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Gender differences in the influence of social isolation and loneliness on depressive symptoms in college students: a longitudinal study

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Abstract

Purpose There is evidence that social isolation or loneliness may be associated with mental health. However, it is unclear to what extent these two factors independently affect mental health and if these effects are gender dependent. This study examined the simultaneous associations of social isolation and loneliness with depressive symptoms in a longitudinal study of male and female college students.

Methods Data were analyzed from 741 college students (28.3% males, 71.7% females; mean age = 18.47, SD = 0.87) at Tianjin Medical University. Multiple linear regression models were conducted to test the independent, relative, and synergistic effects of baseline isolation and loneliness on depressive symptoms at follow-up for female and male college students separately. All analyses were adjusted for baseline depressive symptoms and personality traits.

Results Gender differences were found for the prospective associations of social isolation and loneliness with depressive symptoms. For females, either baseline isolation ($\beta = 0.22$, $p < 0.001$) or loneliness ($\beta = 0.23$, $p < 0.001$) can significantly predict the increased depressive symptoms. For males, baseline isolation ($\beta = 0.25$, $p < 0.01$) rather than loneliness ($\beta = 0.14$, $p > 0.05$) can significantly predict depressive symptoms.

Conclusions This longitudinal study found a gender-dependent impact of isolation and loneliness on depressive symptoms. These results indicated that female and male college students may require different interventions to help them adjust to college life.

Introduction

Social isolation and loneliness are reflections of the objective and subjective characteristics of weak social relationships [1]. Social isolation is a state of estrangement, in which social connections are limited or absent. Loneliness, on the other hand, is a subjective feeling of distress, arising when there is a discrepancy between desired and actual social relationships [2]. Although isolation and loneliness tend to co-occur, they can also be experienced independently of one another. This is supported by research showing that being alone and feeling lonely are only moderately correlated [3].

Both social isolation and loneliness have been individually identified to be associated with depression in multiple studies of different populations. Previous research has identified a wide range of social isolation indicators that can impact on mental health, including being single, living alone, having a weak social network and infrequent social interactions [4, 5]. Longitudinal studies have also found that loneliness correlates with depressive symptoms across time in children [6], adolescents [7], undergraduates [8], and elderly people [9]. However, since the majority of prior research has focused on either social isolation or loneliness, or merging these two together as one concept, there is uncertainty with regard to which of the two plays a more important role in depression [10]. Two recent studies have examined the association of social isolation and loneliness

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with depressive symptoms. One cross-sectional study with community-dwelling adults found that social isolation and loneliness were independently associated with depressive symptoms and loneliness has a stronger association with depressive symptoms than social isolation [11]. Another longitudinal study found an interaction effect of loneliness and social isolation on both mental and physical health, while subjective loneliness and network quality best predicted depressive symptoms [12]. Both these two studies were conducted with older adults. Given that many factors relating to social relationships change with age [13], it is important to examine the simultaneous associations of social isolation and loneliness with depressive symptoms in younger adults such as college students.

Gender differences are of particular interest in this study. One of the most consistent findings in the field of depression is the marked gender differences in prevalence. Research consistently indicates that females are twice as likely than males to develop depressive symptoms [14]. Social relationship factors have been proposed as one possible explanation for these gender differences [15]. Several studies have examined gender differences in the association between loneliness and depressive symptoms, though the results are mixed. Some studies indicate no gender differences [16, 17], while other studies indicate that the association between loneliness and depressive symptoms is stronger for males than for females [9]. One possible reason for these discrepant findings might be that the impact of social isolation factors was ignored in most of these studies. Existing evidence suggests that gender differences may not only exist in the impact of loneliness on depressive symptoms, but also in the impact of social isolation factors. Compared to males, females generally have larger social networks and higher participation in social activities [18, 19]. However, in comparison to males, females have also been found to be more sensitive to the interpersonal context and prefer greater interpersonal connectedness, which may make females more sensitive than males to the negative mental health effects of poor social connections [20]. Although evidence suggests possible gender differences in both the role of loneliness and social isolation for mental health, no study has simultaneously examined if gender moderated the magnitude of the associations between these two indicators of social relationship and depressive symptoms.

Given these limitations and concerns regarding the potential importance of gender differences for understanding the associations between social isolation, loneliness and depressive symptoms, the present study was conducted with college students over a 3-year follow-up period. We hypothesize that: (1) the social isolation and loneliness will have discrepancy effects on depressive symptoms and (2) gender differences may exist in the association of social isolation and loneliness with depressive symptoms.

