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Changes in daily-life social processes and psychopathology symptoms in Flemish youth from before to during the COVID-19 pandemic

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Abstract:

Early findings on the impact of the COVID-19 pandemic on adolescents, suggest that – despite being at the lowest physical health risk – both their mental health and day-to-day social lives are strongly affected. In this longitudinal study, we assessed changes in adolescent psychopathology symptoms, the quality and quantity of daily-life social interactions, and the relationship between social interactions and psychopathology symptoms before and during the pandemic.

A sample of *n*=173 Flemish adolescents (mean age=16.0 at latest measurement; 89% girls) from the SIGMA cohort was tested between January 2018 - June 2019; and between April 27th - May 10th 2020. Subclinical psychopathology was assessed using the Brief Symptom Inventory-53; daily social interactions were assessed in six-day experience sampling periods with ten daily questionnaires.

Multilevel linear and logistic regression analyses indicated lower general psychopathology and anxiety symptoms, beyond age effects; fewer face-to-face social interactions, more online social interactions; and higher-quality face-to-face interactions during the pandemic than before. Negative associations between psychopathology and the quality of face-to-face peer and family interactions were stronger during the pandemic than pre-pandemic.

The observed decrease and stability in psychopathology symptoms is surprising and potentially reflects resilience. Although digital communication may buffer much of the quarantine-induced distress, the current results imply that high-quality face-to-face interactions with family and peers may have been more powerful in keeping adolescents resilient. As restrictions are lifted and adolescents' daily lives and social worlds change, it is crucial to learn more about the longer-term effects of the experienced social deprivation.

The COVID-19 pandemic has brought an unprecedented set of global restrictions, with more than half of the world's population estimated to be in some form of lockdown during March 2020 (New York Times, 2021). These lockdown measures ignited an intense discussion about the potential short- and long-term impact of such restrictions on mental health (Brooks et al., 2020; Gunnell et al., 2020; Holmes et al., 2020). Understandably, research on mental health during COVID-19 has rapidly accelerated, with articles and preprints appearing at an increasing rate. However, the research that has emerged is predominantly cross-sectional and as such, cannot inform us about the actual impact that the pandemic has had on mental health.

Some of the most useful work for understanding the impact of COVID-19 on mental health is longitudinal research, including pre- and mid-pandemic assessment periods, because such studies enable us to assess potential changes in mental health as a function of COVID-19 and its associated restrictions. Emerging findings from longitudinal studies diverge. Some studies in older adolescents and adults describe increases in psychopathology levels more generally (Copeland et al., 2021; Pierce et al., 2020) or, more specifically, in anxiety symptoms (Kwong et al., 2020), while others find no effect of the pandemic on internalizing symptoms (Shanahan et al., 2020). An ongoing 'living' systematic review indicates no overall effect of the COVID-19 pandemic on depression and anxiety symptoms (Sun et al., 2021). For adolescent samples specifically, there is also no consensus: One unpublished study combining data from twelve adolescent samples suggests an increase in depression symptoms, but stability in anxiety symptoms (Barendse et al., 2021). Another study reported increases in anxiety and depression symptoms (Magson et al., 2021), while yet another study found no change in depressive symptoms but a decrease in anxiety (Widnall et al., 2020). In sum: The evidence regarding whether mental health actually deteriorated during the COVID-19 pandemic is mixed.

Across previous longitudinal studies, one group is underrepresented, even though they are likely at increased risk: Young people (Sun et al., 2021). Most of the available evidence in largely adult samples suggest that the youngest participants (older adolescents and young adults, up to age 29) experience the greatest increases in depression and anxiety symptoms, and the greatest deterioration in their well-being, relative to older age groups (Fancourt et al., 2021; Green et al., 2021; Kwong et al., 2020; O'Connor et al., 2020; Pierce et al., 2020; Raw et al., 2021). The increased mental health risk for young people is in spite of the reduced physical health risks of COVID-19, and primarily correlates with pandemic-related restrictions and accompanying economic and psychosocial disruption, rather than physical health concerns for self or others (Magson et al., 2021; Shanahan et al., 2020).

Even without the backdrop of the COVID-19 pandemic, adolescence is a significant period of vulnerability for the development of psychopathology, and almost half of all mental illnesses begin before the age of 14 (Solmi et al., 2021; WHO, 2019). Determining the key risk and protective factors for youth mental health during the pandemic is critical to understanding which adolescents may need additional support - and what type of support could be most helpful. Current evidence suggests the relevance of pre-existing stressors, such as having been bullied, but also COVID-19-related stressors such as being under stricter lockdown rules (Barendse et al., 2021; Magson et al., 2021; Shanahan et al., 2020; Veer et al., 2021), for mental health outcomes during the pandemic. Additionally, social support, having a sense of connection to important others, and resilience to stressors appear crucial for maintaining good mental health during COVID-19 (Barendse et al., 2021; Magson et al., 2021; Veer et al., 2021).

Adolescence is a key period of social development (Blakemore & Mills, 2014), and as social interactions with peers have been greatly stifled by COVID-19-related restrictions, the key mechanism through which the COVID-19 pandemic may affect youth mental health, is likely social in nature (Orben et al., 2020). This is exemplified by previous research on the

effects of social isolation, which highlights how adolescents are more likely to develop anxious and depressive symptoms during and after enforced isolation (Loades et al., 2020). Conversely, receiving support from others during the pandemic has been associated with fewer depressive symptoms (Alvis et al., 2020). As high-quality social engagement with both peers and family members is fundamental for adaptive adolescent development (Antonucci et al., 2019; Grusec & Davidov, 2021; Smetana et al., 2006), focusing on social interaction is central to understanding the potential impact of the pandemic on youth mental health. In addition, to uncover more about the mechanisms that may mediate the impact of COVID-19, we also need to learn more about the *changing* relationship between social interactions and psychopathology. Previously, we have demonstrated how the quality and quantity of social interactions are associated with adolescent psychopathology (in a study on the same sample pre-pandemic; Achterhof et al., 2021). However, given the social deprivation that characterizes the COVID-19 regulations, the question remains to what extent these associations hold during a period of lockdown, and if so, which aspects of social interaction have become more vs. less relevant for predicting psychopathology.

Although much discussion on COVID-19 and mental health has centred around how the pandemic affected adolescents' day-to-day social lives, we know of no studies with data collected before and during the pandemic that have targeted social interactions where they naturally occur: in the context of everyday life. The experience sampling method (ESM; Csikszentmihalyi et al., 1977; Myin-Germeys et al., 2018) is a dynamic approach that prompts participants at random times to provide information on their thoughts, behaviors, feelings, and environments while they go about their daily lives. As such, the ESM is uniquely suited to gain highly ecologically valid insights into adolescents' day-to-day social lives. During the pandemic, researchers have used ESM to reveal decreases in loneliness throughout the initial stages of the pandemic (Fried et al., 2020; Stieger et al., 2021). However, to gain insight into

the impact of the pandemic on social interactions, we must also test changes in day-to-day social interactions from before to during the pandemic - as doing so allows us to make inferences about the actual effects of the pandemic on social behaviors.

Furthermore, in the assessment of changes in day-to-day social interactions, a focus on face-to-face interactions is insufficient. As lockdown measures dramatically reduced the possibility for face-to-face social contact, schools were closed, and socializing with friends in-person was no longer possible, digital communication platforms may in fact provide an important alternative for young people's social behavior (Orben et al., 2020). However, it is largely unknown to what extent the COVID-19 pandemic has boosted digital communication, and to what extent online social interactions have formed worthwhile alternatives to face-to-face contact. Although some initial findings in adults suggest a small negative association between screen time and momentary well-being during the COVID-19 pandemic (Stieger et al., 2021), it has been argued that the concept of screen time is too vague, and it may be more worthwhile to move beyond assessing screen-time effects, to focus more on what digital communication tools are used for - for example, for socializing (Orben, 2020; Orben & Przybylski, 2019).

