RESEARCH PAPER

Paradoxical Impacts of Social Relationship on Well-Being During the COVID-19 Pandemic

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Abstract

Social interaction is an important source of psychological and physical well-being during normal times. However, following the COVID-19 outbreak, which spreads rapidly from person to person, social interaction poses a fatal threat to one's health and life. Therefore, several countries including South Korea implemented an intense social distancing mandate to prevent the spread of the virus. During these unique times of pandemic, the current research investigated whether and how an individual's well-being varies as a function of their interaction with various relationship partners using experience sampling data (Study 1) and online longitudinal data (Study 2). The results indicated that being alone was more detrimental to well-being during the pandemic than before it. Specifically, interaction with close relationship partners (e.g., romantic partner, spouse, or friend) was positively related to well-being, whereas interaction with formal relationship partners (e.g., coworker, boss) was negatively linked to momentary well-being during the pandemic. Furthermore, our study showed that the association between social supports from close relationships and well-being was temporally strengthened during COVID-19 pandemic. In sum, the benefits of close relationships on well-being were stronger during the COVID-19 pandemic than before it.

Keywords COVID-19 · Well-being · Social interaction · Experience sampling

COVID-19, also known as coronavirus disease, is an ongoing global pandemic. Given that the virus is transmitted between individuals via small droplets produced by talking, sneezing, and coughing, social interaction could be hazardous to one's safety during the pandemic (e.g., Burke et al., 2020; Li et al., 2020). Therefore, scientists and healthcare

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professionals have highly recommended social distancing, or maintaining a safe distance between people in both indoor and outdoor spaces, as a countermeasure against the contagion (Centers for Disease Control and Prevention, 2021). As several nations implemented lockdowns to prevent the spread of the virus, individuals were quarantined in their own residences. For example, the Korean government issued the initial social distancing recommendation from the end of February, and then implemented an intense social distancing mandate on March 22, 2020. During this period of intense social distancing, Koreans were urged to refrain from going out other than to buy everyday supplies, visit healthcare facilities, and commute. Moreover, they were encouraged to abstain from gatherings, festivals, and travel. Daily encounters with people, previously taken for granted as social norms, were no longer possible due to the highly infectious nature of the pandemic. In this unprecedented situation wherein social interaction poses a threat to daily living, the positive association between social interaction and individuals' well-being could qualitatively or quantitatively differ from those in normal times. In the present research, we aimed to investigate the link between social interaction and well-being during an epidemic, using an experience sampling method (ESM; Study 1) as well as a short longitudinal method (Study 2). More specifically, we examined whether and how well-being varies as a function of the interaction with specific types of associates (e.g., romantic partners, friends, and coworkers) and compare their effects with those before the pandemic.

1 Relationships and Well-Being

A large body of prior literature has described having strong social relationships as a fundamental source of human motivation and as one of the most important determinants of well-being (Baumeister & Leary, 1995; Lucas & Dyrenforth, 2006; Myers, 2000). This is apparent from various well-being theories, which commonly suggest that social relationships are a critical component of well-being. Among these theories are Ryff's psychological well-being model (Ryff, 1989) and Deci and Ryan's self-determination theory (Deci et al., 1991), and the constructs and measures of flourishing posited by many key researchers in the field (Diener et al., 2010; Seligman, 2012). Countless empirical studies have also supported this premise by showing that positive social relationships are not only critical for health and well-being (Sheldon et al., 2010) but also for a longer life (Holt-Lunstad et al., 2010).

Research on various types of relationships have also consistently shown that positive social interactions contribute to people's well-being. Close relationships such as those between spouses, romantic partners, family, and friends positively predict the well-being of individuals. An abundant amount of literature has demonstrated that married people are generally happier, healthier, and live longer than unmarried people (Coombs, 1991; Lawrence et al., 2019). Family relationships are found to be correlated with people's subjective well-being across their lifespan, for infants, children, and adults (Diener & Diener McGavran, 2008). Finally, frequent contact with friends appears to directly influence subjective well-being (Van der Horst & Coffé, 2012).

Interestingly, formal relationships such as those between supervisors and coworkers also appear be a primary factor associated with people's health and well-being at work (Danna & Griffin, 1999). Previous studies have found that both supervisor (Hämmig, 2017) and subordinate (Shanock & Eisenberger, 2006) support are important for employees' and supervisors' well-being. In addition, a series of multilevel studies have found that daily levels of coworker satisfaction are positively related to the day-to-day

job and life satisfaction of employees (Simon et al., 2010), supporting the notion that even work relationships matter in terms of one's well-being. In general, both close and formal relationships appear to significantly account for the well-being of individuals.

However, all evidence supporting a positive association between these relationships and well-being were obtained during pre-pandemic times. Little is known about whether these positive links could be maintained during the pandemic when social interaction could threaten one's health and life. In the current research, we sought to investigate the relationship between social interaction and well-being during epidemics or pandemics such as COVID-19.

2 Effects of Relationships on Well-Being during Difficult Times

Relationships may particularly impact one's well-being during difficult times. Social and family support have been identified as key environmental resources for successful adjustment and growth during, and in the aftermath of, a variety of stressful contexts from life crises such as illness, divorce, and bereavement to major events such as natural disasters and war (Schaefer & Moos, 1998). During times of distress, relationships may play an even more important role in well-being than during normal times, as they are thought to alleviate the negative impact of stressful events (Bal et al., 2003; Cohen & Wills, 1985).

Although there is much evidence supporting that social relationships buffer psychological difficulties in stressful situations, it is difficult to conclude that social interaction will always be beneficial to individuals' well-being, especially in this situation of a pandemic wherein interacting with others increases the risk of life-threatening infection. In other words, social interaction may operate like a double-edged sword in the period of COVID-19; it can be a source of support and buffer against stress and depression, but it can also pose a risk of infection and trigger anxiety and fear. Therefore, the nature and magnitude of the association between social interaction and well-being during the COVID-19 pandemic could differ from those during other stress events.

Recent studies have investigated the association between social interaction (or social isolation) and well-being after the COVID-19 outbreak (Macdonald & Hülür, 2021; Nitschke et al., 2021; Pancani et al., 2021) and produced empirical evidence supporting that face-to-face (Sommerlad et al., 2021) and online interaction (Juvonen et al., 2021) could have positive effects on well-being during the pandemic. However, previous studies were limited in that both social interaction and well-being were assessed only after the COVID-19 outbreak, and they cannot adequately describe whether the association between social interaction and well-being during the COVID-19 pandemic is different from that before the pandemic. Furthermore, previous studies did not directly consider the types of social relationships while examining the impact of social interaction. Interactions with different types of partners can be differently related to well-being (Choi et al., 2017). For example, Partick et al. (2020) found that frequent interactions with children could diminish parents' well-being during a pandemic. Addressing these limitations, the current study extends this line of inquiry by examining the associations between interactions with various kinds of relationship partners and well-being during the pandemic and comparing these associations with those before the COVID-19 outbreak.

