survey to investigate the relationship between a sense of purpose in life and tobacco use among mothers of adolescents who are in early middle age. We find that there is a strong inverse relationship between a sense of purpose in life and tobacco use in this population, even after controlling for socioeconomic status indicators, age, and psychological distress. We believe that our study makes a significant contribution to the literature, because it is the first to investigate this relationship using a large population-based sample (N = 4,063) of women in early midlife. Further, we believe that this paper will be of interest to the readership of your journal, given that our findings have practical implications for community health professionals involved in promoting tobacco cessation among mid-life women, and especially mothers.

This manuscript has not been published or presented elsewhere in part or in entirety and is not under consideration by another journal. All study participants provided informed consent, and the study's design was approved by the appropriate ethics review board. We have read and understood your journal's policies, and we believe that neither the manuscript nor the study violates any of these. There are no conflicts of interest to declare.

Thank you for your consideration. I look forward to hearing from you.

Sincerely,

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TITLE

Purpose in life and tobacco use among community-dwelling mothers of early adolescents

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ABSTRACT

Objectives The rising prevalence of tobacco use and tobacco-attributable deaths among women is of worldwide concern. In particular, smoking prevention for mothers in early midlife is a significant international public health goal. A higher sense of purpose in life is thought to reduce detrimental health behaviours. However, little is known about the association between a sense of purpose in life (PIL) and tobacco use. This study investigates this association among community-dwelling mothers of early adolescents.

Design This population-based cross-sectional study uses a self-reported questionnaire from the Tokyo Early Adolescence Survey (T-EAS), a large community-based survey conducted in Japan between 2012 and 2014.

Setting Participants were randomly recruited from the resident registries of three municipalities in Tokyo, Japan.

Participants A total of 4,478 children and their primary parents participated. Responses from 4,063 mothers with no missing data were analysed (M age = 42.0 years [SD=4.2]).

Measures Participants' tobacco use, including the number of cigarettes smoked per day, was documented using a questionnaire. PIL was assessed using a Purpose in Life scale derived from Ryff's Psychological Well-Being Scale.

Results Greater PIL was associated with a decreased likelihood of tobacco use, even when adjusted for confounders (OR = 0.80, 95%CI 0.70 to 0.91). Multinomial logistic regression analyses revealed

that PIL was inversely associated with tobacco consumption among mothers. These associations remained after controlling for psychological distress, socioeconomic factors, and frequency of alcohol consumption among moderate to heavy smokers (OR = 0.70, 95%CI 0.57 to 0.86), while attenuated among light smokers.

Conclusions Increasing PIL may be a valuable intervention for reducing tobacco use among women in early midlife. This study can contribute to our understanding of the psychology of smoking behaviour, and shed light on the targeted intervention to reduce tobacco use among early midlife mothers.

KEYWORDS

Purpose in life, Mother, Psychological distress, Tokyo Early Adolescence Survey (T-EAS), Tobacco use

STRENGTHS AND LIMITATIONS OF THIS STUDY

- The study investigated the association between a sense of purpose in life (PIL) and tobacco use among community dwelling mothers in early midlife.
- Data were collected from a large community-based sample of mothers in early-middle age, randomly recruited from the resident registries of three municipalities in Tokyo.
- We demonstrated the association between PIL and tobacco use while controlling for confounders,

including demographic variables and psychological distress.

- The study adopted a cross sectional design and was limited to determining a causal relationship between PIL and tobacco use.

INTRODUCTION

The tobacco epidemic is one of the most significant international public health threats. Globally, more than one in ten adult deaths is estimated to be due to tobacco. The World Health Organization is particularly concerned about the possibility that the global increase in deaths due to tobacco is driven by the accelerating rate of tobacco use in women.[1] Smoking prevalence among women is not decreasing, while that among men has been decreasing rapidly during the past three decades in Japan.[2] Tobacco use among women is dramatically increasing among those between 30 and 50 years old,[3] and tobacco cessation in early midlife is associated with a substantial decline in mortality risk for women.[4 5] In addition, maternal smoking is the major determinant of child's passive smoking[6] and smoking initiation.[7] Smoking prevention for women, especially mothers, in early midlife, is therefore a significant international public health goal.

We examined the association between purpose in life (PIL) and tobacco use in women in early midlife. PIL is a component of psychological eudaemonic well-being, and refers to the extent to which individuals regard their own life as meaningful.[8] Previous studies, which have mainly examined elderly populations, have shown that a higher sense of PIL is associated with reduced risk for diseases (e.g. Alzheimer's disease,[9] myocardial infarction,[10] stroke,[11] cerebral infarctions[12]) and with better physical function[13] and lower mortality.[14-19] A growing body of research indicates the existence of links between PIL and health behaviours[20] (e.g. use of preventive health care services,[21]

daily exercise,[22-24] maintenance of a healthy diet,[25 26] preventive behaviours for breast cancer.[23]). In contrast, lower PIL is associated with detrimental health behaviours. Previous research in this area has mainly concentrated on the association between PIL and addiction.[27-30]

Previous studies suggested that interventions and promotions focusing on psychological factors were important for smoking prevention and cessation among women. Meta-analyses have shown that women have more difficulty maintaining long-term smoking cessation than men,[31] and nicotine replacement therapy for smoking cessation is less effective in women than in men, in particular for supporting long-term maintenance of smoking cessation.[32] Another meta-analysis demonstrated that motivational interviewing, which is a psychological approach used to enhance PIL among people with addictive behaviours, could be effective for tobacco cessation.[33]

Purpose in life might be a significant psychological factor for promoting tobacco cessation among women. However, relatively little is known about the association between PIL and tobacco use, with no study to date examining this association in women in early midlife. A previous survey on 341 adults in Hungary[34] demonstrated that daily smokers had lower PIL than non-smokers, although the sample was limited to a small number and did not focus on women in early midlife. In the current study, we hypothesized that PIL is inversely associated with tobacco use among early midlife mothers, even after controlling for demographic variables and the effect of psychological distress. Psychological distress (depression and/or anxiety) often co-occurs with tobacco use.[35-42] Since psychological distress (ill-being) is inversely associated with PIL[8 43 44] and is positively

associated with substance abuse,[28 29] it could confound associations between PIL and tobacco use. We also hypothesized that PIL is inversely associated with the amount of tobacco consumption.

