

Social Vulnerability and Suicide Risk Among Seoul Residents: Evidence for Targeted Prevention

Subin Park

Korea University

Euntaek Hong

Korea University

Gaeun Son

Korea University

Jihee Jang

Sungkyunkwan University School of Medicine

Kee-Hong Choi

kchoi11@korea.ac.kr

Korea University

Research Article

Keywords: Social determinants of health, Mental health, Suicide, South Korea

Posted Date: May 21st, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-9670815/v1>

License:  This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

Additional Declarations: No competing interests reported.

Version of Record: A version of this preprint was published at BMC Public Health on July 28th, 2026. See the published version at <https://doi.org/10.1186/s12889-026-28691-5>.

Abstract

Background

Suicide is a major public health problem in South Korea, where the suicide rate substantially exceeds the OECD average. However, research investigating the moderating role of social vulnerability on the relationship between mental health outcomes and suicide risk is relatively limited. The present study aims to investigate (i) whether socially vulnerable groups exhibit worse mental health, (ii) whether social vulnerability independently predicts suicide risk, and (iii) whether social vulnerability moderates the associations between psychological factors and suicide risk.

Method

From October 6 to October 12, 2023, an online survey was conducted with 1,000 Seoul residents stratified by sex, age, and residential district. After excluding invalid responses, 995 participants were analyzed. In this study, we examined group differences using independent samples t-tests, predictors of suicide risk via multivariate regression with heteroscedasticity-consistent standard errors (HC3), and conducted moderation analyses using PROCESS Macro Model 1.

Results

238 out of 995 respondents were classified as SVG (23.9%). SVGs exhibited worse mental health outcomes and a higher risk of suicide compared to non-SVGs. Social vulnerability remained a significant independent predictor of suicide risk after controlling for psychosocial covariates. Moderation analyses revealed that social vulnerability significantly amplified the associations between depression and suicide risk ($B = 0.12, p = .008$) and between PTSD symptoms and suicide risk ($B = 0.19, p < .001$).

Conclusion

SVGs were more vulnerable to suicide risk when they were exposed to psychosocial risk factors, particularly in terms of depression and post-traumatic distress. Together, our findings highlight social vulnerability as a critical factor in suicide prevention strategies. This study supports the importance of targeted suicide prevention and early mental health intervention for SVGs.

Background

Health inequity is a significant public health concern, and health is a cumulative product of multiple biological, behavioral, and social determinants [1–3]. One of the most extreme forms of health inequity is mortality, including suicide, which is a major public health problem causing over 700,000 deaths worldwide annually[4].

In South Korea, a high suicide rate is a serious public health problem. The rate reached 29.1 per 100,000 in 2024—nearly 2.4 times higher than the Organization for Economic Co-operation and Development (OECD) average, which was the highest observed in South Korea since 2011[14]. Since 2011, central and local governments have taken action on suicide prevention through initiatives such as the ‘Master Plan for Suicide Prevention’, the 5th version of which was released in 2023[16]. However, these efforts have not achieved the desired outcomes[17]. The policy frameworks were criticized for its limited focus on social determinants[18, 19], despite studies on socioeconomic inequalities in suicide risk in Korea[13, 20–23].

Furthermore, a recent review emphasized that considering and preventing suicidal behaviors is as vital as preventing suicide mortality[5]. Suicidal behavior is a multifaceted continuum that consists of interrelated but distinctive notions: suicidal ideation, suicide attempt, and completed suicide[6, 7]. Socioeconomic factors are consistently shown to impact suicidal behavior or suicide risk[1, 7, 8]. Recent research has identified social determinants (e.g., low income, social isolation, homelessness, unemployment, etc.), psychological factors (e.g., depression and mood symptoms, trauma, self-esteem, etc.), and behavioral factors (e.g., smoking, alcohol use) as interrelated predictors of suicide risk[5, 9–13].

Addressing suicide prevention from a ‘social’ perspective requires ‘social’ approaches: intervening in the structural determinants that shape differential exposure to risk across social groups, alongside individual-level clinical approaches[3, 24–26]. Recent suicide prevention efforts emphasize the social determinants of suicide through population-level structural strategies[27–29]. In line with this, defining and targeting socially vulnerable groups of people (SVGs) becomes necessary.

The term ‘socially vulnerable groups’ (SVGs) refers to population groups at increased risk due to multiple adverse social circumstances. Across studies, the operational definition of social vulnerability and its measurement remain inconsistent. To define this notion, aggregating several social indicators is common[30].

Recent reviews indicate that the domains of finances/income, social support, residence situation, and educational level are included in most individual-level social vulnerability indices (SVIs) [31–33]. Studies on South Korea often include occupation and finances/income, followed by educational level, overall socioeconomic status (SES)/position (SEP), and place of residence[13].

Although prior studies have documented social gradients in suicide risk, most studies have operationalized social vulnerability via conventional SES indicators. However, some important social conditions (e.g., justice system involvement) do not capture these traditional measurements[5]. Additionally, these indicators often diverge from the categorization used by governments and local authorities, which restricts the policy application of research findings[33, 35].

Additionally, only a few previous studies have explored whether social vulnerability *moderates* the relationship between psychological factors and suicide risk. Some studies have investigated the moderating role of social support on the basis of psychological factors [36–38], but they have treated the moderator more as an individual-level perceived social support than as a structural social disadvantage. In South Korea, the law formally defines SVGs, although their application remains limited. The Seoul Metropolitan Region, the capital of South Korea, applies the definition of ‘socially vulnerable populations’ to certificate social enterprises or social cooperatives and to allocate social services and welfare resources[39].

Examining whether SVGs under these criteria present greater mental health burdens and increased suicide risk is directly relevant for current policy. Proactive intervention within existing infrastructure could offer a targeted and immediately implementable suicide prevention strategy.