3 Overview of the Current Study

This study investigated the role of social relationships in people's well-being during the pandemic and whether and how this link has changed during the COVID-19 period as compared to the pre-COVID-19 period. Specifically, we aimed to address the following issues: First, we investigated the association between social interaction and well-being during the most intense social distancing period during the COVID-19 pandemic in South Korea. Second, we examined whether the relationships between social interaction and well-being during the pandemic period differed from those before the COVID-19 pandemic. Third, we explored whether and how the types of social interaction partners could be differently related to one's well-being during the COVID-19 pandemic. Fourth, we examined temporal changes in the association between close social relationships and well-being before and during the COVID-19 outbreak.

To this end, we conducted two studies. In Study 1, we assessed participants' momentary experiences of well-being and their social interaction before and during the COVID-19 period through ESM, which has been widely considered as the "gold standard" for measuring daily experiences and well-being (Kahneman et al., 2004; Stieger et al., 2021). Furthermore, we compared the ESM data collected during the COVID-19 pandemic and data collected before the COVID-19 period to explore whether and how social interactions were related to momentary levels of well-being before and after the COVID-19 outbreak. In Study 2, we directly investigated the temporary changes in the association between social support from close relationships and well-being before and during the COVID-19 period using a within-person design. Our datasets and codes are available in Open Science Framework at https://osf.io/weusk/?view_only=e40845c45083413ca876ba62d957809d. These studies were approved by the Seoul National University Institutional Review Board (2002-001-003) and the Kangwon National University Institutional Review Board (2019-10-009-001).

4 Study 1

4.1 Method

4.1.1 Participants and Procedure

To examine the effect of social interaction on momentary well-being during times of social isolation, we recruited participants during the most intense social distancing period during the COVID-19 pandemic in South Korea. We recruited participants after the intense social distancing policy was announced (March 22, 2020). The participants were recruited through a research company (Research & Research) in Seoul, Republic of Korea, and were enlisted using random-digit-dialing (RDD) of mobile phone numbers with gender, age, and geographic information. Participants who expressed their intention to participate signed up for the study. A total of 199 Korean adults (48.2% males, $M_{age} = 39.40$, $SD_{age} = 5.88$) participated in the current study for two weeks from March 30 to April 12, 2020. During this period, they participated in the study through their own mobile. They received an SMS with a hyperlink that would guide them to an online questionnaire. Signaling texts were randomly sent in the morning (8:00 a.m. to 10:00 a.m.), afternoon (2:00 p.m. to 4:00 p.m.), and evening (6:00 p.m. to 8:00 p.m.). Participants were unable to access the survey page

through the hyperlink after more than one hour after the text was sent. One to four days after completing the entire experience sampling survey, participants answered a demographic survey that included age, gender, monthly family income, marital status, and subjective socioeconomic status questions. They responded to a self-administrated survey and were paid 50,000 Korean Won (KRW, approximately US $45) for their participation.

4.1.2 Experience-Sampling Measures

We created a six-item questionnaire to encompass the multifaceted nature of well-being (Diener, 2010; Michaelson et al., 2009; Stiglitz et al., 2009), which could address the limitation of many ESM studies that failed to take into account different aspects of well-being (e.g., Killingsworth & Gilbert, 2010). During each assessment, the participants were first asked to indicate various aspects of well-being such as their current feeling (How are you feeling right now?; 0=feel very bad, 10=feel very good), happiness (To what extent do you feel happy right now?), sense of meaning (To what extent do you feel the meaning of life right now?), purpose in life (To what extent do you feel the purpose of life right now?), stress (To what extent do you feel stressed right now?), boredom (To what extent do you feel bored right now?), and loneliness (To what extent do you feel lonely or isolated right now?) on an 11-point scale, ranging from not at all (0) to very much (10). The overall well-being index was generated from the average scores of the items (by reverse scoring the last three items). Multilevel reliability estimation indicated that the well-being index was reliable ($\alpha_{within}=0.84$; $\alpha_{within}=0.92$; Geldhof et al., 2014).

Next, the participants were asked to choose one activity from a predetermined list, (commuting, working, housework and childcare, eating, shopping, media usage, exercising, volunteering, religious activity, and relaxing) adapted from the lists of activities used in prior literature (Choi et al., 2017; Killingsworth & Gilbert, 2010). Participants could select "other" and write down a self-generated response if they were unable to find an appropriate activity on the list. Subsequently, the participants were asked to report whether they were with someone. If they answered yes, they were asked to select the applicable individuals from a predetermined list (e.g., spouse, child(ren), friend(s), and coworker/boss). Like the activity question, if the participants could not find the appropriate selection on the list provided, they were prompted to answer "other" and give a self-generated answer. The total number of ESM responses was 7,186. The average compliance rate, which was estimated by dividing the count of ESM measures responded to by the count of ESM measures requested, was 85.98%. This compliance rate was higher than acceptable compliance rates in ESM studies, 78% (Rintala et al., 2019).

4.2 Statistical Analysis

Given that the experience sampling data had a nested structure, multivariate multilevel models were used in all the analyses. In the current study, we had two levels of nesting: the moment level (Level 1) and the person level (Level 2). Thus, we developed a multilevel model in which well-being was indicated as a dependent variable and moment- and person-level factors were indicated as explanatory variables. All of the categorical variables (i.e., daily activities, interacting partner, gender, and marital status) were effect coded, given that they enabled an estimation of the predictor coefficients, which represent the extent to which each predictor adds or subtracts from the grand mean of well-being (Choi et al., 2017; Cohen et al., 2013). Each option was considered separately as a dichotomous

variable for both the daily activity and the interacting partner (0: absent/not engaging; 1: present/engaging); moreover, these options were not able to selected simultaneously.

