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

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16
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18 Fagerström Test for Nicotine Dependence, male worker

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6 22 **Abstract**
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9 23 **Objectives:** To examine the association between the smoking cessation attempts
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11 during the previous 12 months, motivator to quit smoking, and nicotine dependence
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13 level.
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17 26 **Design:** Cross-sectional study.
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20 27 **Setting:** A self-reported questionnaire about smoking habits, nicotine dependence level,
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22 and factors that people identify as motivators to quit smoking was administered to
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24 9,378 (as of October 1, 2011) employees working at a company located in Fukuoka
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26 Prefecture in Japan.
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30 31 **Participants:** A total of 2,264 male current smokers 20–69 years.
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34 32 **Primary and secondary outcome measures:** Nicotine dependence level assessed by
35
36 Fagerström Test for Nicotine Dependence (FTND), attempts to quit smoking during
37
38 the previous 12 months, and motivators for smoking cessation.
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42 35 **Results:** Nicotine dependence level of current smokers was negatively associated with
43
44 attempts to quit smoking during the previous 12 months. Motivators for smoking
45
46 cessation differed according to nicotine dependence levels. 'The rise in cigarette prices
47
48 since October 2010' as a motivator for smoking cessation increased significantly in
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50 medium nicotine dependence level (odds ratio (OR):1.44, 95% confidence interval
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6 40 (CI):1.09–1.90); however, this association was not statistically significant for
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9 41 individuals with high nicotine dependence (OR:1.24, 95% CI:0.80–1.92). ‘Feeling
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11
12 42 unhealthy’ was negatively and statistically significantly associated for both medium
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15 43 (OR:0.42, 95% CI:0.27–0.65) and high (OR:0.31, 95% CI:0.14–0.71) nicotine
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17
18 44 dependence levels. Trend associations assessed by assigning ordinal numbers a total
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21 45 score of FTND for those two motivators were statistically significant.

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23 46 **Conclusions:** For smokers with high and medium nicotine dependence level, more
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26 47 effective strategies aimed at encouraging smoking cessation are needed, such as policy
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29 48 interventions, which could include increasing tobacco taxes or stricter regulation of
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32 49 tobacco products.
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6 **52 Strengths and limitations**
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9 53 This study provides information on the relation between smoking cessation attempts,
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12 54 motivators for quitting smoking, and nicotine dependence level. However, no
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15 55 follow-up measures were taken to determine whether the study's respondents actually
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18 56 succeeded in their smoking cessation attempts.
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58 INTRODUCTION

59 Smoking is the leading avoidable cause of death worldwide. Many countries
60 take action to reduce smoking-related deaths by educating people about the harmful
61 effects of tobacco;¹ youth tobacco control, which is inclusive of passive smoking
62 control;² disseminating information on tobacco cessation programs; and increasing
63 tobacco taxes³ and prices.⁴ These policies and programs appear to be
64 effective—overall, the smoking rate is decreasing in both developed and developing
65 countries.^{5,6}

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

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

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6 76 Health and Nutrition Survey in Japan,⁸ the prevalence of regular smoking among men
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9 77 was 38.2%, 32.2% and 32.4% in 2009, 2010 and 2011, respectively, while that among
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12 78 women was 10.9%, 8.4%, and 9.7%, respectively. Thus, it appears that these increases
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15 79 in tobacco taxes may have contributed towards lower tobacco consumption in Japan,
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18 80 just as was reported in Western European countries.^{4,9} This may be in part attributable
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21 81 to the tax's dissuasion of many young people from smoking.⁵ However, the precise
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24 82 effect of this tax raise on people's intentions to quit smoking in Japan remains
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27 83 unknown.

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29 84 People quit smoking for numerous reasons other than the increase in cigarette
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32 85 prices, such as health problems associated with smoking and anti-smoking social
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35 86 pressures.^{10,11} Nevertheless, in order to implement effective strategies aimed at
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38 87 encouraging smoking cessation among smokers in Japan, it is important to determine
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41 88 the varying roles of factors leading to smoking cessation, including the intention to quit
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44 89 smoking, motivating factors for such intentions, the manner in which nicotine
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47 90 dependence levels affect these intentions, and motivating factors for such intentions.

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49 91 Currently, there is limited availability of information on this topic from current
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52 92 smokers who intend to stop smoking. A Japanese national survey carried out in 1999
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55 93 reported that personal health concerns and complications were major motivations for
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6 94 quitting smoking; however, this survey did not give details on the type of personal
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9 95 health complications/concerns smokers had.¹² Another survey¹¹ reported on the factors
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12 96 related to smoking cessation in former smokers in rural areas of Japan; however, this
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15 97 study did not include current smokers attempting to quit, a population for which there
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18 98 is little data available.¹³ Additionally, these studies^{11,13,14} were conducted before the
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21 99 substantial tobacco tax hike of October 2010, the effect of which has not yet been
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24 100 evaluated. Although high nicotine dependence has been shown to be a strong predictor
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27 101 of failure to quit smoking,¹⁵ the relationship between dependence levels and factors
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30 102 that people identify as motivators to quit smoking in Japan needs clarification. The
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33 103 present study, therefore, focused on the relationship between nicotine dependence level
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36 104 and factors that people identify as motivators to quit smoking among current smokers
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39 105 following the tobacco tax increase of October 2010.
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107 **METHODS AND PROCEDURES**

108 **Study population**

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

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6 112 Prefecture, Japan. Ethical approval for this study was obtained from the Institutional
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9 113 Review Committee of Fukuoka University.

10 11 12 114 **Data collection and measurements**

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15 115 The questionnaire began with questions regarding respondents' age, sex, and
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18 116 smoking habits. Individuals who had never smoked were not required to complete the
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21 117 rest of the questionnaire. Former smokers were asked to answer the following
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24 118 additional questions: (1) the brand of cigarettes that they used to smoke, (2) the age at
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27 119 which they ceased smoking (years), (3) their motivators for quitting smoking, and (4)
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30 120 any pharmacological therapy that they used to alleviate nicotine withdrawal. In this
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33 121 study, the definition of former smoker is any person who had once smoked but
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36 122 currently does not. Current smokers were asked to: (1) specify the brand of cigarettes
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39 123 that they usually smoked, (2) complete the Fagerström Test for Nicotine Dependence
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42 124 (FTND), (3) indicate their intention to quit smoking in the previous 12 months, (4)
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45 125 specify their motivation for quitting smoking, and (5) indicate whether they were
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48 126 taking any form of medication for alleviating nicotine withdrawal symptoms in people
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51 127 attempting to quit.

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53 128 The FTND,¹⁶ a standard questionnaire for assessing physical dependence on
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56 129 nicotine, consists of the following six items: (1) *How soon after you wake up do you*

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6 130 *smoke your first cigarette?* ('after 60 minutes', '31–60 minutes', '6–30 minutes',
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9 131 'within 5 minutes'); (2) *Do you find it difficult to refrain from smoking in places where*
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11 132 *it is forbidden, e.g., in church, at the library, cinema, etc.?* ('No/Yes'); (3) *Which*
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13 133 *cigarette would you hate most to give up?* ('the first one in the morning', 'all others');
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15 134 (4) *How many cigarettes per day do you smoke?* ('10 or less', '11–20', '21–30', '31 or
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17 135 more'); (5) *Do you smoke more frequently during the first hours of waking than during*
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19 136 *the rest of the day?* ('No/Yes'); and (6) *Do you smoke if you are so ill that you are in*
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21 137 *bed most of the day?* ('No/Yes'). In scoring the FTND, the four dichotomous items are
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23 138 scored as 0 or 1, while the two multiple-choice items are scored from 0 to 3. The items
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25 139 are then summed to yield a total score of 0–10. The higher the score, the more
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27 140 dependent the person is on nicotine.
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38 141 We assessed whether the following nine items were respondents' motivators
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40 142 for quitting smoking, to which they could answer 'yes' or 'no': (1) health problems
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42 143 experienced by relatives or friends, (2) personal health problems, (3) recommendation
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44 144 by physicians, (4) feeling unhealthy, (5) in the interests of better health, (6) their
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46 145 preferred brand of cigarettes was no longer available for sale, (7) the rise in cigarette
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48 146 prices after October 2010, (8) having a child (or grandchild), and (9) any other
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50 147 motivators.
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6 148 **Statistical analysis**
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9 149 Of the 9,378 candidates, 7,899 (84.2%), returned the questionnaire. Of the
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12 150 7,899 participants, we excluded 302 with missing data for sex, age, or smoking habits,
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15 151 76 aged < 19 because smoking is illegal among individuals under 20 years old in Japan,
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18 152 and 19 individuals aged 70 or older because of the small number. We excluded 2830
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21 153 females because of the low proportion of current smokers (320, 11.3%). Thus, 4,672
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24 154 men aged 20–69 years old were selected for analysis.

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26 155 Of the 4,672 men aged 20–69 years old that we surveyed, 1,116 individuals
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29 156 who had never smoked and 1,268 former smokers were excluded from the analysis, as
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32 157 FTND scores were available for current smokers only. Finally, we excluded 33 current
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35 158 smokers with missing data for any of FTND components. Thus, the data of 2,251
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38 159 current smokers were analysed in this study.

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41 160 Responses to the questionnaire were stratified according to respondents'
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44 161 nicotine dependence levels, as defined by the FTND: low (FTND score ≤ 3), middle
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47 162 (4–6), and high (≥ 7).