In the current study, we investigate changes in psychopathology symptoms before and during the early phase of the pandemic, the effects of risk (trauma, COVID-19-related stressors, bullying experiences) and protective (social support, interpersonal skills, resilience, posttraumatic growth) factors on psychopathology symptoms, changes in the quality and quantity of social interactions, the relationships between aspects of daily-life social interactions and psychopathology symptoms, and changes in those relationships pre- to early-pandemic. To achieve this, we draw on longitudinal and experience sampling data from the ongoing adolescent cohort study, SIGMA (Kirtley et al., 2021). The combination of registered analyses (available at https://bit.ly/3pSoQlg), the use of both pre- and early-pandemic data, and dynamic

assessments of social interactions using experience sampling methods (ESM) uniquely situates this study to provide essential, ecologically valid, and reliable knowledge on social processes and mental health during the COVID-19 pandemic.

We will focus on the following set of registered research questions:

- When accounting for age effects, is there an increase in psychopathology from pre- to early-pandemic?
- Are there associations between early-pandemic COVID-19-related stressors, social support, posttraumatic growth, resilience and early-pandemic psychopathology symptoms? *(i.e., which potential risk and protective factors have cross-sectional associations with psychopathology?)*
- Are there associations between pre-pandemic social and environmental risk and protective factors (trauma, bullying, social support and interpersonal skills) and early-pandemic psychopathology symptoms during COVID-19, when accounting for pre-pandemic levels of psychopathology? *(i.e., which pre-COVID-19 risk and protective factors are predictors of increases in psychopathology during the pandemic?)*
- Have the quantity and quality of offline/online social interactions - as measured in daily life - with peers/family members significantly changed from pre- to early-pandemic (when taking into account age effects)?
- What is the association between the quality and quantity of social interaction and psychopathology symptoms early-pandemic when taking into account baseline psychopathology symptoms?
- Are the cross-sectional associations early-pandemic described in research question 5 significantly different from the cross-sectional associations between the same variables pre-pandemic?

Method

Setting

The sample in the current study was initially recruited from the Flanders (Dutch-speaking) region of Belgium, for participation in the longitudinal adolescent mental health study 'SIGMA' (Kirtley et al., 2021). Wave 1 of the SIGMA study (hereafter: T0) was completed between January 2018 and June 2019. Wave 2 of the study had just commenced, in January 2020, when the global COVID-19 pandemic spread and the Belgium government implemented restrictive measures on March 18th 2020. Data collection for Wave 2 was consequently postponed. However, given the need for knowledge on adolescent mental health and social processes during the pandemic, we set up an additional wave of the study in April 2020. Participants in this additional wave of SIGMA were reassessed from home, in the week of May 4th - May 10th 2020 (hereafter: T1).

On May 8th, 52,011 Belgian COVID-19 infections, 16,061 hospitalizations, and 8,521 deaths had been reported (Sciensano, 2020). The largest peak in Belgian COVID-19 infections, hospitalizations and deaths during the early phase of the pandemic was in the week of April 6th. In early May (T1), this initial, intense peak began to subside. The regulations implemented by the Belgian federal government on March 18th included a stay-at-home order (excluding essential activities such as buying food, medical visits), closing of schools and non-essential shops, and restrictions on meeting with people from outside one's household (Belgian Federal Government, 2020). The week of May 4th was the first week since the initial regulations were implemented where some restrictions were lifted/relaxed: fabric stores reopened, to facilitate the production of face masks, hospitals increased access for non-COVID-19-related health problems, and open-air sports activities with members of different households were permitted (maximum two people, with 1.5 meters physical distance). Some days preceding the week of May 4th, on April 24th, the government announced a series of further planned relaxations of

lockdown rules, including reopening of all shops on May 11th, schools on May 18th (in Flanders, for all grades of primary education, but only for the first, second, and last year of secondary education), and evaluation of permission for gatherings with more than two people from May 18th onwards.

Samples

T0 Sample.

The initial, T0 sample was recruited as representative for Flemish adolescents in terms of sex, education level, and geographical spread (Kirtley et al., 2021). To recruit participants, all regular secondary education schools from the Flanders region were contacted and asked to participate, of which 22 subsequently agreed. Participants were recruited from the first (~12 years old), third (~14 years old), and fifth (~16 years old) grades, consistent with the planned accelerated longitudinal design of the SIGMA study, where different cohorts are recruited simultaneously (Galbraith et al., 2017). Inclusion criteria for the study involved the ability to read and understand Dutch, and availability to complete the full study at T0. Informed consent was obtained from both students and parents, and the final T0 sample consisted of n = 1913 participants.

T1 Sample.

At T1, all participants for whom contact details were available were contacted through their supplied e-mail address at T0; if no e-mail address was available but a phone number was available, they were sent a text message. Participants were asked to participate in a special follow-up of the SIGMA study, outside of Wave 2 follow-up, in order to assess the impact of the COVID-19 pandemic on their well-being. A final sample of 173 adolescents participated at T1 (see Appendix 1 for T1 recruitment flowchart).

Descriptive statistics of the included n = 173 sample at both T0 and T1 are presented in Tables 1 and 2.

Procedure

Data collection at both waves involved two main methodologies: retrospective questionnaires on general risk/protective factors and psychopathology, administered once (per wave), and experience sampling method (ESM) questionnaires on daily-life thoughts, emotions, behavior and context, administered multiple times during participants' day-to-day life.

T0 Procedure.

At T0, participants from each school were initially tested in groups of maximum 24 students, and were then asked to complete all retrospective questionnaires in a 100-minute session, in their classroom, under supervision of the research team. Questionnaires were presented using REDCap (Harris et al., 2009), on a tablet provided by the research team. At the end of this initial test session, participants were instructed about the second, ESM part of the study, in smaller groups of four to eight students, by a member of the research team. Participants were lent a mobile phone (Motorola Moto E4), with the ESM software (MobileQ; Meers et al., 2020) pre-installed, and a physical activity tracking device (Fitbit Charge 2). Researchers briefed participants on how to complete the ESM questionnaire, including by guiding participants through completion of a demo questionnaire.

The signal-contingent ESM period lasted for six days, starting on the day following the initial questionnaires, with ten ESM prompts per day. ESM prompts were presented at semi-random times, each distributed randomly within one of ten daily 90-minute blocks between 7.30 AM and 10.30 PM, with a minimum of 15 minutes between consecutive prompts. Participants were notified with either a vibration, a sound, or with both vibration and sound (they could not turn off these notifications without turning off the phone entirely); following this notification, they had 90 seconds to open the daily questionnaire, and again 90 seconds to complete each item before the questionnaire would time out. Because participants would also fill out ESM questionnaires in the classroom, all T0 prompts were scheduled at the same random

times for those participants that were in the same class to minimize class disturbance. At the end of the ESM period, participants were asked to return all study material at the end of those six days.

T1 Procedure.

At T1, due to the corona-related restrictions, all data collection took place remotely. After participants agreed to follow-up, they were first sent all retrospective questionnaires via email, using the same REDCap software as was used in T0. Subsequently, participants were asked to download the SEMA3 mobile application (Koval et al., 2019) onto their own phones, allowing for the ESM assessments. The distribution of daily ESM prompts was as similar as possible to the T0 ESM period, with the same signal-contingent, semi-random prompt schedule consisting of ten daily prompts distributed across six days - although, for T1, all participants received the ESM prompts at the same random times to minimize disruption in class. Other differences from T0 were that at T1, starting from the notification time, participants had 10 minutes to both open and complete the questionnaire. Also, by virtue of having the ESM software on participants' own phones, they were able to turn off notifications for the SEMA3 application. Finally, participants were also asked to complete an additional, shorter morning and evening questionnaire right after they woke up and before they went to bed. Thirty-nine participants did not participate in the ESM period at T1 (of whom 17 indicated having a Huawei phone, which was incompatible with the SEMA3 application, and who would have been unable to do the ESM part of the study), resulting in a sample of n = 122 participants for the T1 daily-life measures (see Appendix Figure 1).

