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Original Article

Effect of Work on Medical Expenditures by Elderly: Findings From the Korean Health Panel 2008–2013

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ABSTRACT

Background: This study was conducted to investigate the effects of work on medical expenditures by the elderly.

Methods: Data pertaining to individuals aged 65 or older collected by the Korean Health Panel 2008–2013 were used. The effects of work on medical expenditures were analyzed in a panel tobit model adjusted for several variables of demographic factors, socioeconomic factors, and health factors for health care. Data were also analyzed based on age groups (65–74, 75≤), type of work (waged or self-employed), and working time (daytime work or night time work).

Results: Among the elderly older than 65 years, 34–37% were workers. Work among the elderly reduced medical expenditures relative to nonworking elderly. Specifically, medical expenditures were lower in individuals older than 75 years, as well as among those who were self-employed insured and had medical aid insurance and those who exercised. However, medical expenditures were higher among females, married individuals, those with a higher household income, and those with a chronic disease. Elderly wageworkers showed reduced medical expenditures than nonworking elderly and elderly daytime workers did.

Conclusion: The elderly population's work, especially wage work and daytime work, reduced medical expenditures relative to no work. These results provide valuable information for policymakers by indicating that work was associated with lower medical expenditures than no work. If elderly work is to be encouraged, it is necessary to provide a variety of high-quality wage work.

1. Introduction

The elderly population is defined as people aged 65 and above [1]. The countries with the highest proportion of elderly in 2016 were Japan (27.3%), followed by Italy (22.4%) and Germany (21.2%) [2]. In the Republic of Korea, the elderly population increased from 3.7% in 1960 to 12.8% in 2015, and the proportion is expected to continue to increase to 28.7% in 2035 and then 42.5% in 2065 [3,4]. This is a serious situation that will result in the Republic of Korea having the highest proportion of elderly in 2065 [3]. Increases in the elderly population are associated with various problems, such as decreases in the economically active population and increased elderly medical expenditures. Moreover, health-care expenditures associated with the elderly population can be a burden on national health-care expenditure [5].

Previous reports have shown that some members of the elderly population desire to work due to insufficient pension funds and active aging. However, only 28.9% of the elderly population (male: 37.5%, female: 22.7%) were working more than 1 hour per week for a salary, and 73% of those who were working had jobs such as simple laborers, farmers, livestock raisers, and fishermen in 2014 [6]. Moreover, unemployed members of the elderly population have high self-assessed unhealthy condition, chronic disease prevalence, depression symptoms, and numbers of hospitalization in a year compared with employed members of the elderly population [6].

Therefore, the government of the Republic of Korea is providing public work to the elderly population for the purpose of pension supplementation and active aging. Some researchers have reported that this policy improved health conditions and reduced medical expenditures in the elderly [7,8], whereas others have insisted that members of the elderly population who worked showed decreased medical expenditures only if they have had two or more chronic diseases [9]. A few international studies have investigated the

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relationship between work and health, and new longitudinal studies have begun to examine the association of work and health status in the elderly population [10–12]. However, there is still insufficient information regarding the effects of work and health; accordingly, more research is required based on a variety of data from various countries.

Therefore, this study was conducted to identify the effects of work on medical expenditures by the elderly using the Korean Health Panel data, which contain information pertaining to medical expenditures and health behaviors.

2. Materials and methods

2.1. Database

Data pertaining to individuals aged 65 or older that were collected by the Korean Health Panel 2008–2013 were used. The Korean Health Panel is an ongoing longitudinal survey of a nationally representative Korean population that employed a 2-stage cluster, stratified sampling design with probability proportionate to size. The panel has been conducted regularly by the Korea Institute for Health and Social Affairs and National Health Insurance Corporation to assess the dynamic changes in medical expenditure and its distribution. Surveys were conducted by trained interviewers face-to-face with households and individuals.

This study was approved by the Institutional Review Board of the Dongguk University Gyeongju campus (DGU IRB 2016007).

2.2. Variables definition

2.2.1. Medical expenditure

Medical expenditure was used as the dependent variable. The medical expenditure variable is the sum of emergency medical expenses, hospitalization expenses, outpatient medical expenses, emergency prescription drugs, inpatient prescription drugs, and outpatient prescription drugs.

2.2.2. Work

Three variables related to work were used as the independent variables. One variable was a yes or no question about whether the individual participated in an economic activity. Another was a binary variable categorized as either work or self-employed work (including unpaid family workers) based on a multiple-alternative question. The final variable was a question regarding whether daytime or night time work was selected.