To promote a better understanding of the data and minimize multicollinearity, age was grand-mean centered. Daily activity and interacting partners were person-centered as to detach individual within-person effects on momentary well-being. The relationship between within-person variables and the levels of well-being were likely confounded by between-person differences in these factors. For example, interacting with others might have positive effects on one's experiences of well-being at the moment (within-person effect). On the contrary, it might be that participants who, on average, experienced higher levels of well-being might more frequently have interacted with others during the ESM study period than their counterparts who experienced low levels of well-being (between-person effect). Person-centering daily activity and the social interaction variable eliminated the potential between-person effect, which allowed us to systematically examine how social interaction was related to the moment-to-moment changes in well-being each individual experienced.

5 Results

5.1 Is Momentary Well-Being Positively Related to Social Interaction During the COVID-19 Pandemic?

We first tested the effects of being alone (vs. interacting with others) on momentary well-being during the COVID-19 period. To examine the association between momentary well-being and the presence of others, we developed a multilevel model (0: being alone; 1: interacting with others). Moreover, demographic variables such as age, gender, marital status, monthly household income, and Big Five personality traits were controlled because these within-person indicators could influence the levels of well-being across persons. The results of the regression model show that people experienced greater momentary well-being when they were with others than when they were alone during the COVID-19 pandemic ($b = 0.461$, $SE = 0.086$, $p < 0.001$), which is consistent with past findings (e.g., Kamin et al., 2021).

Next, we classified 'interacting with others' into 'interacting with close others' and 'interacting with public others' and examined whether the effects of being alone, interacting with close others (spouse, extended family, child(ren), and romantic partner), and interacting with public others (coworkers/bosses) were different on momentary well-being during the COVID-19 epidemic. As in the previous model, we controlled for demographic factors. The results of the regression model indicate that people experienced higher levels of well-being while interacting with close others than being alone, even during the pandemic ($b = 0.43$, $SE = 0.03$, $p < 0.001$). On the other hand, people reported lower levels of momentary well-being while interacting with public others than being alone ($b = -0.21$, $SE = 0.03$, $p < 0.001$).

Subsequently, we examined the effects of interacting with each relationship partner (spouse, child(ren), extended family, romantic partner, friends, neighbors, and coworkers/bosses) on momentary well-being during the COVID-19 pandemic. To be clear, the social interaction with each person type was separately effect coded (0: no interaction, 1: interaction). The regression parameters in Table 1 provide the effects of social interaction partners on momentary well-being. The results show that people reported higher

Table 1 Multilevel Model Predicting Well-being Social Interaction with Each Partner during COVID-19

	b	SE	95% CI	p
(Intercept)	5.96	0.09	[5.79, 6.12]	.000
Spouse	0.35	0.06	[.23, .46]	.000
Child(ren)	− 0.03	0.05	[− .13, .08]	.632
Extended family	− 0.09	0.07	[− .23, .04]	.176
Romantic partner	0.48	0.09	[.30, .66]	.000
Friend(s)	0.26	0.09	[.08, .45]	.005
Neighbor(s)	0.07	0.14	[−.20, .33]	.630
Coworker(s)/Boss(es)	− 0.51	0.05	[− .61, − .41]	.000
Gender	0.11	0.06	[.02, .23]	.086
Age	− 0.03	0.01	[− .05, .00]	.024
Marital Status	0.20	0.07	[.06, .35]	.005
Household Income	0.02	0.03	[− .03, .07]	.353
Extraversion	0.09	0.05	[.01, .20]	.083
Agreeableness	0.13	0.06	[.00, .25]	.049
Conscience	− 0.08	0.07	[− .21, .06]	.268
Neuroticism	0.23	0.06	[.11, .35]	.000
Openness	0.05	0.07	[− .09, .18]	.484

b is the unstandardized coefficient in the simultaneous multilevel model. The *b* coefficient indicates the degree to which social interaction with specific partners adds to or subtracts from the averages of well−being. CI represents the confidence interval. Gender (1: female; −1: male) and marital status (1: married; −1: other status) were effect-coded

levels of well-being when they were interacting with a romantic partner ($b=0.48$, $SE=0.09$, $p<0.001$), a spouse ($b=0.35$, $SE=0.06$, $p<0.001$), and friends ($b=0.26$, $SE=0.10$, $p=0.005$) than when they were alone. These findings suggest that interacting with a romantic partner was most positively related to momentary well-being, compared with other relationships during the COVID-19 period. On the other hand, interacting with coworkers/bosses ($b=-0.51$, $SE=0.05$, $p<0.001$) elicited lower levels of momentary well-being than being alone. The interaction with extended family, children, and neighbors was not significantly related to temporary well-being ($ps>0.175$).

We found that social interaction was positively related to momentary levels of well-being during the COVID-19 pandemic, and the strength of associations varied as a function of the social partners with whom individuals interacted. However, as Hudson et al. (2020) pointed out, people are likely to engage in different activities while interacting with different types of social partners. For example, the activities that participants most frequently engaged in while being with a spouse included housework, childcare (30.3%), and media usage (22.2%). On the contrary, the most common activities participants performed with coworkers or bosses were working (89.8%). Given these differences, it is possible that the activities that people engaged in with each social partner, rather than social interaction, could explain the associations between social interactions and well-being. To evaluate this possibility, we examined the relationship between social interaction with different partners and well-being after controlling for all activity variables. As depicted in Table 2, the results were similar to those of the uncontrolled analyses, except for friends. When daily activities

Table 2 Multilevel Model Predicting Well-being from Social Interaction with Each Partner during COVID-19 (Controlling Activity Being Performed)

	b	SE	95% CI	p
(Intercept)	5.94	0.09	[5.77, 6.11]	.000
Spouse	0.35	0.07	[.22, .48]	.000
Child(ren)	− 0.03	0.07	[− .16, .10]	.665
Extended family	− 0.14	0.08	[− .29, .02]	.085
Romantic partner	0.35	0.11	[.12, .57]	.002
Friend(s)	0.10	0.13	[− .16, .36]	.435
Neighbor(s)	0.04	0.21	[− .38, .45]	.859
Coworker(s)/Boss(es)	− 0.28	0.07	[− .40, − .15]	.000
Gender	0.10	0.06	[− .02, − .22]	.103
Age	− 0.02	0.01	[− .05, .00]	.024
Marital Status	0.20	0.07	[.06, .35]	.032
Household Income	0.02	0.03	[− .03, .07]	.005
Extraversion	0.09	0.05	[− .02, .19]	.362
Agreeableness	0.13	0.06	[.00, .26]	.113
Conscience	− 0.07	0.07	[− .20, .07]	.046
Neuroticism	0.23	0.06	[.11, .35]	.000
Openness	0.05	0.07	[− .08, .19]	.434

b is the unstandardized coefficient in the simultaneous multilevel model. The b coefficient indicates the degree to which social interaction with specific partners adds to or subtracts from the averages of well−being. CI represents the confidence interval. Gender (1: female; −1: male) and marital status (1: married; −1: other status) were effect-coded

were controlled, the presence of friends did not significantly predict momentary well-being ($p > 0.40$).