To our knowledge, no prior study has examined the mental health status of SVGs and the moderating effect of vulnerability itself under a legally and institutionally defined classification, particularly in the East Asian context.

This study aims to answer the following questions:

- Do SVGs residing in Seoul Metropolitan Areas report worse mental health status than non-SVGs do?

- What psychosocial factors predict the suicide risk of Seoul residents? Does social vulnerability remain statistically significant after controlling for other psychological factors and demographic characteristics?
- Does social vulnerability moderate the interaction between mental health status and suicide risk? In other words, are the SVGs more vulnerable to suicide risk when they are exposed to psychosocial risk factors?

Methods

Study design and sampling

From October 6 to October 12, 2023, we conducted an online survey and recruited participants through a panel. We gathered a sample stratified by age, gender, and residential district to ensure representativeness. A total of 1,000 people (478 male, 522 female) currently registered in Seoul Metropolitan responded to the survey.

Measures

Psychosocial factors

Depression was assessed with the Patient Health Questionnaire-9 (PHQ-9)[40] via the Korean-validated version by Park et al.[41]. The PHQ-9 is a 9-item measure with a 4-point Likert scale ranging from 0 (never) to 3 (almost always), and it assesses the frequency of symptoms experienced over the last 2 weeks. The internal consistency of this scale in this study was excellent (Cronbach's $\alpha = .897$).

Anxiety symptoms were assessed via the Korean version of the Generalized Anxiety Disorder 7-Item Scale (GAD-7), which was developed by Spitzer et al. [42] and validated in Korea by Seo et al. [43]. The GAD-7 is a 4-point Likert scale ranging from 0 (never) to 3 (almost always) and is based on the severity of anxious symptoms in the past 2 weeks. Its internal consistency in this study was excellent (Cronbach's $\alpha = .929$).

Alcohol use was assessed via the Korean version of the alcohol use disorders identification test (AUDIT), which was developed by Saunders et al.[44] and adapted and validated in Korea by Lee[45]. The AUDIT-KR consists of ten items—three questions on alcohol dependence, three on harmful alcohol use, and four on hazardous alcohol intake. Each question uses a five-point Likert scale (0–3), and the total score ranges from 0 to 40. Considering sex differences in alcohol consumption, a total score of ≥ 10 for males and ≥ 6 for females (≥ 8 for the general population) was used to indicate risky alcohol use. Its internal consistency in this study was excellent (Cronbach's $\alpha = .922$).

To measure loneliness and social isolation, we used the Loneliness and Social Isolation Scale (LSIS), developed and validated by Hwang et al.[46]. This scale measures two distinct notions together: social isolation, the number of objective social connections; and loneliness, a subjective feeling of support and isolation[46]. The LSIS consists of 10 items, each measured on a 4-point Likert scale from 0 (strongly disagree) to 3 (strongly agree). Its internal consistency in this study was acceptable (Cronbach's $\alpha = .752$).

The number of traumatic events that respondents experienced was assessed via a self-reported version of the Life Events Checklist for DSM-5 (LEC-5)[47]. In this study, the Korean version of the LEC-5, translated and validated by Park et al., was used[48]. For each traumatic event, there are 6 options: Happened to me; Witnessed it; Learned about it; Part of my job; Not sure; and Does not apply. We dichotomized the responses by grouping the "not sure" and "does not apply" answers into the "not experienced" (0) category and the other four answers into the "experienced" (1) category. This variable was examined in group comparisons to characterize differences between SVGs and non-SVGs but was not included in regression models.

PTSD and DSO symptoms were assessed via the International Trauma Questionnaire (ITQ), which was developed and validated by Cloitre et al.[50]. The ITQ is a measure based on the ICD-11 criteria for PTSD and complex PTSD (CPTSD). CPTSD is a 'complex' form of trauma that also requires at least one symptom from disturbances in self-organization (DSO) symptom clusters (i.e., affect dysregulation, negative self-concept, and disturbed relationships) in addition to PTSD symptoms (i.e., re-experiencing, avoidance, and a sense of threat)[51]. In the ITQ, the subscale scores of PTSD symptom severity and DSO symptom severity are separated and then summed to calculate the total score. Its internal consistency in this study was excellent (Cronbach's $\alpha = .964$).

Dependent variable

Suicide Risk

We used the Mental Health Screening Tool for Suicide Risk (MHS:S) to assess suicide risk. MHS: S, developed and validated by Yoon et al.[52], comprises a total of four questions and asks the respondents to rate each question from 0 (never) to 4 (always). The items asked the respondents about their experiences within the previous 2 weeks: (1) did not want to live anymore; (2) thought about suicide (suicidal ideation); (3) had seriously thought about suicide and prepared a specific plan (suicidal plan); and (4) had suicide attempts in their lifetime (suicide attempts)[52]. In accordance with item response theory, this tool assigns specific weights to each response to calculate total suicide risk. Therefore, its validated classification is as follows: 0 = no risk; 1 = low risk; 2 = moderate risk; 3 or higher = high risk. The internal consistency of the MHS:S in the study was excellent (Cronbach's $\alpha = .901$).

Moderating variables

Social vulnerability

We operationalized SVGs based on (1) legally defined categories that are directly relevant for the policy framework of Seoul and (2) socioeconomic position (low income, low education) for relevance to previous studies. The respondents who met any of the criteria specified in Article 2 of the 'Enforcement Decree of the Social Enterprise Promotion Act' were classified as the SVG. The criteria were as follows: people with physical or mental disabilities; beneficiaries protected under the Single-Parent Family Support Act; North Korean defectors; marriage migrants; people under rehabilitative protection; crime victims and their families; long-term unemployed individuals (unemployed for one year or longer).

With respect to educational level, most of our sample had graduated from high school, reflecting the high average educational level in Korean society. We included one respondent who only graduated from middle school in the SVGs.