2.3. Statistical analysis

The medical expenditure data were skewed; therefore, they were log transformed to give a log-normal distribution. The panel tobit model, which is also known as a censored regression model, was used because medical expenditures were left-censored data with a zero value. A likelihood-ratio test that formally compares the pooled tobit model estimation with the random effect panel tobit model estimation was confirmed to produce an appropriate estimate using a random effects tobit model.

The effects of work on medical expenditures were analyzed after adjusting for several demographic factors (age, sex, and marital status), socioeconomic factors (household income and type of health insurance), and health factors (chronic disease and physical activity). In addition, the type of work (waged or self-employed) was analyzed as an independent variable to identify differences according to the type of job, while the working time (daytime work or night time work) was analyzed as an independent variable to identify the effects of working at nights. In addition, a propensity score matching method to estimate differences in medical expenditures between workers and nonworkers was performed using one-to-one matching. A propensity score for work variables was calculated by multiple logistic regression, and the variables included in the propensity score were age, sex, marital status, household income, type of health insurance, chronic disease, and physical activity. A two-sided p value of <0.05 was considered to indicate statistical significance in this study. All data manipulation and statistical analyses were performed using Stata/MP version 14 (StataCorp LP, College Station, TX, USA).

3. Results

3.1. Work and job types of participants

Among the elderly older than 65 years, 34–37% were workers, with 41–44% of individuals who were 65–74 years old and 16–21% of individuals older than 75 years working (Table 1). There were more than twice as many self-employed workers as wageworkers (Fig. 1). There were more unpaid family workers among women than men (Fig. 2, Fig. 3).

3.2. Effects of work on medical expenditures by elderly

Work among the elderly reduced medical expenditures relative to nonworking elderly.

Specifically, medical expenditures were lower in individuals older than 75 years, as well as among those who were self-employed insured and had medical aid insurance and those who exercised. However, medical expenditures were higher among females, married individuals, those with a higher household income, and those with a chronic disease.

Analysis by age group revealed that work among individuals who aged 65–74 years reduced medical expenditures relative to nonworking elderly, whereas work was not statistically significant among individuals older than 75 years (Table 2). Calculation of the marginal effects revealed that the working elderly spent 19.54% less than nonworking elderly, whereas the working elderly aged 65–74 years spent 20.30% less than nonworking elderly.

Table 1
Economic activities of participants

Year	Total (65≤)				65–74				75≤			
	Nonworkers		Workers		Nonworkers		Workers		Nonworkers		Workers	
	n	%	n	%	n	%	n	%	n	%	n	%
2008	1,793	63.07	1,050	36.93	1,138	55.32	919	44.68	655	83.33	131	16.67
2009	1,771	62.03	1,084	37.97	1,098	54.74	908	45.26	673	79.27	176	20.73
2010	1,835	63.65	1,048	36.35	1,090	56.16	851	43.84	745	79.09	197	20.91
2011	1,976	66.60	991	33.40	1,139	58.71	801	41.29	837	81.50	190	18.50
2012	1,940	65.04	1,043	34.96	1,088	57.29	811	42.71	852	78.60	232	21.40
2013	1,968	65.45	1,039	34.55	1,031	56.43	796	43.57	937	79.41	243	20.59