5.2 How Have the Effects of the Social Interaction on Momentary Well-being Changed in the COVID-19 Pandemic Compared to the Previous Period?

Next, we explored whether and how the impacts of social interaction on momentary well-being changed during the COVID-19 pandemic, compared to before the pandemic. It was critical to have a pre-COVID-19 sample that followed the exact same ESM procedure as that of the current study in order to compare the effects of social interaction on well-being. Given the unexpected nature of pandemics, it was almost impossible to have a pre-COVID-19 ESM study that covered the same observation period of a year (March 30 to April 12), in that few people anticipated the pandemic. Fortunately, however, our research team obtained an ESM dataset with a comparable number of Koreans ($n = 234$; 49.6% males, $M_{age} = 39.91$, $SD_{age} = 5.48$) who responded to an identical ESM survey method via the same research firm with the current one. These pre-COVID-19 participants took part in the survey from May 17 to June 7, 2017. Both pre-COVID-19 and COVID-19 participants were recruited from the same city in Korea (i.e., Seoul) via the same research firm using random-digit dialing (RDD) of cellular phone numbers with gender, age, and residential information. The total number of ESM responses was 7742 (Table 3).

Table 3 Demographic Characteristics of Respondents

	2017	2020
Gender, n (%)		
Female	118 (50.4%)	103 (51.8%)
Male	116 (49.6%)	96 (48.2%)
Age, *M (SD)*	39.91 (5.50)	39.40 (5.88)
Marital status, n (%)		
Single	69 (29.5%)	69 (34.7%)
Married	161 (68.8%)	123 (61.8%)
Separation	0 (0%)	1 (0.5%)
Divorce	3 (1.3%)	4 (2%)
Remarried	1 (0.4%)	1 (0.5%)
Bereaved	0 (0%)	1 (0.5%)
Having child(ren), n (%)		
Yes	142 (60.7%)	106 (53.3%)
No	92 (39.3%)	93 (46.7%)
Household income (Korean won), n (%)		
Less than 1 million	3 (1.3%)	5 (2.5%)
1—2 million	11 (4.7%)	7 (3.5%)
2—3 million	30 (12.8%)	10 (5%)
3 – 4 million	36 (15.4%)	31 (15.6%)
4 – 5 million	32 (13.7%)	27 (13.6%)
5 – 6 million	45 (19.2%)	29 (14.6%)
6 – 7 million	29 (12.4%)	30 (15.1%)
7 – 8 million	20 (8.5%)	22 (11.1%)
8 – 9 million	7 (3%)	10 (5%)
9 – 10 million	10 (4.3%)	14 (7%)
Over 10 million	11 (4.7%)	14 (7%)
IPIP (Ten-Item Personality Inventory), M (SD)		
Extraversion,	4.20 (1.30)	4.56 (1.25)
Agreeableness,	4.67 (0.93)	4.56 (0.95)
Conscientiousness	4.75 (0.94)	5.04 (0.99)
Emotional Stability	4.28 (1.05)	4.36 (1.13)
Openness to Experience	4.56 (1.04)	5.04 (1.01)

Despite of using the identical random-digit dialing method with the same demographic variables when selecting the pre-COVID-19 and the COVID-19 samples, to ensure comparability of the samples statistically, we utilized the propensity score matching (PSM) procedure. It is a statistical method widely used to allow parallel comparisons between a control group and a treatment group when random allocation of the condition is not feasible, e.g., in the case of unpredictable natural disasters such as an epidemic (Liu et al., 2021; Sibley et al., 2020) and an earthquake (Gomez & Yoshikawa, 2017; Sekiguchi et al., 2019). This method reduces the variations between the characteristics of two groups and hence minimize the effect of selection bias in nonexperimental causal studies (Dehejia & Wahba, 2002; Olivos et al., 2021). The samples were selected by matching participants from the treatment group (COVID-19) with comparable participants from the control
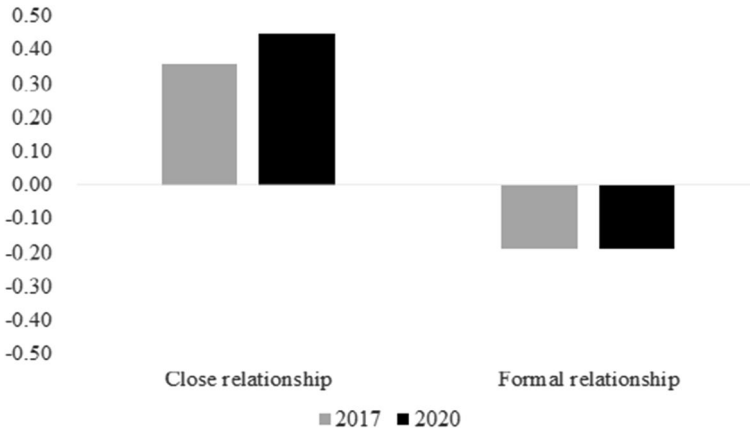
Fig. 1 Coefficients of close vs. formal relationships on well-being before and during the COVID-19 period. *Note.* The black and grey bars indicate 2020 and 2017, respectively. The numbers along the y-axis refer to unstandardized coefficients

group (pre-COVID-19) by demographic factors. Using PSM, the COVID-19 period sample and the pre-COVID-19 sample were matched on age, gender, marital status, having children, household income, compliance rate, and Big Five personality traits in the present research. As a result, 136 pre-epidemic participants (4780 ESM responses) were matched with 136 post-epidemic participants (4812 ESM responses).

We examined whether the effects of being alone (vs. interacting with others) on momentary well-being changed during the COVID-19 period, compared to beforehand. To test the association between the social interaction and momentary well-being, we developed a multilevel model (0: being alone; 1: interacting with others). Year (0: 2017 vs. 1: 2020) was treated as a moderator variable. The results indicated that the positive effect of interacting with others (vs. being alone) on momentary well-being was significantly qualified by year ($b = 0.27$, $SE = 0.006$, $p < 0.001$). Specifically, people reported greater levels of well-being while engaging in social relationships during COVID-19 ($b = 0.44$, $SE = 0.04$, $p < 0.001$) than during the pre-COVID period ($b = 0.17$, $SE = 0.04$, $p < 0.001$).

