

# Do Accessible Exercise Facilities Influence Community Physical Activities?

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## Research Article

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# Abstract

This study was aimed to evaluate how personal perceptions of exercise facility accessibility affect moderate physical activity in Korea. We selected research subjects using data from 2012, 2014, and 2016 community health surveys. We explored whether accessibility to exercise facilities was associated with moderate or higher physical activity. Multivariate logistic regression analysis was performed. Of the 652,954 individuals included in the analyses, 146,725 engaged in moderate physical activity (22.5%) and were more likely to have easier access to exercise facilities. Those who could access exercise facilities very easily were more likely to engage in moderate weekly physical activity compared with those who found access difficult or very difficult (odds ratio = 1.32; 95% confidence interval = 1.28–1.35). The results confirmed that in areas with good accessibility to community exercise facilities, subjects engaged in more moderate physical activity compared with subjects in areas lacking good access.

## Introduction

Lifestyle behaviors affect health at the individual and community levels. Physical activity, cessation of smoking and alcohol consumption, and dietary control improve health<sup>1</sup>. Physical activity refers to all movements that require energy consumption by skeletal muscles, including occupational and housekeeping activities, commuting, and leisure activities such as play<sup>2,3</sup>. A lack of physical activity causes obesity and chronic diseases, including cardiovascular disease, high blood pressure, type 2 diabetes, osteoporosis, and certain cancers<sup>3–5</sup>. Physical inactivity is associated with chronic diseases such as hypertension, diabetes, hyperlipidemia, and metabolic syndrome<sup>3–5</sup>. Today, although the need for physical activity is recognized, opportunities are decreasing given the increasing urbanization of modern society<sup>3</sup>.

The US Centers for Disease Control in the “Guide to Community Preventive Services” recommend increasing accessibility to exercise spaces to enhance physical activity<sup>6</sup>. In Korea, the Ministry of Health and Welfare in the “Physical Activity Guide for Koreans” recommends appropriate physical activity throughout the life cycle<sup>7</sup>. Moderate physical activity refers to an activity performed at 3.0–to 5.9-fold higher-than-resting intensity; such activity generally scores 5–6 when activities are scored from 1 to 10. Regular moderate physical activity improves the musculoskeletal, cardiovascular, respiratory, and endocrine systems, affording many health benefits<sup>8</sup>. According to the Organization for Economic Cooperation and Development report of 2017, the average rate of moderate physical activity in OECD countries in 2016 was 66.5%<sup>9</sup>; the value published by Statistics Korea was 47.8%<sup>10</sup>. However, that rate decreased to 57.1% in 2014, 51.0% in 2015, and 47.8% in 2016<sup>10</sup>.

Social ecological theory suggests that participation in physical activity is influenced by personal characteristics, as well as the compositional, social, and natural environments<sup>11–15</sup>. In particular, physical activity during leisure time can be affected by geographic location, socioeconomic status, the natural environment, cost, and accessibility<sup>16–22</sup>. Accessibility is influenced principally by “distance”, “time”, and

“quantity”, all of which determine the type of exercise<sup>23–26</sup>. The greater the accessibility to sports facilities in residential areas, the higher the participation in physical activity; awareness of exercise facilities differs according to the extent of individual physical activity<sup>27,28</sup>. In addition, personal traits, such as a positive attitude toward exercise, influenced participation in physical activity<sup>29</sup>.

Recent studies indicated that “accessibility” in general influences physical activity, thus not only the objective accessibility to public sports facilities<sup>28</sup>. In addition, the general characteristics and subjective perceptions of the built environment significantly influenced physical activity; such activity varied by the socioeconomic status of the residents<sup>30,31</sup>. Although various authors have explored the associations among the perception, accessibility, and the physical activities of sports facilities, few have evaluated how personal perceptions of exercise facility accessibility affect moderate physical activity in Korea. Accordingly, we examined the association between accessibility to exercise facilities and moderate physical activity using national community health survey data from Korea.

## **Materials And Methods**

### **Study Population**

This study was conducted using data from nationwide community health surveys performed in 2012, 2014, and 2016 in Korea. The surveys yield basic data that allow systematic evaluation of local health project performance. Health statistics are derived for all cities, counties, and districts and are used to establish a national health promotion plan and local healthcare plans. As the surveys include all national public health centers, many demographic and sociological characteristics can be considered. Exercise and physical activity levels have been surveyed every 2 years since 2010. The sample design features secondary sampling (based on probability proportional lineage extraction and lineage extraction) of Korean adults aged over 19 years. As representativeness and accuracy are thus improved, a systematic study of the health behaviors of local communities is possible.