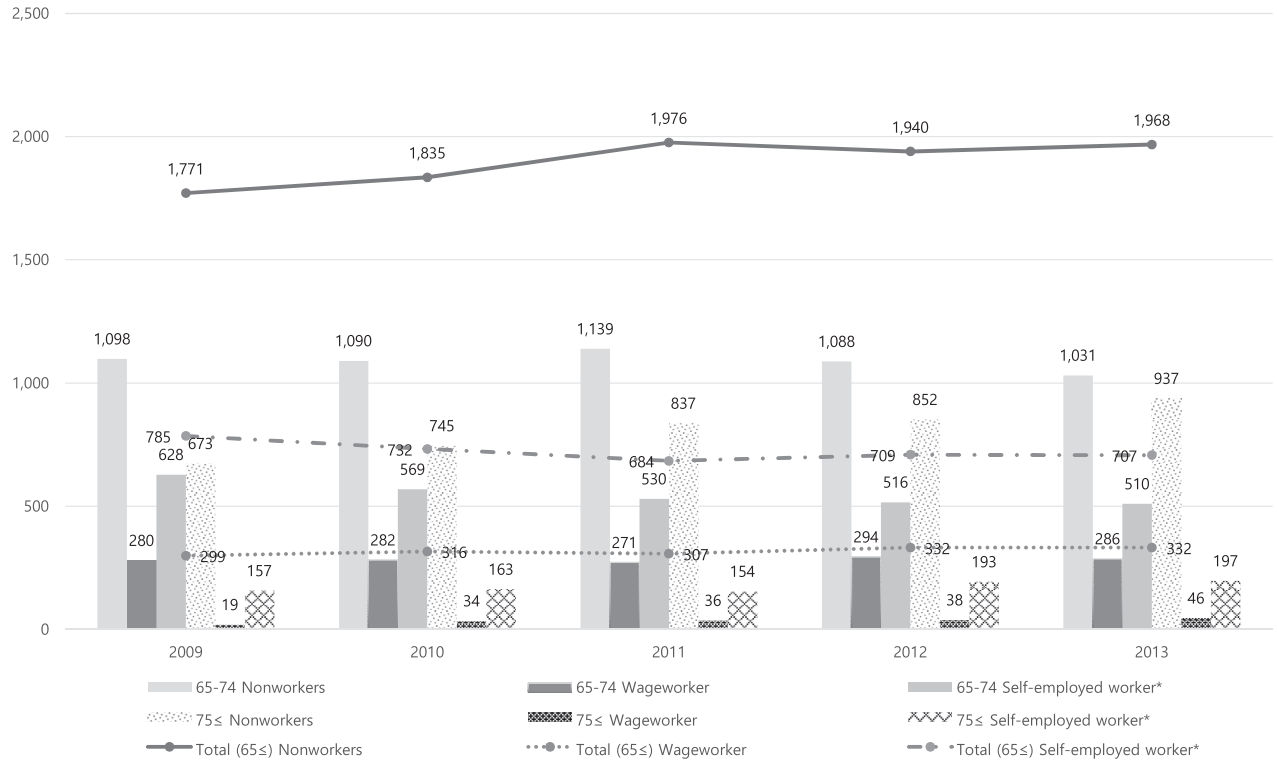

Fig. 1. Participant job types.
* Self-employed workers included unpaid family workers.

