



The effects of outpatient co-payment policy on healthcare usage by the elderly in Taiwan

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Abstract

Aging and declining health are intrinsically related and are resulting in increasing healthcare spending in many countries. Control of healthcare spending and patient usage behavior are linked. This study examines the healthcare usage behavior of chronically ill elderly patients in Taiwan following an increase in co-payments. The differences in usage behavior are interpreted by comparing the frequency of hospital visits and the types of hospitals chosen by patients before and after the implementation of the new co-payment policy. Claim data of the Taipei branch of the National Health Insurance Bureau (NHIB) is used as a basis for this analysis. Analysis results indicate that choice of hospital type by the elderly is affected by an increase in co-payment, but that difference of the hospital type choice before and after the co-payment increase is too small to be practically significant. However, the frequency of visits decreased significantly after the implementation of the new co-payment policy. Medical care costs per visit for individual patients and for the National Health Insurance system both increased significantly. Visit frequency and hospital type choice, as well as diagnosis and treatment cost and co-payment, all show significant differences among different age groups of the elderly. The effects of co-payment increases are also discussed from the viewpoint of patients and of governmental policy.

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Keywords: National Health Insurance; Co-payment; Usage behavior; Visit frequency

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1. Introduction

Life expectancy is increasing in many countries worldwide, with the population of individuals age 65 and above having grown rapidly. For instance, in the United Kingdom and the United States, life expectancies are above 74 years old for males and 79 years old for females (OECD, 2001). In Europe, the average life expectancy is about one year higher than that in the United States for males and two years for females (Global Action on Aging, 2003). Similarly, life expectancy in Taiwan in 2003 was 73.4 years old for males and 79.1 years old for females (DOH, 2004a). In the United States, the proportion of elderly within the total population was 12.4% in 2000, and is projected to reach 19.6% in 2030 (US Census Bureau, 2002). In Europe, the proportion of the elderly population was 16.1% in 2000, and is projected to reach 27.5% by 2050 (EUROPA, 2004). In Taiwan, the total population increased from 9,367,661 to 22,689,122 from 1956 to 2004, and the proportion of the elderly in the population more than tripled during the same period, from 2.5% to 9.4% (Directorate General of Budget, Accounting and Statistics, Executive Yuan, ROC, 2005), and is predicted to reach 21.5% in 2036 (Wu and Chang, 1997). Based on the projections of the Council for Economic Planning and Development (2004), by 2051 the elderly population of Taiwan will exceed 7,000,000 and 3,750,000 of them will be above 75 years old. Because of the rapid growth of this elderly population, healthcare problems are a growing problem in Taiwan society.

The great increase in the numbers of the elderly will be accompanied by a more dramatic increase in people suffering from chronic diseases and disorders (Allert et al., 1994). In the United States, 80% of the elderly have one chronic disease (Zazove et al., 1992; AMA, 2004), more than half have at least two and more than a quarter have three or more (AHRQ, 2001). A similar investigation found that elderly individuals in Taiwan have an average of 1.2 chronic diseases (NHRI, 2001). Individuals in poor health use more medical care services and spend more on healthcare. Hwang et al. (2001) found a positive and nearly linear relationship between medical spending and number of chronic conditions. Chronic diseases account for 70% of all American deaths and comprise over 75% of the \$1.4 trillion in medical costs nationally (AMA, 2004; CDC, 2004). The elderly will consume 50% of the American healthcare budget by the year 2040 (Zazove et al., 1992). In Taiwan, the elderly account for 30% of total OutPatient Department (OPD) medical expenses; their medical visits make up 18.8% of total enrollee visits and, yet, they account for only 9.4% of the total population (DOH, 2004b). Besides the increase in medical expenses, out-of-pocket spending also increases with age (Hwang et al., 2001). The chronically ill elderly require more chronic care, long-term care, and home care than other groups of the population. Providing healthcare for an aging population is an increasingly heavy burden and will become an important issue for patients, families, insurers and the government in the future. The financial burden may make elderly individuals delay their use of healthcare, thereby worsening their health further (Zazove et al., 1992; Peabody et al., 1999). The public must pay increased attention to the medical care needs of the elderly and effectively use healthcare resources.

