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Association of Physical Activity Levels with Space Availability and Program Participation

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조 범 영

Abstract

Association of Physical Activity Levels with Space Availability and Program Participation

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Background

Appropriate levels of Physical Activity (PA) is important to promote health and reduce risk of chronic diseases. The aims of this study is to assess factors associated with health-enhancing PA, including space availability and program participation, and provide evidence for making public health programs to promote health-enhancing PA among Korean adults.

Methods

Cross-sectional study was conducted in 213,458 participants (96,222 males, 117,236 females) aged 19-107 (mean 51.3) selected from South Korea, as part of the 2012 Community Health Survey (CHS). Space availability was classified by

whether participants can easily find spaces for exercise. Program participation was defined by experiences of participating in any exercise programs in the past year. Prevalence of PA levels for each independent variable was examined with Chi-square tests. Multiple logistic regressions were conducted to estimate the associations of health-enhancing PA with space availability and program participation after adjusting for all the other covariates.

Results

Adults who answered that they can find spaces for exercise easily around their residence were more likely to do health-enhancing PA in both urban (*OR*: 1.2, 95% CI: 1.1 - 1.2) and rural (*OR*: 1.1, 95% CI: 1.1 - 1.1) areas. Adults who had experiences of participation in any exercise programs managed by the local governments were more likely to do health-enhancing PA in both urban (*OR*: 2.0, 95% CI: 1.7 - 2.4) and rural (*OR*: 1.2, 95% CI: 1.1 - 1.4) than their counterparts.

Conclusion

Residents in the regions with available space for exercise more frequently performed health-enhancing PA. Participation in exercise programs contributed to perform health-enhancing PA.

Keywords: Physical activity, Space availability, Exercise program
Student Number: 2009 - 23646

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I. Introduction

Promoting regular Physical Activity (PA) is considered as a high public health concern. According to the Healthy People 2020, promotion of PA is identified as one of the most important objectives (United States Development of Human and Health Services [USDHHS], 2010). South Korea also emphasized regular PA as one of the main topics for health promotion in the Health Plan 2020 (Korean Ministry of Health and Welfare, 2011). Lack of PA or Physical Inactivity (PI) is the fourth-leading risk factor of death rate worldwide. About six percent of global mortality was caused by PI (Humpel, Owen, & Leslie, 2002; World Health Organization [WHO], 2010). In addition, PI has been recognized as the main cause of various chronic diseases including coronary heart disease, diabetes, colon cancer, osteoarthritis, and osteoporosis (WHO). Hence, regular PA could reduce the risk of untimely death and disabilities caused by a wide range of chronic diseases (Brownson, Boehmer, & Luke, 2005).

The PA is defined as “any body movement produced by skeletal muscles that results in energy expenditure” (Caspersen, Powell, & Christenson, 1985, p. 126). People can have benefits of proper energy expenditures through performing regular PA.

In general, the term 'exercise' is used synonymously with PA. Of course, there are various common features between PA and exercise. For example, both of them include body movements generated by skeletal muscles that consume energy, so that people can get the same benefits from exercise. However, exercise is not the exactly same with PA. Caspersen and colleagues stated that exercise is a subcategory of PA. According to them, "exercise is physical activity that is planned, structures, repetitive, and purposive in the sense that improvement or maintenance of one or more components of physical fitness is an objective" (Caspersen et al., p.128). As a result, PA includes all activities of energy expenditures generated by exercise as well as non-exercise movements (Caspersen et al.,). Thus, PA is influenced by various daily factors rather than exercise and it can be considered as a daily based intervention tool to promote health.

There is another thing to be thought clearly about PA's definition. According to a PA guideline of the United States Department of Health and Human Services in 2008, PA can be divided into two categories based upon intensities of its bodily movements (USDHHS, 2008). The first one is 'Baseline Activity', which is referred to "the light-intensity activities of daily life, such as standing, walking slowly, and lifting lightweight objects" (USDHHS, p. 2). This PA level is

considered as the inactive. The second category is 'Health-enhancing PA', which includes higher intensity activities, such as moderate-intensity and vigorous-intensity PA, rather than the light-intensity activities. In general, the term 'physical activity' means the health-enhancing PA. As a result, additional benefits on health can occur through performing higher intensity PA frequently (USDHHS). Thus, public health professionals should focus more on higher intensity activities over moderate-intensity PA in order to promote health through performing regular PA.

In spite of the well-known benefits of moderate and vigorous PA and disadvantages of PI on health, people in many developed and developing countries are still physically inactive (Ball et al., 2007). About one in five adults around the world is in PI and nearly 58% of total population do not have proper PA to meet public health recommendations (Dumith, Hallal, Reis, & Kohl III, 2011). The levels of PA in Korea is also very lower. According to the 2012 Community Health Survey (CHS), only 16.8% of adults in Seoul met the recommended moderate or vigorous PA at the health-enhancing levels (Korea Centers for Disease Control and Prevention [KCDC], 2012). More importantly, the overall trend of PA levels in Korea has been decreased from about a decade ago, although there were some fluctuations. According to the Korea National Health and

Nutrition Examination Survey (KNHNES), prevalence of moderate PA was 6.6% and vigorous PA was 13.8% among adults in 2012, whereas prevalence of moderate PA was 18.7% and vigorous PA was 16.2% in 2005 (KCDC, 2013a). Thus, health practitioners and public health professionals are faced a very important challenge in attempting to increase health-enhancing PA among populations (Wen et al., 2002; Korea Health Promotion Foundation. 2012).