For income level, we included people in a state of relative poverty. Relative poverty was operationalized according to the national definition, defined as 'household income below 50% of the median income in the previous year'. In the survey, the respondents were asked to report their average monthly household income over the past year via categorized response options (1: <1 million KRW; 2: 1–<3 million KRW; 3: 3–<5 million KRW; 4: 5–<7 million KRW; 5: 7–<9 million KRW; 6: 9–<11 million KRW; 7: ≥ 11 million KRW).

The midpoint of each income category was used to approximate household income, which was then compared with the 2022 median household income of Seoul, adjusted for household size. Participants whose estimated income was less than 50% of the median income for their household size were classified as relatively poor.

Statistical analysis

The data were analyzed using IBM SPSS 29.0. Five responses were excluded as invalid (e.g., respondents who endorsed all options in the SVG checklist). No data were missing. Finally, a total of 995 responses were analyzed.

For the demographic characteristics of the respondents, group differences between SVGs and non-SVGs were examined by Pearson's chi-square tests. Independent-samples t tests were used to compare the psychosocial health status of the SVGs and non-SVGs.

Hierarchical multivariate regression modeling was conducted to investigate the influence of psychosocial factors on suicide risk. In the regression model, sex and age, known predictors and moderators of suicide risk in Korean adults[53], were included as covariates (Step 1). The second regression model included psychosocial factors, including depression, anxiety, PTSD, DSO, alcohol consumption, social isolation, and social vulnerability, as the independent variables (Step 2).

Moderation analyses were conducted via PROCESS Macro Model 1 by Hayes[54] to examine the moderating effect of social vulnerability. The MHS:S score, the dependent variable, showed a positively skewed distribution (skewness = 2.33, kurtosis = 5.15), with a high proportion of zero scores (61.4%). Therefore, 5,000 bootstrap resamplings, which provide robust estimates under nonnormal residual distributions, were used. To prevent potential heteroscedasticity, heteroscedasticity-consistent standard errors (HC3; Davidson & MacKinnon) were applied.

Results

Among the 995 respondents, 238 were classified as SVG, accounting for 23.9% of the total. 55 respondents reported having physical or mental disabilities (5.5%), and 26 reported that they were protected under the Single-Parent Family Support Act (2.6%). 8 reported that they were North Korean Defectors (0.8%), and 7 reported that they were marriage migrants (0.7%). 4 respondents answered that they were under rehabilitative protection. 60 individuals answered that they were crime victims or their families (6.0%). 84 respondents were unemployed for more than a year (8.4%), and 100 respondents were in a relatively poor state (10.1%).

The demographic characteristics of the respondents are presented in Table 1. The SVGs and non-SVGs differed significantly by age group ($p = .016$), educational level, marital status, employment status and average monthly household income ($p < .001$).

Table 1
Demographic characteristics

	SVG (N = 238)	Non-SVG (N = 757)	χ^2 (df)	p
	N (%)	N (%)		
Sex (Male)	114 (47.9%)	360 (47.6%)	0.01 (1)	.926
Age group				
20–29	63 (26.5%)	127 (16.8%)	12.16 (4)	.016*
30–39	42 (17.6%)	129 (17.0%)		
40–49	35 (14.7%)	139 (18.4%)		
50–59	38 (16.0%)	134 (17.7%)		
60+	60 (25.2%)	228 (30.1%)		
Educational level				
Middle school graduate	1 (0.4%)	0 (0.0%)	33.14 (4)	< .001***
Highschool graduate	53 (22.3%)	90 (11.9%)		
Junior College graduate	38 (16.0%)	71 (9.4%)		
College graduate	130 (54.6%)	502 (66.3%)		
Graduate school	16 (6.7%)	92 (12.4%)		
Marital status				
Not married	134 (56.3%)	268 (35.4%)	41.60 (4)	< .001***
Married	89 (37.4%)	459 (60.6%)		
Divorced/Widowed/other	15 (6.2%)	30 (3.0%)		
Job status				
Employed (full-time)	95 (39.9%)	514 (67.9%)	132.33 (5)	< .001***
Employed (part-time)	41 (17.2%)	81 (10.7%)		
Unemployed	46 (19.3%)	15 (2.0%)		
Student	21 (8.8%)	25 (3.3%)		
Retired	15 (6.3%)	37 (4.9%)		
Domestic Laborer (homemaker)	20 (8.4%)	85 (11.2%)		
Household income				
< 1 million KRW	40 (16.8%)	0 (0.0%)	212.48	< .001***
1–<3 million KRW	77 (32.4%)	86 (11.4%)		
3–<5 million KRW	38 (16.0%)	227 (30.0%)		
*p < .05, ***p < .001				

	SVG (N = 238)	Non-SVG (N = 757)	χ^2 (df)	<i>p</i>
	N (%)	N (%)		
5–<7 million KRW	41 (17.2%)	182 (24.0%)		
7–<9 million KRW	15 (6.3%)	135 (17.8%)		
9–<11 million KRW	14 (5.9%)	65 (8.6%)		
11 + million KRW	13 (5.5%)	62 (8.2%)		
* <i>p</i> < .05, *** <i>p</i> < .001				

Comparison of psychosocial health status between SVGs and non-SVGs

Table 2 shows the results of the comparison between SVGs and non-SVGs. All the variables, except alcohol use, were significantly worse in the SVGs than in the non-SVGs. The proportion of individuals engaging in risky alcohol use did not differ between SVGs and non-SVGs. (34.9% and 34.3%, respectively). Notably, SVGs reported a greater average suicide risk (*M* = 2.77, *SD* = 3.94) than non-SVGs did (*M* = 1.32, *SD* = 2.77).