National Health Insurance (NHI) is the only compulsory nation-wide health insurance system for residents of Taiwan, and is operated by the National Health Insurance Bureau

(NHIB). NHI was launched in March 1995. The insured are separated into six categories based on employment status. These categories are (i) employees of publicly or privately owned enterprises and employers or independent business owners; (ii) members of an occupational union who have no clear employers or who are self-employed; (iii) members of farmers or irrigation associations; (iv) military servicemen and military school students; (v) low-income families; and (vi) veterans (NHIB, 2003). The premium contribution is obtained from government, employer, and employee monthly. The enrollment rates were 99% as of June 2003 (DOH, 2004c).

Healthcare providers are paid on a fee-for-service and case payment basis under the global budget payment system (NHIB, 2002). Fee-for-service payment is based on services rendered, and is calculated according to a uniform payment schedule as listed by NHIB. Case payment consists of 50 items related to the operations of the outpatient department, including Extracorporeal Shockwave Lithotripsy (ESWL), and Herniorrhaphy, and the inpatient department, such as Normal Spontaneous Delivery (NSD), Cesarean Section (C/S), and Total Knee/Hip Replacement (TKR/THR). Beneficiaries can select any hospital and physician without referral (Lu and Hsiao, 2003). The system is a no gatekeeper system in both the inpatient and outpatient departments. Patients can access a specialist as necessary. Physicians are employed by hospitals or practice in private clinics, and can freely select the treatment mode they desire. To participate in the system, the health institutions that comprise the system, which are classified as academic hospitals, regional hospitals, district hospitals or clinics, have to contract with the NHIB. The enrollees must co-pay a portion of their health expenses, including inpatient and outpatient services, when they make use of health services. Low-income households, those suffering from major illnesses, and veterans, are exempt from co-payment (NHIB, 2002).

This co-payment policy is in place to prevent the inappropriate use or misuse of medical resources (Magid et al., 1997; NHIB, 2002). The rationale for co-payments is that they control healthcare costs and curb abuses. Simon et al. (1996) found that the increase of cost-sharing had significant impact on the use of mental health services. When the co-payment was increased by \$20 per visit, the service usage was decreased by 16.8%. An investigation of emergency departments (ED) found that the introduction of a co-payment reduced visits to the ED of a health maintenance organization (HMO) by 15% (Selby et al., 1996). Tamblyn et al. (2001) observed that drug co-payment decreases both essential and non-essential drug use among seniors. Furthermore, in Sweden, Ong et al. (2003) found that the influences of co-payments increase on the prescription of mental health medications differed between males and females. For males the use of antidepressants and sedatives increased, but in females the use of antidepressants decreased. However, Liu and Romeis (2003) and Pilote et al. (2002) explored the effect of drug co-payment among the elderly in Taiwan and Acute Myocardial Infarction (AMI) patients in Canada, respectively, and found that co-payment and cost-sharing did not affect drug prescriptions and the utilization of medical care.

Due to the increased demand for healthcare and for effective use of healthcare services, the NHIB twice increased the co-payment to control health expenses. Increasing the co-payment by patients was considered a powerful method of controlling medical

expenditures (Wang and Friedlob, 1996). Before the first co-payment increase, the rate of co-payment charged varied according to the level of medical institutions, and was called the basic co-payment. The basic co-payment of academic and regional hospitals was more than that for district hospitals and clinics. There was no co-payment for pharmaceutical and diagnosis and treatment costs. In August 2001, the co-payment for certain outpatient services increased besides basic co-payment, and patient had to co-pay for rehabilitation services, pharmaceutical cost and high-frequency user payment—those who visited OPD over 25 times during a calendar year. However, this co-payment increase did not significantly impact the cost of pharmaceuticals (Liu and Romeis, 2003) and healthcare expenditures increased rapidly (NHIB, 2002).