Performing regular PA is influenced by various levels of determinants. So, considering a Socio-Ecological Model (SEM) can provide better understanding of factors associated with health-enhancing PA at the population level (McLeroy, Bibeau, Steckler, & Glanz, 1988; Ducan, & Mummery, 2005). The SEM theory considers that individual's health behaviors, such as PA like in this study, could be influenced by multi-factors in the five different socio-ecological levels, from the intra-personal level to the policy level. The five levels include intra-personal level, inter-personal level, organizational level, community level, and policy level (Sallis et al., 2006). Many studies found various determinants of PA and have suggested the associations between those determinants and PA. Demographic variables among individuals are well-known intra-personal level factors associated with PA (Bauman, et al., 2011). In general, sex and age are recognized as factors associated with various health

outcomes. Levels of PA are also influenced by sex and age differences. For example, males more regularly participate in proper levels of PA than females and older people tend to have lower PA levels than younger people (Zimmermann-Sloutski, Wanner, Zimmermann, & Martin, 2012). So, some health practitioners have focused on promoting regular PA among females and elders. Socio-economic status is another well-known intra-personal factor that influencing PA levels (Giles-Corti, & Donovan, 2002a; Lee, Cubbin, & Winkleby, 2007). People with higher family incomes tend to have higher prevalence of regular PA than people with lower family incomes.

The SEM theory also considers that examining environmental influences on individual's health behaviors is a very crucial process in order to promote purposeful behaviors (Ducan, & Mummery, 2005). For example, residential differences in PA levels between rural and urban areas could be considered as an environmental influence. People live in urban areas has a higher prevalence of regular PA than those who live in rural areas (Ewing, Schmid, Killingsworth, Zlot, & Raudenbush, 2003; Kavanagh et al., 2005). Moreover, built environments, including housing type either apartment or single family house, number of parks, and accessibility to public transportations, in the community were considered as possible determinants of PA

levels as well (An, Lee, & Sohn, 2014) in the SEM.

Among various socio-ecological factors, self-recognized space availability for PA and program participation in exercise programs provided by the local governments were used as the major determinants of health-enhancing PA levels in this study. Space availability had a significant association with PA (Humpel et al., 2002). Individuals' PA levels could vary depending on the level of space availability for PA. The importance of community based exercise programs for regular PA was also considered as an intervention (Fletcher et al., 1996). Although these two factors could be considered important determinants of PA in South Korea as well (Korea Health Promotion Foundation, 2012), in fact, not many studies about the influences of them on PA have been conducted in South Korea. Particularly, only a couple of studies dealing with the similar determinants has been conducted using the Community Health Survey (CHS) data (KCDC, 2015). In addition, they used only a specific regional data in the City of Seoul or Incheon, whereas this study used the nationwide data from the CHS. In this study, however, analyses using recent nationwide data from the CHS were conducted. Hence, results of this study could provide recent nationwide evidence about the associations between the two determinants, space availability and program participation, and PA levels among Korean adults.

The purpose of this study is to estimate the associations of health-enhancing PA with self-recognized space availability and experiences of participation in exercise programs provided by the local governments. Also, results of this study can be evidence for making strategies to promote regular PA levels among Korean adults.

II. Methods

Study Design

This study is a cross-sectional study. In general, cross-sectional study is used to assess prevalence of phenomena at a specific period of time. Also, this study design can be used to estimate predictive relationships between variables by conducting multiple regression analyses. In this study, the 2012 Community Health Survey (CHS) conducted by Korea Centers for Disease Control and Prevention (KCDC) was primarily used to assess the overall prevalence of health-enhancing PA based upon various independent variables and estimate associations between PA and these variables, especially space availability and program participation, among Korean adults.

Community Health Survey

The CHS is one of the huge nationwide surveys to assess the overall health status among Korean populations. The CHS began in 2008 and is currently conducted every year by the KCDC. The survey is aimed to create community-based comparable statistic data on health status of each county and district for making proper health plans. About 220,000 adults

aged 19 and older are participated in the CHS each year. Participants are randomly selected with equal-allocations based upon resident registration information and the average sample size in each district is about 900. The CHS questionnaires in the survey are consisted of 18 categories related to health and socio-economic status including baseline demographic information, family information, subjective health status, health behaviors, physical examination/vaccination, prevalence of chronic diseases, use of healthcare services, injury/substance abuse, quality of life, cardiac arrest, as well as education and economic activity (KCDC, 2013b).

Participants and Selection Procedures

Cross-sectional study was conducted in 213,458 participants (96,222 males, 117,236 females) aged from 19 to 107 (mean 51.3) years selected in South Korea, as part of the 2012 CHS. Data was collected from the face-to-face interviews by the pre-trained interviewers for about three months, from August 16th to October 31th, 2012.

Totaling 228,921 adults in South Korea participated as the original sample of the 2012 CHS. From the original sample, people who do not answer to questionnaires related to the dependent variable and key independent variables were excluded to narrow down proper participants in this study. Figure 1

shows the exclusion criteria from the original sample of the 2012 CHS. First of all, those who do not have proper answer to the dependent variable, PA, were excluded. Also, anyone with missing data for a few independent variables, including space availability, program participation, education level, occupation, annual family income, and marital status, were excluded before the final statistical analyses were conducted. As a result, data of 213,458 participants was included in this study.