Methods

Participants

Potential participants were contacted twice during the span of this study. 1113 freshman college students responded to the survey on the computer at Time 1 (in October of the fall semester, 2014) and all these students were contacted to complete the internet survey at Time 2 (January of the fall semester, 2017). At follow-up, 327 students did not respond to the survey, yielding a response rate of 70.6%. Among 786 students who responded to the survey at both Time 1 and Time 2, 45 students had missing data on the study variables of interest and were, therefore, excluded (see Fig. 1). The final group of 741 participants included 531 (71.7%) females and 210 (28.3%) males with a mean age of 18.47 years at Time 1 (SD = 0.87, range = 16–28 years). Informed consent was obtained from all study participants. All questionnaire data were analyzed anonymously. Study protocols were approved by the Institutional Review Board (IRB) of Tianjin Medical University (IRB Reference number: TMUhMEC 2014012).
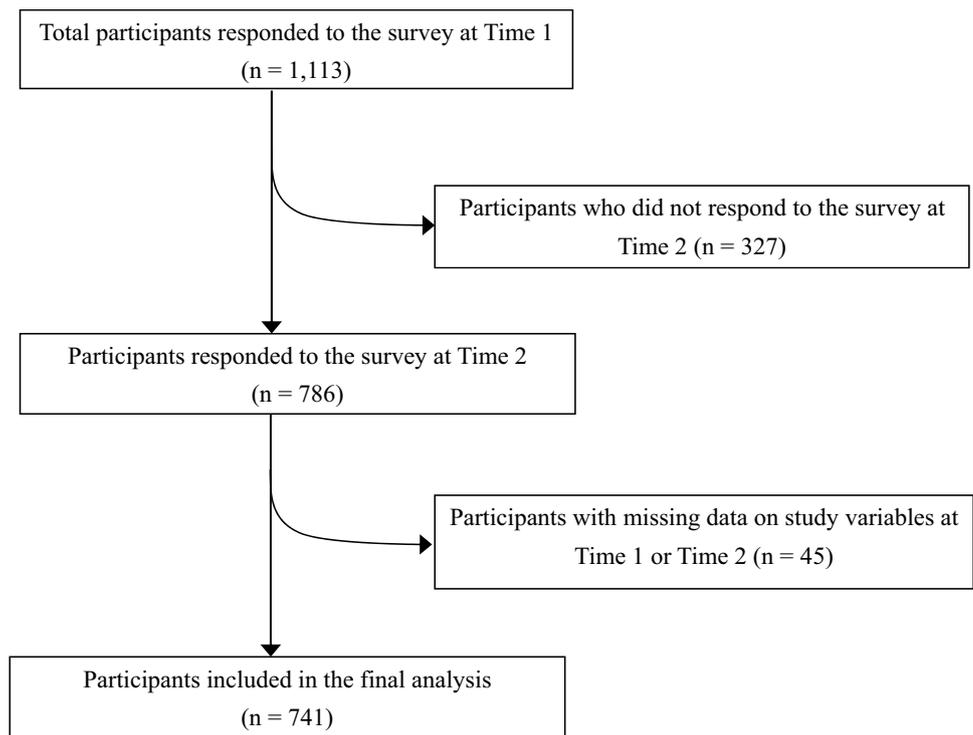
Measures

Depressive symptoms

Depressive symptoms at Time 1 and Time 2 were assessed by the Chinese version of Self-Rating Depression Scale (SDS), which has been found to be a valid measure for the Chinese population [21]. There are 20 items rated on a 4-point scale. Summary scores range from 20 to 80, with higher scores indicating the elevated depressive symptoms. In the present study, Cronbach alpha was 0.80 at Time 1 and 0.86 at Time 2.

Social isolation

Social isolation at Time 1 was measured by combining six items to create an index of social isolation based on previous research [22, 23]. One point was assigned if participants were an only child, come from cities other than Tianjin (where the university was located), have few friends (number of friends ≤ 1), have less than monthly contact with their family members, and friends, and have less than weekly frequency of social activity. Scores ranged from 0 to 6, with higher scores indicating greater social isolation.