Measures

In both waves, questionnaires were used to assess risk/protective factors for psychopathology, and psychopathology symptoms.

Retrospective Questionnaires - Risk and Protective Factors

Interpersonal Skills (T0). An interpersonal skills score was calculated with the mean score on all 18 items of the 'Interpersonal Skills' subscale of the Vragenlijst Psychosociale Vaardigheden (VPV; Scholte & Van der Ploeg, 2013). This subscale consists of the two subscales Relational Skills (e.g., 'I can get along well with different types of people'), and Affective Skills (e.g., 'I recognize in others how they feel or what they think'). The VPV also has two subscales on Self Guidance (e.g., 'I always do my best in school or at work'); and Self Awareness (e.g., 'I think before I act'). These subscales constitute one 'Intrapersonal Skills' subscale, but will not be used for the current study, as we were mainly interested in inter- rather than intra-personal skills. All items are rated '1. Completely disagree' to '5. Completely agree'. The McDonald's Omega (total) coefficient ω was computed as a reliability indicator (Revelle & Condon, 2018), and ω = .85 for the Interpersonal Skills subscale.

Bullying (T0). Bullying prevalence was based on 1 Likert-scale question, asking whether participants have ever been bullied (T0; Wave I). Answer options include (Never; Almost never; Sometimes; Regularly; Often)

Trauma (T0). A total trauma score was calculated through a sum score on all 34 items of the Juvenile Victimisation Questionnaire (Hamby et al., 2004). Items were phrased as 'Has [trauma] ever happened to you?', to which participants could respond yes/no, where yes is scored as 1, and no as 0. Reliability of the total scale was good (ω = .85).

Social Support (T0). A total social support score was calculated by taking the mean score on all 12 items of the Social Support List-Interactions (SSL-I-12; Van Sonderen, 2012). The list consists of three subscales: Daily support (e.g., 'How often does it happen that people show interest in you?'); Support with problems (e.g., 'How often does it happen that people give you good advice?'); and Appreciation (e.g., How often does it happen that people compliment you?'). All items are scored from '1. Rarely or never' to '4. Very often'. Per the

instruction manual, a maximum of four items can be missing to calculate the total score. Reliability of the total score was good (ω = .88).

Social Support (T1). At T1, a different social support measure was used: the Multidimensional Scale of Perceived Social Support (MSPSS; Zimet et al., 1988). The MSPSS consists of 12 items from three subscales: 'Significant others' (e.g., 'There is a special person that helps me when I am in need'); 'Family' (e.g., 'My family gives me the emotional support that I need'); and 'Friends' (e.g., 'I can talk to my friends about my problems'). All items are scored from '1. Completely disagree' to '5. Completely agree'. An average social support score is calculated by taking the mean across all 12 items (ω = .94).

COVID-19-Related Stressors (T1). A questionnaire on COVID-19-related stressors was adapted from the DynaCORE survey on resilience in the corona crisis of the DynaMORE project (https://dynamore-project.eu/; Veer et al., 2021). This questionnaire assesses 22 potential problems that may have arisen in the past two weeks, due to the consequences of the COVID-19 pandemic, such as having potential COVID-19 symptoms, being unable to see people, or family tension. The original questionnaire from the DynaCORE also contains eight additional items that we omitted, as they were not applicable for an adolescent sample (e.g., 'Problems arranging childcare', 'Business travel not possible'). All items were first scored as 0 ('This situation has not happened') or 1 ('This situation has happened'). If participants scored a '1' on any event, they were asked to rate the severity of this event with the item 'How much has this situation troubled you?', rated from 1 ('No trouble at all') to 5 ('Troubled me greatly'). A stressor count score was created by adding up all of the endorsed items (ω = .53). The resulting score between 0 and 22 reflects the number of COVID-19-related stressors for each participant. The full COVID-19 related stressor questionnaire is included in Appendix 7.

Posttraumatic Growth (T1). Posttraumatic growth was assessed with the 10-item Posttraumatic Growth Inventory - Short Form (Cann et al., 2010). Participants were asked to what extent changes have taken place in their lives as a consequence of the COVID-19 pandemic and its associated measures. This scale consists of 5 subscales, with 2 items per subscale: Relating to Others (e.g., 'I have a greater sense of closeness with others'), New Possibilities (e.g., 'I am able to do better things with my life'), Personal Strength (e.g., 'I know better that I can handle difficulties'), Spiritual Change (e.g., 'I have a stronger religious faith'), and Appreciation of Life (e.g., 'I have a greater appreciation for the value of my own life'). All items are scored from '1. Not experienced' to '6. Yes, strongly experienced'. We will use a total score only, defined as the average score across all 10 items (ω = .88).

Resilience (T1). Resilience was assessed with the 16-item Child & Youth Resilience Measure Revised (unvalidated Dutch translation of the questionnaire developed by Jefferies and colleagues (2019), which consists of the two subscales 'intra/interpersonal' (e.g., 'I feel supported by my friends') and 'caregiver' (e.g., 'My caregiver(s) stand by me during difficult times') resilience. Items are all scored from '1. Not at all' to '5. Very much'. One total score is created for each person by averaging the scores to each item (ω = .93).

Retrospective Questionnaire - Mental Health Outcome

Psychopathology Symptoms (T0 and T1). At both waves, the Dutch-language version of the Brief Symptom Inventory-53 (Derogatis, 1993) was used to assess different dimensions of psychopathology. The BSI-53 includes nine dimensions, but as registered, we only looked at the major dimensions of depression, anxiety, and psychoticism more specifically. The selection of these psychopathology dimensions is consistent with the symptomatology that has received most attention in the emerging COVID-19 and mental health literature. BSI items are rated on a scale from 0 ('Not at all') to 4 ('Very much'). For T0 (Wave I), the phrasing of items

follows the original item definitions, asking 'Including today, how much did the following problem trouble you in the last week?' For T1, the time reference was changed so that every symptom referred to asking which problems have troubled participants 'since the first corona measures (March 13)'. A total symptom score (General Severity Index; GSI) was constructed by averaging scores on all SCL-90 items, whereby a maximum amount of three items can be missing; this score was used to represent total psychopathology. Reliability for all subscales and total scores were good (T0 depression, ω = .93; T0 anxiety, ω = .88; T0 psychoticism, ω = .79; T0 GSI = .97; T1 depression, ω = .93; T1 anxiety, ω = .91; T1 psychoticism, ω = .78; T1 GSI = .97).

Experience Sampling - Social Variables

At both T0 and T1, participants were prompted in their daily lives to rate their mood and experience, and to indicate their context and behavior - all pertaining to the moment right before they were prompted. The full ESM questionnaires presented to participants at T0 and T1 are provided in Appendices 2 and 3. For the current study, we only use the face-to-face and online social items that were in the ESM questionnaire.