METHODS

Study design, sample, and survey procedure

This study used data from the Tokyo Early Adolescence Survey (T-EAS),[45, 46] which was originally designed as a baseline survey for the Tokyo Teen Cohort, a currently ongoing longitudinal cohort study (URL: http://ttcp.umin.jp/index.html). The T-EAS is a multidisciplinary survey of 10-year-old adolescents and their main carers (98.5% mothers). The T-EAS contains questions about tobacco use, PIL, and psychological distress, as well as a variety of other potentially confounding variables. Participants were randomly recruited from the resident registries of three municipalities in Tokyo: Setagaya Ward, Mitaka City, and Chofu City. Participants were sent invitation letters on or around the child's tenth birthday. The survey was completed in two home visits. During the first visit, written informed consent from the main carer (generally the mother) was obtained; participants were then asked to complete the questionnaires at home before the second visit. During the second visit, both the adolescent and the main carer were each asked to complete the self-report questionnaires separately. The questionnaires were enclosed in envelopes by the respondents immediately after

completion. In addition, the main carer responded to a semi-structured interview. All data were collected anonymously. The T-EAS was conducted by three research institutes: Tokyo Metropolitan Institute of Medical Science, The University of Tokyo, and SOKENDAI (The Graduate University for Advanced Studies). This survey was approved by the ethics committees of these three institutes.

Participants

A total of 4,478 children and their primary parents participated in the Tokyo Early Adolescence Survey (T-EAS) (response rate 43.8%). We used the primary parent data for the purposes of the current study. Of the 4,478 respondents, 68 were men, and were hence excluded to focus the investigation on the association between PIL and tobacco use in women. An additional 347 female respondents' data were excluded due to incomplete answers to the questions on tobacco use, PIL, psychological distress, or other confounding variables. The final dataset therefore contained data from 4,063 respondents.

Measures

Tobacco Use

Respondents were asked whether they used tobacco. Those who answered 'yes' were

subsequently asked about the number of cigarettes they smoked per day. A binary variable was created ('0: non-smokers' versus '1: smokers'), based on the first question. Respondents were then split into: '0: non-smokers', '1: light smokers (less than half a pack per day)', and '2: moderate to heavy smokers (more than or equal to half a pack per day)', to assess potential dose-response effects.

Purpose in Life

PIL was assessed using a 14-item version of the Purpose in Life scale derived from Ryff's Psychological Well-Being scales.[8] The scale included items such as 'I have a sense of direction and purpose in life', and 'My daily activities often seem trivial and unimportant to me' (reverse coded). Each item was rated on a 6-point Likert scale (1: strongly disagree; 6: strongly agree) and scores were summed, so that continuous scores ranged from 14 to 84. Higher scores indicated a higher sense of PIL.

Psychological Distress

Psychological distress was assessed using the K6.[47] This survey contains six items, assessing how frequently during the past 30 days respondents felt: i) so depressed that nothing could cheer them up, ii) hopeless, iii) restless or fidgety, iv) that everything was an effort, v) worthless, and vi) nervous. Each item was scored on a 5-point Likert scale (0: never; 4: most of the time). Scores were summed, with the resulting raw scores ranging from 0 to 24. Higher scores indicate more

frequent psychological distress during the past 30 days.

Other covariates

The following covariates were examined for their potential confounding effects: age, educational attainment, marital status, annual family income, and frequency of alcohol consumption. High socioeconomic status (represented by educational attainment and annual family income here) is known to be associated with higher PIL,[42] and socioeconomic disadvantage is a risk factor for tobacco use.[48-51] Educational attainment was coded as follows: '1: junior high school or lower', '2: high school', '3: technical or junior college', and '4: 4-year university or higher'. Marital status was dichotomized as '1: yes' or '0: no', depending on whether the respondent was in a marriage or marriage-like relationship. Family income over the past year was divided into four categories: '1: less than 4 million yen', '2: 4–6 million yen', '3: 7–9 million yen', and '4: over 10 million yen'. Frequency of alcohol consumption was assessed using a 5-point Likert scale (0: do not drink; 4: more than 4 times a week).

Statistical analyses

Cross tabulation and chi-square tests were conducted to test the differences between three groups based on the amounts of tobacco used (none, light, and moderate to heavy smokers), and covariates in categorical variables as well as ANOVAs were used in continuous variables. We

conducted binomial logistic regression analyses (using a binary dependent variable: non-smokers vs. smokers) to test the association between PIL and tobacco use. The PIL score was standardized to report odds ratios per one standard deviation change of PIL scores. Logistic regression model 1 was unadjusted for covariates; model 2 was adjusted for socioeconomic covariates: age, education, marital status, and family income; model 3 was further adjusted for alcohol consumption; and finally, model 4 was further adjusted for psychological distress (see Table 2). In order to further examine the relationship between PIL and tobacco use, we conducted multinomial logistic regression analyses to assess the effect of PIL on the degree of tobacco use. Regression models 5 to 8 were identical to models 1 to 4, except that the dependent variable was multivariate: non-smokers, light smokers, and moderate or heavy smokers.

RESULTS

Prevalence of smokers and corresponding descriptive statistics

Of the 4,063 respondents (mean age 42.0 years, standard deviation 4.2; 95.8% married; 40.1% achieved a degree from a 4-year university or higher; 8.8% had family income less than 4 million yen), 324 (8.0%) were smokers. 204 (5.0%) were light smokers, 120 (3.0%) were moderate to heavy smokers. Chi-square tests and ANOVA indicated that inverse associations were clearly

evident between tobacco use and PIL, age, education, marital status, and annual family income (Table 1). Psychological distress was higher in smokers than in non-smokers (Table 1). On the other hand, the highest alcohol consumption was reported by light smokers (Table 1).

[Insert Table 1 about here]

The association between PIL and tobacco use

Table 2 shows the binominal odds ratios for tobacco use compared to no smoking. PIL was strongly inversely associated with tobacco use in the analysis without covariates (Model 1). The odds ratio was not attenuated after adjusting for socioeconomic variables (Model 2). This was also the case after adjusting for alcohol consumption (Model 3) and finally, for psychological distress (Model 4). With regard to the covariates in the fully adjusted model, educational attainment, marital status, and family annual income were inversely associated with tobacco use. There was a positive association between tobacco use and frequency of alcohol consumption. Psychological distress was not associated with tobacco use.

[Insert Table 2 about here]

The association between PIL and amount of tobacco consumption

Figure 1 shows the odds ratios for smoking consumption, produced by multinomial logistic regressions comparing light and moderate to heavy smoking against the no smoking reference category. Without any adjustment (Model 5), PIL was inversely associated with both light and moderate to heavy smoking (light smoking: OR = 0.77, 95%CI: 0.67-0.89, $p < .001$; moderate to heavy smoking: OR = 0.62, 95%CI: 0.52-0.74, $p < .001$). The odds ratios remained significant after adjusting for socioeconomic covariates (Model 6: light smoking: OR = 0.86, 95%CI: 0.74-1.00, $p = 0.046$; moderate to heavy smoking: OR = 0.72, 95%CI: 0.59-0.87, $p < .001$) and further adjustment for alcohol consumption (Model 7: light smoking: OR = 0.86, 95%CI: 0.74-0.99, $p = 0.041$; moderate to heavy smoking: OR = 0.71, 95%CI: 0.59-0.87, $p < .001$). Adjusting further for psychological distress (Model 8), the association between PIL and light smoking was not significant (OR = 0.87, 95%CI: 0.74-1.02, $p = 0.079$). On the other hand, the odds ratio for moderate to heavy smoking was not attenuated after adjustment for any of the aforementioned variables (OR = 0.70, 95%CI: 0.57-0.86, $p < .001$; See Figure 1).