Fig. 1 Flowchart of participants' selection

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┌─────────────────────────────────────────────┐
│ Total participants responded to the survey   │
│ at Time 1 (n = 1,113)                         │
└─────────────────────────────────────────────┘
                     │
                     │──────────────────┐
                     │                  ▼
                     │     ┌──────────────────────────────────┐
                     │     │ Participants who did not respond  │
                     │     │ to the survey at Time 2 (n = 327) │
                     │     └──────────────────────────────────┘
                     ▼
┌─────────────────────────────────────────────┐
│ Participants responded to the survey at      │
│ Time 2 (n = 786)                              │
└─────────────────────────────────────────────┘
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                     │     │ Participants with missing data on │
                     │     │ study variables at Time 1 or      │
                     │     │ Time 2 (n = 45)                    │
                     │     └──────────────────────────────────┘
                     ▼
┌─────────────────────────────────────────────┐
│ Participants included in the final analysis  │
│ (n = 741)                                     │
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Loneliness

We measured loneliness at Time 1 with the UCLA loneliness scale, which is the most widely used instrument to assess loneliness [24]. This scale consists of 11 items worded in a negative/lonely direction and 9 items worded in a positive/non-lonely direction. Participants rate the extent of their agreement with these questions on a 4-point Likert scale ranging from 1 (never) to 4 (often). Participants' scores were calculated by reverse coding the 9 positive items and then summing all 20 items; higher scores indicate greater loneliness (Cronbach alpha = 0.91).

Other measures

Demographic information including age, gender and residential background (rural or urban) was collected. Personality was assessed using the Chinese version of Eysenck Personality Inventory (C-EPI) at Time 1. The C-EPI includes 24 items that measure neuroticism and 21 items that measure extraversion [25]. The participants responded yes or no to each question, resulting in a range of scores from 0 to 24 for neuroticism and 0 to 21 for extraversion.

Statistical analyses

The association between isolation and loneliness was tested using Pearson's correlation. Chi square tests or independent sample t tests were conducted to examine differences for all variables at baseline between females and males. For the longitudinal data with two measures including baseline and follow-ups, there were two standard methods of analysis. The first was an analysis of covariance with follow-ups as outcome and baseline as covariate, while the second involved computing a change score between baseline and follow-up and using the change score as outcome [26]. We conducted our analysis using follow-up SDS score as outcome and baseline SDS score as covariate, which is in accordance with some previous studies with a similar design as ours [6, 27]. We used multiple linear regression to test the independent, relative, and synergistic effects of isolation and loneliness on depressive symptoms for females and males separately. Four different models were estimated and depressive symptoms at Time 2 were used as the dependent variable in all models. First, we regressed depressive symptoms at Time 2 separately on isolation (Model 1) or loneliness (Model 2). Second, we entered isolation and loneliness simultaneously into the model (Model 3). Finally, we tested for an interaction effect between isolation and loneliness (Model 4). All regression analyses were adjusted for age, baseline depressive symptoms, residential background and personality traits. Results are presented using both unstandardized regression coefficients (B) and standardized regression coefficients (β). In the sensitivity analysis, we repeated the Model 3 after excluding the participants with a baseline SDS score ≥ 45. All analyses were conducted using IBM SPSS 22.0 and a p value < 0.05 was considered statistically significant.

Results

Before analyses were conducted, participants who responded to the survey at both Time 1 and Time 2 ($n = 786$) were compared with participants who only responded to the survey at Time 1 ($n = 327$) in terms of their gender, age, loneliness, social isolation, personality traits and depressive symptoms measured at Time 1. Chi square analyses indicated that there was a significant difference between the two groups of participants in terms of gender: $\chi^2 = 23.90$ ($p < 0.001$). Independent sample t tests indicated that there were no significant differences between the groups in terms of age, isolation, loneliness, depressive symptoms, extraversion and neuroticism (all $p > 0.05$).

Of all the participants included in the final analysis, the mean baseline SDS score was 34.36 and 6.5% were classified as having elevated depressive symptoms when using 45 as a cutoff point. The correlation between isolation and loneliness was 0.37 ($p < 0.001$). Table 1 provides information about the characteristics of participants at baseline stratified by gender. Significant differences were only observed in terms of social isolation. Compared to female students, male students were more likely to be an only child ($p < 0.001$), have less than monthly contact with family members ($p = 0.015$), and be less likely to have few friends ($p = 0.022$). The social isolation score for male students was significantly higher than female students ($p = 0.004$). No gender difference was detected for depressive symptoms at Time 1 (females $= 34.46 \pm 6.57$, males $= 34.11 \pm 6.06$, $p = 0.515$). While at Time 2,

depressive symptoms of female students were marginally higher than those of male students (females $= 35.47 \pm 7.57$, males $= 34.25 \pm 7.82$, $p = 0.052$).