Next, we tested the effects of being alone, interacting with close others, and interacting with public others on momentary well-being between the COVID-19 period and the pre-COVID-19 period. As Fig. 1 shows, people experienced higher levels of momentary well-being when they were interacting with close others than when they were alone, regardless of the year ($b = 0.36$, $SE = 0.04$, $p < 0.001$). On the other hand, people reported lower levels of momentary well-being when they were interacting with public others than when they were alone, irrespective of the year ($b = -0.20$, $SE = 0.04$, $p < 0.001$). More importantly, the extent to which people experienced higher levels of well-being while interacting with close others differed before and during the COVID period ($b = 0.10$, $SE = 0.05$, $p = 0.05$). Social interaction with close others was more strongly associated with momentary levels of well-being during the COVID-19 pandemic ($b = 0.45$, $SE = 0.03$, $p < 0.001$) than during normal times ($b = 0.36$, $SE = 0.04$, $p < 0.001$). We did not find a significant moderation effect of year on the association between social interaction with public others and momentary well-being ($p > 0.20$).

For further analysis, we examined whether the impacts of each social interaction partner on well-being changes across the two time periods. As can be seen in Fig. 2 and Table 4,
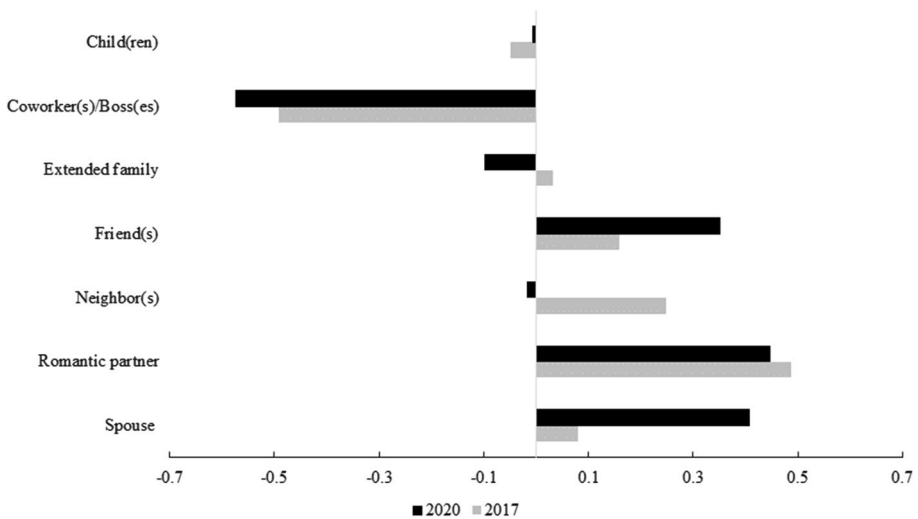
Fig. 2 Coefficients of interaction partners on well-being before and during the COVID-19 period. *Note.* The black and grey bars indicate 2020 and 2017, respectively. The numbers along the x-axis refer to the impacts of interaction with others on well-being (values of unstandardized coefficients). Interaction partners are ordered alphabetically

interacting with a spouse predicted greater boosts in momentary well-being during the COVID-19 period ($b=0.41$, $SE=0.07$, $p<0.001$) compared to beforehand ($b=0.08$, $SE=0.07$, $p=0.274$). There were no significant moderating effects of year on the association between other relationships (including children, extended family, a romantic partner, friends, neighbors, and coworkers/bosses) and well-being ($ps>0.13$). These findings suggest participants experienced the most powerful impact on momentary well-being when they were interacting with a spouse during the COVID-19 period than beforehand. Neither gender nor age did not qualify the associations between each social interaction partner and well-being. Furthermore, we examined the associations between the social interaction with each types of partners and well-being, controlling for all activities. As Table 5 shows, the results were very similar to those of the uncontrolled analyses. Even after activities were controlled, interaction with spouse was more positively associated with one's well-being during the COVID-19 than before it. Social interactions with other partners were not significantly moderated by year when activities were taken into account.[1]

6 Discussion

In Study 1, we tracked individuals' everyday lives during the COVID-19 pandemic using ESM, and found that interacting with close others was beneficial to individual well-being during the COVID-19 period. Furthermore, a comparison between the pre-COVID-19 and COVID-19 samples revealed that the association between close social relationships and

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[1] All results obtained from the PSM datasets. Details of results from the full datasets are available upon request from authors.

Table 4 Multilevel Model Predicting Well-being from Social Interaction with Each Partner before and during the COVID-19 pandemic

	b	SE	95% CI	p
(Intercept)	6.11	0.12	[5.88, 6.34]	0.000
Spouse	0.08	0.07	[−.06, .22]	0.274
Child(ren)	− 0.05	0.08	[−.21, .11]	0.554
Extended family	0.03	0.09	[−.15, .21]	0.732
Romantic partner	0.49	0.17	[.15, .82]	0.004
Friend(s)	0.16	0.10	[−.03, .35]	0.102
Neighbor(s)	0.25	0.10	[.05, .45]	0.014
Coworker(s)/Boss(es)	− 0.49	0.06	[−.61, −.37]	0.000
Gender	0.00	0.07	[−.13, .13]	0.949
Age	0.00	0.01	[−.03, .02]	0.904
Marital Status	0.31	0.08	[.16, .46]	0.000
Household Income	0.02	0.03	[−.04, .07]	0.575
Extraversion	0.07	0.06	[−.04, .18]	0.190
Agreeableness	0.12	0.07	[−.02, .27]	0.088
Conscience	0.03	0.08	[−.12, .19]	0.656
Neuroticism	0.24	0.07	[.10, .37]	0.001
Openness	0.17	0.07	[.04, .31]	0.012
Year	− 0.02	0.13	[−.27, .23]	0.892
Year*Spouse	0.33	0.10	[.14, .52]	0.001
Year*Child(ren)	0.04	0.10	[−.15, .23]	0.679
Year*Extended family	− 0.13	0.12	[−.37, .10]	0.277
Year*Romantic partner	− 0.04	0.20	[−.43, .35]	0.839
Year*Friend(s)	0.19	0.14	[−.09, .47]	0.174
Year*Neighbor(s)	− 0.27	0.18	[−.61, .08]	0.134
Year*Coworker(s)/Boss(es)	− 0.08	0.08	[−.24, .08]	0.301

b is the unstandardized coefficient in the simultaneous multilevel model. The b coefficient indicates the degree to which social interaction with specific partners adds to or subtracts from the averages of well-being. CI represents the confidence interval. Gender (1: female; −1: male) and marital status (1: married; −1: other status) were effect-coded. Year (0: 2017; 1: 2020) was dummy coded

well-being became more evident during the COVID-19 pandemic than before it. These findings support the notion that social interaction with close others might help alleviate psychological distress during the COVID-19 pandemic.

