[Environmental Health and Preventive Medicine 7, 169–172, September 2002]

Original Article

The Impacts of Health Examinations and Smoking on Disease Mortality Risk in Japan: a Longitudinal Cohort of 720,611 Japanese Life Insured Persons

Machi SUKA, Hiroki SUGIMORI and Katsumi YOSHIDA

Department of Preventive Medicine, St. Marianna University School of Medicine, Kanagawa

Abstract

Objectives: To evaluate the impacts of health examinations (HE) and smoking on disease mortality risk in Japan.

Methods: By using the large cohort database of a Japanese life insurance company, 720,611 subjects aged 20 to 80 years, who had contracted for life insurance between April 1, 1995 and March 31, 1998, were followed up until September 30, 1999. Cox's proportional hazard model was used to estimate age-adjusted relative risk (RR) for disease death.

Results: After adjusting for age, disease mortality in smokers was significantly higher than that in non-smokers (men, RR 1.51, 95% CI: 1.25–1.81; women, RR 1.54, 95%CI: 1.12–2.11). Meanwhile, disease mortality in HEees (those who had got HE within the past 2 years) was significantly lower than that in non-HEees (men, RR 0.70, 95% CI: 0.56–0.88; women, RR 0.71, 95% CI: 0.54–0.92). The magnitude of the impact of HE on disease mortality risk varied according to smoking status. Non-smokers showed a significantly lower risk associated with HE, whereas smokers did not.

Conclusions: HE may allow an appreciable reduction in disease mortality, however, the reduction effect may be limited to non-smokers. Smoking cessation may be essential to improve the preventive effects of HE.

Key words: cohort study, health examination, smoking, mortality

Introduction

Similar to "Healthy People 2000" in the US and "Our Healthier Nation" in the UK, the Japanese Ministry of Health and Welfare has developed the national health campaign "Healthy Japan 21" (1). It contains 48 targets that should be realized by 2010 for improvement of community health in Japan. Popularization of health examinations (HE) is presented as one of them. HE are regularly performed as a public health service in Japan. The aim is early detection and prompt treatment (a basic principle of preventing disease), which may reduce health risk for the subject and ultimately minimize the public burden of disease. However, few elements of HE have been proven to be effective for promoting health and preventing disease (2). Moreover, direct epidemiological evidence about reduction in disease mortality by getting HE is insufficient.

Smoking cessation is also presented as one of the targets of "Healthy Japan 21". According to a national survey in 1999, 54.0% of men and 14.5% of women aged 20 years or older were current smokers in Japan (3). The smoking rate in Japan is near the peak level in western countries and ranks highly in the world. Independently of ethnicity, smoking is harmful to health (4). If the smoking rates persist, mortality from smoking-related diseases will increases further in Japan as well as in western countries (5, 6, 7).

By using the large cohort database of a Japanese life insurance company, we evaluated the impacts of HE and smoking on disease mortality risk and demonstrated an association between HE and disease mortality in relation to smoking status.

Subjects and Methods

A longitudinal large cohort database was accumulated from a Japanese life insurance company. The cohort consisted of 720,611 eligible subjects (397,922 men; 322,689 women) aged 20 to 80 years, who had contracted life insurance between April 1, 1995 and March 31, 1998. They had completed on the contract day a structured questionnaire about HE over the past 2 years and their smoking status over the past year. Table 1 shows the baseline characteristics of the study subjects. At baseline, 79% of men and 70% of women were below age 40 years; 68% of men were smokers, whereas 74% of women were non-smokers; 83% of men and 79%

Received Feb. 12 2002/Accepted May 16 2002
Reprint requests to: Machi SUKA
Department of Preventive Medicine, St. Marianna University School of Medicine, 2-16-1 Sugao, Miyamae-ku, Kawasaki, Kanagawa 216-8511, Japan
TEL: +81(44)977-8111, FAX: +81(44)977-8356
E-mail: suka@marianna-u.ac.jp

Table 1 Baseline characteristics of the study subjects

	men (n=397,922)		women (n=322,689)	
	No.	%	No.	%
age, mean±SD, y.o.	32.8±10.1		35.3±12.2	
smoking				
–	127,866	32.1	239,925	74.4
+	270,056	67.9	82,764	25.6
health examination				
–	69,049	17.4	68,686	21.3
+	328,873	82.6	254,003	78.7

of women were HEees (i.e. those who had got HE within the past 2 years).

