【Introduction】

Hypertension (HT) is one of the most important risk factors for cardiovascular diseases (CVD) [2-9]. Blood pressure (BP) strongly predicts mortality from CVD, and screening for high BP is recommended according to the U.S. Preventive Service Task Force to identify people at increased risk for CVD [10].

However, it is hard to perform BP measurements continuously for all members of a community. On the other hand, self-reported history of HT (self-reported HT) obtained, for example, by self-administered questionnaires is easier to obtain and may identify people at high risk for CVD.

Several studies have reported that self-reported HT has a certain sensitivity and high specificity in screening for HT as defined by measured BP [11-13]. Thus, self-reported HT could be a predictive marker for CVD. However, there is little evidence as to whether self-reported HT can predict CVD mortality.

To investigate the relationship between self-reported HT and CVD mortality, we analyzed the database from a 19-year prospective study of 6,427 Japanese citizens under 60 years of age. Our hypothesis is that self-reported HT obtained by self-administered questionnaire can predict CVD mortality.

【Methods】

Study participants

We used data from the National Integrated Project for Prospective Observation of Non-communicable Diseases and its Trends in the Aged, 1980 (NIPPON DATA80). Details of the study have been described elsewhere [14-19]. In this survey, 300 areas were selected by stratified random sampling based on the national census in 1975. All residents aged 30 years or older in these areas were enrolled, and a total of 10,546 people participated in the survey (response rate: 76.6%). Accordingly, these participants were considered to be representative of the Japanese population. Because the percentage of people taking medication for HT was high among those aged 60 and older, we enrolled 6,427 individuals (2,862 males and 3,565 females, mean age: 44.4 years) who were under 60 years of age and free from CVD in our study (percentage on medication: <60 years, 5.3% vs. =60 years, 24.2%).

Case identification

To determine causes of death, we used the National Vital Statistics database of Japan with permission of the Management and Coordination Agency, Government of Japan. The underlying causes of death were coded according to the 9th International Classification of Disease (ICD-9) through the end of 1994 and the 10th International Classification of Disease (ICD-10) from the beginning of 1995. The disease classification in the present study was previously reported [14,19].

Baseline examination

Information on self-reported HT and diabetes, and the habits of smoking and drinking were obtained from interviews by public health nurses. BP was measured after five minutes' rest by trained public health nurses at each public health center using a standard mercury sphygmonometer. Serum total cholesterol levels were determined in a laboratory under the quality control program of the Center for Disease Control and Prevention in the United States [20].

Definition of self-reported hypertension and confirmed hypertension

We considered that a participant had self-reported HT when the participant answered that he or she had been diagnosed with the condition. Conversely, participants who answered that they had never been diagnosed with high BP were considered self-reported normotensives. Confirmative HT assessed by measured BP was defined as systolic BP = 160 mmHg and/or diastolic BP = 95 mmHg (JNC-2), and/or taking antihypertensive medication. Otherwise, we defined participants as confirmed normotensives.

Statistical Analysis

To compare baseline characteristics between the participants with and without self-reported HT, we used t-test for continuous variables and the chi-square test for dichotomous variables.

To calculate the sensitivity and the specificity of self-reported HT, we observed the distribution of true and false positives and negatives in the sampled population, based on the measurement of BP by sphygmonometer.

We used the Cox proportional hazard model for estimating the hazard ratios (HR) of the presence of self-reported HT for CVD mortality and its subtypes. In the model, we included age at study entry, sex, BMI, serum total cholesterol, smoking habit (current or non-current smoker), drinking habit (current or non-current drinker), and history of diabetes mellitus as confounding factors.

We divided the source population into four groups according to the combination of self-reported HT and confirmative HT as assessed by BP measurement. We used two Cox proportional hazard models for estimating HRs of the combination for CVD mortality. In model 1, we included age at study entry, sex, BMI, serum total cholesterol, smoking habit (current or non-current smoker), drinking habit (current or non-current drinker), and history of diabetes mellitus to adjust for confounding factors. We also included systolic BP in the second model (model 2).

To compare the absolute risk of self-reported HT with that of measured systolic BP for CVD mortality, we calculated the age-adjusted mortality rate of the population subdivided by the presence of self-reported HT and categories of systolic BP (every 20 mmHg) in direct standardization. All participants of the study were selected as the reference population.

All statistical analyses were performed using SPSS version 11.0 J (SPSS, Tokyo, Japan). P-values were two-sided; P<0.05 was used to determine statistical significance.

【Results】

In our study population, 611 out of the 879 individuals with self-reported HT had confirmed HT (true positives) and 268 were confirmed as normotensives (false positives). Similarly, among 5548 participants who reported that they had never been diagnosed with high BP, the number of confirmative normotensives (true negatives) was 5104 and 444 had confirmed HT (false negatives). Accordingly, the sensitivity of self-reported HT was 52% in men and 65% in women. The specificity of self-reported HT was 95% in both sexes.

The baseline characteristics of the participants with and without self-reported HT for both sexes are shown in Table 1. The number of study participants with self-reported HT comprised 403 (14%) men and 476 (13%) women. Age, systolic and diastolic BP, serum total cholesterol, BMI and history of diabetes were significantly higher in those with self-reported HT for both sexes. The percentages of current smokers and drinkers were not significantly different between the two groups.

The follow-up time for the 6,427 participants in the present study was 117,738 person-years. There were 524 deaths among all of the participants, including 132 deaths due to CVD, 60 deaths due to all stroke and 30 deaths due to coronary heart diseases.

Table 2 shows person-years of follow-up, the number of deaths, the crude mortality rates per 1,000 person-years for CVD death, and cause-specific mortality according to the presence of self-reported HT. For both sexes, the mortality rates from CVD, all stroke, cerebral infarction, cerebral hemorrhage and coronary heart diseases were higher in the participants with self-reported HT than in those without self-reported HT.

Table 2 also shows age-adjusted and multivariate-adjusted HRs for CVD death and cause-specific mortality. On the whole, the age-adjusted and multivariate-adjusted HRs were almost the same as death from CVD and its subtypes. The multivariate-adjusted HR of CVD death compared to those without self-reported HT was 2.37 (95%CI: 1.48-3.80) in men and 2.73 (95%CI: 1.50-4.96) in women. Since there was no apparent interaction between men and women for CVD mortality or its subtypes, we combined men and women in the following analysis. For overall participants, the HR was 2.49 (95%CI: 1.72-3.61) for death from CVD, 3.22 (95%CI: 1.88-5.53) from all stroke, 3.50 (95%CI: 1.56-7.87) from cerebral infarction, 3.20 (95%CI: 1.13-9.06) from cerebral hemorrhage and 1.53 (95%CI: 0.67-3.47) from coronary heart diseases. When the participants with antihypertensive agents were excluded from the data, the results were almost similar; HR for CVD mortality was 1.98 (95%CI: 1.25-3.16).

