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Longitudinal association of individual and household social capital with suicidal ideation: A multilevel analysis in South Korea

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Abstract

Introduction: Social capital has been shown to operate as a protective factor for suicide-related behaviors. However, empirical studies that considered social capital at the individual and household levels and investigated their longitudinal association with suicide-related behaviors using a multilevel framework have received little attention to date. To fill this gap, the objectives of the current study were to examine: how much of the variance in suicidal ideation could be attributed to the household level and to examine the longitudinal association between social capital at the individual and household levels and suicidal ideation using a nationally representative sample of South Korea.

Methods: This study was a secondary analysis of data from the Korean Welfare Panel Study (KOWEPS). Data for wave 13 (2018) and wave 14 (2019) of the KOWEPS were combined to generate a longitudinal dataset. The final sample for this study includes 10,490 respondents within 6,135 households. A series of multilevel logistic regression analyses were conducted.

Results: The results showed that 30.49% of respondents' variance in suicidal ideation was attributed to the household level. At the individual level, trust (OR=0.70, 95% CI=0.56, 0.86) and reciprocity (OR=0.63, 95% CI=0.50, 0.79) were inversely associated with suicidal ideation. At the household level, trust (OR=0.92, 95% CI=0.85, 0.98) and reciprocity (OR= 0.90, 95% CI=0.84, 0.96) were negatively associated with suicidal ideation, while volunteering did not show a clear relationship with suicidal ideation both at the individual and household levels.

Discussion: In conclusion, this study provides evidence that a relatively large proportion of the variance in ideation could be attributed to the household level, indicating the importance of considering the household context to better understand an individual's suicidal ideation. It further provides evidence that some components of social capital could reduce suicide risks.

Take-home Message: This study found that a relatively large proportion of the variance in suicidal ideation could be attributed to the household level. Additionally, this study found that while cognitive social capital at the individual and household levels was inversely associated with suicidal ideation, structural social capital was not clearly associated with suicidal ideation. Decision makers who consider social capital interventions to prevent suicide need to take into account the household

context and carefully distinguish among different dimensions of social capital, as each dimension may operate differently in relation to suicide.

INTRODUCTION

Suicide is a serious public health problem and is one of the main causes of death at all ages worldwide. Every year, over 800,000 people die by suicide [1]. Suicide is a particularly serious public health problem in South Korea, where the suicide mortality rate was 25.6 per 100,000 people in 2016 [2]. Moreover, South Korea has ranked first among the Organization for Economic Co-operation and Development (OECD) countries in suicide rate for over 10 years, and its suicide rate is more than twice the OECD average [3]. Thus, unsurprisingly, researchers are putting more effort into investigating factors associated with suicide to reduce and prevent suicide deaths.

Previous studies have reported that suicide-related behaviors, such as suicidal ideation and suicide attempts, are strong predictors of suicide death [4-6]. Namely, people who engage in suicide-related behaviors are more likely to end their lives through suicide [7]. Therefore, it is important to investigate factors that affect suicide-related behaviors to prevent future suicide deaths. Prior research has identified a wide range of factors that can influence suicide-related behaviors. In particular age, gender, marital status, religion, mental illness, health behaviors (e.g., drinking alcohol and smoking), and economic factors were reported to be associated with suicide-related behaviors [7-10].

In addition to individual factors, it is acknowledged that various individual health outcomes, including mental health, are influenced by environmental conditions [11-13]. For example, various psychical characteristics of the environment, such as air pollution, green space, and home maintenance, have drawn researcher's attention due to their significance for individual health outcomes [13-15]. In addition to the physical environment, there is increasing recognition of the importance of the social environment in explaining individual health outcomes, including mental health and suicide-related behaviors. This attention by researchers has been driven by the concept of social capital [16,17].

Social capital is defined as the resources available to the individual or group through their social relationship [18]. While social capital is a multidimensional construct, various forms of definitions and measurements can be grouped into cognitive and structural dimensions [19]. Cognitive social capital refers to people's perception of their social relationships while structural social capital refers to behavioral manifestations of social relationships. Although the underlying mechanism connecting social capital to suicide has not been fully established, a theoretical linkage that explains the relationship between social capital and mental health could be applied. For example, cognitive social capital may affect mental health via psychosocial pathways that reduce perceived stress and provide effective support, self-esteem, and buffer against the negative influences of life experiences [20]. Structural social capital may also influence mental health through social support pathways that facilitate the diffusion of information and knowledge about health promotion and the exercise of informal social control over deviant health behaviors and provide instrumental resources, such as job opportunities and better access to local services [21]. Through these mechanisms, social capital may operate as a protective factor for suicide-related behaviors.

