

Research Article

COVID-19 Risk Perception and Loneliness among Korean Adults: The Mediating Effects of Social Distancing and Social Connectedness

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Received 24 August 2022; Accepted 11 October 2022; Published 8 February 2023

Academic Editor: Gianpiero Greco

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This study examined the complex associations among coronavirus disease 2019 (COVID-19) risk perception, social distancing, social connectedness, and loneliness, as well as the mediating effects of social distancing and social connectedness in these associations in younger, middle-aged, and older Korean adults. We used multigroup structural equation modeling to analyze the results of a cross-sectional survey of 2,400 Korean adults aged 20 years or older. We found statistically significant age group differences in the mean values of COVID-19 risk perception, social distancing, social connectedness, and loneliness. The younger group showed significant associations among all major variables in the structural equation model, while their older counterparts demonstrated a significant association between COVID-19 risk perception and loneliness. Social distancing and social connectedness mediated the effect of COVID-19 risk perception on loneliness only for the younger group. In addition, we found significant mediating effects of social connectedness on the association between COVID-19 risk perception and loneliness in the middle-aged and older groups. Our findings imply that social distancing and social connectedness have impacted Korean adults' mental health during the COVID-19 pandemic.

1. Introduction

Since the World Health Organization (WHO) declared the novel coronavirus disease 2019 (COVID-19) pandemic in 2020, numerous contagious variants of this virus have appeared and are still spreading across the globe. In South Korea, as in other countries, confirmed cases and case fatality rates among older people have increased with the emergence of the new Omicron variant, among others. Although patients in their 30s and 40s accounted for the highest rates of confirmed cases as of April 2022 at 14.7% and 15.5% of total confirmed cases, respectively, the highest case fatality rate and death rate among all deaths occurred in patients over 80 years of age at 2.68% and 58.93%, respectively [1].

As the COVID-19 situation has failed to improve, fear and risk perceptions of COVID-19 are still widespread. Risk perception is an intuitive assessment by which people compare any risks to which they are exposed or are likely to be exposed with the negative effects associated with a specific cause for these risks [2–4]. According to Kim et al. [5], Koreans aged 20–60 responded that COVID-19 was more dangerous than other severe illnesses or natural or social disasters. Another study [6] reported that 48.8% and 29.7% of people suffered from anxiety and depression, respectively, due to COVID-19 in South Korea.

Meanwhile, researchers found positive associations between risk perception, social isolation, and loneliness [7–10]. Specifically, while older people were vulnerable to loneliness before COVID-19, the pandemic could have contributed to

even more feelings of loneliness due to reduced social contact [11, 12]. While multiple studies found that loneliness was more prevalent among older adults than younger adults due to their higher COVID-19-related risks [13–16], recent studies showed that loneliness was higher among younger people than other age groups [17, 18]. However, there is insufficient understanding of the association between COVID-19 risk perception and loneliness according to the age group. Therefore, it is necessary to find ways to reduce loneliness among people of different age groups.

Furthermore, researchers have not fully acknowledged the predictors that might affect the association between COVID-19 risk perception and loneliness. Social distancing and social connectedness are possible predictors, as they may have mediating roles in the relationship between risk perception of COVID-19 and loneliness [7, 19]. Most countries used social distancing to prevent the spread of COVID-19, but researchers have not studied the effectiveness of these measures, specifically considering the association between risk perception and loneliness. Social welfare facilities for senior citizens also adopted strict quarantine measures. For example, governments prohibited older adults who often use senior welfare centers from using the facilities and attending activities. Excluding older people from various services (e.g., meal services, leisure, recreational programs, physical therapy, and counseling) weakened their social connectedness and made them feel socially isolated and lonely [5]. These results confirm that the “Corona Blues” can affect all age groups.

Social connectedness is a protective factor in preventing loneliness and socioemotional problems [20]; it is related to a feeling of belongingness within a social group larger than informal networks such as family and friends [21, 22]. The United Kingdom (U.K.) government reported that one strategy for tackling loneliness was to promote a connected society [23]. Numerous studies confirmed that social connectedness could alleviate symptoms of loneliness, depression, and anxiety [24, 25], and it mediated the relationships between dysfunctional interpersonal behaviors and psychological distress [26, 27]. However, an investigation is lacking on the role of social connectedness in the association between COVID-19 risk perception and loneliness.

1.1. Conceptual Framework. We adopted the theoretical framework for the present study from the cognitive discrepancy theory of loneliness [28] and the transactional theory of stress and coping [29–31].

