



The residential, area-specific prevalence and associated factors of suicidal ideation among South Korean adolescents

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ABSTRACT

Objectives: This study investigated the residential, area-specific prevalence and associated factors of suicidal ideation among adolescents in South Korea, based on nationally representative data.

Methods: A secondary analysis was performed using the database of the 17th Korean Youth Health Behavior Survey, which contained data from 54,848 adolescents.

Results: Female adolescents (more influential in counties), low economic status (more influential in metropolitan cities), perceived stress (more influential in metropolitan cities), depression (more influential in counties), loneliness (more influential in counties), and anxiety (more influential in counties) were influencing factors in all areas, and the factors associated with suicidal ideation differed by residential area. The factors related to suicidal ideation were similar by residential area, but the degree of relevance differed from area to area; in particular, the prevalence of variables related to mental health (depression, loneliness, and anxiety) was high in counties. Alcohol drinking was significant only in small- and medium-sized cities in terms of suicidal ideation.

Conclusion: Suicide prevention programs for adolescents should be implemented given the higher incidence of suicidal ideation among female adolescents, the greater influence of mental health-related variables in counties, and the influence of smoking in cities. There were differences in the prevalence and risk factors of suicidal ideation by residential areas.

1. Introduction

Suicide is a major international public health problem, with an estimated 700,000 deaths worldwide annually (World Health Organization, 2021). Among adolescents, suicide is a leading cause of death globally (Bilsen, 2018) and in South Korea (Statistics Korea, 2021). Adolescents go through rapid physical and psychological changes during the transition from childhood to adulthood (Jeong et al., 2020), and suicide and suicidal behavior are public health issues that require special attention for adolescents. According to the 2021 Korean Youth Health Behavior Survey (KYHBS)—a national survey on loneliness and anxiety in adolescents—the suicidal ideation rate, suicide plan, and suicide attempt among adolescents in South Korea was 12.7%, 4.0%, and 2.2%, respectively (Ministry of Education, 2021).

Mental health problems have a significant effect on adolescent suicidal behavior (Adewuya and Oladipo, 2020; Amit et al., 2020; Orri et al., 2020; Pandey et al., 2019). Stress significantly increases the risk of depression, suicidal ideation (Choi and Yang, 2021). The risk of suicidal

ideation is significantly higher in the presence of depression (Orri et al., 2020), and loneliness and anxiety significantly increase the risk of suicidal ideation and suicide attempts (Pandey et al., 2019).

The KYHBS was launched in 2020, and several studies in South Korea have been trying to investigate the effects of stress, depression, loneliness, and generalized anxiety disorder (GAD) on adolescent suicidal ideation. However, only the status of these mental problems has been investigated. There is regional inequality in the suicide rate of adolescents in counties, where the suicide rate is highest, but the suicidal ideation rate is higher in cities compared to counties (Goldman-Mellor et al., 2018). Although many studies show significant gender differences in suicidal ideation rates and in factors related to suicidal ideation (Jeon et al., 2012; Miranda-Mendizabal et al., 2019), studies on the suicidal ideation rate by residential area and related factors are limited. Hence, this study aims to provide basic data for youth suicide prevention by identifying adolescents' suicidal ideation and related factors by residential area.

Specifically, this study (1) compares the general characteristics of

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adolescents by residential area; (2) compares the general characteristics of adolescents by residential area and the suicidal ideation rate according to mental health problems; (3) analyzes the influences of general characteristics and mental health problems by residential area on the risk of suicidal ideation.

2. Materials and methods

2.1. Study design and participants

This study is a secondary analysis that explores the effect of adolescent mental health on suicidal ideation, using raw data from the 2021 KYHBS (Ministry of Education, 2021). The KYHBS is an anonymous, self-reported, online, government-approved statistical survey (approval #117058) that has been conducted every year since 2005. To understand the current status and trend of South Korean youth's health-related behaviors (such as smoking, drinking), the KYHBS surveys youth from the first year of middle school through the third year of high school (Ministry of Education, Korea Disease Control and Prevention Agency, 2022). Statistics on the health behaviors of South Korean adolescents are calculated, and the data are used to plan and evaluate health policies and health promotion projects related to adolescents (Ministry of Education, Korea Disease Control and Prevention Agency, User's Guidelines of the Raw Data from the Korea Youth Risk Behavior Survey [the 1st ~ the 17th editions], 2022). In the 2021 KYHBS, respondents were selected through random stratified cluster sampling data were collected from 54,848 out of 59,066 students at 796 schools (response rate: 92.9%). The present study was conducted using raw data from the Korea Control and Prevention Agency (Ministry of Education, 2021). This study's conceptual framework is drawn from the background and presented in Fig. 1.

