

**Table 1.** Baseline characteristics of the 151 smokers who participated in the support program at a worksite in Toyama, Japan, and the 2,166 smokers who did not participate in the study.

	Participating smokers				Non-participating smokers (n = 2,166)	p value for difference <sup>a</sup>	p value for difference <sup>b</sup>	p value for linear trend <sup>c</sup>
	Overall	Fagerström Test score for Nicotine Dependence						
	(n = 151)	0–2 points	3–6 points	7–10 points				
		(mild) (n = 33)	(moderate) (n = 86)	(severe) (n = 32)				
Age, yrs	44.2±11.2	40.4±12.5	44.5±11.3	47.2±8.3	42.5±11.3	0.08	0.05	<0.01
Female, % (n)	3.3 (5)	6.1 (2)	3.5 (3)	0 (0)	6.0 (130)	0.17	0.39	0.19
Cigarettes smoked each day, n	20.5±7.5	14.1±6.3	20.5±5.1	27.2±8.2	18.2±7.4	<0.01	<0.01	<0.01
≤10 per day, % (n)	13.9 (21)	42.4 (14)	8.1 (7)	0 (0)	22.5 (487)			
11–20 per day, % (n)	60.9 (92)	57.6 (19)	69.8 (60)	40.6 (13)	60.7 (1,314)			
21–30 per day, % (n)	20.5 (31)	0 (0)	22.1 (19)	37.5 (12)	14.6 (316)			
≥31 per day, % (n)	4.6 (7)	0 (0)	0 (0)	21.9 (7)	2.3 (49)			
Fagerström Test score for Nicotine Dependence, point	4.6±2.5	1.2±0.9	4.6±1.1	8.0±1.0	Not available			
History of attempt to quit smoking, % (n)	46.4 (70)	69.7 (23)	40.7 (35)	37.5 (12)	Not available		<0.01	<0.01
Habitual alcohol drinking, % (n)	75.5 (114)	75.8 (25)	76.7 (66)	71.9 (23)	72.4 (1,569)	0.42	0.86	0.21
History of heart disease, % (n)	0.7 (1)	0 (0)	0 (0)	3.1 (1)	1.4 (31)	0.43	0.15	0.98
History of stroke, % (n)	0 (0)	0 (0)	0 (0)	0 (0)	0.3 (6)	0.52		
History of cancer, % (n)	2.0 (3)	0 (0)	1.2 (1)	6.3 (2)	0 (0)	<0.01	0.13	0.18
History of chronic respiratory disease, % (n)	0.7 (1)	0 (0)	1.2 (1)	0 (0)	0.05 (1)	0.01	0.68	0.61
History of hypertension <sup>d</sup> , % (n)	25.2 (38)	18.2 (6)	26.7 (23)	28.1 (9)	20.2 (438)	0.15	0.57	0.73
History of hypercholesterolemia <sup>d</sup> , % (n)	35.1 (53)	30.3 (10)	32.6 (28)	46.9 (15)	33.3 (721)	0.65	0.28	0.30
History of diabetes <sup>d</sup> , % (n)	10.6 (16)	6.1 (2)	11.6 (10)	12.5 (4)	5.4 (117)	<0.01	0.63	0.98
History of a health problem <sup>e</sup> , % (n)	55.6 (84)	45.5 (15)	54.7 (47)	68.8 (22)	48.1 (1,042)	0.07	0.16	0.46
History of a severe health problem <sup>e</sup> , % (n)	3.3 (5)	0 (0)	2.3 (2)	9.4 (3)	1.8 (38)	0.17	0.08	0.06

The data are presented for all the participating smokers and also grouped according to the Fagerström Test score for Nicotine Dependence at baseline. Values are expressed as mean ± standard deviation, or the % (number) of individuals in that category.

a. An unpaired t test or a chi-square test was used to compare each factor between the participating and non-participating smokers.

b. One-way analysis of variance, or a chi-square test was used to compare each factor among the three categories of the Fagerström Test score for Nicotine Dependence.

c. A logistic regression model was used to test the significance of the linear trend for the association between Fagerström Test score for Nicotine Dependence (continuous variable) and each factor after adjustment for age.

d. Hypertension was defined as a systolic blood pressure ≥140 mmHg, diastolic blood pressure ≥90 mmHg and/or taking medication for hypertension; hypercholesterolemia as a serum low-density lipoprotein cholesterol ≥3.62 mmol/l and/or taking medication for hypercholesterolemia; diabetes as a Japan Diabetes Society-Hb<sub>A1c</sub> ≥6.1 % (or the National Glycohemoglobin Standardization Program-Hb<sub>A1c</sub> ≥6.5 %) and/or taking medication for diabetes.

e. A health problem was defined as any combination of the seven diseases listed above; a severe health problem as any combination of heart disease, stroke, cancer and/or chronic respiratory disease.

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**Table 2.** Costs (Japanese Yen) of the support program for smoking cessation at a worksite in Toyama, Japan.

Details	Overall (n = 151)	Fagerström Test score for Nicotine Dependence			
		0–2 points	3–6 points	7–10 points	
		(mild)	(moderate)	(severe)	
		(n = 33)	(n = 86)	(n = 32)	
<b>Material costs</b>					
Diaries and documents	¥300×151 people (33, 86 and 32)	¥45,300	¥9,900	¥25,800	¥9,600
Nicotine patches					
30 mg	¥278×1,091 person-pieces (41, 533 and 517)	¥303,298	¥11,398	¥148,174	¥143,726
20 mg	¥262×889 person-pieces (77, 491 and 321)	¥232,918	¥20,174	¥128,642	¥84,102
10 mg	¥248×560 person-pieces (36, 308 and 216)	¥138,880	¥8,928	¥76,384	¥53,568
Awards	¥5,000×88 people (22, 48 and 18)	¥440,000	¥110,000	¥240,000	¥90,000
<b>Opportunity costs for physician</b>					
Initial counselling	¥4,640×0.1 hours×151 people (33, 86 and 32)	¥70,064	¥15,312	¥39,904	¥14,848
Prescription					
of nicotine patches	¥4,640×0.05 hours×201 person-times (4, 107 and 90)	¥46,632	¥928	¥24,824	¥20,880
<b>Opportunity costs for nurse</b>					
Initial counselling	¥1,800×0.3 hours×151 people (33, 86 and 32)	¥81,540	¥17,820	¥46,440	¥17,280
Prescription					
of nicotine patches	¥1,800×0.05 hours×201 person-times (4, 107 and 90)	¥18,090	¥360	¥9,630	¥8,100
Checking diaries					
and providing comments	¥1,800×0.1 hours×2,797 person-times (665, 1,538 and 594)	¥503,460	¥119,700	¥276,840	¥106,920
Conferring an award					
to 6-month abstainers	¥1,800×0.1 hours×88 people (22, 48 and 18)	¥15,840	¥3,960	¥8,640	¥3,240
Other routine work	¥1,800×0.3 hours×151 people (33, 86 and 32)	¥81,540	¥17,820	¥46,440	¥17,280
<b>Opportunity costs for participants</b>					
Initial counselling <sup>a</sup>	¥1,800×(0.3+0.2) hours×151 people (33, 86 and 32)	¥135,900	¥29,700	¥77,400	¥28,800
Prescription					
of nicotine patches <sup>a</sup>	¥1,800×(0.05+0.2) hours×201 person-times (4, 107 and 90)	¥90,450	¥1,800	¥48,150	¥40,500
Keeping a diary	¥1,800×0.05 hours×13,985 person-times (3,325, 7,690 and 2,970)	¥1,258,650	¥299,250	¥692,100	¥267,300
Being presented with an award	¥1,800×0.1 hours×88 people (22, 48 and 18)	¥15,840	¥3,960	¥8,640	¥3,240
<b>Total</b>		<b>¥3,478,402</b>	<b>¥671,010</b>	<b>¥1,898,008</b>	<b>¥909,384</b>