Table 2
Comparison of psychosocial health status

	SVG (N = 238)	Non-SVG (N = 757)	Mean difference [95% CI]	<i>t</i> (df)	<i>p</i>
	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)			
PHQ-9	8.54 (6.30)	6.10 (5.65)	2.44 [1.54, 3.34]	5.34 (364.76)	< .001***
GAD-7	6.03 (5.72)	3.95 (4.49)	2.07 [1.28, 2.87]	5.12 (333.58)	< .001***
AUDIT	8.02 (9.30)	6.93 (7.59)	1.09 [0.21, 2.39]	1.65 (342.03)	.101
LEC-5	10.56 (8.91)	8.78 (7.54)	1.78 [0.52, 3.03]	2.78 (350.04)	.006**
PTSD	8.53 (5.71)	7.01 (5.72)	1.52 [0.69, 2.35]	3.57 (993)	< .001***
DSO	9.33 (6.66)	6.57 (5.80)	2.76 [1.82, 3.71]	5.75 (357.03)	< .001***
LSIS	8.95 (3.41)	7.47 (3.37)	1.48 [0.98, 1.97]	5.89 (993)	< .001***
MHS:S	2.77 (3.94)	1.32 (2.77)	1.45 [0.91, 1.99]	5.29 (313.59)	< .001***
Note. Mean differences were calculated by subtracting the values of non-SVGs from those of SVGs. Welch's <i>t</i> test was used when homogeneity of variance was violated. All <i>p</i> values are two-tailed.					

Correlation matrix

Table 3 shows the Spearman correlation results among the study variables. Suicide risk was positively associated with depression, anxiety, the number of traumatic events experienced, PTSD symptoms, DSO symptoms, and social isolation. Age was negatively associated with suicide risk (*r* = -.11, *p* < .001), whereas sex was not significantly associated with suicide risk (*p* = .441).

Table 3
Correlation matrix

Variable	1	2	3	4	5	6	7	8	9	10	11
1. Sex	—										
2. Age group	.02	—									
3. Depression	.08*	– .10**	—								
4. Anxiety	.04	– .09**	.80***	—							
5. Alcohol use	–.33***	– .11***	.23***	.27***	—						
6. Traumatic events	– .10**	– .07*	.20***	.21***	.25***	—					
7. PTSD	.02	– .07*	.47**	.52***	.21***	.22***	—				
8. DSO	.02	– .08*	.68***	.63***	.19***	.20***	.66***	—			
9. Social isolation	.01	– .01	.57***	.50***	.07*	.05	.26***	.52***	—		
10. Social vulnerability	– .00	– .09**	.17***	.16***	.00	.09**	.12***	.18***	.19***	—	
11. Suicide risk	.02	– .11***	.65***	.62***	.25***	.19***	.41***	.56***	.42***	.21***	—
Note. <i>N</i> = 995. Each value represents Spearman's rho. * <i>p</i> < .05. ** <i>p</i> < .01. *** <i>p</i> < .001											

PTSD = posttraumatic stress disorder symptom severity; DSO = disturbances in self-organization.

Social vulnerability predict suicidality

Before the multivariate regression analysis, the assumptions of linear regression were examined. Although some of the included variables were highly correlated (e.g., PHQ-9–GAD-7 $r = .80^*$), multicollinearity diagnostics indicated acceptable levels (VIFs = 1.06–3.54). The residual Q–Q plots indicated no substantial deviation from normality or homoscedasticity. No outliers were detected (Cook's $D < .10$). All the continuous variables were mean centered.

Table 4 shows the results of the multivariate regression analysis. In Step 1, age was significantly associated with suicide risk, whereas sex had no significant effect (Adj. $R^2 = 0.01$). However, this significance diminished in Step 2 after including psychosocial predictors in the model (Adj. $R^2 = 0.52$). PTSD symptoms were not significantly associated with suicide risk after other psychosocial factors were included. Social isolation was negatively associated with suicide risk ($p = .020$).

Table 4
Multivariate regression analysis of suicide risk

Predictors	B	SE	β	p
Step 1				
Sex	-0.04	0.20	-0.01	.836
Age group	-0.23	0.07	-0.11	< .001***
R ² = 0.01, Adj. R ² = 0.01, F = 6.07**				
Step 2				
Sex	0.11	0.15	0.02	.478
Age group	-0.06	0.05	-0.03	.232
Depression	0.19	0.02	0.36	< .001***
Anxiety	0.10	0.03	0.15	< .001***
Alcohol use	0.07	0.01	0.19	< .001***
PTSD	0.01	0.02	0.02	.627
DSO	0.10	0.02	0.20	< .001***
Social isolation	-0.06	0.03	-0.07	.020*
Social Vulnerability	0.49	0.17	0.07	.004**
R ² = 0.52, Adj. R ² = 0.52, ΔR^2 = 0.51***, F = 118.30***				

Note

N = 995. * $p < .05$, ** $p < .01$, *** $p < .001$, PTSD = posttraumatic stress disorder symptom severity; DSO = disturbances in self-organization.

Moderating effect of social vulnerability

Figure 1 shows the results of the moderation analysis. The statistics are suggested in the supplementary material.

Social vulnerability significantly moderated the relationships between depression and suicide risk ($p = 0.008$) and between PTSD symptoms and suicide risk ($p < 0.001$). For alcohol use and DSO symptoms, the moderating effect had marginal significance ($p = .062$ and $p = .055$, respectively). For anxiety and social isolation, social vulnerability did not moderate their effects on suicide risk ($p = .194$, $p = .230$, respectively).

Discussion

Our research aimed to investigate the mental health status of SVGs residing in the Seoul metropolitan area and the effects of psychosocial factors, including social vulnerability, on suicide risk.

According to an independent sample t test, the SVGs reported worse mental health status (i.e., depression, anxiety, PTSD, DSO, social isolation), more traumatic/stressful events, and greater suicide risk than their nonvulnerable counterparts did. Alcohol use was not significantly different between the two groups, which might reflect high average alcohol consumption in Korea [55, 56].