The second co-payment increase came into effect on September 1, 2002, and included the increase of basic co-payment and new examination and laboratory testing co-payments for visiting academic or regional hospitals. Therefore, the co-payment comprised basic co-payment, high-frequency user payment and the co-payment of the cost of examination and laboratory testing, rehabilitation services, and pharmaceutical costs for visiting an academic or regional hospital. A patient visiting a district hospital or a clinic only had to make basic co-payments, high-frequency user payments, and co-payments for the cost of drugs and rehabilitation services. The co-payment ceiling per visit was increased by more than 100% in academic and regional hospitals. The co-payments in district hospitals and clinics remained unchanged and were, after the increase, much lower than those in the academic hospitals and regional hospitals. This increase was designed to transfer patients from academic hospitals and regional hospitals to district hospitals and clinics, so as to increase the effectiveness of healthcare resource use (NHIB, 2002).

The Taiwanese healthcare system differs from that in other countries. Most related studies have focused on specific cases of diagnosis and drug utilization. No consistent changes have been observed in hospital OPD visit behavior of the elderly. Moreover, the evidence available for hospital category choice is limited in previous researches. In Taiwan, patients have the right to choose the hospital they wish to visit and do not require a physician's referral. Understanding the impacts of the new program on the usage behavior of elderly adults is imperative to policy makers for improving future decision-making.

Identifying patient subgroups and treating each group differently are highly effective in increasing the efficiency of using scarce resources. Using specific diagnostic, prognostic, and functional criteria, Rubenstein et al. (1986) classified all patients aged 65 and above, who had been hospitalized at the Veterans Administration Hospital, into five clinical subgroups, namely, Geriatric Evaluation Unit (GEU) candidate, severely demented, medical, terminal, and independent. The results showed that such classification of patients offers important and useful information for resource allocation, long range planning, and quality-of-care assessment. Similarly, Kim and Yang (2005) demonstrated that service efficiency was improved when patients in need of long-term care were categorized by level of physical/cognitive function. Since the healthcare use of the elderly is correlated with patient age (Kane and Matthias, 1984), this study uses age to classify groups of elderly and analyzes the healthcare usage behavior of the subgroups before and after the increase in co-payments.

2. Methods

2.1. The sample

The data used in this study were the claim data of the Taipei branch of the NHIB. This claim database accurately records patient age, gender, major diagnosis, hospital type, diagnosis and treatment items, physician diagnosis fee, pharmacist service fee, cost of pharmaceuticals, co-payment, and total cost.

Three criteria are used to screen the individuals in the database for inclusion in the study. First, the individuals must be chronic patients aged 65 and above. The categories of chronic disease are defined and listed by NHIB (1996). Patients diagnosed with chronic disease are marked in claim data and categorized in the chronic disease group. Second, patients included in this study must not have been exempted from co-payment. Third, the patients must have healthcare usage records in the NHIB both before and following the implementation of the new co-payment policy. When a person uses health services, hospitals must record every patient visit using a standard electronic claim form and send this claim to the NHIB for reimbursement.

To estimate how the new co-payment policy impacts the healthcare usage behavior of the elderly, this study examines two periods, one before the co-payment increase and one following the increase. The 'pre-co-payment increase period' runs from September 2001 to March 2002, and the 'post-co-payment increase period' runs from September 2002 to March 2003.

This study examined a total of 329,617 cases (Table 1). The sample comprised 195,760 females and 133,857 males. The mean age is 73.87 years, with a standard deviation (S.D.) of 6.57. Cases are diagnosed mainly using the ICD-9-CM coding system. The five most common conditions are circular system disease (22.8%), respiratory system disease (15.7%), musculoskeletal system (10.7%), nervous system (9.4%), and endocrine and metabolic disease (9%).

2.2. Variables

This study divides variables into five categories (Table 2). The first category includes demographic variables (Demographic), age and gender. The second category is choice of hospital type (Hospital type choice). The hospital type chosen is presented by the percentage pre- and post-co-payment increase period. The third category is the frequency of hospital visits (Visit frequency), which is broken up into three variables: hospital visit frequency before the implementation of the new co-payment policy, hospital visit frequency after the implementation of the new co-payment policy, and the difference between the hospital visit frequencies before and after the implementation of the new co-payment policy.

The fourth category is the mean number of days of physician-prescribed drug use (Drug use days) by chronically ill elderly individuals per OPD visit. This category includes three variables: mean duration of drug use, pre- and post-co-payment increase period, and difference between mean durations of drug use before and after the implementation of the new co-payment policy.