The data are presented for all the participating smokers and also grouped according to the Fagerström Test score for Nicotine Dependence at baseline. ¥100 = \$1.28, £0.83, or €1.03 at the foreign exchange rates on June 1, 2012. Values in parentheses represent the respective values in participants who had 0–2, 3–6, and 7–10 points for the Fagerström Test score for Nicotine Dependence.

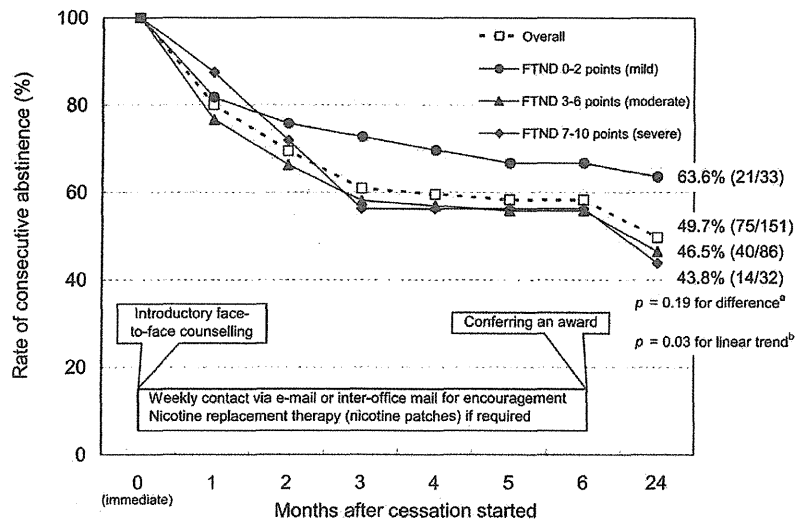
a. Participants spent an additional 0.2 hours during work time for the initial counselling and prescription of the nicotine patches, due to the need to commute between the work place and the clinic.

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participants with higher baseline FTND scores compared to those with lower baseline scores: 30.3% (n = 10) for participants with a FTND score of 0–2 points, 62.8% (n = 54) for those with a score of 3–6 points, and 90.6% (n = 29) for those with a score of 7–10 points. Quantities consumed per user were also higher with increasing baseline FTND score: 15.4 pieces for FTND 0–2 points (30 mg, 4.1 pieces; 20 mg, 7.7 pieces; and 10 mg, 3.6 pieces), 24.7 pieces for FTND 3–6 points (30 mg, 9.9 pieces; 20 mg, 9.1 pieces; and 10 mg, 5.7 pieces), and 36.3 pieces for FTND 7–10 points (30 mg, 17.8 pieces; 20 mg, 11.1 pieces; and 10 mg, 7.4 pieces). Of the participants using nicotine patches, the 30 mg patches were used by 40.0% (n = 4) for 0–2 points, 77.8% (n = 42) for 3–6 points and 93.1% (n = 27) for 7–10 points. No participants received any other relevant support for smoking cessation, or used any other

relevant medication such as nicotine gum during the follow-up period.

The rate of consecutive abstinence in the 151 study participants decreased gradually in the months following the initial cessation of smoking (Figure 1). Over the 24 study months, 49.7% refrained continuously from smoking. Participants with lower baseline FTND scores tended to be successful quitters more frequently compared to those with higher baseline scores (63.6% for 0–2 points vs. 46.5% for 3–6 points vs. 43.8% for 7–10 points). Although the difference in the rates of successful cessation among the three categories was not statistically significant ( $p = 0.19$ ), the test for linear trend reached statistical significance ( $p = 0.03$ ). This indicated that the odds ratio for successful quitting associated with a one point increase in FTND score was 0.81 (95% confidence



**Figure 1. Scheme of the six-month support program and time-related trend in the rate of consecutive abstinence in the 151 study participants at a worksite in Toyama, Japan, after the start of smoking cessation.** Data are presented for the entire study population and also grouped according to the Fagerström Test for Nicotine Dependence (FTND) score at baseline. A chi-square test (a) was used to compare the rate of 24-month consecutive abstinence among the three categories of FTND score, while a logistic regression model (b) was used to test the significance of the linear trend for the association between FTND score (continuous variable) and 24-month consecutive abstinence after adjustment for age, sex, cigarettes smoked each day, cessation history, alcohol drinking habits, and history of either heart disease, stroke, cancer, chronic respiratory disease, hypertension, hypercholesterolemia, or diabetes. Values in parentheses represent the number of successful quitters/study participants. doi:10.1371/journal.pone.0055836.g001

interval, 0.66–0.98) after adjustment for age, sex, cigarettes smoked each day, cessation history, alcohol drinking habit, and history of each of the seven diseases listed.

#### Natural quit rate in the non-participating smokers

Of the 2,166 non-participating smokers, 2,049 (1,920 men and 129 women) aged 20–58 years were included in the cohorts used to estimate the natural quit rate, and were followed-up for two years from 2006 to 2008. Smokers aged 59–60 years were excluded, as they were required to retire by the end of this follow-up period. Of the 2,049 subjects in the cohort, 1,764 (1,651 men and 113 women) provided information on smoking status at an annual health examination in 2008, and were considered eligible for inclusion in the data analysis.

Over the two-year follow-up, 173 individuals ceased smoking. Therefore, the point-prevalence of abstinence in the non-participating smokers was 9.8% (data not shown in the table). The rate of 24-month consecutive abstinence in the smokers who participated in the cessation program was significantly higher than this value ( $p < 0.01$ ).