[Insert Figure 1 about here]

DISCUSSION

In a community-based sample of mothers in early-middle age, we found that PIL was inversely associated with tobacco use after controlling for age, education, marital status, family income, and alcohol use. Importantly, this was also the case even after taking psychological distress into account. PIL was also inversely associated with the risk of moderate to heavy tobacco consumption even after controlling for covariates. This result is consistent with that of a previous study on a community sample in Hungary.[34] We confirmed the association between PIL and tobacco use with a large population-based sample of women in early midlife in Japan.

It is possible that individuals with higher PIL are likely to invest in healthy behaviours because they feel that their lives are meaningful, have a greater will to live and, therefore, are more proactive in taking care of their health[21] (e.g., by the avoidance of smoking). They may also be motivated to acquire knowledge regarding health maintenance (i.e., the knowledge about how detrimental smoking is). In contrast, since those low in PIL lack a high sense of life's meaningfulness, it may seem pointless for them to protect their health, and they may prefer short-term gratification, such as that obtained through tobacco use.

The association between PIL and tobacco use was robust even when controlling for psychological distress. It may suggest a relationship between a lack of eudaemonic well-being (PIL) and tobacco use, rather than a relationship between ill-being (psychological distress) and tobacco

use. Mental well-being and mental illness are correlated but belong to separate continua, with well-being referring to the presence of positive feelings and positive functioning, rather than just the absence of mental illness.[52 53]

The present results suggest that increasing PIL may be a valuable target of intervention for reducing tobacco use, as well as for reducing substance abuse.[29] PIL is modifiable[54 55] and increasing awareness of one's values or long-term goals in life could increase the sense of PIL.[56 57] Promotion focusing on increasing PIL might be effective in reducing tobacco use in public settings.

This study is limited of course, in its capacity to determine causality, since the data were cross-sectional. Longitudinal studies should be conducted in order to determine whether PIL has a role in tobacco use. We are currently conducting a subsequent longitudinal cohort study (Tokyo Teen Cohort Study), which will further clarify causality between PIL and tobacco use among mothers. The sample was limited only to mothers and we could not examine the association among early-middle aged women without children. Further studies including them would be needed. Additionally, given that parental smoking, especially maternal smoking, is the major determinant of passive smoking[6] and smoking initiation[7] in children, follow-up studies should examine the transgenerational effects of mothers' tobacco use on the initiation of smoking in their children.

In summary, in a large community-based study, we found that high PIL is associated with lower consumption of tobacco among mothers, after controlling for a range of potential confounds, including psychological distress. Our hypothesis, that PIL is independently and inversely associated

with tobacco use, was therefore confirmed. This study may contribute to our understanding of the psychology of smoking behaviour and shed light on the target for intervention to reduce tobacco use among early midlife mothers.

Contributors

YM, SY, SA, SKoike, AN, MHH and KK involved in launching and maintaining the survey. SF, SKanata and KE have mainly contributed to data collection. MN, SLH and MR mainly contributed to design the study and proposing the analysis and interpretation of data. YM and SY wrote the first draft of the manuscript and all the other authors have critically reviewed it. All authors approved the final version of the manuscript.

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Project Grant (Kokoronokenko H27-H31). However, these funding sources had no involvement in the study design; in the collection, analysis and interpretation of data; in the writing of the articles; or in the decision to submit it for publication.

Competing interests

None.

Ethics approval

This study was conducted by three research institutes: Tokyo Metropolitan Institute of Medical Science, The University of Tokyo, and SOKENDAI (The Graduate University for Advanced Studies). This study was approved by the ethics committees of these three institutes.

Data sharing statement

This study was planned and conducted in accordance with the ethics committee of Tokyo Metropolitan Institute of Medical Science. When applying to the research ethics committee for the data set, the authors did not request this to be released as public data. However, the data can be made available to all interested researchers upon request to Dr. Atsushi Nishida, Ph.D. (nishida-at@igakuken.or.jp).

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Table 1. Descriptive statistics for T-EAS variables broken down by tobacco use

	Non-smokers	Light smokers	Moderate to heavy smokers	*p*
N (%)	3739 (92.0)	204 (5.0)	120 (3.0)	
Purpose in Life, mean (standard deviation [SD])	57.3 (9.7)	54.8 (9.8)	52.6 (9.9)	<.001
Age, mean (SD)	42.0 (4.1)	41.2 (5.0)	40.5 (4.8)	<.001
Education, n (%)				
Junior high school or lower	22 (0.6)	12 (5.9)	9 (7.5)	<.001
High school	512 (13.7)	66 (32.4)	48 (40.0)	
Technical or junior college	1626 (43.5)	89 (43.6)	51 (42.5)	
4-year university or higher	1579 (42.2)	37 (18.1)	12 (10.0)	
Marital status, n (%)				
Yes	3613 (96.6)	182 (89.2)	97 (80.8)	<.001
No	126 (3.4)	22 (10.8)	23 (19.2)	
Family annual income, n (%)				
Less than 4 million yen	285 (7.6)	42 (20.6)	31 (25.8)	<.001
4–6 million yen	1022 (27.3)	74 (36.3)	57 (47.5)	
7–9 million yen	1162 (31.1)	55 (27.0)	21 (17.5)	
More than 10 million yen	1270 (34.0)	33 (16.2)	11 (9.2)	
Alcohol use, n (%)				
Non	1160 (31.0)	44 (21.6)	43 (35.8)	<.001
Less than once a month	563 (15.1)	35 (17.2)	9 (7.5)	
2–4 times a month	689 (18.4)	24 (11.8)	15 (12.5)	
2–3 times a week	594 (15.9)	21 (10.3)	16 (13.3)	
More than 4 times a week	733 (19.6)	80 (39.2)	37 (30.8)	
K6 (Psychological Distress), mean (SD)	2.9 (3.3)	3.4 (3.4)	3.5 (3.9)	.026

Table 2. Logistic regression coefficients for odds of tobacco use, with and without potential confounding variables

