AMERICAN PSYCHOLOGICAL ASSOCIATION

Developmental Psychology

ISSN: 0012-1649

2021, Vol. 57, No. 10, 1633–1647
https://doi.org/10.1037/dev0001211

Connections During Crisis: Adolescents' Social Dynamics and Mental Health During COVID-19

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Adolescence is a critical period for social development, which COVID-19 has dramatically altered. Quarantined youths had limited in-person interactions with peers. The present study used an intensive longitudinal design to investigate changes in interpersonal dynamics and mental health during COVID-19. Specifically, we investigated whether the associations between different social contexts—that is, "spillover"—changed during COVID-19 and whether changes in social interactions during COVID-19 was associated with changes in depressive symptoms. Approximately 1 year prior to the onset of COVID-19, 139 youths reported depressive symptoms and daily interactions with parents, siblings, and friends, every day for 21 days via online questionnaires. Shortly after schools closed due to COVID-19, 115 of these youths completed a similar 28-day diary. Analyses included 112 youths (62 girls; 73% Caucasian; M_{age} = 11.77, range = 8 to 15 in Wave 1) who completed at least 13 diary days in each data wave. Our results show that younger adolescents experienced significant decreases in negative and positive interactions with friends, whereas older adolescents showed significant decreases in negative interactions with friends and significant increases in positive interactions with siblings. As predicted, within-day spillover of positive interactions and person-level association of negative interactions increased within the family during COVID-19, whereas within-day spillover of positive interactions between family and friends decreased. We also found a dramatic increase in depressive symptoms. More negative interactions and fewer positive interactions with family members were associated with changes in depressive symptoms. Our study sheds light on how youths' social development may be impacted by COVID-19.

Keywords: depression, adolescents, family processes, peer relationship, COVID-19

Supplemental materials: https://doi.org/10.1037/dev0001211.supp

The COVID-19 pandemic has affected many individuals, families, and communities around the world (Choi et al., 2020; Wang et al., 2020; World Health Organization, 2020). Many governments implemented quarantines and restricted social gatherings to decrease infection concerns (Centers for Disease Control and Prevention, 2020). As a result, many individuals markedly diminished in-person contact. Previous quarantines have shown that such dramatic social changes can lead to feelings of social isolation and a greater likelihood of developing mental health issues (Adhanom Ghebreyesus, 2020; Brooks et al., 2020). Studies have begun to delineate the mental health consequences of COVID-19 and related quarantine and already noted increases in psychopathology, including depression (e.g., Adhanom Ghebreyesus, 2020; Chahal et al., 2020).

Children and adolescents may be at a particularly high risk for deleterious mental health outcomes during COVID-19 given their position at a critical developmental stage in which social interactions,

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The present study was supported by National Institute of Mental Health Translational Developmental Neuroscience Training Grant (T32 MH18268), The Israeli Council for Higher Education Postdoctoral Research Fellowship for Women, and the Marie Sklodowska-Curie Individual Fellowship (786460) under the European Union's Horizon 2020 research and innovation program awarded to Reuma Gadassi Polack, the Azrieli Fellowship awarded to Haran Sened, and the National Institute of Mental Health R21 MH119552 awarded to Jutta Joormann and Hedy Kober.

Our hypothesis regarding changes in spillover processes during COVID-19 was preregistered on the Open Science Framework (https://osf.io/eq62h/?view_only=742c1d2916454517b6416302d6211926). The authors thank Itay Polack Gadassi for his help setting up the study and Ralitza Gueorguiva for advice regarding data analysis. The authors also thank the research assistants who helped with data collection and the families who participated.

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particularly with peers, are central (Ellis et al., 2020; Orben et al., 2020). Indeed, adolescence is a time during which youth are at increasingly high risk of developing mental health disorders (e.g., Petersen et al., 2018; Salk et al., 2016). In addition, adolescents can be particularly vulnerable to stress (Cohodes et al., 2021), which may render them susceptible to mental health ramifications from COVID-19. However, most studies thus far on the mental health impact of COVID-19 were based on cross-sectional designs (cf. Chahal et al., 2021); thus, their ability to deduce causality is limited. Moreover, such studies have typically speculated about changes in social relationships during quarantine and have not examined it directly.

During typical transition to adolescence, youths begin spending an increasing amount of time with their peers, and less time with their parents (e.g., Lam et al., 2012; Larson et al., 1996; Larson & Richards, 1991). Additionally, peer groups become more influential, while parental impact is lessened (e.g., De Goede et al., 2009; Hadiwijaya et al., 2017). These processes of becoming closer to peers is thought to support youths' social-emotional development and increased independence from their family (Nelson et al., 2005). In this context, COVID-19 and the social distancing measures it required—especially during early stages—may have been particularly harmful to youths' social-emotional development. Indeed, recent cross-sectional evidence shows that youth have experienced distress over the maintenance of friendships during quarantine (Ellis et al., 2020). Although online social interactions may partially compensate for a lack of in-person meetings (Ellis et al., 2020; Orben et al., 2020), in-person interactions are likely to be more influential and foster more connectedness. Importantly, the current investigation focused on the initial stages of the pandemic, when "stay at home" recommendations were widespread.

One way to assess relationship connectedness is derived from theories that view the social world as comprised of different subsystems (i.e., relationships) that are interconnected (e.g., the mother-adolescent dyad is a subsystem, as is the mother-father dyad; Bronfenbrenner & Morris, 2006; Minuchin, 1985). Although these systems are interconnected, they ideally also have boundaries between them: thus, if there is a problem in a specific subsystem, it would not proliferate to other connected subsystems (e.g., mother–father conflict would not lead to mother–child conflict; Davies & Sturge-Apple, 2014). However, boundaries between relationships are permeable, and events or emotions from one subsystem/relational context are often associated with similar events or emotions in other relational contexts, via a process dubbed *spillover* (e.g., Chung et al., 2011; Flook & Fuligni, 2008; Kaufman et al., 2020; Krishnakumar & Buehler, 2000; Mastrotheodoros et al., 2020). The process of spillover has predominately been studied in the context of how parental conflict affects parent–child relationships (e.g., Chung et al., 2011; Kaufman et al., 2020; Mastrotheodoros et al., 2020; Timmons & Margolin, 2015). Excessive spillover can reflect "enmeshed" family boundaries (Minuchin, 1985); which may be detrimental to youth's mental health, especially when the spillover is of negative interactions or emotions (e.g., Koçak et al., 2017; Lindblom et al., 2017). Spillover can also occur between family and peer relationships, which can create vicious cycles of relational negativity. For instance, higher parental rejection predicted increases in peer victimization 1 year later (Kaufman et al., 2020). In the current investigation, we used spillover processes to assess connectedness within the family system, as well as between family subsystems and peer relationships.

Our study involved two waves of data collection—the first at 1 year prior to COVID-19 and the second during the beginning of the pandemic. Each wave was comprised of an intensive longitudinal design (daily diaries), which allowed us to examine the impact of COVID-19 using two levels of analyses: the day-level and the person-level. Separating day-level from person-level allowed us to separately analyze state (i.e., a given day) and trait (i.e., a specific person) effects (Bolger & Laurenceau, 2013; Trull & Ebner-Priemer, 2020). The distinction between trait and state is of theoretical importance because trait-level effects reflect individual differences in strength of association between relational contexts, whereas state-level effects shed light on daily processes across individuals. Moreover, associations found on the state-level do not necessarily indicate trait-level associations, and vice versa, highlighting the need to examine them separately.

Taken together, the present study contributes to the existing COVID-19 literature in several ways. First, we recruited participants who already provided daily diary data a year prior to COVID-19 (Gadassi Polack, Chertkof, et al., 2021), which served as a baseline. Then, we collected diary data from the same participants shortly after quarantine began. Using both waves, we assessed how COVID-19 impacted youths' mental health as well as their social interactions with family and friends. Importantly, we examined whether these social interactions accounted for changes in mental health during quarantine. Second, by examining spillover effects we assessed how each of these youths' relational contexts were connected to the other. If youths are meant to become more independent from their parents, closer to their friends, and more influenced by them during normative development, we expected that the quarantine and social distancing would disrupt such typical development, resulting in youths becoming closer to and more influenced by their family (vs. friends). Finally, we included siblings as a social context separately from parents. Evaluating sibling relationships was particularly critical during COVID-19, when siblings were the closest thing to a peer group available to most youths.