The results of multivariate regression analysis indicated that psychosocial factors—depression, anxiety, alcohol use, DSO, and social vulnerability—significantly predict the suicide risk of Seoul residents. This finding aligns with previous research reporting the poor mental health of SVGs and the predictive role of social vulnerability in suicide risk.

Although social isolation had a negative coefficient in the analysis, it was positively associated with suicide risk according to the single-variate linear regression model ($\beta = 0.34, p < 0.001$) and the correlation matrix. Because we could rule out multicollinearity ($VIF = 1.54$), this might be due to the suppression effect, which is closely related to the psychological variables in multiple regression, altering the direction or magnitude of regression[57].

Unexpectedly, PTSD was not a significant estimator in the multivariable model, whereas the predictive effect of DSO remained significant. Recent studies have reported a unique association of CPTSD symptoms with suicide risk compared with simple PTSD[12, 58]. These findings highlight the importance of DSO-related symptoms in suicide risk assessment and intervention.

Moderation analyses revealed that social vulnerability significantly moderated the associations of depression and PTSD symptoms with suicide risk. When individuals experience a relatively low level of psychological distress, the suicide risk of SVGs does not differ substantially from that of non-SVGs. However, when they are exposed to elevated distress and mental health risk—higher levels of depressive or PTSD symptoms—SVGs exhibit greater increases in suicide risk than non-SVGs do.

DSO symptoms and alcohol use had marginal significance, with confidence intervals approaching zero. These findings might be further explored in future studies to examine their replicability. For anxiety and social isolation, social vulnerability did not moderate their effects on suicide risk. This result might stem from the mechanism by which anxiety affects suicide, which might be more neurobiological or cognitive[59, 60]. For social isolation and loneliness, this might be because the effect size of social isolation itself was weak or because most of the SVGs were already experiencing isolation and loneliness.

Although PTSD did not remain a significant predictor in the multivariable regression model, the association between PTSD symptoms and suicide risk was stronger among the SVGs than among their nonvulnerable counterparts. This pattern may reflect a distinctive vulnerability among SVGs, indicating that trauma-related distress may translate into suicide risk more readily in contexts with social and structural disadvantages. Further research is needed to replicate and clarify this pattern.

Our findings have several implications for suicide prevention and mental health promotion.

First, the current legal definition of SVGs should be more actively utilized. The definition used in our study focused on the state of individuals or groups (e.g., physical or mental disabilities), which itself is hardly modifiable. Therefore, a targeted approach for the SVGs defined under the current definition is needed.

Second, we replicated the previous findings, demonstrating that socio-contextual factors predicted suicide risk alongside intrapersonal factors in the Korean community sample. This supports that suicide prevention should not be regarded solely as the responsibility of medical or public health sectors but rather as a major goal across a variety of sectors[27, 29]. Therefore, multidisciplinary collaboration in suicide prevention strategies and multisectoral communication in policy development are essential[26].

Third, targeted interventions on SVGs across societal and psychological approaches are crucial. As we elucidated the moderating role of social vulnerability in the relationship between psychological factors and suicide risk, early detection of and intervention in the mental health problems of SVGs could play a salient role in suicide prevention. The enhanced availability of primary care for early intervention, such as psychological support, would be helpful[61]. In

recent years, South Korea has experienced several massive disasters and social traumas (e.g., the Sewol Ferry incident, 10.29 Itaewon Crowd Crush, 12.29 Jeju Aircraft crash). Considering that PTSD symptoms were among the key variables in our study, targeted post trauma care and other stress-related interventions for SVGs are warranted.

In summary, identifying and screening socially vulnerable individuals who are currently experiencing mental health difficulties requires further emphasis. Our findings suggest that this approach might be an effective way to prevent suicide and enhance mental health equity.

Limitations

The current study has several limitations. First, we relied on respondents' self-reported data in this study. Consequently, social vulnerability and other mental statuses may not have been accurately captured. Multiple informant assessments reduce reporting bias and strengthen causal interpretation.

Second, when moderation effects are examined via cross-sectional data, there is also a risk of biased estimation and inflated interaction effects due to shared method variance and the absence of temporal separation[62, 63]. In addition, causal inferences cannot be established because the temporal ordering between variables cannot be determined. Therefore, the moderating relationships identified in this study should be interpreted cautiously, and longitudinal research is needed to confirm their temporal stability.

Third, our study included only the population residing in the Seoul Metropolitan area. As rural residence is a known risk factor for suicide[23] and local extinction is a growing problem in Korea, disparities caused by residence area require greater attention. In recent studies, regional deprivation has been suggested as a risk factor for suicide risk and other mental health problems[64]. Therefore, a nationwide study regarding regional deprivation and regional disparities should be conducted to further generalize our findings.

Finally, although we obtained a definition of SVG under the current legal framework of Seoul, certain 'vulnerable' populations—such as sexual/gender minorities and racial/ethnic minorities—were not included in the operational definition of social vulnerability. Efforts to enact a comprehensive antidiscrimination law prohibiting discrimination against social minorities have continued but have not yet reached legislation. We could also not assess the specific forms of adverse experiences encountered by SVGs, such as perceived discrimination, stigma, workplace exclusion, or other kinds of cumulative life stressors.

As a result, these groups may experience further marginalization within the conservative social context of South Korea, which is underrepresented in research targeting 'vulnerable' populations, including ours. Future studies could examine intersectional vulnerability by considering the cumulative burden of multiple social disadvantages and including other structurally marginalized populations residing in Korea.

Conclusion

SVGs' experience of worse psychosocial health, higher suicide risk, and social vulnerability moderates the effect of psychological distress on suicide risk. Given that suicide remains a critical public health crisis in Korea, SVGs identified through a quantifiable, policy-relevant framework that enables direct targeting for intervention have substantial value. Focusing on SVGs, especially in terms of targeted interventions, will be an effective multidisciplinary suicide prevention strategy.