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50 163 First, the proportion of respondents who reported that they had attempted to
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53 164 quit smoking in the last year were expressed as percentages across nicotine dependence
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56 165 levels. Next, the proportion of the motivators for quitting smoking assessed by the nine
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6 166 items among the respondents who reported that they had attempted to quit smoking in
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9 167 the last year were expressed as percentages across nicotine dependence levels. Third,
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12 168 we selected three motivators for quitting smoking according to the number of
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15 169 respondents and examined the relation between nicotine dependence levels and each
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18 170 motivator for quitting smoking. A chi-square test was used to compare the proportion
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21 171 of respondents according to the three nicotine dependence levels. Multiple logistic
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24 172 regression analysis was used to estimate the odds ratios (OR) with 95% confidence
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27 173 intervals (CI) for the presence of each motivator to quit smoking in the previous 12
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30 174 months, with low nicotine dependence subjects as the reference. We adjusted for age
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33 175 (10-year categories, 20- to 29-year-old group as the reference) in the model. Trend
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36 176 associations were assessed by assigning ordinal numbers a total FTND score (0–10). A
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39 177 two-tailed *p*-value of less than 5% was considered statistically significant. All analyses
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42 178 were performed using SPSS version 19 (International Business Machines Corporation,
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45 179 Armonk, NY, USA).

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48 49 181 **RESULTS**

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52 182 Of the 2,251 current smokers included in our analyses, 913 (40.6%), 1,005
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55 183 (44.6%), and 333 (14.8%) had low, middle, and high FTND scores, respectively; 914
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6 184 (40.6%) reported that they had attempted to quit smoking in the last year (Table 1). The
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9 185 20–29 age group had the lowest proportion of respondents with high nicotine
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12 186 dependence (7.7%), while the 50–59 age group had the highest (22.2%). In general, the
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15 187 older groups had more respondents with high nicotine dependence. The 50–59 age
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18 188 group had the lowest proportion (18.0%) of respondents with low nicotine dependence,
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21 189 while the 20–29 age group had the highest (30.6%). Overall, the groups with older
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24 190 respondents had the lowest proportions of those with low nicotine dependence.

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26 191 The proportion of current smokers who had attempted to quit smoking within
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29 192 the previous 12 months among the low, middle, and high nicotine dependence groups
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32 193 was 48.0%, 37.1%, and 30.9%, respectively, a statistically significant difference. For
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35 194 each age group, the proportion of current smokers who had attempted to quit smoking
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38 195 within the previous 12 months was highest in the low nicotine dependence group. This
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41 196 proportion was lowest in the high nicotine dependence group. This trend was observed
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44 197 across all age groups. For the 30–39, 50–59, and 60–69 age groups, there were
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47 198 significant inverse relations between the proportion of current smokers who had
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50 199 attempted to quit smoking within the previous 12 months and nicotine dependence
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53 200 level. Among the middle and high nicotine dependence groups, the highest proportion
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56 201 of current smokers who had attempted to quit smoking within the previous 12 months
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6 202 was observed in the 20–29 age group (42.5% and 35.3%, respectively). Furthermore,
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9 203 in the group with low nicotine dependence, the highest proportion of current smokers
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12 204 who had attempted to quit smoking within the previous 12 months was observed in the
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15 205 60–69 age group (55.0%).
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18 206 [INSERT TABLE 1 ABOUT HERE]
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21 207 Table 2 shows the relationship between motivators and smoking cessation
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23 208 attempts within the previous 12 months according to respondents' nicotine dependence
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26 209 levels. About half of current smokers who had attempted smoking cessation reported
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29 210 that their motivations for doing so were 'for better health' and 'the rise in cigarette
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32 211 prices since October 2010', regardless of their nicotine dependence level. Only 10% of
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35 212 current smokers who had attempted smoking cessation reported that their reasons were
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38 213 for 'personal health problems', 'recommendation by physicians', and 'feeling
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41 214 unhealthy', regardless of their nicotine dependence level. In the high nicotine
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44 215 dependence group, a higher proportion of current smokers who had attempted smoking
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47 216 cessation within the previous 12 months reported the 'health problems of relatives or
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50 217 friends' and 'personal health problems' as two of their primary motivations for quitting
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53 218 smoking. However, the proportion of respondents who cited 'feeling unhealthy' and
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56 219 'for better health' was highest in the group with low nicotine dependence. Furthermore,
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6 220 in the group with low nicotine dependence, ‘the rise in cigarette prices since October
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9 221 2010’ was the least reported reason, while ‘for better health’ was the most reported. No
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12 222 respondent in the group with high nicotine dependence reported ‘having a child (or
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15 223 grandchild)’ as their motivation for quitting smoking.
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18 224 [INSERT TABLE 2 ABOUT HERE]
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21 225 Age-adjusted logistic regression analysis indicating the associations between
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23 226 selected three motivators for quitting smoking and nicotine dependence levels is shown
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26 227 in Table 3. ‘Feeling unhealthy’ was negatively associated with increases in nicotine
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29 228 dependence levels; the odds ratio (OR) was statistically significant for both medium
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32 229 (OR = 0.42, 95% CI = [0.27–0.65]) and high (OR = 0.31, 95% CI = [0.14–0.71])
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35 230 nicotine dependence levels. ‘For better health’ was also negatively associated with
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38 231 increases in medium nicotine dependence levels (OR = 0.71, 95% CI = [0.54–0.94]);
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41 232 however, this association was not statistically significant for individuals with high
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44 233 nicotine dependence (OR = 0.88, 95% CI = [0.57–1.36]). ‘The rise in cigarette prices
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47 234 since October 2010’ was significantly positively associated with an increase in medium
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50 235 nicotine dependence level (OR = 1.44, 95% CI = [1.09–1.90]); however, this
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53 236 association was not statistically significant for individuals with high nicotine
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56 237 dependence (OR = 1.24, 95% CI = [0.80–1.92]). Furthermore, trend associations
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6 238 assessed by assigning ordinal numbers a total score of FTND (0–10) for all three

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9 239 motivators were statistically significant.

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12 240 [INSERT TABLE 3 ABOUT HERE]

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18 242 **DISCUSSION**

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21 243 This study investigated the relations between nicotine dependence level,

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24 244 intention to quit smoking within the previous 12 months, and various motivators for

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27 245 quitting smoking among male workers in Japan. Three major findings emerged. First,

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30 246 nicotine dependence levels were negatively associated with smoking cessation

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33 247 attempts in the previous 12 months. Second, respondents' motivators for quitting

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36 248 smoking differed according to their nicotine dependence levels. Third, the proportion

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39 249 of smokers who reported 'the rise in cigarette prices since October 2010' as their

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42 250 motivator for quitting smoking increased with nicotine dependence level.

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45 251 A national survey in Japan in 1999 showed that 64.7% of current smokers and

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48 252 41.0% of former smokers acknowledged concerns or problems related to personal

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51 253 health as motivating factors for stopping smoking, respectively.¹² Furthermore, these

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54 254 motivators were ranked as the first and second leading factors for current and former

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57 255 smokers, respectively. Previous studies^{10,17} have also identified personal health

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6 256 concerns, including mild-to-serious personal health problems, and a fear of future
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9 257 illness in the absence of immediate health concerns as predominant motivators for
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12 258 smoking cessation. The present study revealed the relationship between smokers'
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15 259 nicotine dependence levels and motivators for quitting smoking.
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18 260 In Japan, smoking is still not as restricted in public spaces as it is in other
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21 261 countries.¹⁸ In addition, the price of tobacco remains lower than in most developed
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24 262 Western countries.⁷ However, in 2003, the Japanese national government enacted the
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27 263 Health Promotion Law, which requires managers of public facilities to make an effort
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30 264 to protect non-smokers from the environmental effects of tobacco smoke. Since then,
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33 265 greater restrictions have been placed on smoking in public spaces. In addition, the
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36 266 national government increased the tobacco tax in October 2010. The results of our
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39 267 study suggest that the individuals with medium and high nicotine dependence change
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42 268 their smoking cessation attempts according to the tobacco price. The present findings
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45 269 imply that further legislative changes aimed at increasing the cost of cigarettes could
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48 270 be effective in helping people quit smoking.

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50 271 This study has two major strengths. First, it was conducted after the massive
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53 272 tobacco tax increase in October 2010, the effects of which had not been evaluated in
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56 273 previous studies.^{11,13,14} The approximately 40% price increase constituted the highest in
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6 274 Japan within the last two decades. The prevalence of regular smoking among both men
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9 275 and women decreased significantly after the price increase.⁸ A one-year follow-up
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12 276 survey conducted in 2005 in Japan¹³ showed that 23.0% of smokers at the time
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15 277 reported that they had attempted to quit smoking at least once in the previous year. In a
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18 278 US study,¹⁹ 29% of respondents reported that the 2009 federal tobacco tax increase
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21 279 helped initiate their attempts to quit smoking. In this study, 40% of current smokers
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24 280 reported that they had attempted to quit smoking in the previous 12 months. It can be
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27 281 estimated that the increase in tobacco tax changed smoking cessation attitudes among
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30 282 the Japanese male workers included in the current study sample. Smoking cessation
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33 283 intentions may have been affected by the extent of the tax increase and the resulting
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36 284 rise in cigarette retail prices.^{3,4,6,9} Further examination of the influence of tobacco tax
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39 285 increases on smoking cessation in Japan is required.

