Urban-Rural Differences in the Prevalence of Depressive Symptoms in Korean Adults

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This study aimed to investigate the prevalence of depression among Koreans living in urban and rural areas, stratified by socioeconomic status. The study included 216,765 participants from the 2017 Korean Community Health Survey. Depressive symptoms were assessed using the PHQ-9, with a score of 10 or higher indicating depressive symptoms. Residences with the words Eup and Myeon in their addresses were categorized as rural areas, and residences with Dong in their addresses as urban areas. Socioeconomic status was evaluated by household income and education level. A Poisson regression analysis with sampling weights was conducted and adjusted for demographic, lifestyle, socioeconomic status, and comorbidity. The adjusted prevalence rate of depressive symptoms was 3.33% (95% CI, 3.21-3.45) in urban areas and 2.59% (95% CI, 2.43-2.74) in rural areas. The prevalence of depressive symptoms in urban areas was 1.29 times (95% CI, 1.20-1.38) higher than in rural areas. The prevalence rate ratio for depressive symptoms in urban areas compared to rural areas sorted by monthly incomes was 1.39 (95% CI, 1.28-1.51) for less than 2 million won, 1.22 (95% CI, 1.06-1.41) for 2 to 3.99 million won, and 1.09 (95% CI, 0.90-1.32) for more than 4 million won, and the urban-rural difference was more evident in lower household income subjects (p for interaction=0.033). However, urban-rural differences did not differ according to sex, age, or education level. In conclusion, we found urban-rural differences in depressive symptoms in a representative sample of Koreans, and revealed that these differences may vary according to income level. These results suggest that mental health policy must consider the health disparities according to residence and income.

Key Words: *Depression; Patient Health Questionnaire; Prevalence; Humans*

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INTRODUCTION

Depression is a common mental disorder and a leading cause of disability worldwide. According to the Global Burden of Disease study, the crude prevalence of depressive disorders worldwide was about 3.6%, and the number of patients with depressive disorders increased compared to 1990 (170.8 million to 279.6 million).[1] Based on the epidemiological survey of mental disorders in Korea, it appears that the lifetime prevalence of major depressive disorders has tended to increase every five years (4.0% in 2001, 5.6% in 2006, 6.7% in 2011, 6.1% in 2016).[2,3] Depression causes increased mortality and disease morbidity. It results from a complex interplay of biological, psychological, and social factors.[4] Social determinants affect depression at the individual, social network, community, and social levels.[4]

Place of residence may influence depression.[5-7] Several epidemiological studies have investigated the difference in depression prevalence between urban and rural areas reported inconsistent results.[8-11] And, subgroup analysis according to developed or developing countries reported contextual and population characteristics may affect the association between residence and depression.[8] However, many studies conducted in Korea have focused on specific

groups, such as women, the elderly, and residents of certain regions, rather than the general population.[12-14] There is limited evidence on the differences in depression prevalence between urban and rural areas in the Korean general population. Therefore, we compared the difference in depression prevalence between urban and rural areas using community health survey data representing Koreans and evaluated whether these differences correlated with socioeconomic status. Furthermore, there may be differences in the mechanisms of depression between urban and rural residents. In urban areas, stress and lack of social support are often considered as risk factors for depression.[15] On the other hand, in rural areas, factors such as the lack of material resources and lower socioeconomic status of residents are commonly suggested as contributing factors to depression.[16] So, finding the association between residence and depression and its interaction by socioeconomic status may provide valuable information for the development of targeted interventions and policies aimed at promoting mental health equity across diverse settings. By addressing the disparities in depression prevalence, we hope to contribute to the overall improvement of mental health in both urban and rural areas.