Declarations

Ethics approval and consent to participate

This study was approved by the The Institutional Review Board of Korea University [KUIRB-20230316-01]. The study was conducted in accordance with the local legislation and institutional requirements.

Consent for publication

The participants provided their written informed consent to participate in this study.

Availability of data and materials

The datasets generated and/or analysed during the current study are not publicly available as it is primarily a property of the Seoul Metropolitan Government and the research team, but are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

The author(s) declare that financial support was received for the research and/or publication of this article. This research was supported by the [Academic research to establish a proactive response plan for PTSD] funded by the Seoul Metropolitan Government.

Authors' contributions

SP analyzed and interpreted the data, visualized key findings, and was a major contributor to writing the original draft of the manuscript. EH interpreted data and wrote the original draft of the manuscript. GS and JJ reviewed and edited the manuscript and contributed during the collection and pre-processing process. KH reviewed and edited the manuscript and administered the overall project. All authors read and approved the final manuscript.

Acknowledgement

Not applicable.

References

1. Compton MT, Shim RS. The Social Determinants of Mental Health. *Focus*. 2015;13(4):419–25.
2. Lund C, Brooke-Sumner C, Baingana F. Social determinants of mental disorders and the sustainable development goals. *Lancet Psychiatry*. 2018;5(4):357–69.
3. Whitehead M, Dahlgren G. Concepts and principles for tackling social inequities in health: Levelling up Part 1. *World Health Organization: Studies on social and economic determinants of population health* 2006, 2(2006):460–474.
4. World Health O. Suicide. 2025.
5. Na PJ, Shin J, Jeste DV. Social determinants of health and suicide-related outcomes. *JAMA Psychiatry*. 2025;82(4):337.
6. Klonsky ED, May AM, Saffer BY. Suicide, suicide attempts, and suicidal ideation. *Ann Rev Clin Psychol*. 2016;12:307–30.

7. Platt S, Stace S, Morrissey J. Socioeconomic disadvantage and suicidal behaviour: full report. In.: Samaritans; 2017.
8. Turecki G, Brent DA, Gunnell D. Suicide and suicide risk. *Nat Reviews Disease Primers*. 2019;5:74.
9. Kim AM. Alcohol consumption and suicide rate: A cross-sectional analysis in 183 countries. *Psychiatry Res*. 2021;295:113553.
10. Lee J, Pak TY. Machine learning prediction of suicidal ideation, planning, and attempt among Korean adults: A population-based study. *SSM Popul Health*. 2022;19:101231.
11. Balbuena LD, Baetz M, Sexton JA, Harder D, Feng CX, Boctor K, Lapointe C, Letwiniuk E, Shamloo A, Ishwaran H et al. Identifying long-term and imminent suicide predictors in a general population and a clinical sample with machine learning. *BMC Psychiatry* 2022, 22(1).
12. Jannini TB, Longo L, Rossi R, Niolu C, Siracusano A, Di Lorenzo G. Complex post-traumatic stress disorder (cPTSD) and suicide risk: A multigroup mediation analysis exploring the role of post-traumatic symptomatology on hopelessness. *J Psychiatr Res*. 2023;165:165–9.
13. Raschke N, Mohsenpour A, Aschentrup L, Fischer F, Wrona KJ. Socioeconomic factors associated with suicidal behaviors in South Korea: systematic review on the current state of evidence. *BMC Public Health* 2022, 22(1).
14. Statistics K. 2024 cause of death statistics. In.: Statistics Korea; 2025.
15. World Health O. Suicide worldwide in 2021: global health estimates. In. Geneva: World Health Organization; 2025.
16. The 5th action plan for suicide prevention. (2023–2027) [https://www.mohw.go.kr/board.es?mid=a10102010000&bid=0005&list_no=377606].
17. Ryu S, Baek SH, Kim SW. Practicability of suicide reduction target in Korean suicide prevention policy. *J Korean Med Sci*. 2025;40(19):e59.
18. Jun JC, Sumi. A brief review of the 5th national suicide prevention plan. *A Brief Review of the 5th National Suicide Prevention Plan* 2023, 324:58–69.
19. Song IH. What to do about South Korea's suicide problem. *East Asia Foundation Policy Debates* 2023.
20. Jang H, Lee W, Kim Y-O, Kim H. Suicide rate and social environment characteristics in South Korea: the roles of socioeconomic, demographic, urbanicity, general health behaviors, and other environmental factors on suicide rate. *BMC Public Health* 2022, 22(1).
21. Lim D, Kong KA, Lee HA. The population attributable fraction of low education for mortality in South Korea. *BMC Public Health*. 2015;15:313.
22. Hong J, Knapp M, McGuire A. Income-related inequalities in the prevalence of depression and suicidal behaviour: a 10-year trend following economic crisis. *World Psychiatry*. 2011;10(1):40–4.
23. Kim MH, Jung-Choi K, Jun HJ, Kawachi I. Socioeconomic inequalities in suicidal ideation, parasuicides, and completed suicides in South Korea. *Soc Sci Med*. 2010;70(8):1254–61.
24. Solar O, Irwin A. A conceptual framework for action on the social determinants of health. Geneva: World Health Organization; 2010.
25. Kirkbride JB, Anglin DM, Colman I, Dykxhoorn J. The social determinants of mental health and disorder: evidence, prevention and recommendations. *World Psychiatry*. 2024;23(1):58–90.
26. Lee AR, Sun JYH, Baik M, Na PJ, Lee SM, Paik J-W. National Trends and Directions for Suicide Prevention Research in South Korea: A Narrative Review. *Psychiatry Invest*. 2025;22(6):603–11.
27. Organization WH. National suicide prevention strategies: Progress, examples and indicators. 2018.
28. Fitzpatrick SJ. Reshaping the Ethics of Suicide Prevention: Responsibility, Inequality and Action on the Social Determinants of Suicide. *Public Health Ethics*. 2017;11(2):179–90.