#### Economic evaluation for this support for smoking cessation

The support program incurred an estimated total cost of ¥3,478,402 (Table 2 and 3). Material costs, opportunity costs for health care providers (physician and nurse), and opportunity costs for participants accounted for 33.4%, 23.5% (3.4% for physician and 20.1% for nursing costs), and 43.1% of total expenditures, respectively. The crude incremental cost for one individual to successfully quit smoking due to the support program was ¥46,379 (i.e., ¥100 = \$1.28, £0.83, or €1.03 at the foreign exchange rate on June 1, 2012). The corresponding costs varied across the three categories of FTND scores: ¥31,953 for 0–2 points, ¥47,450 for 3–

6 points, and ¥64,956 for 7–10 points. Material costs accounted for a larger proportion of total costs in participants with higher FTND scores, compared with those with lower FTND scores. The sensitivity analysis demonstrated that varying the smoking cessation success rate across a range of values defined by the 95% confidence interval resulted in alterations in the cost-effectiveness of the support program.

Given that 9.8% of the participants succeeded in stopping smoking unassisted, the net incremental cost for one individual to successfully quit smoking due to the support program was ¥57,781. There was a variation of ¥37,697–83,430, when this calculation was conducted according to the FTND score.

#### Discussion

One merit of our study is that it achieved almost complete, long-term follow-up of individuals who had voluntarily attempted to stop smoking and had received individualized support at a worksite in Japan. In a study of 166 subjects who underwent individualized support for smoking cessation at a worksite in Japan, Takayama [14] found that the rate of self-reported abstinence from smoking was 59.6% after 12 months, whereas Sawayama et al. [15] reported corresponding rates of 48.5% after 12 months in 66 subjects at another worksite in Japan. Previous studies in other countries also provided similar or other kinds of smoking cessation support programs for smokers at worksites (e.g., counselling by professional psychologists or former smokers, phone, television, group treatment, competition, or incentives), some of which resulted in 40–50% success rates over one-year or longer [16–22]. Thus, the individual support provided in our program generated outcomes that may be at least comparable to those resulting from the assistance provided in these earlier worksite-based studies. In contrast, a Japanese nationwide clinic/hospital-based survey conducted in 2007 showed that 40.8% and

**Table 3.** Incremental costs (Japanese Yen) for one individual to successfully quit smoking due to the support program at a worksite in Toyama, Japan.

	Overall	Fagerström Test score for Nicotine Dependence		
		0–2 points	3–6 points	7–10 points
		(mild)	(moderate)	(severe)
Participants, n ①	151	33	86	32
24-month consecutive abstinence rate, % ②	49.7	63.6	46.5	43.8
Lower limit of 95% confidence interval	41.4	45.1	35.7	26.4
Upper limit of 95% confidence interval	57.9	79.6	57.6	62.3
24-month consecutive abstainers, n ①×②/100 (=③)	75	21	40	14
Lower limit	62.5	14.9	30.7	8.4
Upper limit	87.4	26.3	49.5	19.9
Total costs of support program, ¥ ④	¥3,478,402	¥671,010	¥1,898,008	¥909,384
Material costs, % of total	33.4	23.9	32.6	41.9
Opportunity costs for physician, % of total	3.4	2.4	3.4	3.9
Opportunity costs for nurse, % of total	20.1	23.8	20.4	16.8
Opportunity costs for participants, % of total	43.1	49.9	43.5	37.4
Crude incremental costs for one individual to successfully quit smoking,				
¥ ④/③	¥46,379	¥31,953	¥47,450	¥64,956
Lower limit	¥39,799	¥25,514	¥38,344	¥45,698
Upper limit	¥55,654	¥45,034	¥61,824	¥108,260
Net incremental costs for one individual to successfully quit smoking,				
¥ (④-①)/③-(①×9.8/100 <sup>b</sup> )	¥57,781	¥37,697	¥60,064	¥83,430
Lower limit	¥47,912	¥29,048	¥46,180	¥54,130
Upper limit	¥72,922	¥57,351	¥85,112	¥171,582

The data are presented for all the participating smokers and also grouped according to the Fagerström Test score for Nicotine Dependence at baseline. ¥100 = \$1.28, £0.83, or €1.03 at the foreign exchange rates on June 1, 2012. a A sensitivity analysis of the incremental costs for one individual to successfully quit smoking was conducted based on the 95% confidence interval of the success rate. b Natural quit rate (9.8%) was estimated on the basis of the two-year point-prevalence of abstinence in the 1,764 smokers who did not participate in the program.  
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32.6% of individuals who attempted to stop smoking remained self-reported abstinent after six and 12 months, respectively [39]. In this survey, the subjects received standard individual support including face-to-face counselling and nicotine replacement therapy (up to five times over 12 weeks) under the medical insurance system in Japan [31], with only nicotine patches and gums being available at that time. Varenicline is a more effective oral medication for smoking cessation than nicotine patches [9,30], and although unavailable at the time of the study, it is now used widely in Japan.

The support provided in our program was characterized by frequent and long-term contact with the individuals attempting to stop smoking using e-mail or inter-office mail. Frequent and long-term visits to clinics or hospitals may be difficult for employees who are unwilling to be absent from work, despite evidence that this type of interaction increases the success rate [39]. In addition, e-mail and inter-office mail are readily available for everyone at worksites without charge, whereas some individuals do not have a computer at their home. Our program also offered an incentive by rewarding individuals who successfully quit smoking for six months. However, attention should be paid to several different characteristics other than the uniqueness of our worksite-based study when comparing its effectiveness with other clinic or hospital-based studies. Our study participants were relatively healthy workers, with the prevalence of a history of smoking-related serious diseases such as heart disease, stroke, cancer, or

chronic respiratory disease [1–3] being lower than in smokers in a hospital-based survey ( $\leq 2\%$  vs. 7–12%) [30]. In particular, our study group appeared to be well-motivated to stop smoking as evidenced by their voluntary rather than mandatory participation in the program. In contrast, at clinics or hospitals, unmotivated smokers who merely followed the advice of their physicians may also have attempted to quit smoking [30], ultimately leading to a decrease in success rate [13,30]. In addition, many subjects attempting to quit smoking at clinics or hospitals may have various diseases [30], such as mental disorders, which may lead to difficulty in cessation [30]. Unfortunately, we have no data on mental health in our study participants. Furthermore, subjects attempting to quit smoking at clinics or hospitals may have higher FTND scores indicating greater nicotine dependence than those at our worksite [30]. Taniguchi et al. [30] reported that smokers with FTND scores  $\geq 6$  had a lower rate of four-week consecutive abstinence compared to those with FTND scores  $\leq 5$  (39.7% vs. 51.8%). This finding is in agreement with the results of our study on the association between FTND score and successful smoking cessation.