However, Study 1 has a limitation that our ESM data were collected from two different samples before and during the COVID-19 period although the propensity score matching was one of the best methods to compare two samples obtained on two different occasions. One might argue that the findings in Study 1 could be due to sampling bias—that is, the COVID-19 sample might have coincidently contained a larger number of participants who likely obtained more benefits from social interaction, compared to the pre-COVID 19 sample. Given that both the pre-COVID-19 and COVID-19 samples were randomly recruited using RDD, this argument does not seem strongly compelling. In addition, we obtained the same results when analyzing subsamples matched on the basis of the propensity scores, which could statistically alleviate sample bias problems. Nevertheless, in order to rule out this possibility, we systematically

Table 5 Multilevel Model Predicting Well-being from Social Interaction with Each Partner before and during the COVID-19 pandemic (Controlling Activity Being Performed)

	b	SE	95% CI	p
(Intercept)	6.09	0.12	[5.87 – 6.32]	0.000
Spouse	0.08	0.07	[−.06, .22]	0.265
Child(ren)	−0.08	0.08	[−.23, .08]	0.346
Extended family	−0.01	0.09	[−.18, .17]	0.948
Romantic partner	0.44	0.17	[.11, .77]	0.009
Friend(s)	0.10	0.10	[−.09, .29]	0.284
Neighbor(s)	0.19	0.10	[−.01, .39]	0.063
Coworker(s)/Boss(es)	−0.34	0.06	[−.46, −.22]	0.000
Gender	0.00	0.07	[−.13, .13]	1.000
Age	0.00	0.01	[−.02, .02]	0.941
Marital Status	0.32	0.08	[.17, .47]	0.000
Household Income	0.02	0.03	[−.04, .07]	0.576
Extraversion	0.07	0.06	[−.04, .18]	0.221
Agreeableness	0.13	0.07	[−.02, .27]	0.085
Conscience	0.04	0.08	[−.11, .19]	0.578
Neuroticism	0.24	0.07	[.10, .37]	0.001
Openness	0.18	0.07	[.04, .31]	0.011
Year	−0.02	0.10	[−.27, .23]	0.884
Year*Spouse	0.27	0.10	[.06, .47]	0.010
Year*Child(ren)	0.06	0.10	[−.14, .26]	0.559
Year*Extended family	−0.14	0.13	[−.39, .10]	0.259
Year*Romantic partner	−0.11	0.21	[−.52, .30]	0.590
Year*Friend(s)	0.10	0.17	[−.24, .43]	0.572
Year*Neighbor(s)	−0.18	0.24	[−.65, .29]	0.458
Year*Coworker(s)/Boss(es)	0.01	0.09	[−.16, .18]	0.890

b is the unstandardized coefficient in the simultaneous multilevel model. The *b* coefficient indicates the degree to which social interaction with specific partners adds to or subtracts from the averages of well−being after controlling activity being performed. CI represents the confidence interval. Gender (1: female; −1: male) and marital status (1: married; −1: other status) were effect-coded. Year (0: 2017; 1: 2020) was dummy coded

investigated the temporal changes in the association between social relationships and well-being, before and during the COVID-19 period, using the longitudinal dataset ($N=832$) in Study 2. Furthermore, based on the finding of Study 1 that interaction with close others was beneficial to individuals' well-being during COVID-19, Study 2 focused on examining the effects of perceived social support which results from close social relationship could be differently related to well-being before and during the COVID-19 pandemic.

In Study 2, we directly examined the within-person changes of the association between close social relationships and well-being, before and during the COVID-19 pandemic, employing a different measure of social relationships in a longitudinal design.

7 Study 2

7.1 Method

7.1.1 Participants

Among the 51,821 individuals who completed online surveys on social support and happiness during the study period (January 20, 2020, to May 31, 2020), we included 831 participants in our analyses who completed surveys both during the COVID-19 pandemic (from January 20, 2020, to May 31, 2020)[2] and during the same period in 2019 (January 20, 2019, to May 31, 2019). The surveys were conducted by Kakao Corporation, a leading information technology company in South Korea, using its online survey platform (Choi et al., 2021; Kim et al., 2021; Na et al., 2021; Suk et al., 2020). The company distributed the surveys through its main application and websites (http://together.kakao.com/hello), and users voluntarily participated by visiting the website via mobile phones or computers. Participants could access and respond to surveys at any time and multiple times. Participants ranged in age from 21 to 70 (M_{age}=33.87, SD_{age}=10.32), and the majority were females (82.8%). Their residential areas reflected a comprehensive regional distribution of the South Korean population.[3] This study was approved for conducting secondary data analysis collected by the Kakao Corporation.

7.2 Measures

7.2.1 Well-being

We used a 10-item scale to measure levels of the participants' well-being. This scale was developed to assess multifaceted aspects of well-being, including life satisfaction, meaning in life, stress, positive affect (PA), and negative affect (NA) (Delle Fave, 2014; Diener et al., 2009; Ryan & Deci, 2001; Ryff & Singer, 1998). Items were adopted and modified from well-known measures such as Satisfaction with Life Scale (Diener et al., 1985), Meaning in Life Questionnaire (Steger et al., 2006), Positive Affect and Negative Affect Schedule (Watson et al., 1988), and Perceived Stress Scale (Cohen et al., 1983). This scale was repeatedly validated among Korean populations (Choi et al., 2021; Kim et al., 2021). Participants were asked to report their thoughts and feelings at the moment they completed the questionnaires on an 11-point Likert scale (e.g., 0=*not satisfied*, 10=*very satisfied*). Life satisfaction ("How satisfied are you with your life right now?"), meaning in life ("How meaningful do you feel your life is right now?"), and stress (How stressed are you right now?) were measured with a single item. For PA and NA, participants responded to such questions as, "How much are you feeling each emotion right now?" with three positive affect adjectives (happy, joyful, and relaxed) and four negative affect adjectives (bored, annoyed, depressed, and anxious). Principal component analyses indicated that all

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[2] We selected January 20, 2020 and May 31, 2020 as the study period, given that the first case of COVID-19 in South Korea was reported on January 20, 2020, and the data collected until May 31, 2020 were available at the time this paper was written.