29. Pirkis J, Gunnell D, Hawton K, Hetrick S, Niederkrotenthaler T, Sinyor M, Yip PSF, Robinson J. A Public Health, Whole-of-Government Approach to National Suicide Prevention Strategies. *Crisis*. 2023;44(2):85–92.
30. Mah JC, Penwarden JL, Pott H, Theou O, Andrew MK. Social vulnerability indices: a scoping review. *BMC Public Health* 2023, 23(1).
31. Mah JC, Penwarden JL, Andrew MK. Social vulnerability indices: a scoping review. *BMC Public Health*. 2023;23:1253.
32. Nezafat Maldonado B, Bell W, Olivera J, Beyer F, Lambert M, Thomson R, Cookson R, Bamba C, Sowden S. Social and policy interventions to reduce hospital admissions among socioeconomically disadvantaged groups in OECD countries with universal health care: a systematic review. *BMJ Public Health*. 2025;3(2):e002592.
33. Valentin G, Pedersen P, Maribo T, Kallestrup P, Meldgaard N, Stenholt L, Larsen MB. Social vulnerability indices for proactively identifying at-risk individuals in healthcare: a systematic review. *Eur J Pub Health*. 2025;35(5):844–54.
34. Evans T, Brown H. Road traffic crashes: operationalizing equity in the context of health sector reform. *Injury Control Saf Promotion*. 2003;10(1–2):11–2.
35. Mezzina R, Gopikumar V, Saraceno B. Social vulnerability and mental health inequalities in the syndemic. *Front Psychiatry*. 2022;13:894370.
36. Kleiman EM, Riskind JH, Schaefer KE, Weingarden H. The moderating role of social support on the relationship between impulsivity and suicide risk. *Crisis* 2012.
37. DeBeer BB, Kimbrel NA, Meyer EC, Gulliver SB, Morissette SB. Combined PTSD and depressive symptoms interact with post-deployment social support to predict suicidal ideation in Operation Enduring Freedom and Operation Iraqi Freedom veterans. *Psychiatry Res*. 2014;216(3):357–62.
38. Panagioti M, Gooding PA, Taylor P, Tarrier N. Perceived social support buffers the impact of PTSD symptoms on suicidal behavior: Implications into suicide resilience research. *Compr Psychiatr*. 2014;55(1):104–12.
39. Lee J. A study on legislative reform for the protection of rights and the development of support systems for socially vulnerable groups. In. Suwon: Industry–Academic Cooperation Foundation, Ajou University; 2012.
40. Kroenke K, Spitzer RL, Williams JBW. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med*. 2001;16:606–13.
41. Park S-J, Choi H-R, Choi J-H, Kim K-W, Hong J-P. Reliability and validity of the Korean version of the Patient Health Questionnaire-9 (PHQ-9). *Anxiety mood*. 2010;6(2):119–24.
42. Spitzer RL, Kroenke K, Williams JBW, Lowe B. A brief measure for assessing generalized anxiety disorder: The GAD-7. *Arch Intern Med*. 2006;166(10):1092–7.
43. Seo J-G, Cho YW, Lee S-J, Lee J-J, Kim J-E, Moon H-J, Park S-P. Validation of the Generalized Anxiety Disorder-7 in people with epilepsy: A MEPSY study. *Epilepsy Behav*. 2014;35:59–63.
44. Saunders JB, Aasland OG, Babor TF. Development of the alcohol use disorders identification test (AUDIT). *Addiction*. 1993;88(6):791–804.
45. Lee BW, Lee CH, Lee PG, Choi MJ, Nam GK. Development of korean version of alcohol use disorders identification test (AUDIT-k): Its reliability and validity. *J Korean Acad Addict Psychiatry*. 2000;4(2):83–92.
46. Hwang SJ, Hong JP, An JH, Kim MH, Jeong SH, Chang H. Development and Validation of Loneliness and Social Isolation Scale. *J Korean Neuropsychiatric Association*. 2021;60(4):291.
47. Weathers F, Blake D, Schnurr P, Kaloupek D, Marx B, Keane T. Life Events Checklist for DSM-5 (LEC-5)-PTSD: National Center for PTSD [WWW Document]. PTSD Natl Cent PTSD 2013.
48. Park J, Kim W, Roh D, Won S, Kim H, Kang S, Hong N, Park S, Kim D, Chae J. Workbook for assessment in disaster behavioral health. Seoul: Korean Acad anxiety mood 2016.