Table 3 shows the multivariate-adjusted HRs of the combination of those with self-reported HT and those with confirmative HT for CVD death. The multivariate-adjusted HRs were 3.42 (95% CI: 2.24-5.20) for confirmative HT with self-reported HT, 2.78 (95% CI: 1.66-4.67) for confirmative HT without self-reported HT, and 2.10 (95% CI: 1.04-4.26) for confirmative normotensives with self-reported HT compared with confirmative normotensives without self-reported HT. When we included systolic BP in the models as a confounder, these tendencies were unchanged. When we excluded the participants under medication for HT, the results were also similar; HR for CVD mortality was 2.69 (95%CI: 1.60-4.54) among confirmative HT without self-reported HT, 2.68 (95%CI: 1.50-4.76) among confirmative HT with self-reported HT, and 2.09 (95%CI: 1.03-4.24) among confirmative normotensive with self-reported HT. These tendencies were unchanged when we further adjusted for systolic BP.

Figure 1 shows the age-adjusted mortality rate for CVD mortality per 1,000 person-years according to the categories of systolic BP. The age-adjusted mortality rate was 2.30 for participants with self-reported HT and 0.85 for those without self-reported HT. The corresponding age-adjusted CVD mortality rate for those with self-reported HT was observed around the systolic BP category of 160-179 mmHg.

【Discussion】

Our study is the first report to present the risk of self-reported HT for CVD mortality and that of its subtypes. A significant increase of CVD death among people with self-reported HT was observed in this study.

Because we had data on both self-reported HT from questionnaires and systolic BP from BP measurement, we reconfirmed the risk of confirmative HT irrespective of self-reported HT and found that self-reported HT without confirmative HT also increased the risk for CVD mortality.

The participants of this study were from a nationwide cohort study, and they were selected by a stratified random sampling method. Accordingly, the results of the present study would apply to the general Japanese population. Furthermore, the participants in our study were observed for 19 years, which is a long follow-up period and increases the value of our study substantially.

The sensitivity (52-65%) and the specificity (95%) of self-reported HT for confirmative HT in our study correspond to the results of previous studies [21-23]. For example, in the National Health and Nutritional Examination Survey Ⅲ, the sensitivity for self-reported diagnosis of HT was 71% and the specificity was 90% [24]. These results suggest that self-reported HT could screen more than half of the cases with confirmative HT.

The merits of the collection of past history by questionnaire include convenience and a high response rate. For example, in the Japan Public Health

Center-based Prospective Study (the JPHC Study), which is a large-scale cohort study in Japan, the participation rate of self-administered questionnaire was 78.8%, while participation rate of BP measurement was only 34.1% [25]. Obviously, measuring BP for all members in worksites or communities is preferable. As we showed the data, confirmed HT as assessed by BP measurement had significantly higher risk for CVD mortality irrespective of self-reported HT. However, measuring BP continuously among all community members is hard to perform. For community members who do not attend the BP measurements, screening for individuals with high BP by self-report can be a useful tool. If those who do not attend BP measurements claim that they have been diagnosed with high BP, their risk for CVD death could be considered as high as their systolic BP is in the 160-179 mmHg range.

We have to note that participants with self-reported HT without confirmative HT also had a significantly higher CVD risk in our study. Although the relationship was not statistically significant after adjusting for systolic BP in the model, the same tendency still remained. These results suggest that a single screening measurement of BP might misclassify the participants with high BP. If participants with confirmative normotension claimed that they had been diagnosed with HT previously, it might be better for health care providers to recheck the measurement or have the measurement performed in another setting such as at home, which is known to have better predictive value for CVD mortality [26], to confirm whether or not the participant's BP is high.

Our study also supports the legitimacy of self-reported HT as one of the confounders in the large-scale studies previously published [27,28]. In several large cohort studies such as the Nurses' Health Study, the Physicians' Health Study, the JPHC Study, and the Japan Collaborative Cohort Study (the JACC Study), self-administered questionnaires including the history of HT were often used for confounders.

One of the limitation of our study is that confirmative HT was defined as systolic BP = 160 mmHg and/or diastolic BP = 95 mmHg, because we followed the definition of HT at the time when the baseline survey was performed. Therefore, further studies are needed to confirm that self-reported HT as a predictive marker for CVD mortality can be applied under the new definition of hypertension (systolic BP = 140 mmHg and/or diastolic BP = 90 mmHg) by prospective cohort study. However, it might be hard to confirm the risk of self-reported HT under the new guidelines with a prospective cohort study, because it has been only 10 years since the new guidelines for HT were established. Thus, we consider that our study includes the best available data for the time being. Secondly, confirmative HT in our study was defined by the single BP measurement in the baseline survey, although repeated measurements are required to confirm HT. Thus, the prevalence of confirmative HT could be overestimated in our study.

In conclusion, self-reported HT is a predictive marker of CVD death in the Japanese population. Since self-reported HT could identify more than half of the cases with confirmed HT, it may be a useful tool for screening. In order to identify individuals at high cardiovascular risk and to improve their health outcomes, assessment of self-reported HT by questionnaire may screen many people with HT who would not otherwise seek appropriate treatment.

【Acknowledgement】

We express great appreciation to the cooperative directors and staff of the public health centers who conducted follow-up surveys for those that had inadequate information on the participants.

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【 Figure Legend 】

Figure 1: Age-adjusted mortality rate per 1000 person-years according to systolic blood pressure: NIPPON DATA80, 1980-1999,Japan

2.3*: Age-adjusted mortality rate per 1000 person-years for participants with self-reported HT. All participants of the study were used for the age-adjusted reference population (direct standardization).

