

Out-of-Pocket (OOP) Expenditure for Prescription Drugs among South Korean Outpatients under the National Health Insurance System: Focus on Chronic Diseases Including Diabetes

Hyun Soon Sohn¹, Jin-Won Kwon² and Eun-Ja Park^{3*}

¹College of Pharmacy, Sookmyung Women's University, Seoul, South Korea

²National Evidence-Based Health Care Collaborating Agency, Seoul, South Korea

³Korea Institute for Health and Social Affairs, Seoul, South Korea

Abstract

Introduction: There is substantial concern about the increasing number of obese children and adolescents, resulting in continuing risks for chronic conditions such as diabetes. This study was aimed at estimating the annual expense of out-of-pocket prescription drugs (OOP-PD) attributable to chronic diseases in adult outpatients in South Korea.

Method: Korea Health Panel Survey (KHPS) data from 2008–2009 were used. Chronic diseases such as diabetes, hypertension, asthma and osteoarthritis were included in analyzing OOP-PD expenses. The annual OOP-PD expenses were defined as total amount paid per person during one year in 2008, for prescription drugs not listed in the national formulary and the legal copayment portion (30%) for formulary-listed prescription drugs in outpatient settings. Relationship of chronic diseases to OOP-PD expenses was analyzed using a generalized linear model with a log link function.

Result: A total of 12,082 subjects were analyzed. Subjects having three or more chronic diseases showed OOP-PD values that were 5-times higher than those without any chronic diseases. Diabetes was the chronic disease contributing the most to OOP-PD expenses. The cost ratio (CR) in diabetic subjects without concurrent chronic diseases (i.e., hypertension, osteoarthritis, and asthma) was 6.1 as compared to those without chronic diseases, followed by subjects with asthma (CR = 4.7), hypertension (CR = 4.0), two or more concurrent chronic diseases but no diabetes (CR = 4.2), and osteoarthritis (CR = 2.0).

Conclusion: High OOP-PD values serve as a proxy for the total healthcare expenditure in patients with chronic disease, especially diabetes. These costs might encourage accelerated prevention programs among populations at higher risks in South Korea public health point of view, as in many countries encountering budget constraints in recent years.

Keywords: Korea health panel survey; Out-of-pocket expense; Prescription drug; Chronic diseases; Diabetes

Abbreviations: OOP-PD: Out-of-Pocket Prescription Drugs

Background

Increasing life expectancy, advancing medical technology, and modernized lifestyles all contribute to an increasing number of people with chronic diseases that require substantial direct healthcare costs [1,2]. A cluster of chronic diseases including diabetes, hypertension, asthma, and arthritis has been reported to have an impact on medical costs [3].

The rapid increase in health care costs with an aging population threatens healthcare systems in many countries, and primary prevention strategies targeting modifiable risk factors of diseases are a major health agenda for most countries [4]. For many years, behavioral risk factors such as obesity and smoking have been known causes of chronic health conditions [5]. In particular, many epidemiologic studies have shown a high prevalence of obesity and associated chronic conditions such as diabetes, hypertension, and asthma [6-9]. There is substantial concern about the increasing number of obese children and adolescents [6,10], resulting in continuing risks for chronic conditions and associated increases in healthcare costs [5].

Recent epidemiologic data from South Korea showed an increasing trend of chronic diseases associated with body mass index (BMI)

similar to that in Western countries [11]. The prevalence of diabetes has been estimated to be 8.2% among Koreans older than 30 years [12], and we are concerned about the consistent increase in the prevalence of severe obesity (BMI > 30 kg/m²) and chronic diseases such as diabetes and hypertension, including their remarkable increase among children and adolescents [11,13]. Furthermore, the relationships between increased BMI and the risk of asthma and osteoarthritis and the rising incidence of these chronic conditions were also identified in South Korea [7,14,15].