To detect gender differences in the influence of social isolation and loneliness on depressive symptoms, we conducted analyses separately for males and females [28, 29]. Table 2 shows the associations between isolation and loneliness at Time 1 with depressive symptoms at Time 2 for female and male students, controlling for other individual characteristics. For females, either baseline isolation ($\beta = 0.22$, $p < 0.001$) or loneliness ($\beta = 0.23$, $p < 0.001$) can significantly predict increased depressive symptoms. When isolation and loneliness were entered simultaneously into the model (Model 3), the regression coefficients for both isolation and loneliness were minimally reduced and remained significant ($p < 0.001$). For males, baseline isolation ($\beta = 0.25$, $p < 0.01$) also significantly predicted depressive symptoms. On the contrast, loneliness was not associated with depressive symptoms ($\beta = 0.14$, $p > 0.05$). When baseline isolation and loneliness were entered simultaneously into the regression model (Model 3), the coefficient for isolation remained significant ($\beta = 0.24$, $p < 0.001$). No significant interaction between isolation and loneliness was found for male or female students (all $p > 0.05$) (Model 4). We repeated Model 3 by treating gender as a binary variable, which indicated a significant effect of gender for depressive symptoms ($\beta = -0.08$, $p = 0.019$). We then conducted further analyses by including interaction terms of gender with isolation or loneliness in the model. However, no significant effects were detected for these terms (gender $\times$ isolation: $\beta = 0.03$, $p = 0.713$; gender $\times$ loneliness: $\beta = -0.07$, $p = 0.618$). The reason for this might be those effects of other

Table 1 Sample characteristics at baseline by gender ($n = 741$)

Variables	All (mean, SD) ($n = 741$)	Females (mean, SD) ($n = 531$)	Males (mean, SD) ($n = 210$)	p value
Age	18.47 (0.87)	18.44 (0.91)	18.55 (0.78)	0.122
Residence (urban, %)	55.1	54.3	57.4	0.453
Neuroticism	10.17 (5.23)	10.18 (5.20)	10.15 (5.33)	0.957
Extraversion	12.78 (4.32)	12.71 (4.28)	12.96 (4.43)	0.510
Social isolation	2.17 (1.13)	2.09 (1.09)	2.36 (1.18)	0.004
Only child (yes, %)	51.9	46.2	66.2	< 0.001
Few friends (yes, %)	19.1	21.1	13.8	0.022
Less than monthly contact with family members (yes, %)	19.6	17.4	25.2	0.015
Less than monthly contact with friends (yes, %)	14.9	13.4	18.5	0.074
Come from Tianjin (yes, %)	32.6	34.2	28.6	0.144
Social activity (yes, %)	56.2	54.9	59.5	0.254
Loneliness	36.63 (9.07)	36.87 (9.23)	36.03 (8.64)	0.245
Depressive symptoms at Time 1	34.36 (6.42)	34.46 (6.57)	34.11 (6.06)	0.515
Depressive symptoms at Time 2	35.12 (7.66)	35.47 (7.57)	34.25 (7.82)	0.052

Table 2 Linear regression for the score of depressive symptoms at follow-up by gender

| | Females | | | | | | | | Males | | | | | | | |
| | Model 1 | | Model 2 | | Model 3 | | Model 4 | | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
	B	β	B	β	B	β	B	β	B	β	B	β	B	β	B	β
Age	0.53	0.06	0.46	0.06	0.52	0.06	0.52	0.06	0.14	0.01	− 0.12	− 0.01	0.08	0.01	− 0.01	− 0.00
Residence	− 0.00	0.00	− 0.74	− 0.05	− 0.15	− 0.01	− 0.16	− 0.01	0.80	0.05	0.49	0.03	0.84	0.05	0.88	0.06
Neuroticism	0.11	0.08	0.08	0.03	0.18	0.02	0.18	0.02	0.02	0.02	− 0.07	0.01	0.05	− 0.00	0.07	0.00
Extraversion	0.12	0.06	0.04	0.04	0.03	0.10*	0.03*	0.10	0.03	0.01	0.01	− 0.04	− 0.00	0.03	0.00	0.04
Baseline SDS	0.33***	0.28	0.24***	0.21	0.27***	0.23	0.27***	0.23	0.35	0.27**	0.29**	0.23	0.32**	0.25	0.32**	0.25
Isolation	1.51***	0.22	–		1.30***	0.19	1.44	0.21	1.68	0.25**	–		1.59**	0.24	− 1.19	− 0.18
Loneliness			0.19***	0.23	0.14***	0.17	0.15	0.19			0.13	0.14	0.07	0.08	− 0.13	− 0.14
Isolation×loneliness							− 0.00	− 0.03							0.08	0.55

***p < 0.001, **p < 0.01, *p < 0.05

variables included in the multiple regression model such as baseline SDS, loneliness or social isolation were too strong, which prevent the detection of these interaction effects.