	Model 1		Model 2		Model 3		Model 4	
	OR [95% CI]	*p*	OR [95% CI]	*p*	OR [95% CI]	*p*	OR [95% CI]	*p*
Purpose in Life	0.71 [0.63-0.80]	<.001	0.81 [0.71-0.91]	.001	0.80 [0.71-0.91]	<.001	0.80 [0.70-0.91]	.001
Age			0.98 [0.95-1.00]	.061	0.97 [0.95-1.00]	.043	0.97 [0.95-1.00]	.044
Education			0.44 [0.38-0.52]	<.001	0.45 [0.38-0.52]	<.001	0.45 [0.38-0.52]	<.001
Marital Status			0.41 [0.27-0.62]	<.001	0.41 [0.27-0.63]	<.001	0.41 [0.27-0.63]	<.001
Family Income			0.71 [0.62-0.82]	<.001	0.71 [0.62-0.81]	<.001	0.71 [0.62-0.81]	<.001
Alcohol Use					1.18 [1.10-1.28]	<.001	1.18 [1.10-1.28]	<.001
Psychological Distress							1.00 [0.96-1.04]	.974

OR: odds ratio, CI: confidence interval

Figure Captions

Figure 1

Figure 1. Odds ratios for purpose in life from multinomial logistic regression analysis predicting smoking consumption (reference: non-smoker) with and without potential confounding variables.

Model 5: without any adjustment; Model 6: adjusting for socioeconomic covariates (educational attainment and family income); Model 7: adjusting for socioeconomic covariates and alcohol consumption; Model 8: adjusting for socioeconomic covariates, alcohol consumption and psychological distress. OR: Odds ratio.

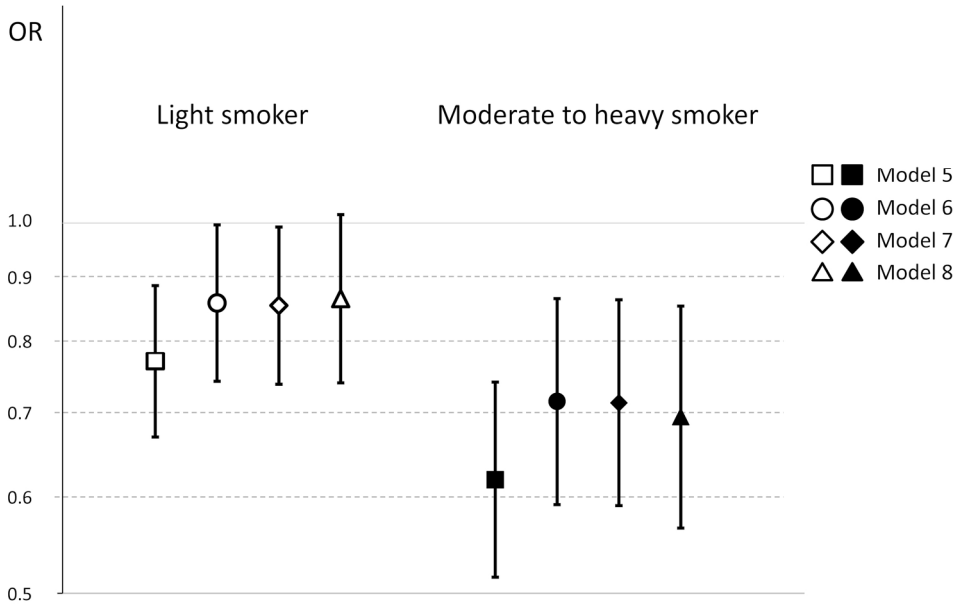

Figure 1. Odds ratios for purpose in life from multinomial logistic regression analysis predicting smoking consumption (reference: non-smoker) with and without potential confounding variables.

Model 5: without any adjustment; Model 6: adjusting for socioeconomic covariates (educational attainment and family income); Model 7: adjusting for socioeconomic covariates and alcohol consumption; Model 8: adjusting for socioeconomic covariates, alcohol consumption and psychological distress. OR: Odds ratio.

99x64mm (600 x 600 DPI)

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	Page No.
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1,3
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3-4
Introduction			
Background/ rationale	2	Explain the scientific background and rationale for the investigation being reported	6-8
Objectives	3	State specific objectives, including any prespecified hypotheses	6-8
Methods			
Study design	4	Present key elements of study design early in the paper	8-9
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	8-9
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	8-9
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	-
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	9-11
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	9-11
Bias	9	Describe any efforts to address potential sources of bias	8-9
Study size	10	Explain how the study size was arrived at	9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	9-12
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	11-12
		(*b*) Describe any methods used to examine subgroups and interactions	-
		(*c*) Explain how missing data were addressed	9
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	-
		(*e*) Describe any sensitivity analyses	-

Continued on next page

Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	12-13 Table1
		(b) Give reasons for non-participation at each stage	-
		(c) Consider use of a flow diagram	-
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	12-13 Table 1
		(b) Indicate number of participants with missing data for each variable of interest	-
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	-
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	-
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	-
		Cross-sectional study—Report numbers of outcome events or summary measures	12-13 Table 1
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	13-14 Table 2 Figure 1
		(*b*) Report category boundaries when continuous variables were categorized	12-13 Table 1
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-
Discussion			
Key results	18	Summarise key results with reference to study objectives	15
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	16
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	15-17
Generalisability	21	Discuss the generalisability (external validity) of the study results	16-17
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	17-18

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Purpose in life and tobacco use among community-dwelling mothers of early adolescents

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TITLE

Purpose in life and tobacco use among community-dwelling mothers of early adolescents

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ABSTRACT

Objectives The rising prevalence of tobacco use and tobacco-attributable deaths among women is of worldwide concern. In particular, smoking prevention for mothers in early midlife is a significant international public health goal. A higher sense of purpose in life is thought to reduce detrimental health behaviours. However, little is known about the association between a sense of purpose in life (PIL) and tobacco use. This study investigates this association among community-dwelling mothers of early adolescents.

Design This population-based cross-sectional study uses a self-reported questionnaire from the Tokyo Early Adolescence Survey (T-EAS), a large community-based survey conducted in Japan between 2012 and 2014.

Setting Participants were randomly recruited from the resident registries of three municipalities in Tokyo, Japan.

Participants A total of 4,478 children and their primary parents participated. Responses from 4,063 mothers with no missing data were analysed (M age = 42.0 years [SD=4.2]).

Measures Participants' tobacco use, including the number of cigarettes smoked per day, was documented using a questionnaire. PIL was assessed using a Purpose in Life scale derived from Ryff's Psychological Well-Being Scale.

