Factors Associated with Physical Activity in Older Adults by Region: Based on the 2017 Community Health Survey

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Purpose: The purpose of this study is to identify personal factors, social factors, and environmental factors related to physical activity in older adults in urban and non-urban areas. **Methods:** We used source data from the 2017 Community Health Survey. The subjects of this study included some older adults aged 65 and over, and analyzed the data of 23,043 older adults living in the urban and 34,063 older adults living in the non-urban area. **Results:** The common factors influencing physical activity in older adults by region include current smoking and drinking, BMI, sleep duration, and subjective health status, help with neighbors, frequency of meeting with neighbors and friends, participation in social and leisure activities, and falls experience ($p<.001$). However, the living environment, public transport satisfaction, and medical service use significantly associated with physical activity for only older adults living in the urban area ($p<.001$). **Conclusion:** In order to improve physical activity in older adults in the community, it is necessary to consider not only the improvement of individual factors that practice health behaviors but also health promotion strategies that take into account social and environmental factors because there are environmental differences among regions.

Key Words: Aged; Exercise; Health; Urban population; Rural population

INTRODUCTION

1. Background

With the growth of the older population, the average life expectancy of Koreans has increased significantly to 82.4 years, but the healthy life expectancy is estimated to be 64.9 years, 17.5 years lower than the life expectancy [1]. This means that older adults live in an unhealthy state due to diseases, frailty, and lying sick in bed during the period. Since most health problems in older adults are chronic diseases, active improvement of lifestyle habits and self-management skills for chronic disease management are required [2]. However, individual efforts alone are insufficient, and the role of the community is important in improving health-related lifestyle habits and enhancing the competency in chronic disease self-management in older adults.

Most older adults aged 65 and older have one or more chronic diseases [2], so the management of geriatric diseases and health-promoting behaviors that enable independent daily life are required. Among health-promoting behaviors, physical activity is a useful method for a healthy old age and independent life by prolonging healthy life expectancies. In other words, physical activity can reduce changes in physical functions due to the aging process, prevent cognitive decline, increase independence, and alleviate depression, thereby improving the quality of life in older adults [3]. Despite the positive effects of such physical activity, it has been reported that 41.9% of older adults in Korea do not participate in physical activity and participation in physical activity decreases gradually with in-

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creasing age [2]. According to the World Health Organization (WHO)[4], the lack of physical activity is the fourth leading cause of death worldwide. Since the lack of physical activity is such a serious level, active measures are required to maintain and promote physical activity to lead a healthy life, and a prerequisite for such measures is to identify factors related to physical activity in older adults.

The physical activity of older adults is reported to be affected by sociodemographic factors such as gender, age, educational level, and economic status [3,5]. Although an individual's biological, genetic and socioeconomic characteristics determine health status levels, health may also be improved by the physical environment or institutional support which provides motivation for health promotion. On the other hand, prolonged exposure to a harmful environment or more limited social support compared to others may result in relatively poorer health conditions or more serious health problems [6]. Individual factors that influence physical activity in older adults are variables that increase or decrease the likelihood that individuals would participate in physical activity, and they include individuals' psychological characteristics, such as self-efficacy, attitude, belief, and motivation and sociodemographic characteristics, such as gender, age, and education level [7]. Social factors are various social factors that influence individual behavior and they include social support, social network, social capital, and neighborhood factors [8]. Since physical activities are performed within a physical environment, physical environmental factors are very important for continuous or regular physical activities, and they include ease of spatial access to exercise facilities, convenience of exercise facilities, and the stability of the surrounding environment [9]. Therefore, it is necessary to gain an understanding of the complex effects of individual, social and environmental factors before developing a plan for improving physical activity among older adults.

In recent years, the composition ratio of the older population has been becoming different according to the residential areas (urban and non-urban areas) across the world. As a result, the exercise participation rate and factors affecting physical activity among older adults may vary according to the residential areas [10]. Therefore, in order to increase physical activity among older adults, it is necessary to develop strategies for promoting physical activity in consideration of the individual, social, and environmental characteristics of older adults in each residential area. Previous studies on the health of older adults according to the place of residence or residential area were mostly focused on individual factors such as demographic

characteristics and health-related characteristics [11,12] and a study considered the impact of social support on health status together with other factors [13]. Most previous studies on physical activity in older adults limited research to one type of area, such as urban or rural areas, or investigated related factors without the division of residential areas [3,5,8,14]. Although a small number of studies compared predictive factors for physical activity among urban and rural older adults [15], few studies have sufficiently considered the social and environmental characteristics reflecting the physical and human health resources of residential areas.

In particular, in Korea, since economic development has been concentrated in the Metropolitan Area around Seoul, distinct disparities in health between the metropolitan and the non-metropolitan areas have been observed in recent years, and the health gap between regions has been widening especially in non-urban areas [16]. With respect to these aspects, it is considered a meaningful research attempt to examine the problem of regional health disparities among older adults since this investigation allows us to identify differences in the social structural conditions. The physical and social environment of a residential area affects the resources and choices available to residents. In particular, for older adults with characteristics such as physical frailty, a lack of resources, and limited accessibility, environmental factors such as medical services, various social facilities, and community capacity [17] affect their physical activities, which may lead to regional disparities in health status.

Therefore, based on the social ecological model (SEM) [18], which considers multidimensional effects including social and environmental factors as well as individual factors in relation to the determinants of health behaviors of individuals, this study aimed to make an integrative investigation of overall factors influencing physical activity in older adults by region. Through this investigation, this study attempted to provide basic data for the development of community programs to promote physical activity among older adults and strategies to create a social environment to reduce regional health inequalities.

2. Purpose

The main purpose of this study was to identify individual, social and environmental factors related to physical activity in older adults in urban and non-urban areas by using the data from the Community Health Survey since the data allows a comparison of health status levels between regions.

3. Conceptual Framework

The conceptual framework of this study was based on the social ecological model. This model has five hierarchical levels of individual, interpersonal, community, organizational, and policy/enabling environments, and it also has the concept of expansion from individuals to society [18]. Since this model presents a comprehensive system for understanding the effects of various levels on physical activity, it has been used as an effective theoretical basis in several previous studies on physical activity [19]. Since the use of the data from the Community Health Survey involves limitations in linking variables in relation to organizational and policy areas with data obtained from a questionnaire survey on health behaviors related to chronic diseases, a modified conceptual model reflecting individual, social, and environmental factors was constructed (Figure 1).