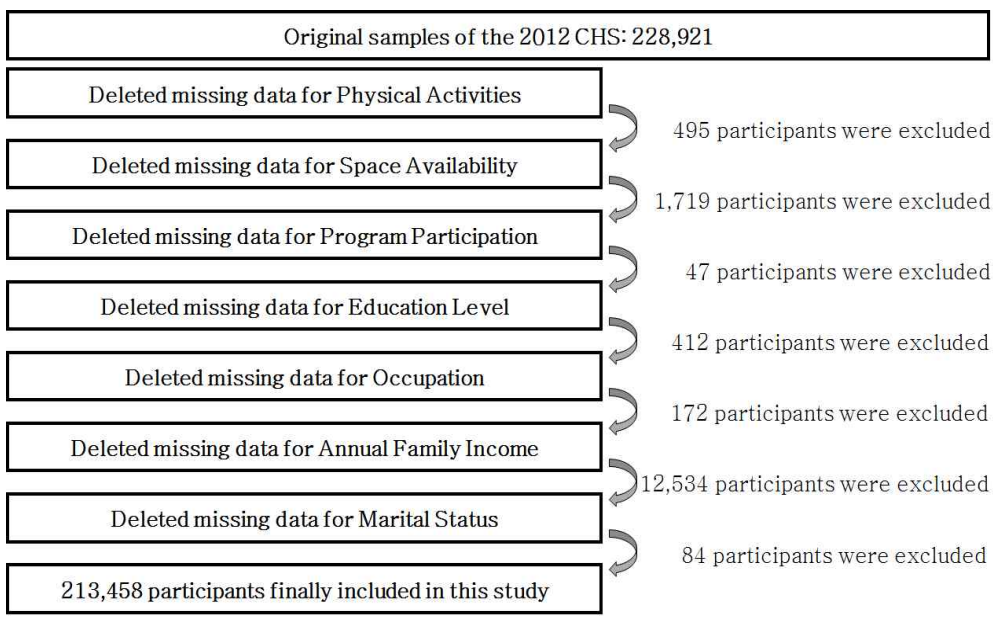

Figure 1. Selection Procedures of Study Participants

Dependent Variable

Two intensities of PA were examined by questionnaires: moderate-intensity PA and vigorous-intensity PA. The guidelines for health-enhancing PA levels in these two intensities were referred by the recommendations of the American College of Sports Medicine and the American Heart Association (Haskell et al., 2007). Health-enhancing moderate-intensity PA was defined as performing any of the following activities a minimum of 30 minutes on five days past week: swimming slowly, tennis (doubles), volleyball, badminton, table-tennis, transferring light-weight objects at work, or exercise. Health-enhancing vigorous-intensity PA was defined as performing any of the following activities a minimum of 20 minutes on three days past week: running (Jogging), hiking uphill, bicycling fast, swimming fast, soccer, basketball, jumping rope, squash, tennis (singles), transferring heavy-weight objects at work, or exercise. Participants who performed health-enhancing moderate-intensity PA or vigorous-intensity PA were included in the regular PA performing group.

Independent Variables

Socio-demographic characteristics including sex, age, education level, annual family income, occupation, marital status, and house type were measured. Sex was classified as males or

females. All participants were aged 19 years or over and they were grouped by decades. Education level was classified based upon participants' finally graduated school level and there were five groups: no-education, elementary school, middle school, high school, and college or more. There were three family income groups: less than $20,000, $20,001-$40,000, and $40,001 or more. Participants were included in one of the following occupational classifications: Profession/Admin, Clerical, Sales/Services, Farmer, Manual worker, and Others. Marital status was classified into two groups: married and unmarried including never married, divorced, widowed, and separated (Schoenborn, 2004). House type was classified as two groups: apartment and general family house.

In addition, two main factors associated with PA were measured: space availability and program participation. Space availability was measured by the answers of four difficulty levels to the question, "how difficult or easy to find spaces for performing PA around residence in the past year": very difficult, difficult, easy, and very easy. Based upon the four difficulty levels of space availability, participants were divided into two groups: 1) very difficult or difficult group and 2) easy or very easy group. Program participation was defined by whether participants have experienced participation in any exercise programs provided by the local governments, such as

city hall, district office, village office, or a public health center, in the past year or not.

Statistical Analysis

General socio-demographic characteristics of participants were explained with descriptive statistics. Prevalence of health-enhancing PA based upon each independent variable were examined with Chi-square tests. Multiple logistic regression analyses were conducted to estimate associations between health-enhancing PA and independent variables, adjusting for all the other independent variables. Also, an interaction term between two major determinants was included in the regression model. Statistical analysis was done by Statistical Analysis System (SAS) version 9.3 for Microsoft Windows. The following equation can explain the multiple logistic regression which is used in this study.

$$logit\ [p(y=1)] = \alpha + \beta_1\chi_1 + \beta_2\chi_2 + ... + \beta_k\chi_k + \beta_{k+1}S*P$$

α = Intercept

p = Probability of health-enhancing physical activity (yes=1)

χ = Independent variables

k = Number of independent variables

$S*P$ = Interaction term between space availability and program participation

Before conducting all statistical analyses, participants were divided into two different regional stratifications based upon resident registration: urban (Dong) and rural (Eup/Myeon).

III. Results

Descriptive Results about Participants

Baseline socio-demographics of participants explained with descriptive statistics are shown in Table 1.

More females (urban: 54.8%, rural: 55.0%) were participated than males (urban: 45.2%, rural: 45.0%) in both areas.

For age groups, people aged 19-29 years were 14.5%, 30-39 years were 20.1%, 40-49 years were 22.8%, 50-59 years were 19.7%, 60-69 years were 12.7%, and 70 years old or over were 10.2% in urban area. In rural area, people aged 19-29 years were 6.7%, 30-39 years were 11.1%, 40-49 years were 15.9%, 50-59 years were 19.9%, 60-69 years were 19.7%, and 70 years old or over were 26.7%.

Regarding education level, 5.5% of participants did not receive any formal educations in urban area, while 20.3% of participants did not receive any formal educations in rural area. Also, 10.1% of participants graduated elementary school, 10.0% of participants graduated middle school, 38.3% of participants graduated high school, and 36.2% of participants had college or more advanced education levels in urban area. In rural area, 23.1% of participants graduated elementary school, 12.8% of

participants graduated middle school, 18.1% of participants graduated high school, and 15.7% of participants had college or more advanced education levels.

For annual family income, 23.2% of participants had less than $20,000 and 42.5% of participants had more than $40,001 in urban area, while 50.2% of participants had less than $20,000 and 21.1% of participants had more than $40,001 in rural area.