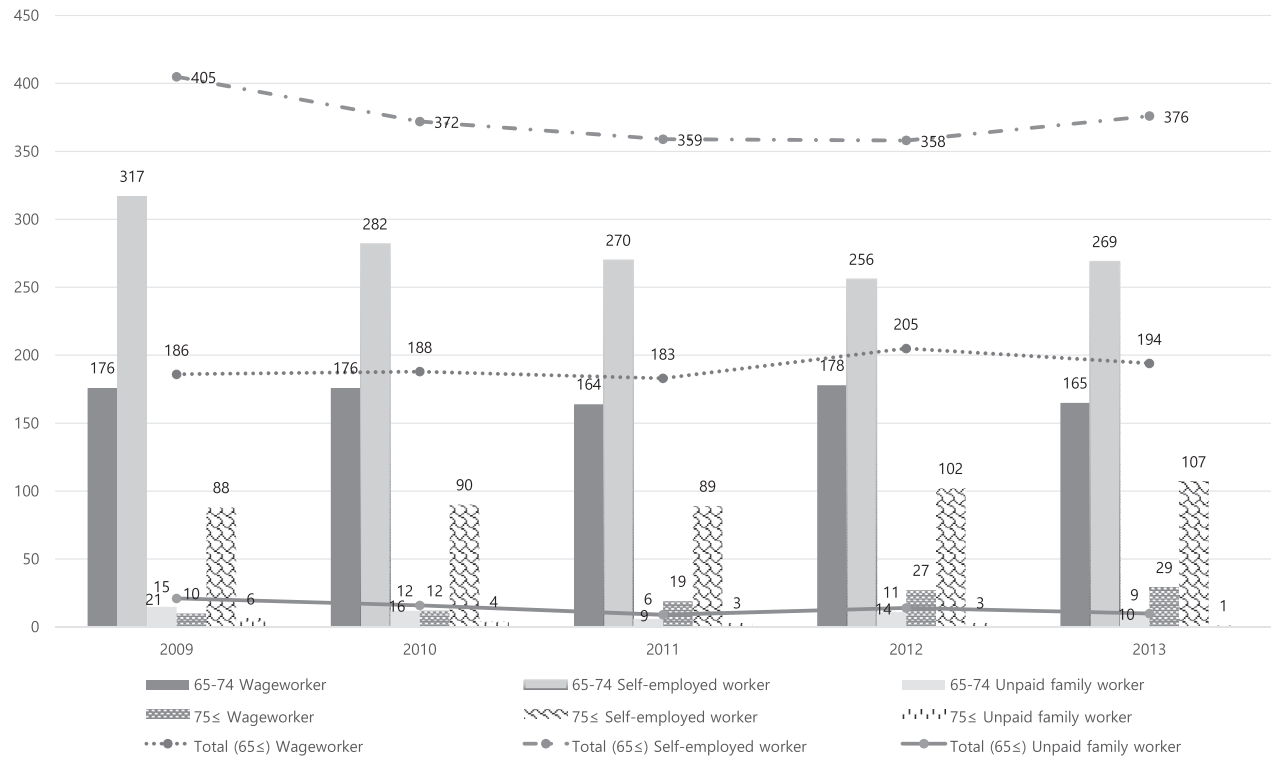

Fig. 2. Participant job types among elderly males.

3.3. *Effect of job types on elderly medical expenditures*

Elderly wageworkers showed reduced medical expenditures relative to nonworking elderly, but elderly self-employed workers did not. Medical expenditures were lower in individuals older than 75 years, as well as those who were self-employed insured and had medical aid insurance and those who exercised. However, medical expenditures were higher among females, married individuals,

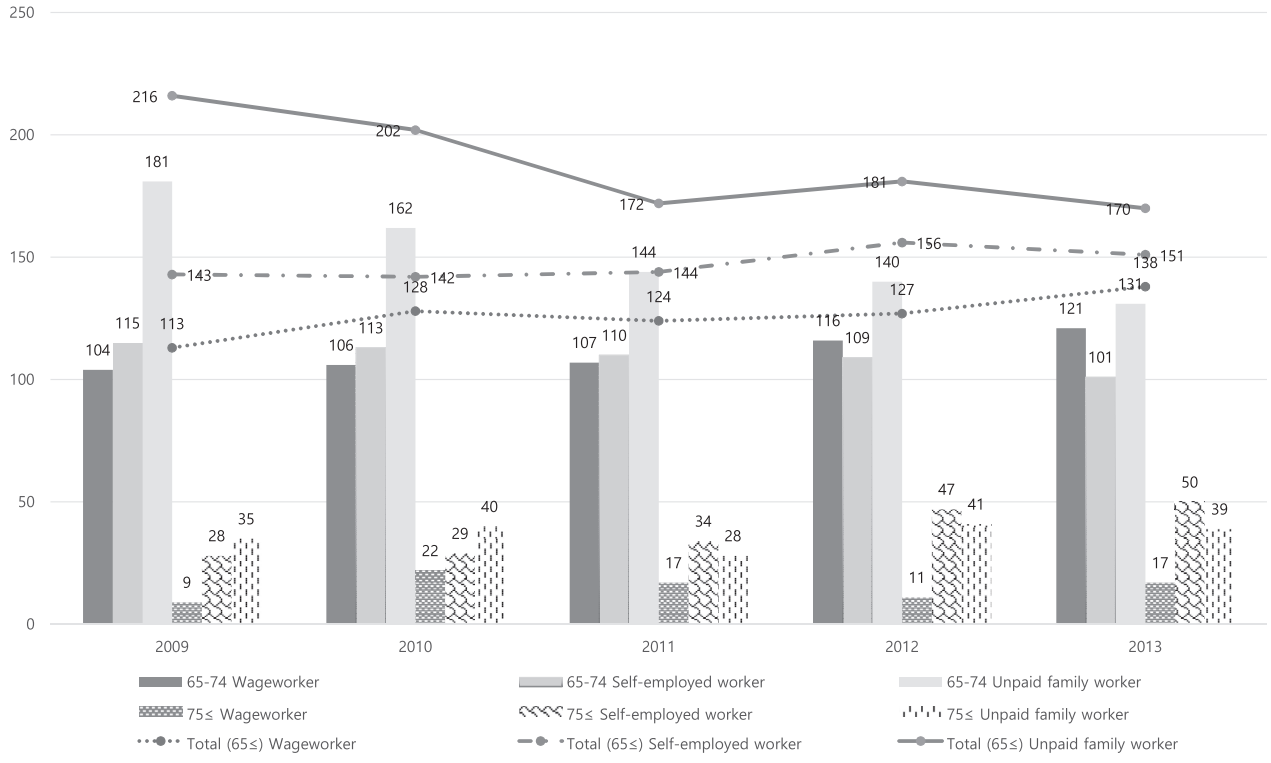

Fig. 3. Participant job types among elderly females.

those with higher household incomes, and individuals with a chronic disease (Table 3). Calculation of the marginal effects revealed that elderly wageworkers spent 42.66% less than nonworking elderly.