METHODS

1. Study Design

This study is a descriptive research to investigate individual, social, and environmental factors related to physical activities among older adults in urban and non-urban areas and to identify influencing factors for physical activity.

2. Participants

This study used data from the 2017 Community Health Survey among 228,381 adults aged 19 and older. The samples of the Community Health Survey were extracted by the complex sampling design method, and the information on the elements of complex sampling design, such as sampling weight, stratified variables, and clustered variables, is included in the raw data. If analysis is conducted by selecting or deleting some part of the data instead of using the total data, the standard error bias of the estimate may occur due to the omission of information on complex sampling design included in the deleted data. Therefore, among the total respondents, older adults aged 65 and older without missing data were first selected, and 23,043 elderly people in urban areas and 34,063 elderly people in non-urban areas were designated as subpopulations. Then, data of the subpopulations was used without further deleting other data.

3. Research variables

The research variables used in this study were individual, social, and environmental factors including sociodemographic and health-related characteristics which were selected among variables available in the Community Health Survey data by referring to the items reported as factors re-
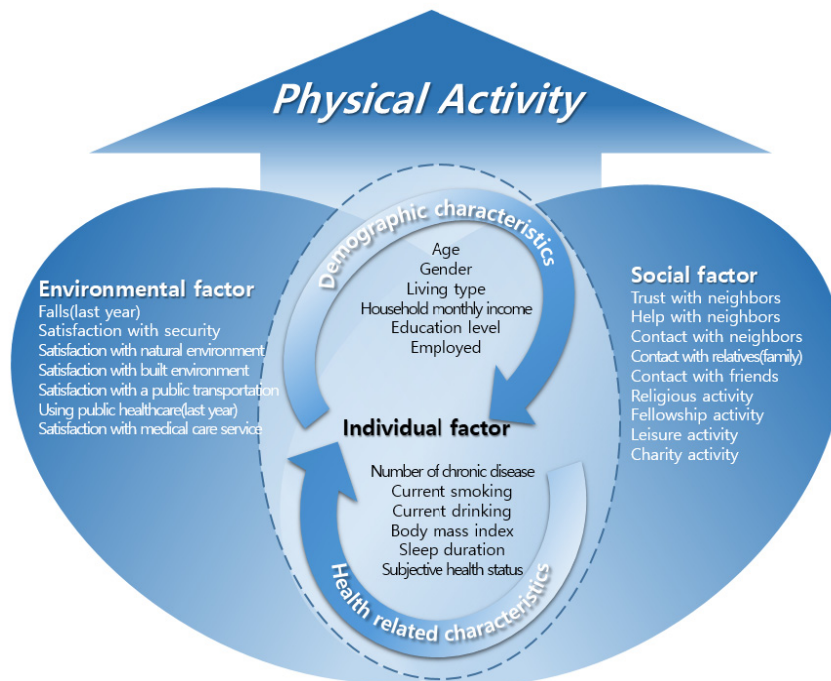

Figure 1. Conceptual framework of this study.

lated to physical activity in previous studies [3,5-9,14,15].

1) Individual factors

Individual factors included sociodemographic and health-related characteristics. Sociodemographic characteristics analyzed in this study were age, gender, residential area, household type, household income, education level, and the presence or absence of economic activity. Regarding the residential area, the variables of dong/eup · myeon administrative units were used to classify residential areas into urban and non-urban areas. In other words, when the place of residence was a 'dong', it was classified as an urban area, and when the place of residence was a 'eup' or 'myeon', it was classified as an non-urban area. In addition, the type of household was reclassified into 'single-person households' and 'multi-person households'.

Health-related characteristics examined in this study were as follows: the number of diseases diagnosed among the five chronic diseases of high blood pressure, diabetes, dyslipidemia, arthritis, and cataract, current smoking status, current drinking status, body mass index (BMI), daily sleep duration and subjective health status. Regarding BMI (kg/m^2), people with a BMI (kg/m^2) of less than 18.5 were reclassified as the 'underweight' group, those with a BMI of 18.5 to less than 25 as the 'normal weight' group, and those with a BMI of 25 or more as the 'obese' group.

2) Social factors

Social factors analyzed in this study were as follows: trust between neighbors, exchanges of help among neighbors, social networks assessed by measuring the frequency of meetings with neighbors, relatives (family members) and friends, and regular participation in each type of social activity at least once per month for social activities such as religious activities, socializing activities, leisure activities, and charitable activities.

3) Environmental factors

Environmental factors examined in this study were as follows: the experience of a fall in the past year, overall safety level, satisfaction with the natural environment, satisfaction with living conditions, satisfaction with public transportation, the use of public health facilities such as public health centers (primary health care centers) or branch offices of public health centers, and satisfaction with medical services.

4) Physical activity

The amount of physical activity was expressed as Meta-bolic equivalent-minutes per week (MET-minutes/week) [15], which was calculated using the time spent performing intense physical activity, moderate physical activity, and walking and the number of days per week when physical activity is performed. Based on MET-minutes/week, participants were classified into the inactive, minimally active, and health-enhancing physical activity groups. The 'inactive' group are people who do not belong to the minimally active group or the health-enhancing physical activity group because they perform the least physical activity. Individuals classified as the 'minimally active' group are those who perform vigorous physical activity for at least 20 minutes a day for at least 3 days a week, or moderate physical activity or walking for at least 30 minutes a day for at least 5 days a week, or total physical activity of 600 or more MET-min/week over 5 or more days a week by performing walking, moderate physical activity, or intense physical activity. The 'health-enhancing physical activity' group' is the most desirable physical activity group, and people classified as this group are those who perform vigorous physical activity of a total of 1,500 or more METmin/ week for at least 3 days per week or those who consume a total of 3,000 or more MET-min/ week through walking, moderate physical activity, or vigorous physical activity for at least 3 days per week [15].

4. Data Collection and Analysis

The Community Health Survey is a cross-sectional study using multi-stage area probability sampling by the two-stage stratified two-stage cluster systematic sampling method. After stratification of dividing the population into regions, administrative units (dong/eup · myeon), and residential types (apartment/single house) to represent all the regions and the entire population in the country, sample households are extracted proportionally to the number of households in the population of each strata by the systematic sampling method. The data is collected on the selected households and all members of those households through interviews and the Community Health Survey (CHS) data is publicly available data. Therefore, this study was conducted using the 2017 CHS data after the investigators signed the agreement for access to personal information for research or statistical purposes and submitted a plan on the use of CHS data to request the data.