While many researchers acknowledge that social capital can be a collective attribute [22,23], there is no consensus on which context is most relevant for investigating the health effects of social

capital [21,24]. Past research commonly chose geographical units, such as a postcode sector, county, or state, as the main context [25-28]. However, this context was often selected due to data availability and convenience rather than as a relevant representation of individuals' social interactions and networks [21]. In response, researchers attempted to find a more appropriate context in which to investigate the health effects of social capital, identifying the workplace as one such context [29,30]. This is because various workplace characteristics were reported to be associated with health outcomes [31]. While investigating the workplace can more accurately capture important social interactions and networks, particularly for the working population, compared to geographic areas [32], this context is inherently limited to the working population. This limitation restricts the extrapolation of findings to the general population, including the non-working population [21]. One of the contexts that has been overlooked in empirical research on social capital is household or family. It has been suggested that the household or family is one of the major sources for forming and maintaining social capital [33]. For example, members of the same household tend to share their societal norms and are more likely to have preferences for civic and social participation and trust in other people and political institutions [21,33]. Moreover, since individuals are largely affected by their family members and environment, spend much of their time within the home, and share a similar genetic background [34-36], it can be assumed that individuals from the same household are likely to have similar tendencies in suicide-related behaviors. Previous empirical studies also supported this logic and found that a relatively large variance in individual health outcomes, including psychological well-being, was attributed to the household level [21,35]. To date, despite the importance of household context for operating social capital and influencing individual psychological well-being, empirical studies that considered social capital at the household level and investigated its association with suicide-related behaviors have received little attention. Thus, the current study considers the household context to better understand the variation in suicide-related outcomes.

In this study, suicidal ideation that precedes suicide attempt and suicide [10] was considered an outcome measure. It was argued that suicidal ideation is the most immediate precursor and an essential condition for a suicide attempt and suicide [37]. Suicidal ideation is referred to as considering, planning, or thinking about suicide; a suicide attempt is regarded as a self-directed, nonfatal, potentially injurious behavior with the intention of dying as a consequence of the behavior, although the behavior may not necessarily lead to injury; and suicide is referred to as death due to self-directed injurious behavior with the intention of dying as a consequence of the behavior [38]. Therefore, investigating the association between social capital and suicidal ideation can provide both theoretical and practical implications for preventing suicide attempt and suicide.

The aims of this study were to investigate how much of the variance in suicidal ideation could be attributed to the household level, to examine the longitudinal association between social capital at both the individual and household levels and suicidal ideation using a nationally representative sample of South Korea. This study is the first research of its kind that simultaneously investigated the longitudinal association between social capital at the individual and household levels and suicidal ideation.

METHODS

Data

The current study was a secondary analysis of data from the Korean Welfare Panel Study (KOWEPS), which is conducted by the Korea Institute for Health and Social Affairs and Seoul National University. The KOWEPS is an annual panel survey that started from 2006. The KOWEPS utilizes a proportional systematic stratified cluster sampling method to choose a nationally representative sample of households in South Korea based on the 2005 National Census Registry. Within each selected household, all the members of households who were 15 years or older completed the individual questionnaire. The head of household also completed the household questionnaire. Trained interviewers conducted face-to-face interviews with respondents by utilizing computer-assisted personal interviewing. Further details for the survey process and data are

available elsewhere (https://www.koweps.re.kr:442/main.do).

In the current study, wave 13 (2018) was used as baseline data and was combined with wave 14 (2019) to create a longitudinal dataset. This study restricted the analysis to adult respondents aged 18 years or older who participated in both waves 13 and 14. In total, 10,490 respondents within 6,135 households were used in the final analysis. As the current study exclusively used publicly available and anonymized data without any access to sensitive information, it was determined to be exempt from ethical review.