Table 1
Demographic characteristics and diseases of the ICD-9-CM codes of the samples ($n = 329617$)

Characteristics	Samples (%)
Elder's age	Mean = 73.87 (S.D. = 6.57)
65–69	103232 (31.32%)
70–74	90026 (27.31%)
75–79	69979 (21.23%)
80 and above	66380 (20.14%)
Gender	
Males	133857 (40.61%)
Females	195760 (59.39%)
Diseases of the ICD-9-CM codes	
Disease of the circulatory system	22.8%
Disease of the respiratory system	15.7%
Disease of the musculoskeletal system and connective tissue	10.7%
Disease of the nervous system and sense organs	9.4%
Endocrine, metabolic disease, and immunity disorders	9.0%
Disease of the digestive system	7.5%
Disease of the genitourinary system	6.4%
Disease of the skin and subcutaneous tissue	3.6%
Neoplasms	3.5%
Mental disorders	3.2%
Symptoms, signs and ill-defined conditions	3.1%
Injury and poisoning	2.1%
Infectious and parasitic diseases	1.5%
Supplementary classification of factors influencing health status and contact with health services	0.9%
Disease of the blood and blood forming organs	0.4%

The fifth category (Medical care cost) includes four medical care cost variables: diagnosis and treatment cost, pharmaceutical cost, co-payment, and total cost. The variables represent the average costs incurred by a patient during a hospital visit. The total costs are the sum of diagnosis and treatment cost, pharmaceutical cost, co-payment, physician diagnosis fee and pharmacist service fee. The last two items remain unchanged before and after the increase in the new co-payment. Co-payment, as mentioned previously, including basic co-payment, high-frequency user payment and sharing the cost of examination and laboratory testing, rehabilitation service and pharmaceutical cost, is the amount a patient must pay to the hospital on visiting that hospital. The total cost, excluding co-payment cost, must be paid by the NHIB to the hospital. Individual patient data include the means of diagnosis and treatment cost, pharmaceutical cost, co-payment, and total cost both before and following the implementation of the new co-payment policy, and the difference of the means of diagnosis and treatment costs, pharmaceutical costs, co-payments, and total medical costs between before and following implementation of the new co-payment policy.

2.3. Statistical analysis

The data were analyzed using SPSS 11.0. Comparisons were conducted using *t*-test, Chi-square test, analysis of variance (ANOVA) and the Scheffé test, a conservative post-

Table 2
Variable names and definitions

Variable names	Definition
Demographic	
Age	Patient's age
Gender	Patient's gender
Hospital type choice	The percentage of patients choosing a hospital type during the study period An academic hospital is 1, regional hospital is 2, district hospital is 3, and a clinic is 4
Visit frequency	The frequency of hospital visits during the study period There are three variables: i. Hospital visit frequency <i>before</i> the new co-payment policy was implemented ii. Hospital visit frequency <i>after</i> the new co-payment policy was implemented iii. The <i>difference</i> between the hospital visit frequencies before and after the new co-payment policy was implemented
Drug use days	The mean number of days of physician-prescribed drug use per visit There are three variables: i. The mean number of days of drug use <i>before</i> the new co-payment policy was implemented ii. The mean number of days of drug use <i>after</i> the new co-payment policy was implemented iii. The <i>difference</i> between the mean number of days of drug use before and after the new co-payment policy was implemented
Medical care cost	Including diagnosis and treatment cost (Diag-Treatment cost), pharmaceutical cost, co-payment, and total cost There are twelve variables: i. The mean diagnosis and treatment cost <i>before</i> the new co-payment policy was implemented ii. The mean diagnosis and treatment cost <i>after</i> the new co-payment policy was implemented iii. The <i>difference</i> of the diagnosis and treatment costs before and after the new co-payment policy was implemented iv. The mean pharmaceutical cost <i>before</i> the new co-payment policy was implemented v. The mean pharmaceutical cost <i>after</i> the new co-payment policy was implemented vi. The <i>difference</i> between the pharmaceutical costs before and after the new co-payment policy was implemented vii. The mean co-payment <i>before</i> the new co-payment policy was implemented viii. The mean co-payment <i>after</i> the new co-payment policy was implemented ix. The <i>difference</i> between the co-payments before and after the new co-payment policy was implemented x. The mean total cost <i>before</i> the new co-payment policy was implemented xi. The mean total cost <i>after</i> the new co-payment policy was implemented xii. The <i>difference</i> between the mean total costs before and after the new co-payment policy was implemented

hoc test, which compensates for spurious significant results that occur with multiple comparisons (Cohen, 1995). Scheffé test gives a valid measure of the difference between all contrasts simultaneously (Christensen, 1996).