Results Greater PIL was associated with a decreased likelihood of tobacco use, even when adjusted for confounders (OR = 0.80, 95%CI 0.70 to 0.91). Multinomial logistic regression analyses revealed

that PIL was inversely associated with tobacco consumption among mothers. These associations remained after controlling for psychological distress, socioeconomic factors, and frequency of alcohol consumption among moderate to heavy smokers (OR = 0.70, 95%CI 0.57 to 0.86), while attenuated among light smokers.

Conclusions Increasing PIL may be a valuable intervention for reducing tobacco use among women in early midlife. This study can contribute to our understanding of the psychology of smoking behaviour, and shed light on the targeted intervention to reduce tobacco use among early midlife mothers.

KEYWORDS

Purpose in life, Mother, Psychological distress, Tokyo Early Adolescence Survey (T-EAS), Tobacco use

STRENGTHS AND LIMITATIONS OF THIS STUDY

- The study investigated the association between a sense of purpose in life (PIL) and tobacco use among community dwelling mothers in early midlife.
- Data were collected from a large community-based sample of mothers in early-middle age, randomly recruited from the resident registries of three municipalities in Tokyo.
- We demonstrated the association between PIL and tobacco use while controlling for confounders,

including demographic variables and psychological distress.

- The study adopted a cross sectional design and was limited to determining a causal relationship between PIL and tobacco use.

INTRODUCTION

The tobacco epidemic is one of the most significant international public health threats. Globally, more than one in ten adult deaths is estimated to be due to tobacco. The World Health Organization is particularly concerned about the possibility that the global increase in deaths due to tobacco is driven by the accelerating rate of tobacco use in women.[1] Smoking prevalence among women is not decreasing, while that among men has been decreasing rapidly during the past three decades in Japan.[2] Tobacco use among women is dramatically increasing among those between 30 and 50 years old,[3] and tobacco cessation in early midlife is associated with a substantial decline in mortality risk for women.[4 5] In addition, maternal smoking is the major determinant of child's passive smoking[6] and smoking initiation.[7] Smoking prevention for women, especially mothers, in early midlife, is therefore a significant international public health goal.

We examined the association between purpose in life (PIL) and tobacco use in women in early midlife. PIL is a component of psychological eudaemonic well-being, and refers to the extent to which individuals regard their own life as meaningful.[8] Previous studies, which have mainly examined elderly populations, have shown that a higher sense of PIL is associated with reduced risk for diseases (e.g. Alzheimer's disease,[9] myocardial infarction,[10] stroke,[11] cerebral infarctions[12]) and with better physical function[13] and lower mortality.[14-19] A growing body of research indicates the existence of links between PIL and health behaviours[20] (e.g. use of preventive health care services,[21]

daily exercise,[22-24] maintenance of a healthy diet,[25 26] preventive behaviours for breast cancer.[23]). Recent systematic review showed that greater PIL is related to a range of better health outcomes for older adults.[27] The significance of PIL on better health is recently recognized cross-culturally (e.g. Ikigai in Japanese). Recent evidence demonstrated that PIL was associated with healthy glucoregulation among Japanese adults,[28] which had also demonstrated in Western countries.[29] In contrast, lower PIL is associated with detrimental health behaviours. Previous research in this area has mainly concentrated on the association between PIL and addiction.[30-33]

Previous studies suggested that interventions and promotions focusing on psychological factors were important for smoking prevention and cessation among women. Meta-analyses have shown that women have more difficulty maintaining long-term smoking cessation than men,[34] and nicotine replacement therapy for smoking cessation is less effective in women than in men, in particular for supporting long-term maintenance of smoking cessation.[35] Another meta-analysis demonstrated that motivational interviewing, which is a psychological approach used to enhance PIL among people with addictive behaviours, could be effective for tobacco cessation.[36]

Purpose in life might be a significant psychological factor for promoting tobacco cessation among women. However, relatively little is known about the association between PIL and tobacco use, with no study to date examining this association in women in early midlife. A previous survey on 341 adults in Hungary[37] demonstrated that daily smokers had lower PIL than non-smokers, although the sample was limited to a small number and did not focus on women in early midlife. In

the current study, we hypothesized that PIL is inversely associated with tobacco use among early midlife mothers, even after controlling for demographic variables and the effect of psychological distress. Psychological distress (depression and/or anxiety) often co-occurs with tobacco use.[38-45] Since psychological distress (ill-being) is inversely associated with PIL[8 46 47] and is positively associated with substance abuse,[31 32] it could confound associations between PIL and tobacco use. We also hypothesized that PIL is inversely associated with the amount of tobacco consumption.

METHODS

Study design, sample, and survey procedure

This study used data from the Tokyo Early Adolescence Survey (T-EAS)[48 49] which was originally designed as a baseline survey for the Tokyo Teen Cohort, a currently ongoing longitudinal cohort study (URL: http://ttcp.umin.jp/index.html). The T-EAS is a multidisciplinary survey of 10-year-old adolescents and their primary caregivers (98.5% mothers). The T-EAS contains questions about tobacco use, PIL, and psychological distress, as well as a variety of other potentially confounding variables. Participants were randomly recruited from the resident registries of three municipalities in Tokyo: Setagaya Ward, Mitaka City, and Chofu City. Participants were sent invitation letters on or around the child's tenth birthday. The survey was completed in two home

visits. During the first visit, written informed consent from the primary caregiver (generally the mother) was obtained; participants were then asked to complete the questionnaires at home before the second visit. During the second visit, both the adolescent and the primary caregiver were each asked to complete the self-report questionnaires separately. The questionnaires were enclosed in envelopes by the respondents immediately after completion. In addition, the primary caregiver responded to a semi-structured interview. All data were collected anonymously. The T-EAS was conducted by three research institutes: Tokyo Metropolitan Institute of Medical Science, The University of Tokyo, and SOKENDAI (The Graduate University for Advanced Studies). This survey was approved by the ethics committees of these three institutes.

Participants

A total of 4,478 children and their primary parents participated in the Tokyo Early Adolescence Survey (T-EAS) (response rate 43.8%). We used the primary parent data for the purposes of the current study. Of the 4,478 respondents, 68 were men, and were hence excluded to focus the investigation on the association between PIL and tobacco use in women. An additional 347 female respondents' data were excluded due to incomplete answers to the questions on tobacco use, PIL, psychological distress, or other confounding variables. The final dataset therefore contained data from 4,063 respondents.

Measures

Tobacco Use

Respondents were asked whether they used tobacco. Those who answered 'yes' were subsequently asked about the number of cigarettes they smoked per day. A binary variable was created ('0: non-smokers' versus '1: smokers'), based on the first question. Respondents were then split into: '0: non-smokers', '1: light smokers (less than half a pack [= 10 cigarettes] per day)', and '2: moderate to heavy smokers (more than or equal to half a pack per day)', to assess potential dose-response effects.