3.4. Effect of working time on elderly medical expenditures

Elderly daytime workers showed reduced medical expenditures relative to nonworking elderly, but elderly night time workers did

Table 2
Effect of work on medical expenditures by elderly

		Total (65≤)		65–74		75≤	
		Coef	SE	Coef	SE	Coef	SE
Work	No	Ref		Ref		Ref	
	Yes	−0.196**	0.057	−0.203**	0.063	−0.193	0.126
Demographic factors							
Age (Y)	65–74	Ref					
	75≤	−0.280**	0.059				
Sex	Male	Ref		Ref		Ref	
	Female	0.354**	0.060	0.393**	0.067	0.315*	0.128
Marital status	Single	Ref		Ref		Ref	
	Married	0.224**	0.065	0.090	0.076	0.393**	0.126
Socioeconomic factors							
Household income (Quintile)	First (lowest)	Ref		Ref		Ref	
	Second	0.197**	0.067	0.186*	0.078	0.241	0.126
	Third	0.310**	0.077	0.246**	0.089	0.510*	0.153
	Fourth	0.209*	0.094	0.186	0.107	0.292	0.194
	Fifth (highest)	0.404**	0.108	0.545**	0.125	0.093	0.213
Type of health insurance	Employee	Ref		Ref		Ref	
	Self-employed	−0.281**	0.060	−0.233**	0.069	−0.386**	0.115
	Medical aid	−2.187**	0.090	−2.254**	0.115	−2.167**	0.149
Health factor							
Chronic disease	No	Ref		Ref		Ref	
	Yes	5.252**	0.104	5.003**	0.115	5.942**	0.225
Physical activity	No	Ref		Ref		Ref	
	Yes	−0.185**	0.064	−0.248**	0.080	−0.122	0.109
Constant		7.294**	0.168	7.663**	0.185	6.250**	0.282
/sigma_u		0.195**	0.067	0.196**	0.069	0.159*	0.076
/sigma_e		3.107**	0.019	2.938**	0.022	3.416**	0.037
rho		0.004	0.003	0.004	0.003	0.002	0.002

**$p < 0.01$, *$p < 0.05$.
Coef, coefficient; SE, standard error.

Table 3
Effect of job type or working time on medical expenditures by elderly

		Job types		Working time	
		Coef	SE	Coef	SE
Job types	No	Ref			
	Waged	−0.427**	0.088		
	Self-employed	−0.102	0.064		
Working time	No			Ref	
	Daytime work			−0.188**	0.065
	Night time work			−0.338	0.177
Demographic factors					
Age (Y)	65–74	Ref		Ref	
	75≤	−0.298**	0.059	−0.282**	0.061
Sex	Male	Ref		Ref	
	Female	0.341**	0.060	0.340**	0.062
Marital status	Single	Ref		Ref	
	Married	0.204**	0.065	0.230**	0.067
Socioeconomic factor					
Household income (Quintile)	First (lowest)	Ref		Ref	
	Second	0.203**	0.067	0.202**	0.069
	Third	0.334**	0.077	0.311**	0.080
	Fourth	0.233*	0.095	0.204*	0.097
	Fifth (highest)	0.431**	0.108	0.398**	0.113
Type of health insurance	Employee	Ref		Ref	
	Self-employed	−0.300**	0.104	−0.273**	0.062
	Medical aid	−2.183**	0.090	−2.211**	0.092
Health factor					
Chronic disease	No	Ref		Ref	
	Yes	5.254**	0.104	5.220**	0.110
Physical activity	No	Ref		Ref	
	Yes	−0.179**	0.064	−0.172*	0.067
Constant		7.728**	7.310**	0.169	7.728**
/sigma_u		0.196**	0.196**	0.068	0.196**
/sigma_e		2.913**	3.105**	0.019	2.913**
rho		0.004	0.004	−0.003	0.004

**$p < 0.01$, *$p < 0.05$.
Coef, coefficient; SE, standard error.

not. Medical expenditures were lower among individuals older than 75 years, as well as those who were self-employed insured and had medical aid insurance and those who exercised. However, medical expenditures were higher among females, married individuals, those with higher household incomes, and individuals with a chronic disease (Table 3). Calculation of the marginal effects revealed that elderly daytime workers spent 18.76% less than nonworking elderly (Table 3).

