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Effectiveness of a Low-Intensity Intra-Worksite Intervention on Smoking Cessation in Japanese Employees: A Three-Year Intervention Trial

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Abstract: Effectiveness of a Low-intensity Intra-Worksite Intervention on Smoking Cessation in Japanese Employees: A Three-Year Intervention Trial, Hideo TANAKA, *et al*. Department of Cancer Control and Statistics, Osaka Medical Center for Cancer and Cardiovascular Diseases—To test the effectiveness of a low-intensity intervention program for smoking cessation targeting the worksite environment in employees who had a low readiness to quit, we conducted an intervention trial at six intervention and six control worksites in Japan. A total of 2,307 smokers at baseline who remained at their worksite throughout the three-year study period were analyzed (1,017 in intervention and 1,290 in control groups). The multi-component program at the worksites consisted of (1) presenting information on the harms of tobacco smoking and the benefits of cessation by posters, websites, and newsletters; (2) smoking cessation campaigns for smokers; (3) advice on designation of smoking areas; and (4) periodic site-visits of the designated smoking areas by an expert researcher. At baseline, the intervention and control groups each had high prevalence of immotive or precontemplation, that reflected low readiness to quit (71.5% and 73.2%, respectively). The smoking cessation rate, as not having smoked for the preceding six months or longer, assessed at 36 months after the baseline survey by a self-administered questionnaire was significantly higher in the intervention group than the control group (12.1%, vs. 9.4%, p=0.021). The intervention program still had a significant effect on the smoking cessation rate after multiple logistic regression analysis adjusted for sex, age, type of occupation, age of starting smoking, quit attempts in the past, number of cigarettes per day, and readiness to quit (odds ratio: 1.38, 95% confidence interval: 1.05–1.81, p=0.02). The cost per additional quitter due to the intervention was calculated to be ¥70,080. These findings indicate that this program is effective and can be implemented in similar workplaces where the prevalence of smoking is high and smokers' readiness to cease smoking is low.
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Population strategies to prevent smoking such as having a smoke-free policy at workplaces are considered to have made substantial contributions to smoking cessation in Western countries[1)]. However, it is uncertain whether population strategies are effective in countries with a high prevalence of smoking[2)] and a high proportion of smokers with a low readiness to quit[3)], such as Japan. The High-risk and Population Strategy for Occupational Health Promotion study (HIPOP-OHP study), which was started in 1998 and was funded by the Japanese Ministry of Health, Welfare and Labour, implemented programs for reducing cardiovascular disease risk factors at

worksites[4, 5]. The aim of this project was to promote three behavioral changes in workers: better dietary habits, increased physical activity and smoking cessation. The intervention program for smoking cessation targets workers at the worksite environment rather than merely targeting smokers, and consists of several low-intensity components. In this report, we assess the effectiveness of a three-year intra-worksite intervention program as measured by the smoking cessation rates as part of the HIPOP-OHP study.

Methods

Study population

The details of this controlled trial have been described elsewhere[4]. Briefly, we recruited 12 companies in Japan, each of which had 500–1,000 employees. A low-intensity, multi-component smoking intervention program was implemented in six companies in the intervention group, while it was not implemented in the other six companies in the control group, according to the preference of the Safety and Health Committee at each company. The prevalence of smoking at baseline as assessed by a self-administered questionnaire that was administered in 1999 and 2000, was 44.3% (1,382/3,121) in the Intervention group, and 45.1% (1,736/3,848) in the control group. Among the current smokers at baseline, 73.6% (1,017/1,382) of the smokers in the intervention group and 74.3% (1,290/1,736) of the smokers in the control group remained at their worksite throughout our three-year study period and were included in our analysis. The intervention and control groups each consisted of one worksite with white-collar workers (the intervention group, a life insurance company: n=72; the control group, a research laboratory of an electrical appliance manufacturer: n 55) and five worksites with blue-collar workers (one chemical plant in each group: n=201 vs. 184; and four electric appliance factories in each group: n=94–302 vs. 179–445, respectively).