The majority of relevant economic evaluations have been reported from the United States [16,26–28]. Ringen et al. [26] studied blue-collar smokers who participated voluntarily in a practical program that provided one- or five-time phone-call counselling combined with various kinds of medications. In that study, the  $\geq 12$ -month point-prevalence of smoking cessation was

27.5%, and the crude incremental cost per one additional quitter was \$1,025 (equivalent to approximately ¥80,000 at current exchange rates). Jason et al. [27] estimated that cost per one additional quitter (12-month point prevalence to continuous abstinence) was \$225–1,179 (approximately ¥17,600–92,100) for self-help, \$250–699 (approximately ¥19,500–54,600) for incentives, and \$455–790 (approximately ¥35,500–61,700) for group treatment. Similarly, Ong et al. [28] estimated that the cost per 12-month quitter was \$7,020 (approximately ¥548,400) for nicotine replacement therapy using patches and gums and \$799 (approximately ¥62,400) for a smoke-free workplace policy. In Japan, the High-Risk and Population Strategy for Occupational Health Promotion Study (HIPOP-OHP) [25], that conducted a smoking cessation intervention trial at manufacturing factories in the early 2000s, reported that factories providing intervention had a higher point-prevalence of smoking cessation after 36 months of follow-up in all workers who smoked compared to control factories (12.1% vs. 9.4%). That trial employed a mandatory, low intensity, comprehensive intervention for all smokers that consisted of the following four components: (1) presenting information on the harms of smoking and the benefits of cessation using posters and other relevant materials, (2) a smoking cessation campaign, (3) advice on the designation of smoking areas, and (4) periodic site visits of the designated smoking areas. The net incremental cost for one individual to successfully quit smoking due to this comprehensive intervention was ¥70,080, compared to no costs without intervention [25]. Whereas the calculated costs included developmental costs, the net incremental cost was reduced to approximately ¥60,000 when developmental costs were omitted from the cost-effectiveness analysis [25]. Although we were unable to reach a definite conclusion due to our small sample size and heterogeneous methods for calculating costs, targeting our intensive intervention to individual smokers who showed a willingness to quit may be comparable to the majority of interventions used in these earlier studies. Importantly, our data suggest it is relatively less cost-effective to promote smoking cessation in smokers who are willing to quit but are severely dependent on nicotine compared to those who are mildly dependent. This is due mainly to a higher rate and greater quantity of nicotine patch use and a lower rate of successful smoking cessation in the former group. It is therefore necessary to pay attention to factors related to nicotine dependence (e.g., nicotine dependence status of study participants, and costs of this therapy) when evaluating the cost-effectiveness of smoking cessation programs. In this regard, implementing our individualized support program mainly in smokers who were willing to quit but were severely dependent on nicotine may have been less cost-effective than anticipated.

Although we consider that our study offers preliminary information on the cost-effectiveness of individualized smoking cessation support at a worksite in Japan over a relatively long-term period, several limitations in the study should be acknowledged. First, the design was a case study and not a randomized controlled trial. Some, but not all, participants used nicotine patches, and to

some extent they elected whether they would use them on their own volition. Despite the marked influence nicotine patches are known to have on costs our analysis did not take into account whether the use of nicotine patches was due to the participants' own volition or was at the physician's discretion. This study required the users of nicotine patches to pay for 30% of the costs, which may have influenced their choice to use the patches. Participants who did not want to spend this money may have refused the use of nicotine patches despite the recommendation of the physician. However, such a situation is usual in real practice settings. Second, we estimated the natural quit rate on the basis of the two-year point-prevalence of abstinence in non-participating smokers that included some dropouts. The readiness to quit may have varied between the participating and non-participating smokers, and therefore it remains unclear how many of the non-participating smokers attempted to quit smoking over the two-year period. In addition, the duration of smoking cessation in the non-participating quitters and whether they had stopped by themselves were both unknown. These limitations require us to use caution when interpreting our data. The true net cost-effectiveness of our support program should therefore be evaluated in a randomized controlled trial. Third, we relied on self-reporting to assess smoking cessation status in both participating and non-participating smokers. In principle, smoking cessation status should be verified objectively. Fourth, we used FTND to assess the levels of nicotine dependence, although there is some evidence to suggest that FTND is not sufficiently sensitive to determine the degree of this dependence [40,41]. Fifth, our results may not be generalized to other worksites in Japan and other countries because the implementation, success rate, and cost-effectiveness of smoking cessation programs may be influenced by complexities of internal dynamics at a specific worksite. Finally, effectiveness in our study was defined as smoking cessation, an intermediate outcome, but we did not evaluate cost-effectiveness in terms of other important clinical and humanistic outcomes, such as improvements in life expectancy and quality of life. Further investigations are required to generate evidence on this topic.

In conclusion, our study demonstrated that worksites can provide effective individualized support for smoking cessation by taking advantage of easy accessibility. Nicotine dependence status may be an important determinant for the cost-effectiveness of smoking cessation programs.

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## Author Contributions

Interpreted the data: KN MS KM YM SN MI TK YN YS HN. Conceived and designed the experiments: KN TK HN. Performed the experiments: KN MS KM YM MI TK YN HN. Analyzed the data: KN. Wrote the paper: KN.

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## Characteristics of Smoking Cessation in Former Smokers in a Rural Area of Japan

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### ABSTRACT

**Objectives:** Japan has a relatively high prevalence of smoking in men. Despite the importance of behavioral patterns on successful smoking cessation, only limited information is available in Japan. The present study collected data from former smokers in a rural community in Japan in order to identify health status at the time of cessation, predominant motivating factors, and the role of smoking cessation aids in individuals who successfully stopped smoking.

**Methods:** This cross-sectional study collected data using a self-reported questionnaire from 149 randomly-selected former smokers (119 men and 30 women, aged 20-79 years) who were residents of Nanao, Ishikawa Prefecture, Japan.

**Results:** Of the male participants, 14.3% quit due to serious personal health problems, including cardiovascular disease, cancer, or respiratory tract disease, while 20.8% of former smokers experienced mild personal health problems or were pregnant at the time of cessation. An approximately equal number stopped smoking due to fear of illness in the absence of immediate health concerns. Compared to personal health motivations, a smaller number of male smokers quit due to anti-smoking social pressure or expense. We also observed a marked increase in former smokers who quit for these reasons in recent years. Smoking lost its appeal in 19.3% of male and 10.0% of female smokers. Approximately, 95% of quitters did not utilize health professional counseling or pharmacological therapy.

**Conclusions:** Personal health concerns in former smokers in Nanao, Japan were the predominant motivation for quitting smoking, with the vast majority of former smokers achieving successful smoking cessation by themselves.

**Key words:** Counseling, Japan, motivation, pharmacological therapy, smoking cessation

### INTRODUCTION

The harmful effects of smoking on cardiovascular disease (coronary heart disease and stroke), respiratory tract disease, and cancer are well-documented in Caucasian,<sup>[1,2]</sup> and Asian



populations.<sup>[3,4]</sup> Men in many Asian countries, including Japan, have a higher prevalence of smoking than men in developed Western countries.<sup>[5,6]</sup> As a result, 38.6% of deaths due to cancers, 23.4% of deaths due to respiratory tract disease, and 23.0% of deaths due to cardiovascular disease in Japanese men have been attributed to a history of smoking.<sup>[3]</sup> In order to reduce the burden of premature illness and death from smoking-related serious diseases in Japanese men, it is necessary to achieve smoking cessation prior to the occurrence of these diseases.