Measures

In wave 13, a question was posed to the respondents about suicidal ideation: "Have you thought about committing suicide in the last year?" A dummy variable was created, with one group reflecting respondents who had experienced suicidal ideation (coded=1), and another group reflecting respondents who had not (coded=0). This variable was included as a confounder to adjust for previous experience of suicidal ideation. Similarly, in wave 14, respondents were asked the same question about suicidal ideation. A dummy variable was again generated, with one group reflecting respondents who had experienced suicidal ideation (coded=1), and another group reflecting respondents who had not (coded=0). This variable was used as the outcome measure for the current study

Three individual level social capital variables were measured. Trust, a cognitive dimension of social capital was measured by the following question: "Generally speaking, do you think that most people can be trusted?" A dummy variable was created, one indicating a group of the respondents who answered that most people can be trusted (high trust=1) and another indicating a group of the respondents answered that they either don't know, or one should be very careful (low trust=0). Reciprocity, another cognitive dimension of social capital was measured with one item. Respondents were asked, "Do you think that you would be willing to help your neighbors if they needed it?" Respondents were asked to rate their answer using a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). A dummy variable was created with the value of 1 indicating a group of respondents who answered the first 3 alternatives (low reciprocity), and the value of 0 indicating another group of respondents who answered the latter 2 alternatives (high reciprocity). Volunteering, a structural dimension of social capital was measured by asking the respondents whether or not they participated in voluntary work in the last year (yes=1, no=0). These measures were frequently used in the social capital research [21].

Household-level social capital variables were measured by using the above individual level social capital variables. The current study utilized the ecometric approach to obtain shrunken residuals from social capital at the individual level for social capital at the household level [39]. Briefly, the two-level random intercept models for trust, reciprocity, and volunteering as outcomes were conducted, and shrunken residuals at the household level were obtained from each model. These shrunken residuals were used as social capital variables at the household level in the final multilevel models of suicidal ideation. The ecometric approach is preferable to the standard aggregation methods because it is based on the portion of the variation that is due to the variation between clusters. It also considers differences in the number of observations per cluster, residuals from cluster with smaller number of observations will be more reduced toward the mean [39].

To reduce residual confounding, a wide range of confounders at the individual and household levels were included based on the previous literature [7,17,40,41]. At the individual level, age (continuous), gender (1=male, 0=female), educational attainment (middle school or below, high school, college, and university or graduate school), occupation (unemployed/no economic activity, group1=legislators, senior officials, managers, and professionals, group 2=service and sales workers and clerical support workers, group 3=skilled agricultural and fishery workers, craft and related trades workers, and plant and machine operators, and group 4=simple labor workers), marital status (married, single, and others), religion (1=yes, 0=no), smokers (1=yes, 0=no), self-rated health (1=very healthy/healthy, 0=fair/unhealthy/very unhealthy), and depressive symptoms were measured. In particular, depressive symptoms were assessed using an 11-item version of the Center for

Epidemiological Studies Depression Scale (CES-D 11), which is a short form of the original 20-item CES-D [42]. The CES-D 11 was reported to be valid as the 20-item CES-D [43] and was frequently used in previous empirical studies [44,45]. Each item was answered using a 4-point scale ranging from 1 (≤1 day in the past week) to 4 (≥6 days in the past week). The scale was created by summing the total score of 11 items, a higher score indicating a higher level of depressive symptoms.

At the household level, household income (log transformed), disabled household member (1=yes, 0=no), public assistance (1=received, 0=no), and housing type (ownership, deposit based, monthly rent, and others) were measured.

Data analysis

To account for the hierarchical data structure, multilevel analysis was conducted. An empty model that does not include any explanatory variables at the individual and household levels was fitted first. This model was fitted to investigate how much variance in suicidal ideation was attributed to the household level. Then, a series of three multilevel logistic models were fitted. In Model 1, social capital at the individual level and confounders at the individual and household levels were included. In Model 2, social capital at the household level and confounders at the two levels were included. In Model 3, social capital at the individual and household levels, all the confounders at the individual and household levels were simultaneously included. By simultaneously including social capital at the individual and household levels, this model aimed to investigate whether one level of social capital is independently associated with suicidal ideation above and beyond another level of social capital.

For each model, the ICC coefficient for the household level was calculated. A higher ICC coefficient indicates a higher degree of similarity between individuals within the same household regarding suicidal ideation. In other words, a higher ICC coefficient at the household level shows more importance of the household context to explain the variation in suicidal ideation.