2.2. Measurements

2.2.1. Mental health and suicidal ideation

Variables related to mental health include stress, depression, loneliness, and GAD. The degree of stress was measured by asking "How much stress do you normally feel?" The participants could choose from "I feel very much," "I feel a lot," "I feel a little," "I do not feel much," or "I do not feel it at all." Perceived stress, measured in 5 categories, was divided into "much (feel it very much, feel it a lot)" and "less (feel it a little, do not feel much, do not feel it at all)." As for depression, respondents could answer "yes" or "no" to the question "Have you ever felt so sad or hopeless that you stopped your daily life for two weeks in the past 12 months?"

Loneliness was measured by responding to the question, "In the past

12 months, how often have you felt lonely?" Respondents could choose from "I felt lonely all the time," or "I felt lonely often" (which were classified as "lonely") or "I felt lonely sometimes," "I rarely felt lonely," or "I did not feel lonely at all" (which were classified as "not lonely"). GAD was measured using the GAD-7 tool developed by Spitzer et al., consisting of 7 items (Spitzer et al., 2006). Information about GAD was gathered by asking, "Over the last 2 weeks, how often have you been bothered by the following problems?" Respondents could choose from "Feeling nervous, anxious or on edge," "Not able to stop or control worrying," "Worrying too much about different things," "Trouble relaxing," "Being so restless that it is hard to sit still," "Becoming easily annoyed or irritable," and "Feeling afraid as if something awful might happen." In addition, for these 7 items, each item was rated by the respondents as *not disturbed at all* (0), *interrupted for several days* (1), *interrupted for more than three days* (2), and *interrupted nearly every day* (3). GAD was divided into severity levels of normal (0–4 points), mild (5–9 points), moderate (10–14 points), and severe (15–21 points) by summing the scores of the 7 items (Spitzer et al., 2006). The reliability of the instrument in this study was 0.90. As for the outcome variable of suicidal ideation, respondents could answer "yes" or "no" to the question, "Have you had serious suicidal thoughts in the past 12 months?"

2.3. Data analysis

The data were analyzed using SAS 9.4. During the analysis, stratification, clustering, and weighting were applied according to the sample design of the KYHBS. The statistical significance level was set at <0.05 (a two-tailed test). Descriptive statistical analysis was performed to establish the respondents' characteristics. A chi-square test was conducted to compare the prevalence of suicidal thoughts according to the participants' characteristics and mental health level, and logistic regression was performed to identify factors affecting suicidal ideation. The results of logistic regression are represented as odds ratios (ORs) with 95% confidence intervals (CIs). The correlation coefficient between variables was 0.005–0.464, indicating not highly correlated. The multiple collinearity analysis revealed variance inflation of 1.004–1.549 and 0.645–0.996 tolerance, indicating that the multicollinearity between the variables was not strong.

3. Results

3.1. Participants' general characteristics by residential area

Overall, the participants were 54,848; 51.7% were male and 48.3% were female. There was no significant difference in gender distribution by residential area. For school performance, 37.1% of the respondents belonged to the "upper" level, and 31.9% belonged to the "lower" level. The proportion of poor test scores was 30.5% in metropolitan cities and 33.4% in counties, highlighting a significant difference in the distribution of test grades by residential area. Moreover, 40.1% of respondents identified as having a high economic status and 10.9% had a low economic status. In metropolitan cities, these figures were 41.7% and 10.9%, respectively, whereas they were 33.4% and 12.9% respectively in counties, indicating a significant difference between residential areas regarding the distribution of economic status levels (Table 1).