The cognitive discrepancy theory focuses on subjective deficits in social relationships [32–34], which is a mismatch between desired and achieved levels of social relationships [35]. A mismatch could happen in specific circumstances such as the COVID-19 situation. For example, the fear or risk perception of COVID-19 leads to reduced social contact, which could loosen social connectedness. Previous studies reported that certain life events and sudden environmental changes could affect older adults’ feelings of loneliness [32, 33, 36, 37]. Therefore, COVID-19 risk perception could also lead to loneliness in older adults.

The transactional theory of stress and coping is the most popular stress pathway model. It assumes that individuals constantly receive stimuli from their living environment and cognitively appraise some of them as threatening and harmful stressors. Individuals then evaluate the stressors, using coping strategies to respond. Lazarus and Folkman [31] identified problem-focused coping and emotion-focused coping as two common strategies. The former relates to changing troubled people or situations, and the latter relates to regulating emotional distress. Finally, coping processes elicit positive or negative outcomes [38–40].

Individuals perceive COVID-19 as a risk to the human body and, thus, a stressor. Stressors trigger preventive actions wherein individuals use coping strategies to prevent harm to their mental health. Coping affects psychological wellbeing, social functioning, and immediate stress responses such as risk perception. Subsequently, the present study concentrated on the problem-focused and emotion-focused strategies people use to cope with the risk perception of COVID-19. For example, social distancing is a problem-focused coping strategy that is used to change individual behaviors and prevent the spread of infection. By following social distancing rules, individuals could feel safe from the risk of COVID-19 disease. Risk perception has also affected the spread of social distancing behavior, an alternative measure to prevent COVID-19 infection [41–43]. Thus, people follow social distancing regulations as they perceive them as a safety measure. However, there is not enough evidence to conclude whether social distancing leads to positive or negative mental health outcomes.

Meanwhile, a study reported that social connectedness was an emotional protective factor against negative mental health issues in younger people [44]. For example, people with a sense of belongingness in a community might feel more comfortable and realize that they are not alone, which will significantly help people cope with the negative effects of social isolation. Furthermore, avoiding close contact with people by social distancing causes low social connectedness, which increases loneliness in older people [11].

In sum, existing studies do not clarify whether social distancing and social connectedness mediate the association between COVID-19 risk perception and loneliness nor do they clear how these effects differ by the age group. Therefore, this study investigated the complex associations among COVID-19 risk perception, social distancing, social connectedness, and loneliness using the cognitive discrepancy theory of loneliness [28] and the transactional theory of stress and coping [30, 31].

Figure 1 presents our study’s hypothesized conceptual model and it implies age group differences in the strengths of the path coefficients. Thus, our hypotheses are as follows:

H₁: the mean values of COVID-19 risk perception, social distancing, social connectedness, and loneliness differ among younger, middle-aged, and older Korean adults.

H₂: social distancing and social connectedness mediate the association between COVID-19 risk perception and loneliness, and the mediating effects differ among the three age groups.

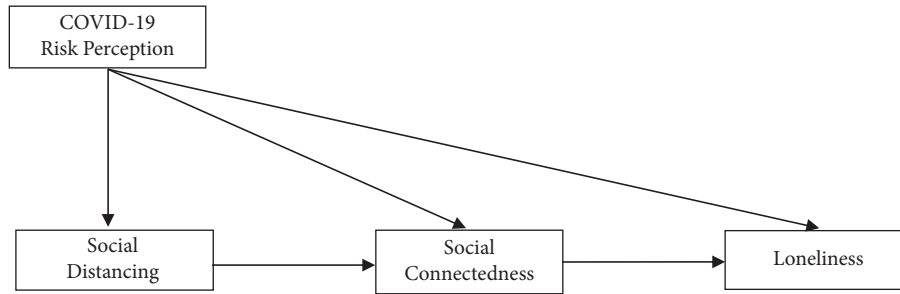


FIGURE 1: Hypothesized conceptual model.

2. Methods

2.1. Data and Sample. This study used a cross-sectional survey design with registered Seoul city residents. Before launching into data collection, we obtained approval from the University Institutional Review Board. Next, we collected data from October 2020 to November 2020. However, due to difficulties connecting with people owing to the COVID-19, we used online surveys with the younger and middle-aged groups. However, there were no online survey panelists from the older population in the research company, so we conducted face-to-face interviews with the older group, albeit with limited access.