In the current study, Bayesian analysis using Markov chain Monte Carlo (MCMC) methods was utilized. For random and fixed effects parameters, non-informative prior distributions were used. In this study, the first 30,000 iterations of the MCMC sampler were discarded as burn-in and the next 150,000 iterations were used. Odds ratios (ORs) and 95% credible intervals (CIs) were presented for each model. Additionally, the goodness-of-fit of each model was compared with the deviance information criterion (DIC). Models with lower DIC are preferred over models with higher DIC [46]. All the statistical analyses were conducted using Stata version 15.1 (StataCorp., College Station, TX).

RESULTS

In Table 1, descriptive statistics for the individual and household level variables used in this study are presented. In wave 13, 2.40% of the respondents answered that they had thought about suicide in the last year. In wave 14, this proportion was reported as 2.03%.

Table 1. Descriptive statistics of variables used in the final analyses.

Variables	No. (%)
Individual-level variables	
Suicidal ideation in wave 13	
Yes	252 (2.40)
No[a]	10238 (97.60)
Suicidal ideation in wave 14	
Yes	213 (2.03)
No	10277 (2.03)
Gender	
Male	4486 (42.76)
Female[a]	6004 (57.24)
Age [mean (SD)]	56.59 (18.15)
Educational attainment	

Middle school or below[a]	4422 (42.15)
High school	3309 (31.54)
College	934 (8.90)
University/graduate school	1825 (17.40)
Marital status	
Married[a]	6617 (63.08)
Single	1468 (13.99)
Others	2405 (22.93)
Religion	
Yes	5048 (48.12)
No[a]	5442 (51.88)
Occupation	
Unemployed[a]	4341 (41.38)
Group 1	1033 (9.85)
Group 2	1826 (17.41)
Group 3	1990 (18.97)
Group 4	1300 (12.39)
Smoker	
Yes	1625 (15.49)
No[a]	8865 (84.51)
Self-rated health	
Poor health[a]	4305 (41.04)
Good health	6185 (58.96)
CES-D [mean (SD)]	1.71 (0.27)
Trust	
High trust	5813 (55.41)
Low trust[a]	4677 (44.59)
Reciprocity	
High reciprocity	7303 (69.62)
Low reciprocity[a]	3187 (30.38)
Volunteering	
Yes	1216 (11.59)
No[a]	9274 (88.41)
Household-level variables	
Household income [mean (SD)]	4225.31 (4235.33)
Disabled household member	
Yes	764 (12.45)
No[a]	5371 (87.55)
Housing type	
Ownership[a]	3617 (58.96)
Deposit based	633 (10.32)
Monthly rent	1165 (18.99)
Others	720 (11.74)
Public assistance	
Received	570 (9.29)
No[a]	5565 (90.71)
Trust [mean (SD)]	0.00 (1.90)
Reciprocity [mean (SD)]	0.00 (1.69)
Volunteering [mean (SD)]	0.00 (0.64)

Note: a = Reference categories used for the final multilevel analysis.

An empty model was fitted first to estimate how much variance in suicidal ideation was attributed to the household level. The results showed that 30.49% of respondents' variance in suicidal ideation was attributed to the household level.

Table 2 shows the results on a series of multilevel logistic regression. Model 1 examines the association between social capital at the individual level and suicidal ideation. The results revealed that trust (OR=0.72; 95% CI=0.58, 0.89), reciprocity (OR=0.67; 95% CI=0.53, 0.84), and volunteering (OR=0.60; 95% CI=0.39, 0.90) were negatively associated with suicidal ideation. Model 2 examines the association between social capital at the household level and suicidal ideation. The results showed that trust (OR=0.92, 95% CI=0.87, 0.97) and reciprocity (OR=0.87, 95% CI=0.82, 0.93) were inversely associated with suicidal ideation. However, volunteering did not show a clear relationship with suicidal ideation.

