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A CASE STUDY OF PHYSICAL ACTIVITY LEVELS AND MEDICAL EXPENDITURE OF THE KOREAN MIDDLE AGED

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ABSTRACT

The author aimed to examine the relationship between physical activity levels and individuals' actual medical expenses in South Korea. Of the 250 middle-aged subjects randomly selected by a multi-staged cluster sampling technique, 211 respondents completed questionnaires. Looking only at total monthly spending for physicians and drug costs attributable to the illness, the figures were ₩6810.04 (US$5.34 in 2009) for active persons, ₩17076.11 (US$13.38 in 2009) for acceptable persons, and ₩24835.57 (US$19.46 in 2009) for inactive persons. The mean differences of active persons and inactive persons with regard to total monthly direct medical expenditures were ₩18,025.53 (US$14.12 in 2009), which means that improvement in physical activity levels from inactive to active could lead to a US$14.12 reduction in monthly direct medical expenditures. The findings from this study indicate that a high level of physical activity based on frequency, duration, and intensity has significant effects on the likelihood of decreasing direct medical expenditures. As a consequence, health care and public health policies that promote a high level of physical activity for individuals aged 40 to 80 years would be good for the government to prevent rising medical expenditures in South Korea.

Keywords: Health benefits; Physical activity level; Medical expenditure; Middle-aged.

INTRODUCTION

With the several amendments of the National Health Insurance Act, the integration of the health insurance system to include all insured persons such as employees and the self-employed was accomplished (MHW, 2003). Because the health insurance system in South Korea is compulsory for everyone living in South Korea, the government should cover almost all medical treatment and the medical providers' fees. However, South Korea has experienced a rapid increase in healthcare spending over the past 20 years. According to the data, public spending on healthcare on a per capita basis has expanded at a 10.1% rate since 1981, well above the Organisation for Economic Cooperation and Development's (OECD) average of 3.6% (WHO, 2005). It was projected that the increase of public healthcare spending will be 12% of the Gross Domestic Product (GDP) by 2050, which would make it the highest in the OECD (KIHSA, 2008).

The rise in public healthcare spending has become a great challenge in South Korea. The

reasons why medical costs are rising is because of a variety of factors such as the increasing number of senior citizens, reducing birth rates, unhealthy lifestyles and extended insurance coverage. Among these factors, the increase in chronic diseases and unhealthy behaviours are reasons for skyrocketing costs in public health care spending. The impact of preventative health practices such as regular exercise and physical activity on healthcare costs has received considerable attention lately. Therefore, the purpose of this study is to examine the relationship between physical activity levels and individuals' actual medical expenses in Korea.

BACKGROUND

Keeping physically fit or active can prevent major illnesses and is the foundation for a healthier lifestyle. The Korean government recommends that adults should do at least 30 minutes of moderate intensity activity on three or more days of the week. It is a well-known fact that adding regular physical activity to one's daily living improves health and well-being. One of the most important benefits of physical activity or exercise is that it can decrease a person's risk of developing cardiovascular disease, hypertension, diabetes and colon cancer (Morris, 1994; Kruger & Kohl, 2008; USDHHS, 2008). Being physically active has also been proven to provide mental and psychological health. Many studies indicated that people who exercise regularly benefit from a positive boost in mood and lower rates of depression (Ekkekakis, 2003; Daley & Welch, 2004; Bartholomew *et al*., 2005). In addition, regular physical activity reduces the overall risk of dying prematurely from any cause. Barnes (2007) estimated that five times as many Americans die from being inactive than from losing their lives in car accidents. This data provide considerable evidence that a definite positive relationship exists between regular physical activity or exercise and healthy living.

Since being physically fit helps people live healthy lives, it is important to make them participate in physical activity or exercise as a part of their daily lives and to continue as they grow older. The research literature suggests that the more often people are active, the more likely they are to experience the health benefits that accompanies physical activity (Cho, 2004; Nam *et al*., 2009). In other words, by increasing the amount of physical activity or level of physical activity, people will increase their health benefits. Much of the literature concerning regular participation in physical activity or physical activity levels is influenced by frequency duration, intensity of physical activity and the mode in which the activities occur. Health professionals and researchers recommend that at least 30 minutes of moderate intensity physical activity on three or more days are required to attain health benefits. This is one of the national physical activity guidelines for everyone (NCSA, 2007).