Our study also contributes to the literature on spillover processes. First, we assessed a wide range of both positive (e.g., support) and negative (e.g., conflict) social interactions reported by youths. This broader approach is necessary given that the literature has historically focused on conflict and negative interactions only (e.g., Chung et al., 2011; Davies & Sturge-Apple, 2014; Kaufman et al., 2020; Mastrotheodoros et al., 2020; Timmons & Margolin, 2015), despite substantial findings showing that positive interactions are important and can proliferate via self-enhancing cycles (Fredrickson, 2013). Second, this study's nested (two–wave) intensive longitudinal design approach treats COVID-19 as an "experiment in nature" (Gleason et al., 2008), thus allowing us to examine how spillover processes change under stressful situations, and how physical proximity contributes to these processes.

Finally, our study contributes to the literature on social deprivation during adolescence, which has scarcely been investigated in humans due to ethical considerations (Orben et al., 2020). The preclinical literature shows that interactions with peers are particularly important for adolescent animals, and that isolation has a lasting detrimental impact on mood, behavioral, and cognitive outcomes (Panksepp, 1981); including increases in anxiety and depression-like behaviors (Orben et al., 2020). Even with partial isolation, adolescent animals exhibit changes in the prefrontal cortex, a brain region associated with executive function (Bell et al., 2010). Although no comparable studies were conducted on human adolescents, a recent study that examined the influence of the COVID-19 lockdown on college students found that their social networks were more sparse compared to prior cohorts, that they had more

mental health difficulties, and that having fewer social interactions was associated with worse mental health outcomes (Elmer et al., 2020).

The following questions guided our analyses:

1. How did social interactions change due to COVID-19? We hypothesized that during (vs. prior to) COVID-19, youths would report more interactions with family members and fewer interactions with friends. We examined age as a moderator of these changes: We expected older (vs. younger) youths to have more interactions with friends and fewer interactions with parents both prior to and during COVID-19. We had no hypothesis regarding siblings.

2. How did within-day spillover and person-level associations of social interactions change during COVID-19? We hypothesized that within-day spillover and person-level associations between family members would increase in strength during COVID-19 (vs. before), whereas within-day spillover and person-level associations between family and friends would decrease. We examined these hypotheses separately for positive and negative interactions.

3. Did youths' depressive symptoms increase during COVID-19? And were these increases moderated by age and gender? We hypothesized that depressive symptoms would increase during COVID-19 and that this increase would be particularly prominent among girls, as gender differences in depression typically emerge during adolescence (e.g., Salk et al., 2016).

4. Do social interactions during COVID-19 account for increases in depressive symptoms from prior to during COVID-19? Specifically, we hypothesized that a lower number of positive interactions and a higher number of negative interactions would account for increases in depressive symptoms from prior to during COVID-19.

Method

All procedures have been approved by the Yale University Institutional Review Board (Protocol no.: 2000022492; Title: "Emotion Regulation in Risk for Depression"). Study materials can be accessed online (Gadassi Polack, Sened, et al., 2021).

Participants

Wave 1

Youths (N = 148) were recruited via flyers in the University area, on Craigslist, and on social media. Advertisements invited youths 9 to 15 years old to a diary study about emotions and social interactions. Inclusion criteria were daily access to an Internet-enabled device and consent from a legal guardian. Siblings were allowed to participate. Participants received $40 if they completed 60% of surveys and $60 if they completed 90%. Those who completed <60% received $10 for participation. One hundred and thirty-nine youths (94%) completed at least 13 diary entries. Since we included children who turned 9 during the diary period, the age range was 8 to 15 years.

Wave 2

We contacted participants who (a) completed Wave 1 and (b) indicated interest in additional studies. They were invited to participate in a one-time background questionnaire session and a 28-day diary study similar to the one they had completed during Wave 1. Due to the increased length of the study, compensation was $50 if they completed 60% of surveys and $70 if they completed 90%; those who completed <60% received $10 for participation. Of the 117 participants who started Wave 2, 115 completed at least 13 entries (98%). Table S1 in the online supplemental material presents demographics for both data waves.

Final Sample Characteristics

We included 112 participants (62 girls) who completed at least 13 diary entries in each data wave. Mean age of participants in Wave 1 was 11.77 (SD = 2.13, Mdn = 12), and 12.64 (SD = 2.12, Mdn = 13) in Wave 2. The sample was mainly Caucasian (73%). Average time between the two waves was 310 days (SD = 58.81, range = 222–436). Youths included in the final sample were similar to those who did not complete Wave 2 in terms of gender, $\chi^2(1) = 1.30$, $p = .254$, race, $\chi^2(6) = 7.80$, $p = .253$, and age at Wave 1, $t(146) = 1.60$, $p = .112$, and all other research variables in Wave 2 (all $ps \geq .072$).

Power Analysis

The present study is part of a larger project on emotions and social interactions; sample size was determined for Wave 1. To offset attrition, we increased the diary period in the Wave 2 to 28 days.

Procedure

Wave 1

Data were collected between January 31, 2019 and September 23, 2019. Participants came to the lab for an initial visit, during which a researcher reviewed the daily diary questionnaire to ensure clarity. Youths signed assent forms and their parents signed consent forms. Participants also completed a practice survey and a demographics questionnaire. Subsequently, every evening for 21 days, participants received a link via e-mail to the daily survey, which they completed on a secure website (www.qualtrics.com). Participants were instructed to complete the survey before going to bed. The link expired after 14 hr.

Wave 2

Data were collected between March 30, 2020 and June 8, 2020. On March 10, 2020, the governor of Connecticut declared a state public health emergency. Public schools were closed on March 13, 2020, public amusement places on March 18, 2020, and nonessential businesses on March 23, 2020. "Stay at home" and mandatory face–covering orders were issued on March 28, 2020. Connecticut started phase 1 of reopening May 20, 2020; Phase 2 started after the end of data collection. According to the Connecticut Department of Public Health (see https://data.ct.gov/Health-and-Human-Services/COVID-19-Tests-Cases-Hospitalizations-and-Deaths-S/rf3k-f8fg), during data collection there were 44,179 confirmed cases of COVID-19, between 293 and 1,972 individuals were hospitalized per day due to COVID-19, and 4,097 COVID-related deaths in Connecticut, and 1,961,781 confirmed cases and 111,774 deaths reported across the United States.

Participants were contacted by email or phone. If they expressed interest, an online Zoom (www.zoom.us) session was scheduled for them and their parents, during which they gave assent and consent respectively (through Qualtrics; www.qualtrics.com) and received explanations about the diary. Then, youths filled out a demographic questionnaire as well as some additional questionnaires not used in the current investigation. Subsequently, every evening for 28 days, participants received a link via e-mail to the daily survey. Participants were instructed to complete the survey before going to bed. The link expired after 16 hr.

Background COVID-19-Related Questions

In the initial session for Wave 2, we asked youths background questions, including if their school had been moved to an online format, if their usual activities had been canceled, how many people were living in their household, and if their parents are working from home.

Diary Measures

The present study is part of a larger study; only relevant measures are described.

Interpersonal Interactions

Every day, participants were asked to report whether or not the following events occurred, and if they did, with whom (mom/dad/sibling/friend/romantic partner in Wave 1; mother/father/sibling/friend/other kid/other adult in Wave 2). The list of interpersonal interactions included positive (e.g., was included by, was complimented by, was supported by) and negative (e.g., had a fight with, was left out by, was criticized by, was insulted by, was made fun of by, and was let down by) interpersonal interactions. Each event within a given social context was scored 1 (event occurred) or 0 (event did not occur). Number of events were summed every day within social context (e.g., if participant indicated that they had a fight with their mother and were criticized by her on a certain day, they received a 2 in the daily score of negative events with mother).