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41 286 Second, this study revealed that the reasons for smoking cessation attempts
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44 287 vary according to nicotine dependence level. High nicotine dependence strongly
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47 288 predicted failure to quit smoking¹⁵ or the cost-effectiveness of smoking cessation
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50 289 programs.²⁰ As an employee who feels ready and capable of changing his behaviour
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53 290 has needs and preferences that significantly differ from one who is not at that stage,²¹
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56 291 workplace smoking cessation interventions that employ only one method²² do not
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6 292 generally have positive effects on the smoking cessation attempts of all employees.
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9 293 According to the current results, which showed that nicotine dependence is related to
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11 294 reasons for smoking cessation attempts, the efficacy of any smoking cessation
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13 295 intervention can be improved by considering the target group's level of nicotine
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15 296 dependence.
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20 297 Three major limitations were identified in this study. First, as this was a
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22 298 cross-sectional study, no follow-up measures were taken to determine whether
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24 299 respondents actually succeeded in their smoking cessation attempts. However, because
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26 300 this study was conducted after the tobacco tax increase in 2010, temporal relationships
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28 301 between the motivators and smoking cessation attempts do not affect the interpretation
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30 302 of the results of this study.
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38 303 In the US, longitudinal studies have been conducted on the effects of a 10%
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40 304 increase in the retail price of a pack of cigarettes (following the 2009 federal tobacco
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42 305 tax increase);¹⁹ however, in Japan, prior investigations of the relationship between
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44 306 retail prices of cigarettes and motivations for smoking cessation among current
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46 307 smokers in Japan were conducted before the tobacco tax increase of 2010.^{11,13,14} Thus,
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48 308 the effects of a one-off 40% increase in retail prices of cigarettes in Japan are still not
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50 309 sufficiently clear. Further, the association between the number of cigarettes smoked per
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6 310 day and smoking cessation has previously been elucidated;^{13,14,19,20} nevertheless,
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9 311 evaluations of the link between reasons behind smoking cessation and precise nicotine
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12 312 dependence are limited.⁴ Although temporal relationships between the tobacco tax
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15 313 increase and smoking cessation attempts must be carefully evaluated, the method
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18 314 employed for measuring nicotine dependence in this study was widely recognized. A
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21 315 longitudinal evaluation that considers the amount of tax increase, nicotine dependence,
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24 316 and smoking cessation intentions must be undertaken.

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26 317 The second limitation is that the study sample consisted of only male Japanese
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29 318 workers at a specific company. Therefore, the data analysed were not necessarily
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32 319 representative of the total population. However, we can perhaps assume that the current
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35 320 results have broader applicability to the development and design of workplace smoking
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38 321 cessation interventions, as all respondents in this study were employed on a full-time
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41 322 basis.

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44 323 Third, socio-economic status was not analysed in this study. It has previously
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47 324 been reported that socioeconomic status, especially income, is related to attitudes
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50 325 towards smoking cessation.^{19,23} However, the influence of wage differences on
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53 326 smoking cessation attempts could be disregarded in this study because an age-adjusted
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56 327 analysis (multiple logistic regression) was performed. Income levels are strongly
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6 328 related to respondents' age because of Japan's traditional seniority-based wage system,
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9 329 which had been adopted in the participating company. It has previously been
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12 330 demonstrated that lower education levels, income levels, and cigarette consumption are
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15 331 associated with perceptions that the tobacco tax increase is helpful in aiding smoking
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18 332 cessation.¹⁹

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21 333 In conclusion, effective smoking cessation strategies among smokers with
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24 334 high nicotine dependence levels are perhaps those involving stricter smoking
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27 335 regulation policies, such as yet another increase in tobacco tax or stricter regulation of
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30 336 tobacco products.

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6 **Contributors:** ST conceived and coordinated the study, participated in its design,
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8 collected and interpreted the data, conducted data analysis, and drafted the manuscript.

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11 YM participated in the study design and data collection, interpreted the data, and
12
13 helped to draft the manuscript. All the authors approved the final version of the paper.
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16
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18
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20
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25 **Competing interests:** All authors have completed the ICMJE uniform disclosure form
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27 at www.icmje.org/coi_disclosure.pdf and declare no competing interests.
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31 **Ethical approval:** The research protocol was approved by the Institutional Review
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33 Committee of Fukuoka University.
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37 **Data sharing:** No additional data are available.
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41 **Transparency:** ST affirms that the manuscript is an honest, accurate, and transparent
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43 account of the study being reported; that no important aspects of the study have been
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45 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*												P value
		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	
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*						Total n = 914	<i>P</i> for trend (crude)	<i>P</i> for trend (age adjusted)	
	Low ¹ n = 438		Medium ² n = 373		High ³ n = 103					
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) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	Line 109-112 on page 7-8
		<i>Case-control study</i> —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	
		<i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants	
		(b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed	N/A
		<i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Outcomes: Line 122-127 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) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed	N/A
		<i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed	
		<i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy	
		(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) <i>Cohort study</i> —Summarise follow-	N/A

		up time (eg, average and total amount)	
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure	
		<i>Cross-sectional study</i> —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	Table 2, 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).

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2 *Give information separately for cases and controls in case-control studies and, if applicable, for exposed and
3 unexposed groups in cohort and cross-sectional studies.
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6 **Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and
7 published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely
8 available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at
9 <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is
10 available at www.strobe-statement.org.
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For peer review only

BMJ Open

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

Journal:	<i>BMJ Open</i>
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Primary Subject Heading:	Smoking and tobacco
Secondary Subject Heading:	Public health, Smoking and tobacco
Keywords:	smoking cessation, nicotine dependence, motivator, tobacco tax increase, Fagerström Test for Cigarette Dependence, male workers

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6 **1 Reasons for smoking cessation attempts among Japanese**
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46 18 Keywords: smoking cessation, nicotine dependence, motivator, tobacco tax increase,

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53 21 Word count: 3244
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6 23 **Abstract**
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9 24 **Objectives:** To examine the association between smoking cessation attempts during
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12 25 the previous 12 months, motivators to quit smoking, and nicotine dependence levels
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15 26 among current male smoker after Japan's massive 2010 tobacco tax increase.
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18 27 **Design:** Cross-sectional study.
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21 28 **Setting:** A self-reported questionnaire about smoking habits, nicotine dependence
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23 29 levels, and factors identified as motivators to quit smoking was administered to 9,378
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26 30 employees working at a company located in Fukuoka Prefecture in Japan (as of
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29 31 October 1, 2011).
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32 32 **Participants:** A total of 2,251 male current smokers 20–69 years old.
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35 33 **Primary and secondary outcome measures:** Nicotine dependence level assessed by
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38 34 Fagerström Test for Cigarette Dependence (FTCD), smoking cessation attempts during
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41 35 the previous 12 months, and motivators for smoking cessation.
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44 36 **Results:** The proportion of current smokers who had attempted to quit smoking within
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47 37 the previous 12 months was 40.6%. Nicotine dependence level of current smokers was
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50 38 negatively associated with cessation attempts during the previous 12 months.
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53 39 Motivators for smoking cessation differed by nicotine dependence levels. 'The rise in
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56 40 cigarette prices since October 2010' as a smoking cessation motivator increased
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6 41 significantly at the medium nicotine dependence level (odds ratio (OR): 1.44, 95%
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9 42 confidence interval (CI): 1.09–1.90); however, this association was not statistically
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12 43 significant for individuals with high nicotine dependence (OR: 1.24, 95% CI: 0.80–
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14 44 1.92). ‘Feeling unhealthy’ was significantly negatively associated for both medium
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17 45 (OR: 0.42, 95% CI: 0.27–0.65) and high (OR: 0.31, 95% CI: 0.14–0.71) nicotine
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20 46 dependence levels. Trend associations assessed by assigning ordinal numbers to total
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23 47 FTCD score for those two motivators were statistically significant.

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26 48 **Conclusions:** The efficacy of smoking cessation strategies can be improved by
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29 49 considering the target group’s nicotine dependence level. For smokers with medium
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32 50 and high nicotine dependence levels, more effective strategies aimed at encouraging
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35 51 smoking cessation are needed, such as policy interventions including increasing
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6 55 **Strengths and limitations**
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9 56 This study provides information on the relationship between smoking cessation
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12 57 attempts, motivators for quitting smoking, and nicotine dependence levels for current
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15 58 smokers after Japan's massive 2010 tobacco tax hike. However, the impact of the tax
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18 59 increase on the cessation attempts was not fully investigated because current smokers
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21 60 before the tax increase were not included in the study. No follow-up measures were
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24 61 taken to determine whether the study's respondents actually succeeded in their
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27 62 smoking cessation attempts.
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64 INTRODUCTION

65 Smoking is the leading avoidable cause of death worldwide. Many countries
66 take action to reduce smoking-related deaths by educating people about tobacco's
67 harmful effects;¹ youth tobacco control, including passive smoking control;²
68 disseminating information on tobacco cessation programs; and increasing tobacco
69 taxes³ and prices.⁴ These policies and programmes appear to be effective—overall, the
70 smoking rate is decreasing in both developed and developing countries.^{5,6}

71 In the past two decades, Japan's tobacco tax has increased four times: in
72 December 1998, July 2003, July 2006, and October 2010. The first three increases
73 were relatively low—the price of an ordinary 20-cigarette pack increased by about 20–
74 30 JPY (about 0.2–0.3 USD) each time. Given the low taxes in 2008, tobacco was still
75 relatively inexpensive (priced at around 300 JPY [2–3 USD] per pack). Thus, smoking
76 prevalence among men remained high in comparison to other Organisation for
77 Economic Co-operation and Development (OECD) countries.⁷

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

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6 82 was 38.2%, 32.2% and 32.4% in 2009, 2010 and 2011, respectively, while that among
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9 83 women was 10.9%, 8.4%, and 9.7%, respectively. Thus, these increases in tobacco
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12 84 taxes may have contributed to lower tobacco consumption in Japan, just as was
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15 85 reported in Western European countries.^{4,9} This may be in part attributable to the tax's
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18 86 dissuasion of young people from smoking.⁵ However, the precise effect of this tax
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21 87 increase on people's smoking cessation attempts in Japan remains unknown.