South Korea has had a compulsory universal national health insurance (NHI) system since 1989 [16]. Under this system, healthcare budgets consist of members' income-based insurance premiums and copayments paid by patients as an out-of-pocket (OOP) expense at the

*Corresponding author: Eun-Ja Park, Jinhungro 235, Bulgwang-dong, Eunpyeong-gu, Seoul, 122-705, South Korea, Tel: + 82-2-380-8269; Fax: + 82-2-353-0344; E-mail: ejpark@kijhansa.re.kr

Received May 16, 2012; Accepted June 23, 2012; Published June 28, 2012

Citation: Sohn HS, Kwon JW, Park EJ (2012) Out-of-Pocket (OOP) Expenditure for Prescription Drugs among South Korean Outpatients under the National Health Insurance System: Focus on Chronic Diseases Including Diabetes. J Diabetes Metab 3:197. doi:10.4172/2155-6156.1000197

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time of healthcare utilization. In the outpatient setting, coinsurance for prescription drugs listed in the national formulary is 30% of the total drug cost for all beneficiaries, except for the elderly (≥ 65 years old) with the total drug cost of \leq US \$10 [17]. Accordingly, patients with chronic disease requiring life-long medications to control their health conditions experience an increasing personal OOP expense for prescription drugs, in addition to the deteriorating financial condition of NHI. Nevertheless, there is little information about which chronic diseases mainly influence prescription drug expense in Asian countries and how much influence those diseases exert on this expense. The prevention of chronic disease becomes an important matter to the patient, the payer, and society, all of whom are concerned with medical expenditures. In this regard, public health programs that encourage lifestyle changes to prevent severe obesity and chronic diseases such as diabetes should be established to reduce health insurance budget constraints from a societal perspective, as well as to reduce the OOP-PD expenses burden from the patient's perspective.

This study aimed to identify the annual OOP-PD expenditures in adult patients diagnosed with at least one chronic disease among diabetes, hypertension, asthma and osteoarthritis. Furthermore, we analyzed how these chronic diseases contribute to OOP-PD expenditure.

Material

Data source

The Korea Health Panel Survey (KHPS) is a readily accessible source of data on healthcare utilization and expenditures for acute or chronic diseases. The KHPS has been conducted on a nationwide representative sample in a non-institutionalized setting by the Korea Institute for Health and Social Affairs and National Health Insurance since 2008 to support public health policy. In the KHPS, participants enrolled in the baseline survey (the first half of 2008, Round 1) were re-surveyed at the following Rounds conducted twice a year. We calculated the annual OOP expenses in 2008 by summing expenditures data collected from Round 1 to 3 surveys.

Subjects

To analyze chronic diseases related OOP-PD expenses, we selected 18,246 subjects who were adults aged 20 or older. Subjects who had concurrent severe disease such as cancer or renal failure that affected OOP expenses as a confounding factor, pregnant women, Medical Aid beneficiaries from whom no or minimum copayment is required, and subjects for whom no information on household income, body weight or height was available were excluded. Total 12,082 subjects were included as the final sample for this study.

Measures of OOP-PD expense

The OOP-PD expense at every visit for all household members was recorded in a diary per individual member, and they were asked to keep every payment receipts and physician's prescriptions as well. The annual OOP-PD expenses are the total amount of money paid by a given household member at community pharmacies for prescription drugs during whole year in 2008.

Variables

Subject socio-demographics data including age, gender, marital status, educational attainment, economic activity, and household income were identified and classified in strata. Household equivalent income was calculated by dividing the 2008 household income by the

square root of the number of household members. Smokers were defined as subjects who had smoked at least 100 cigarettes in their lifetime; subjects who did not currently smoke were classified as ex-smokers. Body mass index was calculated by dividing weight (kilograms) by the square of height (meters) and was classified into four categories: underweight (< 18.5), normal (18.5 to < 23), overweight (23 to < 25), and obese (≥ 25). Weight and height were obtained by self-report.

Chronic conditions were identified by questions about diseases diagnosed by physicians. The four chronic conditions (hypertension, diabetes, asthma, osteoarthritis) focused on this study were selected due to their high rankings for cost per claim submitted to the payer