According to occupation, Professionals/Administrations were 14.1%, Clericals were 11.0%, Sales/Services were 14.7%, Farmers were 1.7%, Manual workers were 20.4%, and 38.1% of participants were included in Other occupations in urban area. Among participants living in rural area, Professionals/Administrations were 5.7%, Clericals were 5.2%, Sales/Services were 10.0%, Farmers were 29.3%, Manual workers were 16.0%, and 33.7% of participants were included in Other occupations.

For marital status, 68.85% of participants were married, whereas 31.15% of participants were unmarried including never married, divorced, widowed, and separated in urban area. In rural area, 71.15% of participants were married, whereas 28.85% of participants were unmarried.

For house type, 56.3% of participants were living in an apartment, whereas 43.7% of participants were living in a general house in urban area. In rural area, 19.0% of participants

were living in an apartment, whereas 81.0% of participants were living in a general house.

For space availability, 83.1% of participants in urban area answered that they can find spaces for exercise easily around their residence, whereas 66.8% of participants in rural area answered that they can find spaces for exercise easily around their residence.

According to program participation, 5.4% of participants in urban area and 7.6% of participants in rural area had experiences of participation in any exercise programs managed by the local governments, such as city hall, district office, village office, or a public health center, in the past year.

Table 1. Baseline Socio-demographics of Participants (N=213,458)

Variables		Urban		Rural	
		n	%	n	%
Sex					
	Males	54,005	45.2	42,217	45.0
	Females	65,574	54.8	51,662	55.0
Age					
	19-29	17,309	14.5	6,247	6.7
	30-39	24,087	20.1	10,420	11.1
	40-49	27,291	22.8	14,958	15.9
	50-59	23,526	19.7	18,672	19.9
	60-69	15,121	12.7	18,484	19.7
	70 or over	12,245	10.2	25,098	26.7
Education Level					
	No-education	6,547	5.5	19,063	20.3
	Elementary school	12,065	10.1	21,653	23.1
	Middle school	11,957	10.0	11,970	12.8
	High school	45,768	38.3	26,418	18.1
	College or more	43,242	36.2	14,775	15.7
Annual Family Income					
	≤$20,000	27,678	23.2	47,133	50.2
	$20,001-$40,000	41,104	34.4	26,930	28.7
	$40,001≤	50,797	42.5	19,816	21.1
Occupation					
	Professional/Administration	16,897	14.1	5,389	5.7
	Clerical	13,174	11.0	4,893	5.2
	Sales/Service	17,620	14.7	9,373	10.0
	Farmer	1,975	1.7	27,519	29.3
	Manual worker	24,392	20.4	15,052	16.0
	Others	45,521	38.1	31,653	33.7
Marital Status					
	Married	82,327	68.9	66,795	71.2
	Unmarried	37,252	31.2	27,084	28.9
House Type					
	Apartment	67,305	56.3	17,861	19.0
	General house	52,274	43.7	76,018	81.0
Space Availability					
	Difficult to find space for exercise	20,224	16.9	31,176	33.2
	Easy to find space for exercise	99,355	83.1	62,703	66.8
Program Participation					
	No	113,098	94.6	86,742	92.4
	Yes	6,481	5.4	7,137	7.6

Prevalence of Health-enhancing Physical Activity

Prevalence of health-enhancing PA among Korean adults in 2012 is shown in Table 2. Health-enhancing PA means performing higher intensity activities, such as moderate-intensity or vigorous-intensity PA, rather than the light-intensity activities (USDHHS, 2008). Prevalence of health-enhancing PA based upon independent variables were measured with Chi-square tests. Overall, 19.7% of adults in urban area and 26.4% of adults in rural area met the recommendations for health-enhancing PA.

In urban area, 23.8% of males did health-enhancing PA, whereas 16.4% of females did it (x^2=1012.28, p<.0001). In rural area, 30.3% of males did health-enhancing PA, whereas 23.2% of females did it (x^2=615.64, p<.0001).

Prevalence of health-enhancing PA was varied by age groups both in urban (x^2=652.77, p<.0001) and (rural x^2 =1230.37, p<.0001) areas. Elders 70 years or over had the lowest prevalence of health-enhancing PA both in urban (13.2%) and rural (19.2%) areas. Participants aged 50-59 years old had the highest (urban: 23.3%, rural: 31.8%) and 60-69 years old had the second highest prevalence of health-enhancing PA (urban: 21.3%, rural: 30.8%).

Prevalence of health-enhancing PA was different based upon education level in both urban (x^2=333.76, p<.0001) and

rural (x^2=504.09, p<.0001) areas. Participants who did not receive any formal educations had the lowest prevalence of health-enhancing PA in both urban (12.0%) and rural (21.0%) areas, whereas those who graduated middle school had the highest prevalence of health-enhancing PA in both urban (21.4%) and rural (30.1%) areas.

Prevalence of health-enhancing PA was varied according to annual family income in both urban (x^2=144.14, p<.0001) and rural (x^2=150.88, p<.0001) areas. Participants who have higher annual family income than $40,000 had the highest prevalence of health-enhancing PA in both urban (20.8%) and rural (28.6%) areas. On the other hand, participants who have annual family income less than $20,000 had the lowest prevalence of health-enhancing PA in both urban (17.3%) and rural (24.6%) areas.

Prevalence of health-enhancing PA was different based upon occupation in both urban (x^2=1097.82, p<.0001) and rural (x^2=5495.39, p<.0001) areas. Farmers had the highest prevalence of health-enhancing PA in both urban (36.0%) and rural (40.1%) areas, while clericals in urban area (16.4%) and people with not-specified occupation group in rural area (13.9%) had the lowest prevalence of health-enhancing PA.

Prevalence of health-enhancing PA was different based upon marital status in both urban (x^2=105.45, p<.0001) and rural (x^2=522.47, p<.0001) areas. Married participants had a higher prevalence of health-enhancing PA (urban: 20.5%, rural: 28.5%) than unmarried participants who are never married, divorced, widowed, or separated (urban: 18.0%, rural: 21.2%).