We selected younger and middle-aged adults from the registered sample panel in the databases of the Hankook Research website to participate in the online survey. We used quota sampling criteria such as age, sex, and residential geographic area until we reached the target number of participants (i.e., 31 men and 33 women in their 20s residing in the southeastern district of Seoul). Next, we used a multistage quota sampling strategy to select older adults (residents of Seoul) for the paper-based in-person survey; we randomly selected participants from 14 large districts among 29 administrative districts in Seoul. Then, we selected small administrative districts from the 14 large districts. Finally, we chose older adults from these small districts according to age and sex as quota criteria. Trained survey interviewers approached potential participants until they successfully recruited the target number of survey respondents (i.e., 398 older adult participants).

Both online and face-to-face survey participants received a written informed consent form and a flyer explaining the purpose of the survey, the overall study procedures, potential risks and benefits, and confirmation of confidentiality. In addition, all survey participants who completed the survey received a three-dollar gift card as a token of appreciation for their time. We selected 2,400 respondents aged 20 years or older residing in Seoul. The sample consisted of 1,000 people from the younger group (20–49 years old), 1,002 people from the middle-aged group (50–64 years old), and 398 people from the older group (65 years and over).

2.2. Measures

2.2.1. COVID-19 Risk Perception. We used a novel COVID-19 eight item scale [45] to measure risk perceptions toward the COVID-19 pandemic. Respondents indicated their

agreement with each item using a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Examples of items include “I think the novel coronavirus is more severe than the flu,” “I am more likely to get the novel coronavirus than other people,” and “The novel coronavirus will inflict serious damage in my community.” Higher scores indicated that respondents were more likely to consider COVID-19 a threat. The present study’s Cronbach’s alpha score for this scale was 0.6.

2.2.2. Social Distancing. We used a social distancing subscale of preventive measures for COVID-19 [7] to measure social distancing. This scale contains six items (e.g., “Avoiding public transport,” “Avoiding going out in general,” and “Avoiding crowded areas”) rated on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Higher scores indicated that respondents were more likely to comply with social distancing preventive measures. The present study’s Cronbach’s alpha score for social distancing was 0.8.

2.2.3. Social Connectedness. We used Social Connectedness Scale-Revised [21] to measure social connectedness. The scale contains eight items (e.g., “I feel disconnected from the world around me,” “I do not feel related to anyone,” and “I catch myself losing all sense of connectedness with society”). Participants rated the items on a five-point Likert scale, ranging from 1 (strongly agree) to 5 (strongly disagree). Higher scores reflected that respondents were more likely to struggle to feel socially connected. The present study’s Cronbach’s alpha score for social connectedness was 0.9.

2.2.4. Loneliness. We used a short version of the Loneliness Scale [46] to measure loneliness. The scale includes three items: “How often do you feel that you have a lack of interaction with others?,” “How often do you feel that you are isolated from people around you?,” and “How often do you feel alienated from others?.” Respondents rated these items with a three-point Likert scale (1 = rarely, 2 = occasionally, 3 = frequently). Higher scores indicated that respondents were more likely to feel lonely. The present study’s Cronbach’s alpha score for loneliness was 0.8.

2.2.5. Covariates. We included a set of sociodemographic variables as covariates. Covariates included participants' age, sex, marital status, number of family members, educational level, total household monthly income, employment status, religion, and subjective health status. We measured subjective health status using a single-item score on a five-point response, ranging from 1 (very bad) to 5 (very good).

2.3. Data Analytic Plan. We used multiple statistical strategies to test the research hypotheses. First, we examined descriptive statistics to assess the sociodemographic characteristics of all respondents and the three age groups. We also evaluated an assumption of normality using univariate indices of skewness and kurtosis and identified outliers using box plots and leverage indices for each individual. Then, we applied analysis of variance with post-hoc tests to compare age groups' mean scores for the key variables.

Second, we used multigroup structural equation modeling to estimate the path coefficients in the structural model across the three age groups. We then compared the constrained model with equivalent path coefficients and the unconstrained model with no equality constraints among groups by performing chi-square difference tests. We used the following goodness-of-fit indices to evaluate the structural model: overall chi-square test ($p > 0.05$), comparative fit index ($CFI > 0.95$), standardized root mean residual ($SRMR \leq 0.08$), and root mean square error of approximation ($RMSEA < 0.06$) [47].

Third, we analyzed total, direct, and indirect effects using a percentile-based bootstrap method [48] to determine whether social distancing and social connectedness mediated the association between COVID-19 risk perception and loneliness among the three age groups. In addition, we implemented several sensitivity analyses (e.g., missing data, outliers, and comparisons of correlations) to examine any biases caused by using two different data collection methods. The results showed neither extreme nor problematic observations. We dealt with missing values in the dataset using full information maximum likelihood [49]; no data were missing for the major variables used in this study. There were no outliers with extremely low or high values and the values of correlation coefficients among continuous variables ranged from -0.234 to 0.117 . We used Mplus 8 and SPSS 24.0 for all data analyses.