The smoking rate was 4.5%, demonstrating no significant difference by residential area, while the drinking rate was 10.7% overall; the drinking rate was 9.7% in metropolitan cities and significantly higher in counties at 14.2%. Among the respondents, 38.8% get stressed out "a lot." The rate of high stress was significantly high in counties at 39.3%; 38.4% in metropolitan cities, and 39.0% in small- and medium-sized cities. Loneliness was experienced by 16.0% of the respondents, with 15.3% in metropolitan areas and 16.5% in small- and medium-sized cities and counties, significantly higher than in large cities. As for GAD, severe anxiety was high in counties at 4.4% compared to (3.9% in large cities and 4.2% in small- and medium-sized cities), but the regional

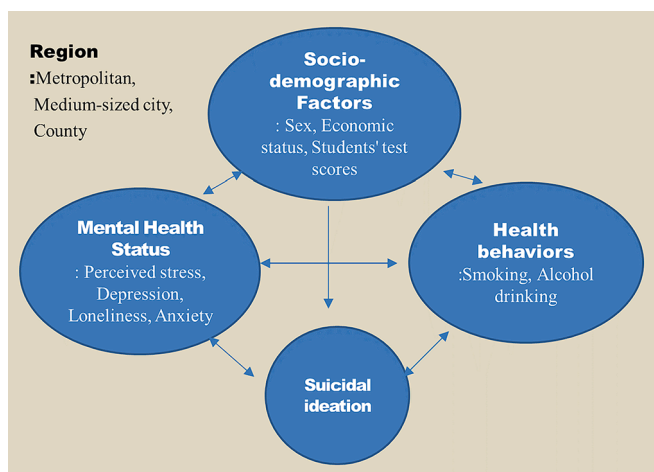


Fig. 1. Conceptual framework: influencing factors of suicidal ideation.

Table 1
Distribution of general characteristics among South Korean adolescents according to residential area in 2021.

| Variables | | Total | | Metropolitan | | Small and medium-sized city | | County | | Rao-Scott Chi | p |
|--------------------------|----------|--------|------|--------------|------|-----------------------------|------|--------|------|---------------|--------|
| | | N | % | N | % | N | % | N | % | | |
| Sex | Male | 28,401 | 51.7 | 12,282 | 51.6 | 13,886 | 51.4 | 2,233 | 54.2 | 0.28 | 0.870 |
| | Female | 26,447 | 48.3 | 11,580 | 48.4 | 12,978 | 48.6 | 1,889 | 45.8 | | |
| Students' test scores | Upper | 20,528 | 37.1 | 9,345 | 38.9 | 9,737 | 35.9 | 1,446 | 35.0 | 39.02 | <0.001 |
| | Middle | 16,903 | 31.0 | 7,274 | 30.5 | 8,328 | 31.3 | 1,301 | 31.6 | | |
| | Lower | 17,417 | 31.9 | 7,243 | 30.5 | 8,799 | 32.8 | 1,375 | 33.3 | | |
| Economic status | Upper | 21,568 | 40.1 | 9,814 | 41.7 | 10,389 | 39.7 | 1,365 | 33.4 | 36.18 | <0.001 |
| | Middle | 27,077 | 49.0 | 11,402 | 47.4 | 13,464 | 49.7 | 2,211 | 53.8 | | |
| | Lower | 6,203 | 10.9 | 2,646 | 10.9 | 3,011 | 10.7 | 546 | 12.9 | | |
| Smoking | No | 52,444 | 95.5 | 22,921 | 95.9 | 25,617 | 95.3 | 3,906 | 94.7 | 5.80 | 0.055 |
| | Yes | 2,404 | 4.5 | 941 | 4.1 | 1,247 | 4.7 | 216 | 5.3 | | |
| Drinking | No | 49,045 | 89.3 | 21,603 | 90.3 | 23,913 | 88.8 | 3,529 | 85.8 | 23.25 | <0.001 |
| | Yes | 5,803 | 10.7 | 2,259 | 9.7 | 2,951 | 11.2 | 593 | 14.2 | | |
| Perceived stress | Less | 33,603 | 61.2 | 14,732 | 61.6 | 16,366 | 61.0 | 2,505 | 60.7 | 0.82 | 0.663 |
| | A lot | 21,245 | 38.8 | 9,130 | 38.4 | 10,498 | 39.0 | 1,617 | 39.3 | | |
| Depression | No | 40,156 | 73.2 | 17,758 | 74.3 | 19,437 | 72.5 | 2,961 | 72.4 | 10.14 | 0.006 |
| | Yes | 14,692 | 26.8 | 6,104 | 25.7 | 7,427 | 27.5 | 1,161 | 27.6 | | |
| Loneliness | No | 46,093 | 84.0 | 20,231 | 84.7 | 22,419 | 83.5 | 3,443 | 83.5 | 7.66 | 0.022 |
| | Yes | 8,755 | 16.0 | 3,631 | 15.3 | 4,445 | 16.5 | 679 | 16.5 | | |
| General anxiety disorder | Minimal | 35,664 | 64.7 | 15,770 | 65.6 | 17,241 | 64.0 | 2,653 | 64.2 | 12.32 | 0.055 |
| | Mild | 12,479 | 23.0 | 5,306 | 22.5 | 6,211 | 23.3 | 962 | 23.4 | | |
| | Moderate | 4,471 | 8.3 | 1,867 | 8.0 | 2,276 | 8.6 | 328 | 8.0 | | |
| | Severe | 2,234 | 4.1 | 919 | 3.9 | 1,136 | 4.2 | 179 | 4.4 | | |
| Suicidal ideation | No | 47,892 | 87.3 | 20,963 | 87.9 | 23,313 | 86.7 | 3,616 | 87.9 | 10.25 | 0.006 |
| | Yes | 6,956 | 12.7 | 2,899 | 12.1 | 3,551 | 13.3 | 506 | 12.1 | | |