Table 1. Characteristics of the baseline survey in 1980 of 6,427 participants according to sex and self-reported HT: NIPPON DATA80,1980-1999,Japan

	Men (n=2,862)			Women (n=3,565)		
	Self-reported HT			Self-reported HT		
	Absent (n=2,459)	Present (n=403)		Absent (n=3,089)	Present (n=476)	
Age (years)†	43.6±8.3	48.9±7.3	*	43.6±8.4	49.9±7.3	*
Systolic blood pressure (mmHg)†	130.8±15.5	155.8±20.7	*	125.5±15.9	152.6±21.6	*
Diastolic blood pressure (mmHg) †	80.9±10.8	95.8±12.3	*	76.5±10.3	90.7±12.3	*
Serum total cholesterol (mg/dl)†	186.8±32.6	193.4±35.6	*	185.4±32.7	197.0±34.2	*
BMI (kg/m²)†	22.6±2.8	23.6±2.8	*	22.6±3.2	24.4±3.7	*
History of diabetes (%)‡	3.0	8.0	*	1.0	2.0	*
Current smoker (%)‡	66.0	66.0		8.0	9.0	
Current drinker (%)‡	78.0	81.0		22.0	20.0	
Medication for hypertension (%)	0.0	33.5		0.0	43.3	

Values located after the mark, ±, indicate standard deviation. The mark, *, indicates statistically significant difference between two groups ($p < 0.05$). † t test. ‡ chi-square test.

Table 2. :Risk of self-reported HT for CVD mortality and its subtypes: NIPPON DATA80,1980-1999,Japan

	Overall		Men		Women	
	Self-reported HT		Self-reported HT		Self-reported HT	
	Absent (n=5,548)	Present (n=879)	Absent (n=2,459)	Present (n=403)	Absent (n=3,089)	Present (n=476)
Person-years of follow-up period	101,989	15,749	644,765	7,063	57,224	8,686
Death due to cardiovascular disases						
Cases	80	52	50	32	30	20
Mortality rate (per 1,000 person-years)	0.78	3.30	0.08	4.53	0.52	2.30
Age-adjusted hazard ratio	1.00	2.57(1.80-3.68) *	1.00	2.54(1.61-4.00) *	1.00	2.62(1.46-4.71) *
Multivaliate-adjusted hazard ratio	1.00	2.49(1.72-3.61) *	1.00	2.37(1.48-3.80) *	1.00	2.73(1.50-4.96) *
Death due to all stroke						
Cases	33	27	19	15	14	12
Mortality rate (per 1,000 person-years)	0.32	1.71	0.03	2.12	0.24	1.38
Age-adjusted hazard ratio	1.00	3.22(1.91-5.43) *	1.00	2.94(1.47-5.85) *	1.00	3.71(1.66-8.29) *
Multivaliate-adjusted hazard ratio	1.00	3.22(1.88-5.53) *	1.00	2.85(1.40-5.82) *	1.00	3.84(1.66-8.88) *
Death due to cerebral infarction						
Cases	13	14	7	8	6	6
Mortality rate (per 1,000 person-years)	0.13	0.89	0.01	1.13	0.10	0.69
Age-adjusted hazard ratio	1.00	3.55(1.65-7.63) *	1.00	3.72(1.33-10.4) *	1.00	3.34(1.05-10.6) *
Multivaliate-adjusted hazard ratio	1.00	3.50(1.56-7.87) *	1.00	3.31(1.12-9.77) *	1.00	3.63(1.04-12.70) *
Death due to cerebral hemorrhage						
Cases	9	7	6	4	3	3
Mortality rate (per 1,000 person-years)	0.09	0.44	0.01	0.57	0.05	0.35
Age-adjusted hazard ratio	1.00	3.09(1.12-8.53) *	1.00	2.39(0.66-8.67)	1.00	5.01(0.92-27.3)
Multivaliate-adjusted hazard ratio	1.00	3.20(1.13-9.06) *	1.00	2.57(0.69-9.63)	1.00	4.68(0.82-26.70)
Death due to coronary heart diseases						
Cases	21	9	15	7	6	2
Mortality rate (per 1,000 person-years)	0.21	0.57	0.02	0.99	0.10	0.23
Age-adjusted hazard ratio	1.00	1.81(0.81-4.03)	1.00	2.11(0.84-5.31)	1.00	1.14(0.22-5.80)
Multivaliate-adjusted hazard ratio	1.00	1.53(0.67-3.47)	1.00	1.65(0.64-4.27)	1.00	1.23(0.24-6.42)

Values in parentheses indicate 95% confidence interval of hazard ratios. The mark, *, indicates statisitically significant difference between two groups.
The age-adjusted hazard ratio: the presence of history of hypertension and age at study entry was entered in the model. Sex was also included in the model when we estimated overall hazard ratio.
The multivariate-adjusted hazard ratio: the presence of history of hypertension , age at study entry, body mass index, serum total cholesterol, smoking habit, drinking habit,
and the presence of history of diabetes were entered in the model. Sex was also included in the model when we estimated overall hazard ratio.

Table 3: Risk of combination of self-reported HT and confirmative HT for CVD mortality:NIPPON DATA80,1980-1999,Japan

	Self-reported HT	
	Present	Absent
Confirmative Hypertension		
N	611	444
Person-years of follow up	10858.78	8014.76
Mean systolic blood pressure (±SD)	161±20	158±15
CVD event	43	20
CVD mortality (per 1000 person-years)	3.96	2.50
Multivariate-adjusted hazard ratio†	3.42 (2.24-5.20)	2.78 (1.66-4.67)
Multivariate-adjusted hazard ratio‡	1.68 (0.94-3.00)	1.52 (0.82-2.79)
Confirmative Normotension		
N	268	5104
Person-years of follow up	4890.42	93974.04
Mean systolic blood pressure (±SD)	138±12	125±13
CVD event	9	60
CVD mortality (per 1000 person-years)	1.84	0.64
Multivariate-adjusted hazard ratio†	2.10 (1.04-4.26)	1.00
Multivariate-adjusted hazard ratio‡	1.72 (0.84-3.50)	1.00

Values located after the mark, ±, indicate standard deviation.

The multivariate-adjusted hazard ratio† : the presence of history of hypertension , age at the study entry, sex, body mass index, serum total cholesterol, smoking habit, drinking habit, and the presence of history of diabetes were entered in the model.

The multivariate-adjusted hazard ratio‡ : the presence of history of hypertension , age at the study entry, sex, body mass index, serum total cholesterol, smoking habit, drinking habit, the presence of history of diabetes, and systolic blood pressure were entered in the model.

Confirmative HT assessed by measured BP was defined as systolic BP ≥ 160 mmHg and/or diastolic BP ≥ 95 mmHg, and/or taking antihypertensive medication.

日本における喫煙状況別にみた日本人の平均余命：NIPPON DATA80

Life expectancy among Japanese of different smoking status in Japan: NIPPON DATA80

(J Epidemiol 2007;17:31-37.)

