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Reason for smoking cessation attempts among Japanese male smokers varies according to nicotine dependence level: cross-sectional study

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Keywords: smoking cessation, nicotine dependence, motivator, tobacco tax increase, Fagerström Test for Nicotine Dependence, male worker

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Abstract

Objectives: To examine the association between the smoking cessation attempts during the previous 12 months, motivator to quit smoking, and nicotine dependence level.

Design: Cross-sectional study.

Setting: A self-reported questionnaire about smoking habits, nicotine dependence level, and factors that people identify as motivators to quit smoking was administered to 9,378 (as of October 1, 2011) employees working at a company located in Fukuoka Prefecture in Japan.

Participants: A total of 2,264 male current smokers 20–69 years.

Primary and secondary outcome measures: Nicotine dependence level assessed by Fagerström Test for Nicotine Dependence (FTND), attempts to quit smoking during the previous 12 months, and motivators for smoking cessation.

Results: Nicotine dependence level of current smokers was negatively associated with attempts to quit smoking during the previous 12 months. Motivators for smoking cessation differed according to nicotine dependence levels. 'The rise in cigarette prices since October 2010' as a motivator for smoking cessation increased significantly in medium nicotine dependence level (odds ratio (OR):1.44, 95% confidence interval

(CI) :1.09–1.90); however, this association was not statistically significant for individuals with high nicotine dependence (OR:1.24, 95% CI:0.80–1.92). 'Feeling unhealthy' was negatively and statistically significantly associated for both medium (OR:0.42, 95% CI:0.27–0.65) and high (OR:0.31, 95% CI:0.14–0.71) nicotine dependence levels. Trend associations assessed by assigning ordinal numbers a total score of FTND for those two motivators were statistically significant.

Conclusions: For smokers with high and medium nicotine dependence level, more effective strategies aimed at encouraging smoking cessation are needed, such as policy interventions, which could include increasing tobacco taxes or stricter regulation of tobacco products.

Strengths and limitations

This study provides information on the relation between smoking cessation attempts, motivators for quitting smoking, and nicotine dependence level. However, no follow-up measures were taken to determine whether the study's respondents actually succeeded in their smoking cessation attempts.

INTRODUCTION

Smoking is the leading avoidable cause of death worldwide. Many countries take action to reduce smoking-related deaths by educating people about the harmful effects of tobacco;[1] youth tobacco control, which is inclusive of passive smoking control;[2] disseminating information on tobacco cessation programs; and increasing tobacco taxes[3] and prices.[4] These policies and programs appear to be effective—overall, the smoking rate is decreasing in both developed and developing countries.[5,6]

In the past two decades, Japan's tobacco tax has increased four times: in December 1998, July 2003, July 2006, and October 2010. The 1998, 2003, and 2006 increases were relatively low—the price of an ordinary 20-cigarette pack increased by about 20–30 JPY (about 0.2–0.3 USD) each time. Given the low taxes, in 2008, tobacco was still relatively inexpensive (priced at around 300 JPY [2–3 USD] per pack). Thus, smoking prevalence among men remained high in comparison to other Organisation for Economic Co-operation and Development (OECD) countries.[7]

However, in October 2010, the price of an ordinary 20-cigarette pack increased by 120 JPY (1.2 USD), roughly four times the increase of the previous three tax hikes (or an estimated 40% increase in retail price). According to the National

Health and Nutrition Survey in Japan,[8] the prevalence of regular smoking among men was 38.2%, 32.2% and 32.4% in 2009, 2010 and 2011, respectively, while that among women was 10.9%, 8.4%, and 9.7%, respectively. Thus, it appears that these increases in tobacco taxes may have contributed towards lower tobacco consumption in Japan, just as was reported in Western European countries.[4,9] This may be in part attributable to the tax's dissuasion of many young people from smoking.[5] However, the precise effect of this tax raise on people's intentions to quit smoking in Japan remains unknown.

People quit smoking for numerous reasons other than the increase in cigarette prices, such as health problems associated with smoking and anti-smoking social pressures.[10,11] Nevertheless, in order to implement effective strategies aimed at encouraging smoking cessation among smokers in Japan, it is important to determine the varying roles of factors leading to smoking cessation, including the intention to quit smoking, motivating factors for such intentions, the manner in which nicotine dependence levels affect these intentions, and motivating factors for such intentions. Currently, there is limited availability of information on this topic from current smokers who intend to stop smoking. A Japanese national survey carried out in 1999 reported that personal health concerns and complications were major motivations for

quitting smoking; however, this survey did not give details on the type of personal health complications/concerns smokers had.[12] Another survey[11] reported on the factors related to smoking cessation in former smokers in rural areas of Japan; however, this study did not include current smokers attempting to quit, a population for which there is little data available.[13] Additionally, these studies[11,13,14] were conducted before the substantial tobacco tax hike of October 2010, the effect of which has not yet been evaluated. Although high nicotine dependence has been shown to be a strong predictor of failure to quit smoking,[15] the relationship between dependence levels and factors that people identify as motivators to quit smoking in Japan needs clarification. The present study, therefore, focused on the relationship between nicotine dependence level and factors that people identify as motivators to quit smoking among current smokers following the tobacco tax increase of October 2010.

METHODS AND PROCEDURES

Study population

A self-reported questionnaire assessing smoking habits, nicotine dependence level, and factors that people identify as motivators to quit smoking was administered to 9,378 (as of October 1, 2011) employees working at a company located in Fukuoka

Prefecture, Japan. Ethical approval for this study was obtained from the Institutional Review Committee of Fukuoka University.

Data collection and measurements

The questionnaire began with questions regarding respondents' age, sex, and smoking habits. Individuals who had never smoked were not required to complete the rest of the questionnaire. Former smokers were asked to answer the following additional questions: (1) the brand of cigarettes that they used to smoke, (2) the age at which they ceased smoking (years), (3) their motivators for quitting smoking, and (4) any pharmacological therapy that they used to alleviate nicotine withdrawal. In this study, the definition of former smoker is any person who had once smoked but currently does not. Current smokers were asked to: (1) specify the brand of cigarettes that they usually smoked, (2) complete the Fagerström Test for Nicotine Dependence (FTND), (3) indicate their intention to quit smoking in the previous 12 months, (4) specify their motivation for quitting smoking, and (5) indicate whether they were taking any form of medication for alleviating nicotine withdrawal symptoms in people attempting to quit.

The FTND,[16] a standard questionnaire for assessing physical dependence on nicotine, consists of the following six items: (1) *How soon after you wake up do you*

smoke your first cigarette? ('after 60 minutes', '31–60 minutes', '6–30 minutes', 'within 5 minutes'); (2) *Do you find it difficult to refrain from smoking in places where it is forbidden, e.g., in church, at the library, cinema, etc.?* ('No/Yes'); (3) *Which cigarette would you hate most to give up?* ('the first one in the morning', 'all others'); (4) *How many cigarettes per day do you smoke?* ('10 or less', '11–20', '21–30', '31 or more'); (5) *Do you smoke more frequently during the first hours of waking than during the rest of the day?* ('No/Yes'); and (6) *Do you smoke if you are so ill that you are in bed most of the day?* ('No/Yes'). In scoring the FTND, the four dichotomous items are scored as 0 or 1, while the two multiple-choice items are scored from 0 to 3. The items are then summed to yield a total score of 0–10. The higher the score, the more dependent the person is on nicotine.

We assessed whether the following nine items were respondents' motivators for quitting smoking, to which they could answer 'yes' or 'no': (1) health problems experienced by relatives or friends, (2) personal health problems, (3) recommendation by physicians, (4) feeling unhealthy, (5) in the interests of better health, (6) their preferred brand of cigarettes was no longer available for sale, (7) the rise in cigarette prices after October 2010, (8) having a child (or grandchild), and (9) any other motivators.

Statistical analysis

Of the 9,378 candidates, 7,899 (84.2%), returned the questionnaire. Of the 7,899 participants, we excluded 302 with missing data for sex, age, or smoking habits, 76 aged < 19 because smoking is illegal among individuals under 20 years old in Japan, and 19 individuals aged 70 or older because of the small number. We excluded 2830 females because of the low proportion of current smokers (320, 11.3%). Thus, 4,672 men aged 20–69 years old were selected for analysis.

Of the 4,672 men aged 20–69 years old that we surveyed, 1,116 individuals who had never smoked and 1,268 former smokers were excluded from the analysis, as FTND scores were available for current smokers only. Finally, we excluded 33 current smokers with missing data for any of FTND components. Thus, the data of 2,251 current smokers were analysed in this study.

Responses to the questionnaire were stratified according to respondents' nicotine dependence levels, as defined by the FTND: low (FTND score ≤ 3), middle (4–6), and high (≥ 7).

First, the proportion of respondents who reported that they had attempted to quit smoking in the last year were expressed as percentages across nicotine dependence levels. Next, the proportion of the motivators for quitting smoking assessed by the nine

items among the respondents who reported that they had attempted to quit smoking in the last year were expressed as percentages across nicotine dependence levels. Third, we selected three motivators for quitting smoking according to the number of respondents and examined the relation between nicotine dependence levels and each motivator for quitting smoking. A chi-square test was used to compare the proportion of respondents according to the three nicotine dependence levels. Multiple logistic regression analysis was used to estimate the odds ratios (OR) with 95% confidence intervals (CI) for the presence of each motivator to quit smoking in the previous 12 months, with low nicotine dependence subjects as the reference. We adjusted for age (10-year categories, 20- to 29-year-old group as the reference) in the model. Trend associations were assessed by assigning ordinal numbers a total FTND score (0–10). A two-tailed *p*-value of less than 5% was considered statistically significant. All analyses were performed using SPSS version 19 (International Business Machines Corporation, Armonk, NY, USA).

RESULTS

Of the 2,251 current smokers included in our analyses, 913 (40.6%), 1,005 (44.6%), and 333 (14.8%) had low, middle, and high FTND scores, respectively; 914

(40.6%) reported that they had attempted to quit smoking in the last year (Table 1). The 20–29 age group had the lowest proportion of respondents with high nicotine dependence (7.7%), while the 50–59 age group had the highest (22.2%). In general, the older groups had more respondents with high nicotine dependence. The 50–59 age group had the lowest proportion (18.0%) of respondents with low nicotine dependence, while the 20–29 age group had the highest (30.6%). Overall, the groups with older respondents had the lowest proportions of those with low nicotine dependence.

The proportion of current smokers who had attempted to quit smoking within the previous 12 months among the low, middle, and high nicotine dependence groups was 48.0%, 37.1%, and 30.9%, respectively, a statistically significant difference. For each age group, the proportion of current smokers who had attempted to quit smoking within the previous 12 months was highest in the low nicotine dependence group. This proportion was lowest in the high nicotine dependence group. This trend was observed across all age groups. For the 30–39, 50–59, and 60–69 age groups, there were significant inverse relations between the proportion of current smokers who had attempted to quit smoking within the previous 12 months and nicotine dependence level. Among the middle and high nicotine dependence groups, the highest proportion of current smokers who had attempted to quit smoking within the previous 12 months

was observed in the 20–29 age group (42.5% and 35.3%, respectively). Furthermore, in the group with low nicotine dependence, the highest proportion of current smokers who had attempted to quit smoking within the previous 12 months was observed in the 60–69 age group (55.0%).