distribution of GAD was not statistically significant. The share of students experiencing suicidal ideation was highest in small- and medium-sized cities (13.3%) and was significantly lower (12.1%) in metropolitan cities and counties than in small- and medium-sized cities.

3.2. Comparison of suicidal ideation rates according to the participants' general characteristics by residential area

When comparing the rates of suicidal ideation by gender in metropolitan cities, small- and medium-sized cities, as well as counties, female adolescents had significantly higher rates of suicidal ideation than male adolescents. In counties, male adolescents had an 8.3% suicidal ideation rate, while female adolescents had a 16.7% rate, indicating a

Table 2
Comparison of suicidal ideation by general characteristics and residential area among South Korean adolescents in 2021.

| | | Metropolitan | | Small and medium-sized city | | County | |
|--------------------------|----------|--------------|--------|-----------------------------|--------|--------|--------|
| | | % | p | % | p | % | p |
| Sex | Male | 8.9 | <0.001 | 10.2 | <0.001 | 8.3 | <0.001 |
| | Female | 15.4 | | 16.6 | | 16.7 | |
| Students' test scores | Upper | 11.1 | <0.001 | 11.8 | <0.001 | 11.4 | <0.001 |
| | Middle | 10.7 | | 12.2 | | 10.0 | |
| | Lower | 14.6 | | 16.0 | | 14.9 | |
| Economic status | Upper | 10.8 | <0.001 | 11.7 | <0.001 | 11.0 | <0.001 |
| | Middle | 11.2 | | 12.6 | | 10.8 | |
| | Lower | 20.4 | | 22.6 | | 20.7 | |
| Smoking | No | 11.5 | <0.001 | 12.7 | <0.001 | 11.5 | <0.001 |
| | Yes | 24.8 | | 25.3 | | 24.1 | |
| Drinking | No | 11.2 | <0.001 | 12.2 | <0.001 | 10.8 | <0.001 |
| | Yes | 19.5 | | 21.7 | | 20.2 | |
| Perceived stress | Less | 4.3 | <0.001 | 5.1 | <0.001 | 4.3 | <0.001 |
| | A lot | 24.5 | | 26.2 | | 24.3 | |
| Depression | No | 4.7 | <0.001 | 5.0 | <0.001 | 4.2 | <0.001 |
| | Yes | 33.1 | | 35.1 | | 32.9 | |
| Loneliness | No | 7.1 | <0.001 | 8.0 | <0.001 | 6.6 | <0.001 |
| | Yes | 39.6 | | 40.2 | | 40.2 | |
| General anxiety disorder | Minimal | 4.4 | <0.001 | 5.3 | <0.001 | 4.1 | <0.001 |
| | Mild | 18.6 | | 19.5 | | 16.5 | |
| | Moderate | 35.9 | | 35.8 | | 42.2 | |
| | Severe | 54.3 | | 55.5 | | 52.4 | |