At the same time, there is a growing concern about low levels of physical activity in many countries (WHO, 2002; Sjöström *et al*., 2006). Especially, in a recent review of physical inactivity and the societal costs, physical inactivity is related most directly to the public health burden. Since the positive relationship between regular physical activity and good health has been recognised as an important indicator to determine healthy lifestyles, researchers in public health, social welfare and medical areas have found that a physical inactive life contributes to higher medical costs (Andreyeva & Sturm, 2006).

Due to the positive association with regular exercise or physical activity and healthy lifestyles, many researchers in developed countries have studied the relationship between exercise or physical activity and medical expenditures, the effects of physical activity on economic burden and the cost-effectiveness of exercise (Katzmarzyk *et al*., 2000; Wang *et al*., 2004; Allender *et al.*, 2007). Pratt *et al*. (2000) reported that the average annual direct medical costs are US$1019 for those who are regularly physically active compared with U$1349 for those who report being inactive. Wang *et al*. (2004) reported that the total medical expenditure of the 7.3 million persons with cardiovascular diseases in the United States of America (USA) in 1996 was US$41.3 billion and that the expenditure of US$5.39 billion (13.1%) was associated with physical inactivity. The estimated cost per inactive person was approximately US$430 (US$ in 2004). Katzmarzyk *et al*. (2000) investigated physical activity levels and health care costs among Canadians (≥18 years) in 1997. It was revealed that the healthcare costs directly attributable to physical inactivity in 1999 were estimated at US$2.12 billion (2.5% of the 1999 total direct healthcare costs). The estimated cost per inactive person was approximately US$170 (US$ in 2004). Allender *et al*. (2007) investigated the burden of ill-health related to physical inactivity in the United Kingdom (UK) and the associated direct costs to the National Health Service. They estimated that £6.48 billion of the 2002 National Health Service costs were associated with the five diseases defined by the World Health Organisation (WHO). This would suggest an estimated cost of US$70 (US$ in 2004) per inactive person.

Several studies have been undertaken to estimate the economic value of regular exercise or physical activity by utilising retrospective database analysis and extensive literature reviews. The findings imply general agreement that regular exercise or physical activity is attributable to reducing direct health-care costs. Considering the fact that the studies on the positive effects of being physically active or regular exercise on medical expenditure have been conducted in developed countries, there is a considerable public health burden due to the rise in the medical costs in developing countries. Studies addressing the direct medical expenditures due to physical inactivity and economic value due to physical inactivity are required. Therefore, the study on the relationship between physical activity levels and medical expenditures in a developing country, such as South Korea, is of interest.

METHODS

Participants

The sample included South Korean men and women, aged over 40 years and older, who participated in leisure activities provided by the community centres in Daegu City, South Korea. A multi-staged cluster sampling technique was used to select representative centres from the city of Daegu. Daegu city has eight census tracts designated by the Statistics of South Korea in the 2008 census. The eight clusters of census tracts were the representative areas used in this study (KNSO, 2008).

The community centres in South Korea consist of a senior centre, a residential culture centre, and a sport complex. The authors randomly selected two census tracts from the eight tracts. One senior centre, one residential culture centre, and one sport centre were randomly selected from the chosen tract. Two classes were randomly selected from each of the centres. Each

class had between 20-30 participants. Of the 250 questionnaires distributed, a total of 230 questionnaires were returned of which 19 questionnaires were unusable because of duplicate or incomplete responses. This left 211 completed questionnaires with a return rate of 84.4%. The respondents ranged in age from 40 to 80 years. The subjects who had functional limitation or chronic conditions interfering with physical activity were excluded from the study.

Instruments

The questionnaire consists of three sections: demographics, physical activity level and medical expenditure.

