

A Prospective Cohort Study on National Health Insurance Beneficiaries in Ohsaki, Miyagi Prefecture, Japan: Study Design, Profiles of the Subjects and Medical Cost During the First Year

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To examine the impact of health-related lifestyle upon medical care utilization and its costs, we conducted a cohort study among all National Health Insurance beneficiaries aged from 40 to 79 years living in the catchment area of Ohsaki Public Health Center, Miyagi, Japan. The baseline survey, using self-completed questionnaire regarding health-related lifestyle, was conducted between October and December 1994. Out of 54,996 eligible subjects, 52,029 (94.6%) responded and formed the cohort under study. Medical care utilization (number of outpatient visits and days of inpatient care) and the costs for each subject have been obtained from National Health Insurance Claim History files since January 1995. The baseline characteristics of health-related lifestyle and medical history at the study subjects were consistent with those at our another cohort subjects (so-called Miyagi cohort study; N=47,605), which included all the residents aged from 40 to 64 years at 14 municipalities in Miyagi Prefecture, Japan conducted in 1990. The medical costs per capita in this cohort was quite compatible with the national average. This prospective cohort study would quantitatively demonstrate the economic impact of health-related lifestyle, thus would lead us to better provision of cost-effective preventive health services. *J Epidemiol*, 1998 ; 8 : 258-263.

Rapidly escalating expenditure for medical care is now one of the major concerns all over the world. In Japan, overall medical care costs amounted to approximately 27 trillion yen in 1995, that is 7.1% of the national income¹⁾. With an increase in the number of the elderly population and the development of medical technology, medical care expenditure has risen in Japan from 4 to 7% every year and would continue to increase. Facing at the limitation in financial resources for national health insurance system, the strategies to contain medical care costs are urgently required.

Fries et al. proposed an approach to reduce health care costs by reducing needs and demands for medical services²⁾. For this purpose, they insisted on expanding health promotion and preventive care which would result in net cost savings. It is important to analyze the influence of lifestyle and

preventive care into medical care costs, and to propose the way how to reduce medical costs by means of preventive health initiatives. There have been limited studies, however, examining the relationship between health-related lifestyle and medical care costs^{3,4,5)}. Although economic effect of smoking have been extensively investigated, the influence of other lifestyle such as obesity, physical exercise, and so forth, upon medical care costs has been hardly investigated.

The objectives of the present study is to examine the impact of health-related lifestyle and utilization of preventive health services such as screening program upon medical care utilization and its costs. This knowledge would lead us to better provision of cost-effective preventive health services. For this purpose, we conducted a baseline survey on National Health Insurance (NHI) beneficiaries in Ohsaki, Miyagi Prefecture,

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Japan in 1994, and since then we have been monitoring medical care utilization and its costs on the individual basis. In this paper, we would report study design, response rate, profiles of the cohort subjects at baseline, and medical care utilization and its costs during the first year.

SUBJECTS AND METHODS

Study Design and Setting

We conducted a baseline survey about physical function and health-related lifestyle on the all National Health Insurance (NHI) beneficiaries, aged from 40 to 79 years, who lived in the catchment area of Ohsaki Public Health Center, Miyagi Prefecture, Japan from September to December 1994, and have been following up their medical care utilization and its costs.

Ohsaki Public Health Center, one of the local government agencies, is in charge of the preventive health services for the residents in 14 municipalities in northern part of Miyagi Prefecture, Japan. According to the Census 1990⁶⁾, the total population of these municipalities was 223,144. Of those, 102,121 (46%) were aged from 40 to 79 years. This is typical rural area and the main industry is agriculture. The number of physicians in this area was 104.0 per 100,000 population (national average: 176.6), and the number of hospital beds was 1 504.9 per 100,000 (national average: 1,559.8)⁷⁾.

Health Insurance System in Japan

The health insurance system, compulsory for everyone living in Japan, is classified into two different categories⁸⁾. One is the insurance system for employees and their dependents, and the other is a system of community-based health insurance for farmers, the self-employed, pensioners, and their dependents. The latter system is named as National Health Insurance (NHI) and covers 35% of the population in Japan. Under the NHI plan, the beneficiaries contribute premiums according to their income (national average in 1994: 158,000 yen per year per household), and pay 30% of inpatient and outpatient costs when they receive medical care. This copayment for all patients has an upper limit of 63,000 yen per month as of the year 1994. Patients, aged 70 years and over, pay a nominal deductible of 1,020 yen per month for outpatient care and 710 yen per day for inpatient care instead of copayment.