[INSERT TABLE 1 ABOUT HERE]

Table 2 shows the relationship between motivators and smoking cessation attempts within the previous 12 months according to respondents' nicotine dependence levels. About half of current smokers who had attempted smoking cessation reported that their motivations for doing so were 'for better health' and 'the rise in cigarette prices since October 2010', regardless of their nicotine dependence level. Only 10% of current smokers who had attempted smoking cessation reported that their reasons were for 'personal health problems', 'recommendation by physicians', and 'feeling unhealthy', regardless of their nicotine dependence level. In the high nicotine dependence group, a higher proportion of current smokers who had attempted smoking cessation within the previous 12 months reported the 'health problems of relatives or friends' and 'personal health problems' as two of their primary motivations for quitting smoking. However, the proportion of respondents who cited 'feeling unhealthy' and 'for better health' was highest in the group with low nicotine dependence. Furthermore,

in the group with low nicotine dependence, 'the rise in cigarette prices since October 2010' was the least reported reason, while 'for better health' was the most reported. No respondent in the group with high nicotine dependence reported 'having a child (or grandchild)' as their motivation for quitting smoking.

[INSERT TABLE 2 ABOUT HERE]

Age-adjusted logistic regression analysis indicating the associations between selected three motivators for quitting smoking and nicotine dependence levels is shown in Table 3. 'Feeling unhealthy' was negatively associated with increases in nicotine dependence levels; the odds ratio (OR) was statistically significant for both medium (OR = 0.42, 95% CI = [0.27–0.65]) and high (OR = 0.31, 95% CI = [0.14–0.71]) nicotine dependence levels. 'For better health' was also negatively associated with increases in medium nicotine dependence levels (OR = 0.71, 95% CI = [0.54–0.94]); however, this association was not statistically significant for individuals with high nicotine dependence (OR = 0.88, 95% CI = [0.57–1.36]). 'The rise in cigarette prices since October 2010' was significantly positively associated with an increase in medium nicotine dependence level (OR = 1.44, 95% CI = [1.09–1.90]); however, this association was not statistically significant for individuals with high nicotine dependence (OR = 1.24, 95% CI = [0.80–1.92]). Furthermore, trend associations

assessed by assigning ordinal numbers a total score of FTND (0–10) for all three motivators were statistically significant.

[INSERT TABLE 3 ABOUT HERE]

DISCUSSION

This study investigated the relations between nicotine dependence level, intention to quit smoking within the previous 12 months, and various motivators for quitting smoking among male workers in Japan. Three major findings emerged. First, nicotine dependence levels were negatively associated with smoking cessation attempts in the previous 12 months. Second, respondents' motivators for quitting smoking differed according to their nicotine dependence levels. Third, the proportion of smokers who reported 'the rise in cigarette prices since October 2010' as their motivator for quitting smoking increased with nicotine dependence level.

A national survey in Japan in 1999 showed that 64.7% of current smokers and 41.0% of former smokers acknowledged concerns or problems related to personal health as motivating factors for stopping smoking, respectively.[12] Furthermore, these motivators were ranked as the first and second leading factors for current and former smokers, respectively. Previous studies[10,17] have also identified personal health

concerns, including mild-to-serious personal health problems, and a fear of future illness in the absence of immediate health concerns as predominant motivators for smoking cessation. The present study revealed the relationship between smokers' nicotine dependence levels and motivators for quitting smoking.

In Japan, smoking is still not as restricted in public spaces as it is in other countries.[18] In addition, the price of tobacco remains lower than in most developed Western countries.[7] However, in 2003, the Japanese national government enacted the Health Promotion Law, which requires managers of public facilities to make an effort to protect non-smokers from the environmental effects of tobacco smoke. Since then, greater restrictions have been placed on smoking in public spaces. In addition, the national government increased the tobacco tax in October 2010. The results of our study suggest that the individuals with medium and high nicotine dependence change their smoking cessation attempts according to the tobacco price. The present findings imply that further legislative changes aimed at increasing the cost of cigarettes could be effective in helping people quit smoking.

This study has two major strengths. First, it was conducted after the massive tobacco tax increase in October 2010, the effects of which had not been evaluated in previous studies.[11,13,14] The approximately 40% price increase constituted the highest in

Japan within the last two decades. The prevalence of regular smoking among both men and women decreased significantly after the price increase. [8] A one-year follow-up survey conducted in 2005 in Japan[13] showed that 23.0% of smokers at the time reported that they had attempted to quit smoking at least once in the previous year. In a US study,[19] 29% of respondents reported that the 2009 federal tobacco tax increase helped initiate their attempts to quit smoking. In this study, 40% of current smokers reported that they had attempted to quit smoking in the previous 12 months. It can be estimated that the increase in tobacco tax changed smoking cessation attitudes among the Japanese male workers included in the current study sample. Smoking cessation intentions may have been affected by the extent of the tax increase and the resulting rise in cigarette retail prices.[3,4,6,9] Further examination of the influence of tobacco tax increases on smoking cessation in Japan is required.

Second, this study revealed that the reasons for smoking cessation attempts vary according to nicotine dependence level. High nicotine dependence strongly predicted failure to quit smoking[15] or the cost-effectiveness of smoking cessation programs.[20] As an employee who feels ready and capable of changing his behaviour has needs and preferences that significantly differ from one who is not at that stage,[21] workplace smoking cessation interventions that employ only one method[22] do not

generally have positive effects on the smoking cessation attempts of all employees. According to the current results, which showed that nicotine dependence is related to reasons for smoking cessation attempts, the efficacy of any smoking cessation intervention can be improved by considering the target group's level of nicotine dependence.

Three major limitations were identified in this study. First, as this was a cross-sectional study, no follow-up measures were taken to determine whether respondents actually succeeded in their smoking cessation attempts. However, because this study was conducted after the tobacco tax increase in 2010, temporal relationships between the motivators and smoking cessation attempts do not affect the interpretation of the results of this study.

In the US, longitudinal studies have been conducted on the effects of a 10% increase in the retail price of a pack of cigarettes (following the 2009 federal tobacco tax increase);[19] however, in Japan, prior investigations of the relationship between retail prices of cigarettes and motivations for smoking cessation among current smokers in Japan were conducted before the tobacco tax increase of 2010.[11,13,14] Thus, the effects of a one-off 40% increase in retail prices of cigarettes in Japan are still not sufficiently clear. Further, the association between the number of cigarettes smoked per

day and smoking cessation has previously been elucidated;[13,14,19,20] nevertheless, evaluations of the link between reasons behind smoking cessation and precise nicotine dependence are limited.[4] Although temporal relationships between the tobacco tax increase and smoking cessation attempts must be carefully evaluated, the method employed for measuring nicotine dependence in this study was widely recognized. A longitudinal evaluation that considers the amount of tax increase, nicotine dependence, and smoking cessation intentions must be undertaken.

The second limitation is that the study sample consisted of only male Japanese workers at a specific company. Therefore, the data analysed were not necessarily representative of the total population. However, we can perhaps assume that the current results have broader applicability to the development and design of workplace smoking cessation interventions, as all respondents in this study were employed on a full-time basis.

Third, socio-economic status was not analysed in this study. It has previously been reported that socioeconomic status, especially income, is related to attitudes towards smoking cessation.[19,23] However, the influence of wage differences on smoking cessation attempts could be disregarded in this study because an age-adjusted analysis (multiple logistic regression) was performed. Income levels are strongly

related to respondents' age because of Japan's traditional seniority-based wage system, which had been adopted in the participating company. It has previously been demonstrated that lower education levels, income levels, and cigarette consumption are associated with perceptions that the tobacco tax increase is helpful in aiding smoking cessation.[19]

In conclusion, effective smoking cessation strategies among smokers with high nicotine dependence levels are perhaps those involving stricter smoking regulation policies, such as yet another increase in tobacco tax or stricter regulation of tobacco products.

Contributors: ST conceived and coordinated the study, participated in its design, collected and interpreted the data, conducted data analysis, and drafted the manuscript. YM participated in the study design and data collection, interpreted the data, and helped to draft the manuscript. All the authors approved the final version of the paper.

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Competing interests: All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare no competing interests.

Ethical approval: The research protocol was approved by the Institutional Review Committee of Fukuoka University.

Data sharing: No additional data are available.

Transparency: ST affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned have been explained.

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Table 1. Proportion of smokers who attempted to quit smoking in the previous 12 months by age and nicotine dependence level

			Nicotine dependence level*												
			Low[1]			Medium[2]			High[3]			Total			
		n(%)	913(40.6)			1005(44.6)			333(14.8)			2251(100)			
	Attempted to quit smoking		Yes	No	Total	Yes	No	Total	Yes	No	Total	Yes	No	Total	P value
Age	20–29	N	104	108	212	88	119	207	12	22	34	204	249	453	0.200
		(%)	(49.1)	(50.9)	(100)	(42.5)	(57.5)	(100)	(35.3)	(64.7)	(100)	(45.0)	(55.0)	(100)	
	30–39	N	125	125	250	91	160	251	19	44	63	235	329	564	0.001
		(%)	(50.0)	(50.0)	(100)	(36.3)	(63.7)	(100)	(30.2)	(69.8)	(100)	(41.7)	(58.3)	(100)	
	40–49	N	86	137	223	90	169	259	27	69	96	203	375	578	0.198
		(%)	(38.6)	(61.4)	(100)	(34.7)	(65.3)	(100)	(28.1)	(71.9)	(100)	(35.1)	(64.9)	(100)	
	50–59	N	101	87	188	95	159	254	39	81	120	235	327	562	<0.001
		(%)	(53.7)	(46.3)	(100)	(37.4)	(62.6)	(100)	(32.5)	(67.5)	(100)	(41.8)	(58.2)	(100)	
	60–69	N	22	18	40	9	25	34	6	14	20	37	57	94	0.027
		(%)	(55.0)	(45.0)	(100)	(26.5)	(73.5)	(100)	(30.0)	(70.0)	(100)	(39.4)	(60.6)	(100)	
	Total	n	438	475	913	373	632	1005	103	230	333	914	1337	2251	<0.001
		(%)	(48.0)	(52.0)	(100)	(37.1)	(62.9)	(100)	(30.9)	(69.1)	(100)	(40.6)	(59.4)	(100)	

*: Nicotine dependence levels were classified according to results on the Fagerström Test for Nicotine Dependence (FTND).

1: FTND score = 0–3; 2: FTND score = 4–6; 3: FTND score = 7–10.