Prevalence of health-enhancing PA was different based upon house type, especially people in rural areas (x^2=212.06, p<.0001), whereas the difference in urban area (x^2=4.51, p<.034) was not much large. In rural area, participants living in general house had a higher prevalence of health-enhancing PA (27.5%) than those who are living in an apartment (22.1%). In urban area, participants living in general house had a little bit higher prevalence of health-enhancing PA (20.0%) than those who are living in an apartment (19.5%).

Prevalence of health-enhancing PA was different by self-recognized space availability in both urban (x^2=101.27, p<.0001) and rural (x^2=15.89, p<.0001) areas. Participants who answered that they can find spaces for exercise easily around their residence had a little bit higher prevalence of health-enhancing PA (urban: 20.3%, rural: 26.8%) than their counterpart (urban: 17.2%, rural: 25.6%).

Prevalence of health-enhancing PA was different based upon program participation in both urban (x^2=438.60, p<.0001) and rural (x^2=93.85, p<.0001) areas. Participants who had experiences of participation in any exercise programs managed by the local governments, such as city hall, district office, village office, or a public health center, in the past year had a much higher prevalence of health-enhancing PA (urban: 29.8%, rural: 31.2%) than their counterpart (urban: 19.2%, rural: 26.0%).

Table 2. Prevalence of Health-enhancing PA among Korean Adults

Variables		Urban		Rural	
		%	*p*	%	*p*
Sex					
	Males	23.8	<.0001	30.3	<.0001
	Females	16.4		23.2	
Age					
	19-29	19.0	<.0001	23.8	<.0001
	30-39	17.5		23.9	
	40-49	21.2		28.9	
	50-59	23.2		31.8	
	60-69	21.3		30.8	
	70 or over	13.2		19.2	
Education Level					
	No-education	12.0	<.0001	21.0	<.0001
	Elementary school	18.6		28.9	
	Middle school	21.4		30.1	
	High school	21.1		27.8	
	College or more	19.3		24.2	
Annual Family Income					
	≤$20,000	17.3	<.0001	24.6	<.0001
	$20,001-$40,000	20.1		27.7	
	$40,001≤	20.8		28.6	
Occupation					
	Professional/Administration	18.9	<.0001	23.4	<.0001
	Clerical	16.4		19.5	
	Sales/Service	21.4		26.9	
	Farmer	36.0		40.1	
	Manual worker	24.9		30.7	
	Others	16.9		13.9	
Marital Status					
	Married	20.5	<.0001	28.5	<.0001
	Unmarried	18.0		21.2	
House Type					
	Apartment	20.0	0.0338	22.1	<.0001
	General house	19.5		27.4	
Space Availability					
	Difficult to find space for exercise	17.2	<.0001	25.6	<.0001
	Easy to find space for exercise	20.3		26.8	
Program Participation					
	No	19.2	<.0001	26.0	<.0001
	Yes	29.8		31.2	

Associations between Health-enhancing Physical Activity and Independent Variables

Associations between health-enhancing PA and independent variables are shown in Table 3. Odds Ratio (*OR*) and 95% Confidence Interval (CI) were calculated to estimate likelihoods of health-enhancing PA within each determinant from multiple logistic regression.

Sex difference was associated with health-enhancing PA after adjusting for all the other covariates. Females were less likely to do health-enhancing PA (*OR*: 0.6, 95% CI: 0.6 - 0.7) than males in urban area. In rural area, the same pattern occurred: females were less likely to do health-enhancing PA than males (*OR*: 0.8, 95% CI: 0.8 - 0.9).

Age was associated with health-enhancing PA after adjusting for all the other covariates, even though there were not a clear negative relationship between age and health-enhancing PA throughout all age group levels. The oldest group aged 70 years old or over had the lowest likelihood of doing health-enhancing PA in both urban area (*OR*: 0.7, 95% CI: 0.7 - 0.8) and rural area (*OR*: 0.5, 95% CI: 0.5 - 0.6). Participants aged between 50 to 59 years old had the highest likelihood of doing health-enhancing PA in urban area (*OR*: 1.2, 95% CI: 1.1 - 1.2), whereas participants aged between 19 to 29 years old had the highest likelihood of doing

health-enhancing PA in rural area (reference group). In urban area, participants aged between 50 to 69 years old had higher *OR*s than the youngest participants aged between 19 to 39 years old.

There was a positive association between education level and health-enhancing PA among people in urban area, whereas education level was not clearly associated with health-enhancing PA in rural area, after adjusting for all the other covariates. Participants in urban area tended to have higher likelihoods of doing health-enhancing PA as their education level increases.

Annual family income showed a clear positive association with health-enhancing PA after adjusting for all the other covariates in both areas. Participants tended to have higher likelihoods of health-enhancing PA as their annual family income increases. Participants whose annual family income is higher than $40,001 had the highest PA level (*OR*: 1.2, 95% CI: 1.1 - 1.2), whereas participants with the lowest annual family income showed the lowest likelihood of doing health-enhancing PA (reference group).

Occupation was associated with health-enhancing PA after adjusting for all the other covariates. Farmers tended to have the highest likelihood of doing health-enhancing PA in both urban (*OR*: 2.8, 95% CI: 2.5 - 3.1) and rural (*OR*: 2.6,

95% CI: 2.4 - 2.8) areas. Clericals tended to have the lowest likelihood of doing health-enhancing PA in urban area (*OR*: 0.8, 95% CI: 0.8 - 0.9), while the not-specified occupation group showed the lowest *OR* in rural area (*OR*: 0.7, 95% CI: 0.6 - 0.7).

Marital status was associated with health-enhancing PA after adjusting for all the other covariates in only rural area. Unmarried participants who are never married, divorced, widowed, or separated were less likely to do health-enhancing PA (*OR*: 0.9, 95% CI: 0.9 - 0.9) than married participants.