The health insurance covers almost all of medical treatment, including diagnostic tests, medication, surgery, supplies and materials, physicians and other personnel costs, and most of the dental treatment. It also covers home care services provided by physicians and nurses but not those by other professionals such as home health aides. The health insurance covers inpatient care but not nursing home care. Preventive health services such as mass screening and health education are not covered by health insurance in Japan.

When medical providers treat a patient, they receive a copayment from the patient and then file a claim to the local NHI association at the patient's residence. The local NHI association then reimburses the provider. Payment to medical providers is made on a fee-for-service basis, where the price of each service is determined by a uniform national fee schedule. The local NHI association has a peer review system to determine the amount of reimbursement to medical providers.

Baseline Survey

The baseline survey was conducted between October and December 1994. The questionnaire consisted of 93 items concerning 10 factors: past medical history, family history, physical health status, drinking habit, smoking habit, dietary habit, occupation, marital status, education, and reproductive history for females. On physical and mental health status, we adopted the questions developed by Medical Outcomes Study Health Perception Survey^{9,10)}, self-rated health, physical functioning score, and pain. On dietary habits, we used the same food frequency questionnaire as so-called Monbusho cohort study¹¹⁾.

The Miyagi NHI Association provided us with a list of all NHI beneficiaries aged from 40 to 79 years on August 1, 1994. The number of subjects listed was 56,294 which was 55% of the total population of the same age-group living in the study area. It was turned out that 105 subjects had died and 212 had moved from the town by the time of survey, thus remained 55,977 subjects. Of those, after excluding those hospitalized or institutionalized (N=425) and those away on business for extended period (N=556), 54,996 subjects were eligible for the survey. Trained survey personnel visited the subjects to deliver a 12-paged questionnaire. After being informed of the study objectives and their freedom to decline, the subjects were asked to complete it by themselves and return it to the same person within a week. Although we did not obtain written informed consent from the study subjects, we considered that response to the questionnaire represented their own consent.

Linkage with the National Health Insurance Claim Data

Allowable charges, obtained from the NHI Claims History files of Miyagi NHI Association since January 1995, were used to capture NHI payments (reimbursement), beneficiary copayments, and deductible charges. The monthly NHI files were linked with our baseline survey data file. Claim files included the beneficiary's ID number, the code number of the medical providers, amount of outpatient care per month (including home care), number of days for inpatient care per month, and the charges per month for outpatient and inpatient care, respectively. Name of diagnosis for each medical care was not available in the Claims files.

When a beneficiary was withdrawn from the NHI system because of death, emigration, or employment, the date of withdrawal and its reason were coded on the NHI Withdrawal

History files which were also linked with our cohort data file every month.

In order to protect the subjects' privacy, their personal names were deleted from all NHI Claims History files, Withdrawal History files, and our baseline data files. Record linkage between NHI data files and our baseline data files were made with the beneficiary's ID number as the key code. Thus, we analyze the data without knowing the subjects' personal names. When we asked the subjects to respond to the questionnaire, we let them know that everyone would be treated anonymously at the stage of data analysis.

RESULTS

Profiles of the Cohort Subjects

Of 54,996 eligible subjects, 52,029 (94.6%) responded and formed the cohort under study. The response rate was the same across age-groups and genders (Table 1). There was no significant difference in response rate between the municipalities.

Mean (SE) age of the study subjects was 60.8 (10.3) years and the mean (SE) duration of school education was 10.4 (1.8) years. Among the subjects, 47.8% were males. Among males, 39% were farmers, 28% were the self-employed, and 28% were retired. For females, 31% were housewives, 25% farmers, and 15% the self-employed.