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24 88 People quit smoking for numerous reasons other than cigarette price increases,
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27 89 such as health problems associated with smoking and anti-smoking social
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30 90 pressures.^{10,11} Nevertheless, in order to implement effective strategies aimed at
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33 91 encouraging smoking cessation among Japanese smokers, it is important to determine
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36 92 the varying roles of factors leading to smoking cessation, including the smoking
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39 93 cessation attempts, motivating factors for such attempts, and the manner in which
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42 94 nicotine dependence levels affect these attempts. Currently, there is limited availability
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45 95 of information on this topic from current smokers who attempted to quit smoking. A
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48 96 Japanese national survey carried out in 1999 reported that personal health concerns and
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51 97 complications were major motivations for quitting smoking; however, this survey did
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54 98 not provide details on the type of personal health complications/concerns smokers
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57 99 had.¹² Another survey¹¹ reported on the factors related to smoking cessation in former
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6 100 smokers in rural areas of Japan; however, this study did not include current smokers
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9 101 attempting to quit, a population for whom there is little data available.¹³ Additionally,
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12 102 these studies^{11,13,14} were conducted before the substantial tobacco tax hike of October
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15 103 2010, the effect of which has not yet been evaluated. In other words, there are few
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18 104 studies focusing on current smokers after Japan's 2010 tobacco tax hike. Although high
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21 105 nicotine dependence has been shown to be a strong predictor of failure to quit
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24 106 smoking,¹⁵ the relationship between dependence levels and factors identified as
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27 107 motivators to quit smoking in Japan needs clarification. The present study, therefore,
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30 108 investigates the relationship between nicotine dependence levels and smoking
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33 109 cessation attempts among the current smokers and factors that current smokers identify
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36 110 as motivators to quit smoking following the October 2010 tobacco tax increase.
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112 **METHODS AND PROCEDURES**

113 **Study population**

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

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6 118 of Fukuoka University.
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9 119 **Data collection and measurements**
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12 120 The questionnaire began with questions regarding respondents' age, sex, and
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14 121 smoking habits. Individuals who had never smoked were not required to complete the
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16 122 rest of the questionnaire. Former smokers were asked to answer the following
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18 123 additional questions: (1) the brand of cigarettes that they used to smoke, (2) the age at
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20 124 which they ceased smoking (years), (3) their motivators for quitting smoking, and (4)
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22 125 any pharmacological therapy used to alleviate nicotine withdrawal. In this study, the
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24 126 definition of former smoker is any person who had once smoked but currently does not.
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26 127 Current smokers were asked to (1) specify the cigarette brand usually smoked, (2)
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28 128 complete the Fagerström Test for Cigarette Dependence (FTCD), (3) whether they had
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30 129 attempted smoking cessation in the previous 12 months ('No/Yes'), (4) specify their
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32 130 motivators for quitting smoking, and (5) indicate whether they were taking any form of
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34 131 medication for alleviating nicotine withdrawal symptoms in people attempting to quit.
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46 132 The FTCD, formerly described as Fagerström Test for Nicotine Dependence
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48 133 (FTND),¹⁶ a standard questionnaire for assessing physical dependence on nicotine,
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50 134 consists of the following six items: (1) *How soon after you wake up do you smoke your*
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52 135 *first cigarette?* ('after 60 minutes', '31–60 minutes', '6–30 minutes', 'within 5
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6 136 minutes’); (2) *Do you find it difficult to refrain from smoking in places where it is*
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9 137 *forbidden, e.g. in church, at the library, cinema, etc.?* (‘No/Yes’); (3) *Which cigarette*
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12 138 *would you hate most to give up?* (‘the first one in the morning’, ‘all others’);
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15 139 (4) *How many cigarettes per day do you smoke?* (‘10 or less’, ‘11–20’, ‘21–30’, ‘31 or
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18 140 *more*’); (5) *Do you smoke more frequently during the first hours of waking than during*
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21 141 *the rest of the day?* (‘No/Yes’); and (6) *Do you smoke if you are so ill that you are in*
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24 142 *bed most of the day?* (‘No/Yes’). In scoring the FTCD, the four dichotomous items are
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27 143 scored as 0 or 1, while the two multiple-choice items are scored from 0 to 3. The items
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30 144 are then summed to yield a total score of 0–10. The higher the score, the more
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33 145 dependent the person is on nicotine.

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35 146 We assessed whether the following nine items were respondents’ motivators
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38 147 for quitting smoking with ‘yes’ or ‘no’ responses: (1) health problems experienced by
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41 148 relatives or friends, (2) personal health problems, (3) physician recommendation, (4)
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44 149 feeling unhealthy, (5) in the interests of better health, (6) their preferred brand of
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47 150 cigarettes was no longer available for sale, (7) the rise in cigarette prices after October
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50 151 2010, (8) having a child (or grandchild), and (9) any other motivators.

52 **Statistical analysis**

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55 153 Of the 9,378 candidates, 7,899 (84.2%), returned the questionnaire. Of the
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6 154 7,899 participants, we excluded 302 with missing data for sex, age, or smoking habits,
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9 155 76 aged < 19 because smoking is illegal among individuals under 20 years old in Japan,
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12 156 and 19 individuals aged 70 or older because of the small number. We excluded 2830
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15 157 females because of their low proportion of current smokers (320, 11.3%). Thus, 4,672
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18 158 men aged 20–69 years old were selected for analysis.

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21 159 Of the 4,672 men aged 20–69 years old surveyed, 1,116 individuals who had
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24 160 never smoked and 1,268 former smokers were excluded from the analysis, since FTCD
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27 161 scores were available for current smokers only. Finally, we excluded 33 current
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30 162 smokers with missing data for any of FTCD components. Thus, the data of 2,251
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33 163 current smokers were analysed in this study.

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35 164 Responses to the questionnaire were stratified according to respondents'
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38 165 nicotine dependence levels, as defined by the FTCD: low (FTCD score ≤ 3), middle
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41 166 (4–6), and high (≥ 7). First, the proportion of respondents who reported that they had
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44 167 attempted smoking cessation in the previous 12 months (afterward, current smokers
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47 168 with cessation attempts) were expressed as percentages across nicotine dependence
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50 169 levels. Next, the proportion of the motivators for quitting smoking assessed by the nine
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53 170 items among the current smokers with cessation attempts was expressed as percentages
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56 171 across nicotine dependence levels. Third, we selected three motivators for quitting
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6 172 smoking by number of respondents and examined the relationships between nicotine
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9 173 dependence levels and each motivator for quitting smoking. A chi-square test was used
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12 174 to compare the proportion of respondents by the three nicotine dependence levels.
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15 175 Multiple logistic regression analysis estimated the odds ratios (OR) with 95%
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18 176 confidence intervals (CI) for the presence of each motivator to quit smoking in the
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21 177 previous 12 months, with low nicotine dependence subjects as the reference. We
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24 178 adjusted for age (10-year categories, 20- to 29-year-old group as the reference) in the
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27 179 model. Trend associations were assessed by assigning ordinal numbers to a total FTCD
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30 180 score (0–10). A two-tailed *p*-value of less than 5% was considered statistically
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33 181 significant. All analyses were performed using SPSS version 19 (International
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35 182 Business Machines Corporation, Armonk, NY, USA).

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41 184 **RESULTS**

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44 185 Of the 2,251 current smokers included in our analyses, 913 (40.6%), 1,005
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47 186 (44.6%), and 333 (14.8%) had low, middle, and high FTCD scores, respectively; 914
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50 187 (40.6%) reported that they had attempted smoking cessation in the previous 12 months
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53 188 (Table 1). The 20–29 age group had the lowest proportion of respondents with high
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56 189 nicotine dependence (7.5%), while the 50–59 age group had the highest (21.4%). In

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6 190 general, the older groups had more respondents with high nicotine dependence. The
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9 191 50–59 age group had the lowest proportion (33.5%) of respondents with low nicotine
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12 192 dependence, while the 20–29 age group had the highest (46.8%). Overall, the groups
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15 193 with older respondents had the lowest proportions of those with low nicotine
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18 194 dependence.

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21 195 The proportion of current smokers with cessation attempts among the low,
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23 196 middle, and high nicotine dependence groups was 48.0%, 37.1%, and 30.9%,
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26 197 respectively, a statistically significant difference. For each age group, the proportion of
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29 198 current smokers with cessation attempts was highest in the low nicotine dependence
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32 199 group. This proportion was lowest in the high nicotine dependence group. This trend
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35 200 was observed across all age groups. For the 30–39, 50–59, and 60–69 age groups, there
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38 201 were significant inverse relations between the proportion of current smokers with
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41 202 cessation attempts and nicotine dependence level. Among the middle and high nicotine
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44 203 dependence groups, the highest proportion of current smokers with cessation attempts
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47 204 was observed in the 20–29 age group (42.5% and 35.3%, respectively). Furthermore,
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50 205 in the group with low nicotine dependence, the highest proportion of current smokers
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53 206 with cessation attempts was observed in the 60–69 age group (55.0%).