Purpose in Life

PIL was assessed using a 14-item version of the Purpose in Life scale derived from Ryff's Psychological Well-Being scales.[8] The scale included items such as 'I have a sense of direction and purpose in life', and 'My daily activities often seem trivial and unimportant to me' (reverse coded). Each item was rated on a 6-point Likert scale (1: strongly disagree; 6: strongly agree) and scores were summed, so that continuous scores ranged from 14 to 84. Higher scores indicated a higher sense of PIL.

Psychological Distress

Psychological distress was assessed using the K6.[50] This survey contains six items, assessing how frequently during the past 30 days respondents felt: i) so depressed that nothing could cheer them up, ii) hopeless, iii) restless or fidgety, iv) that everything was an effort, v) worthless, and vi) nervous. Each item was scored on a 5-point Likert scale (0: never; 4: most of the time). Scores were summed, with the resulting raw scores ranging from 0 to 24. Higher scores indicate more frequent psychological distress during the past 30 days.

Other covariates

The following covariates were examined for their potential confounding effects: age, educational attainment, marital status, annual family income, and frequency of alcohol consumption. High socioeconomic status (represented by educational attainment and annual family income here) is known to be associated with higher PIL,[46] and socioeconomic disadvantage is a risk factor for tobacco use.[51-54] Educational attainment was coded as follows: '1: junior high school or lower', '2: high school', '3: technical or junior college', and '4: 4-year university or higher'. Marital status was dichotomized as '1: yes' or '0: no', depending on whether the respondent was in a marriage or marriage-like relationship. Family income over the past year was divided into four categories: '1: less than 4 million yen', '2: 4–6 million yen', '3: 7–9 million yen', and '4: over 10 million yen'. Frequency of alcohol consumption was assessed using a 5-point Likert scale (0: do not drink; 4:

more than 4 times a week).

Statistical analyses

Cross tabulation, chi-square tests and residual analyses were conducted to test the differences between three groups based on the amounts of tobacco used (none, light, and moderate to heavy smokers), and covariates in categorical variables as well as ANOVAs were used in continuous variables. Correlation coefficients among all variables also examined. We conducted binomial logistic regression analyses (using a binary dependent variable: non-smokers vs. smokers) to test the association between PIL and tobacco use. The PIL score was standardized to report odds ratios per one standard deviation change of PIL scores. Logistic regression model 1 was unadjusted for covariates; model 2 was adjusted for socioeconomic covariates: age, education, marital status, and family income; model 3 was further adjusted for alcohol consumption; and finally, model 4 was further adjusted for psychological distress. In order to further examine the relationship between PIL and tobacco use, we conducted multinomial logistic regression analyses to assess the effect of PIL on the degree of tobacco use. Regression models 5 to 8 were identical to models 1 to 4, except that the dependent variable was multivariate: non-smokers, light smokers, and moderate or heavy smokers.

Patient involvement

Patients were not involved in developing the study hypothesis, recruitment, outcome measures, study

design, or implementation. Patients were not involved in interpretation or writing up on the results. There are no plans to disseminate the results of the research to study participants or the relevant patient community.

RESULTS

Prevalence of smokers and corresponding descriptive statistics

Of the 4,063 respondents (mean age 42.0 years, standard deviation 4.2; 95.8% married; 40.1% achieved a degree from a 4-year university or higher; 8.8% had family income less than 4 million yen), 324 (8.0%) were smokers. 204 (5.0%) were light smokers, 120 (3.0%) were moderate to heavy smokers. Chi-square tests and ANOVA indicated that inverse associations were clearly evident between tobacco use and PIL, age, education, marital status, and annual family income (Table 1). Residual analyses indicated that lower educational attainment (light smokers with junior high school or lower education [adjusted residuals = 6.9, $p < .01$] and those with high school education [adjusted residuals = 6.9, $p < .01$]; moderate or heavy smokers with junior high school or lower education [adjusted residuals = 7.0, $p < .01$] and those with high school education [adjusted residuals = 7.6, $p < .01$]), not being married (light smokers without being married [adjusted residuals = 4.8, $p < .01$]; moderate to heavy smokers without being married [adjusted residuals = 8.3, $p < .01$]),

lower family income (light smokers with the lowest family income (less than 4 million yen) [adjusted residuals = 6.1, p <.01] and those with the second lowest family income (4 to 6 million yen) [adjusted residuals = 2.6, p <.01]; moderate to heavy smokers with the lowest family income [adjusted residuals = 6.7, p <.01] and those with the second lowest family income [adjusted residuals = 4.7, p <.01]), and the most frequent alcohol use (light smokers with the most frequent alcohol consumption (more than 4 times a week) [adjusted residuals = 6.6, p <.01]; moderate to heavy smokers with the most frequent alcohol use [adjusted residuals = 2.7, p <.01]) were associated with increasing tobacco use. Psychological distress was higher in smokers than in non-smokers (Table 1). On the other hand, the highest alcohol consumption was reported by light smokers (Table 1). PIL was positively correlated with age, educational attainment, family annual income while negatively correlated with tobacco consumption and psychological distress (Table 2). Tobacco consumption was positively correlated with alcohol consumption and psychological distress while negatively correlated with age, educational attainment, marital status and family annual income (Table 2). Age, educational attainment and family annual income were positively correlated among each other. Marital status was positively correlated with educational attainment and family annual income. Psychological distress was positively correlated with age while negatively correlated with marital status and family annual income (Table 2).

[Insert Table 1 about here]

[Insert Table 2 about here]

The association between PIL and tobacco use

Table 3 shows the binominal odds ratios for tobacco use compared to no smoking. PIL was strongly inversely associated with tobacco use in the analysis without covariates (Model 1). The odds ratio was not attenuated after adjusting for socioeconomic variables (Model 2). This was also the case after adjusting for alcohol consumption (Model 3) and finally, for psychological distress (Model 4). With regard to the covariates in the fully adjusted model, educational attainment, marital status, and family annual income were inversely associated with tobacco use. There was a positive association between tobacco use and frequency of alcohol consumption. Psychological distress was not associated with tobacco use.