5. Statistical Analysis

Data analysis was carried out using IBM SPSS Statistics 23.0 by applying an analysis method for complex sample

survey data considering the strata, cluster and weights. A x^2 test was conducted to examine differences in individual, social and environmental factors and physical activity in older adults between urban and non-urban areas. Participants were divided into the inactive, minimally active, and health-enhancing physical activity groups according to the amount of physical activity, and the level of physical activity was set as the dependent variable. Based on the results of previous studies [3,5-9,14,15], individual, social, and environmental factors which were expected to affect physical activity were entered into the logistic regression model to calculate the odds ratios and determine statistical significance with a 95% confidence interval. A value of $p < .05$ was considered statistically significant.

6. Ethical Considerations

This study was conducted after receiving an exemption determination from the IRB of Catholic University of Pusan (IRB No. 2019-01-009) for the secondary analysis of the 2017 Community Health Survey data that was collected after obtaining informed consent from all participants prior to data collection.

RESULTS

1. Individual, Social and Environmental Factors and Physical Activity of Participants

The analysis results of differences in individual, social, and environmental factors and physical activities between older adults in urban and non-urban areas are shown in Table 1. In terms of demographic and sociological characteristics among individual factors, there were statistically significant differences between the two groups in age, household type, household income, educational level and economic activity, except for gender ($p < .001$). As for health-related characteristics, the percentages of people with multimorbidity of chronic diseases, current drinkers and obese people were 1.9%, 5.5%, and 3.6% higher, respectively, among older adults in urban areas than those in non-urban areas. The percentage of older adults with a daily sleep duration of less than 6 hours was 4.0 percent higher among older adults in urban areas than in non-urban areas.

With respect to social factors, the level of trust among neighbors and exchanges of help among neighbors were 16.6% and 38.0% higher, respectively, in older adults in non-urban areas than those in urban areas. The proportions of older adults who reported meeting with neigh-

bors, relatives (family members) and friends two or more times a week were 33.8%, 8.0%, and 5.3% higher, respectively, in non-urban areas than in urban areas. On the other hand, the percentage of older adults regularly participating in social activities at least once a month for social activities, such as religious activities, socializing activities, leisure activities and charitable activities, was higher in urban areas.

As for environmental factors, the levels of satisfaction with living conditions, public transportation and medical services were 1.5%, 15.8%, and 14.7% higher, respectively, among older adults in urban areas than those in non-urban areas. On the other hand, the percentage of people satisfied with the natural environment was 7.4% higher among older adults in non-urban areas, and the utilization rate of public health institutions was also 31.5% higher among older adults in non-urban areas, compared to those in urban areas. In terms of physical activity, among older adults in urban areas, the minimally active group constituted the largest proportion (49.6%), but among older adults in urban areas, the inactive group accounted for the largest proportion (53.4%).

2. Influencing Factors for Physical Activity in Urban Older Adults

A multiple logistic regression analysis was performed to examine factors influencing physical activity in older adults in urban areas. As a result, among individual factors, age, gender, economic activity, current smoking status, current drinking status, obesity level, sleep duration and subjective health status were identified as significant influencing factors. Regarding social factors, exchanges of help among neighbors, the frequencies of meeting with neighbors and friends, and regular participation in religious, socializing, and leisure activities were found to be significant influencing factors. As for environment factors, the experience of a fall within the past year, satisfaction with the living conditions, satisfaction with public transportation, and the use of public health facilities were found to be significant influencing factors (Table 2).

With respect to individual factors, smokers were 0.73 times less likely to be in the inactive group than non-smokers (95% CI=0.64~0.82), while drinkers were 1.17 times more likely to be in the inactive group than non-smokers (95% CI=1.10~1.28). Regarding the degree of obesity assessed by the body mass index, the normal weight group was 1.19 times more likely to be in the inactive group (95% CI=1.10~1.28) and in the health-enhancing physical activity group (95% CI=1.03~1.38), compared to the obese group.

Table 1. Individual, Social, Environmental Factors, and Physical Activity among the Older Adults by Regions (*N*=57,106)

Variables	Characteristics	Categories	M±SD	Urban (n=23,043) n[†] (%)[‡] or M±SD[‡]	Non-urban (n=34,063) n[†] (%)[‡] or M±SD[‡]	x^2 (*p*)
Individual Demographic characteristics	Age (year)	65~74 ≥75	73.40±0.40	14,232 (62.5) 8,811 (37.5) 73.09±0.51	18,066 (54.4) 15,997 (45.6) 74.19±0.52	317.22 (<.001)
	Gender	Male Female		10,051 (45.3) 12,992 (54.7)	15,124 (45.8) 18,939 (54.2)	1.10 (.233)
	Living type	Alone With family		4,715 (17.8) 18,328 (82.2)	8,899 (22.5) 25,164 (77.5)	163.23 (<.001)
	Household monthly income (10,000 won)	<100 100~<300 300~<500 ≥500		1,777 (9.5) 8,597 (32.9) 9,454 (41.8) 3,215 (15.7)	889 (4.3) 19,381 (52.6) 11,451 (34.2) 2,342 (8.9)	2,081.01 (<.001)
	Education level	≤Elementary school Middle school High school ≥College		11,501 (46.6) 4,199 (18.3) 4,913 (22.6) 2,430 (12.4)	24,600 (68.2) 4,552 (14.3) 3,697 (12.9) 1,214 (4.5)	2,356.86 (<.001)
	Employed	Yes No		5,897 (24.3) 17,146 (75.7)	17,198 (44.2) 16,865 (55.8)	2,171.47 (<.001)
Health related characteristics	Number of chronic disease	0 1 2 3 ≥4	1.38±0.06	5,493 (24.2) 7,422 (32.1) 6,237 (26.8) 3,153 (13.8) 738 (3.1) 1.40±0.08	8,376 (24.6) 11,609 (33.6) 9,044 (26.5) 4,126 (12.5) 908 (2.8) 1.35±0.09	26.88 (<.001)
	Current smoking	Yes No		2,144 (9.1) 20,899 (90.9)	3,103 (9.7) 30,960 (90.3)	4.81 (.061)
	Current drinking	Yes No		10,817 (48.1) 12,226 (51.9)	13,905 (42.6) 20,158 (57.4)	140.36 (<.001)
	Body mass index (kg/m²)	Underweight Normal Obesity		1,034 (4.2) 15,879 (68.9) 6,130 (26.9)	2,582 (7.2) 23,890 (69.5) 7,591 (23.3)	253.63 (<.001)
	Sleep duration (hour)	≤6 7~8 ≥9	6.44±0.09	12,107 (52.5) 9,891 (42.9) 1,045 (4.5) 6.41±0.11	16,059 (48.5) 16,033 (45.6) 1,971 (5.9) 6.52±0.12	97.23 (<.001)
	Subjective health status	Good Moderate Poor		4,852 (22.3) 9,123 (40.0) 9,068 (37.6)	6,417 (19.3) 11,764 (35.3) 15,882 (45.4)	288.83 (<.001)
Social	Trust with neighbors	Yes No		16,247 (68.0) 6,796 (32.0)	30,065 (84.6) 3,998 (15.4)	1,575.98 (<.001)
	Help with neighbors	Yes No		11,966 (46.9) 11,077 (53.1)	30,796 (84.9) 3,267 (15.1)	6,749.20 (<.001)