MATERIALS AND METHODS

1. Subjects

This study used data from the 2017 Korean Community Health Survey (KCHS). The KCHS is a nationwide health survey that has been conducted annually since 2008 for adults aged 19 and over. In KCHS, sampling points are selected through probability proportion-to-size systematic sampling. The survey is conducted by trained interviewers who collect information from participants across 18 fields, including health behavior, health checkup, quality of life, education, and social environment. The design of the KCHS was described previously.[17] The 2017 KCHS included 228,381 subjects (102,484 males and 125,897 females). A total of 216,771 participants (99,845 males and 116,926 females) with no missing values were included in the final analysis. This study was covered under the review list pursuant to Article 2.2 of the Enforcement Rule of Bioethics and Safety Act in Korea, and the data were exempted from Institutional Review Board review (IRB no. 1040198-221208-HR-151-01). All data were fully anonymized before the data were provided.

2. Definition of depressive symptoms

The Patient Health Questionnaire-9 (PHQ-9) is a self-administered questionnaire consisting of nine questions assessing depressive symptoms. Each item is scored on a 0-3 point scale, with higher scores indicating more severe symptoms. KCHS used the validated Korean version of the PHQ-9 questionnaire.[18] Total PHQ-9 scores ranged from 0-27, and depressive symptoms were defined as a PHQ-9 score ≥ 10, indicating moderate or severe depressive symptoms, as per previous studies.[19]

3. Covariates

Residential area was defined as an urban area when the residence was classified as "dong", and as a rural area when the residence was classified as "eup" or "myeon". Age was categorized into 4 groups: 19-39, 40-59, 60-79, 80 or over. We calculated body mass index (BMI) from self-reported height and weight values. BMI values < 10 or > 50 were considered abnormal and excluded. BMI was classified as underweight (< 18.5 kg/m^2), normal weight (18.5-24.9 kg/m^2), overweight (25-29.9 kg/m^2), and obese (≥ 30 kg/m^2). Marital status was classified as single, married, or other (divorced, widowed, or separated). Education was classified into middle school or less, high school, and college or higher. Household income was determined according to self-reported monthly or annual household income. Monthly household income was classified as less than 200, 200-399, or 400 ten thousand won or more. Smoking was defined as having smoked more than five packs in a lifetime and was categorized as non-smoker, former smoker, and current smoker. Alcohol consumption was defined as drinking at least once a month over the past year. Physical activity was dichotomized based on whether participants engaged in moderate or vigorous physical activity. Moderate-intensity physical activity was defined as 30 minutes or more of moderate-intensity physical activity for at least five days a week. Vigorous physical activity was defined as 20 minutes or more of high-intensity physical activity on at least three days a week. Subjects were classified as having hypertension, diabetes, or arthritis if they self-reported a doctor's diagnosis of these conditions.

4. Statistical analysis

The general characteristics of the study participants were presented in weighted counts and proportion, stratified by residential area. Comparisons between the two groups were conducted using a chi-square test, taking sample weights into consideration. To evaluate the associations between residential area and depressive symptoms, we applied a multivariate Poisson regression analysis with sampling weight and presented the prevalence rate ratio (PRR) with 95% confidence intervals (CI) for depressive symptoms in urban areas as compared to rural areas. In the multivariate analysis, we adjusted age, sex, BMI, marital status, education level, monthly household income, smoking status, alcohol consumption, hypertension, diabetes, and arthritis. To explore whether the disparity in depressive symptoms between urban and rural areas differed based on sex, age, and socioeconomic status, we incorporated interaction terms for these variables and residential areas into the multivariate model. We then displayed the adjusted prevalence of depressive symptoms by sex, age group, and socioeconomic status for each residential area. Furthermore, we provided the PRR for depression in urban areas relative to rural areas. All analyses were performed using STATA statistical software version 16.0 (Stata Corp., College Station, TX, USA).

RESULTS

Urban residents were younger, more likely to be female and unmarried, and had higher education and income levels than rural residents. Urban residents had higher rate of drinking than rural residents, but lower rates of current smoking, physical activity, and lower body mass index. Urban residents had lower rates of hypertension, diabetes, and arthritis than rural residents, but had higher rates of depressive symptoms (Table 1).