House type was associated with health-enhancing PA after adjusting for all the other covariates in only rural area. Participants who live in a general house were more likely to do health-enhancing PA (*OR*: 1.2, 95% CI: 1.1 - 1.2) than those who live in an apartment.

Space availability was associated with health-enhancing PA after adjusting for all the other covariates in both areas. Participants who answered that they can find spaces for exercise easily around their residence were more likely to do health-enhancing PA (*OR*: 1.2, 95% CI: 1.1 - 1.2 in urban area; *OR*: 1.1, 95% CI: 1.1 - 1.1 in rural area) than those who answered that they cannot find spaces for exercise easily around their residence.

Program participation was associated with health-enhancing PA after adjusting for all the other covariates in both areas. Participants who had experiences of participation in any exercise programs managed by the local governments were more likely to do health-enhancing PA (*OR*: 2.0, 95% CI: 1.7 - 2.4 in urban area; *OR*: 1.2, 95% CI: 1.1 - 1.4 in rural area) than those who do not have any experiences of participation in any exercise programs managed by the local governments.

Interaction between space availability and program participation showed a significant result in only rural area. Participants who answered that they can find spaces for exercise easily around their residence and had experiences of participation in any exercise programs managed by the local governments were more likely to do health-enhancing PA (*OR*: 1.2, 95% CI: 1.0 - 1.3) than those who satisfied either space availability or program participation and not-satisfied in both factors.

Table 3. Associations between Health-enhancing PA and Predictors

Variables		Urban		Rural	
		OR	95%	*OR*	%
Sex					
	Males	Ref.		Ref.	
	Females	0.6	[0.6-0.7]	0.8	[0.8-0.9]
Age					
	19-29	Ref.		Ref.	
	30-39	0.9	[0.8-0.9]	0.8	[0.8-0.9]
	40-49	1.1	[1.0-1.1]	0.9	[0.8-0.9]
	50-59	1.2	[1.1-1.2]	0.8	[0.8-0.9]
	60-69	1.1	[1.0-1.2]	0.8	[0.7-0.8]
	70 or over	0.7	[0.7-0.8]	0.5	[0.5-0.6]
Education Level					
	No-education	Ref.		Ref.	
	Elementary school	1.2	[1.1-1.4]	1.0	[0.9-1.0]
	Middle school	1.3	[1.2-1.4]	0.9	[0.9-1.0]
	High school	1.3	[1.2-1.4]	1.0	[0.9-1.0]
	College or more	1.3	[1.2-1.4]	0.9	[0.9-1.0]
Annual Family Income					
	≤$20,000	Ref.		Ref.	
	$20,001-$40,000	1.1	[1.0-1.1]	1.1	[1.1-1.1]
	$40,001≤	1.2	[1.1-1.2]	1.2	[1.1-1.2]
Occupation					
	Professional/Administration	Ref.		Ref.	
	Clerical	0.8	[0.8-0.9]	0.8	[0.7-0.9]
	Sales/Service	1.3	[1.2-1.3]	1.3	[1.2-1.4]
	Farmer	2.8	[2.5-3.1]	2.6	[2.4-2.8]
	Manual worker	1.4	[1.3-1.5]	1.5	[1.4-1.6]
	Others	1.1	[1.0-1.1]	0.7	[0.6-0.7]
Marital Status					
	Married	Ref.		Ref.	
	Unmarried	1.0	[1.0-1.0]	0.9	[0.9-0.9]
House Type					
	Apartment	Ref.		Ref.	
	General house	1.0	[0.9-1.0]	1.2	[1.1-1.2]
Space Availability					
	Difficult to find space for exercise	Ref.		Ref.	
	Easy to find space for exercise	1.2	[1.1-1.2]	1.1	[1.1-1.1]
Program Participation					
	No	Ref.		Ref.	
	Yes	2.0	[1.7-2.4]	1.2	[1.1-1.4]
Interaction					
Space Availability*Program Participation		1.0	[0.8-1.2]	1.2	[1.0-1.3]

IV. Discussion

Purpose of This Study

This study was conducted to estimate the associations between health-enhancing PA and two major factors, self-recognized space availability and experiences of participation in exercise program managed by the local governments, such as city hall, district office, village office, or a public health center, in the past year, after adjusting for all the other covariates. Associations between health-enhancing PA and independent variables dealt with in this study could be used as evidence for planning proper public health programs to promote health-enhancing PA levels among Korean adults.

Factors Affecting Health-enhancing Physical Activity

Socio-demographic factors are very important determinants affecting various health outcomes (Tay et al., 2004), specifically gender and age differences are well-known factors that contribute to health outcomes. In general, women and elders tend to be more susceptible to poor health status than adult men (Sun et al., 2011). For PA levels, women and elders tend to be physically inactive than men and youngers (Zimmermann-Sloutski et al., 2012). Results in this study also

showed the same pattern of PA levels according to gender. Males were more likely to do health-enhancing PA than females. However, results about the association between age and health-enhancing PA in this study showed a little bit different patterns, comparing to previous studies. Young people aged between 19 to 39 years old had lower prevalence of health-enhancing PA than participants aged between 40 to 69 years old. Based upon these results, therefore, public health professionals should pay attention to lower PA levels among young women in Korea and try to find ways to promote their PA levels.

Socio-economic status is a key determinant positively related to health-enhancing PA (Giles-Corti, & Donovan, 2002a; Lee et al., 2007). For example, people having a higher family income tended to be more physically active at the health-enhancing levels. This is because they may have more conditions to visit private areas for exercise. In this study, there was a straightforward positive association between health-enhancing PA and annual family income. Participants were more likely to do health-enhancing PA as their annual family income increases. So, different strategies for promoting health-enhancing PA could be provided appropriately based upon socio-economic status among populations.