HEPA=health enhancing physical activity; [†]Unweighted; [‡]Weighted.

Table 1. Individual, Social, Environmental Factors, and Physical Activity among the Older Adults by Regions (Continued)
(*N*=57,106)

Variables	Characteristics	Categories	M±SD	Urban (n=23,043) n[†] (%)[‡] or M±SD[‡]	Non-urban (n=34,063) n[†] (%)[‡] or M±SD[‡]	x^2 (p)
Social	Contact with neighbors	≤1 per month		8,210 (39.9)	2,551 (11.8)	5,517.45
		2~3 per month		1,546 (6.8)	1,136 (3.8)	(<.001)
		1 per week		1,829 (8.2)	1,736 (5.5)	
		≥2 per week		11,458 (45.1)	28,590 (78.9)	
	Contact with relatives (family)	≤1 per month		6,667 (29.7)	6,832 (21.7)	468.78
		2~3 per month		3,263 (14.6)	4,462 (13.3)	(<.001)
		1 per week		3,351 (14.5)	5,181 (15.9)	
		≥2 per week		9,762 (41.2)	17,588 (49.2)	
	Contact with friends	≤1 per month		9,353 (41.3)	13,959 (41.0)	232.99
		2~3 per month		2,585 (11.6)	3,085 (9.1)	(<.001)
		1 per week		2,211 (9.9)	2,477 (7.4)	
		≥2 per week		8,894 (37.2)	14,542 (42.5)	
	Religious activity	Yes		8,767 (39.2)	9,329 (29.6)	457.54
		No		14,276 (60.8)	24,734 (70.4)	(<.001)
	Fellowship activity	Yes		12,783 (55.1)	16,472 (48.8)	183.21
		No		10,260 (44.9)	17,591 (51.2)	(<.001)
	Leisure activity	Yes		4,737 (21.6)	3,823 (12.0)	680.90
		No		18,306 (78.4)	30,240 (88.0)	(<.001)
	Charity activity	Yes		1,509 (6.7)	1,367 (4.0)	146.51
		No		21,534 (93.3)	32,696 (96.0)	(<.001)
Environmental	Falls (last year)	Yes		4,056 (17.6)	5,789 (17.8)	0.29
		No		18,987 (82.4)	28,274 (82.2)	(.650)
	Satisfaction with security	Yes		19,455 (83.8)	31,682 (91.2)	515.29
		No		3,588 (16.2)	2,381 (8.8)	(<.001)
	Satisfaction with natural environment	Yes		18,872 (81.3)	31,216 (89.7)	579.12
		No		4,171 (18.7)	2,847 (10.3)	(<.001)
	Satisfaction with built environment	Yes		20,497 (89.1)	30,443 (87.6)	27.44
		No		2,546 (10.9)	3,620 (12.4)	(<.001)
	Satisfaction with a public transportation	Yes		19,274 (84.6)	24,200 (68.8)	1,789.36
		No		3,769 (15.4)	9,863 (31.2)	(<.001)
	Using public healthcare (last year)	Yes		10,773 (44.3)	28,008 (75.8)	4,555.80
		No		12,270 (55.7)	6,055 (24.2)	(<.001)
	Satisfaction with medical care service	Yes		19,496 (85.9)	25,251 (71.2)	1,657.35
		No		3,547 (14.1)	8,812 (28.8)	(<.001)
Physical activity	Physical activity	Inactive		10,391 (43.8)	18,199 (53.4)	481.55
		Minimally active		11,203 (49.6)	13,065 (38.4)	(<.001)
		HEPA		1,449 (6.6)	2,799 (8.2)	

HEPA=health enhancing physical activity; [†]Unweighted; [‡]Weighted.

Table 2. Multivariate Logistic Regression Analysis of Factors Influencing Physical Activity by Region