Table 2. The proportion of respondents that replied the motivator is related to the smoking cessation challenge in the previous 12 months

	Nicotine dependence level*									
	Low[1] n = 438		Medium[2] n = 373		High[3] n = 103		Total n = 914		*P* for trend (crude)	*P* for trend (age adjusted)
Motivators to smoking cessation	n	(%)	n	(%)	n	(%)	n	(%)		
Health problems of relatives or friends	24	(5.5)	21	(5.6)	8	(7.8)	53	(5.8)	0.489	0.469
Personal health problems	35	(8.0)	33	(8.8)	12	(11.7)	80	(8.8)	0.372	0.805
Recommended by physicians	39	(8.9)	33	(8.8)	12	(11.7)	84	(9.2)	0.407	0.950
Feeling unhealthy	82	(18.7)	33	(8.8)	7	(6.8)	122	(13.3)	<0.001	<0.001
For better health	244	(55.7)	176	(47.2)	55	(53.4)	475	(52.0)	0.028	0.018
Stopped selling my brand of cigarettes	7	(1.6)	9	(2.4)	1	(1.0)	17	(1.9)	0.999	0.965
Rise in cigarette prices since October 2010	207	(47.3)	209	(56.0)	51	(49.5)	467	(51.1)	0.092	0.023
Having a child (or grandchild)	24	(5.5)	26	(7.0)	0	(0.0)	50	(5.5)	0.088	0.243
Any other motivations	33	(7.5)	33	(8.8)	5	(5.8)	71	(7.9)	0.963	0.929

*: Nicotine dependence levels were classified according to the Fagerström Test for Nicotine Dependence (FTND).

1: FTND score = 0–3; 2: FTND score = 4–6; 3: FTND score = 7–10.

Age (by ten-year age groups) was adjusted by multiple logistic regression analysis.

Table 3. Nicotine dependence level and age distribution for the top three motivators that related to the smoking cessation challenge in the previous 12 months among current smokers

Motivators to quit			Feeling unhealthy			For better health			The rise in cigarette prices since October 2010		
Nicotine dependence level*			Low[1]	Medium[2]	High[3]	Low[1]	Medium[2]	High[3]	Low[1]	Medium[2]	High[3]
Age	20–29	N	18	7	1	57	37	5	56	58	6
		(%)	(17.3)	(8.0)	(8.3)	(54.8)	(42.0)	(41.7)	(53.8)	(65.9)	(50.0)
	30–39	N	22	9	2	64	47	11	63	52	10
		(%)	(17.6)	(9.9)	(10.5)	(51.2)	(51.6)	(57.9)	(50.4)	(57.1)	(52.6)
	40–49	N	16	10	1	49	38	16	43	55	16
		(%)	(18.6)	(11.1)	(3.7)	(57.0)	(42.2)	(59.3)	(50.0)	(61.1)	(59.3)
	50–59	N	23	7	3	63	48	23	41	41	16
		(%)	(22.8)	(7.4)	(7.7)	(62.4)	(50.5)	(59.0)	(40.6)	(43.2)	(41.0)
	60–69	N	3	0	0	11	6	0	4	3	3
		(%)	(13.6)	(0.0)	(0.0)	(50.0)	(66.7)	(0.0)	(18.2)	(33.3)	(50.0)
	Total	n	82	33	7	244	176	55	207	209	51
		(%)	(18.7)	(8.8)	(6.8)	(55.7)	(47.2)	(53.4)	(47.3)	(56.0)	(49.5)
	Odds ratio		(reference)	0.42	0.31	(reference)	0.71	0.88	(reference)	1.44	1.24
	95%CI			0.27-0.65	0.14-0.71		0.54-0.94	0.57-1.36		1.09-1.90	0.80-1.92
	P for trend			<0.001			0.018			0.023	

*: Nicotine dependence levels were classified according to the Fagerström Test for Nicotine Dependence (FTND).

1: FTND score = 0–3; 2: FTND score = 4–6; 3: FTND score = 7–10.

Odds ratio and p for trend was calculated by age-adjusted multiple logistic analysis model.

95%CI: 95% confidence interval

STROBE Statement—checklist of items that should be included in reports of observational studies
Title: Reason for smoking cessation attempts among Japanese male smokers varies according to nicotine dependence level: cross-sectional study

	Item No	Recommendation	Location in manuscript
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	Line 1 on page 1 and line 26 on page 2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	What was done: line 27-34 on page 2 What was found: line 35-44 on page 2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Scientific background: line 59-83 on page 6 and 7 Rationale: Line 84-102 on page 6 and 7
Objectives	3	State specific objectives, including any prespecified hypotheses	Line 102-105 on page 7
Methods			
Study design	4	Present key elements of study design early in the paper	Line 109-112 on page 7-8
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Line 109-112 on page 7-8
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	Line 109-112 on page7-8
		(*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	N/A
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Outcomes: Line122-127 on page 8 Exposures: Line 128-140 on page 8-9 Potential confounders: Line 115-116 on page 8
Data sources/ measurement	8*	For each variable of interest, give	Line 115-147 on page 8-9

		sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	
Bias	9	Describe any efforts to address potential sources of bias	Exclusion: line 149-159 on page 10 Adjustment: line 171-177 on page 11
Study size	10	Explain how the study size was arrived at	Not provided
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Adjustment: line 171-175 on page 11
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	Line 148-179 on page 10-11
		(*b*) Describe any methods used to examine subgroups and interactions	Line 167-170 on page 11
		(*c*) Explain how missing data were addressed	We excluded participants who had missing data (line 149-159 on page 10).
		(*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	N/A
		(*e*) Describe any sensitivity analyses	N/A
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	Line 149-159 on page 10
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1 Line 182-205 on page 11-12
		(b) Indicate number of participants with missing data for each variable of interest	N/A
		(c) *Cohort study*—Summarise follow-	N/A

		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	Table 1 Line 183-184 on page 11-12
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	Table2, Table 3 Line 207-239 on page 13-15
		(*b*) Report category boundaries when continuous variables were categorized	Table 1, Table 2, Table 3
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Table 3 Line 225-239 on page 14-15
Discussion			
Key results	18	Summarise key results with reference to study objectives	Line 243-259 on page 14-15
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	Line 297-332 on page 18-20
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Line 260-270 on page 16
Generalisability	21	Discuss the generalisability (external validity) of the study results	Line 317-322 on page 20
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	This study was funded by a Grant-in-Aid from the Ministry of Health, Labour and Welfare of Japan (Comprehensive Research on Cardiovascular and Life-style Related Disease: H22-Junkankitou [Seisyuu]-Ippan-012).

*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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Reasons for smoking cessation attempts among Japanese male smokers vary by nicotine dependence level: cross-sectional study after the 2010 tobacco tax increase

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Reasons for smoking cessation attempts among Japanese male smokers vary by nicotine dependence level: cross-sectional study after the 2010 tobacco tax increase

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Word count: 3244

Abstract

Objectives: To examine the association between smoking cessation attempts during the previous 12 months, motivators to quit smoking, and nicotine dependence levels among current male smoker after Japan's massive 2010 tobacco tax increase.

Design: Cross-sectional study.

Setting: A self-reported questionnaire about smoking habits, nicotine dependence levels, and factors identified as motivators to quit smoking was administered to 9,378 employees working at a company located in Fukuoka Prefecture in Japan (as of October 1, 2011).

Participants: A total of 2,251 male current smokers 20–69 years old.

Primary and secondary outcome measures: Nicotine dependence level assessed by Fagerström Test for Cigarette Dependence (FTCD), smoking cessation attempts during the previous 12 months, and motivators for smoking cessation.

Results: The proportion of current smokers who had attempted to quit smoking within the previous 12 months was 40.6%. Nicotine dependence level of current smokers was negatively associated with cessation attempts during the previous 12 months. Motivators for smoking cessation differed by nicotine dependence levels. 'The rise in cigarette prices since October 2010' as a smoking cessation motivator increased

significantly at the medium nicotine dependence level (odds ratio (OR): 1.44, 95% confidence interval (CI): 1.09–1.90); however, this association was not statistically significant for individuals with high nicotine dependence (OR: 1.24, 95% CI: 0.80–1.92). 'Feeling unhealthy' was significantly negatively associated for both medium (OR: 0.42, 95% CI: 0.27–0.65) and high (OR: 0.31, 95% CI: 0.14–0.71) nicotine dependence levels. Trend associations assessed by assigning ordinal numbers to total FTCD score for those two motivators were statistically significant.

Conclusions: The efficacy of smoking cessation strategies can be improved by considering the target group's nicotine dependence level. For smokers with medium and high nicotine dependence levels, more effective strategies aimed at encouraging smoking cessation are needed, such as policy interventions including increasing tobacco taxes.

Strengths and limitations

This study provides information on the relationship between smoking cessation attempts, motivators for quitting smoking, and nicotine dependence levels for current smokers after Japan's massive 2010 tobacco tax hike. However, the impact of the tax increase on the cessation attempts was not fully investigated because current smokers before the tax increase were not included in the study. No follow-up measures were taken to determine whether the study's respondents actually succeeded in their smoking cessation attempts.

INTRODUCTION

Smoking is the leading avoidable cause of death worldwide. Many countries take action to reduce smoking-related deaths by educating people about tobacco's harmful effects;[1] youth tobacco control, including passive smoking control;[2] disseminating information on tobacco cessation programs; and increasing tobacco taxes[3] and prices.[4] These policies and programmes appear to be effective—overall, the smoking rate is decreasing in both developed and developing countries.[5,6]

In the past two decades, Japan's tobacco tax has increased four times: in December 1998, July 2003, July 2006, and October 2010. The first three increases were relatively low—the price of an ordinary 20-cigarette pack increased by about 20–30 JPY (about 0.2–0.3 USD) each time. Given the low taxes in 2008, tobacco was still relatively inexpensive (priced at around 300 JPY [2–3 USD] per pack). Thus, smoking prevalence among men remained high in comparison to other Organisation for Economic Co-operation and Development (OECD) countries.[7]

However, in October 2010, the price of an ordinary 20-cigarette pack increased by 120 JPY (1.2 USD), roughly four times the increase of the previous three tax hikes (or an estimated 40% increase in retail price). According to the National Health and Nutrition Survey in Japan,[8] the prevalence of regular smoking among men

was 38.2%, 32.2% and 32.4% in 2009, 2010 and 2011, respectively, while that among women was 10.9%, 8.4%, and 9.7%, respectively. Thus, these increases in tobacco taxes may have contributed to lower tobacco consumption in Japan, just as was reported in Western European countries.[4,9] This may be in part attributable to the tax's dissuasion of young people from smoking.[5] However, the precise effect of this tax increase on people's smoking cessation attempts in Japan remains unknown.