49. Karakurt G, Silver KE. Emotional abuse in intimate relationships: The role of gender and age. *Violence Vict.* 2013;28(5):804.
50. Cloitre M, Shevlin M, Brewin CR, Bisson JI, Roberts NP, Maercker A, Karatzias T, Hyland P. The International Trauma Questionnaire: development of a self-report measure of ICD-11 PTSD and complex PTSD. *Acta psychiatrica Scandinavica.* 2018;138(6):536–46.
51. World Health Organization. *International Classification of Diseases Eleventh Revision (ICD-11)*. Geneva: World Health Organization; 2022.
52. Yoon S, Park K, Choi K-H. The ultra brief checklist for suicidality. *J Affect Disord.* 2020;276:279–86.
53. Lee HY, Hahm MI, Park EC. Differential association of socio-economic status with gender- and age-defined suicidal ideation among adult and elderly individuals in South Korea. *Psychiatry Res.* 2013;210(1):323–8.
54. Hayes AF. *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*. Guilford Press; 2022.
55. Chun S. The Social Meaning of Alcohol Consumption in Korea. *J Korean Diabetes.* 2012;13(2):57.
56. Ko S, Sohn A. Behaviors and culture of drinking among Korean people. *Iran J Public Health.* 2018;47(Suppl 1):47–56.
57. Beckstead JW. Isolating and Examining Sources of Suppression and Multicollinearity in Multiple Linear Regression. *Multivar Behav Res.* 2012;47(2):224–46.
58. Chong D, Qu D, Xi Y, Chen R. Complex posttraumatic stress disorder (CPTSD) is uniquely linked to suicidality beyond posttraumatic stress disorder (PTSD) in adults with childhood maltreatment: A multinational study across four countries. *Soc Sci Med.* 2024;362:117406.
59. Van Heeringen K. The neurobiology of suicide and suicidality. *Can J Psychiatry.* 2003;48(5):292–300.
60. Allan NP, Gorka SM, Saulnier KG, Bryan CJ. Anxiety sensitivity and intolerance of uncertainty: Transdiagnostic risk factors for anxiety as targets to reduce risk of suicide. *Curr psychiatry Rep.* 2023;25(4):139–47.
61. World Health O. National suicide prevention strategies: progress, examples and indicators. In.: WHO; 2018.
62. Maxwell SE, Cole DA. Bias in cross-sectional analyses of longitudinal mediation. *Psychol Methods.* 2007;12(1):23.
63. Podsakoff PM, MacKenzie SB, Lee J-Y, Podsakoff NP. Common method biases in behavioral research: a critical review of the literature and recommended remedies. *J Appl Psychol.* 2003;88(5):879.
64. Jeong SH, Chun BC. Individual and regional factors associated with suicidal ideation among Korean elderly: a multilevel analysis of the Korea Community Health Survey. *Epidemiol Health.* 2019;41:e2019022.

Figures

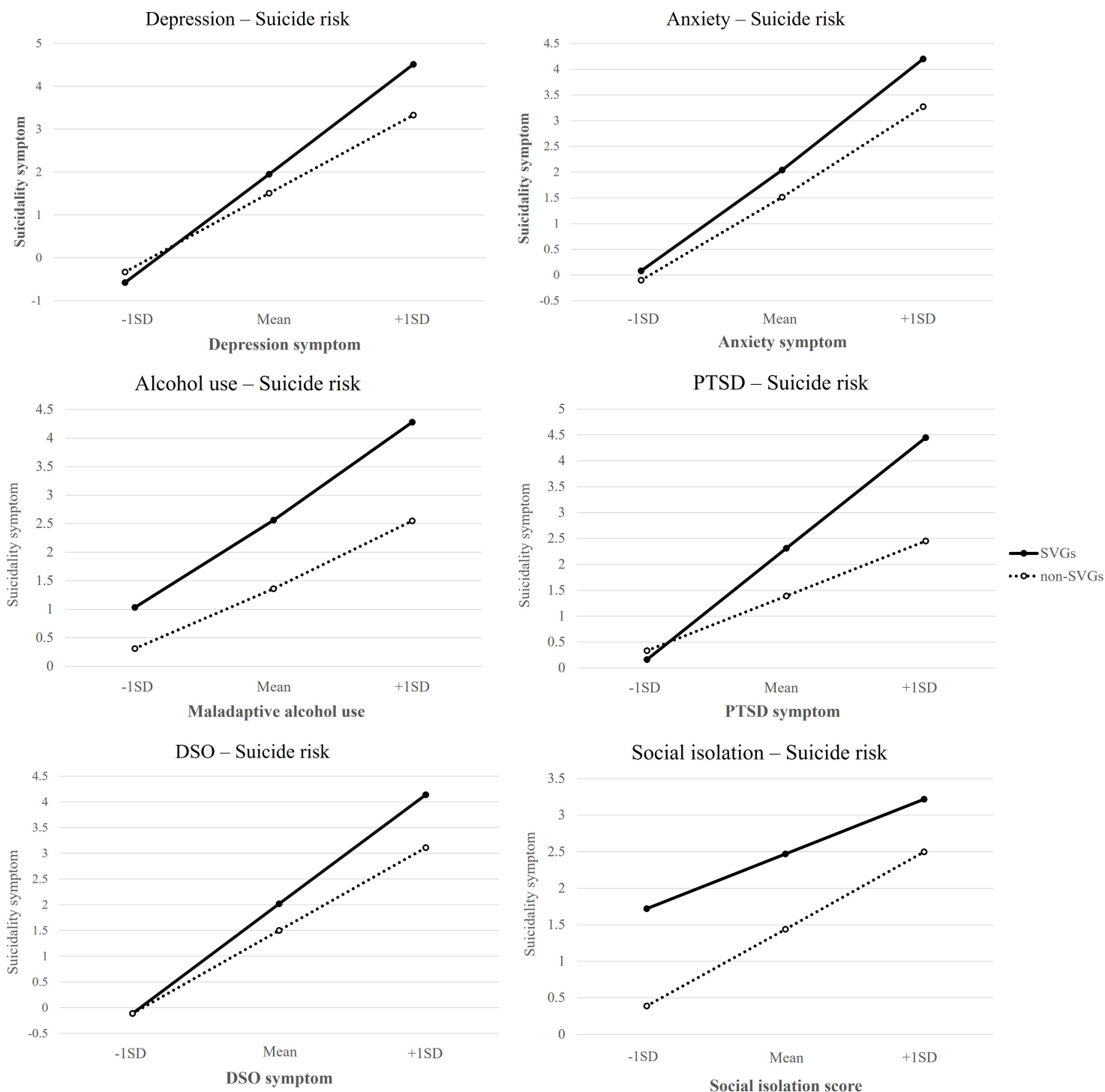


Figure 1

Moderating effect of social vulnerability on the association between psychosocial predictors and suicide risk

Note. The predicted values of the MHSS scores are plotted at -1 SD, the mean, and +1 SD of the predictor variables. The solid lines represent socially vulnerable groups (SVGs), and the dotted lines represent non-socially vulnerable groups (non-SVGs). Analyses were conducted via PROCESS Macro Model 1 with sex and age included as covariates. The predictors were mean-centered prior to analysis.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Supplementarymaterial.docx](#)