Variables	Categories	Urban (n=23,043)				Non-urban (n=34,063)			
		Minimally active		HEPA		Minimally active		HEPA	
		OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
Age (year)	65~74	1.40 (1.30~1.51)	<.001	2.16 (1.84~2.55)	<.001	1.44 (1.33~1.55)	<.001	1.82 (1.60~2.07)	<.001
	≥75	1.00		1.00		1.00		1.00	
Gender	Male	1.49 (1.37~1.61)	<.001	2.85 (2.43~3.34)	<.001	1.26 (1.16~1.36)	<.001	1.49 (1.28~1.74)	<.001
	Female	1.00		1.00		1.00		1.00	
Living type	Alone	1.04 (0.95~1.14)	.376	1.02 (0.98~1.21)	.484	0.96 (0.88~1.05)	.362	0.86 (0.73~1.02)	.088
	With family	1.00		1.00		1.00		1.00	
Household monthly income (10,000 won)	<100	0.89 (0.76~1.03)	.123	1.01 (0.76~1.33)	.963	0.91 (0.69~1.19)	.481	1.02 (0.61~1.72)	.943
	100~<300	0.90 (0.80~1.01)	.063	0.78 (0.62~0.99)	.043	1.02 (0.86~1.21)	.828	0.79 (0.59~1.06)	.111
	300~<500	0.97 (0.87~1.08)	.542	0.90 (0.73~1.09)	.253	1.07 (0.91~1.26)	.385	0.97 (0.74~1.28)	.829
	≥500	1.00		1.00		1.00		1.00	
Education level	≤Elementary school	0.90 (0.79~1.03)	.134	0.84 (0.66~1.08)	.184	1.07 (0.87~1.29)	.485	1.21 (0.85~1.72)	.291
	Middle school	0.89 (0.78~1.03)	.113	0.86 (0.67~1.10)	.226	1.15 (0.93~1.41)	.204	1.17 (0.81~1.68)	.404
	High school	0.93 (0.82~1.06)	.286	0.99 (0.79~1.24)	.929	1.12 (0.92~1.36)	.262	1.19 (0.82~1.72)	.372
	≥College	1.00		1.00		1.00		1.00	
Employed	Yes	1.12 (1.03~1.22)	.006	1.15 (0.98~1.35)	.087	1.40 (1.30~1.52)	<.001	3.05 (2.62~3.54)	<.001
	No	1.00		1.00		1.00		1.00	
Number of chronic disease	0	1.03 (0.85~1.24)	.775	0.86 (0.58~1.28)	.469	0.74 (0.65~0.95)	.018	1.03 (0.71~1.49)	.886
	1	0.97 (0.81~1.16)	.744	0.80 (0.54~1.19)	.284	0.82 (0.65~1.03)	.091	1.12 (0.78~1.60)	.539
	2	1.03 (0.86~1.23)	.783	0.81 (0.55~1.20)	.297	0.81 (0.64~1.02)	.078	1.36 (0.95~1.95)	.095
	3	0.96 (0.79~1.16)	.650	0.76 (0.50~1.17)	.212	0.78 (0.61~0.99)	.041	1.08 (0.75~1.57)	.676
	≥4	1.00		1.00		1.00		1.00	
Current smoking	Yes	0.73 (0.64~0.82)	<.001	0.66 (0.52~0.82)	<.001	0.82 (0.73~0.93)	.002	0.86 (0.70~1.06)	.165
	No	1.00		1.00		1.00		1.00	
Current drinking	Yes	1.17 (1.10~1.28)	<.001	1.15 (0.99~1.33)	.060	1.14 (1.06~1.23)	<.001	1.30 (1.14~1.48)	<.001
	No	1.00		1.00		1.00		1.00	
Body mass index (kg/m²)	Underweight	1.01 (0.86~1.19)	.925	0.77 (0.51~1.15)	.200	1.02 (0.88~1.78)	.810	1.07 (0.82~1.43)	.637
	Standard	1.19 (1.10~1.28)	<.001	1.19 (1.03~1.38)	.017	1.22 (1.12~1.34)	<.001	1.19 (1.03~1.38)	.020
	Obesity	1.00		1.00		1.00		1.00	
Sleep duration (hour)	≤6	1.68 (1.43~1.98)	<.001	1.26 (0.87~1.82)	.216	1.33 (1.14~1.55)	<.001	1.50 (1.14~1.96)	.004
	7~8	1.56 (1.33~1.83)	<.001	1.28 (0.88~1.85)	.198	1.32 (1.13~1.53)	<.001	1.60 (1.22~2.09)	.001
	≥9	1.00		1.00		1.00		1.00	
Subjective health status	Good	2.01 (1.82~2.22)	<.001	3.04 (2.49~3.70)	<.001	1.56 (1.41~1.72)	<.001	1.56 (1.32~1.85)	<.001
	Moderate	1.46 (1.35~1.58)	<.001	1.72 (1.45~2.04)	<.001	1.43 (1.31~1.56)	<.001	1.25 (1.08~1.44)	.003
	Poor	1.00		1.00		1.00		1.00	
Trust with neighbors	Yes	1.03 (0.94~1.12)	.557	0.88 (0.74~1.04)	.138	0.74 (0.64~1.13)	.913	0.88 (0.68~1.15)	.358
	No	1.00		1.00		1.00		1.00	
Help with neighbors	Yes	0.92 (0.85~0.99)	.030	1.04 (0.89~1.22)	.621	0.91 (0.79~1.03)	.143	1.07 (0.78~1.46)	.683
	No	1.00		1.00		1.00		1.00	
Contact with neighbors	≤1 per month	0.74 (0.69~0.81)	<.001	0.62 (0.52~0.73)	<.001	0.74 (0.64~0.87)	<.001	0.38 (0.28~0.52)	<.001
	2~3 per month	0.88 (0.76~1.01)	.062	0.93 (0.72~1.20)	.558	0.81 (0.66~0.99)	.048	0.78 (0.50~1.20)	.259
	1 per week	0.90 (0.79~1.02)	.091	0.68 (0.52~0.89)	.005	0.83 (0.71~0.96)	.015	0.85 (0.62~1.16)	.299
	≥2 per week	1.00		1.00		1.00		1.00	
Contact with relative (family)	≤1 per month	0.98 (0.90~1.06)	.614	1.06 (0.91~1.24)	.456	0.84 (0.76~0.92)	<.001	0.98 (0.82~1.17)	.819
	2~3 per month	1.01 (0.91~1.12)	.857	0.91 (0.74~1.11)	.346	0.94 (0.84~1.04)	.230	1.07 (0.89~1.28)	.471
	1 per week	1.02 (0.92~1.13)	.733	0.86 (0.69~1.07)	.174	0.91 (0.82~1.01)	.087	1.05 (0.87~1.27)	.604
	≥2 per week	1.00		1.00		1.00		1.00	

HEPA=health enhancing physical activity; OR=odds ratio; CI=confidence interval.