3. Results

3.1. Descriptive Analyses. Table 1 presents the sociodemographic characteristics of the sample. The respondents' mean age was 50.4 years ($SD = 15.89$), and females comprised 51.8% of the sample. More than half of the respondents (59.5%) were married, and the mean number of family members was 3.28 ($SD = 1.33$). Most respondents (88%) reported that they were high school graduates or had a higher level of education. Approximately, two-thirds of the respondents (65.3%) had a monthly household income of less than \$3,000. Less than half of the respondents (48.2%)

were employed, and 59.5% of the respondents were religious. In addition, the mean score of subjective health status was 3.28 ($SD = 1.33$) out of 5.

3.2. Group Mean Comparisons. Table 2 presents the mean values of major variables and comparisons between the groups' mean values for these variables. There were statistically significant age group differences in the mean values of COVID-19 risk perception ($F = 17.38$, $p < 0.001$), social distancing ($F = 34.35$, $p < 0.001$), social connectedness ($F = 3.42$, $p < 0.05$), and loneliness ($F = 23.64$, $p < 0.001$). The COVID-19 risk perception and loneliness values were significantly higher in the younger group ($M = 3.58$ and $M = 1.61$, respectively) than in the middle-aged ($M = 3.51$ and $M = 1.55$, respectively) and older groups ($M = 3.44$ and $M = 1.40$, respectively). Conversely, the mean value of social distancing was higher in the older group ($M = 4.03$) than in the younger and middle-aged groups ($M = 3.72$ and $M = 3.76$, respectively). Meanwhile, the mean value of social connectedness was lower in the younger group ($M = 3.49$) than in the middle-aged and older groups ($M = 3.57$ and $M = 3.61$, respectively).

3.3. Multigroup Structural Equation Modeling. We used a multigroup structural equation modeling to evaluate the structural model of COVID-19 risk perception, social distancing, social connectedness, and loneliness among younger, middle-aged, and older adult groups. The initial model fit yielded a good model fit: $\chi^2(df = 1) = 0.55$, $p > 0.05$, $SRMR < 0.001$, $CFI = 1.000$, and $RMSEA = 0.001$. Modification indices and absolute standardized residuals suggested no theoretically significant points of poor fit.

Figure 2 illustrates the unstandardized path coefficient comparisons of the three age groups. The overall model fit was good: $\chi^2(df = 5) = 33.917$, $p < 0.05$, $SRMR = 0.085$, $CFI = 0.985$, and $RMSEA = 0.014$. There were six path coefficient differences among the three age groups. The path from COVID-19 risk perception to social distancing was higher in the younger ($B = 0.56$, $p < 0.001$) and middle-aged groups ($B = 0.56$, $p < 0.001$) than in the older adult group ($B = 0.12$, $p > 0.05$). The path from social distancing to social connectedness was higher in the younger group ($B = -0.18$, $p < 0.001$) than in the middle-aged and older groups ($B = 0.02$, $p > 0.05$; $B = 0.11$, $p > 0.05$). The path from social connectedness to loneliness was higher in the younger ($B = -0.36$, $p < 0.001$) and middle-aged groups ($B = -0.38$, $p < 0.001$) than in the older group ($B = -0.29$, $p < 0.001$). The two path coefficients linking COVID-19 risk perception to social connectedness and loneliness were equivalent among the three age groups.

Table 3 presents the total, direct, and indirect effects using bootstrapping. We used the logic of the joint significance tests and a percentile-based bootstrap method to estimate the mediation effects of each mediator [48, 50]. The path coefficients for four paths in the implied mediational chains were statistically significant for both mediators (all critical ratios $[CR] > 1.96$, $p > 0.05$). For the younger group,

TABLE 1: Sociodemographic characteristics.