Face-to-Face Company and Interactions. The first social item asked about current face-to-face company ('Who am I with?'), with answer options 'Father', 'Mother', 'Other (nuclear) family', 'Other (non-nuclear) family', 'Friend(s)', 'Other peers', 'Teacher', 'Other (known) people', 'Unknown people', and 'No one'. At T1, an answer option 'Boyfriend/Girlfriend' was added to this item. These items were used to construct the variable 'Being in company'. When a participant indicated to be in the company of anyone else, they were presented with several additional questions which they were all asked to rate on a Likert-scale ranging from '1. Not at all' to '7. Very much'. These items were a face-to-face social interaction item ('We are doing something together' at T0; 'I'm doing something together with the people that I am with' at T1) and three face-to-face company quality items ('I feel at ease

in this company'; 'I feel appreciated by this company'; 'I feel like I belong'; all phrased the same at T0 and T1). If participants answered a 2 or higher on the face-to-face social interaction item, this was classified as a face-to-face social interaction.

These items were then used to construct the dichotomous variables 'face-to-face social interaction' (i.e., is someone socially interacting at any given moment?), 'face-to-face peer interaction', and 'face-to-face family interaction'; and the continuous variables of 'face-to-face interaction quality', 'face-to-face peer interaction quality', 'face-to-face family interaction quality' (all by taking the mean on the three interaction quality items, per context). See Appendix 4 for exactly how these variables were constructed.

Online Interactions. At each T0 and T1 ESM prompt, participants were also asked to rate 'I am virtually in contact with others' with 'Yes' or 'No'. If participants were in online contact with others, they were also asked about their online interaction partners (with the same answer options as for offline companies), and about the following online interaction quality items that were rated on a Likert-scale ranging from '1. Not at all' to '7. Very much': 'I feel at ease with the people that I am in online contact with'; 'I feel appreciated by the people that I am in online contact with'; 'I feel like I belong with the people that I am in online contact with'. These items were used to create the following momentary online interaction items (similarly as for the face-to-face interaction): 'online social interaction', 'online peer interaction', and 'online family interaction', 'online interaction quality', 'online peer interaction quality', 'online family interaction quality'.

Power Analysis

Given the absence of comparable literature from which to draw parameters for a power analyses and because our analytic options were dependent upon the number of participants, we conducted sensitivity power analyses (Lakens, 2021) following data collection but before data access, for two hypothesis tests: For H1, testing the changes in T0 to T1 psychopathology; and

for H4a, testing the changes in the quantity of social interactions from T0 to T1. We first calculated the minimum effect sizes that could be detected for n = 171, power = .80, and *a* = .05. For H1, we found that we were able to reliably detect an effect size of d = .19. We also conducted an alternative simulation-based power analysis, which demonstrated that we would be able to detect increases of 35%-36% in psychopathology levels (with .80 power). For H4, we also conducted a simulation-based power analysis, which demonstrated that we had .85 power to detect a relatively small decrease of 3% in the quantity of social interactions (for the n = 122 that had ESM data). All R code pertaining to the estimation of parameter estimates and the power analysis itself have been made available on the OSF-page for this project (https://bit.ly/3x2znyh).

Statistical Analysis

Missing Data Imputation

As much questionnaire data was missing (notably, due to the time constraint when filling out the retrospective questionnaires) we considered a missing data imputation method to be appropriate (van Ginkel et al., 2020). For the missing data on all non-ESM questionnaires (i.e., social support, trauma, bullying, interpersonal skills, COVID-19-related stressors, resilience posttraumatic growth, psychopathology), we impute data in 20 datasets at the item-level, based on the information of all other included variables, using a multiple imputation model by chained equations (MICE), carried out with the latest available version of the 'mice'-package (v. 3.12.0; van Buuren & Groothuis-Oudshoorn, 2011) in R. Across these 20 imputed datasets, analyses are subsequently performed and the pooled estimates are reported (following Rubin's rules; (Rubin, 1987).

Changes in Psychopathology

To assess significant changes in psychopathology from T0 to T1, we will estimate three linear mixed-effects models, where change in the mean level of psychopathology (total,

depression, anxiety, or psychosis) is assessed from T0 to T1, including T1 age and gender as covariates. By including age as a covariate, we are able to assess whether psychopathology has increased beyond what could be expected based on age alone (as older adolescents generally report more psychopathology than younger adolescents). When testing these hypotheses (and all hypotheses below), Holm's multiple comparison correction will be applied, for four tests (for each type of psychopathology) with an initial $\alpha = .05$.

Associations Between Risk/Protective Factors and Psychopathology

For the research questions on the association between T1 psychopathology and T0 and T1 risk and predictive factors, we first estimated a linear regression model where T1 COVID-19-related stressors, resilience, posttraumatic growth, and social support simultaneously predicted T1 psychopathology, and where T1 age and gender were included as covariates; second, we similarly estimated a linear regression model where T0 trauma, bullying, interpersonal skills, and social support simultaneously predicted T1 psychopathology - and where T0 psychopathology, and T1 age and gender were included as covariates. All these variables are time-invariant, and all continuous predicted variables were centered prior to the analyses.

Analyses on Daily-Life Social Quantities and Qualities

For the ESM-based analyses, the first aim was to assess whether changes have happened in the quantity and quality of social interactions from T0 to T1. Because these data have a multilevel structure, we employed multilevel (mixed effects) models, with moments nested within persons. In order to test whether participants generally spent more or less time in the company of others online or offline at T1 compared to T0, each of six moment-level dichotomous social company/interaction variables was predicted by a factor variable representing T0 and T1 in separate logistic multilevel regressions where age and sex were included as covariates. To test whether participants' quality appraisals of offline and online

interactions have changed from T0 to T1, each of six momentary mean social quality scores was predicted by a factor variable representing T0 and T1 in separate multilevel linear regressions where age and sex were included as covariates. Then, to test the association between psychopathology and each social outcome, the person-level psychopathology variable was added to each of the 12 models just described. Finally, in order to assess whether the relationship between psychopathology and social interaction variables has changed from T0 to T1, the interaction between psychopathology and a factor variable representing T0 and T1 was again added to the same 12 models. In all multilevel models, continuous predictor variables (age, psychopathology) were person-mean centered. Also, errors were assumed to be Gaussian distributed and serially correlated with an autoregressive AR(1)-component.

Open Science Practices

All described analyses were registered before full data access (also referred to as 'post-registration'; Benning et al., 2019). At the time of registration, the authors had had access to all T0 variables - but not the main T1 variables of interest (only to the covariates of age and sex). The registration details both the power analysis and all performed analyses (https://bit.ly/3fUqzEZ). All R code used to perform the analyses is uploaded to the OSF-page of this project (https://bit.ly/3zAGnom). Both the included retrospective questionnaires and the full list of ESM items can be found in Appendices 2, 3, and 7. All ESM items from Wave 1 of the SIGMA project can also be found in the ESM Item Repository (www.esmitemrepository.com; Kirtley et al., 2021).

Deviations From Registration

We deviated from our registered analyses in the following respects: Originally, we had planned to use a COVID stressor severity score in which items (i.e. stressors) were weighted by their severity. However, in the DynaCORE study from which this measure originated, the stressor count variable was preferred, as this count variable was more reflective of the objective

situation, and had a stronger relationship with psychopathology (Veer et al., 2020). In line with this study, we therefore also decided to use the COVID stressor count score. Additionally, in our registration we described that we would use linear growth curve analyses. However, we later realized that such models require at least three time points (Curran et al., 2010), where we have two time points. Therefore, we estimated linear mixed-effects models with 'study/wave' included as a separate independent variable.

Results

Summary information of all included variables is described in Tables 1 and 2. Of note is that compliance with the ESM protocol was generally quite low, particularly during the COVID-19 pandemic. Correlations between all included risk/protective and psychopathology variables are included in Appendix 6, Tables 3 and 4.

We also assessed post-hoc whether there were differences between the *n*=173 sample included at both T0 and T1 and the *n*=1740 participants who participated at T0 but not at T1. Generally, participants who re-enrolled at T1 were older, more likely to be female, and reported higher levels of T0 depression, psychoticism, and general psychopathology (see Appendix 5 for full results). As both higher age and being female were related to higher levels of psychopathology, we also tested whether increased T0 psychopathology levels still predicted re-enrollment at T1, when controlling for age and gender. None of those associations were significant, indicating that - taking age and gender into account - participants with more T0 psychopathology were not more likely to re-enroll at T1.