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55 207 [INSERT TABLE 1 ABOUT HERE]
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6 208 Table 2 shows the relationship between motivators and smoking cessation
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9 209 attempts within the previous 12 months by respondents' nicotine dependence levels.
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11 210 About half of current smokers with cessation attempts reported that their motivators
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14 211 were 'for better health' and 'the rise in cigarette prices since October 2010', regardless
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17 212 of their nicotine dependence level. Only 10% of current smokers with cessation
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20 213 attempts reported that their reasons were for 'personal health problems', 'physician
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23 214 recommendation', and 'feeling unhealthy', regardless of their nicotine dependence
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26 215 level. In the high nicotine dependence group, a higher proportion of current smokers
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29 216 with cessation attempts reported the 'health problems of relatives or friends' and
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32 217 'personal health problems' as two of their primary motivators for quitting smoking.
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35 218 However, the proportion of respondents who cited 'feeling unhealthy' and 'for better
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38 219 health' was highest in the group with low nicotine dependence. Furthermore, in the
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41 220 group with low nicotine dependence, 'the rise in cigarette prices since October 2010'
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44 221 was the least reported reason, while 'for better health' was the most reported. No
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47 222 respondent in the group with high nicotine dependence reported 'having a child (or
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50 223 grandchild)' as their motivator for quitting smoking.

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52 224 [INSERT TABLE 2 ABOUT HERE]
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55 225 Age-adjusted logistic regression analysis indicating the associations between
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6 226 the three selected motivators for quitting smoking and nicotine dependence levels is
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9 227 shown in Table 3. 'Feeling unhealthy' was negatively associated with increases in
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12 228 nicotine dependence levels; the odds ratio (OR) was statistically significant for both
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15 229 medium (OR = 0.42, 95% CI = [0.27–0.65]) and high (OR = 0.31, 95% CI = [0.14–
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18 230 0.71]) nicotine dependence levels. 'For better health' was also negatively associated
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21 231 with increases in medium nicotine dependence levels (OR = 0.71, 95% CI = [0.54–
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24 232 0.94]); however, this association was not statistically significant for individuals with
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27 233 high nicotine dependence (OR = 0.88, 95% CI = [0.57–1.36]). 'The rise in cigarette
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30 234 prices since October 2010' was significantly positively associated with an increase in
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33 235 medium nicotine dependence level (OR = 1.44, 95% CI = [1.09–1.90]); however, this
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36 236 association was not statistically significant for individuals with high nicotine
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39 237 dependence (OR = 1.24, 95% CI = [0.80–1.92]). Furthermore, trend associations
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42 238 assessed by assigning ordinal numbers to a total score of FTCD (0–10) for all three
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45 239 motivators were statistically significant.

46 [INSERT TABLE 3 ABOUT HERE]

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50 51 52 242 **DISCUSSION**

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55 243 This study investigated the relationships between nicotine dependence level,
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6 244 cessation attempts within the previous 12 months, and various motivators for quitting
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9 245 smoking among male current smokers after Japan's 2010 tobacco tax hike. Three major
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12 246 findings emerged. First, 40.6% of current smokers had attempted smoking cessation
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15 247 within the previous 12 months and nicotine dependence levels were negatively
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18 248 associated with attempts. Second, respondents' motivators for quitting smoking
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21 249 differed according to their nicotine dependence levels. Third, the proportion of current
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24 250 smokers with cessation attempts who reported 'the rise in cigarette prices since
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27 251 October 2010' as their motivator for quitting smoking increased with nicotine
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30 252 dependence level.

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32 253 A national survey in Japan in 1999 showed that 64.7% of current smokers and
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35 254 41.0% of former smokers acknowledged concerns or problems related to personal
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38 255 health as motivating factors for stopping smoking, respectively.¹² Furthermore, these
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41 256 motivators were ranked as the first and second leading factors for current and former
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44 257 smokers, respectively. Previous studies^{10,17} have also identified personal health
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47 258 concerns, including mild-to-serious personal health problems, and a fear of future
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50 259 illness in the absence of immediate health concerns as predominant motivators for
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53 260 smoking cessation. The present study revealed the relationship between smokers'
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56 261 nicotine dependence levels and motivators for quitting smoking.
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6 262 In Japan, smoking is still not as restricted in public spaces as it is in other
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9 263 countries.¹⁸ In addition, the price of tobacco remains lower than in most developed
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12 264 Western countries.⁷ However, in 2003, the Japanese national government enacted the
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15 265 Health Promotion Law, which requires public facility managers to endeavour to protect
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18 266 non-smokers from the environmental effects of tobacco smoke. Since then, greater
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21 267 restrictions have been placed on smoking in public spaces. In addition, the national
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24 268 government increased the tobacco tax in October 2010. The results of our study
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27 269 suggest that individuals with medium and high nicotine dependence attempted
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30 270 smoking cessation by the tobacco price. The present findings imply that further
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33 271 legislative changes increasing the cost of cigarettes could be effective in helping
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36 272 people quit smoking.

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38 273 This study has two major strengths. First, it was conducted after the massive
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41 274 tobacco tax increase in October 2010, the effects of which had not been evaluated in
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44 275 previous studies.^{11,13,14} The approximately 40% price increase constituted the highest in
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47 276 Japan within the last two decades. The prevalence of regular smoking among both men
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50 277 and women decreased significantly after the price increase.⁸ A one-year follow-up
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53 278 survey conducted from 2005 to 2006 in Japan¹⁴ showed that 23.0% of smokers at the
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56 279 time reported that they had attempted to quit smoking at least once in the previous year.
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6 280 In a U. S. study,¹⁹ 29% of respondents reported that the 2009 federal tobacco tax
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9 281 increase helped initiate their attempts to quit smoking. In this study, 40% of current
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11 282 smokers reported that they had attempted smoking cessation in the previous 12 months.
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14 283 It can be hypothesized that the increase in tobacco tax changed smoking cessation
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17 284 attempts among the Japanese male workers included in the current study sample.
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20 285 Smoking cessation attempts may have been affected by the extent of the tax increase
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23 286 and the resulting rise in cigarette retail prices.^{3,4,6,9} Further examination of the
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26 287 influence of tobacco tax increases on smoking cessation in Japan is required.
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29 288 Second, this study revealed that the reasons for smoking cessation attempts
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32 289 vary by nicotine dependence level. High nicotine dependence strongly predicted failure
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35 290 to quit smoking¹⁵ or the cost-effectiveness of smoking cessation programs.²⁰ As an
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38 291 employee who feels ready and capable of changing his behaviour has needs and
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41 292 preferences that significantly differ from one who is not at that stage,²¹ workplace
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44 293 smoking cessation interventions that employ only one method²² do not generally have
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47 294 positive effects on the smoking cessation attempts of all employees. The current results
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50 295 showed that nicotine dependence is related to motivators for smoking cessation
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53 296 attempts. Thus, the efficacy of any smoking cessation intervention can be improved by
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56 297 considering the target group's level of nicotine dependence.
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6 298 Three major limitations were identified in this study. First, as this was a
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9 299 cross-sectional study conducted retrospectively, the subjects may not recall all attempts
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11 300 for smoking cessation in the previous 12 months. However, we can interpret that their
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14 301 intention to quit is low when the subjects do not recall their attempts. Therefore,
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17 302 excluding the quit attempts that the subjects could not recall does not affect the
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20 303 interpretation of the study results. This study was conducted in October 2011 and
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23 304 analysed current smokers at that time because physical dependence on nicotine
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26 305 assessed by FTCD was available for current smokers only. The temporal relationship
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29 306 between the exposure and the outcome should be evaluated cautiously. However,
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32 307 because the subjects of this study were current smokers after the tobacco tax increase
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35 308 in 2010, we can interpret that fluctuation in nicotine dependence is negligible. Thus,
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38 309 temporal relationships between nicotine dependence level and the motivators and
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41 310 smoking cessation attempts do not affect the interpretation of the study results.

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44 311 In the U. S., longitudinal studies have been conducted on the effects of a 10%
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47 312 increase in the retail price of a pack of cigarettes (following the 2009 federal tobacco
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50 313 tax increase);¹⁹ however, in Japan, prior investigations of the relationship between
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53 314 retail prices of cigarettes and motivators for smoking cessation among current smokers
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56 315 in Japan were conducted before the 2010 tobacco tax increase.^{11,13,14} Thus, the effects
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6 316 of a single 40% increase in retail prices of cigarettes in Japan are still not sufficiently
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9 317 clear. Further, the association between the number of cigarettes smoked per day and
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12 318 smoking cessation has previously been elucidated;^{13,14,19,20} nevertheless, evaluations of
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15 319 the link between reasons behind smoking cessation and precise nicotine dependence
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18 320 are limited.⁴ Although temporal relationships between the tobacco tax increase and
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21 321 smoking cessation attempts must be carefully evaluated, the method employed for
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24 322 measuring nicotine dependence in this study was widely recognized. A longitudinal
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27 323 evaluation that considers the amount of tax increase, nicotine dependence, and
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30 324 smoking cessation attempts must be undertaken.