Depressive Symptoms

A self-report Children's Depression Inventory–Short version (CDI-S; Kovacs, 2003); which consists of 10 items assessed the severity of depressive symptoms. The short form is similar to the full measure in its specificity and sensitivity (Allgaier et al., 2012). Each item consists of three sentences representing different degrees of symptom severity (from 0 to 2), from which participants choose those that best describe them. Instructions were adapted for the daily diary by asking participants to choose the sentence that best describes them at the time they were answering the survey. The score suggested as the clinical cutoff for the short version is ≥3 (Allgaier et al., 2012). We calculated the between- and within-subject reliabilities using procedures outlined in Shrout and Lane (2012). For a given measure, the between-subjects reliability coefficient is the expected between-subjects reliability estimate for a single typical day. The within-subject reliability coefficient is the expected within-subject reliability of change within individuals over the daily diary entries. The between-person and within-person reliabilities were .91 and .75 in Wave 1 and .92 and .74 in Wave 2. These reliabilities are considered good for within-individual measures (Nezlek, 2017).

Data Analytic Plan

Day-Level Analyses

Data within each wave were hierarchically nested: days within individuals to account for the nonindependence of day-level data, and to prevent inflation of effects (Krull & MacKinnon, 2001). Data were analyzed using the nlme package (Pinheiro et al., 2014) of R Studio software (R Core Team, 2013). Level 1 was the day level and Level 2 was the person level. We centered day-level predictors at the person-mean to make interpretation of intercepts clearer, and to separate Level 1 and Level 2 effects (see Zhang et al., 2009). We used a compound symmetry structure across the daily errors. As covariates, we entered into the analyses (a) the lagged mean-centered outcome score (i.e., the previous day's outcome variable, entered as a deviation from the mean) and (b) the person's mean outcome score (averaged across the entire diary period). Thus, the outcome (interpersonal interactions) became a residualized change score.

For example, to test our hypothesis that daily variations in positive interactions with mother predicted daily variations in interactions with father and that this association was moderated by data wave, we ran a model in which data wave (dummy coded such that 0 = Wave 1 and 1 = Wave 2), day-level positive interactions with mother, and the interaction between day-level positive interactions with mother and data wave were the predictors of variations in positive interactions with father. In addition, we entered yesterday's positive interactions with father into the model, along with the participant's mean level of positive interactions with father. Including lagged positive interactions with father means that whatever effect we find for positive interactions with mother would not include variance that is due to yesterday's positive interactions with father and its effects on positive interactions with mother (or directly on today's positive interactions with father). We also entered the participant's mean score of the predictors (e.g., their mean level of positive interactions with mother). Including the person-mean variables allows estimation of both person-level and day-level effects (Bolger & Laurenceau, 2013), and also allows us to rule out static spurious "third variables" as alternative explanations.

$$
\begin{aligned}
&Y_{jkl}(\textit{Positive interactions with dad during wave } l \textit{ on day } k \textit{ for person } j) = \\
&\quad (\beta_0 + b_{0j}) + \\
&\quad (\beta_1 + b_{1j}) \times (\textit{Lagged positive interactions with dad } [\textit{day } k - 1]) + \\
&\quad (\beta_2 + b_{2j}) \times (\textit{Positive interactions with mom on day } k) + \\
&\quad \beta_3 \times (\textit{Data wave}) + \\
&\quad \beta_4 \times (\textit{Data Wave} \times \textit{Positive interactions with mom on day } k) \\
&\quad \beta_5 \times (\textit{M positive interactions with dad}) + \\
&\quad \beta_6 \times (\textit{M positive interactions with mom}) + \\
&\quad \varepsilon_{jkl}
\end{aligned}
$$

Person-Level Analyses

Thirty (26.1%) of our participants were siblings, which entered nonindependence to the data. Thus, we added a variable identifying familial membership to the model's random statement. However, since variance of the random effect of family membership was zero, person-level analyses were evaluated using linear models. To do this, we averaged daily scores of our variables across the entire diary period within individual. For example, depressive symptoms before and during COVID-19 were summed within day, and then averaged across the diary period (21 days for Wave 1, 28 days for Wave 2) within

individual. Examining person-level effect using summed scores across the diary period follows our prior work (e.g., Gadassi et al., 2011) and recommendations in the field (Bolger & Laurenceau, 2013).

To examine if person-level associations between social interactions changed during COVID-19, we examined multilevel models in which social interactions (e.g., positive interactions with mother) were associated with social interactions from a different social context (e.g., positive interaction with father). To examine whether these associations were different in size during COVID-19, we added a dummy-coded variable to indicate "Wave" (coded 0 for Wave 1 and 1 for Wave 2).

$$\text{Yi } (M \text{ number of positive interations with father for person } i) = \beta_0 + \beta_1 (M \text{ number of positive interactions with mother}) + \beta_2 (\text{Data wave}) + \beta 3 (M \text{ number of positive interations with mother} \times \text{Data Wave}) + \varepsilon_i$$

All analyses were repeated adjusting for gender and number of days between data waves; these are reported below only when this changed the effects.

Moderation by Age

To examine for possible moderation by age of Hypotheses 1 and 3, we conducted all analyses with participants' z transformed age at Wave 2 as a moderator. Table S4 in the online supplemental material presents correlations between participants' age and study variables.

Results

Youths' Lives During COVID-19

The vast majority of our sample (97.3%) reported school moving to a full or partial online format (104 participants reported attending school completely online and four reported partially online). Similarly, most (91.9%) reported that afterschool activities were partially or fully cancelled (93 reported all activities cancelled, nine reported some were canceled). The vast majority our sample, 107 participants (95.5%), reported living with three or more people in their household. Finally, most participants reported that at least one parent stayed home (70 participants reported both parents at home, 35 reported at least one parent; together 94.6%).

Changes in Social Interactions During COVID-19 and Their Moderation by Age

To examine our hypothesis that the number of social interactions with family members will increase and the number of social interactions with friends will decrease, and whether these changes will be moderated by youths' age, we conducted a 4-way mixed analysis of variance (ANOVA) with valence (positive vs. negative interactions), time (before vs. during COVID-19), and context (mother, father, sibling, or friend) as within-participant factors, and a dichotomized variable for Age as between-participants factor. Age was coded as 0 for participants who were 12 or younger during Wave 2, and 1 for participants who were 13 or older. Given the significant Valence × Context interaction, $F(1, 110) = 98.08$, $p < .001$, $\eta^2 = .47$, indicating that positive interactions ($M = 1.43$, $SE = .10$) were much more frequent than negative interactions ($M = 0.37$, $SE = .04$), and to simplify reporting, we report three-way mixed ANOVAs separately for positive and negative interactions.

Positive Social Interactions

To examine how positive interactions change during COVID-19, we conducted a 3-way (Time × Context × Age) mixed ANOVA. The ANOVA did not reveal a significant main effect for time, $F(1, 110) = .17$, $p = .677$. However, the time by context, $F(3, 330) = 10.70$, $p < .001$, $\eta^2 = .09$, and Time × Context × Age, $F(3, 330) = 3.52$, $p = .015$, $\eta^2 = .03$, interactions were significant. In addition, the main effects of context, $F(3, 330) = 30.68$, $p < .001$, $\eta^2 = .22$, age, $F(1, 110) = 5.47$, $p = .021$, $\eta^2 = .05$, and Context × Age interaction, $F(3, 330) = 20.72$, $p < .001$, $\eta^2 = .16$, were significant. The Time × Age interaction was not, $F(1, 110) = 1.87$, $p = .666$.

To better understand the three-way Time × Context × Age interaction, we first conducted paired-sample t tests for each social context within each age group. For younger participants, there was a significant decrease in number of positive interactions with friends from prior ($M = 1.44$, $SD = 1.16$) to during COVID-19 ($M = .74$, $SD = 1.15$), $t(51) = 4.86$, $p < .001$, and, for older participants, there was a significant increase in number of positive interactions with siblings from prior ($M = .67$, $SD = .93$) to during COVID-19 ($M = .87$, $SD = 1.12$), $t(59) = 2.03$, $p = .047$; see Table 1). All other comparisons were not significant ($ps \geq .069$).