considerable difference. As for the suicidal ideation rate according to participants' test scores, it was low in metropolitan cities and counties with mid-level performance, while the highest rate occurred in all areas with lower school performance. Differences in the suicidal ideation rate according to school performance were statistically significant. The suicidal ideation rate was highest among adolescents with low economic status; in small- and medium-sized cities in particular, the suicidal ideation rate was 22.6%, higher than in other kinds of residential areas. In metropolitan and small- and medium-sized cities, the lower the economic status, the higher the suicidal ideation rate, whereas in counties, the mid-level economic group showed the lowest suicidal ideation rate. In all regions, the suicidal ideation rate was more than twice as high among smokers compared to non-smokers. Moreover, in all areas, the suicidal ideation rate was significantly higher among drinkers than non-drinkers.

The suicidal ideation rate in the group with "less" stress ranged from 4.3 to 5.1%, whereas in the group with "a lot" of stress ranged from 24.3 to 26.2%. There was a significant difference in the suicidal ideation rate according to the stress level. The suicidal ideation rate for those who experienced depression for more than two weeks in the past year was 33.1–35.1%, which was 7–8 times higher than the range of 4.2–5.0% among those who had not. The suicidal ideation rate in the group that did not experience loneliness was 6.6–8.0%, and in the group that experienced loneliness, the suicidal ideation rate was very high at 39.6–40.2%, revealing a statistically significant difference. In all areas, the more severe the level of GAD, the higher the suicidal ideation rate (Table 2).

3.3. Factors associated with suicidal ideation by area

Multivariate logistic regression was performed to determine the influence of factors affecting suicidal ideation, including mental health problems (Table 3). In metropolitan cities, gender, economic status, smoking, stress, depression, loneliness, and GAD had significant effects on suicidal ideation. Female adolescents had a 1.34 times higher OR for suicidal ideation than male adolescents, and the OR for suicidal ideation was 1.40 times higher in the group with "lower" economic status than in the group with "upper" economic status. Smokers had 1.60 times higher OR for suicidal ideation than non-smokers. As mental health problems, stress, depression, loneliness, and GAD appeared to have a significant effect on suicidal ideation, the group with moderate GAD had 2.86 times higher OR for suicidal ideation, and the group with mild GAD had 2.04 times higher OR for suicidal ideation compared to those with minimal GAD. In contrast to the group that did not experience depression, the OR for suicidal ideation was 3.98 times higher in the group reporting depression, 2.41 times higher in the case of loneliness, and 2.29 times higher in the case of high-stress levels.

In small- and medium-sized cities, gender, economic status, smoking, drinking, stress, depression, loneliness, and GAD were factors that significantly influenced suicidal ideation. Female adolescents had 1.23 times higher OR of suicidal ideation than male adolescents, and the OR of suicidal ideation was 1.42 times higher in the group with "lower" economic status than in the group with "upper" economic status. The OR for suicidal ideation was 1.22 times higher among smokers than non-drinkers. Stress, depression, loneliness, and GAD were all significant factors for suicidal ideation. In the case of severe GAD, compared to the group with minimal GAD, the OR of suicidal ideation was 4.21 times higher, that of the group with moderate GAD was 2.46 times higher, and that of the group with mild GAD was 1.78 times higher. In contrast to the group without psychiatric symptoms (depression, loneliness, or stress), the OR of suicidal ideation was 4.33 times higher in the group reporting depression, 2.31 times higher in the case of loneliness, and 2.15 times higher in the case of "a lot" of stress.