Education level is another key factor of socio-economic status which is positively related to PA levels (Thornórarinsson, Harðarson, Sigvaldason, & Sigfússon, 2002; Saint Onge, 2014). In other words, people with higher education levels tend to do more PA. This might be caused by the fact that highly educated people are more likely to participate in any levels of health education including proper levels of PA than less educated populations. In this study, people in urban area showed the similar pattern in the association between education level and health-enhancing PA. This might reveal that there is more strong socio-economic disparities in terms of the education level in urban area, whereas there is not much strong socio-economic disparities in terms of the education level in rural area. Furthermore, this results could indicate that the existence of gap in socio-economic status between urban and rural areas.

Occupation should be associated with PA. In fact, PA is simply divided into two different categories: Occupational Physical Activity and Leisure-time Physical Activity (Howley, 2001). Therefore, not only leisure time PA, but also activities performed during work hours are included in the overall PA level, even though sometimes these two activities are studied separately. In other words, the overall PA level could be varied by occupational classifications. For example, people who have

an occupation which requires heavy physical movements might be in the higher levels of overall PA. In this study, farmers had the highest likelihood of doing health-enhancing PA, whereas clerical had the lowest likelihood of doing health-enhancing PA. This implies that public health professionals should use different approaches to promote PA levels among populations based upon target populations' occupation.

Income, education level, and occupation can play a role simultaneously in performing PA (Saint Onge, 2014). Less educated people tend to have jobs that require heavy physical movements with a lower income, so they live in a area with less safe environments and lower space availability for excise. According to a recent research of Saint Onge, people with a high school degree are more active in weekdays, whereas people with college or advanced degrees are more active in weekends. This might be because people with lower socio-economic status don't have much time to enjoy leisure time exercise during the weekends and they are requires to do heavy activities during work time. Hence, multi-factual considerations within factors that reflect socio-economic status should be done when health promotion programs for PA are planned.

Marital status is one of well-known factors associated with various health outcomes. According to a study of Cramm and her colleagues, marriage was positively related to well-being of people (Cramm, Møller, & Nieboer, 2012). Married people are healthier than unmarried people including never married, divorced, separated, and widowed (Schoenborn, 2004). Likewise, in this study, married people were more likely to do health-enhancing PA than unmarried people in rural area. There is a possible explanation for the association between marital status and health-enhancing PA: married people live with their spouse, so that their behaviors could be motivated by their spouse when they work out together. According to the socio-cognitive theory, individuals are influenced by interactions with others around them, such as peers and family members (Young, Plotnikoff, Collins, Callister, & Morgan, 2014), and spouse could play a role as a motivator. However, there was no difference in health-enhancing PA between married and unmarried people in urban area. In urban area, people can easily find out and join in a wide variety of networks sources that can promote unmarried people's PA levels rather than spouse, so that this might affect unmarried people's PA level in urban area. Thus, increasing social networks or interactions between individuals would be a good approach to promote PA levels for people who don't have much interactions with others.

House type can be considered as a physical environment affecting health-enhancing PA (An et al., 2014). Results in this study showed that people who live in an apartment were less physically active than people live in a general family house. However, this difference in health-enhancing PA levels based upon house types did exist in only rural area. This might suggest that individuals' house type could be considered when public health professionals make strategies to promote health-enhancing PA levels for people in rural areas, whereas it is not necessary for people in urban area. Also, this discrepancy between urban and rural areas could be explained with other socio-economic factors. Although health-enhancing PA levels were different by whether people live in an apartment or a general house, it might be affected by other factors, such as occupational differences and car ownership.

Physical environments including space availability have been considered as an important factor related to regular PA (Humpel et al., 2002). People with a higher availability to spaces or facilities for exercise would have more opportunities to perform PA, so their prevalence of regular PA might be higher. This study also showed similar patterns of health-enhancing PA based upon space availability. Adults who live in residences with a relatively higher space availability for PA were more likely to do health-enhancing PA than their

counterpart in both urban and rural areas. However, this difference in likelihoods of health-enhancing PA based upon space availability was not big. It could be caused by inappropriate measurements of space availability. To estimate a more accurate association between space availability and health-enhancing PA, more proper and objective measurements of space availability should be used. Some researchers calculated physical distances to public spaces for PA and number of spaces for exercise around individuals' residential areas by using the Geographical Information System (Hillsdon, Panter, Foster, & Jones, 2006). Some others used self-reported perceptions about influences of social environments on PA using five point Likert scales (Booth, Owen, Bauman, Clavisi, & Leslie, 2000). In this study, however, the level of space availability was classified into only two categories whether participants can easily find spaces for PA or not. In addition, it was measured by just a self-reported questionnaire. Therefore, more appropriate measurement methods for space availability should be conducted in the future studies to propose more reliable evidence on the association between space availability and PA.

Furthermore, supportive physical environments itself may not be enough to promote health-enhancing levels of PA (Giles-Corti, & Donovan, 2002b), so that public health

practitioners should consider much complex interventions with environmental changes. For example, contributions of space availability to health-enhancing PA may vary depending on individuals' socio-economic status. According to Lee and colleagues, increasing in PA resource availability was more beneficial for women with lower socio-economic status (Lee et al., 2007). Therefore, increasing public areas installed equipment for moderate and vigorous intensities PA could be a more beneficial intervention when it is targeted to people with lower socio-economic status to promote their health-enhancing levels of PA.

Program participation was a significant factor associated with health-enhancing PA. People who had experienced in any exercise programs were more likely to do health-enhancing PA. According to Fletcher and colleagues, communities should play a role in promoting PA levels among people in their communities by developing exercise programs in various facilities including local club, park, church, and schools (Fletcher et al., 1996). It might reveal that people live in the communities that provide a lot of exercise programs could have more opportunities to do PA, so that their PA levels would be increased. Anther possible explanation for the association between program participation and health-enhancing PA is the effect of program participation on person's motivations. In other

words, highly motivated people may be more likely to participate in any exercise programs, so that these people do more health-enhancing PA. Since there were no variables that reflect individual's motivations or perceptions on PA, such as perceived risks or benefits, accurate estimations for these relations could not be conducted in this study. However, program participation could be considered as a mediator between person's motivations and health-enhancing PA. As a result, a direct effect of program participation on health-enhancing PA could be significant, even though this caused by motivations.