Changes in Psychopathology Pre- to Early-Pandemic - Beyond Age Effects

We observed a significant decrease in anxiety symptoms and general psychopathology symptoms from T0 to T1, after age effects were also taken into account (Table 3). Results demonstrated no significant changes in either depression or psychotic symptoms across waves.

Because mean GSI and anxiety scores did not differ greatly across waves (Table 1), we conducted exploratory post-hoc analyses to examine the extent to which significant decreases were due to age effects - as older participants generally reported more symptoms. When age was excluded as a covariate from these analyses, there was no longer a significant decrease in GSI (B(SE) = .07 (.05), p = .18), while there was still a significant decrease in anxiety symptoms (B(SE) = 1.10 (.40), p = .007).

Associations Between Early-Pandemic Risk Factors and Early-Pandemic Psychopathology Levels

In the analyses focusing on the associations between T1 total psychopathology symptoms and T1 risk and protective factors, psychopathology was significantly and negatively associated with resilience, and significantly and positively associated with COVID-19-related stressors (Table 4). Analyses do not support a significant relationship between psychopathology symptoms and either social support or posttraumatic growth.

Associations Between Pre-Pandemic Risk Factors and Changes in Psychopathology Levels From Pre- to Early-Pandemic

T0 total psychopathology significantly predicted T1 total psychopathology during the pandemic (Table 4). No T0 risk or resilience factor predicted early-pandemic psychopathology when also taking into account psychopathology at the previous time point.

Changes in the Quantity of Social Interactions Pre- to Early-Pandemic

In the early phase of the pandemic at T1, adolescents reported fewer face-to-face social interactions overall, and fewer face-to-face interactions with peers than at T0. On the other hand, they reported more face-to-face interactions with family members, and more online social interactions overall. See Table 5 for further details.

Changes in the Quality of Social Interactions Pre- to Early-Pandemic

On average, participants indicated a higher mean quality of all their reported face-to-face social interactions during the pandemic than before the pandemic (Table 6). Specifically, the quality of face-to-face interactions with peers increased significantly. For face-to-face interactions with family members, and for online interactions, there are no significant changes in the quality.

Early-Pandemic Associations between Total Psychopathology and the Quality and Quantity of Social Interactions

We found no statistically significant association between T1 psychopathology and the quantity of T1 social interactions - neither face-to-face, online, nor across all interactions or interactions only with family members or peers (Table 7). In contrast, T1 psychopathology was negatively associated with the quality of most types of social interactions - both when offline and online, and both across all interactions and when with family members and peers (Table 8). Only the quality of online social interactions with family members was not significantly predicted by total psychopathology levels. It should be noted here that the mean proportion of online social interactions with family members was very low (Table 2).

Changes in the Associations Between Psychopathology and the Quantity and Quality of Social Interactions Pre- to Early-Pandemic

The interaction effects in Tables 7 and 8 reveal several differences in the relationship between psychopathology and aspects of daily-life social interactions across waves. First, the positive interaction effect when predicting the quantity of face-to-face peer interactions indicates that the negative relationship between psychopathology and the quantity of face-to-face peer interactions was significantly weaker (i.e., less negative) at T1 than at T0 (Table 7). The other interaction effects between social interaction quantity and psychopathology were non-significant, indicating no evidence for weaker (or stronger) relationships between social

interaction quantity and psychopathology across waves. Then, associations between psychopathology and the quality of all types of social interactions were all significant and negative - and, when predicting the quality of family and peer interactions, these associations were stronger (i.e., more negative) during than before the pandemic (Table 8). This interaction effect did not hold for the negative association between psychopathology and the quality of face-to-face interactions overall, or for the association between psychopathology and the quality of online interactions.

Discussion

By building on an existing longitudinal study and using ESM, we have been able to gain unique insights into how the COVID-19 pandemic has affected adolescents' mental health and social interactions in daily life. Surprisingly, anxiety and general psychopathology symptoms were lower than would be expected based on age from pre- to early-pandemic, while depression and psychoticism symptoms did not significantly change. In fact, anxiety symptoms even decreased without taking into account age effects. When investigating general psychopathology symptoms, we found that resilience and COVID-19-related stressors were significantly associated with contemporaneous general psychopathology symptoms. However, none of the pre-pandemic risk and protective factors we investigated significantly predicted change in general psychopathology symptoms during the early phase of the pandemic.

As expected, we observed significant changes in the amounts of social behaviors adolescents engaged in: they reported fewer face-to-face social interactions overall, fewer face-to-face interactions with peers, more face-to-face interactions with parents, and more online social interactions. However, adolescents also reported a higher *quality* of social interactions overall, and more specifically, a higher quality of face-to-face interactions with peers. No change in the quality of interactions with family members could be observed. During the

pandemic, psychopathology symptoms were not significantly associated with the amount of social behaviors. The relationship between the amount of peer interactions and psychopathology symptoms was significantly more negative pre-pandemic. During the pandemic, the quality of different types of social interactions was significantly and strongly negatively associated with general psychopathology symptoms. Moreover, the negative relationships between psychopathology symptoms and the quality of face-to-face interactions with peers and family members were stronger during the pandemic than before, thereby highlighting the heightened importance of qualitative face-to-face interactions with close others during the COVID-19 pandemic.

Decrease in Anxiety Symptoms And Less Overall Symptoms Than Expected

We were surprised to observe a decrease in anxiety symptoms, and lower than expected general psychopathology symptoms. Previous early-pandemic studies have reported high levels of adolescent psychopathology and anxiety symptoms (e.g., Luijten et al., 2021; Waite et al., 2021). However, since many of these studies have no pre-COVID-19 data, their results may reflect the moderate to high levels of adolescent psychopathology already present in adolescent populations before the pandemic (e.g., Kessler et al., 2005; Solmi et al., 2021). Where studies have been able to combine pre- and early-pandemic data on psychopathology symptoms, results are limited and conflicting. One study reported increases in anxiety levels pre- to early-pandemic (Magson et al., 2021), while other studies have reported decreases (Widnall et al., 2020) or stability in anxiety symptoms (Barendse et al., 2021; Bignardi et al., 2020).

Despite the inconsistencies across studies, it appears that, for some young people, anxiety levels have decreased pre- to early- or mid-pandemic. One potential explanation for this is that for many young people - particularly those struggling with social anxiety - their ‘normal’ situation of going to school induces anxiety (Morrissette, 2020). Consequently, anxiety may have decreased due to the reduced opportunities and expectations for peer interactions during

the lockdown. Whilst respite from social stressors may have reduced anxiety during the early phase of the pandemic, this effect is likely to be short-term, as when schools reopen, adolescents may be less well-equipped to engage with others (Loades & Reynolds, 2021; Morrissette, 2020). Therefore, adolescents - particularly those who already experienced anxiety before the pandemic - should be adequately supported as they return to school.