Characteristics	N	(%)
Total	12,082	100.0
Gender	Male	5,351 44.3
	Female	6,731 55.7
Age (years old)	20-34	2,692 22.3
	35-49	4,203 34.8
	50-64	3,034 25.1
	65-74	1,641 13.6
	75+	512 4.2
Number of concurrent chronic diseases*	0	9,215 76.3
	1	1,938 16.0
	2	809 6.7
	3+	120 1.0
Chronic diseases†	No	9,215 76.3
	Hypertension	1,205 10.0
	Diabetes	215 1.8
	Osteoarthritis	65 0.5
	Asthma	453 3.7
	Two or more conditions w/o diabetes	527 4.4
BMI (kg/m ²)‡	Two or more conditions with diabetes	402 3.3
	< 18.5	589 4.9
	18.5 to < 23	5,490 45.4
	23 to < 25	2,982 24.7
Smoking	≥ 25	3,021 25.0
	None-smoker	7,618 63.1
	Ex-smoker	1,761 14.6
Marital status	Current-smoker	2,703 22.4
	Married	9,059 75.0
	Separated/widowed/divorced	1,230 10.2
Education	Single	1,793 14.8
	Elementary school	2,579 21.3
	Middle school	1,361 11.3
	High school	4,628 38.3
Economic activity	College or more	3,514 29.1
	No	4,666 38.6
Household income (average per year)§	Yes	7,416 61.4
	Low ($<$ US \$11,110)	3,042 25.2
	Middle 1 (US \$11,110-17,600)	2,978 24.7
	Middle 2 (US \$17,600-26,100)	3,047 25.2
	High ($\geq 26,100$)	3,015 25.0

*Number of concurrent chronic diseases diagnosed among four diseases (hypertension, diabetes, asthma and osteoarthritis)

†Chronic conditions were defined as mutually exclusive diseases.

‡Weight (kilograms) divided by the square of height (meters)

§Strata were divided on a quartile basis. Average household income per year is US \$20,300.

BMI = Body Mass Index

Table 1: Subjects characteristics.

Variables		Any of 4 chronic diseases			Diabetes		
		OR	95% CI		OR	95% CI	
Gender	Female	1			1		
	Male	0.73	0.61	0.87	1.28	0.98	1.68
Age	20-34	1			1		
	35-49	7.55	4.79	11.90	3.68	1.78	7.61
	50-64	37.57	23.75	59.44	18.04	8.76	37.12
	65-74	90.86	56.67	145.69	28.62	13.72	59.72
	75+	118.58	71.41	196.90	29.25	13.53	63.20
BMI (kg/m ²)*	<18.5	0.64	0.47	0.86	0.77	0.47	1.25
	18.5 to <23	1			1		
	23 to <25	1.67	1.47	1.90	1.45	1.19	1.77
	≥25	2.55	2.25	2.90	1.90	1.57	2.30
Smoking	None-smoker	1			1		
	Current-smoker	0.98	0.81	1.17	1.26	0.96	1.66
	Ex-smoker	1.22	1.01	1.48	0.97	0.73	1.28
Education	Elementary school	1			1		
	Middle school	0.79	0.68	0.92	0.83	0.66	1.05
	High school	0.63	0.55	0.73	0.78	0.63	0.98
	College or more	0.59	0.49	0.71	0.76	0.56	1.02
Marital status	Married	1			1		
	Separated/widowed/divorced	1.16	0.99	1.35	1.04	0.84	1.29
	Single	0.62	0.41	0.96	0.57	0.27	1.21
Household income (average per year)	Low (< US \$11,110)	1			1		
	Middle 1 (US \$11,110-17,600)	0.90	0.78	1.03	0.90	0.74	1.11
	Middle 2 (US \$17,600-26,100)	0.92	0.79	1.07	0.86	0.68	1.09
	High (≥ 26,100)	0.85	0.72	1.00	0.72	0.55	0.93
	Economic activity	No	1			1	
	Yes	0.85	0.76	0.96	0.64	0.54	0.76

*Weight (kilograms) divided by the square of height (meters)
 BMI = Body Mass Index; OR = Odds Ratio; CI = Confidence Interval

Table 2: Odds ratios for chronic condition prevalence: Logistic regression.

and frequent diagnosis in outpatient settings on the National Health Insurance statistics index [18]. Each chronic condition was tabulated independently. A subject who had hypertension with no any of the other chronic conditions was categorized into subjects with hypertension, and a subject who had multiple chronic diseases was categorized into one of two groups depending on the presence of diabetes, namely multiple chronic diseases with diabetes or without diabetes, considering the contribution of diabetes to increased healthcare consumption.

Statistical analysis

Subject distributions for each stratum per variable and mean OOP-PD expense were represented descriptively. Because the presence of chronic disease influences prescription drug expenditures significantly, we first identified risk factors for chronic diseases using a logistic regression model. Then, the relationships of chronic diseases to OOP-PD expenditures with adjustments for socio-demographics, smoking status, and obesity were determined. Considering the general feature that cost data did not follow a normal distribution [19-21], the bootstrap method and a generalized linear model with a log link function and a gamma distribution were used in analyzing factors attributable to OOP-PD expense. The relative contributions of variable to OOP-PD expenses were reported as cost ratio and 95% confidence interval (CI).