One of significant findings in this study is that prevalence of program participation among Korean adults was very low. Only 6.4% of Korean adults (5.4% in urban area, 7.6% in rural area) reported that they had experiences of participation in any exercise programs managed by the local governments, such as city hall, district office, village office, or a public health center, in the past year. If there are not strong mediation effects or effect modifiers between program participations and health-enhancing PA, levels of health-enhancing PA would be increased by promoting people participating in exercise programs frequently.

Space availability and program participation were significant determinants of health-enhancing PA among Korean

adults. Some people live in an area with higher space availabilities and had experiences of participation in exercise programs provided by the local governments. In this case, their health-enhancing PA would be increased more than those who are satisfied with only one of those two factors or neither. However, it did exist only in rural area. Integrative use of those two factors simultaneously would increase people's health-enhancing PA levels in rural area.

Limitations of This Study

There are some limitations in this study. First of all, this study might not fully explain the causations between predictor variables and the criterion variable. Cross-sectional survey data, the 2012 CHS, was used in this study, so that long-term time dimensions between causes and outcomes might not be fully considered, even though statistical results of this study were able to reveal strong associations between independent variables and health-enhancing PA. Thus, further study considering time dimensions between relevant determinants and health-enhancing PA like longitudinal studies should be supported. Secondly, only nine independent variables were included in the multiple regression analyses as covariates. In reality, a wide variety of factors are influenced performing health-enhancing PA. So, statistical analyses adjusting for more

covariates should be conducted to obtain more appropriate results. Thirdly, variables used in this study might not be measured clearly. For example, the dependent variable, health-enhancing PA, was measured by self-reported answers instead of other objective methods, such as physiological assessments. Also, key determinants of health-enhancing PA, space availability and program participation, were measured by self-recognized values. Thus, there might be some measurement errors in the results. Fourthly, the data used in the study was collected by face-to-face interview between persons, so some reporting errors might occur during the data collecting process. For example, there could be recall biases occurring by interviewees or criterion biases occurring by interviewers.

V. Conclusions

This study provided information about factors associated with health-enhancing PA among Korean adults. Space availability was an important factor allowing people to perform moderate and vigorous intensities PA more easily. People who answered that they can find spaces for exercise easily around their residence were more likely to do health-enhancing PA. Also, program participation was another significant determinant influencing health-enhancing PA. People who had experiences of participation in any exercise programs managed by the local governments were more likely to do health-enhancing levels PA. The findings in this study might suggest that increasing spaces for exercise around people's community and advocating people to participate in exercise programs provided by the local governments could promote health-enhancing PA among Korean adults.

VI. References

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국문초록

운동장소 접근성과 운동프로그램 참여 유무에 따른 신체활동 실천율

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연구배경 및 목적

적절한 수준의 주기적 신체활동의 수행은 건강을 증진시키고 만성질환의 위험을 줄이는데 있어서 중요한 요인들 중 하나이다. 이 연구의 목적은 건강을 증진시키는 수준의 신체활동 수행에 영향을 미치는 주요 요인들 중 운동장소 접근성과 프로그램 참여 유무에 따른 신체활동 실천율을 평가하고, 그에 따른 결과를 토대로 대한민국 성인들에게 맞는 신체활동 증진을 위한 공공보건정책의 수립을 위한 근거자료를 제공하기 위함에 있다.

연구방법

이 연구의 주된 방법은 단면조사연구로서 질병관리본부에서 수행된 2012년 지역사회건강조사의 전국 19세 이상 성인 대상자 213,458명의 자료가 사용되었다. 건강을 증진시키는 수준의 신체활동 실천율은 일주일 동안 중등도 신체활동을 5회 30분 이상 또는 고강도 신체활동을 3회 20분 이상 하는 경우를 실천한 경우로 보

았다. 주요 독립변수인 운동장소 접근성은 거주지역에서 운동장소를 쉽게 찾을 수 있었는지에 따라, 그리고 프로그램 참여 유무는 지난 한 해 동안 지역자치단체에서 운영하는 운동프로그램에 참여한 적이 있었는지에 따라 각각 두 그룹으로 분리되었다. 각 독립변수들에 따른 건강을 증진시키는 수준의 신체활동 실천율은 카이제곱분석과 함께 측정되었고. 여러 가지 공변량변수들을 보정한 후, 두 주요 변수와 신체활동 실천율과의 관계를 살펴보기 위해 다중로지스틱 회귀분석이 사용되었다.

연구결과

거주지역 내에서 운동장소를 쉽게 찾을 수 있었다고 대답한 경우, 건강을 증진시키는 수준의 신체활동 실천율이 도시지역(*OR*: 1.2, 95% CI: 1.1 - 1.2)과 농촌지역(*OR*: 1.1, 95% CI: 1.1 - 1.1) 모두에서 더 높았다. 지난 한 해 동안, 지역자치단체에서 운영하는 운동프로그램에 참여한 적이 있었다고 대답한 경우, 건강을 증진시키는 수준의 신체활동 실천율이 도시지역(*OR*: 2.0, 95% CI: 1.7 - 2.4)과 농촌지역(*OR*: 1.2, 95% CI: 1.1 - 1.4) 모두에서 더 높았다.

결론

운동장소 접근성이 좋은 지역에 거주하는 성인들이 보다 주기적으로 건강을 증진시키는 수준의 신체활동을 실천하였고, 운동 프로그램의 참여 유무 역시 건강을 증진시키는 수준의 신체활동 실천율에 영향을 미쳤다.

주요어: 신체활동, 운동장소 접근성, 운동 프로그램
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