The multivariate adjusted prevalence rate of depressive symptoms was 3.33% (95% CI, 3.21-3.45) in urban areas and 2.59% (95% CI, 2.43-2.74) in rural areas, and the prevalence of depressive symptoms in urban areas was 1.29 times (95% CI, 1.20-1.38) higher than in rural areas. Women had a higher prevalence of depressive symptoms than men in both urban and rural areas, but the PRR of de-

pressive symptoms between urban and rural areas was 1.18 (95% CI, 1.05-1.34) in men and 1.36 (95% CI, 1.25-1.47) in women, which was not statistically different (p for interaction=0.063). In all age groups, the prevalence of depressive symptoms was higher in urban areas compared to rural areas, and the PRR of depressive symptoms between urban and rural areas did not differ according to age (p for interaction=0.797) (Table 2).

At all levels of education, individuals in urban areas had a higher prevalence of depressive symptoms than those in rural areas, and the PRR for depressive symptoms in urban areas compared to rural areas was 1.29 (95% CI, 1.18-1.42) for those with a middle school education or less, 1.41 (95% CI, 1.22-1.62) for those with high school education, and 1.18 (95% CI, 1.01-1.36) for those with a college education or more. However, there was no statistical difference in PRR according to education level (p for interaction=0.223).

TABLE 1. General characteristics of the study subjects according to the residential area

	Urban	Rural	p-value
N	177,109.3 (81.7)	39,655.7 (18.3)	
Sex (men)	88,038.3 (49.7)	20,620.8 (52.0)	<0.001
Age, years	46.4 (16.3)	51.2 (17.5)	<0.001
Age group			<0.001
19-39	65,359.2 (36.9)	11,245.5 (28.4)	
40-59	73,161.2 (41.3)	15,302.8 (38.6)	
60-79	34,290.2 (19.4)	11,082.6 (27.9)	
≥80	4,298.7 (2.4)	2,024.7 (5.1)	
Body mass index, kg/m^2	23.3 (3.3)	23.6 (3.3)	<0.001
Body mass index			<0.001
Underweight	8,646.2 (4.9)	1,877.3 (4.7)	
Normal	120,147.1 (67.8)	25,991.1 (65.5)	
Overweight	42,453.5 (24.0)	10,331.8 (26.1)	
Obese	5,862.4 (3.3)	1,455.4 (3.7)	
Marital status			<0.001
Single	43,235.3 (24.4)	7,030.4 (17.7)	
Married	114,549.7 (64.7)	27,114.3 (68.4)	
Divorce/bereavement/separation	19,324.3 (10.9)	5,511.0 (13.9)	
Education			<0.001
Middle school or less	29,442.8 (16.6)	13,117.0 (33.1)	
High school	51,945.1 (29.3)	12,417.0 (31.3)	
College or more	95,721.4 (54.0)	14,121.7 (35.6)	
Household income, 10,000 KRW			<0.001
Less than 200	35,004.6 (19.8)	13,532.0 (34.1)	
200-399	61,635.1 (34.8)	14,680.0 (37.0)	
400 and more	80,469.6 (45.4)	11,443.7 (28.9)	
Smoking			<0.001
Nonsmoker	110,537.7 (62.4)	23,548.7 (59.4)	
Former smoker	30,786.0 (17.4)	7,655.7 (19.3)	
Current smoker	35,785.6 (20.2)	8,451.3 (21.3)	
Drinking (Yes)	108,453.8 (61.2)	21,354.3 (53.8)	<0.001
Physical activity (Yes)	39,076.6 (22.1)	9,455.2 (23.8)	<0.001
Hypertension (Yes)	33,261.1 (18.8)	9,958.9 (25.1)	<0.001
Diabetes (Yes)	13,499.7 (7.6)	4,206.4 (10.6)	<0.001
Arthritis (Yes)	15,894.9 (9.0)	5,488.7 (13.8)	<0.001
Depressive symptoms (Yes)	5,662.7 (3.2)	1,215.9 (3.1)	0.227

All values were represented as weighted counts (proportion).