Variable	Total (N = 2,400) n (%)	Younger group (n ₁ = 1,000) n (%)	Middle-aged group (n ₂ = 1,002) n (%)	Older group (n ₃ = 398) n (%)
Age (Mean ± SD)	50.40 ± 15.89	34.98 ± 8.39	56.34 ± 4.43	74.20 ± 6.59
Sex				
Male	1157 (48.2)	493 (49.3)	488 (48.7)	176 (44.2)
Female	1243 (51.8)	507 (50.7)	514 (51.3)	222 (55.8)
Marital status				
Married	1427 (59.5)	398 (39.8)	803 (80.1)	226 (56.8)
Single/divorced/widowed/separated	973 (40.5)	602 (60.2)	199 (19.9)	172 (43.2)
Number of family members (Mean ± SD)	3.28 ± 1.33	2.79 ± 1.30	3.31 ± 1.26	4.42 ± 0.73
1	704 (29.4)	436 (43.6)	268 (26.8)	0 (0)
2	534 (22.3)	228 (22.8)	249 (24.9)	57 (14.3)
3	631 (26.3)	232 (23.2)	282 (28.1)	117 (29.4)
≥4	531 (22.1)	104 (10.4)	203 (20.2)	224 (56.3)
Educational level				
Junior high school graduate or below	288 (12.0)	2 (0.2)	3 (0.3)	283 (71.1)
High school graduate	427 (17.8)	96 (9.6)	234 (23.4)	97 (24.4)
College graduate or some college	1401 (58.4)	774 (77.4)	611 (61.0)	16 (4.0)
Postgraduate education	284 (11.8)	128 (12.8)	154 (15.4)	2 (0.5)
Monthly household income				
< \$1,000	616 (25.7)	220 (22.0)	176 (17.6)	220 (55.3)
\$1,000 ~ \$1,999	460 (19.2)	171 (17.1)	176 (17.6)	113 (28.4)
\$2,000 ~ \$2,999	489 (20.4)	247 (24.7)	204 (20.4)	38 (9.5)
\$3,000 ~ \$3,999	323 (13.5)	168 (16.8)	138 (13.8)	17 (4.3)
\$4,000 ~ \$ 4,999	225 (9.4)	94 (9.4)	124 (12.4)	7 (1.8)
≥\$5,000	287 (12.0)	100 (10.0)	184 (18.4)	3 (0.8)
Employment status				
Yes	1157 (48.2)	493 (49.3)	488 (48.7)	176 (44.2)
No	1243 (51.8)	507 (50.7)	514 (51.3)	222 (55.8)
Religion				
Yes	1427 (59.5)	398 (39.8)	803 (80.1)	226 (56.8)
No	973 (40.5)	602 (60.2)	199 (19.9)	172 (43.2)
Subjective health status (Mean ± SD)	3.28 ± 1.33	2.79 ± 1.30	3.31 ± 1.26	4.42 ± 0.73

TABLE 2: Group mean comparisons of COVID-19 risk perception, social distancing, social connectedness, and loneliness among the three age groups.

Variable	Total (N = 2,400) Mean ± SD	Younger group (n ₁ = 1,000) Mean ± SD	Middle-aged group (n ₂ = 1,002) Mean ± SD	Older group (n ₃ = 398) Mean ± SD	F	LSD ^a
COVID-19 risk perception	3.53 ± 0.43	3.58 ± 0.46	3.51 ± 0.41	3.44 ± 0.37	17.38***	B,C < A; C < B
Social distancing	3.79 ± 0.65	3.72 ± 0.66	3.76 ± 0.63	4.03 ± 0.60	34.35***	A,B < C
Social connectedness	3.55 ± 0.87	3.49 ± 0.95	3.57 ± 0.85	3.61 ± 0.71	3.42*	A < B,C
Loneliness	1.55 ± 0.51	1.61 ± 0.54	1.55 ± 0.50	1.40 ± 0.44	23.64***	B,C < A; C < B

^aGroup A is the younger group (20–49 years old), group B is the middle-aged group (50–64 years old), and group C is the older group (65 years or over). * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

we found two indirect effects of COVID-19 risk perception on loneliness. Specifically, we could attribute 0.07 of the units of change to the mediational chain through social connectedness (CR = 2.60, $p < 0.01$). In addition, we attributed 0.03 of the units of change to the mediational chain through social distancing and social connectedness (CR = 3.39, $p < 0.01$). For the middle-aged and older groups, the effect of COVID-19 risk perception on loneliness was fully mediated by social connectedness; the estimated

indirect effects were 0.12 (CR = 4.04, $p < 0.001$) and 0.06 (CR = 2.02, $p < 0.05$), respectively.