Intervention methods

The intervention for smoking cessation consisted of the following four components: (1) placing posters with information on smoking cessation at worksites, and placing information on stages of change in smoking cessation behavior on worksite websites and in worksite newsletters; (2) conducting a six-week worksite smoking cessation campaign that consisted of <1> delivery of five brochures on the stages of change in smoking cessation behavior; <2> short-term counseling sessions a total of four times with prescriptions for nicotine patches for 28 days if requested; <3> giving an award to the winner among those who continued to abstain from smoking during the campaign; (3) providing suggestions to individuals on ways to avoid second-hand smoking and designation of smoking areas by the Safety and Hygiene Committee at the worksites, and (4) conducting periodic site-visits to the designated smoking areas by an expert researcher once a year[4]. Components (1) and (2) were conducted by on-site personnel (mainly a public health nurse) at each worksite, with materials and technical support provided by our research group. We anticipated that these comprehensive but low-intensity programs would increase smokers' readiness to quit smoking, and that those who succeeded in cessation would affect other smokers. We set the intervention period to be 36 months, which is longer than that of typical intervention studies on smoking cessation, on the basis of the assumption that the majority of the smokers had low readiness to quit smoking. At each worksite, the smoking cessation campaign was held five times during the 36-month intervention period. During the intervention period, 12.3% (125/1,017) of the smokers in the intervention group participated in the smoking cessation campaign voluntarily, and 79 (63%) of them received the short-term counseling sessions with prescription of nicotine patches.

All twelve participating companies had neither a company-wide smoke-free policy nor designated smoking areas from which tobacco smoke did not leak outside the smoking area, at the beginning of the study. No interventions on smoking cessation were provided to the control group, although they received routine annual health check-ups at worksites with advice on health by occupational physicians. Approval for this study was obtained from the Institutional Review Board of Shiga University of Medical Science for Ethical Issues (No. 10–16).

Outcome measurement and statistical analyses

Smoking status was assessed 36 months after the baseline survey using a self-administered questionnaire which was distributed at each worksite. The smoking cessation rate was defined as the proportion of group members who reported not smoking any cigarettes for six months or longer prior to the survey. To examine the effectiveness of the intervention within the intervention period, we also compared the smoking cessation rate between the two groups at 12 months and 24 months after the baseline survey. The significance of differences in the cessation rates was assessed by chi-square tests. We used multiple logistic regression analysis to obtain odds ratios (ORs) with 95% confidence intervals (CIs) to adjust the effect of the intervention for potential confounding factors obtained from the baseline survey. In the analysis, sex, age (<30 yr/30–39/40–49/50–59), type of occupation, age at which the individual started smoking (<20 yr/20+), whether the individual attempted to quit smoking in the past, number of cigarettes per day (<20/20+), and readiness to quit smoking at study entry were included as independent variables. These classifications were

performed to allocate an appropriate number of study subjects to each variable. We used dummy variables in age categories. Readiness to quit smoking was categorized into three categories: (1) the immotives (not interested in quitting smoking) or precontemplation stage (interested in quitting smoking but not thinking about quitting in the next 6 months), (2) the contemplation stage (planning to quit within the next 6 months), and (3) the preparation stage (planning to quit during the next month)[6, 7]. The stepwise method for logistic regression analysis was also used. The reported *p*-values are for two-sided alternative hypotheses. Data analyses were performed with the SAS/PC statistical package (SAS Institute, Cary, NC).

In addition, we performed a cost-effectiveness analysis of this intervention when the adjusted odds ratio for the intervention was statistically significant. In the analysis, we calculated the number of additional quitters due to the intervention to be:

Number of subjects in the intervention group (1017) × [smoking cessation rate among the control group × (adjusted odds ratio-1)].

The cost of the intervention program was estimated to be the opportunity costs (a) for the providers of the components, who were the on-site personnel including worksite physicians at each worksite, (b) for the smokers who participated in the smoking cessation campaign and (c) for the researchers, plus the cost of the materials used in the intervention. The earnings used to calculate the opportunity costs were as follows. For the worksite physicians among the providers who participated in the smoking cessation campaign, the hourly earning of ¥4,760 was used. For the other providers and for the participants, the hourly earning of ¥1,420 was used, which was based on the average hourly earning of workers at manufacturing companies in Japan in 2005. For the researchers, the earning of ¥14,100 per day was used, which is the cost of reimbursement for technical advice or instruction as set by the Ministry of Health, Labour and Welfare of Japan. The cost per additional smoker who quit smoking due to the intervention was expressed with the 95% CI using the lower and upper limits of the adjusted odds ratio.