To better understand the interaction of Context and Age, we averaged positive interactions across the two data waves. For participants 12 years of age or younger, positive interactions with mothers were the most frequent, followed by fathers, $t(51) = 3.24$, $p = .002$, and siblings, $t(51) = 5.77$, $p < .001$; see Table 1. Least frequent were positive interactions with friends, although they did not significantly differ from siblings, $t(51) = 1.48$, $p = .146$. For participants 13 years of age or older, positive interactions with mothers and friends were the most frequent, with no significant difference, $t(59) = .49$, $p = .629$. Next were positive interactions with fathers, which were significantly less frequent than with friends, $t(59) = 2.34$, $p = .023$. Least frequent were positive interactions with siblings, $t(59) = 4.88$, $p < .001$.

Negative Social Interactions

To examine how negative interactions change during COVID-19, we conducted a three-way (Time × Context × Age) mixed ANOVA. The ANOVA did not reveal a significant main effect for time, $F(1, 110) = 1.38$, $p = .244$. However, there was a significant time by context interaction, $F(3, 330) = 4.52$, $p = .004$, $\eta^2 = .04$. In addition, there was a main effect for relational context, $F(3, 330) = 22.11$, $p < .001$, $\eta^2 = .17$, and a significant Context × Age interaction, $F(3, 330) = 7.04$, $p < .001$, $\eta^2 = .06$. To better understand the source of the Time × Context interaction, we conducted a series of paired-sample t-tests comparing the frequency of negative interactions within context. The number of negative interactions with friends significantly decreased during COVID-19, but there were no changes in frequency of negative interactions in other relational contexts (see Table 1).

For participants who were 12 years of age or younger, negative interactions with siblings were the most frequent, followed by negative interactions with mother, $t(51) = 4.35$, $p < .001$; see Table 1). Negative interactions with mothers were similar in frequency to fathers, $t(51) = 1.48$, $p = .146$, and friends, $t(51) = 1.34$, $p = .185$. For participants 13

Table 1
Depressive Symptoms and Social Interactions Before and During COVID-19

Age	Wave 1	Wave 2[a]	% change	*t*	*p*
		Depressive symptoms			
Younger	1.99 (2.54)	3.36 (3.87)	+69	3.50	.001
Older	3.60 (3.42)	4.48 (3.68)	+24	2.74	.008
All	2.85 (3.14)	3.96 (3.79)	+39	4.24	<.001
		Positive interactions			
Mother					
Younger	2.46 (1.45)	2.56 (1.72)	+4	0.44	.658
Older	1.47 (1.41)	1.53 (1.61)	+4	0.38	.702
All	1.93 (1.50)	2.01 (1.73)	+4	0.59	.556
Father					
Younger	1.97 (1.38)	2.05 (1.70)	+4	0.44	.665
Older	1.05 (1.38)	0.94 (1.43)	−11	−1.00	.322
All	1.48 (1.45)	1.45 (1.66)	−2	−0.22	.829
Sibling					
Younger	1.17 (1.24)	1.46 (1.52)	+25	1.86	.069
Older	0.67 (0.93)	0.87 (1.12)	+30	2.03	.047
All	0.90 (1.11)	1.15 (1.35)	+28	2.71	.008
Friend					
Younger	1.44 (1.16)	0.74 (1.15)	−49	−4.86	<.001
Older	1.51 (1.18)	1.32 (1.29)	−13	1.11	.271
All	1.47 (1.17)	1.05 (1.26)	−29	−3.70	<.001
		Negative interactions			
Mother					
Younger	0.27 (0.35)	0.37 (0.41)	+37	1.84	.071
Older	0.38 (0.51)	0.26 (0.31)	−32	−2.26	.028
All	0.33 (0.44)	0.31 (0.36)	−6	−0.46	.642
Father					
Younger	0.20 (0.25)	0.33 (0.51)	+65	1.94	.058
Older	0.22 (0.38)	0.17 (0.33)	−23	−1.02	.310
All	0.21 (0.32)	0.25 (0.43)	+19	0.90	.369
Sibling					
Younger	0.71 (0.86)	0.76 (0.89)	+7	0.44	.661
Older	0.53 (0.94)	0.49 (0.84)	−7	−0.40	.694
All	0.62 (0.91)	0.62 (0.87)	0	−0.01	.999
Friend					
Younger	0.38 (0.60)	0.13 (0.22)	−66	−3.42	.001
Older	0.45 (0.57)	0.32 (0.44)	−29	−1.83	.072
All	0.42 (0.58)	0.23 (0.36)	−45	−3.65	<.001

[a] For this wave, "younger" refers to participants who were ages 9 through 12, and "older" refers to participants who were ages 13 through 17.

years of age or older, negative interactions with siblings were the most frequent, together with friends, $t(59) = 1.31$, $p = .194$. Next were negative interactions with mothers, which were less frequent than with siblings, $t(59) = 2.28$, $p = .026$, but similar in frequency to friends, $t(59) = 1.28$, $p = .205$. Negative interactions with fathers were the least frequent, significantly lower than mothers, $t(59) = 2.98$, $p = .004$. The main effect of age, $F(1, 110) = .20$, $p = .659$, as well as its interactions with time, $F(1, 110) = .49$, $p = .485$, and with time and context, $F(3, 330) = .92$, $p = .433$, were not significant.

Positive and Negative Spillover and Associations

Day-Level

For simplicity, we denote spillover of positive social interactions from one context to the other as *positive spillover* and spillover of negative social interactions *negative spillover*. Significant within-day positive and negative spillover was found between almost every couple of interactions examined—mother–father, mother–siblings, mother–friends, father–siblings, father–friends, and siblings–friends. See Table S2 and S3 in the online supplemental material for present all day-level spillover analyses. The only interactions that did not spillover were negative interactions with friends; father–friends and sibling–friends negative spillovers in both directions were not significant across data waves. Similarly, negative interactions with friends did not spillover to negative interactions with mothers. Moderation by Wave was found for positive spillover between family and friends: positive spillover from mothers, fathers, and siblings to friends was weaker during COVID-19 versus prior (see Table 2 and Figure 1B through 1D). Negative spillover from friends to fathers was stronger during COVID-19 (see Table 3 and Figure 1E). The only moderation of within-family spillover was the positive spillover from fathers to mothers (see Table 2 and Figure 1A), which intensified during COVID-19. Adjusting for gender and time altered the results in one case—sibling-friend negative spillover became significant.

Table 2
Day-Level Positive Spillover Within and Outside the Family: Spillover Moderated by Data Wave Only

Predictor	Estimate (*SE*)	$t(df = 4{,}790)$	p	Moderation by wave $t(df = 4{,}790)$	Moderation by wave p
Outcome: Positive interactions mother					
Intercept	−.02 (.02)	−0.917	.359	−0.521	.603
Previous day interactions: Mother	.14 (.02)	5.709	<.001	−1.198	.231
Same day interactions: Father	.46 (.04)	12.380	<.001	2.369	.018
M interactions: Mother	.97 (.01)	76.845	<.001	2.009	.045
M interactions: Father	.03 (.01)	2.309	.021	−1.680	.093
Outcome: Positive interactions friends					
Intercept	0.01 (.03)	0.471	.638	−0.938	.348
Previous day interactions: Friends	0.25 (.03)	9.313	<.001	−2.816	.005
Same day interactions: Father	0.19 (.03)	5.747	<.001	−3.406	.001
M interactions: Friends	1.01 (.01)	68.205	<.001	−0.417	.676
M interactions: Father	0 (.01)	−0.057	.955	0.353	.724
Outcome: Positive interactions friends					
Intercept	0.02 (.03)	0.546	.585	−1.008	.314
Previous day interactions: Friends	0.26 (.03)	9.592	<.001	−3.214	.001
Same day interactions: Mother	0.15 (.03)	5.667	<.001	−2.244	.025
M interactions: Friends	1.01 (.01)	71.937	<.001	−0.504	.614
M interactions: Mother	0 (.01)	−0.161	.872	0.584	.559
Outcome: Positive interactions friends					
Intercept	.01 (.03)	0.503	.615	−1.067	.286
Previous day interactions: Friends	.24 (.03)	8.863	<.001	−2.284	.022
Same day interactions: Siblings	.23 (.04)	5.817	<.001	−3.091	.002
M interactions: Friends	>.99 (.01)	71.705	<.001	0.293	.770
M interactions: Siblings	.02 (.02)	1.387	.166	−0.396	.692

Person-Level

Positive Person-Level Associations. The associations between positive interactions within family and from family to friends were positive and significant (see Table 4). Specifically, individuals who had more positive interactions with one family member had more positive interactions with other family members as well as with friends. However, our hypothesis that the strength of the associations would increase during COVID-19 was not supported, as can be seen by the nonsignificant Context × Wave interaction.