3. Results

3.1. Hospital type choice

The hospital type is calculated based on the hospital accreditation by the Department of Health (DOH) in Taiwan. Numbers were used to represent the hospital types. Academic hospitals are designated as 1, regional hospitals as 2, district hospitals as 3, and clinics as 4. The percentage for hospital type choice were 23.4% academic hospitals, 25.0% regional hospitals, 14.5% district hospitals, and 37.1% clinics before the implementation of the new co-payment policy, and 22.3%, 25.2%, 14.6%, and 37.9%, respectively, after the implementation of the new co-payment policy. A comparison by using Chi-square test of hospital type choice before and after the implementation of the new co-payment policy indicates that the differences were statistically significant (Table 3). However, the differences were too small to have practical significance.

3.2. Hospital visit frequency

The hospital visit frequency was the total number of visits by a patient during the period either before or after the implementation of the new co-payment policy. The visit frequency was 12.15 for the pre-co-payment increase period and 11.99 afterwards, a decrease of 0.17 (Table 4). A *t*-test of the difference indicated that it is significant ($p < 0.01$).

3.3. Medical care cost

The medical care costs, as shown in Table 4, include diagnosis and treatment cost, pharmaceutical cost, co-payment, and total cost. The pharmaceutical cost increased significantly ($p < 0.01$) from US\$21.16 for the pre-co-payment increase period to US\$22.36 afterwards. The increase in pharmaceutical cost is related to drug use duration and drug price (AMA, 2004). According to our results, the duration of drug use increased significantly ($p < 0.01$), from 17.06 to 17.14 days. Pharmaceutical costs of chronically ill

Table 3
Percentage of hospital type choice and Chi-square test results

Co-payment increase	Hospital type ^a (% of choice)				Pearson's Chi-square test
	1	2	3	4	
Before	23.4	25.0	14.5	37.1	
After	22.3	25.2	14.6	37.9	1665.2**

^a Hospital type 1–4 represent the academic hospital, regional hospital, district hospital and clinics, respectively.

** $p < 0.01$.

Table 4
Variable mean, standard deviation and comparison between pre- and post-co-payment increase period

Variable	Pre-co-payment increase		Post-co-payment increase		T-value
	Mean	S.D.	Mean	S.D.	
Visit frequency	12.15	9.84	11.99	10.01	10.75**
Drug use days	17.06	7.72	17.14	7.05	−6.14**
Pharmaceutical cost (\$) ^a	21.16	20.21	22.36	21.91	−39.70**
Diagnosis–treatment cost (\$)	6.81	15.32	7.80	16.51	−27.21**
Co-payment (\$)	5.12	2.17	6.00	2.84	−222.30**
Total cost (\$)	35.57	25.16	39.55	28.34	−84.08**

^a US dollars per elderly person. US\$1 = NTD\$34.

** $p < 0.01$.

elderly patients accounted for nearly 59% and 56%, respectively, of the total cost before and after the implementation of the co-payment policy. These percentages are much higher than that for prescription drug spending by seniors in the United States, accounting for 7.7% of total national healthcare expenditure in 1996 (Families USA, 2000) and for 15.7% of the total prescription spending of enrollees in 2000 (AMA, 2004). Taiwanese elderly use more drugs than their American counterparts. Such increases in pharmaceutical costs are caused by several factors, including newer high-priced drugs, increases in the price of drugs, and prolonged drug usage.