Results

Table 1 shows the baseline characteristics of the study

Table 1. Baseline characteristics of 1,017 smokers in the intervention group and 1,290 smokers in the control group

	Intervention group		Control group		
Characteristic	n	(%)	n	(%)	*p*-value
Sex					
Male	956	(94.0)	1,256	(97.4)	0.001*
Female	61	(6.0)	34	(2.6)	
Age (yr)					
–29	255	(25.1)	274	(21.3)	0.016#
30–39	411	(40.4)	506	(39.3)	
40–49	227	(22.3)	355	(27.5)	
50–59	124	(12.2)	154	(11.9)	
Type of occupation					
Blue-collar worker	945	(92.9)	1,235	(95.7)	0.005*
White-collar worker	72	(7.1)	55	(4.3)	
Age when started smoking (yr)					
19 or younger	379	(37.6)	502	(39.0)	0.521*
20 or older	628	(62.4)	784	(61.0)	
Quit attempts in the past					
No	658	(64.9)	840	(65.5)	0.805*
Yes	356	(35.1)	443	(34.5)	
Number of cigarettes per day					
19 or lower	342	(33.9)	496	(38.5)	0.025*
20 or higher	668	(66.1)	793	(61.5)	
Readiness to quit					
Immotive or precontemplation	727	(71.6)	944	(73.2)	0.524#
Contemplation	270	(26.6)	304	(23.6)	
Preparation	19	(1.9)	42	(3.3)	

*p-value by chi-square test, #p-value by Wilcoxon's signed rank test

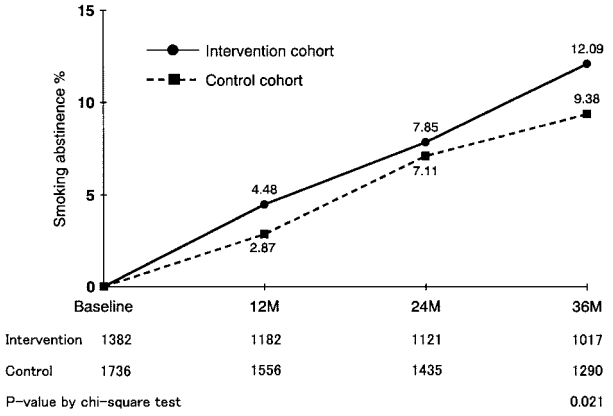

Fig. 1. Smoking cessation rates over time among the smokers at the baseline survey in the HIPOP-OHP study.

subjects in the intervention and the control group. The distribution of sex, age, type of occupation and the number of cigarettes per day were statistically different between the two groups. Both the intervention and control groups had high proportions of immotive or precontemplation stage, which reflected low readiness to quit (71.5% (727/1,017) and 73.2% (944/1,290) respectively), and a low proportion of individuals at the preparation stage (1.9% (19/1,017) and 3.3% (42/1,290), respectively) (Table 1). The dropout rates of immotives or precontemplation, contemplation, and preparation were 26.0% (255/982), 25.8% (94/364), 47.2% (17/36) in the intervention group, and 25.3% (320/1,264), 26.7% (111/415), 26.3% (15/57) in the control group, respectively.

Figure 1 shows the smoking cessation rates at 12, 24 and 36 months after the baseline survey. There was a steady increase in the cessation rate over the 36-month period in both groups. The intervention group showed a higher smoking cessation rate than the control group

Table 2. Smoking cessation rate assessed 36 months after the baseline survey in the intervention and control groups

	Intervention group		Control group		
Subgroup	Smoking cessation rate (%)	n	Smoking cessation rate (%)	n	*p*-value*
Total	12.1	(123/1,017)	9.4	(121/1,290)	0.021
Sex					
Male	12.5	(119/956)	9.2	(116/1,256)	0.015
Female	16.4	(9/61)	20.6	(7/34)	0.609
Age (yr)					
–29	7.5	(18/255)	8.8	(24/274)	0.582
30–39	14.4	(59/411)	8.1	(40/506)	0.003
40–49	12.8	(29/227)	8.5	(29/355)	0.092
50–59	17.7	(21/124)	17.5	(26/154)	0.964
Type of occupation					
Blue-collar worker	11.9	(112/945)	9.4	(116/1235)	0.063
White-collar worker	23.6	(17/72)	12.7	(7/55)	0.121
Age when started smoking (yr)					
19 or younger	10.3	(39/379)	7.6	(38/502)	0.157
20 or older	14.3	(90/628)	10.8	(85/784)	0.048
Quit attempts in the past					
No	10.5	(69/658)	7.1	(59/840)	0.022
Yes	16.6	(58/356)	14.2	(62/443)	0.358
Number of cigarettes per day					
19 or lower	14.6	(50/342)	11.9	(59/496)	0.249
20 or higher	11.7	(78/668)	7.9	(63/793)	0.016
Readiness to quit Immotive or precontemplation	9.8	(71/727)	8.2	(77/944)	0.251
Contemplation	19.3	(52/270)	12.2	(37/304)	0.019
Preparation	31.6	(6/19)	21.4	(9/42)	0.394

*p-value by chi-square test. This study was conducted during 1999–2003 in Japan.