Negative Person-Level Associations. The associations between negative interactions within family and between family and friends were positive and significant (see Table 5). Specifically, individuals who had more negative interactions with one family member had more negative interactions with other family members as well as with friends. Importantly, the strength of most of these associations changed significantly during COVID-19 in the predicted direction. The association between interactions with mothers and interactions with fathers (see Table 4 and Figure 2A), as well as between fathers and siblings (see Table 4 and Figure 2B) increased in strength, whereas the person-level associations between family members and friends decreased in strength (see Table 4 and Figure 2C through 2E), as can be seen by the significant Context × Wave interactions. The only association that remained unchanged was the person-level associations of negative interactions between mothers and siblings.

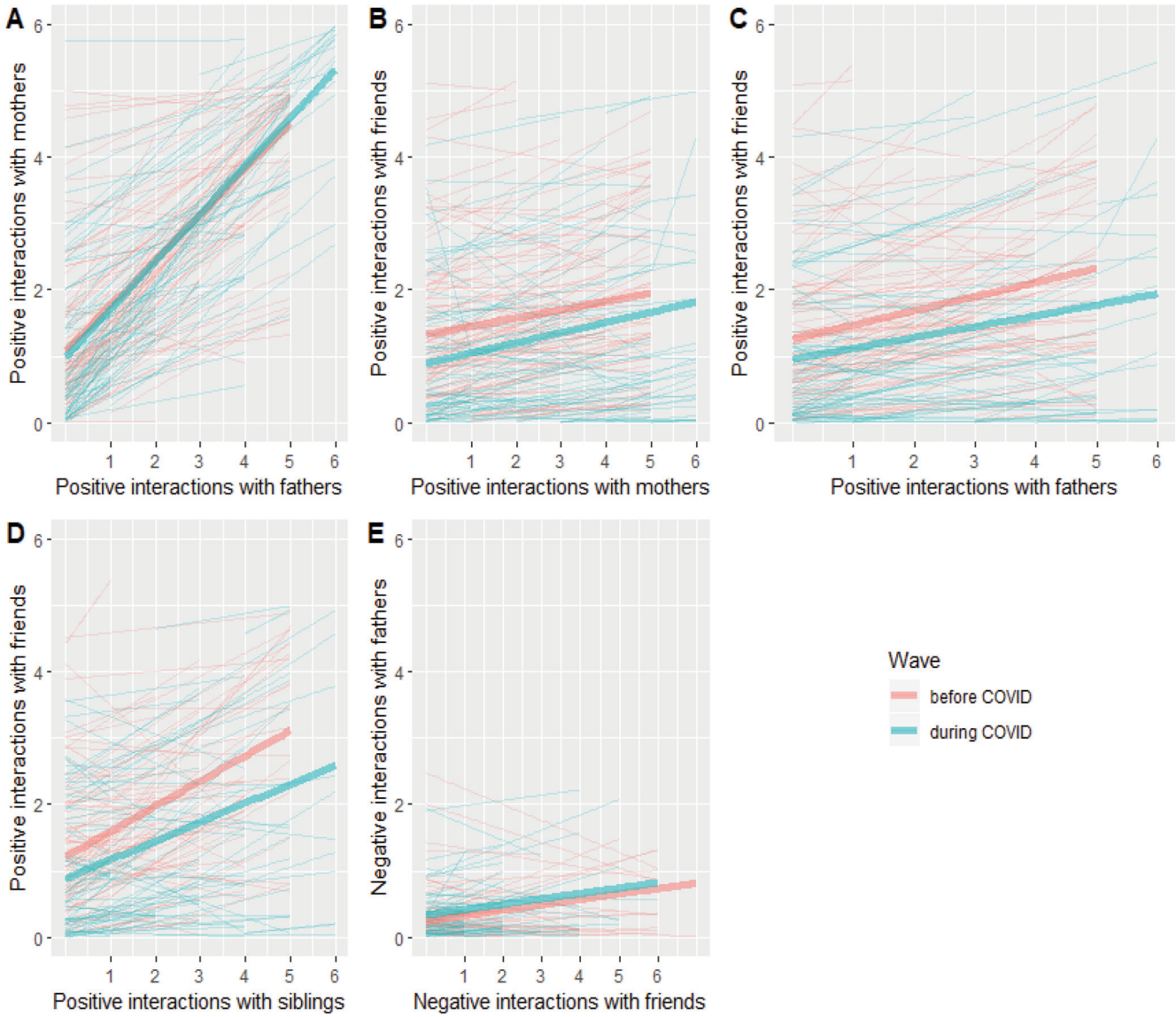
Changes in Depressive Symptoms During COVID-19

To examine our hypothesis that depressive symptoms would increase during COVID-19, and that this increase would be moderated by age and gender, we conducted a mixed model ANOVA with time (prior to vs. during COVID-19) as the within-participant variable, and participants' Gender and Age (*z*-transformed) as between-participants factors. As predicted, there was a main effect of Time: there was a significant increase

Table 3
Day-Level Negative Spillover Within and Outside the Family: Spillover Moderated by Data Wave Only

Predictor	Estimate (*SE*)	$t(df = 4{,}790)$	p	Moderation by wave $t(df = 4{,}790)$	Moderation by wave p
Outcome: Negative interactions father					
Intercept	0 (.01)	−0.118	.906	−0.316	.752
Previous day interactions: Father	0.02 (.03)	0.774	.439	2.469	.014
Same day interactions: Friends	−0.02 (.02)	−0.842	.400	2.395	.017
M interactions: Father	1.06 (.03)	38.944	<.001	−1.355	.175
M interactions: Father	−0.01 (.02)	−0.572	.568	0.127	.899

Figure 1
Day-Level Spillover Processes Before and During COVID-19



Note. See the online article for the color version of this figure.

in depressive symptoms from prior to during COVID-19, $F(1, 109) = 19.82$, $p < .001$, $\eta^2 = .15$; see Table 1). This increase was not moderated by age, $F(1, 109) = .31$, $p = .579$, or gender, $F(1, 109) = .51$, $p = .476$. The main effect of age was not significant, $F(1, 109) = 2.81$, $p = .097$. However, the main effect of gender was significant, $F(1, 109) = 14.62$, $p < .001$, $\eta^2 = .12$, indicating that, across data waves, girls had higher levels of depressive symptoms ($M = 4.38$, $SE = .38$) compared with boys ($M = 2.20$, $SE = .43$).

Do Social Interactions During COVID-19 Explain Increases in Depressive Symptoms?

To examine this, we conducted a hierarchical regression analysis predicting depressive symptoms during COVID-19. In the first step, depressive symptoms before COVID-19 were the predictor. In the second step of the regression, we added positive and negative interactions with friends and with family members. Due to the high associations between interactions within the family, we created a compound variable that summarized number of interactions across family members within individuals. In line with our hypotheses, positive and negative interactions with family members significantly predicted depressive symptoms during COVID-19 above and beyond depressive symptoms before COVID-19 (see Table 6). Number of interactions with friends did not significantly contribute to the model.[1]

[1] We repeated this analysis with participants age and the interactions between social contexts and age as predictors; however, interactions with age were not significant (*ps* ≥ .073) and therefore the regression is presented in its simpler form.