In Model 3, social capital at both the individual and household levels was simultaneously included. This was done to examine whether social capital at the individual level, the household level, or both, has an effect on suicidal ideation, while controlling for the effect of the other level. At the individual level, trust (OR=0.70, 95% CI=0.56, 0.86) and reciprocity (OR=0.63, 95% CI=0.50, 0.79) were inversely associated with suicidal ideation. Thus, compared to those respondents in the low trust group, respondents in the high trust group were associated with a decrease in the odds of suicidal ideation by a factor of 0.70. Similarly, compared to those respondents in the low reciprocity group, respondents in the high reciprocity group were associated with a decrease in the odds of suicidal ideation by a factor of 0.63. However, volunteering did not show a clear association with suicidal ideation. At the household level, trust (OR=0.91, 95% CI=0.87, 0.96) and reciprocity (OR=0.88, 95% CI=0.78, 0.99) were negatively associated with suicidal ideation. Thus, a one-unit increase in trust and reciprocity was associated with a decrease in the odds of suicidal ideation by factors of 0.91 and 0.88, respectively. However, volunteering did not show a clear relationship. The DIC statistic was 3592.54, 3562.33, and 3495.23 for Models 1, 2, and 3, respectively. This indicates that Model 3 had the lowest DIC statistic, suggesting it performed better than the other two models.

Table 2. Multilevel models of social capital and suicidal ideation.

	OR (95% CI)		
Variables	Model 1	Model 2	Model 3
Individual-level variables			
Suicidal ideation in wave 13			
Yes	2.33 (1.49, 3.64)	2.64 (2.21, 3.15)	2.29 (1.47, 3.58)
Gender			
Male	1.45 (1.13, 1.87)	1.44 (1.13, 1.85)	1.44 (1.12, 1.84)
Age	0.99 (0.97, 1.00)	1.00 (0.98, 1.01)	0.99 (0.98, 1.01)
Educational attainment			
High school	1.31 (0.96, 1.78)	1.30 (0.95, 1.78)	1.31 (0.96, 1.79)
College	0.93 (0.56, 1.55)	0.93 (0.57, 1.54)	0.94 (0.57, 1.55)
University/graduate school	0.94 (0.62, 1.44)	0.93 (0.60, 1.42)	0.93 (0.61, 1.43)
Marital status			
Single	2.39 (1.66, 3.43)	2.38 (1.66, 3.44)	2.43 (1.69, 3.49)
Others	1.58 (1.18, 2.13)	1.57 (1.17, 2.11)	1.57 (1.17, 2.11)
Religion			
Yes	1.03 (0.83, 1.29)	1.02 (0.82, 1.27)	1.02 (0.82, 1.27)
Occupation			
Group 1	0.87 (0.55, 1.37)	0.86 (0.55, 1.34)	0.86 (0.55, 1.35)
Group 2	0.94 (0.68, 1.30)	0.94 (0.68, 1.31)	0.94 (0.68, 1.31)

Group 3	0.67 (0.49, 0.93)	0.68 (0.49, 0.96)	0.69 (0.49, 0.96)
Group 4	0.55 (0.37, 0.81)	0.56 (0.38, 0.82)	0.56 (0.38, 0.82)
Smoker			
Yes	1.01 (0.75, 1.37)	1.01 (0.75, 1.37)	1.01 (0.75, 1.37)
Self-rated health			
Good health	0.74 (0.56, 0.96)	0.74 (0.56, 0.97)	0.74 (0.56, 0.97)
CES-D	1.50 (1.05, 2.14)	1.52 (1.06, 2.17)	1.54 (1.08, 2.20)
Trust			
High trust	0.72 (0.58, 0.89)	-	0.70 (0.56, 0.86)
Reciprocity			
High reciprocity	0.67 (0.53, 0.84)	-	0.63 (0.50, 0.79)
Volunteering			
Yes	0.60 (0.39, 0.90)	-	0.79 (0.50, 1.21)
Household-level variables			
Ln (household income)	0.92 (0.88, 0.96)	0.98 (0.82, 1.17)	1.17 (0.98, 1.41)
Disabled household member			
Yes	1.11 (0.81, 1.54)	1.12 (0.81, 1.55)	1.12 (0.80, 1.57)
Housing type			
Deposit based	1.05 (0.73, 1.52)	1.04 (0.72, 1.50)	1.04 (0.72, 1.51)
Monthly rent	1.17 (0.86, 1.58)	1.16 (0.86, 1.57)	1.18 (0.88, 1.59)
Others	1.31 (1.01, 1.78)	1.41 (1.02, 1.91)	1.40 (1.00, 1.96)
Public assistance			
Received	1.23 (1.08, 1.51)	1.25 (1.07, 1.59)	1.34 (1.02, 1.72)
Trust	-	0.92 (0.87, 0.97)	0.91 (0.87, 0.96)
Reciprocity	-	0.87 (0.82, 0.93)	0.88 (0.78, 0.99)
Volunteering	-	0.99 (0.83, 1.18)	0.90 (0.60, 1.34)
Household level ICC (%)	26.08	25.89	23.98
DIC	3592.54	3562.33	3495.23

Note: OR = odds ratios; 95% CI = 95% credible interval.