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背景：平均余命は人間集団において健康状況を記述する重要な指標である。米国および欧州のいくつかの研究では、異なる喫煙状況における平均余命を記述することによって喫煙の害を示している。男性で高い喫煙率を示すにも関わらず、長い平均余命を誇る国である日本において、そのような研究は実施されていない。

方法：40 歳から 85 歳のおける喫煙状況別の男女の平均余命を算定するために、簡易生命表法を適用した。喫煙状況で層別した年齢階級別死亡率は日本人集団の無作為抽出標本の追跡データ(NIPPON DATA80)から得た。

結果：1980 年のベースライン時の調査で、喫煙している人の割合は男性 62.9%、女性 8.8%であった。40 歳平均余命は男性では喫煙者で 42.1 年、禁煙者で 40.4 年、喫煙者で 38.6 年、女性では非喫煙者で 45.6 年、禁煙者で 45.9 年、喫煙者で 43.4 年であった。男性の喫煙者では、40 歳平均余命でみると、1 日 1 箱未満の集団で 39.0 年であり、1 日 1-2 箱(38.8 年)、2 箱以上(38.1 年)と比して長かった。

結論：日本人集団において、平均余命は喫煙の度合いが増すにつれて次第に減少することが観察された。

キーワード：平均余命、喫煙、死亡、NIPPON DATA80

Original Article

Life Expectancy among Japanese of Different Smoking Status in Japan: NIPPON DATA80

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BACKGROUND: The life expectancy is an important measure for describing health status among population. Several studies from the United States and Europe showed the harm of smoking by describing the life expectancies with different smoking status. No such study is examined in Japan, the country with the world's highest life expectancy irrespective of high smoking rate among men.
METHODS: The abridged life table method was applied to calculate the life expectancies of men and women among different smoking status from age 40 until age 85. Age-specific mortality rates stratified by different smoking status were obtained from follow-up data from random sample in Japanese population (NIPPON DATA80).
RESULTS: Proportion of current smokers was 62.9% in men and 8.8% in women at the baseline survey in 1980. The life expectancies of 40-year-old never smokers, ex-smokers and current smokers were 42.1, 40.4, and 38.6 years in men and 45.6, 45.9, and 43.4 years in women. The life expectancy of 40-year-old men who smoked less than one pack per day was 39.0 and was longer than that of those who smoked one or two packs (38.8) and more than two packs (38.1).
CONCLUSION: Life expectancy decreased gradually as the grade of smoking increased in the Japanese population.
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Key words: Life Expectancy, Smoking, Mortality, NIPPON DATA80.

The harm of smoking has been known for many years[1] and evidences from a cohort study shows that smoking is a prominent risk factor for total mortality,[2,3] lung cancer,[4,5] all cardiovascular disease,[6,7] ischemic heart disease,[7] and stroke[7,8] in the Japanese population. Though the proportion of men's smoker in Japan has been quite high (52.8 % in year 1999) among the developed countries,[9] the highest levels of life expectancy in men (78 years in 2002) have continued for a long period.[10] This situation, so-called 'Japanese smoking paradox',[11] is still matter of discussion. Though longevity in Japan is suffered from smoking, the difference of life expectancy between never smokers and current smokers is not yet examined in Japan. In order to activate public health measures for smoking cessation in Japan, it is necessary to show the impacts of smoking on health in an intelligible way. Life expectancy is a well-known comprehensive figure that represents the health status of a population. In the broad area of public health, life expectancy is used for comparing the health statuses of different groups.

The present study examined life expectancies among Japanese

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with different smoking statuses in Japan, which has world's highest life expectancy even though high proportion of smoking has been observed in men.

METHODS

Data Source

Age-specific mortality rates among Japanese with different smoking statuses were calculated from the data of the nationwide cohort study in Japan, called the NIPPON DATA80 (National Integrated Project for Prospective Observation of Non-communicable Disease And its Trends in the Aged). Baseline examination was conducted in year 1980 and the details of the study were described elsewhere.[7,12,13] Persons who were aged 30 and over in 1980 were enrolled by stratified random sampling throughout Japan, and a total of 10,546 participants (men: 4,639, women: 5,907) were followed until the end of 1999. The national vital statistics were used for ascertaining the vital status of participants. Of the 10,546 original participants, 921 participants were excluded from the present study because they were lost to follow-up (n=908) or because there was no smoking information in the baseline survey (n=13). The remaining 9,625 participants consist of 4,237 men and 5,388 women. Approval for this study was obtained from Institutional Review Board of Shiga University of Medical Science (no. 12-18, 2000). Study group members are listed in Reference 13.

The participants' profiles, including smoking status, were collected by the questionnaire in the baseline survey. The smoking status was classified into three categories: never smoking, ex-smoking, and current smoking. The amount of cigarette smoking per day was also classified into three categories: smoking less than one pack per day, smoking one or two packs per day, and smoking more than two packs per day.

Statistical Analysis

Age-specific mortality rates were calculated with the person-year method.[14] Age-specific mortality rates were calculated within five-year age categories. The age categories began at age 40 year and the highest age category was set at age 85 years and over. The age-specific mortality rates in men and women with different smoking statuses are shown in the appendix 1. Byer's method[15] was used for calculating the 95 % confidence intervals.

The abridged life table method was used to calculate life expectancies. The fraction of the last age interval of life[16,17] was used to construct an abridged life table. Those fractions were calculated from a complete life table for the year 1990 in Japan[18] and those figures were shown in appendix 2. Each life expectancy was calculated from age 40 until age 85 by five-year interval. We also calculated 95 % confidence intervals of life expectancy in each age group. As the current smokers in women were so few that cannot examine the difference among the amount of cigarettes, life expectancies for participants with different amounts of cigarette smoking per day were only examined in men. The amount of cigarettes smoking was classified into three groups: less than one pack, one to two packs and more than two packs. To examine the differences from the general Japanese population, the overall life expectancies calculated from NIPPON DATA80 were compared with those from a complete life table for the year 1990 in Japan.18 All statistical analysis was performed using SAS® version 8.2 (SAS Institute, Cary, NC).

RESULTS

Table 1 shows the basic characteristics of participants with different smoking statuses in the baseline survey. The proportion of current smokers in the baseline survey was 62.9 % in men and 8.8 % in women. In men, the proportion of non-drinkers among never smokers (28.2 %) was slightly larger than that among current smokers (17.8 %) and among ex-smokers (19.4 %), but no difference was found in other characteristics (physical activity of daily living, residence, age at entry, height and weight). In women, the proportion of non-drinkers among never smokers (81.7 %) was greater than that among current smokers (54.2 %) and among ex-smokers (51.3 %), and the proportion of current smokers living in urban areas (73.1 %) was larger than that of never smokers (53.9 %). No apparent difference was found in physical activity of daily living, age at entry, height and weight.

