Relationship between Health-Seeking Behavior by Basic Health Examination and Subsequent Health Expenditure among Remote Island Inhabitants of Japan

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ABSTRACT

Background Convincing evidence has not been obtained as to whether having a basic health examination in the prime of life inhibits the surge of health expenditure in old age.

Methods **Data sources:** Data on participants in the basic health examination from 1996 to 2000 among residents of a remote island in Japan, and individual health care expenditure data from March 2005 to February 2008. **Study design:** A community-based retrospective study. **Data collection:** Japanese residents who were subscribers to the National Health Insurance Scheme of Chibu Town from March 1996 to March 2007 and were aged 40 to 64 years in March 1996 (n = 179) were divided into 3 groups depending on the frequency of participating in the basic health examination over 5 years: 0 times (nontakers), 1 to 3 times (occasional takers), or 4 to 5 times (regular takers). The distribution of total health expenditure according to the frequency of having a basic health examination was determined, and the Cochrane-Armitage test was used for comparison.

Results Nontakers formed the highest proportion of subjects with low expenditure (0–200,000 yen) (nontaker, occasional, regular: 38.5%, 24.1%, 23.5%; P = 0.002), and also accounted for the highest proportion of subjects with high expenditure (> 1,400,000 yen) (33.3%, 16.1%, 9.4%; P = 0.004).

Conclusion Persons not participating in health examinations during middle age include a group with high future health care expenditure.

Key words basic health examination; health expenditure; Japan; middle age; rural health

In Japan, a basic health examination (also translated into English as the "general health examination" or "health checkup" in other reports) has been provided for persons aged 40 years or older since 1963 by local governments. Currently, this is done under the Act for Assurance of Medical Care for Elderly People, which was promulgated in 1982 to maintain the health of elderly persons.

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This examination includes anthropometric measurements, blood pressure, laboratory tests, electrocardiography, fundoscopy and physical examination by a doctor. Since revision of the law in 2008, disease prevention and containment of health care costs for the elderly by early detection of illnesses are emphasized as the roles of the basic health examination.[1] However, there is still no convincing evidence that undergoing the basic health examination in the prime of life reduces the explosion of health care costs in the elderly. Many previous studies performed in Japan have shown that in areas with a high percentage of residents undergoing the basic health examination, per capita health care costs are lower.[2–9] However, other studies that compared health care expenditure between participants and nonparticipants in the basic health examination have not consistently found a relation with lower costs,[10–14] possibly as a result of differences in the age of the subjects and the observation period, calculation of health care costs as mean or median values, and differences of access to medical resources among the regions studied. Accordingly, to evaluate the association between undergoing the basic health examination and health care expenditure 10 to 12 years, we compared health care costs between participants and nonparticipants in the basic examination among persons aged 40 to 64 years old living on a remote Japanese island.

SUBJECTS AND METHODS

Subjects

We performed this study on a remote Japanese island, Chiburijima (administrative center: Chibu Town, Oki County, Shimane Prefecture), which is one of the Oki Islands and is located about 40 km from the mainland. In June 2007, the population was 666 and 44.7% were aged 65 years or older. The medical resources consist of one municipal clinic without beds and a dental clinic. For diseases requiring secondary medical care, patients are transported to a hospital on a neighboring island or to the mainland. The subjects were 179 local residents who belonged to the National Health Insurance Scheme of Chibu Town from March 1996 to March 2007 without interruption and were age from 40 to 64 years in March 1996. Co-serial numbers were used to combine indi-