Table 4
Person-Level Associations of Positive Social Interactions Within and Outside the Family and Differences During COVID-19

Predictor	β	*SE*	*df*	*t*	95% CI
		Outcome: Positive interactions father			
Intercept	0.08	0.11	141	0.71	[−0.14, 0.31]
Positive interactions: Mother	0.69	0.04	109	15.98***	[0.60, 0.78]
Wave	−0.11	0.11	109	−1.02	[−0.33, 0.11]
Positive interactions: Mother × Wave	0.03	0.04	109	0.76	[−0.05, 0.12]
		Outcome: Positive interactions father			
Intercept	0.62	0.10	141	6.10***	[0.42, 0.83]
Positive interactions: Siblings	0.93	0.07	109	13.09***	[0.79, 1.07]
Wave	−0.21	0.12	109	−1.79	[−0.45, 0.02]
Positive interactions: Siblings × Wave	−0.04	0.08	109	−0.46	[−0.19, 0.12]
		Outcome: Positive interactions mother			
Intercept	1.20	0.13	141	9.36***	[0.95, 1.46]
Positive interactions: Siblings	0.86	0.09	109	9.75***	[0.69, 1.04]
Wave	−0.15	0.15	109	−1.05	[−0.44, 0.14]
Positive interactions: Siblings × Wave	−0.03	0.10	109	−0.37	[−0.22, 0.15]
		Outcome: Positive interactions friends			
Intercept	1.13	0.15	141	7.37***	[0.83, 1.44]
Positive interactions: Mother	0.15	0.06	109	2.40*	[0.03, 0.27]
Wave	−0.46	0.18	109	−2.57*	[−0.81, −0.11]
Positive interactions: Mother × Wave	0.03	0.07	109	0.44	[−0.11, 0.17]
		Outcome: Positive interactions friends			
Intercept	1.09	0.13	141	8.17***	[0.83, 1.35]
Positive interactions: Father	0.23	0.06	109	3.55***	[0.10, 0.36]
Wave	−0.37	0.15	109	−2.42*	[−0.68, −0.07]
Positive interactions: Father × Wave	−0.01	0.07	109	−0.18	[−0.16, 0.13]
		Outcome: Positive interactions friends			
Intercept	1.04	0.11	141	9.07***	[0.82, 1.27]
Positive interactions: Siblings	0.44	0.08	109	5.38***	[0.28, 0.60]
Wave	−0.43	0.13	109	−3.00**	[−0.72, −0.15]
Positive interactions: Siblings × Wave	−0.07	0.09	109	−0.73	[−0.25, 0.12]

Note. CI = confidence interval. Wave was coded as follows: 1 = during COVID-19, 0 = before COVID-19.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Discussion

The current study investigated how social dynamics of children and adolescents (youths) and their mental health changed during the emergence of COVID-19. Specifically, we explored changes in the frequency of these interactions as well as in the associations between them during COVID-19, and how these interactions subsequently related to increases in depressive symptoms. This is a unique investigation utilizing two waves of a daily diary design: one prior to COVID-19 and the other shortly after pandemic-induced school closures. The results largely support our hypotheses as they point to significant changes in social dynamics and depression during the pandemic and shed light on the association between the two.

One key finding was that the number of daily negative social interactions with friends decreased during COVID-19 for all participants. Interestingly, the decrease in positive interactions was observed only for younger participants (9 to 12 years old during COVID-19)—and was not evident at all for participants 13 years or older. Additionally, for older participants only, there was a significant increase in the number of positive interactions with siblings during COVID-19. Surprisingly, although the vast majority of our participants reported being at home with their parents during COVID-19, there was no change in the number of interactions with parents. Overall, it appears that younger participants were impacted from the sequela of COVID-19 via greater changes in social interactions. A possible explanation for this may be that older (vs. younger) adolescents have more advanced social skills (Białecka-Pikul et al., 2020; Dumontheil et al., 2010), which they are able to use to preserve friendships and improve their relationships with their siblings. Importantly, given data on typical development, we would have expected all our participants to show an increase in the number of interactions with friends, and decreases in interactions with parents (e.g., De Goede et al., 2009; Hadiwijaya et al., 2017; Lam et al., 2012; Larson et al., 1996; Larson & Richards, 1991). This suggests that the COVID-19 pandemic has significantly impacted the developmental trajectory of adolescents' interpersonal relationships.

Further, the current results show that it is not only the number of interactions that changed but also the magnitude of their reciprocal influence, evaluated by spillover processes and person-level associations. Prior to COVID-19, social interactions in one social context were significantly and positively associated with social interactions in other social contexts (e.g., positive interactions with mother were associated with positive interactions with father). These associations were found both at day-level and person level. As predicted, the strength of the associations changed during COVID-19. Specifically, on the day level, we detected significant decreases in positive

Table 5
Person-Level Associations of Negative Social Interactions Within and Outside the Family and Differences During COVID-19

Predictor	β	*SE*	*df*	*t*	95% CI
Outcome: Negative interactions father					
Intercept	0.06	0.03	141	2.09*	[0.003, 0.11]
Negative interactions: Mother	0.47	0.05	109	8.95***	[0.36, 0.57]
Wave	−0.07	0.04	109	−1.85	[−0.14, 0.005]
Negative interactions: Mother × Wave	0.37	0.08	109	4.95***	[0.22, 0.52]
Outcome: Negative interactions father					
Intercept	0.10	0.03	141	3.25**	[0.04, 0.16]
Negative interactions: Siblings	0.17	0.03	109	5.80***	[0.11, 0.23]
Wave	−0.03	0.04	109	−0.77	[−0.11, 0.05]
Negative interactions: Siblings × Wave	0.11	0.04	109	2.78**	[0.03, 0.19]
Outcome: Negative interactions mother					
Intercept	0.18	0.04	141	5.11***	[0.11, 0.25]
Negative interactions: Siblings	0.20	0.03	109	5.93***	[0.13, 0.27]
Wave	0.02	0.05	109	0.54	[−0.06, 0.11]
Negative interactions: Siblings × Wave	−0.06	0.04	109	−1.36	[−0.14, 0.03]
Outcome: Negative interactions friends					
Intercept	0.25	0.05	141	4.92***	[0.15, 0.34]
Negative interactions: Mother	0.56	0.09	109	5.94***	[0.37, 0.74]
Wave	−0.01	0.06	109	−0.20	[−0.14, 0.12]
Negative interactions: Mother × Wave	−0.52	0.14	109	−3.78***	[−0.79, −0.25]
Outcome: Negative interactions friends					
Intercept	0.24	0.05	141	5.10***	[0.15, 0.33]
Negative interactions: Father	0.88	0.13	109	6.97***	[0.63, 1.12]
Wave	−0.05	0.06	109	−0.87	[−0.17, 0.07]
Negative interactions: Father × Wave	−0.66	0.15	109	−4.38***	[−0.95, −0.36]
Outcome: Negative interactions friends					
Intercept	0.28	0.05	141	5.63***	[0.18, 0.38]
Negative interactions: Siblings	0.24	0.05	109	4.95***	[0.14, 0.33]
Wave	−0.10	0.06	109	−1.61	[−0.22, 0.02]
Negative interactions: Siblings × Wave	−0.14	0.06	109	−2.21*	[−0.26, −0.01]

Note. CI = confidence interval. Wave was coded as follows: 1 = during COVID-19, 0 = before COVID-19.
* $p < .05$. ** $p < .01$. *** $p < .001$.

spillover (i.e., within-day association) from family members to friends during COVID-19, and an intensification of fathers-to-mothers positive spillover. Contrary to predictions, friends-to-father negative spillover was stronger (vs. weaker) during COVID-19.