Table 2 shows the life expectancies among participants with different smoking statuses from age 40 year until age 85 year and over. Life expectancies in 40-year-old men and women were 42.1 years and 45.6 years in never smokers, 40.4 years and 45.9 years in ex-smokers, and 38.6 years and 43.4 years in current smokers, respectively. The life expectancies of 40-year-old never smokers were longer than those of current smokers in both men and women. This order of life expectancy with respect to smoking status was seen in most age groups with a few exceptions.

The life expectancy of men who smoked less than one pack per day was longer than that of men who smoked more than two packs per day. Though there was some fluctuation, the life expectancies of people who smoked one or two packs per day were slight longer than other groups from age 50.

The overall life expectancy of 40-year-old participants, regardless of smoking status, was 39.5 years in men and 45.4 years in women. Those figures were larger than the life expectancies from the complete life table in Japan in 1990, which are 37.52 years in men and 42.90 years in women.[18] This difference was seen consistently in all age groups in both men and women.

DISCUSSION

The current study presented the life expectancies among different smoking statuses determined from the data in the nationwide cohort study in Japanese population. The results showed that the life expectancy of current smokers was two or three years shorter than that of ex-smokers and of never smokers in both men and women in most age categories. Among men's current smokers, the

Table 1. The basic characteristics of Japanese with different smoking status in the baseline survey in 1980, NIPPON DATA80, 1980-1999, Japan.

		Never smokers n (%)	Ex-smokers n (%)	Current smokers n (%)	Number of cigarette packs per day: <1 pack n (%)	1-2 packs n (%)	2+ packs n (%)
				Men (n=4,237)			
Total		777 (18.3)	794 (18.7)	2666 (62.9)	1635 (38.6)	880 (20.8)	151 (3.6)
Alcohol drinking	Non-drinkers	219 (28.2)	154 (19.4)	475 (17.8)	298 (18.2)	153 (17.4)	24 (15.9)
	Ex-drinkers	33 (4.2)	87 (11.0)	127 (4.8)	95 (5.8)	27 (3.1)	5 (3.3)
	Current	525 (67.6)	551 (69.4)	2061 (77.3)	1240 (75.8)	700 (79.5)	121 (80.1)
	Missing	0	2 (0.3)	3 (0.1)	2 (0.1)	0	1 (0.7)
Physical activity in daily living	Light	256 (36.3)	268 (33.8)	992 (37.2)	602 (36.8)	330 (37.5)	60 (39.7)
	Midium	282 (36.3)	260 (32.7)	974 (36.5)	607 (37.1)	327 (37.2)	40 (26.5)
	Heavy	209 (26.9)	264 (33.2)	696 (26.1)	424 (25.9)	222 (25.2)	50 (33.1)
	Missing	4 (0.5)	2 (0.3)	4 (0.2)	2 (0.1)	1 (0.1)	1 (0.7)
Residence	Urban	422 (54.3)	467 (58.8)	1447 (54.3)	857 (52.4)	501 (56.9)	89 (58.9)
	Rural	337 (43.4)	312 (39.3)	1138 (42.7)	723 (44.2)	356 (40.5)	59 (39.1)
	Others	18 (2.3)	12 (1.5)	74 (2.8)	51 (3.1)	20 (2.3)	3 (2.0)
	Missing	0	3 (0.4)	7 (0.3)	4 (0.2)	3 (0.3)	0
		Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Age at study entry (years)		50.6 (14.4)	53.3 (13.7)	49.0 (12.7)	51.2 (13.3)	45.9 (11.0)	44.3 (9.5)
Height (cm)		161.4 (7.2)	162.9 (30.5)	162.7 (17.5)	161.5 (6.6)	164.7 (28.9)	164.5 (5.8)
Weight (kg)		60.2 (9.3)	59.3 (9.3)	59.0 (9.1)	57.6 (8.9)	61.0 (9.0)	62.8 (9.1)

		Never smokers n (%)	Ex-smokers n (%)	Current smokers n (%)
			Women (n=5,388)	
Total		4793 (89.0)	119 (2.2)	476 (8.8)
Alcohol drinking	Non-drinkers	3916 (81.7)	61 (51.3)	258 (54.2)
	Ex-drinkers	46 (1.0)	13 (10.9)	24 (5.0)
	Current	825 (17.2)	45 (37.8)	194 (40.8)
	Missing	6 (0.1)	0 (0.0)	0
Physical activity in daily living	Light	871 (18.2)	27 (22.7)	62 (13.0)
	Midium	1698 (35.4)	43 (36.1)	181 (38.0)
	Heavy	2183 (45.5)	48 (40.3)	228 (47.9)
	Missing	41 (0.9)	1 (0.8)	5 (1.1)
Residence	Urban	2583 (53.9)	82 (68.9)	348 (73.1)
	Rural	2086 (43.5)	37 (31.1)	113 (23.7)
	Others	106 (2.2)	0	12 (2.5)
	Missing	18 (0.4)	0	3 (0.6)
		Mean (SD)	Mean (SD)	Mean (SD)
Age at study entry (years)		50.2 (13.3)	54.4 (14.3)	51.2 (13.6)
Height (cm)		149.9 (6.1)	150.3 (6.1)	150.3 (6.3)
Weight (kg)		51.5 (8.3)	52.2 (8.3)	50.8 (9.1)

SD: Standard deviation

Table 2. Life expectancies of Japanese with different smoking status from NIPPON DATA80, 19 year follow-up, 1980-1999, Japan