Table 3. Factors associated with smoking cessation among smokers who participated in the HIPOP-OHP study* according to multiple logistic regression analysis

Variable	n	Odds ratio	95% confidence interval	*p*-value
Sex				
Male	2,212	1.00		
Female	95	1.46	0.81–2.63	0.206
Age (yr)				
–29	526	1.00		
30–39	917	1.32	0.89–1.94	0.166
40–49	582	1.27	0.82–1.96	0.283
50–59	279	2.49	1.57–3.95	<.001
Type of occupation				
Blue-collar worker	2,180	1.00		
White-collar worker	127	1.74	1.07–2.80	0.024
Age when started smoking (yr)				
19 or younger	379	1.00		
20 or older	628	1.16	0.86–1.56	0.327
Quit attempts in the past				
No	658	1.00		
Yes	356	1.60	1.21–2.11	<.001
Number of cigarettes per day				
19 or lower	1,461	1.00		
20 or higher	838	1.26	0.95–1.68	0.108
Readiness to quit				
Immotive or precontemplation	1,671	1.00		
Contemplation	574	1.67	1.24–2.24	<.001
Preparation	61	2.75	1.45–5.22	0.002
Control group	1,290	1.00		
Intervention group	1,017	1.38	1.05–1.81	0.022

This study was conducted during 1999–2003 in Japan.

throughout the study period.

Overall, the intervention group had a significantly higher cessation rate than the control group (12.1% (n=123) vs. 9.4% (n=121), p=0.02, Table 2). When expressed as percentages of gender, age, occupation, smoking behavior and attitude, the cessation rates were higher in the intervention group than in the control group for most subgroups (Table 2).

Multiple logistic regression analysis showed that age of 50 yr or older, white-collar occupation, having attempted to quit in the past, and having higher readiness to quit (stages of contemplation and preparation) were significantly associated with high smoking cessation rate at 36 months after study entry (Table 3). The intervention group had a significantly higher cessation rate than the control group after adjustment for confounding factors (OR:1.38, 95% CI:1.05–1.81, p=0.022). In the stepwise method, six pairs of subgroups showed significant differences: age, 50–59 yr against those aged 20–29 yr, white-collar workers against blue-collar workers, having attempted to quit in the past, contemplation stage against immotive or precontemplation stage, preparation stage against immotive or precontemplation stage, and intervention. Intervention still had a significant effect in the stepwise method (OR:1.36, 95% CI:1.04–1.78, p=0.027).

In the cost-effectiveness analysis, the number of additional quitters due to the intervention was calculated to be 1,017 × [0.094 × (1.38–1)]=36.3. The total cost of the intervention program was ¥2,543,964, as shown in Table 4. The cost per additional quitter was thus ¥70,080 (¥2,543,964 /36.3). Using the 95% CI for the adjusted odds ratio of the intervention, the 95% CI of the cost per additional quitter ranged from ¥32,800 to ¥532,200.

Discussion

Worksites are important venues for promoting lifestyle modifications to reduce cardiovascular disease risk

Table 4. Cost of the intervention for smoking cessation in the HIPOP-OHP study

Item	Number of person-hours	Cost (¥)
1. Opportunity cost for Providers, who were among the existing personnel at each worksite		
(1) Placing posters, newsletters, etc.	24 person-hours (0.5 h × 8 times × 6 persons)	34,080
(2) Preparation, explanation, sending brochures and giving out awards during the campaign	45 person-hours (1.5 h × 5 times × 6 persons)	63,900
(3) Brief counseling provided by work-site nurse	78 person-hours (0.25 h × 52 times × 6 persons)	110,760
(4) Brief counseling with prescription for nicotine patch provided by work-site physician	19.5 person-hours (0.25 h × 13 times × 6 persons)	92,820
(5) Receiving instructions from researchers	48 person-hours (8 h × 6 persons)	68,160
2. Opportunity cost for Participants		
(1) Filling out self-administered questionnaire	203.4 person-hours (0.05 h × 4 times × 1,017 persons)	288,828
(2) Receiving instructions from the campaign	82.5 person-hours (0.33 h × 2 times × 125 persons)	117,150
(3) Receiving brief counseling	98.8 person-hours (0.25 h × 5 times × 79 persons)	140,300
3. Opportunity cost for Researchers		
(1) Providing guidance to managers at worksites	12 person-days (2 d × 6 sites × 1 person)	169,200
(2) Giving instructions to providers	12 person-days (0.5 d × 24 times × 1 person)	169,200
(3) Giving suggestions to the Committee for Controlling Environmental Smoke	6 person-days (1 d × 6 times × 1 person)	84,600
(4) Making periodic site visits to the designated smoking areas	18 person-days (3 d × 6 sites × 1 person)	253,800
4. Materials		
(1) Self-administered questionnaire	¥8.7 × 4 times × 1,017 persons	35,392
(2) Posters	¥275 × 10 × 4 times × 6 sites	66,000
(3) Brochures	¥50 × 5 × 125 persons	31,250
(4) Diaries for participants	¥250 × 46 persons	11,500
(5) Nicotine patches	¥9,456 × 79 persons	747,024
(6) Miscellaneous		60,000
Total		2,543,964