Table 2. Multivariate Logistic Regression Analysis of Factors Influencing Physical Activity by Region (Continued)

Variables	Categories	Urban (n=23,043)				Non-urban (n=34,063)			
		Minimally active		HEPA		Minimally active		HEPA	
		OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
Contact with friends	≤1 per month	0.72 (0.66~0.78)	<.001	0.80 (0.68~0.95)	.010	0.77 (0.71~0.84)	<.001	0.78 (0.67~0.90)	.001
	2~3 per month	0.91 (0.81~1.02)	.098	0.74 (0.60~0.91)	.005	0.82 (0.72~0.93)	.001	0.69 (0.55~0.86)	.001
	1 per week	0.84 (0.75~0.95)	.004	0.87 (0.69~1.09)	.223	0.92 (0.80~1.05)	.207	0.94 (0.76~1.17)	.582
	≥2 per week	1.00		1.00		1.00		1.00	
Religious activity	Yes	1.16 (1.08~1.25)	<.001	0.94 (0.81~1.09)	.398	1.01 (0.92~1.10)	.845	0.96 (0.82~1.11)	.561
	No	1.00		1.00		1.00		1.00	
Fellowship activity	Yes	1.18 (1.10~1.27)	<.001	1.44 (1.23~1.69)	<.001	1.20 (1.11~1.29)	<.001	1.04 (0.90~1.21)	.593
	No	1.00		1.00		1.00		1.00	
Leisure activity	Yes	1.97 (1.79~2.18)	<.001	4.02 (3.41~4.74)	<.001	1.81 (1.61~2.03)	<.001	2.09 (1.68~2.60)	<.001
	No	1.00		1.00		1.00		1.00	
Charity activity	Yes	.097 (0.84~1.13)	.701	0.96 (0.74~1.25)	.779	1.04 (0.87~1.24)	.655	1.06 (0.79~1.41)	.710
	No	1.00		1.00		1.00		1.00	
Falls (last year)	Yes	0.90 (0.83~0.97)	.010	0.90 (0.74~1.10)	.302	0.91 (0.83~0.99)	.037	1.15 (0.97~1.37)	.110
	No	1.00		1.00		1.00		1.00	
Satisfaction with security	Yes	0.93 (0.84~1.03)	.164	1.01 (0.82~1.26)	.911	0.88 (0.75~1.02)	.097	0.98 (0.72~1.33)	.889
	No	1.00		1.00		1.00		1.00	
Satisfaction with natural environment	Yes	0.97 (0.88~1.07)	.520	0.97 (0.79~1.20)	.795	1.00 (0.88~1.14)	.994	1.11 (0.86~1.44)	.440
	No	1.00		1.00		1.00		1.00	
Satisfaction with built environment	Yes	1.15 (1.02~1.29)	.021	0.92 (0.72~1.16)	.474	1.05 (0.93~1.19)	.411	0.90 (0.73~1.11)	.322
	No	1.00		1.00		1.00		1.00	
Satisfaction with a public transportation	Yes	1.18 (1.07~1.31)	.001	0.99 (0.80~1.22)	.930	1.07 (0.97~1.67)	.166	0.94 (0.80~1.10)	.429
	No	1.00		1.00		1.00		1.00	
Using public ealthcare (last year)	Yes	1.09 (1.02~1.16)	.013	1.11 (0.97~1.27)	.142	1.00 (0.92~1.10)	.947	1.11 (0.95~1.31)	.200
	No	1.00		1.00		1.00		1.00	
Satisfaction with medical care service	Yes	1.05 (0.95~1.17)	.321	0.94 (0.76~1.17)	.591	0.94 (0.86~1.03)	.207	0.84 (0.71~0.99)	.039
	No	1.00		1.00		1.00		1.00	

HEPA=health enhancing physical activity; OR=odds ratio; CI=confidence interval.

In terms of daily sleep duration, the normal sleeping group with a sleep duration of 7~8 hours per day was 1.56 times more likely to belong to the inactive group than the over-sleeping group with a sleep duration of 9 hours or more per day (95% CI=1.33~1.83).

With respect to social factors, older adults meeting with neighbors less than once per month were 0.74 times less likely to belong to the minimally active group (95% CI=0.69~0.81) and 0.62 times less likely to belong to the health-enhancing physical activity group (95% CI=0.52~0.73), compared to those who met with neighbors two or more times a week. Older adults participating in religious activities were 1.16 times more likely to belong to the minimally active group (95% CI=1.08~1.25) than those who did not. Also, older adults participating in socializing activities were 1.18 times more likely to belong to the minimally active group (95% CI=1.10~1.27) and 1.44 times more likely to belong to the

health-enhancing physical activity group (95% CI=1.23~1.69) than those who did not. In addition, older adults participating in leisure activities were 1.97 times more likely to belong to the minimally active group (95% CI=1.79~2.18) and 4.02 times more likely to belong to the health-enhancing physical activity group (95% CI=3.41~4.74) than those who did not.

In terms of environmental factors, those who had experienced a fall in the past year were 0.90 times less likely to belong to the inactive group than those who did not (95% CI=0.83~0.97). Older adults who were satisfied with their living conditions were 1.15 times more likely to belong to the minimally active group than those who were not (95% CI=1.02~1.29), and those satisfied with public transportation were 1.18 times more likely to belong to the minimally active group than those who were not (95% CI=1.07~1.31). In addition, older adults using public health facili-

ties were 1.09 times more likely to be in the minimally active group than those who did not (95% CI=1.02~1.16).

3. Influencing Factors for Physical Activity in Non-urban Older Adults

The multiple logistic regression analysis was performed to analyze factors influencing physical activity among older adults in non-urban areas, and the results showed that among individual factors, age, gender, economic activity, the number of chronic diseases, current smoking status, current drinking status, obesity level, sleep duration, and subjective health status were identified as significant influencing factors. As for social factors, the frequencies of meeting with neighbors, family and friends and the regular participation in socializing and leisure activities were identified as influencing factors. Regarding environmental factors, the experience of a fall within the past year and satisfaction with medical services were found to affect physical activity in non-urban older adults (Table 2).

In terms of individual factors, those without chronic diseases were 0.74 times less likely to belong to the minimally active group (95% CI=0.65~0.95) than those with 4 or more chronic diseases. Among older adults, smokers were 0.82 times less likely to belong to the minimally active group than non-smokers (95% CI=0.73~0.93), whereas drinkers were 1.14 times more likely (95% CI=1.06~1.23) and 1.30 times more likely (95% CI=1.14~1.48) to belong to the minimally active group and the health-enhancing physical activity group than non-drinkers. In terms of the degree of obesity, the normal weight group was 1.22 times more likely to belong to the minimally active group (95% CI=1.12~1.34) and 1.19 times more likely to belong to the health-enhancing physical activity group (95% CI=1.03~1.38), respectively, compared to the obese group. Regarding the daily sleep duration, the normal sleeping group with an average sleep duration of 7~8 hours was 1.32 times more likely to belong to the minimally active group (95% CI=1.13~1.53) and 1.60 times more likely to belong to the health-enhancing physical activity group (95% CI=1.22~2.09), compared to the oversleeping group with a sleep duration of 9 hours or more.