Furthermore, the diagnosis and treatment costs increased by US\$1, from US\$6.81 for the pre-co-payment increase period to US\$7.80 afterwards (Table 4), representing a significant increase ($p < 0.01$). When patients decreased their frequency of hospital visits, the needs for diagnosis and treatment on each visit increased. Moreover, the co-payment that patients must pay per visit also increased. Resulting from the implementation of the new co-payment policy, co-payment increased significantly from US\$5.12 to US\$6.00 ($p < 0.01$) and the total costs increased from US\$35.57 to US\$39.55 ($p < 0.01$).

3.4. Age group comparison

To understand the various healthcare usage behaviors of different age groups of the elderly both pre- and post-co-payment increase period, chronically ill patients are divided into four different age groups. Those aged between 65 and 69 years old make up group 1, which contains 103,232 cases; group 2, aged between 70 and 74 years old, contains 90,026 patients; group 3, aged between 75 and 79 years old, contains 69,979; and group 4, aged 80 years old and above, contains 66,380 patients (Table 1).

Hospital type choice for group 1 was as follows: 23.9% of all group 1 cases were treated in academic hospitals before implementing the new co-payment policy, compared to 22.5% afterwards (Table 5). Meanwhile, the equivalent figures for other types of hospitals were 24.0% and 24.1%, respectively, treated in regional hospitals; 13.7% and 13.8%, respectively, treated in district hospitals; and 38.4% and 39.7%, respectively, treated in clinics. Hospital type choice for all groups differs significantly ($p < 0.01$) before and after the new co-payment policy implemented (Table 5).

Table 5
Percentage of hospital type choice of age group and Chi-square test results

Age group	Co-payment implemented	Hospital type ^a (% of choice)				Pearson's Chi-square test	d.f.	p-value
		1	2	3	4			
1 (65–69)	Before	23.9	24.0	13.7	38.4	805.7	3	< 0.01
	After	22.5	24.1	13.8	39.7			
2 (70–74)	Before	23.7	24.7	14.2	37.4	612.3	3	< 0.01
	After	22.4	24.7	14.5	38.4			
3 (75–79)	Before	23.3	25.1	14.7	37.0	337.4	3	< 0.01
	After	22.2	25.5	14.8	37.6			
4 (80 and above)	Before	22.6	26.6	15.6	35.2	185.1	3	< 0.01
	After	21.9	27.2	15.8	35.1			

^a Hospital type 1–4 represent the academic hospital, regional hospital, district hospital and clinics, respectively.

The visit frequencies of all groups decreased after the implementation of the new co-payment policy (Table 6). The visit frequencies of group 3 were higher than those of the other age groups during both the periods. The visit frequencies decrease between pre-co-payment increase period and post-co-payment increase period was 0.35 for group 4; 0.23 for group 3; 0.09 and 0.045 for groups 2 and 1, respectively (Table 7). The differences in visit frequency are significant in all age groups ($p < 0.01$). The oldest of the elderly displayed the most severe reduction in visit frequency, compared with other groups of younger seniors.

The durations of drug use by chronically ill elderly patients all exceed 16 days per visit (Table 6). The durations increase for all age groups after the implementation of the new co-payment policy and the differences in the increases between group 2 and 3 and between group 2 and 4 are significant ($p < 0.05$). Furthermore, the increases in pharmaceutical costs do not differ among the age groups ($p > 0.05$). Before the implementation of the new co-payment policy, the pharmaceutical costs accounted for 59% of total costs in group 1, 60% in groups 2 and 3, and 61% in group 4. After the introduction of the new co-payment policy, the ratio of pharmaceutical costs to total costs are 56% in group 1, and 57% in groups 2–4.

Diagnosis and treatment spending accounts for nearly 20% of the total cost of the chronically ill elderly during both the periods. The increase in diagnosis and treatment cost between the two periods is US\$0.99 for group 1, US\$0.90 for group 2, US\$0.93 for group 3, and US\$1.20 for group 4 (Table 7). The increases in diagnosis and treatment costs differ significantly ($p < 0.05$) between the group aged above 80 years old and the group aged between 70 and 74 years old. Patients with chronic conditions are prone to more complications with increasing age, resulting in the need for more medical treatment for the group aged 80 years old and above.