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32 325 The second limitation is that the study sample consisted of only male Japanese
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35 326 workers at a specific company. Therefore, the data analysed were not necessarily
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38 327 representative of the total population. However, we can perhaps assume that the current
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41 328 results have broader applicability to the development and design of workplace smoking
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44 329 cessation interventions, as all respondents in this study were employed on a full-time
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47 330 basis.

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49 331 Third, socio-economic status was not analysed in this study. It has previously
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52 332 been reported that socioeconomic status, especially income, is related to attitudes
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55 333 towards smoking cessation.^{19,23} However, the influence of wage differences on
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6 334 smoking cessation challenges could be disregarded in this study because an
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9 335 age-adjusted analysis (multiple logistic regression) was performed. Income levels are
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12 336 strongly related to respondents' age because of Japan's traditional seniority-based wage
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15 337 system, which had been adopted in the participating company. It has previously been
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18 338 demonstrated that lower education levels, income levels, and cigarette consumption are
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21 339 associated with perceptions that the tobacco tax increase is helpful in aiding smoking
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24 340 cessation.¹⁹

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26 341 In conclusion, the efficacy of smoking cessation strategies can be improved by
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29 342 considering the target group's nicotine dependence level. A longitudinal evaluation of
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32 343 strategies focused on current smokers with high nicotine dependence levels should be
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35 344 undertaken.

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6 **Contributors:** ST conceived and coordinated the study, participated in its design,
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8 collected and interpreted the data, conducted data analysis, and drafted the manuscript.

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11 YM participated in the study design and data collection, interpreted the data, and
12
13 helped to draft the manuscript. Both authors approved the final version of the paper.
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16
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25 **Competing interests:** All authors have completed the ICMJE uniform disclosure form
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27 at www.icmje.org/coi_disclosure.pdf and declare no competing interests.
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31 **Ethical approval:** The research protocol was approved by the Institutional Review
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33 Committee of Fukuoka University.
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37 **Data sharing:** No additional data are available.
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41 **Transparency:** ST affirms that the manuscript is an honest, accurate, and transparent
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43 account of the study being reported, that no important aspects of the study have been
44
45 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*												P value		
		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			
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*						Total n = 914	P for trend (crude)	P for trend (age adjusted)	
	Low ¹ n = 438		Medium ² n = 373		High ³ n = 103					
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) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	Line 114-116 on page 7-8
		<i>Case-control study</i> —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	
		<i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants	
		(b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed	N/A
		<i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Outcomes: Line 127-131 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) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed <i>Cross-sectional study</i> —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) <i>Cohort study</i> —Summarise follow-	N/A

		up time (eg, average and total amount)	
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure	
		<i>Cross-sectional study</i> —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	Table 2, 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).

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2 *Give information separately for cases and controls in case-control studies and, if applicable, for exposed and
3 unexposed groups in cohort and cross-sectional studies.
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6 **Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and
7 published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely
8 available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at
9 <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is
10 available at www.strobe-statement.org.
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For peer review only

BMJ Open

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

Journal:	<i>BMJ Open</i>
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Primary Subject Heading:	Smoking and tobacco
Secondary Subject Heading:	Public health, Smoking and tobacco
Keywords:	smoking cessation, nicotine dependence, motivator, tobacco tax increase, Fagerström Test for Cigarette Dependence, male workers

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46 18 Keywords: smoking cessation, nicotine dependence, motivator, tobacco tax increase,

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6 23 **Abstract**
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9 24 **Objectives:** To examine the association between smoking cessation attempts during
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12 25 the previous 12 months, motivators to quit smoking, and nicotine dependence levels
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15 26 among current male smoker after Japan's massive 2010 tobacco tax increase.
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18 27 **Design:** Cross-sectional study.
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21 28 **Setting:** A self-reported questionnaire about smoking habits, nicotine dependence
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23 29 levels, and factors identified as motivators to quit smoking was administered to 9,378
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26 30 employees working at a company located in Fukuoka Prefecture in Japan (as of
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29 31 October 1, 2011).
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32 32 **Participants:** A total of 2,251 male current smokers 20–69 years old.
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35 33 **Primary and secondary outcome measures:** Nicotine dependence level assessed by
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38 34 Fagerström Test for Cigarette Dependence (FTCD), smoking cessation attempts during
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41 35 the previous 12 months, and motivators for smoking cessation.
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44 36 **Results:** The proportion of current smokers who had attempted to quit smoking within
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47 37 the previous 12 months was 40.6%. Nicotine dependence level of current smokers was
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50 38 negatively associated with cessation attempts during the previous 12 months.
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53 39 Motivators for smoking cessation differed by nicotine dependence levels. 'The rise in
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6 41 significantly at the medium nicotine dependence level (odds ratio (OR): 1.44, 95%
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9 42 confidence interval (CI): 1.09–1.90); however, this association was not statistically
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12 43 significant for individuals with high nicotine dependence (OR: 1.24, 95% CI: 0.80–
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15 44 1.92). ‘Feeling unhealthy’ was significantly negatively associated for both medium
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18 45 (OR: 0.42, 95% CI: 0.27–0.65) and high (OR: 0.31, 95% CI: 0.14–0.71) nicotine
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21 46 dependence levels. Trend associations assessed by assigning ordinal numbers to total
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24 47 FTCD score for those two motivators were statistically significant.

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26 48 **Conclusions:** The efficacy of smoking cessation strategies can be improved by
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29 49 considering the target group’s nicotine dependence level. For smokers with medium
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32 50 and high nicotine dependence levels, more effective strategies aimed at encouraging
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6 55 **Strengths and limitations**
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9 56 This study provides information on the relationship between smoking cessation
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12 57 attempts, motivators for quitting smoking, and nicotine dependence levels for current
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14 58 smokers after Japan's massive 2010 tobacco tax hike. However, the impact of the tax
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17 59 increase on the cessation attempts was not fully investigated because current smokers
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20 60 before the tax increase were not included in the study. No follow-up measures were
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23 61 taken to determine whether the study's respondents actually succeeded in their
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64 INTRODUCTION

65 Smoking is the leading avoidable cause of death worldwide. Many countries
66 take action to reduce smoking-related deaths by educating people about tobacco's
67 harmful effects;¹ youth tobacco control, including passive smoking control;²
68 disseminating information on tobacco cessation programs; and increasing tobacco
69 taxes³ and prices.⁴ These policies and programmes appear to be effective—overall, the
70 smoking rate is decreasing in both developed and developing countries.^{5,6}

71 In the past two decades, Japan's tobacco tax has increased four times: in
72 December 1998, July 2003, July 2006, and October 2010. The first three increases
73 were relatively low—the price of an ordinary 20-cigarette pack increased by about 20–
74 30 JPY (about 0.2–0.3 USD) each time. Given the low taxes in 2008, tobacco was still
75 relatively inexpensive (priced at around 300 JPY [2–3 USD] per pack). Thus, smoking
76 prevalence among men remained high in comparison to other Organisation for
77 Economic Co-operation and Development (OECD) countries.⁷

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

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6 82 was 38.2%, 32.2% and 32.4% in 2009, 2010 and 2011, respectively, while that among
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9 83 women was 10.9%, 8.4%, and 9.7%, respectively. Thus, these increases in tobacco
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12 84 taxes may have contributed to lower tobacco consumption in Japan, just as was
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15 85 reported in Western European countries.^{4,9} This may be in part attributable to the tax's
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18 86 dissuasion of young people from smoking.⁵ However, the precise effect of this tax
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21 87 increase on people's smoking cessation attempts in Japan remains unknown.

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24 88 People quit smoking for numerous reasons other than cigarette price increases,
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27 89 such as health problems associated with smoking and anti-smoking social
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30 90 pressures.^{10,11} Nevertheless, in order to implement effective strategies aimed at
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33 91 encouraging smoking cessation among Japanese smokers, it is important to determine
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36 92 the varying roles of factors leading to smoking cessation, including the smoking
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39 93 cessation attempts, motivating factors for such attempts, and the manner in which
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42 94 nicotine dependence levels affect these attempts. Currently, there is limited availability
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45 95 of information on this topic from current smokers who attempted to quit smoking. A
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48 96 Japanese national survey carried out in 1999 reported that personal health concerns and
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51 97 complications were major motivations for quitting smoking; however, this survey did
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54 98 not provide details on the type of personal health complications/concerns smokers
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57 99 had.¹² Another survey¹¹ reported on the factors related to smoking cessation in former
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6 100 smokers in rural areas of Japan; however, this study did not include current smokers
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9 101 attempting to quit, a population for whom there is little data available.¹³ Additionally,
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12 102 these studies^{11,13,14} were conducted before the substantial tobacco tax hike of October
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15 103 2010, the effect of which has not yet been evaluated. In other words, there are few
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18 104 studies focusing on current smokers after Japan's 2010 tobacco tax hike. Although high
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21 105 nicotine dependence has been shown to be a strong predictor of failure to quit
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24 106 smoking,¹⁵ the relationship between dependence levels and factors identified as
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27 107 motivators to quit smoking in Japan needs clarification. The present study, therefore,
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30 108 investigates the relationship between nicotine dependence levels and smoking
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33 109 cessation attempts among the current smokers and factors that current smokers identify
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36 110 as motivators to quit smoking following the October 2010 tobacco tax increase.
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112 **METHODS AND PROCEDURES**