In terms of social factors, when the frequency of meeting between neighbors was less than once a month, the likelihoods of belonging to the minimum activity group and the health-enhancing physical activity group were 0.74 times (95% CI=0.64~0.87) and 0.38 times lower (95% CI=0.28~0.52), respectively, compared to when the frequency of meeting between neighbors was two or more times a week. Older adults who participated in social ac-

tivities were 1.20 times more likely to belong to the minimally active group than those who did not (95% CI=1.11~1.29). Also, older adults who participated in leisure activities were 1.81 times more likely to belong to the minimally active group (95% CI=1.61~2.03) and 2.09 times more likely to belong to the health-enhancing physical activity group (95% CI=1.68~2.60) than those who did not.

Regarding environmental factors, older adults who had experienced a fall in the past year were 0.91 times less likely to belong to the minimally active group (95% CI=0.83~0.99) than those without the experience of falls. Older adults who were satisfied with medical services were 0.84 times more likely to belong to the health-enhancing physical activity group than the inactive group (95% CI=0.71~0.99).

DISCUSSION

This study aimed to identify differences in individual, social, and environmental factors between older adults residing in urban and non-urban areas, and to identify factors that affect the physical activities of older adults by region by using data from the 2017 Community Health Survey in order to provide basic data for the development of community programs to promote physical activity in older adults and for the exploration of strategies to create a social environment to reduce health inequalities between regions.

Regarding the health-related characteristics of older adults in urban and non-urban areas, the prevalence of multimorbidity and the percentages of the drinking group and the obese group related to undesirable lifestyle habits were higher among urban older adults. These findings were consistent with those of prior studies in Korea [11, 12], which reported that the prevalence of major chronic diseases was higher among urban or metropolitan older adults than rural older adults, but the results were inconsistent with the findings of a foreign study [14], which found that the prevalence of multimorbidity was higher among rural older adults. Considering the health care system of Korea, this disagreement in study results can be attributed to the fact that the use of medical services is not constrained by a high financial burden in Korea because of low medical costs due to the National Health Insurance system [20] and that since urban areas provide greater ease of use for medical institutions and higher accessibility to them than rural areas [11], the percentage of older adults who get an early diagnosis and management of diseases through regular health check-ups or visits to hospitals is higher in urban areas than rural areas. In contrast with the findings of this study, some previous studies

[12,21] reported that there was no difference between residential areas in the drinking or smoking rate. The body mass index can be affected by factors related to dietary behavior or weight control attempts, so these factors should also be considered in future studies. As for daily sleep duration, the percentage of under-sleeping people with a daily sleep duration of less than 6 hours was higher among urban older adults than non-urban older adults, while the percentage of people sleeping 7 hours or longer was higher among older adults in rural areas than those in urban areas. These findings are thought to be due to the fact that the characteristic living conditions of rural communities affect sleep duration in rural older adults of whom a high percentage are engaged in agriculture. In the case of older adults in urban areas, it is thought that their sleep duration is affected by the social atmosphere of enjoying a lot of leisure activities in the evening and environmental factors due to higher levels of noise in urban areas [22].

With respect to social factors, the proportion of social networks, such as trust and exchanges of help among neighbors and the frequency of meetings with neighbors, relatives (family members), and friends, was higher among non-urban older adults, while the proportion of social activities such as religious, socializing, leisure and charitable activities was higher among urban older adults. These findings are considered to be largely consistent with the results of a prior study [13], which reported that rural older adults living along with their neighbors have a better peer relationship while urban older adults have more opportunities for leisure activities since they have more time to spare compared to rural adults who are busy with farming. Regarding the environmental factors, older adults in non-urban areas showed greater use of health institutions compared to those in urban areas, while the level of satisfaction with medical services was higher among older adults in urban areas. In other words, considering that while older adults in urban areas show greater use of secondary and tertiary medical institutions such as general hospitals, older adults in non-urban areas show greater use of primary medical institutions such as public health centers and their branch offices [11], the analysis results of this study are thought to reflect the differences in the size and type of health care institutions used and the health care services offered.

As for physical activity, 55.2 percent of urban older adults and 46.6 percent of non-urban older adults were found to perform at least minimal physical activities, indicating that the practice rate of physical activity is higher among older adults in urban areas than those in non-urban areas. This finding is consistent with a previous study [23], which reported that urban older adults showed a higher level of physical activity. Although physical activity is one of the major areas which require improvements among health promotion behaviors for older adults [23], differences in physical activity levels found in this study are thought to be due to the fact that the health infrastructure for the promotion of physical activity is concentrated in urban areas and the proportion of people spending time on activities to earn a living such as agriculture is higher among non-urban older adults.

Individual factors affecting the physical activity of older adults common to both urban and nonurban areas were found to be age, gender, economic activity, current smoking status, current drinking status, degree of obesity, sleep duration and subjective health status. In this study, it was found that current smokers, current drinkers, and those who rated their subjective health status as good were significantly more likely to be in the physical activity group than in the inactive group, which is inconsistent with the results of a previous study [14]. In addition, the current smoker group, the obese group, and the poor subjective health status group were significantly less likely to be in the physical activity group than in the inactive group. In consideration of these results, it is urgently needed to develop and apply community-oriented health promotion programs that take into account the characteristics and environmental factors of older adult groups according to regions in order to increase physical activity in older adults focusing on older adults who practice relatively fewer health promotion behaviors.

Among older adults in non-urban areas, the group with no chronic diseases and the group with three or more chronic diseases were significantly less likely to belong to the minimally active group than the inactive group, compared to the group with four or more chronic diseases. In this regard, older adults tend to assess their health conditions favorably [25], and in the case of older adults without chronic diseases, their excessive confidence in their health is thought to hinder them from getting motivated to promote their health status, which may be a factor influencing the reduction in physical activity. However, in older adults in urban areas, the number of chronic diseases was found to have no significant impact on physical activity, and these results suggest that physical activity may be affected by differences in other social and environmental factors between urban and non-urban areas, so a follow-up study is needed to confirm them.