Data were analyzed using SAS (ver. 9.1; SAS Institute, Inc., Cary, NC, USA) and STATA (ver. 10.0; StataCorp, College Station, TX, USA) systems for Windows. A *p*-value of ≤0.05 was considered to indicate statistical significance.

Results

In total, 12,082 subjects were included in the analysis. Among them,

Variables		Model 1			Model 2		
		US \$75 (95% CI = 73-76)*			US \$74 (95% CI = 72-76)*		
		CR	95% CI		CR	95% CI	
Age	20-34	1			1		
	35-49	1.61	1.39	1.86	1.51	1.30	1.76
	50-64	3.64	3.06	4.34	3.06	2.56	3.67
	65-74	4.96	4.02	6.13	4.17	3.35	5.18
	75+	5.31	3.99	7.06	4.34	3.24	5.81
Number of concurrent chronic diseases	0	1					
	1	3.09	2.64	3.60			
	2	4.47	3.71	5.39			
	3+	4.81	3.05	7.58			
Chronic diseases	No				1		
	Hypertension				3.97	3.38	4.66
	Diabetes				6.14	4.35	8.68
	Osteoarthritis				1.98	1.54	2.54
	Asthma				4.67	2.51	8.70
	Two or more conditions w/o diabetes				4.24	3.24	5.54
	Two or more conditions with diabetes				7.36	5.83	9.29
BMI (kg/m ²)†	< 18.5	0.96	0.77	1.19	0.95	0.76	1.18
	18.5 to < 23	1			1		
	23 to < 25	1.11	0.99	1.24	1.07	0.95	1.20
	≥ 25	1.13	1.00	1.26	1.09	0.97	1.23
	Smoking	Current-smoker	0.86	0.74	1.00	0.82	0.70
Ex-smoker		1.14	0.96	1.35	1.12	0.94	1.33
None-smoker		1			1		
Gender	Male	0.87	0.75	1.00	0.85	0.74	0.99
	Female	1			1		
Education	Elementary school	1			1		
	Middle school	1.07	0.90	1.27	1.13	0.95	1.35
	High school	0.85	0.74	0.99	0.95	0.82	1.11
	College or more	0.89	0.75	1.05	0.99	0.83	1.17
Marital status	Married	1			1		
	Separated/widowed/divorced	1.06	0.90	1.25	1.05	0.89	1.24
	Single	0.70	0.60	0.82	0.73	0.62	0.86
Household income (average per year)	Low (< US \$11,110)	1			1		
	Middle 1 (US \$11,110-17,600)	1.07	0.94	1.22	1.07	0.94	1.22
	Middle 2 (US \$17,600-26,100)	1.09	0.95	1.25	1.06	0.92	1.22
	High (≥ 26,100)	1.07	0.93	1.23	1.07	0.93	1.23

* Predicted OOP-PD expense

†Weight (kilograms) divided by the square of height (meters)

BMI = Body Mass; CR = Cost Ratio; CI = Confidence Interval

Table 3: Factors attributing OOP-PD expenses: Multivariate Generalized Linear Model.