In order to be able to plan an effective strategy for smoking cessation in Japan, it is important to determine the characteristics that led to smoking cessation in Japanese former smokers, including whether or not to have had a new diagnosis or history of smoking-related serious diseases at the time of cessation, motivating factors, and aids that assist individuals to stop smoking. Information is limited on this topic in community-based settings, but not in hospital/clinic-based settings. A Japanese national survey carried out in 1999 reported that the major motivations for smoking cessation were concern and problems related to personal health, although the precise concerns and problems that led to smoking cessation were not described.<sup>[7]</sup> Another survey reported on the use of smoking cessation aids in Japanese current smokers who had attempted smoking cessation,<sup>[5]</sup> although little is known on this subject in former smokers who successfully quit smoking. The present study, therefore, collected data from Japanese former smokers in a rural community-based setting, with the aim of identifying health status at the time of cessation, the predominant motivating factors, and the role of health professional counseling and pharmacological therapies on smoking cessation.

## METHODS

The city of Nanao, which covers an area of 318 km<sup>2</sup>, is located in Ishikawa Prefecture in the central part of Japan and includes semi-industrial, agricultural, and fishing areas. According to a recent census, Nanao has approximately 59,000 residents (28,000 men and 31,000 women).

This cross-sectional study was carried out in July 2010 and collected data on smoking cessation using a self-reported questionnaire. A total of 1,488 candidates between the ages of 20 and 79 years

were selected randomly and stratified according to sex and age using the Nanao City Municipal Government resident registry data. Investigators then visited the home of each candidate to deliver the questionnaire. Of the 1,488 candidates, 310 who had relocated from their residence due to education, work, or hospitalization, or failed to meet investigators after multiple attempts were excluded from the study. The investigators were able to collect questionnaires enclosed in envelopes and written informed consents from 737 of the remaining 1,178 candidates during follow-up visits. Of the 737 participants, 45 participants provided incomplete data. Of the remaining 692 participants, 43.0% ( $n = 142$ ), 36.1% ( $n = 119$ ), and 20.9% ( $n = 69$ ) of men and 10.2% ( $n = 37$ ), 8.3% ( $n = 30$ ), and 81.5% ( $n = 295$ ) of women, were self-identified as either current smokers, individuals who had quit smoking, or individuals who had never smoked, respectively. After excluding the 179 current smokers and the 364 non-smokers, the questionnaires from 149 former smokers were used for the analyses. The present study was approved by the Institutional Review Committee of Kanazawa Medical University for Ethical Issues.

The questionnaire provided to each participant began with questions regarding age, sex and smoking habits, and did not require the participants to write down their name or address. For current smokers and individuals who had never smoked, the questionnaire terminated after this question. However, former smokers were asked to provide the following additional information: (1) age when smoking ceased (years), (2) new diagnosis or history of serious disease such as heart disease, stroke, cancer, pulmonary emphysema, or chronic bronchitis when smoking ceased (yes, or no), (3) main motivation for quitting smoking, (4) health professional counseling, and (5) pharmacological therapy. As multiple possible responses were provided for the third, fourth and fifth questions, the participants were required to select only one choice that most closely represented their situation. Regarding the main motivation for quitting smoking, the closest reason was chosen among the following 8 choices: (i) serious personal health problems (defined in the second question), (ii) mild personal health problems such as hypertension, dyslipidemia, diabetes, mild symptoms of the respiratory tract such as cough and sputum, or



other diseases that have minimal serious effects on vital prognosis, (iii) pregnancy for women, (iv) fear of illness in the absence of immediate health concerns, (v) anti-smoking social pressure, (vi) expense, (vii) loss of smoking's appeal, and (viii) any other motivations. For having undergone health professional counseling, the closest locality was chosen from the following 4 choices: (i) at a hospital/clinic, (ii) at a public health center, (iii) at a workplace or (iv) nowhere. For pharmacological therapy, the closest modality was chosen from the following 4 choices: (i) nicotine patches, (ii) nicotine gum, (iii) any other medications, and (iv) none. Participants who were prescribed smoking cessation aids, but did not use them, were classified as non-users. The duration of smoking cessation prior to study entry was calculated by subtracting the participant's age at smoking cessation from their age at study entry.

The responses to the questionnaire were summarized for the entire population, grouped by sex. The data were then stratified according to the median duration of smoking cessation prior to study entry, in order to determine variation across years when smoking had ceased. A chi-square test was used to compare the summaries between the stratified subgroups. The statistical analyses were performed using the Statistical Package for the Social Sciences Version 12.0J for Windows (SPSS Japan Inc., Tokyo, Japan). All probability values were 2-tailed, and the significance level was set at  $P < 0.05$ .

## RESULTS

Of the 149 former smokers (119 men and 30 women) who participated in this study, 4.7% ( $n = 7$ ) were aged 20-29 years, 13.4% ( $n = 20$ ) 30-39 years, 18.8% ( $n = 28$ ) 40-49 years, 21.5% ( $n = 32$ ) 50-59 years, 20.8% ( $n = 31$ ) 60-69 years, and 20.8% ( $n = 31$ ) 70-79 years. The mean age  $\pm$  standard deviation at study entry was  $57.2 \pm 15.0$  years for men and  $46.3 \pm 11.5$  years for women. A total of 26.2% ( $n = 39$ ) of the participants had quit smoking for  $< 5$  years prior to study entry, 18.1% ( $n = 27$ ) for 5-9 years, 26.2% ( $n = 39$ ) for 10-19 years, 18.8% ( $n = 28$ ) for 20-29 years, and 10.7% ( $n = 16$ ) for  $\geq 30$  years. The median duration for smoking cessation prior to study entry was 10 years.

Of the male former smokers, 14.3% had a new diagnosis or history of serious disease when they had stopped smoking, which was the main motivation for nearly all the individuals in this group [Table. 1]. Although the study participants stopped smoking for a variety of motivating factors, the major factors were mild personal health problems, pregnancy, or a fear of illness in the absence of immediate health concerns. Compared to these motivating factors, a smaller number of male smokers quit due to anti-smoking social pressure, expense, and other motivations. In recent years, there was a marked increase in former smokers who quit for these reasons [Table 2]. Some individuals quit smoking due merely to smoking losing its appeal. Approximately 95% of male and female former smokers did not use any pharmacological therapies or health professional counseling to stop smoking.

## DISCUSSIONS

A national survey in Japan in 1999 showed that 64.7% and 41.0% of former smokers acknowledged concern or problems related to personal health as motivating factors for stopping smoking, respectively.<sup>[7]</sup> These motivations were ranked as the first and second leading factors.<sup>[7]</sup> Previous studies in other countries also identified personal health concerns, including mild-to-serious personal health problems and fear of illness in the absence of immediate health concerns, as the predominant motivation for smoking cessation. However, variable prevalences of this composite motivation were observed.<sup>[8]</sup> As a previous survey in Japan allowed multiple responses,<sup>[7]</sup> some respondents may have chosen both factors. However, these motivations should be evaluated in detail, and therefore, one merit of our study was to refine this disadvantage. As a consequence, our study showed that approximately one-fourth of Japanese former smokers quit smoking due to experiencing mild personal health problems or being pregnant, whereas another one-fourth quit because of fearing illness in the absence of immediate health concerns. Over 10% of individuals who stopped smoking did so at a late stage due to the occurrence of smoking-related serious diseases. Although it is unclear whether smoking cessation awareness may have failed these individuals who developed

**Table 1:** Characteristics of 149 former smokers in Nanao, Japan, 2010. Data are presented for the entire study population and also grouped by sex.