People quit smoking for numerous reasons other than cigarette price increases, such as health problems associated with smoking and anti-smoking social pressures.[10,11] Nevertheless, in order to implement effective strategies aimed at encouraging smoking cessation among Japanese smokers, it is important to determine the varying roles of factors leading to smoking cessation, including the smoking cessation attempts, motivating factors for such attempts, and the manner in which nicotine dependence levels affect these attempts. Currently, there is limited availability of information on this topic from current smokers who attempted to quit smoking. A Japanese national survey carried out in 1999 reported that personal health concerns and complications were major motivations for quitting smoking; however, this survey did not provide details on the type of personal health complications/concerns smokers had.[12] Another survey[11] reported on the factors related to smoking cessation in former

smokers in rural areas of Japan; however, this study did not include current smokers attempting to quit, a population for whom there is little data available.[13] Additionally, these studies[11,13,14] were conducted before the substantial tobacco tax hike of October 2010, the effect of which has not yet been evaluated. In other words, there are few studies focusing on current smokers after Japan's 2010 tobacco tax hike. Although high nicotine dependence has been shown to be a strong predictor of failure to quit smoking,[15] the relationship between dependence levels and factors identified as motivators to quit smoking in Japan needs clarification. The present study, therefore, investigates the relationship between nicotine dependence levels and smoking cessation attempts among the current smokers and factors that current smokers identify as motivators to quit smoking following the October 2010 tobacco tax increase.

METHODS AND PROCEDURES

Study population

A self-reported questionnaire assessing smoking habits, nicotine dependence level, and factors identified as motivators to quit smoking was administered to 9,378 employees working at a company in Fukuoka Prefecture, Japan (as of October 1, 2011). Ethical approval for this study was obtained from the Institutional Review Committee

of Fukuoka University.

Data collection and measurements

The questionnaire began with questions regarding respondents' age, sex, and smoking habits. Individuals who had never smoked were not required to complete the rest of the questionnaire. Former smokers were asked to answer the following additional questions: (1) the brand of cigarettes that they used to smoke, (2) the age at which they ceased smoking (years), (3) their motivators for quitting smoking, and (4) any pharmacological therapy used to alleviate nicotine withdrawal. In this study, the definition of former smoker is any person who had once smoked but currently does not. Current smokers were asked to (1) specify the cigarette brand usually smoked, (2) complete the Fagerström Test for Cigarette Dependence (FTCD), (3) whether they had attempted smoking cessation in the previous 12 months ('No/Yes'), (4) specify their motivators for quitting smoking, and (5) indicate whether they were taking any form of medication for alleviating nicotine withdrawal symptoms in people attempting to quit.

The FTCD, formerly described as Fagerström Test for Nicotine Dependence (FTND),[16] a standard questionnaire for assessing physical dependence on nicotine, consists of the following six items: (1) *How soon after you wake up do you smoke your first cigarette?* ('after 60 minutes', '31–60 minutes', '6–30 minutes', 'within 5

minutes'); (2) *Do you find it difficult to refrain from smoking in places where it is forbidden, e.g. in church, at the library, cinema, etc.?* ('No/Yes'); (3) *Which cigarette would you hate most to give up?* ('the first one in the morning', 'all others'); (4) *How many cigarettes per day do you smoke?* ('10 or less', '11–20', '21–30', '31 or more'); (5) *Do you smoke more frequently during the first hours of waking than during the rest of the day?* ('No/Yes'); and (6) *Do you smoke if you are so ill that you are in bed most of the day?* ('No/Yes'). In scoring the FTCD, the four dichotomous items are scored as 0 or 1, while the two multiple-choice items are scored from 0 to 3. The items are then summed to yield a total score of 0–10. The higher the score, the more dependent the person is on nicotine.

We assessed whether the following nine items were respondents' motivators for quitting smoking with 'yes' or 'no' responses: (1) health problems experienced by relatives or friends, (2) personal health problems, (3) physician recommendation, (4) feeling unhealthy, (5) in the interests of better health, (6) their preferred brand of cigarettes was no longer available for sale, (7) the rise in cigarette prices after October 2010, (8) having a child (or grandchild), and (9) any other motivators.

Statistical analysis

Of the 9,378 candidates, 7,899 (84.2%), returned the questionnaire. Of the

7,899 participants, we excluded 302 with missing data for sex, age, or smoking habits, 76 aged < 19 because smoking is illegal among individuals under 20 years old in Japan, and 19 individuals aged 70 or older because of the small number. We excluded 2830 females because of their low proportion of current smokers (320, 11.3%). Thus, 4,672 men aged 20–69 years old were selected for analysis.

Of the 4,672 men aged 20–69 years old surveyed, 1,116 individuals who had never smoked and 1,268 former smokers were excluded from the analysis, since FTCD scores were available for current smokers only. Finally, we excluded 33 current smokers with missing data for any of FTCD components. Thus, the data of 2,251 current smokers were analysed in this study.

Responses to the questionnaire were stratified according to respondents' nicotine dependence levels, as defined by the FTCD: low (FTCD score ≤ 3), middle (4–6), and high (≥ 7). First, the proportion of respondents who reported that they had attempted smoking cessation in the previous 12 months (afterward, current smokers with cessation attempts) were expressed as percentages across nicotine dependence levels. Next, the proportion of the motivators for quitting smoking assessed by the nine items among the current smokers with cessation attempts was expressed as percentages across nicotine dependence levels. Third, we selected three motivators for quitting

smoking by number of respondents and examined the relationships between nicotine dependence levels and each motivator for quitting smoking. A chi-square test was used to compare the proportion of respondents by the three nicotine dependence levels. Multiple logistic regression analysis estimated the odds ratios (OR) with 95% confidence intervals (CI) for the presence of each motivator to quit smoking in the previous 12 months, with low nicotine dependence subjects as the reference. We adjusted for age (10-year categories, 20- to 29-year-old group as the reference) in the model. Trend associations were assessed by assigning ordinal numbers to a total FTCD score (0–10). A two-tailed *p*-value of less than 5% was considered statistically significant. All analyses were performed using SPSS version 19 (International Business Machines Corporation, Armonk, NY, USA).

RESULTS

Of the 2,251 current smokers included in our analyses, 913 (40.6%), 1,005 (44.6%), and 333 (14.8%) had low, middle, and high FTCD scores, respectively; 914 (40.6%) reported that they had attempted smoking cessation in the previous 12 months (Table 1). The 20–29 age group had the lowest proportion of respondents with high nicotine dependence (7.5%), while the 50–59 age group had the highest (21.4%). In

general, the older groups had more respondents with high nicotine dependence. The 50–59 age group had the lowest proportion (33.5%) of respondents with low nicotine dependence, while the 20–29 age group had the highest (46.8%). Overall, the groups with older respondents had the lowest proportions of those with low nicotine dependence.

The proportion of current smokers with cessation attempts among the low, middle, and high nicotine dependence groups was 48.0%, 37.1%, and 30.9%, respectively, a statistically significant difference. For each age group, the proportion of current smokers with cessation attempts was highest in the low nicotine dependence group. This proportion was lowest in the high nicotine dependence group. This trend was observed across all age groups. For the 30–39, 50–59, and 60–69 age groups, there were significant inverse relations between the proportion of current smokers with cessation attempts and nicotine dependence level. Among the middle and high nicotine dependence groups, the highest proportion of current smokers with cessation attempts was observed in the 20–29 age group (42.5% and 35.3%, respectively). Furthermore, in the group with low nicotine dependence, the highest proportion of current smokers with cessation attempts was observed in the 60–69 age group (55.0%).

[INSERT TABLE 1 ABOUT HERE]

Table 2 shows the relationship between motivators and smoking cessation attempts within the previous 12 months by respondents' nicotine dependence levels. About half of current smokers with cessation attempts reported that their motivators were 'for better health' and 'the rise in cigarette prices since October 2010', regardless of their nicotine dependence level. Only 10% of current smokers with cessation attempts reported that their reasons were for 'personal health problems', 'physician recommendation', and 'feeling unhealthy', regardless of their nicotine dependence level. In the high nicotine dependence group, a higher proportion of current smokers with cessation attempts reported the 'health problems of relatives or friends' and 'personal health problems' as two of their primary motivators for quitting smoking. However, the proportion of respondents who cited 'feeling unhealthy' and 'for better health' was highest in the group with low nicotine dependence. Furthermore, in the group with low nicotine dependence, 'the rise in cigarette prices since October 2010' was the least reported reason, while 'for better health' was the most reported. No respondent in the group with high nicotine dependence reported 'having a child (or grandchild)' as their motivator for quitting smoking.

[INSERT TABLE 2 ABOUT HERE]

Age-adjusted logistic regression analysis indicating the associations between

the three selected motivators for quitting smoking and nicotine dependence levels is shown in Table 3. 'Feeling unhealthy' was negatively associated with increases in nicotine dependence levels; the odds ratio (OR) was statistically significant for both medium (OR = 0.42, 95% CI = [0.27–0.65]) and high (OR = 0.31, 95% CI = [0.14–0.71]) nicotine dependence levels. 'For better health' was also negatively associated with increases in medium nicotine dependence levels (OR = 0.71, 95% CI = [0.54–0.94]); however, this association was not statistically significant for individuals with high nicotine dependence (OR = 0.88, 95% CI = [0.57–1.36]). 'The rise in cigarette prices since October 2010' was significantly positively associated with an increase in medium nicotine dependence level (OR = 1.44, 95% CI = [1.09–1.90]); however, this association was not statistically significant for individuals with high nicotine dependence (OR = 1.24, 95% CI = [0.80–1.92]). Furthermore, trend associations assessed by assigning ordinal numbers to a total score of FTCD (0–10) for all three motivators were statistically significant.

[INSERT TABLE 3 ABOUT HERE]

DISCUSSION

This study investigated the relationships between nicotine dependence level,

cessation attempts within the previous 12 months, and various motivators for quitting smoking among male current smokers after Japan's 2010 tobacco tax hike. Three major findings emerged. First, 40.6% of current smokers had attempted smoking cessation within the previous 12 months and nicotine dependence levels were negatively associated with attempts. Second, respondents' motivators for quitting smoking differed according to their nicotine dependence levels. Third, the proportion of current smokers with cessation attempts who reported 'the rise in cigarette prices since October 2010' as their motivator for quitting smoking increased with nicotine dependence level.

A national survey in Japan in 1999 showed that 64.7% of current smokers and 41.0% of former smokers acknowledged concerns or problems related to personal health as motivating factors for stopping smoking, respectively.[12] Furthermore, these motivators were ranked as the first and second leading factors for current and former smokers, respectively. Previous studies[10,17] have also identified personal health concerns, including mild-to-serious personal health problems, and a fear of future illness in the absence of immediate health concerns as predominant motivators for smoking cessation. The present study revealed the relationship between smokers' nicotine dependence levels and motivators for quitting smoking.

In Japan, smoking is still not as restricted in public spaces as it is in other countries.[18] In addition, the price of tobacco remains lower than in most developed Western countries.[7] However, in 2003, the Japanese national government enacted the Health Promotion Law, which requires public facility managers to endeavour to protect non-smokers from the environmental effects of tobacco smoke. Since then, greater restrictions have been placed on smoking in public spaces. In addition, the national government increased the tobacco tax in October 2010. The results of our study suggest that individuals with medium and high nicotine dependence attempted smoking cessation by the tobacco price. The present findings imply that further legislative changes increasing the cost of cigarettes could be effective in helping people quit smoking.