3.5. Effects of work on medical expenditures by the elderly before and after propensity score matching

Before propensity score matching, the medical expenditures of workers and nonworkers differed by 124.19 US dollars (based on 1,000 Korean Won equals one US dollar). After propensity score matching, medical expenditures by workers and nonworkers differed by 201.79 US dollars (Table 4).

4. Discussion

This study analyzed the impact of elderly work on elderly medical expenditures using representative panel data with comprehensive information. The choice of variables that affect the impact of work on medical expenditures referenced the demand-side factors in the method of predicting the future health-care expenditures of the European economy [13]. Therefore, this study analyzed the effects of elderly work on health expenditures using models including demographic, socioeconomic, and health factors. We found that the elderly population's work, especially wage work and daytime work, reduced medical expenditures relative to no work.

Although not based on studies of the elderly, members of the Swedish working population who are sole proprietors in trade and transportation and in the welfare industry were found to have higher mortality among the self-employed than paid employees, whereas Korean male workers who were self-employed had higher levels of cardiovascular disease than shipyard office workers [14,15]. Moreover, previous studies reported that night-shift work was related to increased risk of obesity, type 2 diabetes, lung cancer, and coronary heart disease [16–20]. These results are likely related to the finding that elderly self-employed workers and elderly night workers did not have statistically significant medical savings.

Consistent with previous studies, age, being female, and exercise were associated with health-care expenditure. The factors related to increased health-care expenditure among the elderly were age, gender, married, income, education level, disease status, and poor perceived health status in a study by Chung [21], whereas they were age, female, and disease/disability in a study by Yoon et al [22], having chronic disease and household income level in an investigation by Lee [23], and the period and frequency of sports-for-all participation in Kim's research [24,25]. There are consistent reports of the association of work and health in the elderly population [10,11], while there is also debate regarding whether this effect could actually be a healthy worker effect because populations with occupations are healthier as people with serious illnesses or disabilities are often excluded from employment [26,27]. In the present study, analysis of differences in medical expenditures by the propensity score matching method showed that elderly workers had lower medical expenditures than nonworkers.

However, despite the positive effects of work in the elderly, it is difficult for members of the elderly population to reduce medical expenditures and maintain their health by working because they generally have a hard time joining the labor market. These findings were verified by the results of a survey of the elderly in 2014, which revealed that 24.6% of the jobs were government supported and that the jobs were short-term jobs that ended within 1 year [5].

It should be noted that this study has several limitations. First, we could not analyze the differences in the effects of work on medical expenditures by working hours on a daily or monthly scale. Excessive work can have adverse health effects; therefore, it will be necessary to study the most effective monthly or daily working hours. Previous research reported that working more than 60 hours per week was associated with adverse effects on self-rated health among adults [28,29]. Accordingly, further studies in the elderly are needed to investigate the relationship between working hours and medical expenditures to provide more detailed information regarding the effects of work on health in the elderly. Second, depending on the type of disease the elderly have, there may be differences in the effects of work; therefore, sufficient data to

Table 4
Effect of work on medical expenditures by elderly before and after propensity score matching

	Matching	Workers	Nonworkers	Difference	SE	T-stat
Medical expenditure	Before	787,435.46	911,630.05	−124,194.60	25,053.97	−4.96
	After	787,435.46	989,213.49	−201,778.03	153,362.87	−1.32

Cost unit: Korean Won, 1,000 Korean Won equals one US dollar; SE, standard error.

perform subgroup analysis by disease must be collected. Despite these limitations, this study provides meaningful results that will assist the management policy of national medical expenditure as the population continues to age.

In conclusion, the working elderly had lower medical expenditures than nonworking elderly. Especially, having a wage job or daytime work reduced medical expenditures relative to having no work. These results provide valuable information for policymakers in that they indicate that work can have lower medical expenditures than no work. If elderly work is to be encouraged for elderly health, it is necessary to provide a variety of high-quality wage work for the elderly and to establish the health management policy for self-employed work and night work.

Conflicts of interest

The author has no conflicts of interest to declare with respect to the authorship and/or publication of this article.

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