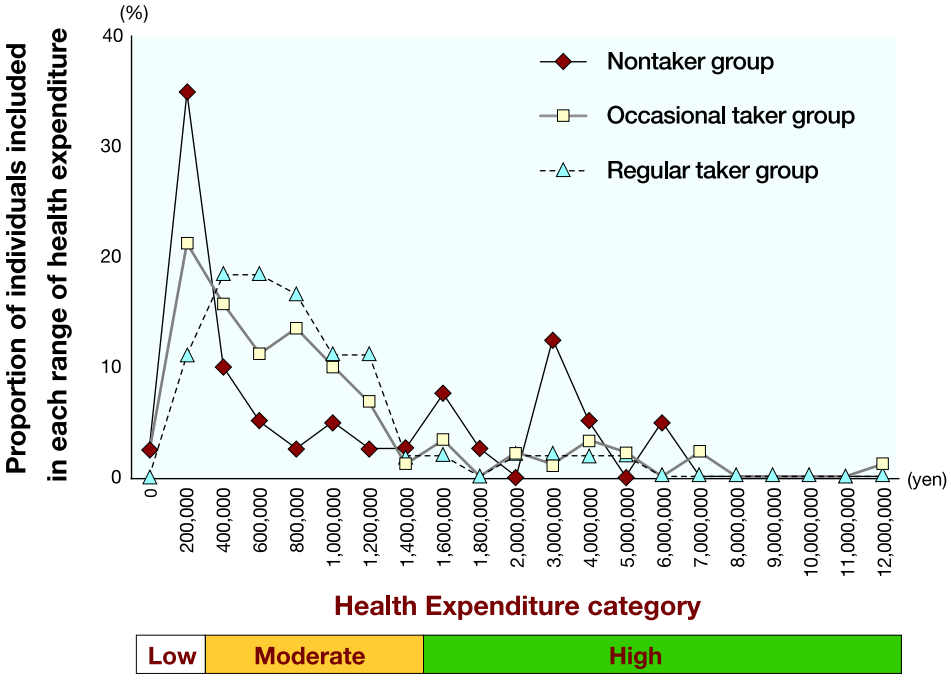

Fig. 1. Distribution of individual health expenditure according to frequency of having a basic health examination.

vidual data from basic health examinations and health expenditure. Researchers used only anonymous data. The study protocol was reviewed and approved by the Ethics Committee of Tottori University (approval number: 1226).

Identifying the frequency of health examination

The frequency of each subject undergoing the basic health examination during 5 years from 1996 to 2000 was determined from the basic health examinee lists of Chibu Town and the subjects were divided into 3 groups depending on the frequency of undergoing the examination: the nontaker group had no examinations over 5 years, the occasional taker group had 1 to 3 examinations and the regular takers had 4 to 5 examinations.

Determining individual medical costs

To determine the medical costs, the National Health Insurance invoices of Chibu Town were used to calculate the total health expenditure from March 2005 to February 2007 for each subject. A single invoice is generated by each medical institution every month, even if a patient consults 2 or more doctors in that month. If a patient attends doctors at different medical institutions in a month, multiple invoices are generated. Therefore, the amounts on all invoices were totaled on an individual basis.

Statistical analysis

We compared the total health expenditure over 3 years from 2005 to 2007 and the frequency of undergoing the basic health examination over 5 years from 1996 to 2000. The total health expenditure of each subject in relation to the frequency of undergoing the health examination is shown in Fig. 1. Based on total health expenditure, patients were divided into 3 categories: expenditure of ≤ 200,000 yen over 3 years was defined as low health expenditure, from 200,000 yen to 1,400,000 yen was moderate expenditure, and > 1,400,000 yen was high expenditure. (For reference, the average annual salary in Japan was about 4,400,000 yen in 2006.) The Cochrane-Armitage test was used to compare the

Table 1. Charactristics of participants

	Frequency of basic health examination for 5 years				
	Nontaker group	Occasional taker group	Regular taker group	Total	*P* value
Number	39	87	53	179	
Age in 1996 (years old)	54.1 ± 6.4	53.2 ± 7.1	55.1 ± 6.3	54.0 ± 6.7	0.291*
Male	28 (71.8%)	40 (46.0%)	16 (30.2%)	84 (46.9%)	< 0.001†
Female	11 (28.2%)	47 (54.0%)	37 (69.8%)	95 (53.1%)	

Age in 1996 presented mean ± SD. Male and Female showed the number of people.
*Student *t*-test.
†χ^2 test.