In counties, gender, economic status, stress, depression, loneliness, and GAD had significant effects on suicidal ideation, while school performance, smoking, and drinking did not. Female adolescents exhibited

Table 3
Analysis of the influencing factors of suicidal ideation by residential area among South Korean adolescents in 2021.

| Variables (Reference) | | Odds ratio | 95 % CI | | p value |
|------------------------------------|--------------------|------------|---------|-------|---------|
| | | | Upper | Lower | |
| Metropolitan city | | | | | |
| Sex (male) | Female | 1.34 | 1.19 | 1.50 | <0.001 |
| Students' test scores (upper) | Middle | 0.91 | 0.79 | 1.04 | 0.168 |
| | Lower | 0.93 | 0.82 | 1.06 | 0.255 |
| Economic status (upper) | Middle | 1.02 | 0.92 | 1.15 | 0.682 |
| | Lower | 1.40 | 1.20 | 1.64 | <0.001 |
| Smoking (no) | Yes | 1.60 | 1.23 | 2.08 | 0.001 |
| Drinking (no) | Yes | 1.12 | 0.93 | 1.33 | 0.231 |
| Perceived stress (less) | A lot | 2.29 | 2.04 | 2.58 | <0.001 |
| Depression (no) | Yes | 3.98 | 3.55 | 4.46 | <0.001 |
| Loneliness (no) | Yes | 2.41 | 2.16 | 2.70 | <0.001 |
| General anxiety disorder (minimal) | Mild | 2.04 | 1.79 | 2.33 | <0.001 |
| | Moderate | 2.86 | 2.44 | 3.34 | <0.001 |
| | Severe | 4.32 | 3.57 | 5.21 | <0.001 |
| Small and medium-sized city | | | | | |
| Sex (male adolescents) | Female adolescents | 1.23 | 1.11 | 1.37 | <0.001 |
| Students' test scores (upper) | Middle | 0.96 | 0.85 | 1.08 | 0.489 |
| | Lower | 0.95 | 0.84 | 1.08 | 0.420 |
| Economic status (upper) | Middle | 1.03 | 0.92 | 1.14 | 0.616 |
| | Lower | 1.42 | 1.22 | 1.64 | <0.001 |
| Smoking (no) | Yes | 1.40 | 1.13 | 1.72 | 0.002 |
| Drinking (no) | Yes | 1.22 | 1.06 | 1.39 | 0.005 |
| Perceived stress (less) | A lot | 2.15 | 1.90 | 2.43 | <0.001 |
| Depression (no) | Yes | 4.33 | 3.90 | 4.81 | <0.001 |
| Loneliness (no) | Yes | 2.31 | 2.06 | 2.60 | <0.001 |
| General anxiety disorder (minimal) | Mild | 1.78 | 1.55 | 2.03 | <0.001 |
| | Moderate | 2.46 | 2.11 | 2.88 | <0.001 |
| | Severe | 4.21 | 3.50 | 5.07 | <0.001 |
| County | | | | | |
| Sex (male adolescents) | Female adolescents | 1.38 | 1.05 | 1.81 | 0.022 |
| Students' test scores (upper) | Middle | 0.84 | 0.62 | 1.13 | 0.237 |
| | Lower | 1.21 | 0.95 | 1.54 | 0.126 |
| Economic status (upper) | Middle | 0.94 | 0.69 | 1.29 | 0.700 |
| | Lower | 1.39 | 1.06 | 1.84 | 0.020 |
| Smoking (no) | Yes | 1.52 | 0.98 | 2.37 | 0.061 |
| Drinking (no) | Yes | 1.20 | 0.86 | 1.68 | 0.273 |
| Perceived stress (less) | A lot | 1.96 | 1.51 | 2.54 | <0.001 |
| Depression (no) | Yes | 4.35 | 3.40 | 5.56 | <0.001 |
| Loneliness (no) | Yes | 2.72 | 2.10 | 3.52 | <0.001 |
| General anxiety disorder (minimal) | Mild | 1.83 | 1.31 | 2.55 | 0.001 |
| | Moderate | 3.69 | 2.55 | 5.36 | <0.001 |
| | Severe | 4.56 | 3.04 | 6.83 | <0.001 |

1.38 times higher OR of suicidal ideation than male adolescents, and the OR for suicidal ideation was 1.39 times higher in the group with "lower" economic status than in the group with "upper" economic status. Stress, depression, loneliness, and GAD were all significant factors influencing suicidal ideation. In the case of severe GAD, the OR of suicidal ideation was 4.56 times higher, 3.69 times higher in the group with moderate GAD, and 1.83 times higher in the group with mild GAD in comparison with the group with minimal GAD. Compared to the non-depressed group, the OR of suicidal ideation was 4.35 times higher in the group that reported depression, 2.72 times higher in the case of loneliness, and 1.96 times higher in the case of high stress.