Table 2 shows the distribution of several health-related lifestyle and medical history among this cohort subjects at the baseline survey. Among the subjects, 55% of males and 9% of females reported as being current smokers, 72% of males and 28% of females as current drinkers. These values declined with age for both sexes. About a half of the subjects answered they walked 1 hour or more per day. About 25% of males and 29% of females admitted having hypertension, 8% of males

and 6% of females having diabetes mellitus, and 3% of males and 2% of females having had stroke. Complete list on the baseline characteristics of the study subjects has already been reported elsewhere¹², which is available on request.

We previously established a cohort study on 47,605 persons living in Miyagi Prefecture, Japan in 1990 (so-called Miyagi cohort study)^{13,14}. The baseline survey was conducted for all the residents aged 40 to 64 years at randomly selected 14 municipalities, Miyagi Prefecture, Japan. Both Miyagi cohort and the present Ohsaki NHI cohort studies used the same questionnaire. The last two lines at Table 2 compared percentage of each characteristic, among those aged from 40 to 64 years, between the present cohort subjects and the Miyagi cohort subjects as standardized to age- and sex-composition of the present subjects. The results indicated that these values were quite compatible.

Medical Care Utilization and its Costs

Table 2 shows medical care utilization among the study subjects. About 10% of the subjects had received inpatient care. This hospitalization rate increased with age, and it was higher among males than females. Among the subjects who had been hospitalized in 1995, the mean days spent at hospital per year was 48.1 for males and 45.6 for females. The mean days for inpatient care per monthly NHI Inpatient Claim among the study subjects was 14.6 for males and 14.1 for females, which were rather lower than the national average (19.3 days)¹⁵. More than 80% of the subjects had received outpatient care. This visit rate increased with age, and it was higher among females than males. The mean number of visits per year for those who had been outpatients was about 30 times (the national average: 29 times)¹⁵.

Table 3 shows the per capita medical costs of the study subjects. Costs increased with age, and were 4.5 times higher for

Table 1. The number of respondents and the response rate for baseline survey by sex and age group.

Age	Males		Females	
	No. of respondents	Response rate (%)	No. of respondents	Response rate (%)
40-44	3,123	93.1	2,380	95.3
45-49	2,508	90.3	2,081	94.2
50-54	2,314	92.0	2,466	96.0
55-59	3,062	93.6	3,966	96.6
60-64	4,788	96.0	5,591	96.4
65-69	4,603	95.8	5,022	95.8
70-74	2,804	95.4	3,286	93.1
75-79	1,693	92.6	2,342	91.2
Total	24,895	94.0	27,134	95.2

Table 2. Medical care utilization by sex and age group in 1995.

Age	Inpatient care		Outpatient care	
	Hospitalization rate, %	Mean days at hospital (SE)*	Visit rate, %	Mean number of visit (SE) ⁺
Males				
40-49	5.0	49.5 (3.5)	71.1	14.2 (0.5)
50-59	7.9	51.5 (2.9)	80.2	20.0 (0.5)
60-69	12.8	44.7 (1.7)	87.6	31.2 (0.4)
70-79	21.1	50.3 (1.9)	92.9	47.5 (0.5)
All ages	11.5	48.1 (1.1)	83.2	29.0 (0.2)
Females				
40-49	3.9	46.0 (4.6)	78.6	15.8 (0.6)
50-59	6.0	41.8 (3.2)	87.5	25.0 (0.5)
60-69	9.2	45.0 (2.0)	91.7	36.3 (0.3)
70-79	16.7	47.8 (2.0)	93.5	49.7 (0.5)
All ages	9.1	45.6 (1.2)	89.0	33.7 (0.2)

* : among the subjects who had ever been hospitalized

+ : among the subjects who had ever visited outpatient clinics

Table 3. Per capita medical costs by sex and age group in 1995.