[3] Due to the company's privacy policy, we were permitted to collect only limited demographic information such as age, gender, and region of residence.

Table 6 Descriptive Statistics and Bivariate Correlations among Well-Being and Perceived Social Supports in the periods of pre COVID-19 and COVID-19 (Study 2)

Variables	Mean	SD	Correlations		
			1	2	3
1. Well-Being in pre COVID-19	5.07	1.94	–		
2. PSS in pre COVID-19	4.56	1.40	.47***	–	
3. Well-Being in COVID-19	5.02	2.08	.65***	.36***	–
4. PSS in COVID-19	4.55	1.42	.41***	.66***	.56***

PSS refers to perceived social support

*$p < .05$. **$p < .01$. ***$p < .001$

ten items loaded on the first factor (> 0.67). This factor accounted for 57% (during the pre-COVID-19 period) and 59% (during the COVID-19 period) of the variance. The reliability coefficients were 0.92 (during the pre-COVID-19 period) and 0.91 (during the COVID-19 period). The well-being index was calculated by averaging the scores of 10 items (the stress and NA items were reverse coded).

7.2.2 Perceived Social Support

The perceived social support scale (Zimet et al., 1988), which consisted of 12 items, was used to measure participants' social relationships. The participants reported the extent to which they believed they were cared for by close others, including family, friends, and special persons (e.g., "There is a special person who is around when I am in need"; "I get the emotional help and support I need from my family"; and "I can count on my friends when things go wrong.") on a 7-point Likert scale. The average score was used for the analysis. The reliability coefficients were 0.94 (during the pre-COVID-19 period) and 0.94 (during the COVID-19 period).

8 Results

The descriptive statistics and correlation coefficients are presented in Table 6. There was no difference between the levels of well-being ($M_{pre-COVID-19} = 5.07$ vs. $M_{COVID-19} = 5.02$) and the levels of perceived social support ($M_{pre-COVID19} = 4.56$ vs. $M_{COVID-19} = 4.55$) between the pre-COVID-19 and COVID-19 periods ($ts < 0.82$, $ps > 0.420$). Perceived social support was positively correlated with well-being, before and during the COVID-19 period, but its association with well-being during the COVID -19 period ($r_{COVID-19} = 0.56$) was stronger than that before the COVID-19 period ($r_{preCOVID-19} = 0.47$).

Next, we systematically examined within-person changes in the association between social relationships and well-being, before and during the COVID-19 period. To this end, we generated a linear mixed model with random intercepts (Bates et al., 2015; Galecki & Burzykowski, 2013), in which the time period (pre-COVID-19 vs. COVID-19), perceived social support, and their interaction terms (with gender and age as covariates) were simultaneously entered.[4] The results revealed that a positive effect of perceived social support

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[4] All the results held when gender and age were not included as covariates.

on well-being was significantly moderated by the time period ($b = 0.101$, $SE = 0.041$, $p = 0.014$), indicating that the within-person association between perceived social support and well-being changed temporally between the pre-COVID-19 and COVID-19 periods. Specifically, the magnitude of the within-person association between perceived social support and well-being became larger during the COVID-19 period ($b = 0.736$, $SE = 0.037$, $p < 0.001$), compared to the pre-COVID-19 period ($b = 0.635$, $SE = 0.038$, $p < 0.001$).

9 Discussion

Taken together, the findings obtained from the within-person comparison in Study 2 indicate that the positive impact of social relationships on well-being loomed large after the COVID-19 outbreak. It is noteworthy that Study 2 utilized a within-subject design to compare the positive effects of social relationship between before and after the pandemic, which is rare in studies on the psychological impacts of COVID-19. Most extant studies on COVID-19 suffer from an inevitable lack of a pre-COVID-19 comparison group. Yet, Study 2 analyzed the same sample of participants, whose well-being was measured both before and after the pandemic, and found that the association between social support from close social relationship and well-being became stronger after the pandemic than before it.

10 General Discussion

This study examined the relationship between social interactions and well-being during the COVID-19 pandemic and compared it to those during pre-COVID periods through two studies with different methodologies: an ESM study (Study 1) and a longitudinal study (Study 2). Our study revealed several interesting and important observations on this topic. First, despite the danger of infection during the pandemic, participants experienced greater well-being when engaging in social interactions with close others than when they were alone. Second, participants experienced greater well-being in daily lives when they were with a spouse or romantic partner rather than with other partners, whereas they reported lower levels of momentary well-being in relation with coworkers and bosses. Third, the positive association between engaging in interaction with close relationships and well-being was strengthened after the COVID-19 outbreak.

Why have social interactions, particularly with close others but not with formal work partners, become increasingly important for well-being during the COVID-19 pandemic? There are a few plausible explanations for this change in the salience and pattern of social relationships on people's well-being. First, consistent with previous research on the protective role of social relationships during difficult times, individuals during the COVID-19 pandemic may have sought additional social support from their close friends or relatives to cope with increased stress due to social distancing measures (Saltzman et al., 2020). Several recent studies have directly tested the stress-buffering hypothesis of social relationships (i.e., Cohen & Wills, 1985) during COVID-19. One longitudinal study conducted in the U.S. found that while people felt more lonely during social distancing periods, they also experienced an increased sense of emotional and instrumental support from social relationships (Philpot et al., 2021). Another study in the U.S. found that perceived social support reduced the impact of COVID-19 anxiety on psychological health, accounting for the degree of social isolation (Szkody et al.,

2021). Our findings further contribute to the evidence that social support had a stress-buffering effect on the South Korean samples during the COVID-19 pandemic.

Another possibility is that the positive association between social interactions with close individuals and well-being has strengthened due to the lack of opportunities to interact with other types of social relationships (e.g., friends, neighbors, etc.). Public health scholars have suggested that the COVID-19 pandemic restrictions have limited social networks and interactions with close relationships, such as family members, partners, and cohabitants, which has provided opportunities for these close ties to reconnect and strengthen due to the unavailability of other external social activities (Long et al., 2022). This limited access to the interactions of other types of social relationships also explains the negative impact of workplace relationships on well-being during the COVID-19 pandemic. While previous research on work relationships and well-being has indicated possible positive associations (e.g., Simon et al., 2010), interactions with work partners may have shifted to focus on work-related matters and non-interactive email communications, whereas spontaneous positive social interactions with co-workers, such as having lunch or coffee breaks, may have been missed because of social distancing (Long et al., 2022).