Information on vital status and cause of death (disease, accident, suicide or others) was collected through the insurance payment records. We focused on disease death (death caused by any disease) and followed up the subjects to observe the occurrence of disease death until September 30, 1999. Mean±SD of the follow-up duration was 32.7±28.0 months. During the follow-up, 292,093 subjects (40.5%) had withdrawn the contracts. We considered them as censored cases, which were included in the data analysis.

We paid attention to protection of anonymity and confidentiality of the available data.

Statistical analyses

The statistical analyses were performed with the Statistical Analysis Systems (SAS, version 6.12). Mortality rate was estimated as the number of deaths per 100,000 person-months. Age-adjusted relative risks (RRs) and their corresponding 95% confidence intervals (CIs) were calculated from Cox's proportional hazard model (8).

Results

There were 829 disease deaths (508 men; 321 women), which accounted for 74% of the total deaths. Disease mortality rates (per 100,000 person-months) were 3.79 among men and 3.16 among women (Table 2, 3).

After adjusting for age, disease mortality in smokers was significantly higher than that in non-smokers. Compared with non-smokers, smokers had a 1.5-fold higher risk among men (RR 1.51, 95% CI: 1.25–1.81, Table 2), and also among women (RR 1.54, 95%CI: 1.12–2.11, Table 3). Meanwhile, disease mortality in HEees was significantly lower than that in non-HEees. Compared with non-HEees, HEees had a 0.7-fold lower risk among men (RR 0.70, 95% CI: 0.56–0.88, Table 2), and also among women (RR 0.71, 95% CI: 0.54–0.92, Table 3).

The magnitude of the impact of HE on disease mortality risk varied according to smoking status (Table 4). Non-smokers showed a significantly lower risk associated with HE (men, RR 0.84, 95% CI: 0.35–0.67; women, RR 0.71, 95% CI: 0.53–0.95), whereas smokers did not (men, RR 0.93, 95% CI: 0.68–1.28;

Table 2 Disease mortality rates (per 100,000 person-month) and age-adjusted relative risks (RRs) for disease death according to smoking and health examination among men

	No. of disease deaths	Mortality rate per 100,000 person-months, age, y.o. 20–29	30–39	40–49	50–	age adjusted RR†	(95%CI)
smoking							
–	208	0.52	1.89	3.23	25.03	1	
+	300	0.67	1.82	5.49	33.32	1.51	(1.25–1.81)
health examination							
–	90	1.42	3.12	5.97	37.97	1	
+	418	0.47	1.63	4.52	27.41	0.70	(0.56–0.88)
total	508	0.62	1.84	4.71	28.53		

† Calculated from the Cox's proportional hazard model with adjustment for age (y.o.).

Table 3 Disease mortality rates (per 100,000 person-month) and age-adjusted relative risks (RRs) for disease death according to smoking and health examination among women

	No. of disease deaths	Mortality rate per 100,000 person-months, age, y.o. 20–29	30–39	40–49	50–	age adjusted RR†	(95%CI)
smoking							
-	272	0.45	0.98	2.57	12.45	1	
+	49	0.11	1.72	2.60	20.04	1.54	(1.13–2.11)
health examination							
-	73	0.13	1.02	2.83	21.91	1	
+	248	0.43	1.19	2.51	11.56	0.71	(0.54–0.92)
total	321	0.37	1.15	2.57	13.06		

† Calculated from the Cox's proportional hazard model with adjustment for age (y.o.).