The co-payment increased for all groups (Table 6) after the implementation of the new co-payment policy. The elderly had to pay more than before the implementation of the new policy, even though there were alternative hospitals for which co-payment costs did not increase. The co-payment increases differ significantly ($p < 0.01$) between the group aged below 79 years old and the group aged above 80 years old (Table 7). For all the elderly

Table 6
Variable means and standard deviations of age groups before and after the implementation of the new co-payment policy

Variable	1 (65–69)		2 (70–74)		3 (75–79)		4 (80 and above)		
	Before ^a	After ^b	Before	After	Before	After	Before	After	
Visit frequency	Mean (S.D.)	11.23 (9.10)	11.19 (9.43)	12.27 (9.89)	12.18 (10.09)	12.91 (10.46)	12.69 (10.54)	12.58 (10.05)	12.22 (10.11)
Drug use days	Mean (S.D.)	16.91 (7.76)	16.98 (7.68)	17.02 (7.67)	17.05 (7.60)	17.09 (7.70)	17.21 (7.66)	17.34 (7.75)	17.47 (7.67)
Pharmaceutical cost (\$) ^c	Mean (S.D.)	20.03 (19.89)	21.22 (21.70)	21.37 (20.81)	22.53 (22.32)	21.85 (20.26)	23.09 (21.89)	21.92 (19.94)	23.06 (21.66)
Diagnosis–Treatment cost (\$)	Mean (S.D.)	6.60 (14.57)	7.59 (15.61)	6.90 (15.56)	7.81 (16.38)	7.07 (15.85)	8.00 (16.08)	6.71 (15.58)	7.91 (18.39)
Co-payment (\$)	Mean (S.D.)	5.05 (2.18)	5.94 (2.88)	5.10 (2.17)	6.01 (2.85)	5.17 (2.17)	6.05 (2.81)	5.20 (2.18)	6.04 (2.79)
Total cost (\$)	Mean (S.D.)	34.13 (24.51)	38.20 (28.77)	35.78 (25.84)	39.69 (28.10)	36.45 (25.43)	40.50 (27.40)	36.23 (24.88)	40.47 (28.94)

^a Before means before the implementation of the new co-payment policy.

^b After means after the implementation of the new co-payment policy.

^c US dollars per elderly person. US\$1 = NTD\$34.

Table 7
ANOVA test results across age groups for comparing the differences before and after the implementation of the new co-payment policy

Variable	1 (65–69)	2 (70–74)	3 (75–79)	4 (80 and above)	F-value	Post-hoc comparisons (Scheffé test)					
						1 vs. 2	1 vs. 3	1 vs. 4	2 vs. 3	2 vs. 4	3 vs. 4
Frequency difference	−0.045 ^a	−0.094	−0.230	−0.350	20.82 ^{**}		**	**	**	**	**
Duration of drug	0.065	0.023	0.124	0.125	3.63 ^{**}				*	*	
Pharmaceutical cost (\$) ^b	1.20	1.16	1.24	1.20	1.20						
Diagnosis–treatment cost (\$)	0.99	0.90	0.93	1.20	2.965 [*]					**	
Co-payment (\$)	0.89	0.91	0.88	0.83	14.97 ^{**}			**		**	**
Total cost (\$)	3.99	3.84	3.98	4.17	1.874						

^a Figures represent the difference between means of variables.

^b US dollars per elderly person. US\$1 = NTD\$34.

* $p < 0.05$.

** $p < 0.01$.

patients, the total expense increased after the implementation of the new co-payment policy, but the increase in total medical costs of the four age groups did not differ significantly ($p > 0.05$).

4. Discussion and conclusions

This study examines how increasing the co-payment for academic and regional hospitals impacts the utilization behavior of elderly patients. The analytical results reveal that the increase in co-payment does not significantly affect hospital type choice. However, the increase in co-payment significantly affects visit frequency. After the co-payment increase, the frequency of hospital visits decreases significantly despite the existence of low co-payment alternatives, namely, district hospitals and clinics. This finding is consistent with previous findings that substantial financial burden might cause elderly beneficiaries to reduce their use of health services (Horgan, 1986; RAND, 2004). However, this result differed from the findings of Pilote et al. (2002) for two reasons. First, the samples of this study are all the chronic elders while Pilote et al. (2002) focused on AMI patients only. Furthermore, the total co-payment of NHI contains not only drug prescription cost but also the costs of basic co-payment, examination and laboratory testing, the cost of rehabilitation services, and the payments by high-frequency users. The decrease in visit frequency probably implies that patients delay fulfilling their healthcare needs. Previous research has also shown that increase in healthcare cost affected health outcomes (RAND, 2004) and hospitalization (Tamblyn et al., 2001). The decrease in visit frequency might reduce the adequacy of healthcare provision to the elderly.