Age	Medical costs, $\times 10^3$ yen (SE)		
	Total	Inpatient	Outpatient
Males			
40-49	117.3 (9.6)	36.0 (7.4)	81.3 (5.3)
50-59	205.8 (9.8)	82.5 (7.6)	123.3 (5.4)
60-69	330.2 (7.4)	131.2 (5.7)	199.0 (4.1)
70-79	532.7 (10.6)	227.5 (8.2)	305.2 (5.9)
All ages	292.3 (4.6)	116.8 (3.5)	175.5 (2.6)
Females			
40-49	108.6 (8.1)	30.0 (6.1)	78.6 (4.7)
50-59	177.5 (6.8)	42.3 (5.1)	135.1 (4.0)
60-69	283.1 (5.3)	80.4 (4.0)	202.6 (3.1)
70-79	439.7 (7.2)	144.3 (5.4)	295.4 (4.2)
All ages	262.3 (3.4)	76.5 (2.5)	185.7 (2.0)

males and 4.1 times higher for females aged 70-79 years than those aged 40-49 years. Medical costs for females were lower than for males at all age-groups. The mean medical costs among the subjects aged between 40 and 69 years in this cohort was 226.6×10^3 yen which was slightly lower than the national average for NHI beneficiaries (257.5×10^3 yen, as standardized to the age- and sex-composition of the present cohort)¹⁵⁾.

DISCUSSION

We conducted a baseline survey on NHI beneficiaries in a rural Japanese community with a satisfactorily high response rate, and have been following up their medical care utilization and its costs. Based on this prospective cohort, we would examine the influence of health related lifestyle such as smoking and obesity into medical care costs. It would also be possible to evaluate economic effects of preventive health services such as mass screening, health education, and home care.

These knowledge would lead us to better provision of cost-effective health services.

The present study has the following strength. First, the present data would be considered as representative of the study population because response rate of the baseline survey was high enough (94.6%). Second, medical care utilization and its costs for the individual cohort member of this size (N=52,029) have been continuously monitored, which has never been performed in Japan. Third, medical care utilization and its costs for the present cohort was well compatible with national average, thus suggesting generalizability of the findings.

As previously described, we have another cohort study of the residents in Miyagi Prefecture, which started in 1990^{13,14}. The primary objective of this Miyagi cohort study was to examine the relationship between health-related lifestyle and cancer incidence. Both Miyagi cohort and the present Ohsaki NHI cohort studies used the same questionnaire, and the distribution of health-related lifestyle and medical history was quite compatible between the both two cohort subjects. Therefore, merging the both cohorts would substantially increase the statistical power to detect the risk factors for cancer. In addition, approximately 8,000 subjects responded to the baseline surveys of both Miyagi and Ohsaki NHI cohort studies. We would be able to examine the changes in lifestyle among these subjects between four-year intervals, and to identify risk factors after considering these sequential changes in health-related lifestyle.

The study subjects would be somehow biased from the general population in the study area. Because the NHI beneficiaries are limited to the farmers, the self-employed, pensioners, and so forth, their socio-economic status and life-style might be different from the beneficiaries of other insurance system for employees and their dependents. As the study subjects included as low as 55% of the population in the study area, representativeness of this cohort subjects should be carefully examined. Comparison of baseline characteristics between Ohsaki and Miyagi cohort subjects, the latter of which included all the residents at the study area, indicated that there was no large difference. Thus, selection bias of the present study subjects, if any, would not be so large to limit its generalizability.

Limitation of our study was that the diagnosis for each medical care was not available in the present data. Therefore, we are unable to analyze the relative importance of a certain diagnostic group on the medical care utilization and its costs. Another limitation was that we excluded those who were hospitalized or institutionalized from the eligible subjects at baseline survey. Although this will not be a problem for internal comparison within the cohort, when making external comparison, such as the national average, this exclusion will make the medical utilization and cost in this cohort artificially low.

Facing at the escalating medical care expenditure and the limiting financial capacity for health insurance system, it is

urgently required to establish the strategy toward reducing health care costs by reducing needs and demands for medical services. It is self-evident that such lifestyle as smoking and obesity would increase the risk for cancer and/or cardiovascular diseases, thus increase the demands and costs for medical care. Although the economic impact of lifestyle has been qualitatively or semi-quantitatively recognized, there has been limited knowledge on how much of the excess medical costs are attributable to individual lifestyle. It is because it has been hardly measured quantitatively in the field surveys. The present study attempted to clarify this point, based on the linkage between the lifestyle data at the baseline survey and the NHI Claim History data on subsequent medical care utilization and its costs. Therefore, the marginal costs attributable to each lifestyle would be quantitatively demonstrated. These knowledge would lead us to better provision of preventive health services for medical cost containment.

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