Table 4 Age-adjusted relative risks (RRs) for disease death according to health examination (non-smokers vs. smokers)

	men		women	
	non-smokers	smokers	non-smokers	smokers
	RR† (95%CI)	RR† (95%CI)	RR† (95%CI)	RR† (95%CI)
No. of disease deaths	280	300	272	49
person-months	4667616.3	8744620.2	8143363.4	2020207.1
health examination	0.48 (0.35–0.67)	0.93 (0.68–1.28)	0.71 (0.53–0.95)	0.73 (0.39–1.36)

† Calculated from the Cox's proportional hazard model with adjustment for age (y.o.).

women, RR 0.73, 95% CI: 0.39–1.36).

Discussion

This study was based on a large cohort database of HE, smoking and disease mortality in Japan. We demonstrated an association between HE and disease mortality in relation to smoking status, which might provide valuable evidence about reducing disease mortality in Japan by getting HE.

Disease mortality risk was significantly lower in HEees (i.e. those who had got HE within the past 2 years). As one possible reason, the HEees might have received counseling on medical treatment after the HE. Also, the HEees might be habitually careful about their health. The lower disease mortality risk in HEees seems to suggest both a preventive effect of HE and a good underlying well awareness of health.

In contrast to non-smokers, smokers showed no significantly lower disease mortality risk associated with HE. As one possible reason, excess risk associated with smoking might exceed the preventive effects of HE. Also, counseling on medical treatment after the HE might have limited effects on improvement of smokers' health. In spite of the excess risk associated with smoking, smokers tend to underestimate their health risk (9). Because of awareness of health among smokers, it might be difficult to give them appropriate medical treatment and improve their lifestyles. Moreover, there are various potential complicating factors in the higher disease mortality risk in smokers (e.g. alcohol intake (5, 10, 11), diet (10, 11, 12), personality (9, 13, 14) and other cardiovascular risk factors (15, 16, 17, 18)); smokers might have unhealthier lifestyles, besides smoking, than non-smokers. For smokers' health, it is important to promote awareness of health as well as encouraging them to quit smoking.

Due to the use of the database of a life insurance company, this study had the following potential limitations. First, the subjects were selected from life-insured persons. Since 75.2% of Japanese men and women aged 20 years or older had contracted life insurance (19), the sampling bias of this study would seem to have a minor effect on our findings. However, the proportion of smokers was higher than that shown in the national survey (3) (men, 67.9% vs. 54.0%; women, 25.6% vs. 14.5%); the proportion of HEees (80.9%) was higher than that for the community populations (40.4%) (3) and lower than that for the worksite populations (85.1%) (20). Second, the subjects were followed up for less than 4.5 years. The sample size of this study seems large enough to cancel out the effect of the short follow-up duration. We expect that other long cohort studies may confirm our findings. Finally, 40.5% of the subjects did not complete the follow-up. It is a well-known fact that large number of censored cases undermines the credibility of the risk estimation by Cox's proportional hazard model. However, we found that the survival rates calculated from Cox's proportional hazard model were almost similar to those obtained in Kaplan-Mayer analysis. Unfortunately, we had no in-depth information on the disease death (name or classification of the disease) and HE (contents of the HE). Further studies, taking into account these factors, may be required to gain a better understanding of the impacts of health examinations and smoking on disease mortality risk.

In conclusion, our results suggest that HE may allow an appreciable reduction in disease mortality; however, the reduction effect may be limited to non-smokers. Smoking cessation may be essential to improve the preventive effects of HE in Japan.

References

(1) Health and Welfare Ministry. Healthy Japan 21. Available at: http://www.kenkounippon21.gr.jp/index.html (Japanese)

(2) U.S. Preventive Services Task Force. Guide to clinical preventive services: report of the U.S. Preventive Services Task Force. 2nd edition. Baltimore: Williams & Wilkins, 1996.