Age group (year)	Complete life table (1990)	Smoking status: Over all	Never smokers	Ex-smokers	Current smokers	Cigarettes packs per day: <1 pack	1-2 packs	2+ packs
Men								
40	37.52	39.5 (39.0 - 40.1)	42.1 (40.8 - 43.3)	40.4 (39.3 - 41.6)	38.6 (37.9 - 39.3)	39.0 (38.2 - 39.8)	38.8 (37.2 - 40.3)	38.1 (34.5 - 41.6)
45	32.85	34.8 (34.3 - 35.3)	37.5 (36.4 - 38.6)	35.4 (34.3 - 36.6)	33.9 (33.2 - 34.5)	34.2 (33.4 - 35.0)	34.1 (32.6 - 35.7)	33.1 (29.5 - 36.6)
50	28.33	30.2 (29.8 - 30.7)	32.6 (31.5 - 33.7)	30.9 (29.8 - 31.9)	29.4 (28.8 - 30.1)	29.7 (29.0 - 30.4)	29.8 (28.2 - 31.3)	28.7 (25.2 - 32.3)
55	23.99	25.6 (25.1 - 26.1)	27.8 (26.7 - 28.9)	26.5 (25.5 - 27.5)	24.8 (24.2 - 25.4)	25.0 (24.3 - 25.7)	25.2 (23.6 - 26.7)	24.3 (20.7 - 27.8)
60	19.95	21.5 (21.0 - 21.9)	23.8 (22.8 - 24.8)	22.1 (21.2 - 23.0)	20.7 (20.1 - 21.3)	20.8 (20.1 - 21.5)	21.1 (19.6 - 22.7)	20.4 (16.8 - 23.9)
65	16.16	17.4 (16.9 - 17.8)	19.3 (18.3 - 20.2)	17.7 (16.8 - 18.5)	16.8 (16.2 - 17.3)	16.9 (16.2 - 17.5)	17.4 (15.8 - 19.0)	16.0 (12.5 - 19.6)
70	12.60	13.6 (13.2 - 14.0)	14.9 (14.0 - 15.8)	13.8 (13.0 - 14.6)	13.1 (12.6 - 13.7)	13.0 (12.5 - 13.6)	14.2 (12.6 - 15.8)	13.2 (9.5 - 16.9)
75	9.44	10.3 (10.0 - 10.7)	11.3 (10.6 - 12.1)	10.2 (9.5 - 11.0)	10.1 (9.6 - 10.6)	9.8 (9.3 - 10.4)	12.0 (10.3 - 13.7)	9.6 (5.8 - 13.4)
80	6.82	7.5 (7.2 - 7.8)	7.7 (7.1 - 8.3)	7.6 (6.9 - 8.2)	7.4 (7.0 - 7.9)	7.1 (6.6 - 7.5)	10.4 (8.8 - 12.1)	7.3 (3.0 - 11.6)
85	4.82	5.5 (4.8 - 6.2)	5.2 (4.0 - 6.4)	5.7 (4.2 - 7.3)	5.6 (4.5 - 6.7)	5.1 (4.0 - 6.1)	9.2 (3.8 - 14.6)	6.5 (- - -)
Women								
40	42.90	45.4 (44.9 - 45.8)	45.6 (45.1 - 46.1)	45.9 (43.1 - 48.6)	43.4 (41.7 - 45.2)			
45	38.12	40.6 (40.1 - 41.0)	40.8 (40.3 - 41.3)	40.9 (38.1 - 43.6)	38.7 (37.0 - 40.4)			
50	33.41	35.8 (35.4 - 36.3)	36.0 (35.6 - 36.5)	35.9 (33.1 - 38.6)	33.9 (32.2 - 35.5)			
55	28.80	31.1 (30.7 - 31.6)	31.3 (30.9 - 31.8)	30.9 (28.1 - 33.6)	29.3 (27.7 - 30.9)			
60	24.29	26.6 (26.2 - 27.0)	26.8 (26.3 - 27.2)	25.9 (23.1 - 28.6)	25.2 (23.7 - 26.7)			
65	19.92	22.1 (21.7 - 22.5)	22.3 (21.9 - 22.8)	21.3 (18.7 - 24.0)	20.5 (19.1 - 22.0)			
70	15.76	17.9 (17.5 - 18.3)	18.0 (17.6 - 18.4)	17.5 (15.0 - 20.0)	16.9 (15.6 - 18.3)			
75	11.95	14.0 (13.6 - 14.3)	14.0 (13.6 - 14.4)	13.8 (11.4 - 16.2)	13.9 (12.6 - 15.1)			
80	8.60	10.6 (10.3 - 10.9)	10.5 (10.1 - 10.8)	11.9 (9.9 - 13.9)	11.3 (10.3 - 12.3)			
85	5.90	8.0 (7.0 - 8.9)	7.9 (6.9 - 8.8)	9.7 (2.9 - 16.6)	8.5 (5.2 - 11.8)			

Over all: Life expectancies of all participants were calculated by using age-specific mortality rates regardless of smoking status (data of never smokers, ex-smokers and current smokers were all combined).

life expectancy of those who smoked less than one pack per day was longer than that of smokers who smoked more than two packs per day.

Our finding is applicable to general Japanese population. The cohort of NIPPON DATA80 was selected initially by stratified random sampling. This participant selection ensured that our result also apply to the general Japanese population without difficulty. Comparing our results to the complete life table for the same period in Japan, the life expectancies that we determined were longer than those from the complete life table. Participants lost to follow-up in the cohort were excluded from our analysis. In the baseline survey, people with health problems, such as inpatients or people with recuperation, could not participate in the survey. That may have caused age-specific mortality rates to move downwards and affect the difference of life expectancies. The stable population of final age interval (age 85 and over) is calculated number of survivors of 85 years old divided by death rate of 85 years and over. Though this is usual way to deal the final age interval in the calculation of a life expectancy, it may overestimate the life expectancy.[17] This overestimation also influences the difference between our results and those from complete life table. Though the absolute life expectancies were different, relative orders of life expectancies with respect to smoking status might be the same.

Though there were some exceptions in specific age categories, there was a consistent order of life expectancy with respect to the smoking status. There was a two or three year difference between never smokers and current smokers, and a two year difference between never smokers and ex-smokers in both men and women. Among three categories on the amount of cigarette packs, decrease of life expectancies of 40 year-old was observed as the amount of cigarette increase. This tendency came obscure when we observed life expectancy of the older age group. Small sample was only available in older age group and that reflected the wide 95 % confidence interval of life expectancies on older age group. We should be caution when we discussed about the life expectancy in older age group.

Several studies found a harm of smoking by using life expectancy and other related measures. In the United States, the life expectancy of 40-year-old non-smokers, former and current smokers are 38.7, 37.5, and 31.8 years in men, and 46.1, 42.9, and 39.3 years in women.[19] The multi-state life table data of the Framingham Heart Study reveals that the differences of life expectancies between 50-years-old always-smokers and never-smokers are 8.66 year in men and 7.59 years in women.[20] In Australia, the difference of life expectancies of 15 year-old men between non-smokers and current smokers was 5.6 years in mid 1980-1990.[21] In Denmark, the cohort life table technique was applied to find that the differences in median survivals between non-smokers and heavy smokers were 9.2 years in men and 9.4 years in women.[22] These consistent differences of life expectancy between never smokers and current smokers were found in all studies.