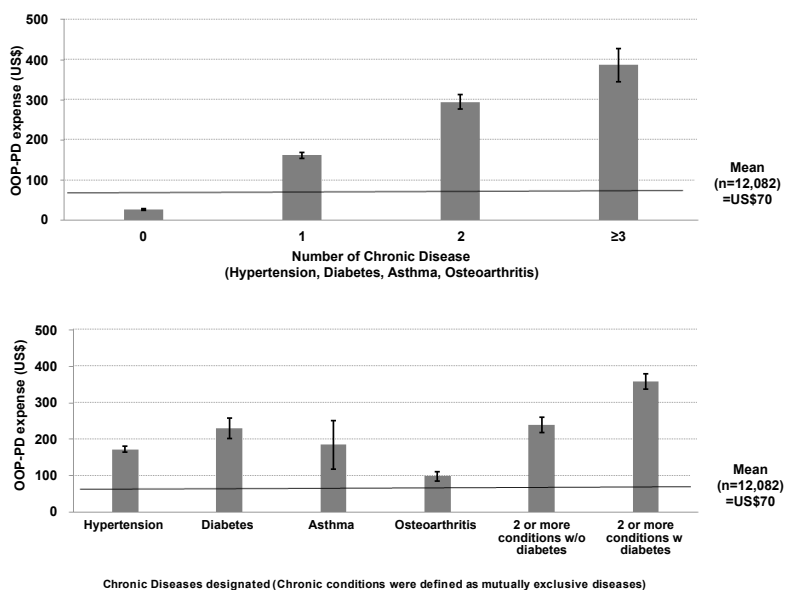


Figure 1: Annual expense of out-of-pocket prescription drugs (OOP-PD).

18% were elderly, i.e., aged 65 years or older, and 56% were female. Half of the subjects were overweight or obese, and 63% were non-smokers. Of the subjects, 24% had at least one of the four medically diagnosed chronic conditions designated in this study, and 1.0% had more than three conditions (Table 1).

The average annual OOP-PD expense in 2008 was US \$70 (95% CI 68–73), and it varied according to the diagnosis and the number of concurrent diseases (Figure 1). The number of chronic diseases affected the OOP-PD expenses. Subjects having more than three chronic conditions spent 14-times more on OOP-PD than did subjects having none of these diseases. Especially, diabetes was shown to be a highly influential factor for increased OOP-PD expenses (Figure 1).

Logistic regression analysis results showed a positive association between having a chronic disease and older age, obesity, and smoking. Compared with the 20–34 age group, the prevalence of the four kinds of chronic diseases was higher in older groups (odds ratios in subjects aged 75 or more and in those aged 65–74 were 118.58 and 90.86, respectively), and the odds ratio for the prevalence of diabetes was 29.25 in subjects aged 75 or older. Chronic disease risks were higher in the overweight groups (odds ratios in overweight (BMI 23 to <25) and obese (BMI ≥ 25) were 1.67 and 2.55 respectively) compared with normal-weight (BMI 18.5 to <23) subjects. Ex-smokers had a higher risk for chronic diseases (odds ratio 1.22) compared with non-smokers (Table 2).

In Model 1 using multivariate generalized linear model, subjects' age and the number of concurrent chronic diseases were demonstrated to be contributing factors for increased OOP-PD expenses. Those aged 75 or older showed 5-times higher OOP-PD values than subjects aged 20–34, and subjects having three or more concurrent chronic diseases showed 5-times higher OOP-PD expense compared with subjects having none of the chronic diseases (Table 3). In particular, Model 2 demonstrated that diabetes was a highly significant factor contributing to increased OOP-PD expenditures (Table 3). The cost ratio in diabetic subjects who had none of the other three chronic diseases (hypertension, asthma and osteoarthritis) was 6.14, which was higher than that in subjects with

osteoarthritis, hypertension and asthma (cost ratios 1.98, 3.97 and 4.67, respectively) and in subjects with two or more concurrent chronic diseases without diabetes (cost ratio 4.24), as compared with subjects who had none of the four chronic diseases.

Discussion

In this analysis, the annual OOP-PD expense was higher for adults who reported four kinds of common chronic diseases (hypertension, diabetes, asthma and osteoarthritis) compared with subjects without these chronic diseases. The cost ratios of OOP-PD in subjects with 1, 2, and 3 concurrent chronic diseases compared with subjects who had no chronic diseases were 3.1, 4.5, and 4.8, respectively. In particular, diabetic subjects spent much more on OOP-PD than did non-diabetic subjects with multiple chronic conditions. The cost ratio among subjects with diabetes was 6.1 compared with those subjects who had none of the four chronic diseases, followed by subjects with asthma, hypertension and osteoarthritis (cost ratio 4.7, 4.0, and 2.0, respectively). Furthermore, the cost ratio in subjects who had two or more chronic diseases with diabetes was 7.4, whereas that of subjects with two or more chronic diseases without diabetes was 4.2.

South Korea is applying a positive formulary listing system and requires coinsurance payments (30%) by patients for prescription drug expenditures under the current national health insurance benefit scheme [17]. Based on the national statistics on healthcare utilizations, prescription drug expenditures constituted about 30% of overall NHI healthcare expenditures [22], and this would be higher (around 50–60%) in outpatient settings [23]. Given South Korea's healthcare circumstances, the OOP-PD expenses would be a significant indicator for healthcare cost burden at an individual level. Diabetes requiring higher expense in terms of OOP-PD could be considered a disease with higher economic burden for healthcare system at a national level. This is in keeping with many reports highlighting the national burden of diabetes based on medical expenditure data in South Korea and other countries [23–25].