4. Discussion

Among adolescents, being female, having a low economic status, perceived stress, depression, loneliness, and anxiety were influencing factors in general in all areas. The factors related to suicidal ideation were similar, but the degree of relevance differed by area; in particular, the relevance of variables related to mental health (depression, loneliness, and anxiety) was high in counties. Alcohol drinking was significant only in small and medium-sized cities for suicidal ideation. This study confirmed that female adolescents' suicidal ideation was high, the influence of mental health-related variables in counties was greater, and the influence of smoking was significant in all cities. This study reveals that the suicidal ideation rate among South Korean adolescents was 12.7% in 2021. This is lower than the reported suicidal ideation rate of 14.0% in a study of adolescents from 82 countries between 2003 and 2015, but is higher than the 8.0% suicidal ideation rate among adolescents in Asian countries (Biswas et al., 2020).

Mental health problems such as stress, depression, loneliness, and anxiety are significant factors influencing suicidal ideation. A study that analyzed raw data on adolescent health behaviors in South Korea from 2007 to 2017 revealed that depression was the factor most strongly associated with suicidal ideation (Jeong et al., 2020); loneliness and anxiety were not investigated during that period (Ministry of Education, Korea Disease Control and Prevention Agency, 2022). In terms of the OR, the risk of suicidal ideation was higher in patients with severe anxiety (rather than depression) than among those without anxiety. Therefore, when scrutinizing the degree of anxiety's influence on suicidal ideation, anxiety has as much influence as depression. Hence, in exploring the relationship between mental health problems and suicidal ideation, several mental health problems should be considered simultaneously. A study of Nepalese adolescents found that students who experienced anxiety had a 2.32 times greater risk of suicidal ideation compared to students without anxiety, while those with loneliness had a 2.54 times higher risk of suicidal ideation (Pandey et al., 2019). In a study on adolescents, the suicidal ideation rate was significantly higher when the participants did not have any friends and when experiencing loneliness (Biswas et al., 2020). These studies support the results of the present research.

Studies of suicidal ideation by region show inconsistent outcomes. Some studies indicate that the suicidal ideation risk is significantly higher in rural areas than in urban ones (Nguyen et al., 2022), but others found that to be significantly lower in rural areas than in urban zones (Tasnim et al., 2020). Another study demonstrated that the suicidal ideation rate was lower in counties than in cities, even though the actual suicide rate was higher in counties (Goldman-Mellor et al., 2018). The regional effect on suicidal ideation exhibited conflicting results, but the regional variable was a significant factor influencing suicidal ideation. It was difficult to find a prior study that analyzed the degree of influence of mental health problems (such as stress, depression, loneliness, and anxiety) on suicidal ideation by region.

This study is meaningful in that it identifies the influence of general characteristics and mental health problems on suicidal ideation by residential areas. The ORs of those with severe anxiety were 4.56 in counties, 4.32 in metropolitan areas, and 4.21 in small- and medium-sized cities. The OR turned out to be the highest in counties. In the presence of loneliness, the OR of suicidal ideation was 2.72 in counties, 2.41 in metropolitan cities, and 2.31 in small- and medium-sized cities. The OR was also highest in counties. In addition, the OR for suicidal ideation according to the experience of depression was 4.35 in counties, 4.33 in small- and medium-sized cities, and 3.98 in metropolitan areas. The OR was once again the highest in counties.

The OR for suicidal ideation according to the degree of stress was 2.29 in metropolitan areas, 2.15 in small- and medium-sized cities, and 1.96 in counties. The OR of suicidal ideation according to the degree of stress was the highest in metropolitan cities. In this study, the proportion of adolescents who experienced stress, depression, loneliness, and severe

anxiety disorders was highest in counties, and the influence of depression, loneliness, and anxiety on suicidal ideation—except for stress—was greater than in other areas. In this respect, it is necessary to pay more attention to adolescents' mental health problems to prevent adolescent suicides in rural areas, as well as to develop and apply suicide prevention programs targeting adolescents with mental health problems.