[Insert Table 3 about here]

The association between PIL and amount of tobacco consumption

Figure 1 shows the odds ratios for smoking consumption, produced by multinomial logistic regressions comparing light and moderate to heavy smoking against the no smoking reference category. Without any adjustment (Model 5), PIL was inversely associated with both light and

moderate to heavy smoking (light smoking: OR = 0.77, 95%CI: 0.67-0.89, $p < .001$; moderate to heavy smoking: OR = 0.62, 95%CI: 0.52-0.74, $p < .001$). The odds ratios remained significant after adjusting for socioeconomic covariates (Model 6: light smoking: OR = 0.86, 95%CI: 0.74-1.00, $p = 0.046$; moderate to heavy smoking: OR = 0.72, 95%CI: 0.59-0.87, $p < .001$) and further adjustment for alcohol consumption (Model 7: light smoking: OR = 0.86, 95%CI: 0.74-0.99, $p = 0.041$; moderate to heavy smoking: OR = 0.71, 95%CI: 0.59-0.87, $p < .001$). Adjusting further for psychological distress (Model 8), the association between PIL and light smoking was not significant (OR = 0.87, 95%CI: 0.74-1.02, $p = 0.079$). On the other hand, the odds ratio for moderate to heavy smoking was not attenuated after adjustment for any of the aforementioned variables (OR = 0.70, 95%CI: 0.57-0.86, $p < .001$; See Figure 1).

[Insert Figure 1 about here]

DISCUSSION

In a community-based sample of mothers in early-middle age, we found that PIL was inversely associated with tobacco use after controlling for age, education, marital status, family income, and alcohol use. Importantly, this was also the case even after taking psychological distress into account. PIL was also inversely associated with the risk of moderate to heavy tobacco

consumption even after controlling for covariates. This result is consistent with that of a previous study on a community sample in Hungary.[37] We confirmed the association between PIL and tobacco use with a large population-based sample of women in early midlife in Japan.

It is possible that individuals with higher PIL are likely to invest in healthy behaviours because they feel that their lives are meaningful, have a greater will to live and, therefore, are more proactive in taking care of their health[21] (e.g., by the avoidance of smoking). They may also be motivated to acquire knowledge regarding health maintenance (i.e., the knowledge about how detrimental smoking is). In contrast, since those low in PIL lack a high sense of life's meaningfulness, it may seem pointless for them to protect their health, and they may prefer short-term gratification, such as that obtained through tobacco use.

The association between PIL and tobacco use was robust even when controlling for psychological distress. It may suggest a relationship between a lack of eudaemonic well-being (PIL) and tobacco use, rather than a relationship between ill-being (psychological distress) and tobacco use. Mental well-being and mental illness are correlated but belong to separate continua, with well-being referring to the presence of positive feelings and positive functioning, rather than just the absence of mental illness.[55 56]

The present results suggest that increasing PIL may be a valuable target of intervention for reducing tobacco use, as well as for reducing substance abuse.[32] PIL is modifiable[57 58] and increasing awareness of one's values or long-term goals in life could increase the sense of PIL.[59 60] A systematic

review indicated positive psychological intervention (PPI) had an impact on improving psychological well-being,[61] as well as a meta-analysis showed behavioural intervention had a moderate effect on improving psychological well-being including PIL.[62] A new community-based group intervention to promote psychological well-being has been developed and had a positive effect of improving PIL.[63] Promotion focusing on increasing PIL might be effective in reducing tobacco use in public settings.

This study is limited of course, in its capacity to determine causality, since the data were cross-sectional. Longitudinal studies should be conducted in order to determine whether PIL has a role in tobacco use. We are currently conducting a subsequent longitudinal cohort study (Tokyo Teen Cohort Study), which will further clarify causality between PIL and tobacco use among mothers. The sample was limited only to mothers and we could not examine the association among early-middle aged women without children. Further studies including them would be needed. Additionally, given that parental smoking, especially maternal smoking, is the major determinant of passive smoking[6] and smoking initiation[7] in children, follow-up studies should examine the transgenerational effects of mothers' tobacco use on the initiation of smoking in their children. The relatively low response rate (43.8%) was also a limitation of the study. A recent study indicated that response rates of national cross-sectional surveys in Japan have declined in the recent decade (from around 70% to 50%).[64] One reason would be that many apartment buildings in Tokyo have recently adopted an automated system that enables residents talk with visitors at the locked gate through video. It allows potential

respondents to make a decision of refusing participation without having a face-to-face encounter with the field worker.[64] In future study, we should consider how to overcome this obstacle to achieve higher response rate in general population survey in Tokyo.

In summary, in a large community-based study, we found that high PIL is associated with lower consumption of tobacco among mothers, after controlling for a range of potential confounds, including psychological distress. Our hypothesis, that PIL is independently and inversely associated with tobacco use, was therefore confirmed. This study may contribute to our understanding of the psychology of smoking behaviour and shed light on the target for intervention to reduce tobacco use among early midlife mothers.

Contributors

YM, SY, SA, SKoike, AN, MHH and KK involved in launching and maintaining the survey. SF, SKanata and KE have mainly contributed to data collection. MN, SLH and MR mainly contributed to design the study and proposing the analysis and interpretation of data. YM and SY wrote the first draft of the manuscript and all the other authors have critically reviewed it. All authors approved the final version of the manuscript.

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Competing interests

None.

Ethics approval

This study was conducted by three research institutes: Tokyo Metropolitan Institute of Medical Science, The University of Tokyo, and SOKENDAI (The Graduate University for Advanced Studies). This study was approved by the ethics committees of these three institutes.

Data sharing statement

This study was planned and conducted in accordance with the ethics committee of Tokyo Metropolitan Institute of Medical Science. When applying to the research ethics committee for the data set, the authors did not request this to be released as public data. However, the data can be made available to all interested researchers upon request to Dr. Atsushi Nishida, Ph.D. (nishida-at@igakuken.or.jp).

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Table 1. Descriptive statistics for T-EAS variables broken down by tobacco use

	Non-smokers	Light smokers	Moderate to heavy smokers	*p*
N (%)	3739 (92.0)	204 (5.0)	120 (3.0)	
Purpose in Life, mean (standard deviation [SD])	57.3 (9.7)	54.8 (9.8)	52.6 (9.9)	<.001
Age, mean (SD)	42.0 (4.1)	41.2 (5.0)	40.5 (4.8)	<.001
Education, n (%)				
Junior high school or lower	22 (0.6)	12 (5.9)	9 (7.5)	<.001
High school	512 (13.7)	66 (32.4)	48 (40.0)	
Technical or junior college	1626 (43.5)	89 (43.6)	51 (42.5)	
4-year university or higher	1579 (42.2)	37 (18.1)	12 (10.0)	
Marital status, n (%)				
Yes	3613 (96.6)	182 (89.2)	97 (80.8)	<.001
No	126 (3.4)	22 (10.8)	23 (19.2)	
Family annual income, n (%)				
Less than 4 million yen	285 (7.6)	42 (20.6)	31 (25.8)	<.001
4–6 million yen	1022 (27.3)	74 (36.3)	57 (47.5)	
7–9 million yen	1162 (31.1)	55 (27.0)	21 (17.5)	
More than 10 million yen	1270 (34.0)	33 (16.2)	11 (9.2)	
Alcohol use, n (%)				
Non	1160 (31.0)	44 (21.6)	43 (35.8)	<.001
Less than once a month	563 (15.1)	35 (17.2)	9 (7.5)	
2–4 times a month	689 (18.4)	24 (11.8)	15 (12.5)	
2–3 times a week	594 (15.9)	21 (10.3)	16 (13.3)	
More than 4 times a week	733 (19.6)	80 (39.2)	37 (30.8)	
K6 (Psychological Distress), mean (SD)	2.9 (3.3)	3.4 (3.4)	3.5 (3.9)	.026

Table 2. Correlation coefficients among all variables.