DISCUSSION

Although many empirical studies have examined the association between social capital and suicide-related outcomes, those considering the household level in this context have received relatively little attention to date. To fill this gap in the literature, the current study utilized a nationally representative sample from South Korea to investigate how much of the variance in suicidal ideation could be attributed to the household level and to examine the longitudinal association between social capital at the individual and household levels and suicidal ideation, using multilevel analysis. The results suggested that a large proportion of the variation in suicidal ideation was attributed to the household level. The results also suggested that some components of social capital at the individual and household levels were negatively associated with suicidal ideation, even after adjusting for confounders at the individual and household levels, in addition to baseline suicidal ideation.

The ICC coefficient from the empty model showed that 30.49% of the total variance in suicidal ideation was attributed to the household level. The results showed that a multilevel modeling framework that takes into account the clustering effect at the household level is necessary. The results also supported that it is important to consider a household or family context to better understand the variation in individual psychological well-being [35] and indicated that household or family social capital may play an important role to explain the variation in individual health outcomes [21].

To verify the robustness of the results, further analysis was conducted by excluding households with only one member. The results still showed that a relatively large proportion of the variance in suicidal ideation (21.23%) could be explained by the household level (results not reported). Overall, the results provided evidence that one's suicidal ideation from the same household is somewhat

similar. The results supported a notion that household environment could be an important context to influence individual health outcomes [21,35]. These findings may be due to South Korea's characteristics. For instance, South Korea has experienced rapid social change and economic development. Additionally, the traditional culture of South Korea has been largely influenced by patriarchy [47]. Thus, a family or household is an especially important social context that can provide a variety of emotional and material resources and establishes individual characteristics, which in turn influence household members' thoughts about suicide. Additionally, it is important to note that previous research [21,35,48] conducted in Western countries also found a relatively high proportion of variance in individual health outcomes attributed to the household context. Therefore, further research is needed to confirm whether similar findings can be observed in suicide-related outcomes.

This study also found that some social capital variables at the individual and household levels were associated with suicidal ideation. At the individual level, trust and reciprocity were negatively associated with suicidal ideation. Specifically, the odds of suicidal ideation for respondents with high trust and high reciprocity were 30% and 37% less than respondents with low trust and low reciprocity, respectively. At the household level, an increase in trust was associated with a decrease in the odds of suicidal ideation. Respondents living in households with higher trust had lower odds of suicidal ideation than those respondents living in households with lower trust. Similarly, respondents living in households with higher reciprocity had lower odds of suicidal ideation than respondents from households with lower reciprocity. However, volunteering at the individual and household levels was not clearly associated with suicidal ideation.

The findings of the current study suggest that it is important to simultaneously consider social capital at different levels. For instance, the association between volunteering at the individual level and suicidal ideation (see Model 1 of Table 2) and the association between volunteering at the household level and suicidal ideation (see Model 2 of Table 2) were clear when considering volunteering at either individual or household level. After simultaneously including volunteering at the individual and household levels in one model (see Model 3 of Table 2), the impacts of volunteering at the individual and households were attenuated on suicidal ideation, and no longer showed a clear association with suicidal ideation. This is because a health effect of social capital at one level can be confounded by another level [21].