Physical activity level: This section of the questionnaire consisted of a brief four-item query of usual leisure time physical activity based on the studies of Cho (2004) and Nam *et al*. (2009). The first question was "considering the previous week, did you participate in any of the following kinds of physical activities (for example, walking, rhythmical exercise/dancing, cycling, basketball, swimming, badminton, tennis, etc.)?" The second question was "during a week, how often do you participate in the activity in your free time?" The frequency of physical activity was categorised as 'almost every day', '4-5 days/week', '3 days/week', '1-2 days/week', and 'sometimes'. "How intensely do you breathe when you participate in the activity?" served as the third question. The intensity of physical activity was categorised as 'very heavy breathing', 'heavy breathing', 'moderate breathing', 'light breathing', and 'very light breathing'. The last question was "how long do you do the activity in your free time?" The duration of physical activity was categorised as 'almost 10 minutes', '20 minutes', '30 minutes', '40 minutes', and 'more than 50 minutes'.

A 5-point Likert-type response format was used with values ranging from 1 to 5. To determine physical activity levels, a score was obtained by multiplying the responses on each item. The maximum and minimum scores were '125' and '1' respectively. The physical activity levels were divided into five categories with specific cut-offs: 'high active level' (101-125), 'active level' (100-64), 'acceptable level' (63-27), 'low active level' (26-18), and 'inactive level' (17-8). Higher scores indicated higher physical activity levels. The average inter-item correlation for the physical activity level questionnaire was 0.706.

Medical expenditure: A self-reported questionnaire based on the data of the National Health Insurance Corporation (NHIC, 2008) was developed to obtain information on conditions and illness, hospital outpatient department visits, community health and medical care centre visits and medical expenditures. Respondents were asked to report health care visits and direct medical expenditures including physician and drug costs for the last one month.

Pilot testing, content and internal validity: A pilot study was conducted with 25 Koreans. The purpose of this pilot study was to test the procedures to be used to conduct the survey and to ensure respondents understood what they were being asked. The content validity required several specific procedures. Firstly, an item pool was generated; secondly, the instrument was constructed and then evaluated by the authors; thirdly, the instrument was sent to a panel of recognised experts in the field of recreation and medical and social services. The selected experts were asked to evaluate and comment on the initial questionnaire with regard to: the

clarity of questions; the appropriateness of the items included within each question; and the overall applicability of the survey instrument. Finally, comments were noted and appropriate revisions were made.

Data collection

Copies of the survey questionnaires were distributed to each of the 250 participants in community centres from the three different centres in Daegu, South Korea. To increase the rate of response to the questionnaire, letters were mailed to coordinators. All coordinators responded with their willingness to help participants to complete the questionnaire. Dates were set with the coordinators for meeting with the participants at the different centres. The written consent forms and questionnaires were distributed to participants by the researchers. The participants were informed that participation in the study was voluntary and that they were free to withdraw from the study at any time. After completion of the consent forms and questionnaires, they were collected.

Data analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS 10.0)/PC Windows computer software. Descriptive statistics were used to analyse physical activity levels and medical expenditures. In order to test differences in direct medical expenditures of hospital outpatient visits and community health and medical service centre visits among physical activity levels, data was analysed using a One-way Analysis of Variance (ANOVA). A significance level of $p<0.05$ was accepted as significant differences.

RESULTS

Of the respondents, 57.3% replied that they did not go to the outpatient department with health conditions or problems caused during the previous one-month period and 47.2% reported that they did go to the outpatient department with health conditions during the last month (Table 1). The most frequently reported health conditions or problems were diseases of the musculoskeletal system and connective tissue (21.3%) and diseases of the respiratory system (14.7%). Of the respondents, 72.0% did not go to the community health and medical service centre with health conditions or problem during the last month and 28.0% reported that they went to the community health and medical service centre with health problems. The most frequently reported diseases were “other intestinal infectious diseases” (12.8%) and “certain infectious and parasitic diseases” (5.7%) (Table 1).