4. Discussion

The present study examined differences among younger, middle-aged, and older Korean adults regarding COVID-19 risk perception, social distancing, social connectedness, and loneliness. We also investigated the association of COVID-

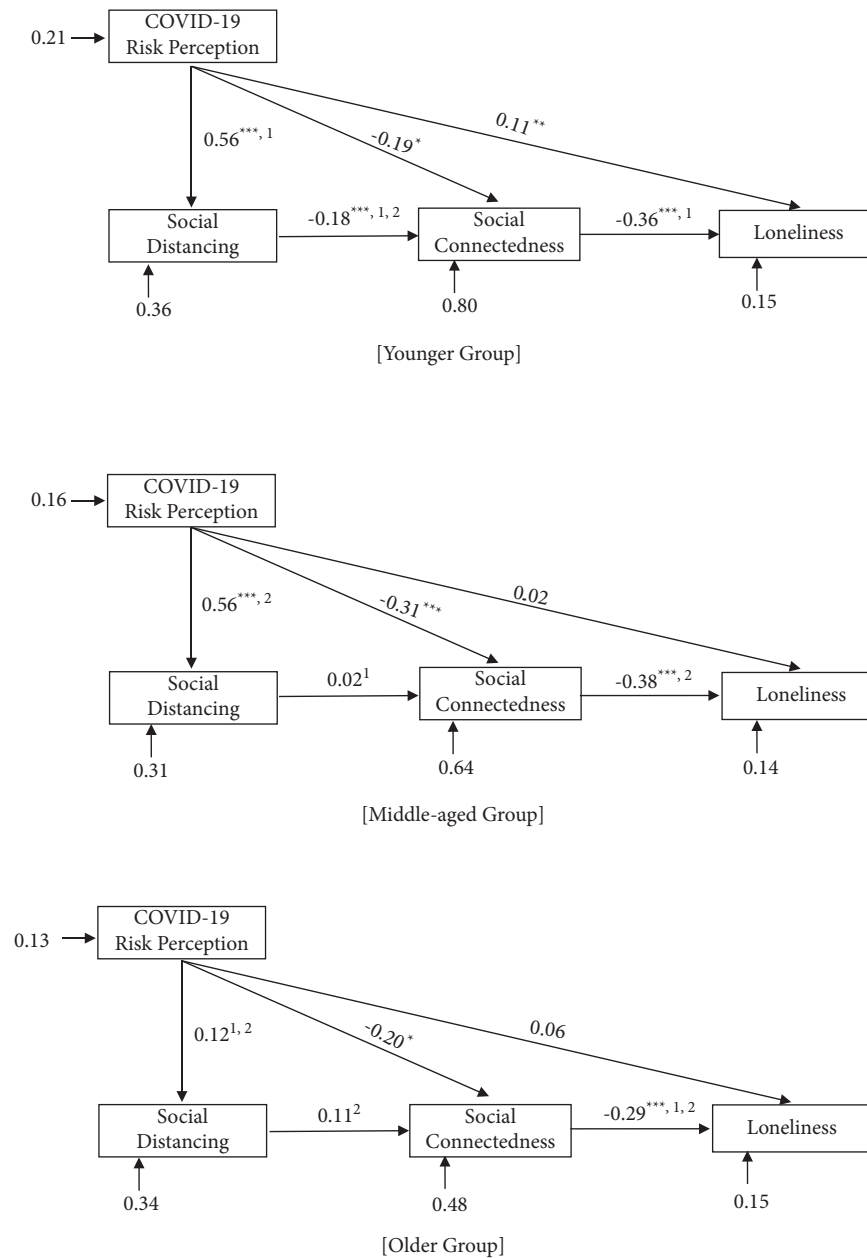


FIGURE 2: Multigroup structural equation model results. Groups with a common numerical superscript are statistically significantly different from each other at $p < 0.05$. Covariates included age, sex, marital status, number of family members, educational level, total household monthly income, employment status, religion, and subjective health status. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

19 risk perception with social distancing, social connectedness, and loneliness for each age group and the mediating effects of social distancing and social connectedness on the association between COVID-19 risk perception and loneliness across the three age groups.

We found that the older group was more likely to practice social distancing and feel socially connected than the other age groups. In comparison, the younger group showed higher levels of COVID-19 risk perception and loneliness than their middle-aged and older counterparts. Social distancing implies physical distancing; thus, it permits social interaction with people living together and digital interactions with the outside world [51, 52]. In fact, there

were no older adults in the present study who lived alone, while the proportion of persons living alone was markedly high in their younger and middle-aged counterparts at nearly 44% and 27%, respectively. Therefore, older Korean adults might not easily feel detached or socially disconnected in this context. In addition, participants comprised community-dwelling residents in Seoul, the largest city in the Republic of Korea, with a high quality of social infrastructure for social connection. For instance, AARP [53] states that a robust community social infrastructure is a vital social support system.

The findings of our study are partially in line with previous studies. For example, Atchison et al. [7] reported

TABLE 3: Direct, indirect, and total effects among the three age groups.