We carried out a sensitivity analysis to guard against the possibility that associations were caused by individuals having become isolated or lonely as a consequence of depressive symptoms. We repeated the Model 3 after excluding participants whose baseline SDS score was 45 or higher ($n = 48$), which yielded a similar result [for females, isolation ($\beta = 0.20$, $p < 0.001$) and loneliness ($\beta = 0.17$, $p = 0.004$) were both significant; for males, isolation ($\beta = 0.25$, $p = 0.001$) was significant but loneliness ($\beta = 0.04$, $p = 0.654$) was not].

Discussion

The purpose of this study was to examine the differential associations of isolation and loneliness with depressive symptoms in college students and if these associations were moderated by gender. In this longitudinal study, higher levels of both social isolation and loneliness were found to be prospectively associated with increased depressive symptoms for female students. However, for male students, only social isolation was positively associated with increased depressive symptoms. These longitudinal findings showed that females were more vulnerable to the negative effects of loneliness on mental health. As far as we know, this is the first longitudinal study to find a gender-dependent impact of isolation and loneliness on mental health.

Social isolation has been found to be associated with depressive symptoms in multiple studies. Previous research has identified a wide range of social isolation indicators that may be associated with depression [5, 30]. Our longitudinal study results are in accord with those showing a significant association between isolation and depressive symptoms in both female and male college students. We used a multidimensional measure of social isolation as opposed to assessing separate aspects of social isolation. Moreover, our results extend earlier findings by indicating that this association is independent of the subjective feeling of loneliness.

Two recent studies have investigated the simultaneous associations of social isolation and loneliness with depressive symptoms, and found that loneliness has a stronger association with depressive symptoms than social isolation [11, 12]. However, both studies were conducted with samples of older adults and gender differences were not examined. As noted previously, few studies have investigated gender differences in the association between loneliness and depressive symptoms and results were mixed. A cross-sectional study with adolescents found that the association between loneliness and depressive symptoms was strong in girls and boys [31]. Another study with older adults

found that the association between loneliness and depressive symptoms was significantly stronger for men than for women [9]. A recent study with African American college students indicated a significant interaction effect of gender and loneliness in predicting both anxious and depressive symptoms. Specifically, higher levels of anxious and depressive symptoms were found among lonely African American women compared to men [32], which is consistent with our results. One possible explanation for these inconsistent findings would be that most prior studies testing gender differences have used cross-sectional samples [31, 32], which would not allow gender comparisons for different directions of effects. Another possible explanation may relate to different characteristics of the study populations (e.g., age, racial).

There is a well-established gender difference in the rates of depressive symptoms and depression across the lifespan, with females presenting with higher levels of depressive symptoms and depression than males [14, 33]. It has been suggested in the literature that social relationship factors may, at least in part, account for such gender differences [15]. Our study together with another recent study [32] showed that the subjective feeling of loneliness, rather than social isolation, could be the social risk factor for depression that might differentially affect females and males. There may be several reasons why females are more vulnerable than males to the negative mental health effects of loneliness. First, women, compared to men, are believed to be more sensitive to the interpersonal context and prefer greater interpersonal connectedness [20, 34, 35]. Second, previous research suggests that social relationships for females are characterized by greater amounts of emotional sharing in comparison to males, which emphasize shared activities [36]. Therefore, females' mood might be influenced more by the emotional component of social relationships, while males' mood might be influenced more by the actual component of social relationships. Third, evidence has shown that lonely individuals have negative emotional self-regulatory strategies, which may reduce their abilities to regulate emotions in response to distress [37].

The strengths of this study include longitudinal assessment and examination of the concurrent effects of social isolation and loneliness on depressive symptoms. There are also limitations. First, the majority of participants in the present study were young adult college students. Therefore, caution must be taken in generalizing these findings to other populations, such as older students or adults. Second, this study only collected data from two time points. The addition of more data points would enhance understanding of these relationships. Finally, the current study was limited to self-report data, which raises the potential problem of mono-method bias.

In conclusion, this study indicates that both social isolation and loneliness were associated with increased depressive symptoms after 3 years among female college students, while only social isolation was associated with increased depressive symptoms among male college students. The present results indicated that gender differences in depressive symptoms could be partly attributed to females' experience of more negative consequences of loneliness than males. The results also suggest that female and male college students may need different interventions to help them adjust to college life. To reduce depressive symptoms among male students, it may be beneficial to encourage them to increase their levels of social connectedness, whereas female students might benefit more from simultaneously increasing levels of social connection and decreasing feelings of loneliness.

Compliance with ethical standards

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