	Overall (n=149)		Sex			P values*
			Men (n=119)	Women (n=30)		
New diagnosis or history of serious disease <sup>†</sup> at time smoking ceased						0.02
Presence	12.1%	18	15.1%	18	0.0%	0
Absence	87.9%	131	84.9%	101	100.0%	30
Main motivation for quitting smoking						<0.01
Serious personal health problems <sup>†</sup>	11.4%	17	14.3%	17	0.0%	0
Mild personal health problems <sup>‡</sup>	20.8%	31	22.7%	27	13.3%	4
Pregnancy	2.7%	4	0.0%	0	13.3%	4
Fear of illness in the absence of immediate health concerns	24.2%	36	25.2%	30	20.0%	6
Anti-smoking social pressure	10.1%	15	7.6%	9	20.0%	6
Expense	5.4%	8	3.4%	4	13.3%	4
Loss of smoking's appeal	17.4%	26	19.3%	23	10.0%	3
Other motivations	8.1%	12	7.6%	9	10.0%	3
Undergoing health professional counselling						0.45
At a hospital/clinic	3.4%	5	4.2%	5	0.0%	0
At a public health centre	0.0%	0	0.0%	0	0.0%	0
At a workplace	2.0%	3	1.7%	2	3.3%	1
Nowhere	94.6%	141	94.1%	112	96.7%	29
Undertaking pharmacologic therapy						0.66
Nicotine patches	2.7%	4	2.5%	3	3.3%	1
Nicotine gum	2.0%	3	2.5%	3	0.0%	0
Other medications	0.0%	0	0.0%	0	0.0%	0
None	95.3%	142	95.0%	113	96.7%	29

\* Chi-square test was used to compare each characteristic between the two subgroups. † Serious personal health problems included heart disease, stroke, cancer, pulmonary emphysema, or chronic bronchitis. ‡ Mild personal health problems included hypertension, dyslipidemia, diabetes, mild symptoms of the respiratory tract such as cough and sputum, or other diseases that have minimal serious effects on vital prognosis.

serious personal health problems, the awareness of the health risks associated with smoking is much lower in the Japanese population compared to Caucasians, particularly regarding the effects of smoking on cardiovascular disease.<sup>[5,7,9]</sup> This unfortunate situation requires public education on the harmful effects of smoking as the aim of smoking cessation programs is to prevent the occurrence of smoking-related serious diseases. Although individuals who stopped smoking due to other motivations were unlikely to be concerned about their own health, almost all of them quit prior to the occurrence of smoking-related serious diseases.

In Japan, smoking remains less restricted in public spaces, and the price of tobacco remains lower than in developed Western countries.<sup>[6,10,11]</sup> However, in 2003, the Japanese national government

proclaimed the Health Promotion Law, which requires managers of public facilities to make an effort to protect non-smokers from environmental tobacco smoke.<sup>[12]</sup> Greater restrictions have, therefore, been placed on smoking in public spaces in Japan during the recent years.<sup>[11]</sup> In addition, the national government is considering increasing the tobacco tax.<sup>[11]</sup> Although the results of our study do not imply that more and more Japanese stop smoking due to anti-smoking social pressures or increased cost of cigarettes, our results may be worth taking notice of when considering whether recent and future rigorous policies affect smoking cessation in Japanese current smokers in the next decade. Interestingly, there were male individuals who stopped smoking due to its loss of appeal at the time of cessation. However, only a few previous studies have identified this as a motivation,

**Table 2:** Characteristics of 149 former smokers stratified by median duration of smoking cessation (yrs) at study entry

	Duration of smoking cessation at study entry				P values*
	≤10 years (n=79) (58 men & 21 women)		≥11 years (n=70) (61 men & 9 women)		
New diagnosis or history of serious disease† at time smoking ceased					0.82
Presence	12.7%	10	11.4%	8	
Absence	87.3%	69	88.6%	62	
Main motivation for quitting smoking					<0.01
Serious personal health problems‡	12.7%	10	10.0%	7	
Mild personal health problems‡	20.3%	16	21.4%	15	
Pregnancy	0.0%	0	5.7%	4	
Fear of illness in the absence of immediate health concerns	22.8%	18	25.7%	18	
Anti-smoking social pressure	17.7%	14	1.4%	1	
Expense	7.6%	6	2.9%	2	
Loss of smoking's appeal	11.4%	9	24.3%	17	
Other motivations	7.6%	6	8.6%	6	
Undergoing health professional counselling					0.65
At a hospital/clinic	2.5%	2	4.3%	3	
At a public health centre	0.0%	0	0.0%	0	
At a workplace	1.3%	1	2.9%	2	
Nowhere	96.2%	76	92.9%	65	
Undertaking pharmacologic therapy					0.14
Nicotine patches	5.1%	4	0.0%	0	
Nicotine gum	2.5%	2	1.4%	1	
Other medications	0.0%	0	0.0%	0	
None	92.4%	73	98.6%	69	

\* A chi-square test was used to compare each characteristic between the two subgroups. † Serious personal health problems included heart disease, stroke, cancer, pulmonary emphysema, or chronic bronchitis. ‡ Mild personal health problems included hypertension, dyslipidemia, diabetes, mild symptoms of the respiratory tract such as cough and sputum, or other diseases that have minimal serious effects on vital prognosis.

probably due to methodological issues with the questionnaires used in the majority of these studies that provided several choices of motivation.<sup>[8]</sup> Less than 10% of individuals who quit smoking identified other motivating factors, which included concerns regarding family health problems or fear of illness, responsibility to others, self-control, or fear of addiction. Our questionnaire did not provide the choice that a former smoker stopped smoking due to the advice of some another person such as health professional, family member or colleague, as we consider this advice is just an opportunity to considering smoking cessation rather than a defined motivation such as personal health concerns, family health concerns or expense. For example, the advice given by health professional

advice usually results in smokers quitting smoking by raising personal health concerns.