We reviewed data on 686,085 participants in the 2012, 2014, and 2016 community health surveys, selected from 17 municipalities and 254 public health centers each year. Those under the age of 19 years were excluded. After also excluding non-responders, 652,954 subjects were finally included.

### **Variables**

The variables were the individual perceptions of exercise facility accessibility, engagement in moderate physical activity, the survey year, demographic and socioeconomic characteristics, and health behaviors. Demographic characteristics were evaluated according to sex and age. Socioeconomic characteristics were investigated in terms of region, monthly household income, educational level, marital status, and job type. Health behaviors were investigated in terms of smoking status, alcohol consumption, subjective health status, and stress. As defined by the World Health Organization and the Korea Centers for Disease Control and Prevention, “moderate physical activity” was defined as either ‘3 or more days of vigorous-intensity physical activity of at least 20 minutes per day’ or ‘5 or more days of moderate-intensity physical

activity of at least 30 minutes per day' during the past week, "no moderate physical activity" was defined as insufficient physical activity. The accessibility to exercise facilities in the community was rated "very difficult or difficult", "easy", or "very easy" in response to the question "Have you been able to easily find a place to exercise in your area during the past year?".

Of the demographic characteristics, sex was classified as male and female. Age was classified as  $\leq 29$ , 30–39, 40–49, 50–59, 60–69, and  $\geq 70$  years.

In terms of socioeconomic characteristics, regions were divided into rural, urban, and metropolitan. The monthly household income was classified as  $\leq$  \$999, \$1,000–2,999, \$3,000–4,999, and  $\geq$  \$5000. The final education level was classified as high school graduation or below, university graduation, and graduate school graduation. Marital status was categorized as unmarried, married and living together, and separated/widowed/divorced. Job types were divided into white-collar, blue-collar, and others (unemployed, housewives, students, and others).

Of variables related to health behavior, those who had smoked more than five packs of cigarettes (100 cigarettes) in their lifetime were divided into "current smokers" and "past smokers"; those who had never smoked were "non-smokers"<sup>32</sup>. In terms of alcohol use, "high-risk drinker" was defined as consuming seven or more drinks for men and five or more drinks for women on a single occasion on at least 2 days within the previous 7 days; drinking less than these amounts was classified as "drinker" and no drinking as "non-drinkers"<sup>32</sup>. Those who answered "very good" or "good" to the question "How do you usually view your health?" were considered subjectively healthy; those who responded "moderate" were considered normally healthy, and those who answered "bad" or "very poor" were considered unhealthy. When posed the question "How much stress do you usually feel during daily life?", respondents had the choices of "a lot", "a little", and "minimal".

## Statistical Analyses

The statistical analysis of the data was performed Sept 2020. The general characteristics of the study subjects exhibiting moderate or higher physical activity levels, including accessibility to exercise facilities, demographic and socioeconomic characteristics, and community health behaviors, were analyzed. After collecting the statistics and performing cross-tabulation, we confirmed the reported differences in exercise facility accessibility among local communities and associated each factor with moderate or higher physical activity. Next, multivariate logistic regression was performed to determine the effect of community exercise facility accessibility on moderate or higher physical activity. We adjusted the significance of the trends by year, demographic and socioeconomic characteristics, and health behaviors. In addition, we performed subgroup analyses to understand the effects of community sports facility accessibility on moderate or higher physical activity according to socioeconomic level. Each presented result reflects the weights generated by the community health survey. Thus, the statistics are very representative and the estimates accurate. The weights assigned to strata and colonies during the composite sample design were considered. All statistical analyses were performed using SAS statistical software, version 9.4 (SAS Institute Inc., Cary, NC, USA), and statistical significance was set at  $P < 0.05$ .

# Ethics approval and consent to participate

This study was approved by the Institutional Review Board (IRB) at Korean Centers for Disease Control and Prevention in each year (2012: 2012-07CON-01-2C, 2014: 2014-08EXP-09-4C-A, 2016: 2016-10-01-P-A). This study was performed in accordance with the Declaration of Helsinki amendments and all research was performed in accordance with relevant guidelines/regulations, and where applicable informed consent was obtained from all participants and/or their legal guardians.