Cost sharing systems, such as copayment for prescription drugs,

have been considered as one of strategies to mitigate healthcare expenditure increases in patients with chronic diseases [26], and reducing medication use due to the OOP-PD expenditures burden has been reported in older groups with diabetes [27]. Optimal OOP-PD expenditures burden at an individual level will be important because higher copayment is associated lower medication adherence from limited affordability, which ultimately results in higher healthcare costs [28].

The average annual OOP-PD expense per person in 2008 found in this study (US\$70) might be considered not much of a burden when compared with the level in other country (A\$134 per person in 2007 in Australia [29]). But, mean out-of-pocket spending for prescription drugs per person with chronic disease was increased almost 4 times comparing to no chronic disease in US as like as this study [30].

The fact that OOP-PD expenses as well as total medical expenditures increase in subjects with concurrent chronic conditions leads healthcare policy makers to develop various strategies to prevent chronic diseases. The personal cost burden has been reported to be a risk factor for under-utilization of medication in other countries, but this issue has not been studied in South Korea. Thus, further studies to investigate the relationship between OOP burden and treatment compliance would be required to design firm national strategies for appropriate disease management.

Some methodological limitations should be considered when interpreting the results of our study. First, it was not possible to make any definite inference on causality due to the cross-sectional nature of the dataset. The relationship between smoking and chronic disease is a typical example showing the limitation of a cross-sectional design study.

In this study, current obesity or current smoking was not a significant contributing factor for higher OOP-PD expense, but we assume that obesity and ex-smoking are indirect risk factors for increased OOP-PD expenditures because chronic diseases were shown to be significantly correlated with obesity and ex-smoking. Unfortunately, we could not examine a direct association between lifestyle and OOP-PD expense due to the lack of data in this study using cross-sectional dataset. Second, the OOP-PD expense information derived from the KHPS was based on subject self-report diary entries, so inaccuracies may exist. However, the subjects participating in the KHPS were asked to keep all payment receipts and prescriptions during the survey period, so inaccuracies were minimized as far as possible. Third, the prevalence of obesity or overweight might be underreported because BMI was calculated from self-reported body weight and height values at the time of survey. Subjects who are overweight or obese usually report values lower than the actual measured values [31]. Fourth, dyslipidemia, a major chronic disease, was not included in this study due to a lack of data from KHPS.

We found that the number of concurrent chronic diseases was related to increasing of OOP-PD expenses, and especially diabetes contributed much more to these expenses than did other chronic diseases. The reason why diabetes was the chronic disease contributed the most to OOP-PD expenses is not clearly explained, but complications of diabetes might be related to the increase in medication cost. The glycemic control of Korean diabetic patients was poor comparing to developed countries [32]. Poor glycemic control leads to complications, resulting in increased drug expenditures. There was a report that medication costs in diabetic patients with micro- or macro-vascular

complications were 2.4 times and 5 times higher than no complications [24].

On the other hand, out-of-pocket spending is increasing in US. Spending increases were 19% higher overall when holding the rising prevalence of chronic conditions constant, and Medicaid continued to provide financial protection for people with chronic conditions from high out-of-pocket spending [30]. Higher out-of-pocket medication costs significantly increased risks of cost-related nonadherence in diabetic patients, and it has been associated with poorer health [33].

This result highlights the fact that the prevention of chronic diseases, especially diabetes, and risk factors associated with chronic diseases such as obesity would be important in terms of reducing the personal OOP-PD expenditures burden as well as societal disease burdens. Considering evidences that reducing patient cost sharing for essential medications is an effective strategy to enhance medication adherence, further researches to investigate what impact expenses have on drug compliance and clinical outcomes in chronic diseases in South Korea are expected [34].

Conclusion

Positive associations between chronic conditions and increased expenditures suggest that the national payer should implement accelerated prevention programs among populations who are at higher risk for chronic diseases in South Korea, a public health point of view, as one of many countries encountering budget constraints in recent years. Furthermore, reducing the personal cost burden at an individual level should be considered favorable for medication compliance, ultimately reducing the overall healthcare cost.

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