In general, the use of smoking cessation aids may depend largely on product availability, which has been limited in Japan.<sup>[6]</sup> In addition, the use of these aids may depend on other factors such as aid effectiveness<sup>[13-15]</sup> education, motivation to use aids, and physician knowledge of aids. Nevertheless, the great majority of former smokers achieved successful smoking cessation by themselves, which suggests that the self-help is the most common and, possibly, the most important element for smoking cessation.<sup>[16]</sup> In this regard, the United States national smoking surveys conducted in 1986<sup>[17]</sup> and 2000<sup>[18]</sup> estimated that approximately 90% and 80% of former smokers quit smoking without aids,

respectively. It is, therefore, important to keep this fact in mind in individuals who attempt smoking cessation, as well as for health professionals. The National Health and Nutrition Survey in 2008 showed that less than 10% of current smokers who had previously unsuccessfully attempted to stop smoking had undergone health professional counseling or used pharmacological agents.<sup>[5]</sup> The use of smoking cessation aids may, therefore, differ only marginally between individuals who successfully quit and those who failed.

Although the community-based setting and random sampling used in this study are major strengths, several limitations should be acknowledged. First, the study participants were limited to residents in one rural area of Japan, with a relatively small sample size. Second, the questionnaire was developed originally by referring to questionnaires used in other relevant studies.<sup>[5,7,8]</sup> Although we did not determine the reliability and validity of our questionnaire, we consider that it was as standardized as the questionnaires used in these other studies. The complete data response in the questionnaires by the majority of participants partially justifies this belief. However, we are uncertain whether the participants correctly answered each question by retrospective self-assessment. Fourth, detailed former smoking habits and socio-demographic characteristics were not included in the analysis due to the absence of information. Lastly, detailed medical histories at the time of smoking cessation were not available.

In conclusion, over one-half of Japanese former smokers living in a rural area quit smoking due to personal health concerns. However, the exact health concern varies considerably, with an equally large number of former smokers stopped smoking due to either experiencing mild personal health problems or being pregnant, or of having a fear of illness in the absence of immediate health concerns. The great majority of former smokers appeared to have successfully stopped smoking without undergoing health professional counseling or undertaking pharmacological therapy.

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[学会発表]

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目的：喫煙者が依然として多い日本において、喫煙が医療費に与える影響は大きいと考えられる。しかし喫煙の健康影響は長期的な曝露によってもたらされるため、行政での単年度を中心とした評価ではその影響を明らかにすることは難しい。喫煙者の中で近い将来に医療費が上がりやすい者を同定することができれば、医療費適正化上、効率的な禁煙指導を行うことが可能である。

方法：比較的短い期間での喫煙と医療費の直接的な関係を検討するため、大阪府羽曳野市の2007年度健診で聴取された喫煙状況と、翌2008年度の医療費の突合を行った。羽曳野市では健診受診者に体内の炎症所見の指標である高感度CRPの測定を行っており、これと喫煙状況を組み合わせて、喫煙による影響を強く受けたと思われる対象者を同定する試みを行った。

結果：喫煙と1年後の医療費には特に関連を認めなかったが、喫煙者では高感度CRPは非喫煙者よりも高かった。また高感度CRPが高くなると医療費も高くなる傾向を認めた。高感度CRP値0.1mg/dL以上の40-49歳の女性喫煙者では、非喫煙者に比べて年間総医療費が有意に高く(継続喫煙者の平均値110,000円/生涯非喫煙者の平均値36,000円)、また性・年齢別の全国平均値と比較した場合に全国平均を超えた人数の割合も、継続喫煙は生涯非喫煙に比べて有意に多かった(継続喫煙22%/生涯非喫煙9%)。

結論：1年後という短期間であっても、40歳代の女性継続喫煙者においては、高感度CRP基準範囲上限以上(0.1mg/dL以上)の場合は、非喫煙者より医療費が高くなる傾向にあった事から、該当する者はより積極的に禁煙を勧めた方がよいと考えられた。今後、より長期間での関連がどうなっているかを検討する必要がある。

2. Tanaka H.

Cost-effectiveness of smoking cessation therapy in Japan.

World cancer congress, Montreal, 2012.

**[OC12] COST-EFFECTIVENESS OF SMOKING CESSATION THERAPY IN JAPAN**

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**Background:** In Japan, national health insurance system introduced reimbursement for smoking cessation therapy (SCT) for smokers who are highly nicotine dependent but willing to quit in April 2006. The SCT consists of behavioral counseling by trained nurse and nicotine patch or varenicline prescription in 5 times of out-patients clinic through 12 weeks.

**Objectives:** We estimated the cost per additional smoker who succeeded to quit smoking due to the SCT.

**Methods:** The study subjects were 525 smokers who started to receive SCT between April 2008 and July 2010 in 6 hospitals in Japan. The cost was calculated to be the summation of (1) opportunity costs for physicians and nurses who were engaged in the SCT, (2) costs of prescription for smoking cessation and (3) the other medical costs for SCT in the 6 hospitals. Effectiveness of the SCT was defined as a success rate which was calculated as the number of 48 hours-quitters at 6 months after the termination of the SCT based on self-administered questionnaire, divided by the number of the subjects who received SCT at least once. We assumed that the subjects did not succeed smoking cessation without SCT, because most of them had high Tobacco Dependence Score at the beginning of SCT.

**Results:** Total cost of the SCT in 525 subjects was accumulated to 31,286,538 Japanese-yen (JY), so the cost per subject was JY59,593. Among the 525 subjects, 388 reached their potential length of follow-up in 6 months and longer from the termination of the SCT at the closing date. The success rate was 23% (89/388). From these data, we estimated the cost per additional quitter was JY259,799. The cost was more expensive in the subjects who had psychiatric disorder (JY400,898), mainly due to their low success rate (15%).

**Conclusion:** The cost per additional smoker who succeeded to quit smoking by the Japanese SCT was estimated to JY259,799 (approximately 2,880 USD). It varied according to the patients complications.

**Disclosure of Interest:** None Declared

**Keywords:** smoking cessation

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3. 中村幸志, 岡村智教, 早川岳人, 岡山 明, 三浦克之, 上島弘嗣.  
動脈硬化性疾患危険因子の医療費へのインパクト.  
第 44 回日本動脈硬化学会総会・学術集会, 福岡, 2012 年.

動脈硬化性疾患危険因子の医療費へのインパクト

Impacts of atherosclerotic risk factors on medical expenditures

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平成 20 年から始まった特定健康診査・特定保健指導制度は「危険因子の適正な管理で動脈硬化性疾患の予防することによって国民医療費の削減を図る」ことを目的に掲げているため、動脈硬化性疾患危険因子と医療費の関係に関心が高まっている。しかし、一般集団を対象にして原因である動脈硬化性疾患危険因子と結果である医療費の関係を前向きに長期間追跡して検討した事例はわが国にはあまりない。ここで先駆的事例として紹介する滋賀県国保コホート研究は、滋賀県国民健康保険（国保）団体連合会の地域健康づくり検討委員会の事業の一環として行われ、1990 年の滋賀県内の 8 町村（当時）に在住の 40～69 歳の国保加入者のうち、同年の基本健康診査（健診）を受けた約 4,500 人を前向きに追跡して、健診所見とその後 10 年間の医科レセプトに基づく医療費の関係を検討したものである。動脈硬化性疾患危険因子を有する者はこれを有しない者よりも将来医療費が高く、しかも、危険因子の集積がみられる者では医療費がさらに高かった。追跡期間中の死亡による国保資格喪失の有無も把握したことで、危険因子保有者では総死亡リスクの上昇を伴って医療費が高いことが明らかになった。このような個人の視点からの危険因子と医療費の関係の検討に留まることなく、公衆衛生学的に重要な集団の視点からの危険因子と医療費の関係も検討した。集団全体の動脈硬化性疾患危険因子と関連する医療費を削減するためには、医療機関で重症危険因子保有者を対象とするハイリスク・アプローチと地域で集団全体を対象とするポピュレーション・アプローチの両方に基づいた動脈硬化性疾患危険因子対策が必要であることが示唆された。

Keywords

動脈硬化性疾患危険因子、医療費、ハイリスク・アプローチ、ポピュレーション・アプローチ

4. 谷原真一.