In the case of small- and medium-sized cities, the impact of depression, loneliness, and anxiety disorders on suicidal ideation was small compared to other types of areas, but attention must be paid to the fact that the rate of experiencing suicidal ideation due to depression, loneliness, and severe anxiety resulted in the highest ORs for suicidal ideation. In small- and medium-sized cities, smoking and drinking had significant effects on suicidal ideation, along with mental health problems, and the OR for suicidal ideation was greater than in other areas. It is thus necessary to consider health behaviors such as drinking and smoking.

In the current study, female students displayed a higher suicidal ideation rate than male students, which corroborated the outcomes of other studies (Jeon et al., 2012; Miranda-Mendizabal et al., 2019; Orri et al., 2020). Many previous studies have reported that women face a greater risk of suicidal ideation than men, so the development of suicide prevention programs that take gender differences into account is required. In addition, the risk of suicidal ideation proved statistically and significantly higher in the case of lower economic status, which results are similar to those of prior studies (Biswas et al., 2020). As such, it is necessary to consider strategies to reduce the gap in suicidal ideation according to economic status.

The areas were classified into three regions based on their common characteristics—metropolitan, small and medium-sized cities, and counties. Large cities are overpopulated areas with relatively large schools, a remarkable gap between the rich and poor, and minimal interaction with neighbors compared to rural areas. In rural areas, opportunities for private education rarely exist, making the gap in academic ability among students insignificant (Woo, 2011; Byun et al., 2018).

In South Korea, youth suicide prevention policies have not differentiated according to residential areas. However, the South Korean government aims to present and implement overall suicide prevention policies. These policies are as follows: First, supporting mental health services for survivors of suicide attempters with a high risk of suicide; second, mental health screening during health checkups; third, strengthening treatment for mental illnesses such as depression, bipolar disorder, and schizophrenia; and fourth, monitoring the provision of suicide information, and fifth, strengthening follow-up management after suicidal thoughts and suicide attempts. According to the Ministry of Health and Welfare (2024), a customized suicide prevention policy should be implemented according to various age groups and regions in the future.

5. Conclusion

This study analyzed representative data of South Korean adolescents and found a significant difference in the suicidal ideation rate among adolescents by residential areas; the factors influencing suicidal ideation among adolescents and their degree also differed by residential areas. This is meaningful in that the findings can be used to identify adolescent groups at high risk for suicidal ideation and to develop suicide prevention strategies tailored to regional characteristics. However, since cross-sectional data were used, care and caution must be taken in interpreting the factors influencing suicidal ideation as causal relationships. In the future, it will be necessary to conduct research to explore the causes of differences in the suicidal ideation rate by residential area and the differences in related factors and degrees of influence. In this study—except for GAD—suicidal ideation, loneliness, depression, and stress were measured with a single item, so the instrument's reliability or

validity was limited. Nonetheless, the study's secondary data are nationally representative samples that cover adolescents in the entire South Korean country, and it has the advantage of looking at their mental health at the national level. In Additionally, KYRBS has been conducted in South Korea for a long time, providing a variety of evidence and various health policies at the national level (Kim et al., 2016). In future studies, the relationship between mental health problems and suicidal ideation in adolescents should be explored in depth, using a measurement tool whose reliability and validity have been confirmed.

6. Ethics approval and consent to participate

The ethics committee of Jeju National University approved this study, reference number JJNU-IRB-2022-077. Written informed consent was obtained from all participants and all methods were carried out in accordance with relevant guidelines and regulations.

Author contributions

HL and EP contributed to study design, data collection, analysis, interpretation, drafting of a research manuscript, and final approval of the manuscript for publication. EP was responsible for literature reviews and analyzing the data. All authors contributed to an interpretation of the results. The authors read and approved of the final manuscript.

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CRediT authorship contribution statement

Eunok Park: Writing – review & editing, Writing – original draft, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Hyo Young Lee:** Writing – review & editing, Writing – original draft, Visualization, Validation, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data.

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