TABLE 2. Adjusted prevalence of depressive symptoms by residential area according to sex and age

	Prevalence (95% CI)		Prevalence rate ratio (95% CI)	p for interaction
	Urban	Rural		
Total population	3.33 (3.21-3.45)	2.59 (2.43-2.74)	1.29 (1.20-1.38)	
Sex				0.063
Men	2.16 (2.00-2.31)	1.82 (1.63-2.01)	1.18 (1.05-1.34)	
Women	4.85 (4.57-5.14)	3.58 (3.27-3.88)	1.36 (1.25-1.47)	
Age group				0.797
19-39	5.14 (4.68-5.61)	4.19 (3.58-4.79)	1.23 (1.07-1.42)	
40-59	2.91 (2.7-3.11)	2.15 (1.88-2.42)	1.35 (1.17-1.56)	
60-79	2.47 (2.28-2.66)	1.93 (1.74-2.11)	1.28 (1.15-1.42)	
≥80	3.58 (3.07-4.09)	2.69 (2.27-3.11)	1.33 (1.11-1.60)	

Adjusted for age, sex, marital status, education, household income, body mass index, smoking status, drinking, hypertension, diabetes, and arthritis.

TABLE 3. Adjusted prevalence of depressive symptoms by residential area according to socioeconomic status

	Prevalence (95% CI)		Prevalence rate ratio (95% CI)	p for interaction
	Urban	Rural		
Education level				0.223
Middle school or less	4.44 (4.00-4.70)	3.36 (3.04-3.68)	1.29 (1.18-1.42)	
High school	3.33 (3.10-3.56)	2.36 (2.06-2.66)	1.41 (1.22-1.62)	
College or more	2.73 (2.54-2.91)	2.32 (2.00-2.65)	1.18 (1.01-1.36)	
Household income, 10,000 KRW				0.033
Less than 200	5.32 (5.00-5.64)	3.81 (3.52-4.10)	1.39 (1.28-1.51)	
200-399	2.79 (2.60-2.98)	2.28 (2.00-2.55)	1.22 (1.06-1.41)	
400 or more	2.25 (2.08-2.42)	2.07 (1.70-2.43)	1.09 (0.90-1.32)	

Adjusted for age, sex, marital status, education, household income, body mass index, smoking status, drinking, hypertension, diabetes, and arthritis.

Urban-rural differences in the prevalence of depressive symptoms differed according to household income and were more evident in subjects with a lower household income (p for interaction=0.033). The PRR for depressive symptoms of those living in urban areas compared to rural areas was 1.39 (95% CI, 1.28-1.51) for individuals whose monthly income was less than 2 million won, 1.22 (95% CI, 1.06-1.41) for those making between 2-3.99 million won per month, and 1.09 (95% CI, 0.90-1.32) for individuals making more than 4 million won per month (Table 3).

DISCUSSION

Using the Community Health Survey data representing Koreans, we found that the prevalence of depressive symptoms was 1.29 times higher in those living in urban areas than those in rural areas. Urban-rural differences in the prevalence of depressive symptoms differed according to household income and were more evident in subjects of a lower household income. However, urban-rural differences in the prevalence of depressive symptoms did not vary according to sex, age, and education level.