This study has two major strengths. First, it was conducted after the massive tobacco tax increase in October 2010, the effects of which had not been evaluated in previous studies.[11,13,14] The approximately 40% price increase constituted the highest in Japan within the last two decades. The prevalence of regular smoking among both men and women decreased significantly after the price increase.[8] A one-year follow-up survey conducted from 2005 to 2006 in Japan[14] showed that 23.0% of smokers at the time reported that they had attempted to quit smoking at least once in the previous year.

In a U. S. study,[19] 29% of respondents reported that the 2009 federal tobacco tax increase helped initiate their attempts to quit smoking. In this study, 40% of current smokers reported that they had attempted smoking cessation in the previous 12 months. It can be hypothesized that the increase in tobacco tax changed smoking cessation attempts among the Japanese male workers included in the current study sample. Smoking cessation attempts may have been affected by the extent of the tax increase and the resulting rise in cigarette retail prices.[3,4,6,9] Further examination of the influence of tobacco tax increases on smoking cessation in Japan is required.

Second, this study revealed that the reasons for smoking cessation attempts vary by nicotine dependence level. High nicotine dependence strongly predicted failure to quit smoking[15] or the cost-effectiveness of smoking cessation programs.[20] As an employee who feels ready and capable of changing his behaviour has needs and preferences that significantly differ from one who is not at that stage,[21] workplace smoking cessation interventions that employ only one method[22] do not generally have positive effects on the smoking cessation attempts of all employees. The current results showed that nicotine dependence is related to motivators for smoking cessation attempts. Thus, the efficacy of any smoking cessation intervention can be improved by considering the target group's level of nicotine dependence.

Three major limitations were identified in this study. First, as this was a cross-sectional study conducted retrospectively, the subjects may not recall all attempts for smoking cessation in the previous 12 months. However, we can interpret that their intention to quit is low when the subjects do not recall their attempts. Therefore, excluding the quit attempts that the subjects could not recall does not affect the interpretation of the study results. This study was conducted in October 2011 and analysed current smokers at that time because physical dependence on nicotine assessed by FTCD was available for current smokers only. The temporal relationship between the exposure and the outcome should be evaluated cautiously. However, because the subjects of this study were current smokers after the tobacco tax increase in 2010, we can interpret that fluctuation in nicotine dependence is negligible. Thus, temporal relationships between nicotine dependence level and the motivators and smoking cessation attempts do not affect the interpretation of the study results.

In the U. S., longitudinal studies have been conducted on the effects of a 10% increase in the retail price of a pack of cigarettes (following the 2009 federal tobacco tax increase);[19] however, in Japan, prior investigations of the relationship between retail prices of cigarettes and motivators for smoking cessation among current smokers in Japan were conducted before the 2010 tobacco tax increase.[11,13,14] Thus, the effects

of a single 40% increase in retail prices of cigarettes in Japan are still not sufficiently clear. Further, the association between the number of cigarettes smoked per day and smoking cessation has previously been elucidated;[13,14,19,20] nevertheless, evaluations of the link between reasons behind smoking cessation and precise nicotine dependence are limited.[4] Although temporal relationships between the tobacco tax increase and smoking cessation attempts must be carefully evaluated, the method employed for measuring nicotine dependence in this study was widely recognized. A longitudinal evaluation that considers the amount of tax increase, nicotine dependence, and smoking cessation attempts must be undertaken.

The second limitation is that the study sample consisted of only male Japanese workers at a specific company. Therefore, the data analysed were not necessarily representative of the total population. However, we can perhaps assume that the current results have broader applicability to the development and design of workplace smoking cessation interventions, as all respondents in this study were employed on a full-time basis.

Third, socio-economic status was not analysed in this study. It has previously been reported that socioeconomic status, especially income, is related to attitudes towards smoking cessation.[19,23] However, the influence of wage differences on

smoking cessation challenges could be disregarded in this study because an age-adjusted analysis (multiple logistic regression) was performed. Income levels are strongly related to respondents' age because of Japan's traditional seniority-based wage system, which had been adopted in the participating company. It has previously been demonstrated that lower education levels, income levels, and cigarette consumption are associated with perceptions that the tobacco tax increase is helpful in aiding smoking cessation.[19]

In conclusion, the efficacy of smoking cessation strategies can be improved by considering the target group's nicotine dependence level. A longitudinal evaluation of strategies focused on current smokers with high nicotine dependence levels should be undertaken.

Contributors: ST conceived and coordinated the study, participated in its design, collected and interpreted the data, conducted data analysis, and drafted the manuscript. YM participated in the study design and data collection, interpreted the data, and helped to draft the manuscript. Both authors approved the final version of the paper.

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Competing interests: All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare no competing interests.

Ethical approval: The research protocol was approved by the Institutional Review Committee of Fukuoka University.

Data sharing: No additional data are available.

Transparency: ST affirms that the manuscript is an honest, accurate, and transparent account of the study being reported, that no important aspects of the study have been omitted, and that any discrepancies from the study as planned have been explained.

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Table 1. The distribution of age, nicotine dependence level, and cessation attempts of the subjects

			Nicotine dependence level*												
			Low[1]			Medium[2]			High[3]			Total			
		n(%)	913(40.6)			1005(44.6)			333(14.8)			2251(100)			
	Cessation attempts		Yes	No	Total	Yes	No	Total	Yes	No	Total	Yes	No	Total	P value
Age	20–29	N	104	108	212	88	119	207	12	22	34	204	249	453	0.200
		(%)	(49.1)	(50.9)	(100)	(42.5)	(57.5)	(100)	(35.3)	(64.7)	(100)	(45.0)	(55.0)	(100)	
	30–39	N	125	125	250	91	160	251	19	44	63	235	329	564	0.001
		(%)	(50.0)	(50.0)	(100)	(36.3)	(63.7)	(100)	(30.2)	(69.8)	(100)	(41.7)	(58.3)	(100)	
	40–49	N	86	137	223	90	169	259	27	69	96	203	375	578	0.198
		(%)	(38.6)	(61.4)	(100)	(34.7)	(65.3)	(100)	(28.1)	(71.9)	(100)	(35.1)	(64.9)	(100)	
	50–59	N	101	87	188	95	159	254	39	81	120	235	327	562	<0.001
		(%)	(53.7)	(46.3)	(100)	(37.4)	(62.6)	(100)	(32.5)	(67.5)	(100)	(41.8)	(58.2)	(100)	
	60–69	N	22	18	40	9	25	34	6	14	20	37	57	94	0.027
		(%)	(55.0)	(45.0)	(100)	(26.5)	(73.5)	(100)	(30.0)	(70.0)	(100)	(39.4)	(60.6)	(100)	
	Total	n	438	475	913	373	632	1005	103	230	333	914	1337	2251	<0.001
		(%)	(48.0)	(52.0)	(100)	(37.1)	(62.9)	(100)	(30.9)	(69.1)	(100)	(40.6)	(59.4)	(100)	

*: Nicotine dependence levels were classified according to results on the Fagerström Test for Cigarette Dependence (FTCD).

1: FTCD score = 0–3; 2: FTCD score = 4–6; 3: FTCD score = 7–10.

Table 2. The proportion of respondents that replied the motivator is related to the smoking cessation attempts in the previous 12 months

	Nicotine dependence level*									
	Low[1] n = 438		Medium[2] n = 373		High[3] n = 103		Total n = 914		*P* for trend (crude)	*P* for trend (age adjusted)
Motivators to smoking cessation	n	(%)	n	(%)	n	(%)	n	(%)		
Health problems of relatives or friends	24	(5.5)	21	(5.6)	8	(7.8)	53	(5.8)	0.489	0.469
Personal health problems	35	(8.0)	33	(8.8)	12	(11.7)	80	(8.8)	0.372	0.805
Physician recommendation	39	(8.9)	33	(8.8)	12	(11.7)	84	(9.2)	0.407	0.950
Feeling unhealthy	82	(18.7)	33	(8.8)	7	(6.8)	122	(13.3)	<0.001	<0.001
For better health	244	(55.7)	176	(47.2)	55	(53.4)	475	(52.0)	0.028	0.018
Stopped selling my brand of cigarettes	7	(1.6)	9	(2.4)	1	(1.0)	17	(1.9)	0.999	0.965
Rise in cigarette prices since October 2010	207	(47.3)	209	(56.0)	51	(49.5)	467	(51.1)	0.092	0.023
Having a child (or grandchild)	24	(5.5)	26	(7.0)	0	(0.0)	50	(5.5)	0.088	0.243
Any other motivations	33	(7.5)	33	(8.8)	5	(5.8)	71	(7.9)	0.963	0.929

*: Nicotine dependence levels were classified according to the Fagerström Test for Cigarette Dependence (FTCD).

1: FTCD score = 0–3; 2: FTCD score = 4–6; 3: FTCD score = 7–10.

Age (by ten-year age groups) was adjusted by multiple logistic regression analysis.

Table 3. Nicotine dependence level and age distribution for the top three motivators that related to the smoking cessation attempts in the previous 12 months among current smokers

Motivators to quit			Feeling unhealthy			For better health			The rise in cigarette prices since October 2010		
Nicotine dependence level*			Low[1]	Medium[2]	High[3]	Low[1]	Medium[2]	High[3]	Low[1]	Medium[2]	High[3]
Age	20–29	N	18	7	1	57	37	5	56	58	6
		(%)	(17.3)	(8.0)	(8.3)	(54.8)	(42.0)	(41.7)	(53.8)	(65.9)	(50.0)
	30–39	N	22	9	2	64	47	11	63	52	10
		(%)	(17.6)	(9.9)	(10.5)	(51.2)	(51.6)	(57.9)	(50.4)	(57.1)	(52.6)
	40–49	N	16	10	1	49	38	16	43	55	16
		(%)	(18.6)	(11.1)	(3.7)	(57.0)	(42.2)	(59.3)	(50.0)	(61.1)	(59.3)
	50–59	N	23	7	3	63	48	23	41	41	16
		(%)	(22.8)	(7.4)	(7.7)	(62.4)	(50.5)	(59.0)	(40.6)	(43.2)	(41.0)
	60–69	N	3	0	0	11	6	0	4	3	3
		(%)	(13.6)	(0.0)	(0.0)	(50.0)	(66.7)	(0.0)	(18.2)	(33.3)	(50.0)
	Total	n	82	33	7	244	176	55	207	209	51
		(%)	(18.7)	(8.8)	(6.8)	(55.7)	(47.2)	(53.4)	(47.3)	(56.0)	(49.5)
	Odds ratio		(reference)	0.42	0.31	(reference)	0.71	0.88	(reference)	1.44	1.24
	95%CI			0.27-0.65	0.14-0.71		0.54-0.94	0.57-1.36		1.09-1.90	0.80-1.92
	P for trend			<0.001			0.018			0.023	

*: Nicotine dependence levels were classified according to the Fagerström Test for Cigarette Dependence (FTCD).