Resilience and COVID-19-related Stressors Are Significantly and Contemporaneously Associated With Psychopathology Symptoms

In trying to understand why the mental health of most adolescents in this study did not worsen during the early phase of the pandemic, it is worthwhile to examine relevant risk and protective factors. We investigated whether pre-pandemic assessments of social support, interpersonal skills, traumatic experiences and bullying predicted changes in psychopathology symptoms during the pandemic; however, none of these were significant predictors. This may be because, generally, there was not much change in psychopathology levels, and as such, little change to predict. Interestingly, our measures of resilience and COVID-19-related stressors (but neither social support nor posttraumatic growth) were significantly associated with contemporaneous psychopathology levels. The significant association of psychopathology with COVID-19 stressors (e.g., having a family member with [increased risk for] COVID-19) highlights the relevance of external factors for adolescent well-being. Moreover, the significance of resilience might also reflect more external than internal resilience factors, as this measure included many items on social support, and as the correlation with our social support measure was quite high (i.e., 0.70; see Appendix 6). Therefore, despite the non-significance of the association between social support and psychopathology, strong social networks are still likely important factors in safeguarding adolescents' mental health during the pandemic - in line with previous work evidencing this link (Dvorsky et al., 2021; Nitschke et al., 2021; Rens et al., 2021; Veer et al., 2021).

Changes in Daily Social Interactions

Our investigation and comparison of daily-life social interactions both before and during the pandemic allows us to gain a more in-depth view of changes in social behaviors and experiences during the COVID-pandemic. Unsurprisingly, during the pandemic, adolescents spent less time interacting face-to-face, both in general and with peers, and more time interacting with their family. What was somewhat surprising, was that the mean *quality* of face-to-face social interactions (both in general and with peers) had increased. One potential explanation for this social quality increase might be that, during the social restrictions, adolescents are more selective in the peers that they are with, and as such, choose to interact more with closer friends or romantic partners - people who would make them feel a greater sense of ease, appreciation, and belonging. Alternatively, adolescents may have had a greater appreciation for their peers when they did get the rare opportunity to meet them.

In addition, adolescents interacted more with others online during than pre-pandemic. Connection with close others is of crucial importance for adaptive development (Baumeister & Leary, 1995; Snyder-Mackler et al., 2020), especially during a crisis situation such as the COVID-19 pandemic. Online communication with close others has likely served as a valuable placeholder of social connection when face-to-face interactions were restricted - and this may be one of the reasons why so many adolescents have remained resilient. One study in Flemish adolescents demonstrated how social media use was used as a constructive coping strategy during the COVID-19 pandemic, particularly by those feeling anxious, and for them, this led to greater well-being as well (Cauberghe et al., 2021). As such, in the current sample, it is also likely that digital communication has helped adolescents to stay connected to others and to remain resilient. At the same time, it is of note to mention the importance of high-quality social interactions in this regard, as we observed that psychopathology levels were related to the quality of online interactions, but not to their quantity.

Relationships Between Psychopathology and Quantity and Quality of Daily Social Interactions

Results indicated how, for both online face-to-face interactions, psychopathology levels were related to the quality but not the quantity of social interactions. We had previously established the association between psychopathology and social interaction quality in SIGMA study pre-pandemic (Achterhof et al., 2021), but now, we also see it during this period of social deprivation. Interestingly, pre-pandemic, we observed that those with higher psychopathology levels reported fewer face-to-face interactions - but this relationship weakened and became non-significant in the pandemic, particularly for peer interactions. The change in the relationship between psychopathology and the amount of peer interactions may be explained by all adolescents having very limited opportunities to see peers - both those with low and those with high psychopathology levels. However, this finding is inconsistent with the results from one study in Austrian adults, where it was found that retrospectively assessed social network size (the number of people that the participant has been in contact with during the preceding two weeks) was actually predictive of less distress (Nitschke et al., 2021). The difference with the current results may be because of the difference in samples (maybe these Austrian adults had more opportunities to interact with others), or because of the difference in methods (experience sampling vs. retrospective questionnaire).

We also see that psychopathology was related to the quality of interactions with both peers and with family members. Furthermore, although the relationship between psychopathology and the quality of social interactions overall has not changed pre- to early-pandemic, the specific associations between psychopathology and interactions with both peers and family members have strengthened. Thus, the social connectedness that has been considered as a resilience factor in previous work (Dvorsky et al., 2021; Nitschke et al., 2021; Rens et al., 2021; Veer et al., 2021) relates to both family members and to peers. This is in line

with contemporary theories of social development during adolescence, in which the role of friends becomes more important, while parents and family members also remain influential support figures (Grusec & Davidov, 2021; Smetana et al., 2006). Although online tools may still provide a meaningful way of staying in touch with others during lockdown periods (Cauberghe et al., 2021; Orben et al., 2020), the fewer opportunities for face-to-face social interaction with close others seems to have become increasingly valuable.

Strengths and Limitations

A major strength of the current study is the longitudinal cohort design, meaning that we were able to compare data from Wave I (pre-COVID-19) with data collected during the early phase of the COVID-19 pandemic in order to investigate changes in psychopathology symptoms and social interaction. To the best of our knowledge, this is one of the few published adolescent studies to date on mental health and COVID-19 where comparisons could be made with data collected from the same individuals prior to the pandemic.

Given the rapid proliferation of research conducted on effects of the pandemic, some have raised valid concerns regarding the quality (Nieto et al., 2020; Townsend et al., 2020) and ethical conduct of such research (Townsend et al., 2020). In the current study, we used pre-existing data from an established and well-characterised cohort - the SIGMA study (Kirtley et al., 2021) - and invited participants from the cohort to take part in an extra measurement to assess their well-being during COVID-19 physical distancing. The study received full ethical approval and additional measures were put in place to ensure full informed consent could be obtained from adolescents and, where necessary, their parents, as well as taking additional steps to ensure participants were safe and supported during research participation.

As much as possible, we used open science practices within this research. Specifically, the research questions, hypotheses and analysis plans for the data presented within the current study were post-registered (Benning et al., 2019), i.e. following data collection but prior to data

access and analysis, although we initially had in mind to make a pre-data collection pre-registration. The feasibility of our preferred analyses depended upon the number of participants from the SIGMA cohort that we were able to re-recruit for the extra COVID-19 measurement. Conducting power analysis for ESM studies is, however, complex even under normal circumstances (Kirtley, Lafit, Achterhof, et al., 2020; Lafit et al., 2020), and we had little idea what to expect in terms of recruitment during the unprecedented pandemic situation. Planning and pre-registering highly complex analyses requiring close to the full sample to be re-recruited, would likely have resulted in us having to make significant deviations from our pre-registered plans or even abandon them completely. Post-registration was a good option, facilitated by the data check-out system in place within our lab (see Kirtley, Lafit, Wampers, et al., 2020), meaning we had no access to the data prior to registration, and we were able to make non-data dependent hypotheses and analytic plans. In further transparency and reproducibility efforts, we have shared analysis code and measures on the Open Science Framework and all ESM items used in Wave 1 of the SIGMA study are publicly available online in the ESM Item Repository (Kirtley, Hiekkaranta, Kunkels, et al., 2020).

Despite these strengths, some limitations regarding the representativeness of this sample need to be considered when interpreting the results. Critically, our sample only reflects a subsample of 9% of the larger SIGMA dataset. As such, there is a high risk of sampling bias. The participants who re-enrolled at T1 had greater levels of T0 psychopathology than the T0 participants who did not re-enroll. However, this was likely due to the fact that older and female participants were both more likely to re-enroll and had higher T0 psychopathology levels. After controlling for age and sex, psychopathology levels did not significantly predict the likelihood to re-enter the study at T1 (further details of these analyses are described in Appendix 5). However, it is still conceivable that, compared to participants who re-enrolled, those who did not re-enroll had larger declines or increases from T0 to T1 in their mental health - and we are

currently not able to assess this. Moreover, whereas at T0, participants were enrolled through school and were provided with a study device to complete the ESM, at T1 (during the pandemic), we asked participants to complete all questionnaires on their own devices at home. This means that we could not include participants with fewer resources, who have limited access to the internet at home, who do not have a personal smartphone, or who do not have a safe place at home to fill out the questionnaires. It is of fundamental importance to learn more about adolescents who have fewer resources and may be economically underprivileged as well - as they are likely at increased risk of experiencing deteriorated mental health due to the COVID-19-related restrictions (Dooley et al., 2020; Singh et al., 2020).