113 **Study population**

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

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9 119 **Data collection and measurements**
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12 120 The questionnaire began with questions regarding respondents' age, sex, and
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14 121 smoking habits. Individuals who had never smoked were not required to complete the
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16 122 rest of the questionnaire. Former smokers were asked to answer the following
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18 123 additional questions: (1) the brand of cigarettes that they used to smoke, (2) the age at
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20 124 which they ceased smoking (years), (3) their motivators for quitting smoking, and (4)
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22 125 any pharmacological therapy used to alleviate nicotine withdrawal. In this study, the
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24 126 definition of former smoker is any person who had once smoked but currently does not.
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26 127 Current smokers were asked to (1) specify the cigarette brand usually smoked, (2)
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28 128 complete the Fagerström Test for Cigarette Dependence (FTCD), (3) whether they had
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30 129 attempted smoking cessation in the previous 12 months ('No/Yes'), (4) specify their
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32 130 motivators for quitting smoking, and (5) indicate whether they were taking any form of
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34 131 medication for alleviating nicotine withdrawal symptoms in people attempting to quit.
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46 132 The FTCD, formerly described as Fagerström Test for Nicotine Dependence
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48 133 (FTND),¹⁶ a standard questionnaire for assessing physical dependence on nicotine,
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50 134 consists of the following six items: (1) *How soon after you wake up do you smoke your*
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52 135 *first cigarette?* ('after 60 minutes', '31–60 minutes', '6–30 minutes', 'within 5
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6 136 minutes’); (2) *Do you find it difficult to refrain from smoking in places where it is*
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9 137 *forbidden, e.g. in church, at the library, cinema, etc.?* (‘No/Yes’); (3) *Which cigarette*
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12 138 *would you hate most to give up?* (‘the first one in the morning’, ‘all others’);
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15 139 (4) *How many cigarettes per day do you smoke?* (‘10 or less’, ‘11–20’, ‘21–30’, ‘31 or
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18 140 *more*’); (5) *Do you smoke more frequently during the first hours of waking than during*
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21 141 *the rest of the day?* (‘No/Yes’); and (6) *Do you smoke if you are so ill that you are in*
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24 142 *bed most of the day?* (‘No/Yes’). In scoring the FTCD, the four dichotomous items are
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27 143 scored as 0 or 1, while the two multiple-choice items are scored from 0 to 3. The items
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30 144 are then summed to yield a total score of 0–10. The higher the score, the more
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33 145 dependent the person is on nicotine.

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35 146 We assessed whether the following nine items were respondents’ motivators
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38 147 for quitting smoking with ‘yes’ or ‘no’ responses: (1) health problems experienced by
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41 148 relatives or friends, (2) personal health problems, (3) physician recommendation, (4)
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44 149 feeling unhealthy, (5) in the interests of better health, (6) their preferred brand of
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47 150 cigarettes was no longer available for sale, (7) the rise in cigarette prices after October
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50 151 2010, (8) having a child (or grandchild), and (9) any other motivators.

52 **Statistical analysis**

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55 153 Of the 9,378 candidates, 7,899 (84.2%), returned the questionnaire. Of the
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6 154 7,899 participants, we excluded 302 with missing data for sex, age, or smoking habits,
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9 155 76 aged < 19 because smoking is illegal among individuals under 20 years old in Japan,
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12 156 and 19 individuals aged 70 or older because of the small number. We excluded 2830
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15 157 females because of their low proportion of current smokers (320, 11.3%). Thus, 4,672
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18 158 men aged 20–69 years old were selected for analysis.

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21 159 Of the 4,672 men aged 20–69 years old surveyed, 1,116 individuals who had
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24 160 never smoked and 1,268 former smokers were excluded from the analysis, since FTCD
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27 161 scores were available for current smokers only. Finally, we excluded 33 current
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30 162 smokers with missing data for any of FTCD components and four current smokers
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33 163 with missing data for cessation attempts or motivators for quitting smoking. Thus, the
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36 164 data of 2,251 current smokers were analysed in this study.

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38 165 Responses to the questionnaire were stratified according to respondents'
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41 166 nicotine dependence levels, as defined by the FTCD: low (FTCD score ≤ 3), middle
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44 167 (4–6), and high (≥ 7). First, the proportion of respondents who reported that they had
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47 168 attempted smoking cessation in the previous 12 months (afterward, current smokers
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50 169 with cessation attempts) were expressed as percentages across nicotine dependence
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53 170 levels. Next, the proportion of the motivators for quitting smoking assessed by the nine
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56 171 items among the current smokers with cessation attempts was expressed as percentages
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6 172 across nicotine dependence levels. Third, we selected three motivators for quitting
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9 173 smoking by number of respondents and examined the relationships between nicotine
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12 174 dependence levels and each motivator for quitting smoking. A chi-square test was used
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15 175 to compare the proportion of respondents by the three nicotine dependence levels.
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18 176 Multiple logistic regression analysis estimated the odds ratios (OR) with 95%
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21 177 confidence intervals (CI) for the presence of each motivator to quit smoking in the
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24 178 previous 12 months, with low nicotine dependence subjects as the reference. We
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27 179 adjusted for age (10-year categories, 20- to 29-year-old group as the reference) in the
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30 180 model. Trend associations were assessed by assigning ordinal numbers to a total FTCD
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33 181 score (0–10). A two-tailed *p*-value of less than 5% was considered statistically
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36 182 significant. All analyses were performed using SPSS version 19 (International
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38 183 Business Machines Corporation, Armonk, NY, USA).

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185 **RESULTS**

186 Of the 2,251 current smokers included in our analyses, 913 (40.6%), 1,005
187 (44.6%), and 333 (14.8%) had low, middle, and high FTCD scores, respectively; 914
188 (40.6%) reported that they had attempted smoking cessation in the previous 12 months
189 (Table 1). The 20–29 age group had the lowest proportion of respondents with high

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6 190 nicotine dependence (7.5%), while the 50–59 age group had the highest (21.4%). In
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9 191 general, the older groups had more respondents with high nicotine dependence. The
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12 192 50–59 age group had the lowest proportion (33.5%) of respondents with low nicotine
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15 193 dependence, while the 20–29 age group had the highest (46.8%). Overall, the groups
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18 194 with older respondents had the lowest proportions of those with low nicotine
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21 195 dependence.

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23 196 The proportion of current smokers with cessation attempts among the low,
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26 197 middle, and high nicotine dependence groups was 48.0%, 37.1%, and 30.9%,
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29 198 respectively, a statistically significant difference. For each age group, the proportion of
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32 199 current smokers with cessation attempts was highest in the low nicotine dependence
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35 200 group. This proportion was lowest in the high nicotine dependence group. This trend
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38 201 was observed across all age groups. For the 30–39, 50–59, and 60–69 age groups, there
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41 202 were significant inverse relations between the proportion of current smokers with
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44 203 cessation attempts and nicotine dependence level. Among the middle and high nicotine
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47 204 dependence groups, the highest proportion of current smokers with cessation attempts
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50 205 was observed in the 20–29 age group (42.5% and 35.3%, respectively). Furthermore,
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53 206 in the group with low nicotine dependence, the highest proportion of current smokers
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56 207 with cessation attempts was observed in the 60–69 age group (55.0%).
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9 209 Table 2 shows the relationship between motivators and smoking cessation
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11 210 attempts within the previous 12 months by respondents' nicotine dependence levels.
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14 211 About half of current smokers with cessation attempts reported that their motivators
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17 212 were 'for better health' and 'the rise in cigarette prices since October 2010', regardless
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20 213 of their nicotine dependence level. Only 10% of current smokers with cessation
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23 214 attempts reported that their reasons were for 'personal health problems', 'physician
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26 215 recommendation', and 'feeling unhealthy', regardless of their nicotine dependence
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29 216 level. In the high nicotine dependence group, a higher proportion of current smokers
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32 217 with cessation attempts reported the 'health problems of relatives or friends' and
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35 218 'personal health problems' as two of their primary motivators for quitting smoking.
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38 219 However, the proportion of respondents who cited 'feeling unhealthy' and 'for better
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41 220 health' was highest in the group with low nicotine dependence. Furthermore, in the
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44 221 group with low nicotine dependence, 'the rise in cigarette prices since October 2010'
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47 222 was the least reported reason, while 'for better health' was the most reported. No
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50 223 respondent in the group with high nicotine dependence reported 'having a child (or
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53 224 grandchild)' as their motivator for quitting smoking.
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55 225 [INSERT TABLE 2 ABOUT HERE]
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226 Age-adjusted logistic regression analysis indicating the associations between
227 the three selected motivators for quitting smoking and nicotine dependence levels is
228 shown in Table 3. ‘Feeling unhealthy’ was negatively associated with increases in
229 nicotine dependence levels; the odds ratio (OR) was statistically significant for both
230 medium (OR = 0.42, 95% CI = [0.27–0.65]) and high (OR = 0.31, 95% CI = [0.14–
231 0.71]) nicotine dependence levels. ‘For better health’ was also negatively associated
232 with increases in medium nicotine dependence levels (OR = 0.71, 95% CI = [0.54–
233 0.94]); however, this association was not statistically significant for individuals with
234 high nicotine dependence (OR = 0.88, 95% CI = [0.57–1.36]). ‘The rise in cigarette
235 prices since October 2010’ was significantly positively associated with an increase in
236 medium nicotine dependence level (OR = 1.44, 95% CI = [1.09–1.90]); however, this
237 association was not statistically significant for individuals with high nicotine
238 dependence (OR = 1.24, 95% CI = [0.80–1.92]). Furthermore, trend associations
239 assessed by assigning ordinal numbers to a total score of FTCD (0–10) for all three
240 motivators were statistically significant.