HIPOP-OHP study: The High-risk and Population Strategy for Occupational Health Promotion study
Cost per quitter (¥): ¥2,543,964/36.3 = ¥70,080 (95% CI= ¥32,800–¥532,200)

factors[8]. In Japan, there was a study showing that repeated individual counseling on smoking cessation at the worksite had a significant positive effect on smoking cessation[3]. However, there have been no trials assessing the effect of a comprehensive but low-intensity program at the worksite. There have been several intervention trials at worksites for smoking cessation using environmental support for no-smoking[9–12] or using comprehensive smoking cessation programs[13–17]. However, those programs that showed significant effectiveness had an "enriched menu", that featured skilled intervention[9], use of a cigarette substitute[12],

frequent group sessions[16] or integration of occupational health and safety and health promotion[17].

The current study demonstrated that our three-year, multi-component program at worksites increased the probability of smoking cessation by approximately 1.4 times. The stratified analysis showed a favorable effect of the intervention for almost all subsets, some of which were related to smoking behavior.

A strength of this study is its potential generalization, due to the large number and their comprehensive range of ages and occupations. In addition, the low-intensity smoking cessation program was administered only by on-site employees at each worksite. This may allow the generalization of our results to other worksites with similar smoking environments and high prevalence of smokers with little readiness to quit smoking.

The cost per additional quitter was ¥70,080 (equivalent to U.S.$610 in October 2005). This cost is less expensive than the "high-intensity" interventions administered by primary care clinicians and smoking cessation specialists in which participants do not use nicotine replacement as recommended by the Agency for Health Care Policy and Research of the U.S. ($2,100–$7,900)[18], and is similar to the cost per quitter in companies with a smoke-free workplace policy ($799)[19].

Our univariate analysis demonstrated the intervention group showed a statistically higher smoking cessation rate than the control group among heavy smokers who smoked 20 cigarettes or more per day (p=0.016) and those who had no quit attempts in the past (p=0.022), but not among light smokers (p=0.249) nor those who had quit attempts in the past (p=0.358). We had assumed the low intensity program would be more effective on the workers who were light smokers and had quit attempts in the past. These statistically insignificant findings might result from the relatively higher smoking cessation rates shown among in the light smokers (11.9%) and those who had quit attempts in the past (14.2%) in the control group, although the reason was not well-determined.

There were three notable limitations that may have affected the outcome of our study. First, the participating worksites were not randomly assigned to receive or not receive the intervention program. There were different distributions of some baseline characteristics among the smokers in the intervention and control groups, which may have affected the smoking behaviors in the two groups. However, our stratified analyses showed a superior cessation rate in the intervention group in the majority of subgroups stratified by possible confounders. In addition, factors related to smoking behavior were adjusted using the stepwise method for logistic regression analysis, even though the effect of the model-based adjustments could be limited, because some characteristics of the background were considerably different between the intervention and the control groups.

Second, unexpectedly, due to the economic recession in Japan during the study period, there were a considerable number of dropouts as a result of lay-offs, in addition to dropouts through personnel changes and retirement in both groups. However, the dropout rate in the intervention group was very similar to that in the control group and it is considered that the reason for layoff in the majority of cases was not unhealthy status related to smoking. In addition, we compared the cessation rates between the two groups prior to the endpoint, and found a consistent tendency for superior cessation rate in the intervention group.

Third, since we had no feasible alternative but to rely on self-reports for assessment of the smoking status, the possibility of false reporting cannot be fully denied. However, as the subjects were told that all completed questionnaires would remain confidential, it is realistic to assume there was no reason for the smokers to answer falsely. Furthermore, the same questionnaire was used in both the intervention and control groups and was administered at the time of annual health check-ups. Therefore, a non-differential misclassification of the response might have occurred, which would result in underestimation of the effectiveness of the intervention.

In conclusion, we have demonstrated that a comprehensive and low-intensity smoking cessation program conducted by human resources personnel at worksites significantly increased the smoking cessation rate, even though the majority of smokers in this study had low readiness to quit smoking at baseline. The finding indicates that this program is effective and can be implemented in similar workplaces where the prevalence of smoking is high and smokers' readiness to quit smoking is low.

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