The results that only cognitive component of social capital was associated with suicidal ideation has an important implication. Indeed, the findings of the current study are in consistent with the previous research [49,50] in that the cognitive component of social capital was more consistently associated with mental health outcomes than the structural component of social capital. These results corroborate that different components of social capital may not be as closely correlated to one another as original thought [21] and further provide evidence that social capital may not be consistently associated with suicidal ideation. While it was suggested that social capital is a beneficial factor for psychological well-being [49] and operates as a protective factor for suicide, it was also argued that the role of social capital for suicide-related behaviors is complicated in that certain forms of social capital may have an adverse effect on suicide. For instance, social capital inherently requires an individual's active effort to generate and maintain social assets, which can create benefits for psychological well-being [51]. Consequently, possessing social capital requires investment and reciprocity, which may be harmful for one's mental health [52]. Thus, structural social capital may have an adverse effect on mental health by depleting personal energy and resources [53]. Moreover, structural social capital, measured by volunteering may be associated with an elevated mental distress and suicide risk due to the pressure of moral directives [54]. Overall, the results of the current study corroborate the notion that the diverse roles and values generated by various forms of social capital might not have a uniform effect on suicidal ideation and mental health in general. To better understand the complex relationship between social capital and mental health, future research needs to investigate the broader measures of social capital and their associations with different types of mental health outcomes, including suicide-related behaviors.

The results of the current study also have important policy implications. Much of the previous social capital research has identified relatively small area-level variations in health outcomes [55-58]. This suggests that social interventions aimed solely at facilitating individual health at the area level may not have a significant effect, even though they may be effective, as only a small proportion of the variation in health outcomes can be attributed to this level. Instead, decision-makers considering social capital interventions for preventing suicide need to take into account the household context and carefully distinguish among different dimensions of social capital, as each dimension of social capital may operate differently about suicide.

It was also argued that the impact of social capital on health may differ depending on gender [59,60]. Thus, further analysis was conducted to examine the association between social capital and suicidal ideation, stratified by gender. The results showed that trust and reciprocity at the individual level were inversely associated with suicidal ideation for both women and men (Table 3). However, volunteering did not show a clear relationship with suicidal ideation for either gender. The impacts of social capital variables on suicidal ideation tend to be larger for women than men in absolute terms, but differences were not statistically conclusive. Additionally, similar results were found at the household level. Specifically, trust and reciprocity at the household level were inversely associated with suicidal ideation for both women and men, and the impacts of social capital variables tend to be larger for women than for men. However, volunteering did not show a clear relationship with suicidal ideation for either gender. Previous research reported that risks of mental disorders or suicide were high in certain occupational groups, such as healthcare workers and police officers [61-63], and these risks may vary by gender [64]. The results showed that compared with unemployed respondents, respondents with group 3 occupation (OR=0.59, 95% CI=0.42, 0.83) and respondents with group 4 occupation (OR=0.51, 95% CI=0.30, 0.89) had lower odds of suicidal ideation for women. However, occupation did not show a clear relationship with suicidal ideation for men. Additionally, the impacts of occupation-related dummy variables tend to be larger for women than for men in absolute terms. The results of this analysis suggest that occupation may be a more important factor in influencing suicidal ideation in women than in men. Future research needs to utilize more specific occupational categories in its analysis.

Table 3. Social capital and suicidal ideation by gender.

Variables	OR (95% CI)	
	Women	Men
Individual-level variables		
Trust		
High trust	0.63 (0.44, 0.89)	0.71 (0.43, 0.98)
Reciprocity		
High reciprocity	0.62 (0.44, 0.85)	0.67 (0.41, 0.97)
Volunteering		
Yes	0.70 (0.35, 1.34)	0.97 (0.77, 1.23)
Occupation		
Group 1	0.62 (0.28, 1.38)	0.91 (0.53, 1.57)
Group 2	0.84 (0.50, 1.38)	0.99 (0.62, 1.57)
Group 3	0.59 (0.42, 0.83)	0.75 (0.51, 1.10)
Group 4	0.51 (0.30, 0.89)	0.70 (0.40, 1.23)
Household-level variables		
Trust	0.89 (0.83, 0.99)	0.92 (0.85, 0.99)
Reciprocity	0.81 (0.72, 0.92)	0.88 (0.79, 0.98)
Volunteering	1.01 (0.75, 1.36)	0.99 (0.77, 1.23)

Note: OR=odds ratios; 95% CI=95% credible interval; The same variables are included as in Table 2.

Overall, the findings of the current study are in agreement with previous studies, showing that the cognitive dimension of social capital is more consistently associated with psychological well-being outcomes than the structural dimension of social capital. Additionally, different dimensions of social capital may influence psychological well-being through different pathways [49]. At the same time, caution should be taken since this study only included one component of structural social capital and was not able to consider other important components, such as organizational participation due to a lack of data.