Table 2 provides the results for average monthly medical expenditures by physical activity levels among individuals aged 40 to 80 years. Although physical activity levels were classified into five levels (high active level, active level, acceptable level, low active level, and inactive level), the five levels were combined into three levels (active level, acceptable level, inactive level) because of the small sample. A one-way analysis of variance was conducted to evaluate the differences in outpatient care expenditures by physical activity levels. The ANOVA produced significant results with F (2, 208) = 3.20, p = 0.04. Follow-up tests were conducted to evaluate pair-wise differences among the means. There were significant differences in the means between the active and inactive level, but no significant differences among the other physical activity levels. The analysis also showed significant

differences in community health and medical care expenditures among physical activity levels, F (2, 208) = 3.04, p = 0.05. Follow-up tests were conducted to evaluate pair-wise differences among the means. There were significant differences in the means between the active and inactive levels, but no significant differences among the other physical activity levels.

TABLE 1: **REASONS FOR VISITS TO THE OUTPATIENT DEPARTMENT AND THE COMMUNITY HEALTH AND MEDICAL SERVICE CENTRE DURING ONE MONTH**

Centres	Diseases	N (%)
Out-patient Department visit (N=211)	None	121(57.3)
	Certain infectious and parasitic diseases	1(0.5)
	Diseases of the skin and subcutaneous tissue	1(0.5)
	Diseases of the ear and mastoid process	1(0.5)
	Diseases of the eye and adnexa	1(0.5)
	Diseases of the circulatory system	6(2.8)
	Diseases of the respiratory system	31(14.7)
	Diseases of the digestive system	3(1.4)
	Diseases of the genitourinary system	1(0.5)
	Diseases of the musculoskeletal system and connective tissue	45(21.3)
Community Health and Medical Service Centre visit (N=211)	None	152(72.0)
	Certain infectious and parasitic diseases	12(5.7)
	Diarrhoea and gastroenteritis of presumed infectious origin	8(3.7)
	Other intestinal infectious diseases	27(12.8)
	Respiratory tuberculosis	3(1.4)
	Other tuberculosis	1(0.5)
	Diseases of the digestive system	8(3.8)

The ANOVA was conducted to evaluate the differences in total medical expenditures by physical activity levels. The ANOVA was significant, F (2, 208) = 3.18, p = 0.04. Follow-up tests were conducted to evaluate pair-wise differences among the means. There were significant differences in the means between the active and inactive levels, but no significant differences among the other physical activity levels. The high level physical activity group showed a greater decrease in medical expenditures in comparison to the low level physical activity group.

TABLE 2: **MEDICAL EXPENDITURES (₩Korean Won) DURING ONE MONTH BY PHYSICAL ACTIVITY LEVELS**

Centre	Physical activity levels	N	M	SD	F	P	Post-Hoc
Outpatient care	Inactive Acceptable Active	95 67 49	22006.10 14661.19 5826.53	41713.69 41309.83 9400.85	3.20	.04	Low < High
Community Health and Medical Centre	Inactive Acceptable Active	95 67 49	2829.47 2414.92 983.67	5596.88 4252.45 1970.01	3.04	.05	Low < High
Total medical expenditure	Inactive Acceptable Active	95 67 49	24835.57 17076.11 6810.04	47310.57 41922.38 10471.13	3.18	.043	Low < High

DISCUSSION

The aim was to examine the relationship between physical activity levels and medical expenses among Koreans aged 40 to 80 years. A descriptive analysis and a one-way analysis of variance were conducted to evaluate the differences in outpatient care and community health and medical service expenditures by physical activity levels. The results of the study showed that individuals who belonged to the active level were observed to be less likely to have spent on medical expenditures than individuals who classified as acceptable and inactive levels of physical activity. The total medical cost (outpatient care and community health and medical care service) was found to differ between active and inactive levels. The evaluated out-patient and community health services medical expenditures were found to be much higher for the inactive and acceptable level physical activity groups. The finding that the significant difference in medical expenditures was among individuals aged 40 to 80 years is consistent with previous studies where regular physical activity or exercise and medical expenditures show a significant link.