Our findings of the differences in life expectancies between never smokers and current smokers are smaller than those of other articles.[19-22] In addition to the dilution problem we mentioned bellow, these smaller differences might be a reflection of the circumstances in Japan in 1980. In men, the smoking habit was so widespread in 1980 and some never smokers probably had other health problems. Also, smoking by women was not popular at that time, especially for housewives. This circumstance is quite different from other developed countries in those days, and this could account for the smaller differences in life expectancies with respect to smoking status in Japan. Comparison of life expectancies between current smokers with never smokers in Japan may be considered as the contrast between men's current smokers and those never smokers mixed with unhealthy people, and also the contract between women's current smokers with vitality and women in common. This might due to the relatively small difference in life expectancies compared with those of other developed countries. In the circumstance of Japan around 1980, separation of smoking areas was insufficient and passive smoking in the household was speeded. That may also causes the relatively small difference in life expectancies among never-smokers and current smokers.

Possible misclassification of smoking categories might influence our results. Classification of smoking status was only made with the smoking information in the baseline survey, and we assumed that the smoking status of individuals did not change during the follow-up period. This assumption would be violated if smokers quit smoking or never smokers started smoking. Some people might make false statements in the survey. It is not certain how much change of smoking habit would occur during a 19-year period and how many people did not answer the true condition of smoking. Even though, the influence of this misclassification might dilute the difference of life expectancies among groups and that might make our results conservative.

We recognize that all the differences in life expectancies are not caused by smoking, and other factors would also affect the mortality rate. There was no distinct difference in baseline characteristics between the three different smoking statuses in men. The differences in life expectancy might come mainly from smoking; whereas in women, some characteristics such as drinking status and residence were different between never smokers and smokers (former and current) in our study. As mentioned above, the smoking experience among Japanese women was not so common in 1980 and such experience was highly associated with life style and health behavior. In addition to smoking, other factors probably influence on life expectancy in women.

In conclusion, life expectancies of participants with different smoking statuses were examined using data from a nationwide cohort study in Japan. A gradual decrease in life expectancy was observed as the grade of smoking increased in Japan. A two or three years gain in life expectancy could still be possible if the smoke free society were established in Japan, the country with the world's highest life expectancy.

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Appendix 2. The fraction of the last age interval of life from Vital statistics in 1990, Japan.

Age (year)	Men	Women
40-44	0.537	0.533
45-49	0.537	0.539
50-54	0.542	0.526
55-59	0.534	0.534
60-64	0.525	0.532
65-69	0.528	0.541
70-74	0.531	0.542
75-79	0.523	0.541
80-84	0.501	0.528
85-89	0.470	0.499

Appendix 1. Age specific mortality rates of Japanese with different smoking statuses from NIPPON DATA80, 19 year follow-up, 1980-1999, Japan.

Age-specific mortality rates (per 1,000) among never smokers, ex-smokers and current smokers, 1980-1999, Japan

	Never smokers			Ex-smokers			Current smokers		
Age (year)	No. of deaths	Person-years	Motality rate (/1000) (95% confidence interval)	No. of deaths	Person-years	Motality rate (/1000) (95% confidence interval)	No. of deaths	Person-years	Motality rate (/1000) (95% confidence interval)
Men									
30-34	0	290.0	0.0 (0.0 - 8.5)	0	250.0	0.0 (0.0 - 9.9)	2	1207.8	1.7 (0.3 - 5.3)
35-39	0	754.0	0.0 (0.0 - 3.3)	0	553.3	0.0 (0.0 - 4.5)	2	3005.8	0.7 (0.1 - 2.1)
40-44	3	1309.8	2.3 (0.6 - 6.1)	0	1017.0	0.0 (0.0 - 2.4)	6	4671.9	1.3 (0.5 - 2.6)
45-49	1	1896.5	0.5 (0.0 - 2.5)	4	1448.2	2.8 (0.9 - 6.6)	23	6173.6	3.7 (2.4 - 5.5)
50-54	3	1995.9	1.5 (0.4 - 4.0)	7	1649.7	4.2 (1.9 - 8.3)	17	6469.7	2.6 (1.6 - 4.1)
55-59	14	1795.9	7.8 (4.5 - 12.7)	9	1733.3	5.2 (2.6 - 9.5)	48	6280.7	7.6 (5.7 - 10.0)
60-64	6	1441.7	4.2 (1.7 - 8.6)	9	1614.9	5.6 (2.8 - 10.2)	66	5560.7	11.9 (9.3 - 15.0)
65-69	8	1153.1	6.9 (3.3 - 13.1)	23	1535.4	15.0 (9.8 - 22.1)	86	4682.8	18.4 (14.8 - 22.6)
70-74	21	935.2	22.5 (14.3 - 33.7)	31	1301.1	23.8 (16.5 - 33.4)	115	3392.8	33.9 (28.1 - 40.5)
75-79	22	762.4	28.9 (18.6 - 42.9)	53	1014.5	52.2 (39.6 - 67.8)	115	2107.9	54.6 (45.3 - 65.2)
80-84	43	544.9	78.9 (57.9 - 105.2)	59	614.8	96.0 (73.8 - 122.9)	107	1112.1	96.2 (79.3 - 115.8)
85+	56	292.1	191.7 (146.3 - 247.0)	45	258.4	174.2 (128.7 - 230.8)	85	474.7	179.1 (144.0 - 220.3)
Women									
30-34	0	1939.3	0.0 (0.0 - 1.3)	0	39.0	0.0 (0.0 - 63.2)	0	184.9	0.0 (0.0 - 13.3)
35-39	1	4880.7	0.2 (0.0 - 1.0)	0	113.0	0.0 (0.0 - 21.8)	0	474.6	0.0 (0.0 - 5.2)
40-44	8	7919.5	1.0 (0.5 - 1.9)	0	149.4	0.0 (0.0 - 16.5)	1	744.4	1.3 (0.1 - 6.3)
45-49	13	10723.5	1.2 (0.7 - 2.0)	0	186.0	0.0 (0.0 - 13.2)	1	1000.0	1.0 (0.1 - 4.7)
50-54	20	11396.5	1.8 (1.1 - 2.7)	0	205.0	0.0 (0.0 - 12.0)	3	1021.1	2.9 (0.8 - 7.8)
55-59	34	11143.2	3.1 (2.2 - 4.2)	0	188.0	0.0 (0.0 - 13.1)	6	954.7	6.3 (2.6 - 13.0)
60-64	49	10339.2	4.7 (3.5 - 6.2)	1	244.6	4.1 (0.4 - 19.1)	3	961.2	3.1 (0.9 - 8.3)
65-69	61	8963.0	6.8 (5.3 - 8.7)	3	249.9	12.0 (3.3 - 32.0)	14	933.3	15.0 (8.6 - 24.5)
70-74	88	7101.9	12.4 (10.0 - 15.2)	4	236.9	16.9 (5.6 - 40.1)	19	739.7	25.7 (16.0 - 39.3)
75-79	119	4956.7	24.0 (20.0 - 28.6)	9	185.3	48.6 (24.0 - 88.7)	21	546.1	38.5 (24.5 - 57.7)
80-84	163	3087.7	52.8 (45.1 - 61.4)	6	114.2	52.5 (21.8 - 108.3)	15	335.1	44.8 (26.2 - 72.0)
85+	225	1766.5	127.4 (111.5 - 144.8)	7	68.2	102.6 (45.8 - 201.5)	22	186.6	117.9 (76.0 - 175.3)