Subgroup	Path	Total effects		Direct effects		Indirect effects	
		B	Critical ratio	B	Critical ratio	B	Critical ratio
Younger group	COVID-19 risk perception → loneliness	0.21	5.57***	0.11	3.41**	0.10	4.13***
	COVID-19 risk perception → social connectedness → loneliness					0.07	2.60**
	COVID-19 risk perception → social distancing → social connectedness → loneliness					0.03	3.39**
Middle-aged group	COVID-19 risk perception → loneliness	0.14	3.57***	0.02	0.76	0.12	4.37***
	COVID-19 risk perception → social connectedness → loneliness					0.12	4.04***
	COVID-19 risk perception → social distancing → social connectedness → loneliness					-0.004	-0.33
Older group	COVID-19 risk perception → loneliness	0.12	1.67	0.06	0.95	0.05	1.90
	COVID-19 risk perception → social connectedness → loneliness					0.06	2.02*
	COVID-19 risk perception → social distancing → social connectedness → loneliness					-0.004	-1.01

B = unstandardized coefficient; bootstrapping = 2,000 iterations. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

that older adults in the UK were more likely than their younger counterparts to adopt self-quarantine and self-isolation measures to protect themselves and their communities. However, other research studies [54, 55] demonstrated that compared to younger adults, older adults (especially older Medicare beneficiaries or those who had infrequent social contact) were at a greater risk of social disconnection during the COVID-19 pandemic.

A previous research study has shown mixed results on COVID-19 risk perception and loneliness among younger adults. However, recent studies demonstrated that younger adults experienced worse mental health outcomes during the COVID-19 outbreak than older adults [56]. In addition, loneliness remained the highest among younger adults during the COVID-19 lockdowns in the United States (US), the UK, and South Korea [17, 18, 57–59]. However, other studies documented that older adults showed higher levels of loneliness than other age groups [13, 14, 16].

These mixed results indicate that factors other than age, such as being single, psychiatric diagnoses, depression, and anxiety symptoms, influence loneliness [60]. For example, Atchison et al. [7] highlighted that socioeconomically vulnerable populations (e.g., those from disadvantaged backgrounds) were less likely to comply with COVID-19 preventive measures or self-isolate if necessary. This finding suggests that these populations are at increased risk for COVID-19-related consequences (e.g., hospitalization, death, or loneliness caused by strictly enforced quarantines). The present study’s findings emphasize the importance of targeting high-risk groups and implementing effective coping strategies to mitigate adverse mental health outcomes during the COVID-19 pandemic.

Furthermore, there were six significant age group differences in the pathways of COVID-19 risk perception, social distancing, social connectedness, and loneliness in the present study. Compared to their older and middle-aged counterparts, the younger group had significantly higher effects on the paths from COVID-19 risk perception to social

distancing, from social distancing to social connectedness, and from social connectedness to loneliness. According to the transactional theory of stress and coping [30, 31], these results imply that younger adults are more likely than middle-aged or older adults to perceive the COVID-19 outbreak as a stressor. Consequently, they would use preventive coping strategies such as social distancing (problem-focused coping) and social connectedness (emotion-focused coping) to maintain their mental health.

Consistent with our findings, a recent study reported that younger adults were more likely than older adults to experience increased negative feelings such as anxiety and depression due to the COVID-19 lockdown [56]. Furthermore, another study showed that loneliness, in particular, was elevated among adults who maintained social distancing and experienced social isolation during the COVID-19 pandemic in the US and the UK [9, 61]. As restrictive coping strategies (e.g., social distancing and social isolation) can increase feelings of loneliness and lead to mental health problems such as depression and suicide [62, 63], it is imperative to take actions to prevent psychological problems among vulnerable populations such as younger adults with lack of social support during and after the pandemic.

Finally, we found two mediating effects of social distancing and social connectedness in the younger group. In contrast, middle-aged and older groups displayed a full mediation effect of social connectedness on the association between COVID-19 risk perception (a stressor or a life event causing lack of social relationships) and loneliness (a negative outcome). According to the transactional theory of stress and coping [30, 31] and the cognitive discrepancy theory of loneliness [28], the mediating effects of social distancing and social connectedness in the younger group illustrate that individuals who adhere to social distancing rules due to high levels of risk perception of COVID-19 are unlikely to form and maintain social networks, which, in turn, can increase loneliness. These results emphasize the important roles of mediating variables (social distancing and

social connectedness) in reducing loneliness during the COVID-19 pandemic. Further research is necessary to explain why these mediating effects were more apparent among the younger group than the other age groups during the pandemic.