## Results

Of the 652,954 individuals, 146,725 reported moderate physical activity (22.5%) and were more likely to have easier access to exercise facilities (difficult or very difficult 21.6%, easy 21.3%, very easy 25.4%). These subjects were more likely to be male (male, 26.6%; female 19.1%), aged 50–59 years (25.7%), living in rural areas (24.8%), less educated (high school or below, 22.5%), lower income (\$1,000–2,999 monthly: 23.9%), married and living together (23.7%), blue-collar workers (29.0%), past smokers (25.9%), high-risk drinkers (26.9%), and subjectively healthy (26.4%) (Table 1).

To explore how accessibility to exercise facilities affects moderate physical activity, multivariate logistic regression analyses were performed after adjusting for sex, age, region, household income, educational and marital statuses, job type, smoking status, alcohol consumption, subjective health status, stress, and year. Those with very easy access to exercise facilities were more likely to engage in weekly moderate physical activity compared with those who difficult or very difficult access (odds ratio [OR] = 1.32; 95% confidence level [CI] = 1.28–1.35). Sex, age, region, household income, marital status, job status, smoking status, alcohol consumption, subjective health status, stress, and year were all correlated with a moderate level of physical activity (Table 2).

We performed subgroup analyses to confirm the effect of accessibility to exercise facilities on moderate physical activity under the same socio-demographic characteristics. Male and female performed similarly more physical activities as the accessibility improved in each gender ([very easy access] male: OR = 1.31; female: OR = 1.32; reference: difficult or very difficult). In those aged  $\leq 29$  and  $\geq 70$  years, accessibility to exercise facilities had a significant effect on moderate physical activity than in other age groups ([very easy access]  $\leq 29$  years: OR = 1.41; 30–39 years: OR = 1.30; 40–49 years: OR = 1.33; 50–59 years: OR = 1.23; 60–69 years: OR = 1.19;  $\geq 70$  years: OR = 1.45; reference: difficult or very difficult). In addition, the effect of accessibility to exercise facility was greater in large cities, in low-income subjects, highly educated subjects and white-collar workers. Finally, in order to confirm the effect of accessibility on physical activity over time, it was analyzed by survey year. The effect gradually decreased from years 2012 to 2016 (Fig. 1).

## Discussion

Physical activity improves overall health and fosters an active and independent lifestyle<sup>33</sup>. In particular, regular physical exercise prevents chronic diseases<sup>34,35</sup>. Therefore, recently, urban planners have actively created open spaces<sup>31</sup>. However, physical inactivity remains common worldwide, and efforts to increase activity are needed<sup>36</sup>. We found that accessibility to exercise facilities was significantly associated with moderate physical activity after adjusting for factors that might affect such activities; the easier the access, the higher the rate of physical activity. Other studies also found that physical activity is affected not only by the physical environment but also subjective perception<sup>27-31</sup>. We confirmed that the relevant social factors included sex, age, and income<sup>30,31</sup>. Overall, men engaged in more exercise than women, but a subgroup analysis showed that the effect of accessibility to exercise facilities on moderate exercise was similar between the sexes. Thus, awareness of accessibility must be increased in women. As in previous studies, the elderly engaged in the least physical activity<sup>37</sup>, but the effect of accessibility to exercise facilities was greater in those  $\leq 29$  and  $\geq 70$  years of age, who engaged in more physical activity compared with those aged 30–70 years (who spend more time working). As physical activity is usually performed during leisure time, better accessibility might promote more physical activity among the working population.

We analyzed the results by region. In large cities, a knowledge of nearby exercise facilities affected physical activity<sup>28</sup>. We also found that accessibility affected the physical activity of metropolitan populations more than that of rural populations. The attractive architectural features of modern urban public spaces promote various forms of physical activity<sup>38</sup>. In addition, blue-collar workers engaged in more moderate physical activity than white-collar workers, because the former effectively exercise at work. However, the difference in accessibility to exercise facilities according to job type identified in the subgroup analysis suggests that increasing access effectively encourages more physical activity during leisure time.

Finally, overall, we found that moderate physical activity gradually increased by year in Korea, but subgroup analysis confirmed that the effect of accessibility to exercise facilities decreased by year because more sports facilities are being built. However, the current and desired sports activities differ<sup>39</sup>. Therefore, the government should not only increase the number of public facilities but also emphasize accessibility.