Common social factors affecting physical activities in both urban and non-urban older adults were found to be exchanges of help among neighbors, frequencies of meet-

ing with neighbors and friends, and regular participation in socializing and leisure activities. In particular, lower frequencies of meeting with neighbors and friends were associated with a lower likelihood of being in the physical activity group. However, considering that the frequency of meeting with relatives or family members was found to have no significant impact on physical activity among urban older adults, it is thought that neighbors and friends who older adults meet frequently near their residence function as an important source of social support for older adults and they have a significant effect on health promotion behaviors including physical activities in older adults. In the case of older adults in non-urban areas, the frequency of meeting with relatives was also identified as a factor affecting physical activity, showing a difference between urban and nonurban older adults. This difference is thought to reflect the regional characteristics of rural areas where people live with their relatives in the same village and interact with each other in various ways [13]. In addition, regular participation in social activities, that is, regular participation in socializing activities and leisure activities at least once a month was found to affect physical activities in older adults, and regular participation in religious activities was also identified as a significant influencing factor among urban older adults. Therefore, it is also considered a useful method for promoting physical activities among older adults to encourage older adults' participation in various programs for older adults provided by facilities in the community, such as welfare centers, public health centers, and religious facilities, by promoting such programs so that older adults can regularly go out and maintain physical activities without staying only at home [26]. On the other hand, since the proportion of people engaged in economic activities such as agriculture is higher among older adults in non-urban areas [13], policies to encourage social activities should be developed taking into account these situations.

A common environmental factor significantly affecting physical activity in both urban and non-urban older adults was the experience of a fall in the past year, and for other influencing factors, there were some differences between the two groups. Deaths from falls are reported to account for more than two-thirds of deaths caused by accidents among older adults aged 65 and older [27] and they are greatly affected by environmental factors, such as the residential environment or living conditions in which older adults actually reside [28]. Therefore, the government and local governments should pay more attention to the expansion of safety facilities when creating physical environments, including those of existing health-related in-

stitutions. Especially, there is a need for active discussion on welfare policies for the safety management of residential environments in non-urban areas that have a higher percentage of older adults living alone, as shown in this study.

Among older adults in urban areas, satisfaction with the living conditions as well as satisfaction with public transportation was significantly associated with a higher likelihood to belong to the physical activity group. These findings are significant because they show that not only the health status of individuals but also the neighborhood facilities or environmental factors of the community affect physical activities in older adults. A previous study reported that older adults in rural areas have many obstacles to performing regular physical activity [29]. More specifically, in rural areas, there is a lack of health service facilities such as gyms and welfare centers where people can perform active physical activities such as leisure activities and various sports, making it difficult for older adults to take interest in and participate in physical activities for a long time [29]. Therefore, in order to improve the health status level in older adults in non-urban areas by increasing their physical activity, the improvement of the neighborhood environments and the establishment of health-related policies by local governments are required.

In addition, among older adults in urban areas, the use of public health facilities was associated with a higher likelihood of belonging to the physical activity group. This result is thought to be due to the fact that more improvements in lifestyle habits, including the promotion of physical activities, are made in urban older adults since they are given opportunities to receive counseling on chronic disease management requiring an improvement in lifestyle habits or on physical activities from professional health care providers through the use of health institutions. On the other hand, older adults in non-urban areas are more vulnerable in terms of disease management through regular hospital visits or medical checkups [29], and have lower accessibility to public health facilities such as public health centers and branch offices of public health centers, so community health policies should be developed and implemented to reduce the vunerability of rural older adults. Specifically, in order to enable non-urban older adults to maintain healthy lifestyles, including the practice of physical activities, and to efficiently manage various chronic diseases, health service facilities which can fulfill the diverse needs of older adults should be expanded. In addition, it is necessary to increase the number of health professionals in the community, including nurses, so that appropriate exercise prescription and counseling

can be provided for older adults in non-urban areas who are relatively more vulnerable.

Unlike previous studies, this study attempted to identify individual- and regional-level health determinants based on a social-ecological model and to conduct a comprehensive analysis of individual, social and environmental factors affecting physical activity in older adults by region in order to elucidate compositional and contextual factors which contribute to health inequalities between regions. The results of this study can be utilized as basic data for the development of community-based health management programs for older adults which include physical activity promotion. In addition, based on the findings of the present study, community healthcare management professionals will be able to take a comprehensive approach considering various factors when they operate health promotion programs for older adults with chronic diseases.

In a prior study [3], psychological factors such as beliefs about exercise, health attitude, and depression were also reported as significant predictors of physical activity in older adults. However, in this study, psychological factors such as depression and stress were not included in the analysis, and this is one of the limitations of this study. Thus, there is a need to investigate psychological factors affecting physical activities in older adults in a follow-up study. In addition, further analysis of the data used in this study revealed that general characteristics of the subpopulation groups used in the study and those of non-subpopulation groups among older adults aged 65 or older were not homogeneous, so there is a limitation in generalizing the results of this study.

CONCLUSION

This study was conducted using the data from the 2017 Community Health Survey to identify differences in individual, social and environmental factors between urban and non-urban older adults and to identify factors affecting physical activities in older adults by region. Common factors affecting physical activity in both urban and non-urban older adults were found to be current smoking status, current drinking status, obesity level, sleep duration and subjective health status. Among social factors, exchanges of help among neighbors, the frequencies of meeting with neighbors and friends, and regular participation in socializing and leisure activities were identified as common influencing factors. As for environmental factors, the experience of a fall was a common influencing factor for physical activity in both urban and nonurban older adults,

but there were some regional differences. Specifically, satisfaction with the living conditions, satisfaction with public transportation, and the use of medical services were significant factors affecting physical activity among older adults in urban areas, but they were not significant factors for physical activity among those in non-urban areas. Therefore, in order to promote physical activities among older adults in the community, it is necessary to develop strategies for health promotion programs by taking into account social and environmental factors as well as improvements in individual factors in relation to the practice of health behaviors. In addition, since there are regional differences in the physical environment, they should also be considered in developing intervention programs. Furthermore, it is also necessary to develop and establish policies suitable for the community at the level of local governments to narrow health gaps, taking into account regional differences in population composition and diversities in terms of health indicators by identifying factors influencing regional health inequalities.

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