Previous studies investigating the prevalence of depression in urban and rural areas have produced inconsistent results. While some studies have reported a positive association between urban area residence and depression, including in meta-analyses,[8] others have found no significant difference in depression prevalence between urban and rural areas. A cross-sectional analysis of the Canadian Longitudinal Study on Aging (CLSA) examined 21,241 adults aged 45-85 and found that rural or peri-rural residents had lower CES-D 10 scores than urban residents, which is in line with our findings.[20] However, in the CLSA study, the difference in CES-D scores between urban and rural areas was relatively small, and there was no statistical significance when the CES-D scores were classified by the presence or absence of depressive symptoms. A 2002 Canadian Community Health Survey found that depression was more prevalent in urban areas. Additionally, a study that pooled data from Canadian Community Health Surveys conducted between 2000 and 2014 found that the odds of a major depressive disorder were 18% higher in residents of urban areas compared to rural areas.[21] Another study conducted with the Canadian National Population Health Survey reported a positive association between urban residence and depression.[11] However, in a study in the United States using data from the National Survey of Drug Use and Health in 2009-2011,[22] the odds of major depres-

sion and serious mental illness were higher in small metro and semi-rural areas than in large metro areas, but there were no differences between the rural areas and the large metropolitan areas in adults. This study found no differences in mental disorders in youth between regions (aged 12-17 years). Furthermore, a study conducted in United States adults from National Health Interview Survey reported a higher prevalence in residents in rural areas compared to those in urban areas.[9]

In this study, the prevalence of depressive symptoms was higher in residents of urban areas than in rural areas. This may be due to several causes. Urbanization is linked to various social problems, including an increased prevalence of mental illness, particularly depression. This relationship is possibly linked to urban growth, as urbanization is associated with an increase in the prevalence of mental disorders.[23,24] First, residents in urban areas often have higher rates of social isolation and a lack of social support networks, which may contribute to the development of depressive symptoms.[23] Second, residents of urban areas are exposed to more stressors than those in rural areas.[25,26] For example, urban areas have stressors such as noise pollution, traffic, and crime, which may contribute to the development of depressive symptoms. Third, those living in urban areas often have higher rates of poverty, unemployment, and financial stress. Individuals of lower socioeconomic status are more likely to experience mental disorders, particularly depression.[27,28] Fourth, environmental factors, such as poor air quality, a lack of green space, and insufficient natural light, which are more prevalent in urban areas, may contribute to the development of depressive symptoms.[29,30] Fifth, the sense of belonging and identity provided by a community has a significant impact on mental health.[10,31] A sense of belonging to a community is important for mental health support because it can reduce anxiety, increase self-esteem, and positively influence health-promoting behaviors.[32,33] A study that compared the three types of place identity showed affective and evaluative place identity was higher in rural areas than urban areas.[34] Finally, lifestyle factors such as smoking, alcohol consumption, and physical activity may also contribute to differences in the prevalence of depressive symptoms between urban and rural areas.[35-37] Our study also found that urban residents had higher rates of smoking and alcohol consumption and lower levels of physical activity when compared to rural residents. We considered these lifestyle variables in our multivariate analysis.

In addition, the disparity by income level was higher in urban areas than in rural areas in our study. While there is limited evidence about the interaction between residential locations and income on depression, one possible explanation for our findings is the health effects of relative deprivation. According to the "relative deprivation model," low-income individuals in wealthy areas may experience more economic stress and are more likely to experience depression than low-income individuals in low-income areas. When considering the population structure in rural areas and the poverty rate of the elderly population in Korea, individuals with low absolute income are likely to experience higher economic stress in urban areas than in rural areas, and may therefore have a higher risk of depression.[38,39]

Our study has the advantage of being conducted in a large-scale representative sample of Korea. However, this study has some limitations. First, the region was divided into rural and urban areas, but it should be further subdivided according to the level of urbanization. Second, in this study, only individual-level characteristics were evaluated as factors influencing regional health disparities. Further studies are needed to evaluate regional-level characteristics that affect urban-rural differences in depression prevalence.

In conclusion, we found urban-rural differences in depressive symptoms in a representative sample of Koreans and revealed that these differences may vary according to income level. These results suggest that mental health policy must consider the health disparities according to residence and income.

CONFLICT OF INTEREST STATEMENT

None declared.

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