Consistent with Liu and Romeis (2003), this study found that increasing co-payment for pharmaceutical costs did not reduce overall pharmaceutical costs. One possible explanation for this phenomenon is that the amount of drugs a patient requires is determined by the physician of that patient. A patient seldom argues with their physician to reduce the quantity of drugs prescribed and rarely refuses to pay for the drugs because of high co-payment costs. Thus, the net effect of raising co-payment for drugs is simply shifting a larger share of the burden of pharmaceutical costs from the NHIB to patients. Overall pharmaceutical costs continue to rise.

The co-payment increase affected the various age groups within the elderly population differently. This study shows that visit frequencies differ significantly between those aged below 74 years old and those aged 75 years old and above. Patients aged 80 years old and above have significantly decreased frequency of hospital visits compared to other age groups. Hospital type selection also differs between the age groups both before and after the implementation of the new co-payment policy. Generally, the elderly require more healthcare than young adults. Increasing the co-payments for academic and regional hospitals just puts a much heavier financial burden on the elderly and the impact of this must be considered.

Cost is a reason that often prevents the elderly from seeking health services (Zazove et al., 1992). After the implementation of co-payment to control medical expenses, office visits by the elderly decreased, while the hospitals they choose remained virtually unchanged. To explain their disease history repeatedly to different healthcare providers is very frustrating for chronically ill patients and is not the purpose of the co-payment increase. Chronic diseases

are a part of old age and are not curable. However, the control of such diseases is important for both chronically ill patients and for the government. For chronically ill patients, their health status is related to their quality of life and functional outcome. For government, chronic conditions are an important predictor of medical spending (Hwang et al., 2001). An adequate healthcare system that meets the needs of geriatric patients can improve patient quality life, maintain their health status, and effectively utilize healthcare resources. This study demonstrates that frequency with which patients use healthcare decreases with an increase in the amount they have to co-pay. When patients omit some necessary visits, their health condition is likely to deteriorate quickly. The poor health of the elderly will negatively impact the long-term public and household financial burden, and worsen the quality of life of patients and their families. To control rising healthcare costs, increasing co-payments and so shifting the financial burden to patients appears not to be the correct solution. The government must put more energy into deriving solutions that will ease the financial burden on the public and provide adequate healthcare for the elderly.

Elders should be treated based on their healthcare needs. Rubenstein et al. (1986) demonstrated that the hospital inpatient utilization of elders would decrease with earlier identification of required health services. They classified patients into different subgroups first and then provided them with alternative services. The analytical results showed that patient mortality and usage of inpatient services were markedly reduced from GEU. Similarly, this study divided patients by age to analyze healthcare usage behavior and found that patients above 75 years old had reduced hospital visit frequency compared to patients below 74 years old after the co-payment increase. Patients above 75 years old require more healthcare than other groups of the elderly. However, this group is hit the hardest by increasing co-payments. If co-payments can be adjusted according to age, for example by reducing co-payments for patients above 75 years old, the healthcare needs and expenses could be regulated and managed more effectively. Future research can examine this issue in detail.

An important issue that deserves further research is whether the increase in co-payment saves medical resources in the long run. Owing to the increases in co-payment, the healthcare expenditure of the NHIB may shift from outpatient departments to critical care departments, which have higher average medical expenses per visit. As Tamblyn et al. (2001) found, the increase in co-payments for the elderly increases emergency department visits; further research might shed light on this issue by investigating healthcare usage in emergency departments, inpatient departments or other healthcare services before and after the co-payment increase. Furthermore, patients are provided with no information to help them make wise decisions regarding their treatment needs and how often to visit medical services. Patient usage behavior is associated with doctor recommendations. Preventing physicians from recommending unnecessary patient's visits deserves careful consideration by the NHIB.

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