Implications and Future Directions

The current results have several important implications. First, it appears that - at least in the initial stages of lockdown - adolescents generally remained resilient and did not experience a worsening of their mental health. However, as social restrictions have continued far beyond the period assessed in this study, we should not assume that this resilience is permanent. Adolescents have missed out on many opportunities for social interactions with peers - a fundamental developmental task (Blakemore & Mills, 2014) - and this may be related to psychological distress in the medium- to long-term - throughout 2020, 2021 and in the years to come. Moreover, as restrictions are lifted and adolescents go back to school and work, they may experience some levels of distress and anxiety. Those adolescents who experienced the highest levels of COVID-19-related distress reported the most psychopathology symptoms, and they may represent the group that could benefit most from treatment and intervention programmes. For future work, it is crucial to learn more about the medium and longer-term effects of the social deprivation produced by pandemic-related regulations.

Although it has been previously suggested that digital communication has buffered much of the quarantine-induced distress, the current results also suggest that high-quality face-

to-face interactions with family and peers may have actually been more helpful in keeping adolescents resilient. This also implies that those adolescents who have fewer opportunities for qualitative social interactions at home may actually be at increased risk for developing distress. In developing interventions during periods of social deprivation, it is therefore crucial to consider the importance of opportunities to physically meet close others. However, as this may not always be possible to the fullest extent, better digital youth mental health interventions are also required - as their effectiveness is currently still limited.

References

Achterhof, R., Kirtley, O. J., Schneider, M., Hagemann, N., Hermans, K., Hiekkaranta, A. P., Lecei, A., Decoster, J., Derom, C., Hert, M. De, Guloksuz, S., Jacobs, N., Menne-Lothmann, C., Rutten, B., Thiery, E., Os, J. van, Winkel, R. van, Wichers, M., & Myin-Germeys, I. (2021). *General psychopathology and its social correlates in the daily lives of youth*. https://doi.org/10.31234/OSF.IO/95AFU

Alvis, L., Douglas, R., Shook, N., & Oosterhoff, B. (2020). Associations between Adolescents' Prosocial Experiences and Mental Health During the COVID-19 Pandemic. https://doi.org/10.31234/osf.io/2s73n

Antonucci, T. C., Ajrouch, K. J., Webster, N. J., & Zahodne, L. B. (2019). Social Relations Across the Life Span: Scientific Advances, Emerging Issues, and Future Challenges. *Annual Review of Developmental Psychology*, *1*(1), 313–336. https://doi.org/10.1146/annurev-devpsych-121318-085212

Barendse, M., Flannery, J., Cavanagh, C., Aristizabal, M., Becker, S. P., Berger, E., Breaux, R., Campione-Barr, N., Church, J. A., Crone, E., Dahl, R., Dennis-Tiwary, T. A., Dvorsky, M., Dziura, S., Groep, S. van de, Ho, T., Killoren, S. E., Langberg, J., Larguinho, T., … Pfeifer, J. (2021). *Longitudinal change in adolescent depression and anxiety symptoms from before to during the COVID-19 pandemic: A collaborative of 12 samples from 3 countries*. https://doi.org/10.31234/OSF.IO/HN7US

Baumeister, R. F., & Leary, M. R. (1995). The Need to Belong: Desire for Interpersonal Attachments as a Fundamental Human Motivation. *Psychological Bulletin*, *117*(3), 497–529. https://doi.org/10.1037/0033-2909.117.3.497

Belgian Federal Government. (2020). *Coronavirus: reinforced measures | Belgium.be*. https://www.belgium.be/en/news/2020/coronavirus_reinforced_measures

Benning, S. D., Bachrach, R. L., Smith, E. A., Freeman, A. J., & Wright, A. G. C. (2019). The registration continuum in clinical science: A guide toward transparent practices. *Journal of Abnormal Psychology*, *128*(6), 528–540. https://doi.org/10.1037/abn0000451

Bignardi, G., Dalmaijer, E. S., Anwyl-Irvine, A. L., Smith, T. A., Siugzdaite, R., Uh, S., & Astle, D. E. (2020). Longitudinal increases in childhood depression symptoms during the COVID-19 lockdown. *Archives of Disease in Childhood*, archdischild-2020-320372. https://doi.org/10.1136/archdischild-2020-320372

Blakemore, S.-J., & Mills, K. L. (2014). Is Adolescence a Sensitive Period for Sociocultural Processing? *Annual Review of Psychology*, *65*(1), 187–207. https://doi.org/10.1146/annurev-psych-010213-115202

Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N., & Rubin, G. J. (2020). The psychological impact of quarantine and how to reduce it: rapid review of the evidence. In *The Lancet* (Vol. 395, Issue 10227, pp. 912–920). Lancet Publishing Group. https://doi.org/10.1016/S0140-6736(20)30460-8

Cann, A., Calhoun, L. G., Tedeschi, R. G., Taku, K., Vishnevsky, T., Triplett, K. N., & Danhauer, S. C. (2010). A short form of the Posttraumatic Growth Inventory. *Taylor & Francis*, *23*(2), 127–137. https://doi.org/10.1080/10615800903094273

Cauberghe, V., Van Wesenbeeck, I., De Jans, S., Hudders, L., & Ponnet, K. (2021). How Adolescents Use Social Media to Cope with Feelings of Loneliness and Anxiety during COVID-19 Lockdown. *Cyberpsychology, Behavior, and Social Networking*, *24*(4), 250–257. https://doi.org/10.1089/cyber.2020.0478

Copeland, W. E., McGinnis, E., Bai, Y., Adams, Z., Nardone, H., Devadanam, V., Rettew, J., & Hudziak, J. J. (2021). Impact of COVID-19 Pandemic on College Student Mental Health and

Wellness. *Journal of the American Academy of Child and Adolescent Psychiatry*, *60*(1), 134-141.e2. https://doi.org/10.1016/j.jaac.2020.08.466

Csikszentmihalyi, M., Larson, R., & Prescott, S. (1977). The ecology of adolescent activity and experience. *Journal of Youth and Adolescence*, *6*(3), 281–294. https://doi.org/10.1007/BF02138940

Curran, P. J., Obeidat, K., & Losardo, D. (2010). Twelve frequently asked questions about growth curve modeling. *Journal of Cognition and Development*, *11*(2), 121–136. https://doi.org/10.1080/15248371003699969

Derogatis, L. R. (1993). BSI: brief symptom inventory. *Minneapolis: National Computer Systems*.

Dooley, D. G., Bandealy, A., & Tschudy, M. M. (2020). Low-Income Children and Coronavirus Disease 2019 (COVID-19) in the US. In *JAMA Pediatrics* (Vol. 174, Issue 10, pp. 924–925). American Medical Association. https://doi.org/10.1001/jamapediatrics.2020.2065

Dvorsky, M., Breaux, R., Cusick, C., Fredrick, J. W., Green, C. D., Steinberg, A., Langberg, J., Sciberras, E., & Becker, S. P. (2021). *Coping with COVID-19: Longitudinal Impact of the Pandemic on Adjustment and Links with Coping for Adolescents with and without ADHD*. https://psyarxiv.com/q6jzg/

Fancourt, D., Steptoe, A., & Bu, F. (2021). Trajectories of anxiety and depressive symptoms during enforced isolation due to COVID-19 in England: a longitudinal observational study. *The Lancet Psychiatry*, *8*(2), 141–149. https://doi.org/10.1016/S2215-0366(20)30482-X

Fried, E., Papanikolaou, F., & Epskamp, S. (2020). Mental Health and Social Contact During the COVID-19 Pandemic: An Ecological Momentary Assessment Study. https://doi.org/10.31234/osf.io/36xkp