The strengths of our study are that we minimized selection bias by using a representative nationwide sample. Our database included 652,954 subjects. Finally, the survey data questionnaire was very consistent and reproducible; the annual trends were comparable. However, there were certain limitations. First, this was a cross-sectional study; no temporal relationship can be established between accessibility to exercise facilities and moderate physical activity. However, by applying various weights, we improved representativeness and reliability, and all data were corrected by significance testing by year. Second, self-reporting questionnaire surveys have inherent limitations. However, we explored subjective accessibility, and thus self-reported data were appropriate. Third, we did not evaluate physical accessibility (travel time and distance to the facility). We focused on awareness of nearby exercise facilities, thereby approaching

the relationship between the physical environment and physical activity (which has been widely investigated) from a different perspective. However, future research is needed to consider future situations. Despite the limitations, this was a multidisciplinary study of the relationship between accessibility to exercise facilities and moderate physical activity, and the results yielded valuable basic data on the (common) lack of such activity.

## **Conclusion**

We confirmed that in areas with good accessibility to community exercise facilities, more subjects engaged in moderate physical activity. The results could be used to enhance the health of individuals and communities by implementing policies that consider socioeconomic parameters; these policies would increase the use of exercise facilities. However, we evaluated exercise facilities in local communities at the level of individual participation in physical activities; follow-up studies are needed to consider the physical environment.

## **Declarations**

### **Contributions**

Author responsibilities were as follows: MIH contributed to funding acquisition. DJK, SJK and MIH contributed to conceptualization of the study. DJK, SJK and MIH contributed to the investigation. DJK, SJK and MIH contributed to data curation. DJK, SJK and MIH contributed to formal analysis of the study. DJK contributed to visualization of the study. SJK and MIH contributed to validation of the study. DJK, SJK and MIH contributed to results interpretation of the study. DJK, SJK and MIH contributed to writing–original draft; DJK, SJK and MIH contributed to review and editing of the final manuscript.

### **Competing Interests**

The authors declare no competing interests.

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### **Informed Consent Statement**

Informed consent was obtained from all subjects involved in the study.

### **Data Availability Statement**

The data included in this study are available from KCHS, but restrictions apply to availability. These data were used under a license for the current study only and are not publicly available.

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## Tables

Table 1.

## General characteristics of the sample by moderate physical activity

Variation	Total		Non moderate physical activity		Moderate. physical activity		P-value
	N/	%	N/	%	N/	%	
TOTAL	652,954	(100.0)	506,229	(77.5)	146,725	(22.5)	
Accessibility to exercise facilities							
Difficult or very difficult	156,176	(23.9)	122,393	(78.4)	33,783	(21.6)	< .01
Easy	324,871	(49.8)	255,602	(78.7)	69,269	(21.3)	
Very easy	171,907	(26.3)	128,234	(74.6)	43,673	(25.4)	
Sex							
Male	294,896	(45.2)	216,459	(73.4)	78,437	(26.6)	< .01
Female	358,058	(54.8)	289,770	(80.9)	68,288	(19.1)	
Age group (years)							
≤ 29	65,948	(10.1)	50,933	(77.2)	15,015	(22.8)	< .01
30–39	99,196	(15.2)	78,579	(79.2)	20,617	(20.8)	
40–49	125,625	(19.2)	95,386	(75.9)	30,239	(24.1)	
50–59	131,565	(20.1)	97,715	(74.3)	33,850	(25.7)	
60–69	106,532	(16.3)	79,562	(74.7)	26,970	(25.3)	
≥ 70	124,088	(19.0)	104,054	(83.9)	20,034	(16.1)	
Region							
Rural	304,765	(46.7)	229,288	(75.2)	75,477	(24.8)	< .01
Urban	181,212	(27.8)	143,601	(79.2)	37,611	(20.8)	
Metropolitan	166,977	(25.6)	133,340	(79.9)	33,637	(20.1)	
Household income/month*							
≤ \$999	134,349	(20.6)	109,857	(81.8)	24,492	(18.2)	< .01
\$1,000–2,999	229,830	(35.2)	174,864	(76.1)	54,966	(23.9)	
\$3,000–4,999	176,943	(27.1)	136,331	(77.0)	40,612	(23.0)	
≥ \$5,000	111,832	(17.1)	85,177	(76.2)	26,655	(23.8)	