The role of social connectedness as a mediator in the association between COVID-19 risk perception and loneliness confirms that COVID-19 risk perception is negatively associated with a sense of social connectedness. Similarly, Trad et al. [64] found that precautionary responses to COVID-19 (e.g., high levels of risk perception and social distancing) were likely to reduce intimate social interactions, thereby increasing loneliness. Specifically, previous studies provided a well-documented research study on the impact of social relationships and social disconnectedness on mental health outcomes among older adults [65, 66]. However, there is insufficient research supporting the mediating effects of social distancing and social connectedness in the pathway linking COVID-19 risk perception with loneliness among different age groups. Thus, it is necessary to develop and evaluate a theoretical framework of stressors (e.g., COVID-19 risk perception), coping strategies (e.g., social distancing, social connectedness), and mental health outcomes (e.g., loneliness, depression) across various age groups during and after the COVID-19 pandemic.

4.1. Limitations. The present study has several limitations. First, due to the nature of cross-sectional survey data, the findings do not provide information about the causal associations between COVID-19-related risk factors and mental health outcomes. Future research should extend the current work by collecting longitudinal data and investigating possible long-term consequences of the COVID-19 pandemic. Second, this study used a newly developed unidimensional COVID-19 risk perception measure, which lacks sufficient evidence to support its reliability and validity. An especially noteworthy limitation is that Cronbach's alpha value for the measure was relatively low in this study. Thus, future studies need to test the reliability and validity of the measure in different settings or populations. In addition, it would be beneficial to use a multidimensional measure that provides comprehensive information on COVID-19 risk perception. Third, we surveyed fewer older adults than other age groups due to restricted access owing to the COVID-19 restrictions. The unequal group sizes may have affected the results (e.g., due to unequal variances between samples or low statistical power). Thus, researchers should interpret our findings with caution. Future research should consider recruiting a more representative sample.

However, despite the limitations, the present study broadens the general knowledge and understanding of the associations between COVID-19 preventive measures, social connectedness, and loneliness across different age groups based on the cognitive discrepancy theory of loneliness and the transactional theory of stress and coping.

4.2. Implications. It is essential to encourage people to stay socially connected with their loved ones through various communication tools (e.g., telephone, e-mail, text messaging, social networking sites, and video conferencing). Doing so alleviates COVID-19-related concerns and negative feelings [67] while following preventive quarantine measures. Therefore, health and mental health professionals should actively screen people at a high risk for COVID-19 and psychological problems to achieve these goals. In addition, they should provide them with social services such as education, case management, and friendly visiting programs supported by local government officials and volunteers. [64]. Also, the government should make available effective psychological interventions (e.g., virtual therapy via phone, video chat, or other device options) designed to connect people (specifically, COVID-19 patients and quarantined persons) [64, 68].

Furthermore, trust in government agencies and health experts is crucial to reduce unnecessary fear among people with high COVID-19 risk perceptions [45]. Thus, it is necessary to build trust by promoting and implementing effective COVID-19 measures and open and respectful communication with the public. In addition, based on the results, we suggest that stakeholders focus on developing and using a measure to reflect age-related changes to assess loneliness and mental health problems due to COVID-19. Finally, future research must identify other potential individual, family, and societal level determinants that have led to positive or negative mental health outcomes during the COVID-19 pandemic.

5. Conclusion

This study revealed that social distancing and social connectedness substantially impact loneliness during the COVID-19 pandemic. Growing evidence indicates that perceptions and behavioral responses to the COVID-19 crisis are associated with psychological outcomes such as loneliness [7–9]. However, most recent studies focused on the descriptive features of the associations between potential risk factors and COVID-19-related outcomes. The present study emphasizes the importance of social relationships in people's ability to cope with adverse mental health outcomes due to COVID-19 among different age groups. Future research should examine other possible social determinants of mental health and the long-term effects of COVID-19 on individuals and society.

Data Availability

The data that support the findings of this study are not publicly available due to the information they contain that could compromise the privacy of the research participants.

Additional Points

The following are known about this topic: (i) COVID-19 restrictions have caused adverse mental health outcomes

such as loneliness and social isolation. (ii) A sense of social connectedness is an important protective factor that can alleviate psychological distress among people of all ages. (iii) There is a lack of information on the associations between possible risk factors and loneliness during the COVID-19 pandemic. What this paper adds. (i) We found that social distancing and social connectedness have mediating roles in the association between COVID-19 risk perception and loneliness in different age groups.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

The authors acknowledge the support of the National Research Foundation of Korea (NRF-2020S1A5C2A03092919).

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