Table 2. The proportions of individuals involved in each frequency groups of taking basic health examination according to sex and 3 health expenditure categories

		Health Expenditure category (yen)		
		Low	Moderate	High
		0–200,000	200,001–1,400,000	1,400,001–
All	Nontaker group [39]	15 (38.5%)	11 (28.2%)	13 (33.3%)
	Occasional taker group [87]	21 (24.1%)	52 (59.8%)	14 (16.1%)
	Regular taker group [53]	6 (11.3%)	42 (79.2%)	5 (9.4%)
	Total [179]	42 (23.5%)	105 (58.7%)	32 (17.9%)
	P value	0.002	< 0.001	0.004
Male	Nontaker group [28]	12 (42.9%)	8 (28.6%)	8 (28.6%)
	Occasional taker group [40]	11 (27.5%)	23 (57.5%)	6 (15.0%)
	Regular taker group [16]	3 (18.8%)	12 (75.0%)	1 (6.2%)
	Total [84]	26 (31.0%)	43 (51.2%)	15 (17.9%)
	P value	0.079	0.002	0.051
Female	Nontaker group [11]	3 (27.3%)	3 (27.3%)	5 (45.5%)
	Occasional taker group [47]	10 (21.3%)	29 (61.7%)	8 (17.0%)
	Regular taker group [37]	3 (8.1%)	30 (81.1%)	4 (10.8%)
	Total [95]	16 (16.8%)	62 (65.3%)	17 (17.9%)
	P value	0.067	0.001	0.021

P value with Cochran-Armitage test among 3 group divided by the frequency of basic health examination for 5 years at each medical expenditure categories. Total medical care expenditure for 3 years from 2005 to 2007 was adopted.

number of subjects in each health expenditure category among the health examination groups. Student's *t*-test was employed to compare age among the health examination groups, while the chi-square test was performed to compare the proportion of men and women among these groups. The mean health expenditure was calculated as the total health expenditure over 3 years in each group divided by the number of subjects in that group. Statistical analysis was performed with Microsoft Excel and the SPSS 16.0 statistical software package (SPSS, Chicago, IL), with $P < 0.05$ being considered significant.

RESULTS

The baseline characteristics of the subjects in 1996 are shown in Table 1. There was no significant difference of age among the 3 health examination groups. The proportion of men was significantly higher than that of women in the nontaker group ($P < 0.001$, Table 1). The distribution of total health care expenditure is shown according to the frequency of basic health examination in Fig. 1. The nontakers formed the largest proportion of the low expenditure group, regular takers were the largest proportion of the moderate expenditure group and nontakers were predominant in the high expenditure group.

The proportion of subjects in each basic health examination group stratified according to sex and health expenditure category is shown in Table 2. Subjects who had fewer examinations were more likely to be in the low expenditure group, although not significantly. Subjects who had more examinations were more likely to be in the moderate expenditure group, while those with fewer examinations formed a high proportion of the high expenditure group. Both men and women showed similar results.

Among men, the average total health care expenditure over 3 years was 1,022,658 yen for nontakers, 830,793 yen for occasional takers and 848,254 yen for regular takers. Among women, the average total health care expenditure over 3 years was 1,164,339 yen for non-

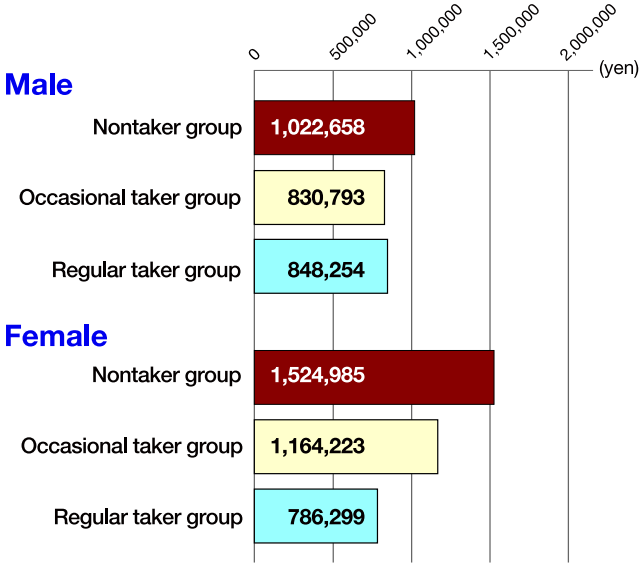

Fig. 2. Total health expenditure for 3 years per capita according to the frequency of having a basic health examination.

takers, 1,010,922 yen for occasional takers and 805,002 yen for regular takers (Fig. 2).