There are several limitations to this study. First, while the current study considered various confounders at the individual and household levels, it is still possible that that are unmeasured factors that are correlated with the association between social capital and suicidal ideation. These unmeasured factors could have biased the found associations. Second, while the current study assumed that social capital affects suicidal ideation, it is also possible that respondents' tendency toward suicidal ideation influences the formation of social capital. This reverse causality could have influenced the found association. Third, while the current study considered three factors to measure social capital, there are still other aspects of social capital that may be important to explain the variation in suicidal ideation. For instance, it was reported that network social capital and linking social capital could influence individual mental health outcomes [65]. Moreover, the current study used the same individual level social capital variables to generate social capital at the household level. It is not clear whether or not aggregating the individual level of social capital to a higher level appropriately represents social capital at the targeted contextual level under investigation [66]. Thus, future research may directly consider an ecological measure of social capital. However, it is still not clear whether this ecological measure better reflects social capital in the context being investigated than aggregated variables of social capital. Fourth, the current study used a single item to measure suicidal ideation. While the single item has been frequently used in population-based research [67], the severity of suicidal ideation could not be captured. Fifth, the variables used for the current study were based on self-reports and from the same source, and thus it may be vulnerable to common method bias. Sixth, suicide is a continuous process, starting from suicide-related behaviors, such as suicidal ideation or suicide attempt to suicide [7,10,68]. To better understand a mechanism behind the relationship between social capital and suicide, more comprehensive research is needed.

Seventh, while the current study focused on the household as the main context, it is also important to consider other contexts, such as the workplace. For instance, people in the workforce spend the majority of their time at their workplace, and it is highly likely that the health status of workers is greatly influenced by the work environment and work-related variables [69,70]. Indeed, previous research [31,71-76] reported that various work-related variables, such as work engagement, work motivation, role stress, workplace discrimination, and job satisfaction were associated with mental health and workplace well-being.

Moreover, studies on workplace social capital also indicated that it was linked to health outcomes [77,78]. In the workplace, high levels of social capital manifest through collaborative and trusting relationships among coworkers, as well as between employees and their employers or supervisors [79]. Workplace social capital fosters instrumental and emotional support and mutual respect, facilitating the sharing of health-promoting information. This, in turn, can cultivate health norms of behavior and exert informal social control over deviant health behaviors within the workplace, consequently influencing workers' mental health status [30,80]. Considering these points, future research needs to examine how workplace factors, including workplace social capital, and household factors, including household social capital, interact to better understand their influence suicidal ideation.

Finally, The COVID-19 pandemic has wreaked havoc worldwide and triggered a global public health emergency. This pandemic led to varying degrees of psychological disorders among people of all ages and various workers, including healthcare workers [81-83]. In response to this crisis,

governments around the world-imposed restrictions on gatherings and movement to prevent the spread of the virus. However, these measures received mixed evaluations, as they negatively impacted mental health and raised concerns about human rights [84-86]. It was argued that social capital may play an important role in health under the influence of crises such as the COVID-19 pandemic [87]. For instance, social capital may facilitate the acquisition and diffusion of health-related knowledge that protects people from contracting and transmitting COVID-19 [88]. Additionally, social capital may lower the harmful impacts of loneliness or isolation during a pandemic which can mitigate psychological distress [89], which in turn prevent suicide-related behaviors. However, the current study only considered the period before the onset of the COVID-19 pandemic. Accordingly, future research is needed that considers the role of social capital in suicide before and after the onset of the COVID-19 pandemic to better understand the relationship between social capital and suicide during extraordinary times.

CONCLUSION

Based on a longitudinal analysis of a nationally representative survey in South Korea, the current study found that a relatively large proportion of the variance in suicidal ideation could be attributed to the household level (30.49%). The results also showed that cognitive social capital, measured by trust and reciprocity at the individual and household levels was negatively associated with suicidal ideation. However, structural social capital, measured by volunteering did not show a clear relationship with suicidal ideation. In conclusion, the results of this study suggest that understanding suicide risk could be enhanced by investigating household factors and that some components of social capital could help reduce suicide risks.
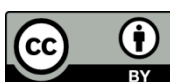
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