The previous studies on the economic impact of regular exercise or physical activity levels have largely been investigated in a variety of extensive literature reviews or based on mathematical modelling (Weiss *et al*., 2004). Colditz (1999) investigated the database for reporting the economic costs of obesity and inactivity. The direct costs of inactivity were US$24 billion or 2.4% of America's health-care expenditures. Katzmarzyk *et al*. (2000) evaluated the direct health-care costs relating to inactivity. They suggested that US$2.1 billion or 2.5% of the total direct health-care costs could be contributed to physical inactivity in 1999. Mathematical models that emphasise retrospective database analysis were used to estimate the health and economic implications of exercise or physical activity in preventing chronic diseases. Munro *et al*. (1997) suggests that regular moderate exercise for over 65

year-olds could achieve important health benefits at relatively low cost. Individuals with exercise habits or high levels of physical activity are less likely to incur high medical expenses.

This study found that the direct medical expenditures were lower for active persons than for acceptable and inactive persons. Looking only at total monthly spending for physicians and drug costs attributable to illness, the figures were ₩6 810.04 (US$5.34 in 2009) for active persons, ₩17 076.11 (US$13.38 in 2009) for acceptable persons and ₩24 835.57 (US$19.46 in 2009) for inactive persons. The mean differences of active and inactive persons with regard to total monthly direct medical expenditures were ₩18 025.53 (US$14.12 in 2009), which means that improvement in physical activity level from inactive to active levels can lead to a US$14.12 reduction of monthly direct medical expenditures. Although there was no significant difference in total monthly direct medical expenditures between the acceptable and inactive levels, the acceptable active persons had much less direct medical expenditures than the inactive persons.

It is generally acknowledged that the health care costs or medical expenditure related to physical inactivity are substantial and that improvement in fitness levels may be a favourable cost-efficacy (Weiss *et al*., 2004). Higher levels of exercise capacity or physical activity would be associated with lower health-care costs. Pratt *et al*. (2000) reported that for respondents 15 years and older without physical limitations, the average annual direct medical costs were US$1 019 for those who participated in physical activity regularly and US$1 349 those who did not actively participate. Andreyeva and Sturm (2006) studied longitudinal data from a nationally representative sample of individuals aged 54 to 69 years to measure health care costs. They found that lack of regular physical activity was associated with an average US$483 increase in total health care costs in 2004. Lin (2008) explored the relationship between the exercise variable and the likelihood of out- and in-patient care services usage and the related costs. He found that people with exercise habits are less likely to use care services and to spend on medical treatments. The findings from this study indicated that a high level of physical activity based on frequency, duration, and intensity have significant effects on the likelihood of decreasing direct medical expenditures.

In summary, there were statistically no significant differences in the direct medical expenditure between the acceptable and under active levels, but a significant difference was found in the direct medical expenditures between the active and inactive levels. This study confirms in part the results of previous studies (Pratt *et al*., 2000; Andreyeva & Sturm, 2006; Allender *et al*., 2007) and has provided empirical support for the negative relationship between physical activity level and direct medical expenditures. In other words, the inactive and acceptable active persons spent much more on direct medical expenses than active persons. These results indicated that if a person wishes to decrease direct medical expenditure related to common problems, the improvement in physical activity level based on frequency, duration, and intensity should be implemented. As a consequence, health care and public health policies that promote high levels of physical activity for individuals aged 40 to 80 years would be good for the government to prevent rising medical expenditures in South Korea.

LIMITATIONS AND FUTURE STUDIES

This study has some limitations. Firstly, the sample was too small to offer a general quantitative analysis thus limiting the representativeness and generalisability of the data. A large sample size with a different sample is necessary to get reasonable precision in direct medical expenditures, which is highly skewed. Therefore, future studies should include large samples across the nation to be representative. The second limitation is that the direct medical expenditures are from a self-reported questionnaire. Although this study focused on direct medical expenditures with a common problem, there are many factors that affect medical expenditures. Thus, the claims data in the National Health Insurance Research Database (NHIC) should be used. The claims data in the NHIC includes diagnosis codes and actual healthcare expenditures on out- and in-patient care services for a number of years.

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