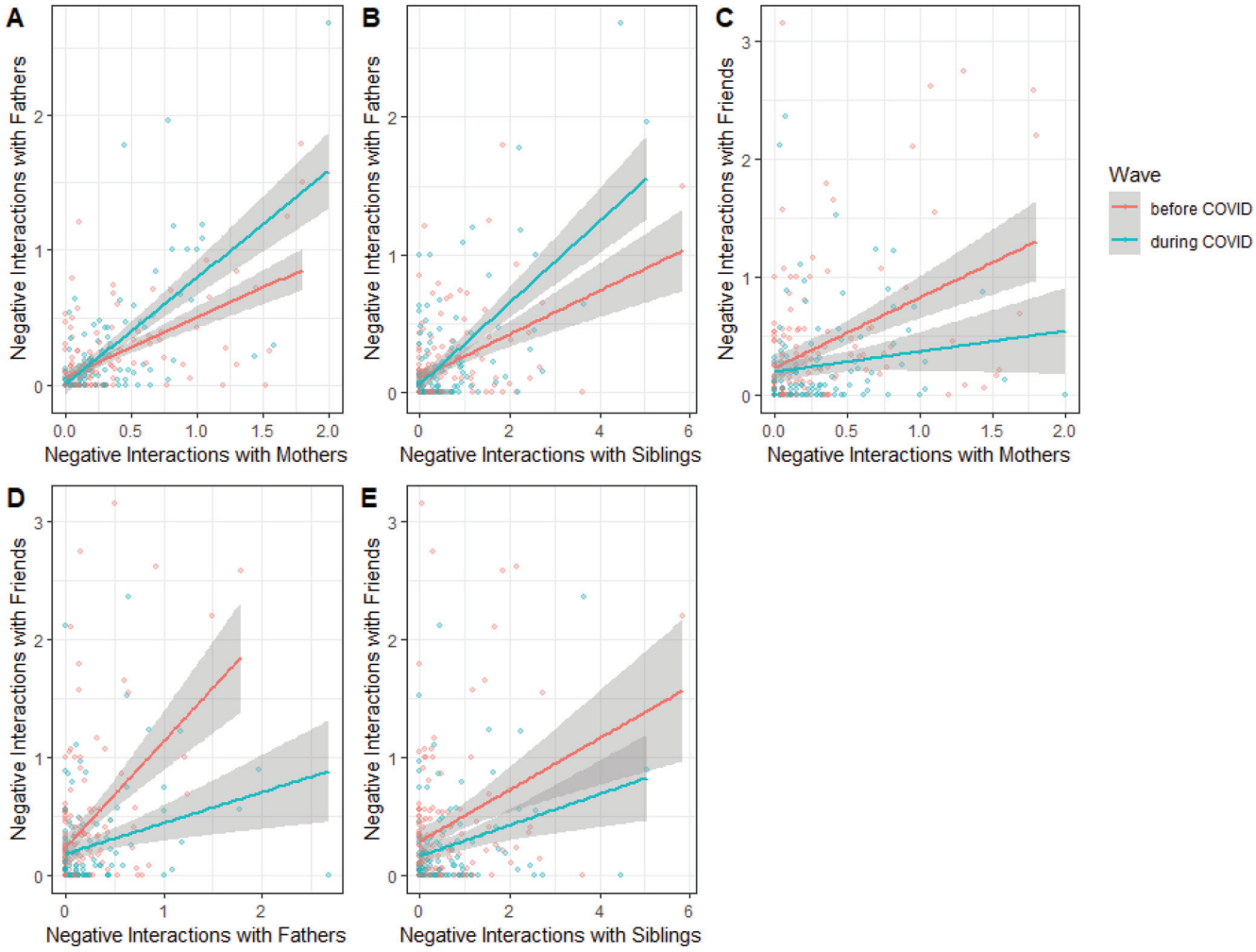
Person-level associations further supported our hypotheses: the association of mother-father and father-sibling negative interactions increased, whereas family–friends associations of negative interactions decreased during COVID-19. Because what was assessed here was the change in person-level correlation, these results reflect an intensification of individual differences—youths who had, for example, a high correlation between negative interactions with father and negative interactions with mother, had an even higher correlation now. Taken together, these results suggest that social dynamics during COVID-19 changed in ways that rendered the family more of a "closed system", decreasing spillover/associations outside it and increasing daily spillover and person-level associations within it. It should be noted that the pattern of decreases in the family-to-friend association is in line with normative developmental patterns (e.g., Lam et al., 2012; Larson et al., 1996), and therefore we cannot conclude that they are facilitated by COVID-19 (vs. peers). Nevertheless, the combination of reductions in day-level positive spillover with increases in within-person association of negative interactions suggests that COVID-19 has had a detrimental effect on social dynamics, but more so to youth who had more negative family relationships prior to the pandemic.

In addition to exploring changing social dynamics due to COVID-19, we also examined its mental health consequences. As predicted, youth experienced significant increases—almost 40% – in depressive symptoms over just under 1 year. Importantly, a higher frequency of negative interactions and a lower frequency of positive interactions with family members partially accounted for these increases. These findings are in line with prior longitudinal studies showing that adolescents experience increases in depressive symptoms during times of stress and uncertainty (Jenness et al., 2019); and specifically during COVID-19 (Chahal et al., 2021). Moreover, the findings are in line with prior work on the social context of depression (Schwartz et al., 2012); and on the impact of social deprivation (Orben et al., 2020). Importantly, these findings add to the accumulating literature showing the mental health impact of COVID-19 (Choi et al., 2020; Wang et al., 2020; World Health Organization, 2020).

It is important to note that—unlike most of the findings regarding changes in social interactions, which were opposite to the expected course of typical development, and therefore likely caused by COVID-19 – results regarding depression are more challenging to interpret. Studies have long established typical increases in depressive symptoms from middle childhood to adolescence (e.g., Salk et al., 2016); with steeper increases in girls (e.g., Marcotte et al., 2002; Salk et al., 2016). Although we found

Figure 2

Person-Level Associations of Negative Interactions Across Social Contexts Before and During COVID-19



Note. See the online article for the color version of this figure.

increases in depression symptoms from Wave 1 to Wave 2, this increase was not associated with the number of days between Wave 1 and Wave 2, or with age. Furthermore, we found that, although girls had higher levels of depressive symptoms in both data waves, gender did not moderate the increases in symptoms, as would be expected in typical development (e.g., Salk et al., 2016). This suggests that COVID-19 acted as a stressor for both boys and girls (vs. other stressors that emerge during adolescence, such as body image; Marcotte et al., 2002). Nevertheless, we cannot completely separate typical developmental changes in depression from the impact of COVID-19. Another important caveat is the issue of directionality. Although changes in social interactions were associated with changes in depressive symptoms, we believe that this association is likely significant in the opposite direction as well; in fact, prior literature has shown that the association between depression and social interactions is bidirectional (e.g., Hankin et al., 2010).

Collectively, our results suggest that, during the early stages of COVID-19, the family unit's importance increased, whereas peer-group influence decreased—a pattern that opposes the expected developmental trajectory (e.g., De Goede et al., 2009; Hadiwijaya et al., 2017; Lam et al., 2012; Larson et al., 1996; Larson & Richards, 1991). These findings have at least two possible explanations. The first and more obvious explanation is that, despite youths having grown up in an electronic age with ubiquitous online communication (Jensen et al., 2019), physical presence and encounters with peers still matters. Indeed, similar concerns have arisen for children hospitalized for extended periods and who are thus away from school for a long time (Wadley et al., 2014). Considering that almost all the youths in our sample no longer had in-person school or afterschool activities, this interpretation has important public policy implications, as it suggests that conducting school online poses unique challenges for adolescents, especially those whose home life is more disrupted. Further, increased youth reliance on the family unit, especially since COVID-19 is ongoing, may exert a high price on parents. The current study focused on the children's perspective; but social dynamics within family include the parents. Future research should examine parents' needs

Table 6
Predicting Change in Depressive Symptoms From Before to After COVID-19 From Positive and Negative Interactions With Family Members and Friends

Predictor	*B*	*SE*	*t*	*p*
Step 1				
Intercept	1.47	0.24	4.37	<.001
Depressive symptoms before COVID-19	0.87	0.08	10.94	<.001
		$F(1, 110) = 119.73$, $p < .001$, $R^2 = .52$		
Step 2				
Intercept	1.74	0.50	3.50	<.001
Depressive symptoms before COVID-19	0.76	0.08	9.25	<.001
Positive interactions with friends	0.05	0.22	0.24	.812
Negative interactions with friends	0.59	0.76	0.78	.438
Positive interactions with family members	−0.15	0.06	−2.34	.020
Negative interactions with family members	0.47	0.18	2.64	.010
		$F_{change}(4, 106) = 3.58$, $p = .009$, $R^2 = .06$		

and test ways of providing them with the support they may require.