Variation	Total		Non moderate physical activity		Moderate. physical activity		P-value
	N /	%	N /	%	N /	%	
Education							
High school or below	428,658	(65.6)	332,022	(77.5)	96,636	(22.5)	< .01
University	203,180	(31.1)	157,780	(77.7)	45,400	(22.3)	
Graduate school	21,116	(3.2)	16,427	(77.8)	4,689	(22.2)	
Marital status							
Unmarried	92,224	(14.1)	70,815	(76.8)	21,409	(23.2)	< .01
Separated/widowed/divorced	106,386	(16.3)	88,689	(83.4)	17,697	(16.6)	
Married and living together	454,344	(69.6)	346,725	(76.3)	107,619	(23.7)	
Job type							
White-collar	128,100	(19.6)	102,025	(79.6)	26,075	(20.4)	< .01
Blue-collar	288,468	(44.2)	204,796	(71.0)	83,672	(29.0)	
Other**	236,386	(36.2)	199,408	(84.4)	36,978	(15.6)	
Smoking status							
Non-smoker	409,904	(62.8)	325,595	(79.4)	84,309	(20.6)	< .01
Past smoker	113,112	(17.3)	83,838	(74.1)	29,274	(25.9)	
Smoker	129,938	(19.9)	96,796	(74.5)	33,142	(25.5)	
Alcohol use							
No	213,329	(32.7)	171,926	(80.6)	41,403	(19.4)	< .01
Yes (not high-risk)	362,572	(55.5)	277,970	(76.7)	84,602	(23.3)	
High-risk	77,053	(11.8)	56,333	(73.1)	20,720	(26.9)	
Subjective health status							
Unhealthy	138,871	(21.3)	114,529	(82.5)	24,342	(17.5)	< .01
Normal	272,268	(41.7)	213,649	(78.5)	58,619	(21.5)	
Healthy	241,815	(37.0)	178,051	(73.6)	63,764	(26.4)	
Stress							
A lot	168,609	(25.8)	131,667	(78.1)	36,942	(21.9)	< .01

Variation	Total		Non moderate physical activity		Moderate. physical activity		P-value
	N/	%	N/	%	N/	%	
A little	344,674	(52.8)	266,491	(77.3)	78,183	(22.7)	
Minimal	139,671	(21.4)	108,071	(77.4)	31,600	(22.6)	
Year							
2012	210,902	(32.3)	163,032	(77.3)	47,870	(22.7)	< .01
2014	221,120	(33.9)	172,194	(77.9)	48,926	(22.1)	
2016	220,932	(33.8)	171,003	(77.4)	49,929	(22.6)	
*1\$=1,000won **Unemployed / housewife / student / other							