		1	2	3	4	5	6	7	8
1	PIL	-	**-0.092*****	**0.034***	**0.147*****	0.006	**0.138*****	0.013	**-0.342*****[a]
2	Tobacco consumption		-	**-0.067*****	**-0.203*****	**-0.144*****	**-0.172*****	**0.065*****	**0.038***
3	Age			-	**0.048****	0.030	**0.143*****	0.020	**0.055*****
4	Education				-	**0.076*****	**0.323*****	-0.019	-0.023
5	Marital status					-	**0.257*****	-0.003	**-0.054*****
6	Family annual income						-	0.021	**-0.048****
7	Alcohol use							-	-0.006
8	Psychological distress (K6)								-

Spearman's rank correlation coefficients except a correlation between continuous variables (PIL and K6; a: pearson correlation coefficient)

*** p <.001, ** p <.01, * p <.05

Table 3. Logistic regression coefficients for odds of tobacco use, with and without potential confounding variables

	Model 1		Model 2		Model 3		Model 4	
	OR [95% CI]	*p*	OR [95% CI]	*p*	OR [95% CI]	*p*	OR [95% CI]	*p*
Purpose in Life	0.71 [0.63-0.80]	<.001	0.81 [0.71-0.91]	.001	0.80 [0.71-0.91]	<.001	0.80 [0.70-0.91]	.001
Age			0.98 [0.95-1.00]	.061	0.97 [0.95-1.00]	.043	0.97 [0.95-1.00]	.044
Education			0.44 [0.38-0.52]	<.001	0.45 [0.38-0.52]	<.001	0.45 [0.38-0.52]	<.001
Marital Status			0.41 [0.27-0.62]	<.001	0.41 [0.27-0.63]	<.001	0.41 [0.27-0.63]	<.001
Family Income			0.71 [0.62-0.82]	<.001	0.71 [0.62-0.81]	<.001	0.71 [0.62-0.81]	<.001
Alcohol Use					1.18 [1.10-1.28]	<.001	1.18 [1.10-1.28]	<.001
Psychological Distress							1.00 [0.96-1.04]	.974

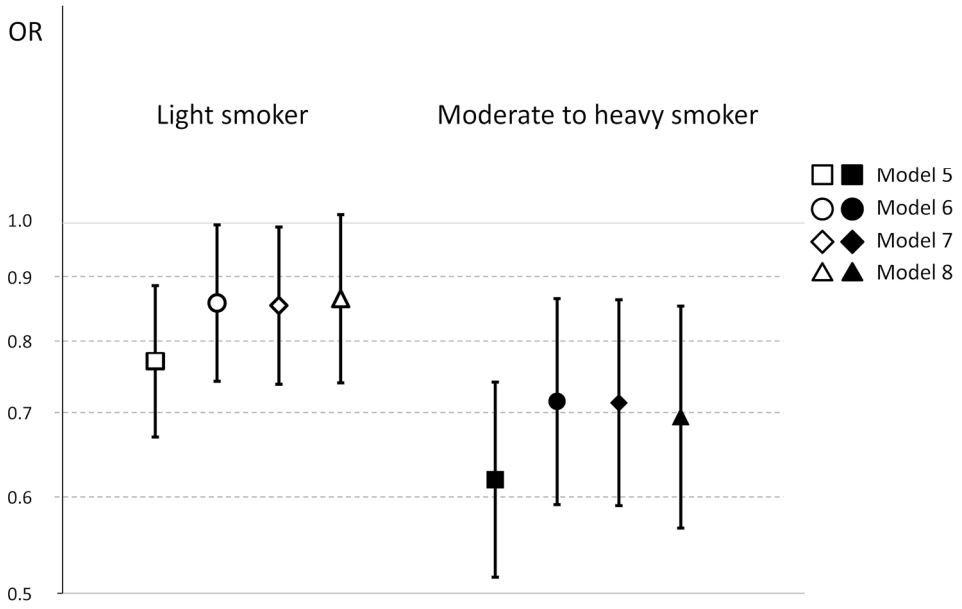
529 OR: odds ratio, CI: confidence interval

Figure Captions

Figure 1

Figure 1. Odds ratios for purpose in life from multinomial logistic regression analysis predicting smoking consumption (reference: non-smoker) with and without potential confounding variables.

Model 5: without any adjustment; Model 6: adjusting for socioeconomic covariates (educational attainment and family income); Model 7: adjusting for socioeconomic covariates and alcohol consumption; Model 8: adjusting for socioeconomic covariates, alcohol consumption and psychological distress. OR: Odds ratio.



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99x64mm (600 x 600 DPI)

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	Page No.
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1,3
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3-4
Introduction			
Background/ rationale	2	Explain the scientific background and rationale for the investigation being reported	6-8
Objectives	3	State specific objectives, including any prespecified hypotheses	6-8
Methods			
Study design	4	Present key elements of study design early in the paper	8-9
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	8-9
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	8-9
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	-
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	9-11
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	9-11
Bias	9	Describe any efforts to address potential sources of bias	8-9
Study size	10	Explain how the study size was arrived at	9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	9-12
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	11-12
		(*b*) Describe any methods used to examine subgroups and interactions	-
		(*c*) Explain how missing data were addressed	9
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	-
		(*e*) Describe any sensitivity analyses	-

Continued on next page

Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	12-13 Table1
		(b) Give reasons for non-participation at each stage	-
		(c) Consider use of a flow diagram	-
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	12-13 Table 1
		(b) Indicate number of participants with missing data for each variable of interest	-
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	-
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	-
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	-
		Cross-sectional study—Report numbers of outcome events or summary measures	12-13 Table 1
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	13-14 Table 2 Figure 1
		(*b*) Report category boundaries when continuous variables were categorized	12-13 Table 1
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-
Discussion			
Key results	18	Summarise key results with reference to study objectives	15
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	16
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	15-17
Generalisability	21	Discuss the generalisability (external validity) of the study results	16-17
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	17-18

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.