(3) Health and Welfare Statistics Association. Trend of National Health 2001. Tokyo: Health and Welfare Statistics Association, 2001. (Japanese)

(4) Jacobs DR, Adachi H, Mulder I, et al. Cigarette smoking and mortality risk. Twenty-five-year follow-up of the seven countries study. Arch. Intern. Med. 1999; 159: 733–740.

(5) Kuller LH, Ockene JK, Meilahn E, Wentworth DN, Svendsen KH, Neaton JD. Cigarette smoking and mortality. Prev. Med. 1991; 20: 638–654.

(6) Tverdal A, Thelle D, Stensvold I, Leren P, Bjartveit K. Mortality in relation to smoking history: 13 year's follow-up of 68,000 Norwegian men and women 35–49 years. J. Clin. Epidemiol. 1993; 46: 475–487.

(7) Doll R, Peto R, Wheatley K, Gray R, Sutherland I. Mortality in relation to smoking: 40 years' observations on male British doctors. BMJ 1994; 309: 901–911.

(8) Cox DR. Regression models and life-tables. J. Royal. Stat. Soc. Series B 1972; 34: 187–220.

(9) Strecher VJ, Kreuter MW, Kobrin SC. Do cigarette smokers have unrealistic perceptions of their heart attack, cancer, and stroke risks? J. Behav. Med. 1995; 18: 45–54.

(10) Kato I, Tominaga S, Matsuoka I. Characteristics of life style of smokers and drinkers. Nippon Koshu Eisei Zasshi 1987; 34: 692–701. (Japanese)

(11) Nakamura Y, Sakata K, Yanagawa H. Relationships between

smoking habits and other behavior factors among males: from the results of the 1990 National Cardiovascular Survey in Japan. J. Epidemiol. 1996; 6: 87–91.
(12) Margetts BM, Jackson AA. Interactions between people's diet and their smoking habits: the dietary and nutritional survey of British adults. BMJ 1993; 307: 1381–1384.
(13) Evsenck HJ, Grossarth-Maticek R, Everitt B. Personality, stress, smoking, and genetic predisposition as synergistic risk factors for cancer and coronary heart disease. Integr. Physiol. Behav. Sci. 1991; 26: 309–322.
(14) Arai Y, Hosokawa T, Fukao A, Izumi Y, Hisamichi S. Smoking behaviour and personality: a population-based study in Japan. Addiction 1997; 92: 1023–1033.
(15) Stamler J, Wentworth D, Vaccaro O, Neaton JD. Diabetes, other risk factors, and cardiovascular mortality for men screened in the Multiple risk factor intervention trial. Diabetes. Care. 1993; 16: 434–444.
(16) Kawakami N, Takatsuka N, Shimizu H, Ishibashi H. Effects of smoking on the incidence of non-insulin-dependent diabetes mellitus. Replication and extension in a Japanese cohort of male employees. Am. J. Epidemiol. 1997; 145: 103–109.
(17) Uchimoto S, Tsumura K, Hayashi T, Suematsu C, Endo G, Fujii S, Okada K. Impact of cigarette smoking on the incidence of Type 2 diabetes mellitus in middle-aged Japanese men: the Osaka Health Survey. Diabet. Med. 1999; 16: 951–955.
(18) Liu L, Choudhury SR, Okayama A, Hayakawa T, Kita Y, Ueshima H. Changes in body mass index and its relationships to other cardiovascular risk factors among Japanese population: results from the 1980 and 1990 national cardiovascular surveys in Japan. J. Epidemiol. 1999; 9: 163–174.
(19) Social Insurance Agency. 1998 Investigation of actual conditions for contributors to the national pension fund. Available at: http://www.mhlw.go.jp/houdou/0103/h0309-7.html (Japanese)
(20) Labor Ministry. 1998 Investigation of health conditions for workers. Available at: http://www1.mhlw.go.jp/toukei/h10knenkin_21/text/index.html (Japanese)