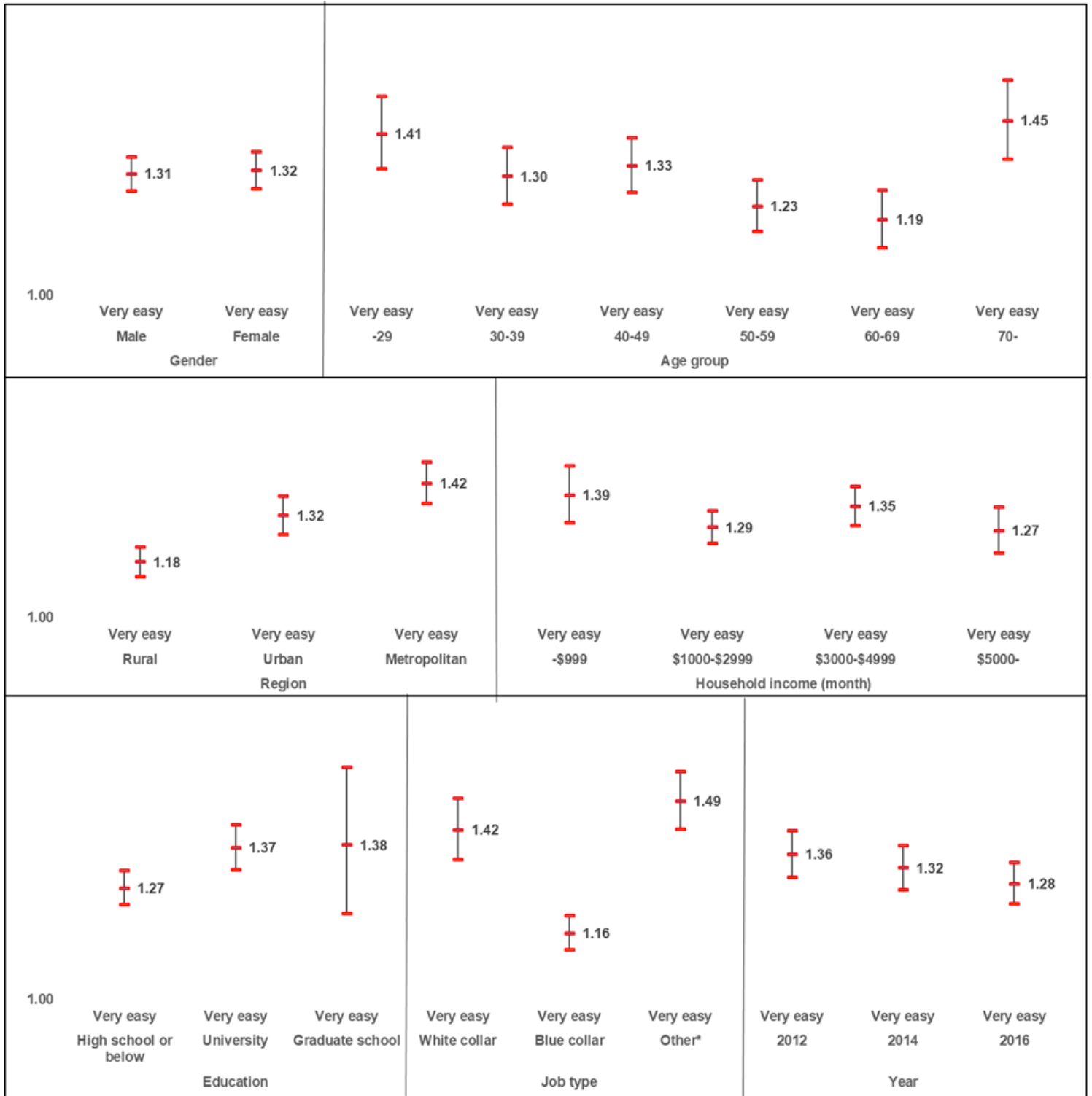
Table 2.

Results of multivariate logistic regression for factors affecting of moderate physical activity

Variation	Odds Ratio	95% Wald Confidence Limit	
Accessibility to exercise facilities			
Difficult or very difficult	1.00		
Easy	1.01	0.99	-1.04
Very easy	1.32	1.28	-1.35
Sex			
Female	1.00		
Male	1.46	1.42	-1.49
Age group (years)			
≥ 70	1.00		
60-69	1.27	1.21	-1.34
50-59	1.17	1.12	-1.22
40-49	1.35	1.30	-1.40
30-39	1.44	1.39	-1.50
≤ 29	1.49	1.44	-1.54
Region			
Rural	1.00		
Urban	0.82	0.80	-0.84
Metropolitan	0.82	0.80	-0.84
Household income/month*			
≥ \$5,000	1.00		
≤ \$999	0.84	0.81	-0.88
\$1,000-2,999	0.93	0.91	-0.96
\$3,000-4,999	0.91	0.89	-0.94
Education			
Graduate school	1.00		
High school or below	0.98	0.94	-1.03

University	0.99	0.95	-1.03
Marital status			
Separated/widowed/divorced	1.00		
Unmarried	1.26	1.21	-1.31
Married and living together	1.13	1.10	-1.16
Job type			
White-collar	1.00		
Blue-collar	1.44	1.41	-1.48
Other**	1.09	1.06	-1.12
Smoking			
Non-smoker	1.00		
Past smoker	1.05	1.02	-1.08
Smoker	0.92	0.90	-0.95
Alcohol use			
No	1.00		
Yes (not high-risk)	1.08	1.06	-1.11
High-risk	1.13	1.10	-1.16
Subjective health status			
Unhealthy	1.00		
Normal	1.11	1.08	-1.14
Healthy	1.50	1.46	-1.54
Stress			
A lot	1.00		
A little	0.98	0.96	-1.00
Minimal	1.06	1.03	-1.09
Year			
2012	1.00		
2014	1.06	1.04	-1.09
2016	1.08	1.06	-1.11
*1\$=1,000won **Unemployed / housewife / student / other			

# Figures



**Figure 1**

The results of subgroup analyses of the effect of accessibility of exercise facilities on moderate physical activity. All values are adjusted by sex, age, region, household income, educational level, marital status, job



type, smoking and alcohol use status, subjective health status, stress, and year. Reference: difficult or very difficult.