DISCUSSION

We examined the relationship between the frequency of undergoing the basic health examination from 1996 to 2000 and health care expenditure from 2005 to 2007 among the inhabitants aged 40 to 64 years living on a remote Japanese island. We found that nontakers were likely to be in either the low or high expenditure group, while occasional or regular takers were likely to be in the moderate expenditure group. In addition, health expenditure per capita after 10 to 12 years was highest for the nontakers. In other words, the nontakers included a subgroup within which they required high health care expenditure over time. Our results suggested that undergoing the basic health examination regularly increased contact with medical services and reduced future medical costs per capita despite the high consultation rate for this small island population with enthusiastic public health nurses.

In Japan, several community-based studies have already compared individual health care expenditure with the frequency of undergoing the basic health examination.[10–14] The common result of these studies was that the number of consultations was higher for examinees than non-examinees. This is consistent with the present result that health care expenditure shifted from low to moderate as the frequency of undergoing the basic health examination increased. However, the results of these 5 studies on the relationship between participation in the basic health examination and health care expenditure did not correspond, and such differences may have been related to the distribution of medical expenditure according to the frequency of a basic health examination that we found in our study. We found 2 peaks (low and high) of health care expenditure among nontakers, so the proportion of individuals with low or high expenditure decreased and the proportion with moderate expenditure increased as the frequency of participating in the basic health examination became higher. In some takers, chronic diseases such as hypertension or diabetes were detected during the basic health examination and they subsequently attended a doctor regularly. As a result, the proportion of takers with moderate health care expenditure became higher. It has been reported that frequent takers of the basic health examination show a significant increase of outpatient health care expenditure for a 5-year period after taking the examination.[13] However, such findings regarding health care expenditure during this period after the basic health examination may largely reflect the cost of new outpatients in whom disease was detected. The study also showed that inpatient health care expenditure tended to be higher for nontakers, although the difference was not significant, so nontakers may include a high-risk population that requires expensive health care. In the present study, the nontaker men with a high health care expenditure had hypertension or diabetes and developed complications such as cardiovascular disease or stroke requiring hospitalization. For disease prevention, intervention targeting high-risk nontakers is required. If health care expenditure had been compared on the basis of average or median values, the difference of distribution according to the frequency of examination might have been missed. Also, health care expenditure was assessed either at the same time as the basic examination[11–13] or up to a few years it in most other studies,[10, 13, 14] and few studies allowed a long period from examination to assessment of expenditure. The present results suggested that participation of middle-aged people in the basic health examination was related to lower health care expenditure not only just after examination, as reported by previous studies, but also after 10 years.

There were several limitations of this study. First, the study population was so small that the age of each health care expenditure category did not match. Therefore, the subjects were limited to those 40 to 64 years old. There was no significant age difference among the examination frequency groups. Second, the health and consultation status of the nontakers in 1996 was not assessed. Individuals who visited hospital regularly might not have needed the basic health examination and so could have been included among the nontakers. Some studies of basic health examination participants have shown that the health status and the presence of lifestyle-related diseases increase future health expenditure.[15–19] Third, there was no adjustment for lifestyle and interest in health. Some researchers have reported that smoking, drinking and regular exercise influence an increase or decrease of health care expenditure.[20–22] In another study, nontakers were divided into 2 groups according to whether they saw a doctor regularly or not,[23] and the results suggested that bachelors and low-income earners accounted for a higher proportion of the people who did not undergo the basic health examination and did not see a doctor. The nontakers in our study may have contained both of these groups, suggesting that a social epidemiologic approach with improvement of socioeconomic status may be needed for the high-risk group of nontakers. To adjust for these factors, a cohort study would be required, but it would be difficult to perform because most nontakers refuse to cooperate. Despite these limitations, we confirmed that the highest future expenditure was

required by nontakers. Fourth, health care expenditure was not examined in relation to the underlying diseases. In contrast to cancer screening, however, the basic health examination is used to check for multiple diseases, so it seemed appropriate to assess total health care expenditure.

In conclusion, our findings suggested that more frequent participation in basic health examinations reduced the proportion of subjects with either low or high health care expenditure and increased those with moderate expenditure. In a small community, like the setting of this study, the per capita health expenditure decreases as the frequency of basic health examination increases.

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The authors declare no conflict of interest.

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