1: FTCD score = 0–3; 2: FTCD score = 4–6; 3: FTCD score = 7–10.

Odds ratio and p for trend was calculated by age-adjusted multiple logistic analysis model.

95%CI: 95% confidence interval

STROBE Statement—checklist of items that should be included in reports of observational studies
Title: Reason for smoking cessation attempts among Japanese male smokers varies according to nicotine dependence level: cross-sectional study

	Item No	Recommendation	Location in manuscript
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	Line 1-3 on page 1 and line 27 on page 2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	What was done: line 28-35 on page 2 What was found: line 36-47 on page 2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Scientific background: line 65-87 on page 5 and 6 Rationale: Line 88-107 on page 6 and 7
Objectives	3	State specific objectives, including any prespecified hypotheses	Line 107-110 on page 7
Methods			
Study design	4	Present key elements of study design early in the paper	Line 114-116 on page 7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Line 114-116 on page 7
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	Line 114-116 on page7-8
		(*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	N/A
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Outcomes: Line127-131 on page 8 Exposures: Line 132-145 on page 8-9 Potential confounders: Line 120-121 on page 8
Data sources/ measurement	8*	For each variable of interest, give	Line 120-151 on page 8-9

		sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	
Bias	9	Describe any efforts to address potential sources of bias	Exclusion: line 153-163 on page 9-10 Adjustment: line 175-181 on page 11
Study size	10	Explain how the study size was arrived at	Not provided
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Adjustment: line 175-181 on page 11
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	Line 153-182 on page 9-11
		(*b*) Describe any methods used to examine subgroups and interactions	Line 171-173 on page 10-11
		(*c*) Explain how missing data were addressed	We excluded participants who had missing data (line 153-163 on page 10).
		(*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	N/A
		(*e*) Describe any sensitivity analyses	N/A
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	Line 153-163 on page 10
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1 Line 185-206 on page 11-12
		(b) Indicate number of participants with missing data for each variable of interest	N/A
		(c) *Cohort study*—Summarise follow-	N/A

		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	Table 1 Line 185-188 on page 11
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	Table2, Table 3 Line 208-239 on page 13-14
		(*b*) Report category boundaries when continuous variables were categorized	Table 1, Table 2, Table 3
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Table 3 Line 225-239 on page 13-14
Discussion			
Key results	18	Summarise key results with reference to study objectives	Line 243-261 on page 14-15
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	Line 298-340 on page 18-20
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Line 262-272 on page 16
Generalisability	21	Discuss the generalisability (external validity) of the study results	Line 325-330 on page 19
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	This study was funded by a Grant-in-Aid from the Ministry of Health, Labour and Welfare of Japan (Comprehensive Research on Cardiovascular and Life-style Related Disease: H22-Junkankitou [Seisyuu]-Ippan-012).

*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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Reasons for smoking cessation attempts among Japanese male smokers vary by nicotine dependence level: cross-sectional study after the 2010 tobacco tax increase

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Keywords:	smoking cessation, nicotine dependence, motivator, tobacco tax increase, Fagerström Test for Cigarette Dependence, male workers

Reasons for smoking cessation attempts among Japanese male smokers vary by nicotine dependence level: cross-sectional study after the 2010 tobacco tax increase

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Abstract

Objectives: To examine the association between smoking cessation attempts during the previous 12 months, motivators to quit smoking, and nicotine dependence levels among current male smoker after Japan's massive 2010 tobacco tax increase.

Design: Cross-sectional study.

Setting: A self-reported questionnaire about smoking habits, nicotine dependence levels, and factors identified as motivators to quit smoking was administered to 9,378 employees working at a company located in Fukuoka Prefecture in Japan (as of October 1, 2011).

Participants: A total of 2,251 male current smokers 20–69 years old.

Primary and secondary outcome measures: Nicotine dependence level assessed by Fagerström Test for Cigarette Dependence (FTCD), smoking cessation attempts during the previous 12 months, and motivators for smoking cessation.

Results: The proportion of current smokers who had attempted to quit smoking within the previous 12 months was 40.6%. Nicotine dependence level of current smokers was negatively associated with cessation attempts during the previous 12 months. Motivators for smoking cessation differed by nicotine dependence levels. 'The rise in cigarette prices since October 2010' as a smoking cessation motivator increased

significantly at the medium nicotine dependence level (odds ratio (OR): 1.44, 95% confidence interval (CI): 1.09–1.90); however, this association was not statistically significant for individuals with high nicotine dependence (OR: 1.24, 95% CI: 0.80–1.92). 'Feeling unhealthy' was significantly negatively associated for both medium (OR: 0.42, 95% CI: 0.27–0.65) and high (OR: 0.31, 95% CI: 0.14–0.71) nicotine dependence levels. Trend associations assessed by assigning ordinal numbers to total FTCD score for those two motivators were statistically significant.

Conclusions: The efficacy of smoking cessation strategies can be improved by considering the target group's nicotine dependence level. For smokers with medium and high nicotine dependence levels, more effective strategies aimed at encouraging smoking cessation are needed, such as policy interventions including increasing tobacco taxes.

Strengths and limitations

This study provides information on the relationship between smoking cessation attempts, motivators for quitting smoking, and nicotine dependence levels for current smokers after Japan's massive 2010 tobacco tax hike. However, the impact of the tax increase on the cessation attempts was not fully investigated because current smokers before the tax increase were not included in the study. No follow-up measures were taken to determine whether the study's respondents actually succeeded in their smoking cessation attempts.

INTRODUCTION

Smoking is the leading avoidable cause of death worldwide. Many countries take action to reduce smoking-related deaths by educating people about tobacco's harmful effects;[1] youth tobacco control, including passive smoking control;[2] disseminating information on tobacco cessation programs; and increasing tobacco taxes[3] and prices.[4] These policies and programmes appear to be effective—overall, the smoking rate is decreasing in both developed and developing countries.[5,6]

In the past two decades, Japan's tobacco tax has increased four times: in December 1998, July 2003, July 2006, and October 2010. The first three increases were relatively low—the price of an ordinary 20-cigarette pack increased by about 20–30 JPY (about 0.2–0.3 USD) each time. Given the low taxes in 2008, tobacco was still relatively inexpensive (priced at around 300 JPY [2–3 USD] per pack). Thus, smoking prevalence among men remained high in comparison to other Organisation for Economic Co-operation and Development (OECD) countries.[7]

However, in October 2010, the price of an ordinary 20-cigarette pack increased by 120 JPY (1.2 USD), roughly four times the increase of the previous three tax hikes (or an estimated 40% increase in retail price). According to the National Health and Nutrition Survey in Japan,[8] the prevalence of regular smoking among men

was 38.2%, 32.2% and 32.4% in 2009, 2010 and 2011, respectively, while that among women was 10.9%, 8.4%, and 9.7%, respectively. Thus, these increases in tobacco taxes may have contributed to lower tobacco consumption in Japan, just as was reported in Western European countries.[4,9] This may be in part attributable to the tax's dissuasion of young people from smoking.[5] However, the precise effect of this tax increase on people's smoking cessation attempts in Japan remains unknown.

People quit smoking for numerous reasons other than cigarette price increases, such as health problems associated with smoking and anti-smoking social pressures.[10,11] Nevertheless, in order to implement effective strategies aimed at encouraging smoking cessation among Japanese smokers, it is important to determine the varying roles of factors leading to smoking cessation, including the smoking cessation attempts, motivating factors for such attempts, and the manner in which nicotine dependence levels affect these attempts. Currently, there is limited availability of information on this topic from current smokers who attempted to quit smoking. A Japanese national survey carried out in 1999 reported that personal health concerns and complications were major motivations for quitting smoking; however, this survey did not provide details on the type of personal health complications/concerns smokers had.[12] Another survey[11] reported on the factors related to smoking cessation in former

smokers in rural areas of Japan; however, this study did not include current smokers attempting to quit, a population for whom there is little data available.[13] Additionally, these studies[11,13,14] were conducted before the substantial tobacco tax hike of October 2010, the effect of which has not yet been evaluated. In other words, there are few studies focusing on current smokers after Japan's 2010 tobacco tax hike. Although high nicotine dependence has been shown to be a strong predictor of failure to quit smoking,[15] the relationship between dependence levels and factors identified as motivators to quit smoking in Japan needs clarification. The present study, therefore, investigates the relationship between nicotine dependence levels and smoking cessation attempts among the current smokers and factors that current smokers identify as motivators to quit smoking following the October 2010 tobacco tax increase.

METHODS AND PROCEDURES

Study population

A self-reported questionnaire assessing smoking habits, nicotine dependence level, and factors identified as motivators to quit smoking was administered to 9,378 employees working at a company in Fukuoka Prefecture, Japan (as of October 1, 2011). Ethical approval for this study was obtained from the Institutional Review Committee

of Fukuoka University.

Data collection and measurements

The questionnaire began with questions regarding respondents' age, sex, and smoking habits. Individuals who had never smoked were not required to complete the rest of the questionnaire. Former smokers were asked to answer the following additional questions: (1) the brand of cigarettes that they used to smoke, (2) the age at which they ceased smoking (years), (3) their motivators for quitting smoking, and (4) any pharmacological therapy used to alleviate nicotine withdrawal. In this study, the definition of former smoker is any person who had once smoked but currently does not. Current smokers were asked to (1) specify the cigarette brand usually smoked, (2) complete the Fagerström Test for Cigarette Dependence (FTCD), (3) whether they had attempted smoking cessation in the previous 12 months ('No/Yes'), (4) specify their motivators for quitting smoking, and (5) indicate whether they were taking any form of medication for alleviating nicotine withdrawal symptoms in people attempting to quit.

The FTCD, formerly described as Fagerström Test for Nicotine Dependence (FTND),[16] a standard questionnaire for assessing physical dependence on nicotine, consists of the following six items: (1) *How soon after you wake up do you smoke your first cigarette?* ('after 60 minutes', '31–60 minutes', '6–30 minutes', 'within 5

minutes'); (2) *Do you find it difficult to refrain from smoking in places where it is forbidden, e.g. in church, at the library, cinema, etc.?* ('No/Yes'); (3) *Which cigarette would you hate most to give up?* ('the first one in the morning', 'all others'); (4) *How many cigarettes per day do you smoke?* ('10 or less', '11–20', '21–30', '31 or more'); (5) *Do you smoke more frequently during the first hours of waking than during the rest of the day?* ('No/Yes'); and (6) *Do you smoke if you are so ill that you are in bed most of the day?* ('No/Yes'). In scoring the FTCD, the four dichotomous items are scored as 0 or 1, while the two multiple-choice items are scored from 0 to 3. The items are then summed to yield a total score of 0–10. The higher the score, the more dependent the person is on nicotine.

We assessed whether the following nine items were respondents' motivators for quitting smoking with 'yes' or 'no' responses: (1) health problems experienced by relatives or friends, (2) personal health problems, (3) physician recommendation, (4) feeling unhealthy, (5) in the interests of better health, (6) their preferred brand of cigarettes was no longer available for sale, (7) the rise in cigarette prices after October 2010, (8) having a child (or grandchild), and (9) any other motivators.