Age-specific mortality rates (per 1,000) of current smokers by number of cigarettes smoked per day (Men), 1980-1999, Japan

	Never smokers			Ex-smokers			Current smokers		
Age (year)	No. of deaths	Person-years	Motality rate (/1000) (95% confidence interval)	No. of deaths	Person-years	Motality rate (/1000) (95% confidence interval)	No. of deaths	Person-years	Motality rate (/1000) (95% confidence interval)
Men									
30-34	1	669.4	1.5 (0.1 - 7.0)	1	476.4	2.1 (0.2 - 9.8)	0	62.0	0.0 (0.0 - 39.7)
35-39	0	1638.2	0.0 (0.0 - 1.5)	1	1144.6	0.9 (0.1 - 4.1)	1	223.1	4.5 (0.4 - 20.9)
40-44	2	2439.7	0.8 (0.2 - 2.6)	4	1876.2	2.1 (0.7 - 5.1)	0	356.0	0.0 (0.0 - 6.9)
45-49	11	3237.1	3.4 (1.8 - 5.9)	10	2469.2	4.0 (2.1 - 7.2)	2	467.3	4.3 (0.9 - 13.7)
50-54	8	3442.8	2.3 (1.1 - 4.4)	7	2537.8	2.8 (1.2 - 5.4)	2	489.2	4.1 (0.8 - 13.1)
55-59	24	3546.6	6.8 (4.4 - 9.9)	20	2345.1	8.5 (5.4 - 12.9)	4	389.0	10.3 (3.4 - 24.4)
60-64	40	3452.5	11.6 (8.4 - 15.6)	24	1818.6	13.2 (8.7 - 19.3)	2	289.6	6.9 (1.4 - 22.1)
65-69	51	3208.4	15.9 (12.0 - 20.7)	29	1276.6	22.7 (15.5 - 32.2)	6	197.8	30.3 (12.6 - 62.5)
70-74	80	2527.3	31.7 (25.3 - 39.2)	32	742.8	43.1 (30.0 - 60.0)	3	122.7	24.4 (6.8 - 65.2)
75-79	89	1686.9	52.8 (42.6 - 64.6)	22	358.4	61.4 (39.6 - 91.3)	4	62.6	63.9 (21.4 - 151.9)
80-84	91	913.1	99.7 (80.7 - 121.8)	14	182.8	76.6 (43.9 - 125.1)	2	16.2	123.3 (24.6 - 395.2)
85+	75	380.8	197.0 (156.1 - 245.5)	10	91.9	108.8 (55.8 - 193.0)	0	2.0	0.0 (0.0 - 1232.0)

Relationship between metabolic risk factor clustering and cardiovascular mortality stratified by high blood glucose and obesity: NIPPON DATA90, 1990-2000
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危険因子の集積と循環器疾患死亡の関連: NIPPON DATA90, 1990-2000

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(目的)心筋梗塞、脳卒中に代表される、動脈硬化疾患はADLおよびQOLに大きな影響を与え、ハイリスク群の探索および究明は現在も重要な課題である。近年、提唱されたメタボリックシンドロームは危険因子の集積状態の概念であり、現在、診断基準は複数ある。WHOの診断基準は耐糖能障害を必須項目としているが、IDFや本邦の診断基準は腹部肥満を必須としている。一方、NCEPの診断基準は必須項目を設けていない。本研究では危険因子の集積と循環器疾患死亡の関連において高血糖および肥満が及ぼす影響を日本人を代表する大規模コホートを用いて検討した。

(方法)1990年に全国から無作為抽出された300地区に居住する30歳以上の循環器疾患基礎調査受検者8,384人を10年間追跡した（NIPPON DATA90コホート）。循環器疾患既往歴者や追跡不能例等を除いた7,219人(男性2,999人、女性4,220人)を解析対象とした。危険因子集積数と循環器疾患死亡の関連を検討するため、Cox比例ハザードモデルを用いて調整ハザード比（HR）と95%信頼区間（95%CI）を算出した。年齢、性別、総コレステロール値、喫煙習慣、飲酒、運動習慣を調整因子とし、血圧高値（収縮期血圧130mmHg以上、拡張期血圧85mmHg以上）、高血糖（随時血糖140mg/dl以上）、中性脂肪高値（随時中性脂肪200mg/dl以上）、ＨＤＬコレステロール低値（男性40mg/dl以下、女性50mg/dl以下）、肥満（BMI25kg/m^{2}以上）を危険因子とした。治療中の者はそれぞれの項目に含めた。

(結果)観察人年は69,120人年、**平均追跡期間は9.6年であった。追跡期間中、173人の循環器疾患死亡を確認した。**危険因子集積数は循環器疾患死亡と正の相関を認めた(P for trend=0.07)。高血糖の有無で層別化すると、循環器疾患死亡のHRは、危険因子を有さない者を基準群とすると、高血糖に加えてその他の危険因子を2つ以上有する者で高かった（危険因子数2つで3.67(95%CI,1.49-9.03)）。一方、高血糖を有さないがその他の危険因子を3つ以上有する者のHRは1.99(0.93-4.28)であった。肥満の有無で層別化して同様に検討を行うと、危険因子集積数と循環器疾患死亡の関連は肥満の有無であまり差を認めなかった。

(まとめ)日本人を代表するコホート集団において循環器疾患死亡と危険因子集積数は正の関連を示し、高血糖の有無は肥満の有無よりも強い影響を与えていた。非肥満であっても、危険因子集積者は多く存在し、彼らの循環器疾患死亡リスクは高い。循環器疾患予防のためには、個々の危険因子の管理が重要である。