Another possible explanation for the increased importance and influence of the family during COVID-19 is less specific. In times of more extreme stress and threat from the outside world, youths may regress back into the safety of their immediate family (Pfefferbaum et al., 2017). Indeed, research on youths exposed to natural disasters acknowledges that the parents' role in offering support and safety becomes amplified due to youths' greater need for this reassurance postdisaster (Costa et al., 2009). Although the family unit may indeed serve as a protective factor at such times (Banks & Weems, 2014), this phenomenon of safety-seeking within the family may thwart youths' developmental goals, especially as the pandemic persists. Thus, although physical health is —and should be—our utmost priority, it is important to try and find creative ways for youths to interact with their peers amid this crisis. For example, schools may encourage students to work on assignments in person, in pairs (or small "pods"), or via virtual one-on-one meetings, which may create more socialization opportunities. Families could try and ensure youths have the means and opportunities to communicate with peers privately, whenever possible.

Although these findings may appear grim, we are encouraged by two hopeful observations regarding within-family bonds. First, even during the pandemic, positive interactions were significantly more frequent compared to negative interactions. Moreover, more positive experiences with family members were associated with less steep increases in depressive symptoms during COVID-19. Second, the steep increase in positive (but not negative) interactions with siblings found for older adolescents during the pandemic also offers some hope. This is particularly interesting as when surveyed prepandemic, older adolescents had the smallest number of social interactions with their siblings. However, during the early stages of COVID-19, they had as many positive interactions with siblings as with peers; indeed, the only significant increase in positive interactions (almost 30%) was with siblings. Together with the absence of change in negative interactions with siblings, this finding suggests that the sibling relationship may serve, at least for older adolescents, as a natural compensation for the decrease in peer relationships. Consistently, previous studies have shown that siblings can have a beneficial influence on youth's mental health (McHale et al., 2012), this may even be intensified by COVID-19. Pre-COVID research showed that adolescents without siblings experience greater levels of solitude than adolescents with siblings, and that those without siblings also derive lower levels of satisfaction from both time with friends and solitude (Wikle et al., 2019). Given the social isolation induced by the pandemic, it is likely that the impact of being an only child may exacerbate the experience of loneliness in youths.

One of the main contributions of the current investigation is our focus on a wide assessment of youths' social networks. Although the developmental psychology literature widely recognizes the important role of the social context during adolescence (Flynn et al., 2017; Orben et al., 2020) and acknowledges the influence of parents (Brinberg et al., 2017), siblings (McHale et al., 2012), and peers (Schacter & Margolin, 2019); the majority of the literature examines the family separately from the peer group (Schacter & Margolin, 2019; though see Kaufman et al., 2020), rather than exploring these contexts together. The current study is one of the first to investigate the reciprocal associations between youths' interactions with family members and friends (Chung et al., 2011; Kaufman et al., 2020) and adds to past work in several ways. First, we investigated how an external stressor alters the strength of these associations. Second, whereas previous studies on spillover focused on a single positive (e.g., support; Schacter & Margolin, 2019) or negative (e.g., conflict; Ehrlich et al., 2012) interaction, we included a wide range of both positive and negative interactions. Thus, our study reveals that the spillover process is relevant to a wide range of behaviors.

Clinical Implications

The results of the present study have direct implications for clinical practice and public health. First and foremost, our data describe changes in the social dynamics of youths and suggest that their normative developmental trajectory may be thwarted. In typical development, adolescence is a time of transition from reliance on immediate family to seeking support from peer groups, thus establishing autonomy and self-identity (Savard et al., 2013). The opposite pattern of development appeared in our sample, whereby youths became more emotionally removed from peers and instead, more intimately involved in family relationships. This finding—in

conjunction with the increased rates of depressive symptoms in our sample—highlights the importance of creating a normative environment in which youth can interact with peers, preferably in person. More broadly, this topic has far-reaching implications even beyond COVID-19, as it can generalize to youths who may be isolated from their peers in other circumstances such as illness, war, or immigration, to name a few.

Limitations and Future Research

The present research has several limitations. First, COVID-19 is a "natural experiment." This means that we could not control intervening variables or examine dose-response effects. Therefore, although the analyses ruled out the alternative explanation that time between Waves explains the results, our ability to deduce causality is limited. Future studies manipulating spillover processes or examining other types of stressors are needed to better understand the nature of changes in spillover processes. Similarly, our assessment of day-level spillover is constrained to same-day processes, limiting our understanding of temporal precedence in these effects; future studies examining different time lags are needed. Second, although daily diaries are far better than single timepoint retrospective data, they nevertheless also rely on self-report (Stone et al., 2007). Thus, future research using, for example, reports from other informants (e.g., parents) are required to further validate the findings. Third, from a statistical perspective, we tested each hypothesis multiple times for several types of spillover. This is mitigated by the fact that findings followed consistent patterns (e.g., multiple types of spillover to friends were weaker during COVID-19), and largely remained significant when controlling for gender and time that passed between Waves. Still, future studies could focus on specific types of spillover and replicate our findings. Another limitation of our statistical analyses is the use of multilevel models, rather than more advanced statistical methods that may be better suited for our data. Like other data sets that combine multiple waves of intensive longitudinal designs, our data combined two different questions: How do youth change over a year (from before to during COVID)—specifically, how did the mean levels change (e.g., mean level of depressive symptoms)—and how daily variability around the mean in one variable explains daily variability around the mean in another variable? Growth models are best suited to examine the first question, whereas multilevel models are best suited to examine the second question (McNeish & Hamaker, 2020). Recently developed methods combine these models of change (e.g., dynamic structural equation modeling) and could be a better fit for similar data sets that combine panel designs with intensive longitudinal designs as we did here. Fourth, the current study captured youths' initial reactions to COVID-19 and school closures. It is quite possible that, as youths and their families start adapting to the "new normal," social dynamics will revert back to their normal developmental course and depressive symptoms will subside. However, the animal/preclinical literature suggests that social deprivation from peers during adolescence may have long-term effects on mental health and brain development (Orben et al., 2020). Conducting additional follow-ups is necessary to characterize the long-term sequelae of COVID-19 on youths' social–emotional development. Finally, since we aimed to explore the social context in all of its complexity (i.e., four different relational contexts, with positive and negative interactions in each), we conducted a high number of statistical tests. Although we believe that there are theoretical benefits to understanding the complexity of the social context, we recognize that conducting multiple analyses decreased the power of the study. Future studies using larger samples are needed to replicate these findings.

Summary

The present study is an innovative investigation of social dynamics and mental health symptoms in children and adolescents, and how they changed during the COVID-19 pandemic and its associated quarantine. To examine these factors, we used a unique design in which youths filled out daily diaries twice: approximately a year prior to the onset of COVID-19 as well as during the early stages of the pandemic. Our results suggest that quarantine and the restriction of in-person interactions to the immediate family thwarted normative youths' social-emotional development. Rather than gaining more independence from their family and affiliating more with friends—as is foundational in typical developmental trajectories—youths became more dependent on their family members. The present investigation demonstrated the relevance of social interactions to mental health by showing that social interactions contributed to increases in depressive symptoms observed in youth during COVID-19.

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Received September 30, 2020
Revision received March 29, 2021
Accepted April 20, 2021 ■