Statistical analysis

Of the 9,378 candidates, 7,899 (84.2%), returned the questionnaire. Of the

7,899 participants, we excluded 302 with missing data for sex, age, or smoking habits, 76 aged < 19 because smoking is illegal among individuals under 20 years old in Japan, and 19 individuals aged 70 or older because of the small number. We excluded 2830 females because of their low proportion of current smokers (320, 11.3%). Thus, 4,672 men aged 20–69 years old were selected for analysis.

Of the 4,672 men aged 20–69 years old surveyed, 1,116 individuals who had never smoked and 1,268 former smokers were excluded from the analysis, since FTCD scores were available for current smokers only. Finally, we excluded 33 current smokers with missing data for any of FTCD components and four current smokers with missing data for cessation attempts or motivators for quitting smoking. Thus, the data of 2,251 current smokers were analysed in this study.

Responses to the questionnaire were stratified according to respondents' nicotine dependence levels, as defined by the FTCD: low (FTCD score ≤ 3), middle (4–6), and high (≥ 7). First, the proportion of respondents who reported that they had attempted smoking cessation in the previous 12 months (afterward, current smokers with cessation attempts) were expressed as percentages across nicotine dependence levels. Next, the proportion of the motivators for quitting smoking assessed by the nine items among the current smokers with cessation attempts was expressed as percentages

across nicotine dependence levels. Third, we selected three motivators for quitting smoking by number of respondents and examined the relationships between nicotine dependence levels and each motivator for quitting smoking. A chi-square test was used to compare the proportion of respondents by the three nicotine dependence levels. Multiple logistic regression analysis estimated the odds ratios (OR) with 95% confidence intervals (CI) for the presence of each motivator to quit smoking in the previous 12 months, with low nicotine dependence subjects as the reference. We adjusted for age (10-year categories, 20- to 29-year-old group as the reference) in the model. Trend associations were assessed by assigning ordinal numbers to a total FTCD score (0–10). A two-tailed *p*-value of less than 5% was considered statistically significant. All analyses were performed using SPSS version 19 (International Business Machines Corporation, Armonk, NY, USA).

RESULTS

Of the 2,251 current smokers included in our analyses, 913 (40.6%), 1,005 (44.6%), and 333 (14.8%) had low, middle, and high FTCD scores, respectively; 914 (40.6%) reported that they had attempted smoking cessation in the previous 12 months (Table 1). The 20–29 age group had the lowest proportion of respondents with high

nicotine dependence (7.5%), while the 50–59 age group had the highest (21.4%). In general, the older groups had more respondents with high nicotine dependence. The 50–59 age group had the lowest proportion (33.5%) of respondents with low nicotine dependence, while the 20–29 age group had the highest (46.8%). Overall, the groups with older respondents had the lowest proportions of those with low nicotine dependence.

The proportion of current smokers with cessation attempts among the low, middle, and high nicotine dependence groups was 48.0%, 37.1%, and 30.9%, respectively, a statistically significant difference. For each age group, the proportion of current smokers with cessation attempts was highest in the low nicotine dependence group. This proportion was lowest in the high nicotine dependence group. This trend was observed across all age groups. For the 30–39, 50–59, and 60–69 age groups, there were significant inverse relations between the proportion of current smokers with cessation attempts and nicotine dependence level. Among the middle and high nicotine dependence groups, the highest proportion of current smokers with cessation attempts was observed in the 20–29 age group (42.5% and 35.3%, respectively). Furthermore, in the group with low nicotine dependence, the highest proportion of current smokers with cessation attempts was observed in the 60–69 age group (55.0%).

[INSERT TABLE 1 ABOUT HERE]

Table 2 shows the relationship between motivators and smoking cessation attempts within the previous 12 months by respondents' nicotine dependence levels. About half of current smokers with cessation attempts reported that their motivators were 'for better health' and 'the rise in cigarette prices since October 2010', regardless of their nicotine dependence level. Only 10% of current smokers with cessation attempts reported that their reasons were for 'personal health problems', 'physician recommendation', and 'feeling unhealthy', regardless of their nicotine dependence level. In the high nicotine dependence group, a higher proportion of current smokers with cessation attempts reported the 'health problems of relatives or friends' and 'personal health problems' as two of their primary motivators for quitting smoking. However, the proportion of respondents who cited 'feeling unhealthy' and 'for better health' was highest in the group with low nicotine dependence. Furthermore, in the group with low nicotine dependence, 'the rise in cigarette prices since October 2010' was the least reported reason, while 'for better health' was the most reported. No respondent in the group with high nicotine dependence reported 'having a child (or grandchild)' as their motivator for quitting smoking.

[INSERT TABLE 2 ABOUT HERE]

Age-adjusted logistic regression analysis indicating the associations between the three selected motivators for quitting smoking and nicotine dependence levels is shown in Table 3. 'Feeling unhealthy' was negatively associated with increases in nicotine dependence levels; the odds ratio (OR) was statistically significant for both medium (OR = 0.42, 95% CI = [0.27–0.65]) and high (OR = 0.31, 95% CI = [0.14–0.71]) nicotine dependence levels. 'For better health' was also negatively associated with increases in medium nicotine dependence levels (OR = 0.71, 95% CI = [0.54–0.94]); however, this association was not statistically significant for individuals with high nicotine dependence (OR = 0.88, 95% CI = [0.57–1.36]). 'The rise in cigarette prices since October 2010' was significantly positively associated with an increase in medium nicotine dependence level (OR = 1.44, 95% CI = [1.09–1.90]); however, this association was not statistically significant for individuals with high nicotine dependence (OR = 1.24, 95% CI = [0.80–1.92]). Furthermore, trend associations assessed by assigning ordinal numbers to a total score of FTCD (0–10) for all three motivators were statistically significant.

[INSERT TABLE 3 ABOUT HERE]

DISCUSSION

This study investigated the relationships between nicotine dependence level, cessation attempts within the previous 12 months, and various motivators for quitting smoking among male current smokers after Japan's 2010 tobacco tax hike. Three major findings emerged. First, 40.6% of current smokers had attempted smoking cessation within the previous 12 months and nicotine dependence levels were negatively associated with attempts. Second, respondents' motivators for quitting smoking differed according to their nicotine dependence levels. Third, the proportion of current smokers with cessation attempts who reported 'the rise in cigarette prices since October 2010' as their motivator for quitting smoking increased with nicotine dependence level.

A national survey in Japan in 1999 showed that 64.7% of current smokers and 41.0% of former smokers acknowledged concerns or problems related to personal health as motivating factors for stopping smoking, respectively.[12] Furthermore, these motivators were ranked as the first and second leading factors for current and former smokers, respectively. Previous studies[10,17] have also identified personal health concerns, including mild-to-serious personal health problems, and a fear of future illness in the absence of immediate health concerns as predominant motivators for smoking cessation. The present study revealed the relationship between smokers'

nicotine dependence levels and motivators for quitting smoking.

In Japan, smoking is still not as restricted in public spaces as it is in other countries.[18] In addition, the price of tobacco remains lower than in most developed Western countries.[7] However, in 2003, the Japanese national government enacted the Health Promotion Law, which requires public facility managers to endeavour to protect non-smokers from the environmental effects of tobacco smoke. Since then, greater restrictions have been placed on smoking in public spaces. In addition, the national government increased the tobacco tax in October 2010. The results of our study suggest that individuals with medium and high nicotine dependence attempted smoking cessation by the tobacco price. The present findings imply that further legislative changes increasing the cost of cigarettes could be effective in helping people quit smoking.

This study has two major strengths. First, it was conducted after the massive tobacco tax increase in October 2010, the effects of which had not been evaluated in previous studies.[11,13,14] The approximately 40% price increase constituted the highest in Japan within the last two decades. The prevalence of regular smoking among both men and women decreased significantly after the price increase.[8] A one-year follow-up survey conducted from 2005 to 2006 in Japan[14] showed that 23.0% of smokers at the

time reported that they had attempted to quit smoking at least once in the previous year. In a U. S. study,[19] 29% of respondents reported that the 2009 federal tobacco tax increase helped initiate their attempts to quit smoking. In this study, 40% of current smokers reported that they had attempted smoking cessation in the previous 12 months. It can be hypothesized that the increase in tobacco tax changed smoking cessation attempts among the Japanese male workers included in the current study sample. Smoking cessation attempts may have been affected by the extent of the tax increase and the resulting rise in cigarette retail prices.[3,4,6,9] Further examination of the influence of tobacco tax increases on smoking cessation in Japan is required.

Second, this study revealed that the reasons for smoking cessation attempts vary by nicotine dependence level. High nicotine dependence strongly predicted failure to quit smoking[15] or the cost-effectiveness of smoking cessation programs.[20] As an employee who feels ready and capable of changing his behaviour has needs and preferences that significantly differ from one who is not at that stage,[21] workplace smoking cessation interventions that employ only one method[22] do not generally have positive effects on the smoking cessation attempts of all employees. The current results showed that nicotine dependence is related to motivators for smoking cessation attempts. Thus, the efficacy of any smoking cessation intervention can be improved by

considering the target group's level of nicotine dependence.

Four major limitations were identified in this study. First, as this was a cross-sectional study conducted retrospectively, the subjects may not recall all attempts for smoking cessation in the previous 12 months. However, we can interpret that their intention to quit is low when the subjects do not recall their attempts. Therefore, excluding the quit attempts that the subjects could not recall does not affect the interpretation of the study results. This study was conducted in October 2011 and analysed current smokers at that time. Thus, the temporal relationship between the exposure and the outcome should be evaluated cautiously. However, because the subjects of this study were current smokers at the time that this study was conducted, we believe that fluctuation in nicotine dependence is negligible. Thus, temporal relationships between nicotine dependence level and the motivators and smoking cessation attempts do not affect the interpretation of the study results.

In the U. S., longitudinal studies have been conducted on the effects of a 10% increase in the retail price of a pack of cigarettes (following the 2009 federal tobacco tax increase);[19] however, in Japan, prior investigations of the relationship between retail prices of cigarettes and motivators for smoking cessation among current smokers in Japan were conducted before the 2010 tobacco tax increase.[11,13,14] Thus, the effects

of a single 40% increase in retail prices of cigarettes in Japan are still not sufficiently clear. Further, the association between the number of cigarettes smoked per day and smoking cessation has previously been elucidated;[13,14,19,20] nevertheless, evaluations of the link between reasons behind smoking cessation and precise nicotine dependence are limited.[4] Although temporal relationships between the tobacco tax increase and smoking cessation attempts must be carefully evaluated, the method employed for measuring nicotine dependence in this study was widely recognized. A longitudinal evaluation that considers the amount of tax increase, nicotine dependence, and smoking cessation attempts must be undertaken.