男性勤労者における糖尿病と医療費に関する追跡調査.

第 55 回日本糖尿病学会年次学術集会, 横浜, 2012 年.

II-P-1 男性勤労者における糖尿病と医療費に関する追跡調査

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谷原 真一

【目的】糖尿病が医療費に及ぼす影響を検討する.

【方法】ある健保組合の健康診断を2002年度に受診し2008年3月31日まで在籍が確認された者の内, 血糖値が測定された男性で既往歴および治療中の傷病が「特になし」と回答した49歳以下の2193名について, 2002年度と2007年度の医療費総額(医科と調剤の合計)を糖尿病型47名と正常型2146名の間で比較した.

【結果】2002年度の平均医療費は糖尿病型59969円, 正常型46767円であり, 両群間で有意差は認められなかった. 2007年度は糖尿病型295529円, 正常型72734円であり, 糖尿病群が有意に高額であった ( $p=0.01$ ).

【考察】健康診断にて糖尿病型と判定された者は, 以後5年間の間に糖尿病に関連する医療費の急激な増加が生じると考えられる.

5. 谷原真一, 百瀬義人.

男性勤労者のニコチン依存度と禁煙取り組み状況及び理由に関する分析.  
第22回日本産業衛生学会産業医・産業看護全国協議会, 東京, 2012年.

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男性勤労者のニコチン依存度と禁煙取組状況及び理由に関する分析

谷原 真一、百瀬 義人

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【緒言】禁煙が健康に与える影響を検証する場合、疾病に罹患したために禁煙する者が含まれるため、禁煙理由や時間の前後関係を考慮する必要がある。また、ニコチン依存度は禁煙への取り組みに影響を与えると考えられるが、ニコチン依存度と禁煙への取り組み及び禁煙理由との関連についての検討は限られている。今回、男性勤労者を対象にニコチン依存度と喫煙状況、禁煙への取組状況、禁煙に取り組んだ理由の関連を分析した。

【方法】平成23年10月1日現在で福岡県のある健保組合に被保険者本人として在籍する9206人を対象に、現在の喫煙状況、喫煙者に対してはニコチン依存度及び過去1年間の禁煙に対する取り組みの有無、禁煙者に対しては禁煙開始後の年数、禁煙者及び喫煙者で過去1年間に禁煙に対して取り組んだ者に対しては禁煙に取り組んだ場合の理由などに関する調査票を配布した。ニコチン依存度は、Fagerstrom Test for Nicotine Dependence (FTND) (Heatherton, 1991) より、高 (7点以上)、中 (3-6点)、低 (2点以下) と判定した。本研究は疫学研究倫理指針に沿って実施し、福岡大学委の倫理委員会による承認を受け、研究実施時に対象者から書面によるインフォームド・コンセントを得た。

【結果】有効回答が得られた7592人 (82.5%) 中、男は4701人 (61.9%) であった。その内、喫煙者2290人 (48.7%)、非喫煙者1140人 (24.3%)、禁煙者1271人 (27.0%) であった。性・年齢・生年月日などに欠損値のなかった男の喫煙者2270名の内、過去1年間で禁煙に取り組んだ者は922名 (40.6%) であった。ニコチン依存度が低いの方が過去1年間に禁煙に対する取り組んだ者の割合が高くなっていった。(高110人 (31.8%)、中532人 (38.7%)、低280人 (50.9%)) 禁煙に取り組んだ理由として、「健康のため」と「平成22年10月にタバコの値段が上がった」はニコチン依存度によらず約50%であった。「身内・知人の病気」及び「自分の病気」はニコチン依存度が高い群の方が該当する者の割合が高く、「病気ではないが体調が悪い」及び「子供ができた」はニコチン依存度が低い群の方が該当する者の割合が高くなっていった。

【考察】ニコチン依存度は禁煙に対する取り組みだけではなく、禁煙する理由とも関連していることが明らかになった。ニコチン依存度が高い者ほど禁煙に積極的ではないという結果は従来知見と矛盾がない。ニコチン依存度を考慮することで職域における喫煙対策の効果が向上すると予測される。

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6. Murakami Y, Okamura T, Miura K and Ueshima H.

Age, sex, and BMI-specific increase in medical expenditure due to the clustering of established atherosclerotic risk factors: a community-based cost analysis among 38,890 Japanese.

XVI International Symposium of Atherosclerosis 2012. Sydney, 2012.

**252. Age, sex, and BMI-specific increase in medical expenditure due to the clustering of established atherosclerotic risk factors: a community-based cost analysis among 38,890 Japanese**

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striking increase in medical expenditures, which is quite distinct in Japan. The investigation on the relationship between medical expenditure and atherosclerotic risk factors is indispensable and an interaction effect of obesity is worth to examine from the public health perspective.

Methods: Data-linkage analysis between average annual medical expenditure from April 2000 to March 2006 and their retrospective health examination data was performed in a total of 38,890 men and women aged 40 years and over living in all local municipalities in Shiga prefecture, Japan. The components of atherosclerotic risk factors were defined as follows: hypertension (SBP>140 mmHg or DBP>90 mmHg), hypercholesterolemia (serum total cholesterol>240mg/dl), high blood glucose (casual blood glucose>126 mg/dl) and smoking (current smoking). The overweight was defined as BMI $\geq$ 25.0 kg/m<sup>2</sup>. The elderly was defined as the people aged 65 and over. Gamma regression was used to compare annual medical expenditure per as the number of components.

Results: In relative comparisons, a graded increase in annual medical expenditures was observed in women both the elderly and the non-elderly as per atherosclerotic risk clustering. These trends were consistent imperative of overweight. In men, the similar trends were observed in the non-overweight, but not in the overweight.

Conclusion: An annual medical expenditure was increased as per atherosclerotic risk clustering in women and men of non-overweight in Japan.



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(循環器疾患・糖尿病等生活習慣病対策総合研究事業)

各種禁煙対策の経済影響に関する研究－医療費分析と費用効果分析－

(H22－循環器等(生習)－一般－012)

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