241 [INSERT TABLE 3 ABOUT HERE]

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243 **DISCUSSION**

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6 244 This study investigated the relationships between nicotine dependence level,
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9 245 cessation attempts within the previous 12 months, and various motivators for quitting
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12 246 smoking among male current smokers after Japan's 2010 tobacco tax hike. Three major
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15 247 findings emerged. First, 40.6% of current smokers had attempted smoking cessation
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18 248 within the previous 12 months and nicotine dependence levels were negatively
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21 249 associated with attempts. Second, respondents' motivators for quitting smoking
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24 250 differed according to their nicotine dependence levels. Third, the proportion of current
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27 251 smokers with cessation attempts who reported 'the rise in cigarette prices since
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30 252 October 2010' as their motivator for quitting smoking increased with nicotine
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33 253 dependence level.

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35 254 A national survey in Japan in 1999 showed that 64.7% of current smokers and
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38 255 41.0% of former smokers acknowledged concerns or problems related to personal
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41 256 health as motivating factors for stopping smoking, respectively.¹² Furthermore, these
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44 257 motivators were ranked as the first and second leading factors for current and former
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47 258 smokers, respectively. Previous studies^{10,17} have also identified personal health
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50 259 concerns, including mild-to-serious personal health problems, and a fear of future
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53 260 illness in the absence of immediate health concerns as predominant motivators for
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56 261 smoking cessation. The present study revealed the relationship between smokers'

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6 262 nicotine dependence levels and motivators for quitting smoking.
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9 263 In Japan, smoking is still not as restricted in public spaces as it is in other
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11 264 countries.¹⁸ In addition, the price of tobacco remains lower than in most developed
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14 265 Western countries.⁷ However, in 2003, the Japanese national government enacted the
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17 266 Health Promotion Law, which requires public facility managers to endeavour to protect
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20 267 non-smokers from the environmental effects of tobacco smoke. Since then, greater
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23 268 restrictions have been placed on smoking in public spaces. In addition, the national
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26 269 government increased the tobacco tax in October 2010. The results of our study
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29 270 suggest that individuals with medium and high nicotine dependence attempted
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32 271 smoking cessation by the tobacco price. The present findings imply that further
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35 272 legislative changes increasing the cost of cigarettes could be effective in helping
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38 273 people quit smoking.
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40 274 This study has two major strengths. First, it was conducted after the massive
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43 275 tobacco tax increase in October 2010, the effects of which had not been evaluated in
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46 276 previous studies.^{11,13,14} The approximately 40% price increase constituted the highest in
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49 277 Japan within the last two decades. The prevalence of regular smoking among both men
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52 278 and women decreased significantly after the price increase.⁸ A one-year follow-up
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55 279 survey conducted from 2005 to 2006 in Japan¹⁴ showed that 23.0% of smokers at the
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6 280 time reported that they had attempted to quit smoking at least once in the previous year.

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9 281 In a U. S. study,¹⁹ 29% of respondents reported that the 2009 federal tobacco tax

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12 282 increase helped initiate their attempts to quit smoking. In this study, 40% of current

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15 283 smokers reported that they had attempted smoking cessation in the previous 12 months.

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18 284 It can be hypothesized that the increase in tobacco tax changed smoking cessation

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21 285 attempts among the Japanese male workers included in the current study sample.

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24 286 Smoking cessation attempts may have been affected by the extent of the tax increase

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27 287 and the resulting rise in cigarette retail prices.^{3,4,6,9} Further examination of the

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30 288 influence of tobacco tax increases on smoking cessation in Japan is required.

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32 289 Second, this study revealed that the reasons for smoking cessation attempts

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35 290 vary by nicotine dependence level. High nicotine dependence strongly predicted failure

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38 291 to quit smoking¹⁵ or the cost-effectiveness of smoking cessation programs.²⁰ As an

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41 292 employee who feels ready and capable of changing his behaviour has needs and

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44 293 preferences that significantly differ from one who is not at that stage,²¹ workplace

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47 294 smoking cessation interventions that employ only one method²² do not generally have

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50 295 positive effects on the smoking cessation attempts of all employees. The current results

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53 296 showed that nicotine dependence is related to motivators for smoking cessation

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56 297 attempts. Thus, the efficacy of any smoking cessation intervention can be improved by

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6 298 considering the target group's level of nicotine dependence.
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9 299 Four major limitations were identified in this study. First, as this was a
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11 300 cross-sectional study conducted retrospectively, the subjects may not recall all attempts
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13 301 for smoking cessation in the previous 12 months. However, we can interpret that their
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15 302 intention to quit is low when the subjects do not recall their attempts. Therefore,
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17 303 excluding the quit attempts that the subjects could not recall does not affect the
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19 304 interpretation of the study results. This study was conducted in October 2011 and
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21 305 analysed current smokers at that time. Thus, the temporal relationship between the
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23 306 exposure and the outcome should be evaluated cautiously. However, because the
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25 307 subjects of this study were current smokers at the time that this study was conducted,
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27 308 we believe that fluctuation in nicotine dependence is negligible. Thus, temporal
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29 309 relationships between nicotine dependence level and the motivators and smoking
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31 310 cessation attempts do not affect the interpretation of the study results.
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44 311 In the U. S., longitudinal studies have been conducted on the effects of a 10%
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46 312 increase in the retail price of a pack of cigarettes (following the 2009 federal tobacco
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48 313 tax increase);¹⁹ however, in Japan, prior investigations of the relationship between
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50 314 retail prices of cigarettes and motivators for smoking cessation among current smokers
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52 315 in Japan were conducted before the 2010 tobacco tax increase.^{11,13,14} Thus, the effects
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6 316 of a single 40% increase in retail prices of cigarettes in Japan are still not sufficiently
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9 317 clear. Further, the association between the number of cigarettes smoked per day and
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11 318 smoking cessation has previously been elucidated;^{13,14,19,20} nevertheless, evaluations of
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14 319 the link between reasons behind smoking cessation and precise nicotine dependence
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17 320 are limited.⁴ Although temporal relationships between the tobacco tax increase and
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20 321 smoking cessation attempts must be carefully evaluated, the method employed for
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23 322 measuring nicotine dependence in this study was widely recognized. A longitudinal
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26 323 evaluation that considers the amount of tax increase, nicotine dependence, and
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29 324 smoking cessation attempts must be undertaken.

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32 325 The second limitation is that the smokers successfully quit smoking before
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35 326 October 2011 were not included in this study because physical dependence on nicotine
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38 327 assessed by the FTCD was available for current smokers only. It is rational to
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41 328 hypothesize that smoking cessation attempts are stronger in smokers who successfully
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44 329 quit smoking than in smokers who continued smoking. Thus, the association between
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47 330 smoking cessation attempts during the previous 12 months and nicotine dependence
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50 331 may be underestimated in this study because the subjects in this study were smokers
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53 332 who continued smoking until this study was conducted. This means that the exclusion
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56 333 of the smokers who successfully quit smoking before this study does not influence the
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6 334 interpretation of the results. However, we could not estimate the magnitude of the
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9 335 association between smoking cessation attempts during the previous 12 months and
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12 336 nicotine dependence among the excluded subjects. A longitudinal evaluation to
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15 337 investigate the impact of the nicotine dependence level and success in smoking
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18 338 cessation must be undertaken.

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21 339 The third limitation is that the study sample consisted of only male Japanese
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24 340 workers at a specific company. Therefore, the data analysed were not necessarily
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27 341 representative of the total population. However, we can perhaps assume that the current
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30 342 results have broader applicability to the development and design of workplace smoking
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33 343 cessation interventions, as all respondents in this study were employed on a full-time
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36 344 basis.

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38 345 Fourth, socio-economic status was not analysed in this study. It has previously
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41 346 been reported that socioeconomic status, especially income, is related to attitudes
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44 347 towards smoking cessation.^{19,23} However, the influence of wage differences on
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47 348 smoking cessation challenges could be disregarded in this study because an
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50 349 age-adjusted analysis (multiple logistic regression) was performed. Income levels are
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53 350 strongly related to respondents' age because of Japan's traditional seniority-based wage
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56 351 system, which had been adopted in the participating company. It has previously been
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6 352 demonstrated that lower education levels, income levels, and cigarette consumption are
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9 353 associated with perceptions that the tobacco tax increase is helpful in aiding smoking
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12 354 cessation.¹⁹
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15 355 In conclusion, the efficacy of smoking cessation strategies can be improved by
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17 356 considering the target group's nicotine dependence level. A longitudinal evaluation of
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20 357 strategies focused on current smokers with high nicotine dependence levels should be
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23 358 undertaken.
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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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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*												P value
		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	
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*						Total n = 914	P for trend (crude)	P for trend (age adjusted)	
	Low ¹ n = 438		Medium ² n = 373		High ³ n = 103					
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) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	Line 114-116 on page 7-8
		<i>Case-control study</i> —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	
		<i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants	
		(b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed	N/A
		<i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Outcomes: Line 127-131 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) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed <i>Cross-sectional study</i> —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) <i>Cohort study</i> —Summarise follow-	N/A

		up time (eg, average and total amount)	
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure	
		<i>Cross-sectional study</i> —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	Table 2, 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).

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2 *Give information separately for cases and controls in case-control studies and, if applicable, for exposed and
3 unexposed groups in cohort and cross-sectional studies.
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6 **Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and
7 published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely
8 available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at
9 <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is
10 available at www.strobe-statement.org.
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