Finally, the importance of safety during the pandemic may lead individuals to perform more activities with close others after COVID-19 than before, which in turn might increase their experience of well-being while being with close partners during the COVID-19 pandemic. The COVID-19 pandemic has threatened our sense of safety (Marazziti & Stahl, 2020), and thus people might seek interpersonal safety behaviors such as preferring to engaged in their favorite activities with close partners that have already established trust, rather than distant partners. Since we measured daily activities that participants engaged in, as well as momentary well-being, via ESM surveys in Study 1, we enabled to test whether differences in activities that people engaged in with close partners between the pre-COVID-19 and the COVID-19 periods could be attributable to the stronger link between close relationship and well-being during the COVID-19 pandemic than before it. To this end, we reanalyzed the moderating effects of the year (2017 vs. 2020) on the association between interaction with close others and momentary well-being in Study 1, after controlling for activity variables. The results revealed that the interaction effect became non-significant ($p = 0.244$). This partially supports the possibility that a stronger association between social interactions with close others and well-being during the COVID-19 period, compared to the pre-COVID-19 period could be attributed to engaging in more positive activities with close others during the COVID-19 period than during the pre-COVID-19 period. However, a recent meta-analysis reported that there has been a moderate to the strong increase in domestic violence during the COVID-19 pandemic (Piquero et al., 2021), suggesting that spending more time with close others during the pandemic may not always lead to well-being. Therefore, future research should study the specific conditions and contexts in which interactions with close relationships lead to higher well-being in social distancing situations.

One key strength of the current research is that we used an ESM design to investigate the association between social interaction and well-being during the pandemic. Although numerous ESM studies have demonstrated the relationship between social interaction and momentary well-being in normal times (e.g., Hudson et al., 2020), to the best of our knowledge, relatively few studies have investigated their link during the pandemic. Among the exceptions is the research conducted by Merolla et al. (2021), which demonstrated how pandemic-related anxiety and depression manifested in daily relational life. The present study extended this line of inquiry by examining the relation between social interaction and

momentary well-being during COVID-19 and comparing the effects before and after the pandemic.

Furthermore, our study builds on the existing literature on COVID-19 by separating the types of social relationships and exploring the association between interaction with different kinds of partners and well-being. By using the ESM approach rather than retrospective assessments and separating types of relationships, we attempted to draw more accurate and comprehensive findings. In this study, we found that individuals experience greater well-being when interacting with close others, even in person, rather than being alone, whereas they reported lower well-being when engaging in formal relationships during the epidemic. Extant literature has demonstrated that support from supervisors (Hämmig, 2017) and subordinates (Shanock & Eisenberger, 2006) is positively related to well-being and work performance. The current study focused on the effects of interaction with others at work, which does not necessarily indicate positive social support. Interaction with formal relationships can either be a positive or negative experience in the workplace. Therefore, we assume that interactions in public relationships that are not voluntary during the pandemic period might become burdensome and reduce well-being.

Despite the timely findings of the current research, there are limitations to the study. First, our ESM data before and after the pandemic were not obtained from the same participant sample because of the unpredictable nature of the epidemic. However, following previous research, we applied the PSM to compensate for these limitations in the data. Similar to a prior study conducted by Sibley et al. (2020), we included similar participants from the pre- and post-pandemic groups based on demographic variables including age, gender, marital status, having children, household income, compliance rate, and Big Five personality traits. Moreover, to account for this issue, we tested the within-subject analyses using the large online longitudinal data in Study 2. We confirmed the findings of the propensity matched analyses by suggesting that the engaging in close relationships are more influential on well-being after the pandemic.

Second, our findings may be limited to the South Korean context, which is among the few nations that flattened the curve; hence, infection through family and friends has been relatively rare. In addition, cultural factors such as a greater likelihood of cohabitation among family members and collectivist values may have influenced the importance of close social relationships on well-being during the pandemic. Thus, our findings may not be replicated in other countries, especially in countries that hold individualistic values and those in which the severity of COVID-19 is much greater than in South Korea. It seems plausible that interacting with close others in a country where COVID-19 is widespread and where the emphasis is on individual well-being rather than social well-being may lower one's well-being. Therefore, future research could explore whether values or cultural customs including cohabitation, psychological safety zone, or frequency of interactions have any role in changing the impact of social relationships on well-being.

Third, future research could consider more diverse and refined relationships. Despite the fact that this study examines the link between interacting with different types of relationships and momentary well-being, there is a wider range of potentially significant partners that we did not test. For example, interactions with acquaintances or strangers in daily lives (e.g., greeting a next-door neighbor or briefly chatting with a barista), which were limited by social distancing, were not taken into account in the current research. The positive effects of small daily interactions with acquaintances or strangers on well-being could become more evident after the COVID-19 pandemic. Future research should explore the consequences of small interactions on well-being and compare their benefits with other interactions. Furthermore, since virtual/digital social interactions including

texting, Zooming, or facetiming have increased during the pandemic (Okabe-Miyamoto & Lyubomirsky, 2021), considering the effect of digital interactions on well-being and comparing it with face-to-face interactions could be an interesting avenue of investigation. Likewise, future attempts to explore more diverse and meaningful relationship partners would provide more fruitful findings.

Finally, the measurement of negative emotions was limited to stress, boredom, and loneliness in the present research. Given that data on multifaceted stress, including work, health, and COVID-19 that must be highly correlated with individual well-being would likely provide more comprehensive understanding, future research should consider and include more detailed measurements of stress, anxiety, or depression.

Close relationships in the COVID-19 era may serve as a double-edged sword—interacting closely with other people can increase the risk of infection (e.g., Li et al., 2020); however, they are still the key to our well-being during these difficult times. Our findings suggest that people should continue to protect themselves from virus transmission by adhering to social distancing measures and preventive behaviors in the presence of others. However, people should also be aware of the greater beneficial role of interactions with close others on their mental well-being during the pandemic than in normal times. It is important to understand the role of close relationships in enhancing well-being during the pandemic, such as the provision of social support that buffers pandemic stress and the satisfaction of social needs that are deprived during social distancing. Such understanding could further guide choosing how to interact with family and partners to maximize the benefits of social interactions despite the possible costs. As the COVID-19 pandemic continues to influence lives worldwide, we hope our findings will help improve daily well-being during this crisis.

Declarations

Conflict of Interest The authors have no relevant financial or non-financial interests to disclose.

Ethical Approval Data were collected in accordance with protocols from institutional or other relevant ethics committee.

Consent to Participate Informed consent had been obtained from participants.

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