The second limitation is that the smokers successfully quit smoking before October 2011 were not included in this study because physical dependence on nicotine assessed by the FTCD was available for current smokers only. It is rational to hypothesize that smoking cessation attempts are stronger in smokers who successfully quit smoking than in smokers who continued smoking. Thus, the association between smoking cessation attempts during the previous 12 months and nicotine dependence may be underestimated in this study because the subjects in this study were smokers who continued smoking until this study was conducted. This means that the exclusion of the smokers who successfully quit smoking before this study does not influence the

interpretation of the results. However, we could not estimate the magnitude of the association between smoking cessation attempts during the previous 12 months and nicotine dependence among the excluded subjects. A longitudinal evaluation to investigate the impact of the nicotine dependence level and success in smoking cessation must be undertaken.

The third limitation is that the study sample consisted of only male Japanese workers at a specific company. Therefore, the data analysed were not necessarily representative of the total population. However, we can perhaps assume that the current results have broader applicability to the development and design of workplace smoking cessation interventions, as all respondents in this study were employed on a full-time basis.

Fourth, socio-economic status was not analysed in this study. It has previously been reported that socioeconomic status, especially income, is related to attitudes towards smoking cessation.[19,23] However, the influence of wage differences on smoking cessation challenges could be disregarded in this study because an age-adjusted analysis (multiple logistic regression) was performed. Income levels are strongly related to respondents' age because of Japan's traditional seniority-based wage system, which had been adopted in the participating company. It has previously been

demonstrated that lower education levels, income levels, and cigarette consumption are associated with perceptions that the tobacco tax increase is helpful in aiding smoking cessation.[19]

In conclusion, the efficacy of smoking cessation strategies can be improved by considering the target group's nicotine dependence level. A longitudinal evaluation of strategies focused on current smokers with high nicotine dependence levels should be undertaken.

Contributors: ST conceived and coordinated the study, participated in its design, collected and interpreted the data, conducted data analysis, and drafted the manuscript. YM participated in the study design and data collection, interpreted the data, and helped to draft the manuscript. Both authors approved the final version of the paper.

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Competing interests: All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare no competing interests.

Ethical approval: The research protocol was approved by the Institutional Review Committee of Fukuoka University.

Data sharing: No additional data are available.

Transparency: ST affirms that the manuscript is an honest, accurate, and transparent account of the study being reported, that no important aspects of the study have been omitted, and that any discrepancies from the study as planned have been explained.

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Table 1. The distribution of age, nicotine dependence level, and cessation attempts of the subjects

			Nicotine dependence level*												
			Low[1]			Medium[2]			High[3]			Total			
	N (%)		913 (40.6)			1005 (44.6)			333 (14.8)			2251 (100)			
	Cessation attempts		Yes	No	Total	Yes	No	Total	Yes	No	Total	Yes	No	Total	P value
Age	20–29	N	104	108	212	88	119	207	12	22	34	204	249	453	0.200
		(%)	(49.1)	(50.9)	(100)	(42.5)	(57.5)	(100)	(35.3)	(64.7)	(100)	(45.0)	(55.0)	(100)	
	30–39	N	125	125	250	91	160	251	19	44	63	235	329	564	0.001
		(%)	(50.0)	(50.0)	(100)	(36.3)	(63.7)	(100)	(30.2)	(69.8)	(100)	(41.7)	(58.3)	(100)	
	40–49	N	86	137	223	90	169	259	27	69	96	203	375	578	0.198
		(%)	(38.6)	(61.4)	(100)	(34.7)	(65.3)	(100)	(28.1)	(71.9)	(100)	(35.1)	(64.9)	(100)	
	50–59	N	101	87	188	95	159	254	39	81	120	235	327	562	<0.001
		(%)	(53.7)	(46.3)	(100)	(37.4)	(62.6)	(100)	(32.5)	(67.5)	(100)	(41.8)	(58.2)	(100)	
	60–69	N	22	18	40	9	25	34	6	14	20	37	57	94	0.027
		(%)	(55.0)	(45.0)	(100)	(26.5)	(73.5)	(100)	(30.0)	(70.0)	(100)	(39.4)	(60.6)	(100)	
	Total	n	438	475	913	373	632	1005	103	230	333	914	1337	2251	<0.001
		(%)	(48.0)	(52.0)	(100)	(37.1)	(62.9)	(100)	(30.9)	(69.1)	(100)	(40.6)	(59.4)	(100)	

*: Nicotine dependence levels were classified according to results on the Fagerström Test for Cigarette Dependence (FTCD).

1: FTCD score = 0–3; 2: FTCD score = 4–6; 3: FTCD score = 7–10.

Table 2. The proportion of respondents that replied the motivator is related to the smoking cessation attempts in the previous 12 months

	Nicotine dependence level*									
	Low[1] n = 438		Medium[2] n = 373		High[3] n = 103		Total n = 914		*P* for trend (crude)	*P* for trend (age adjusted)
Motivators to smoking cessation	n	(%)	n	(%)	n	(%)	n	(%)		
Health problems of relatives or friends	24	(5.5)	21	(5.6)	8	(7.8)	53	(5.8)	0.489	0.469
Personal health problems	35	(8.0)	33	(8.8)	12	(11.7)	80	(8.8)	0.372	0.805
Physician recommendation	39	(8.9)	33	(8.8)	12	(11.7)	84	(9.2)	0.407	0.950
Feeling unhealthy	82	(18.7)	33	(8.8)	7	(6.8)	122	(13.3)	<0.001	<0.001
For better health	244	(55.7)	176	(47.2)	55	(53.4)	475	(52.0)	0.028	0.018
Stopped selling my brand of cigarettes	7	(1.6)	9	(2.4)	1	(1.0)	17	(1.9)	0.999	0.965
Rise in cigarette prices since October 2010	207	(47.3)	209	(56.0)	51	(49.5)	467	(51.1)	0.092	0.023
Having a child (or grandchild)	24	(5.5)	26	(7.0)	0	(0.0)	50	(5.5)	0.088	0.243
Any other motivations	33	(7.5)	33	(8.8)	5	(5.8)	71	(7.9)	0.963	0.929

*: Nicotine dependence levels were classified according to the Fagerström Test for Cigarette Dependence (FTCD).

1: FTCD score = 0–3; 2: FTCD score = 4–6; 3: FTCD score = 7–10.

Age (by ten-year age groups) was adjusted by multiple logistic regression analysis.

Table 3. Nicotine dependence level and age distribution for the top three motivators that related to the smoking cessation attempts in the previous 12 months among current smokers

Motivators to quit			Feeling unhealthy			For better health			The rise in cigarette prices since October 2010		
Nicotine dependence level*			Low[1]	Medium[2]	High[3]	Low[1]	Medium[2]	High[3]	Low[1]	Medium[2]	High[3]
Age	20–29	N	18	7	1	57	37	5	56	58	6
		(%)	(17.3)	(8.0)	(8.3)	(54.8)	(42.0)	(41.7)	(53.8)	(65.9)	(50.0)
	30–39	N	22	9	2	64	47	11	63	52	10
		(%)	(17.6)	(9.9)	(10.5)	(51.2)	(51.6)	(57.9)	(50.4)	(57.1)	(52.6)
	40–49	N	16	10	1	49	38	16	43	55	16
		(%)	(18.6)	(11.1)	(3.7)	(57.0)	(42.2)	(59.3)	(50.0)	(61.1)	(59.3)
	50–59	N	23	7	3	63	48	23	41	41	16
		(%)	(22.8)	(7.4)	(7.7)	(62.4)	(50.5)	(59.0)	(40.6)	(43.2)	(41.0)
	60–69	N	3	0	0	11	6	0	4	3	3
		(%)	(13.6)	(0.0)	(0.0)	(50.0)	(66.7)	(0.0)	(18.2)	(33.3)	(50.0)
	Total	n	82	33	7	244	176	55	207	209	51
		(%)	(18.7)	(8.8)	(6.8)	(55.7)	(47.2)	(53.4)	(47.3)	(56.0)	(49.5)
	Odds ratio		(reference)	0.42	0.31	(reference)	0.71	0.88	(reference)	1.44	1.24
	95%CI			0.27-0.65	0.14-0.71		0.54-0.94	0.57-1.36		1.09-1.90	0.80-1.92
	P for trend			<0.001			0.018			0.023	

*: Nicotine dependence levels were classified according to the Fagerström Test for Cigarette Dependence (FTCD).

1: FTCD score = 0–3; 2: FTCD score = 4–6; 3: FTCD score = 7–10.

Odds ratio and p for trend was calculated by age-adjusted multiple logistic analysis model.

95% CI: 95% confidence interval

STROBE Statement—checklist of items that should be included in reports of observational studies
Title: Reason for smoking cessation attempts among Japanese male smokers varies according to nicotine dependence level: cross-sectional study

	Item No	Recommendation	Location in manuscript
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	Line 1-3 on page 1 and line 27 on page 2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	What was done: line 28-35 on page 2 What was found: line 36-47 on page 2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Scientific background: line 65-87 on page 5 and 6 Rationale: Line 88-107 on page 6 and 7
Objectives	3	State specific objectives, including any prespecified hypotheses	Line 107-110 on page 7
Methods			
Study design	4	Present key elements of study design early in the paper	Line 114-116 on page 7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Line 114-116 on page 7
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	Line 114-116 on page7-8
		(*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	N/A
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Outcomes: Line127-131 on page 8 Exposures: Line 132-145 on page 8-9 Potential confounders: Line 120-121 on page 8
Data sources/ measurement	8*	For each variable of interest, give	Line 120-151 on page 8-9

		sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	
Bias	9	Describe any efforts to address potential sources of bias	Exclusion: line 153-164 on page 9-10 Adjustment: line 176-183 on page 11
Study size	10	Explain how the study size was arrived at	Not provided
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Adjustment: line 176-181 on page 11
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	Line 153-183 on page 9-11
		(*b*) Describe any methods used to examine subgroups and interactions	Line 172-174 on page 11
		(*c*) Explain how missing data were addressed	We excluded participants who had missing data (line 153-164 on page 10).
		(*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	N/A
		(*e*) Describe any sensitivity analyses	N/A
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	Line 153-164 on page 10
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1 Line 186-207 on page 11-12
		(b) Indicate number of participants with missing data for each variable of interest	N/A
		(c) *Cohort study*—Summarise follow-	N/A

		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	Table 1 Line 186-189 on page 11
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	Table2, Table 3 Line 209-240 on page 13-14
		(*b*) Report category boundaries when continuous variables were categorized	Table 1, Table 2, Table 3
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Table 3 Line 226-240 on page 14
Discussion			
Key results	18	Summarise key results with reference to study objectives	Line 244-262 on page 15-16
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	Line 299-354 on page 18-21
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Line 263-273 on page 16
Generalisability	21	Discuss the generalisability (external validity) of the study results	Line 345-354 on page 19
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	This study was funded by a Grant-in-Aid from the Ministry of Health, Labour and Welfare of Japan (Comprehensive Research on Cardiovascular and Life-style Related Disease: H22-Junkankitou [Seisyuu]-Ippan-012).

*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.

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