Galbraith, S., Bowden, J., & Mander, A. (2017). Accelerated longitudinal designs: An overview of modelling, power, costs and handling missing data. *Statistical Methods in Medical Research*, *26*(1), 374–398. https://doi.org/10.1177/0962280214547150

Green, K., Groep, S. van de, Sweijen, S., Becht, A., Buijzen, M., Leeuw, R. de, Remmerswaal, D., Zanden, R. van der, Engels, R., & Crone, E. (2021). *Emotional Reactivity and Wellbeing of Adolescents During the COVID-19 Pandemic: Short and Long Term Effects and The Impact of Social and Socioeconomic Stressors*. https://doi.org/10.31234/OSF.IO/KEJTG

Grusec, J. E., & Davidov, M. (2021). Socializing Children. In *Elements in Child Development*. Cambridge University Press. https://doi.org/10.1017/9781108920780

Gunnell D, Appleby L, A. E. (2020). COVID-19 Suicide Prevention Research Collaboration. Suicide risk and prevention during the COVID-19 pandemic. *Lancet Psychiatry*, *7*(6), 468–471. https://www.thelancet.com/journals/lanpsy/article/PIIS2215-0366(20)30171-1/fulltext?fbclid=IwAR3hgyZavB7fLztwhhQAj5PXP607IdiOuYn_Vg-X-uKjxl6bTuqH0eW0ttI

Hamby, S. L., Finkelhor, D., Ormrod, R., & Turner, H. (2004). The Juvenile Victimization Questionnaire (JVQ): In *unh.edu* (Issue March). http://www.unh.edu/ccrc/pdf/CV55_2004.pdf

Harris, P. A., Taylor, R., Thielke, R., Payne, J., Gonzalez, N., & Conde, J. G. (2009). Research electronic data capture (REDCap)-A metadata-driven methodology and workflow process for providing translational research informatics support. *Journal of Biomedical Informatics*. https://doi.org/10.1016/j.jbi.2008.08.010

Holmes, E. A., O'Connor, R. C., Perry, V. H., Tracey, I., Wessely, S., Arseneault, L., Ballard, C., Christensen, H., Cohen Silver, R., Everall, I., Ford, T., John, A., Kabir, T., King, K., Madan, I., Michie, S., Przybylski, A. K., Shafran, R., Sweeney, A., … Bullmore, E. (2020). Multidisciplinary research priorities for the COVID-19 pandemic: a call for action for mental health science. In *The Lancet Psychiatry* (Vol. 7, Issue 6, pp. 547–560). Elsevier Ltd. https://doi.org/10.1016/S2215-0366(20)30168-1

Jefferies, P., McGarrigle, L., & Ungar, M. (2019). The CYRM-R: A Rasch-Validated Revision of the Child and Youth Resilience Measure. *Journal of Evidence-Informed Social Work*, *16*(1), 70–92. https://doi.org/10.1080/23761407.2018.1548403

Kessler, R. C., Berglund, P., Demler, O., Jin, R., Merikangas, K. R., & Walters, E. E. (2005). Lifetime Prevalence and Age-of-Onset Distributions of DSM-IV Disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry*, *62*(6), 593. https://doi.org/10.1001/archpsyc.62.6.593

Kirtley, O. J., Achterhof, R., Hagemann, N., Hermans, K. S. F. M., Hiekkaranta, A. P., Lecei, A., Boets, B., Henquet, C., Kasanova, Z., Schneider, M., van Winkel, R., Reininghaus, U., Viechtbauer, W., & Myin-Germeys, I. (2021). *Initial cohort characteristics and protocol for SIGMA: An accelerated longitudinal study of environmental factors, inter- and intrapersonal processes, and mental health in adolescence*. https://doi.org/10.31234/OSF.IO/JP2FK

Kirtley, O. J., Hiekkaranta, A. P., Kunkels, Y. K., Eisele, G., Verhoeven, D., Nierop, M. Van, & Myin-Germeys, I. (2020). *The Experience Sampling Method (ESM) Item Repository*. https://doi.org/10.17605/OSF.IO/KG376

Kirtley, O. J., Lafit, G., Achterhof, R., Hiekkaranta, A. P., & Myin-Germeys, I. (2020). Making the black box transparent: A template and tutorial for (pre-)registration of studies using Experience Sampling Methods (ESM). *Advances in Methods and Practices in Psychological Science*.

Kirtley, O. J., Lafit, G., Wampers, M., & Myin-Germeys, I. (2020). PsychArchives: Establishing a low-threshold data checkout system using REDCap, to facilitate preregistration and Registered Reports for pre-existing data. Paper presented at the CSPD 2020: Sharing Psychological Research Data: Best Practices and New Develo. https://www.psycharchives.org/handle/20.500.12034/4057

Koval, P., Hinton, J., Dozo, N., Gleeson, J., Alvarez, M., Harrison, A., Vu, D., Susanto, R., Jayaputera, G., & R, S. (2019). *SEMA3: Smartphone Ecological Momentary Assessment, Version 3*. http://www.sema3.com

Kwong, A. S. F., Pearson, R. M., Adams, M. J., Northstone, K., Tilling, K., Smith, D., Fawns-Ritchie, C., Bould, H., Warne, N., Zammit, S., Gunnell, D. J., Moran, P. A., Micali, N., Reichenberg, A., Hickman, M., Rai, D., Haworth, S., Campbell, A., Altschul, D., … Timpson, N. J. (2020). Mental health before and during the COVID-19 pandemic in two longitudinal UK population cohorts. *The British Journal of Psychiatry*, 1–10. https://doi.org/10.1192/bjp.2020.242

Lafit, G., Adolf, J., Dejonckheere, E., Myin-Germeys, I., Viechtbauer, W., & Ceulemans, E. (2020). Selection of the Number of Participants in Intensive Longitudinal Studies: A User-friendly Shiny App and Tutorial to Perform Power Analysis in Multilevel Regression Models that Account for Temporal Dependencies. https://doi.org/10.31234/osf.io/dq6ky

Lakens, D. (2021). *Sample Size Justification*. https://doi.org/10.31234/OSF.IO/9D3YF

Loades, M. E., Chatburn, E., Higson-Sweeney, N., Reynolds, S., Shafran, R., Brigden, A., Linney, C., McManus, M. N., Borwick, C., & Crawley, E. (2020). Rapid Systematic Review: The Impact of Social Isolation and Loneliness on the Mental Health of Children and Adolescents in the Context of COVID-19. *Journal of the American Academy of Child & Adolescent Psychiatry*. https://doi.org/10.1016/j.jaac.2020.05.009

Loades, M. E., & Reynolds, S. (2021). Dr. Loades and Prof. Reynolds Reply. In *Journal of the American Academy of Child and Adolescent Psychiatry* (Vol. 60, Issue 1, pp. 7–8). Elsevier Inc. https://doi.org/10.1016/j.jaac.2020.08.437

Luijten, M. A. J., van Muilekom, M. M., Teela, L., Polderman, T. J. C., Terwee, C. B., Zijlmans, J., Klaufus, L., Popma, A., Oostrom, K. J., van Oers, H. A., & Haverman, L. (2021). The impact of lockdown during the COVID-19 pandemic on mental and social health of children and adolescents. *Quality of Life Research*, *1*, 3. https://doi.org/10.1007/s11136-021-02861-x

Magson, N. R., Freeman, J. Y. A., Rapee, R. M., Richardson, C. E., Oar, E. L., & Fardouly, J. (2021). Risk and Protective Factors for Prospective Changes in Adolescent Mental Health during the COVID-19 Pandemic. *Journal of Youth and Adolescence*, *50*(1), 44–57. https://doi.org/10.1007/s10964-020-01332-9

Meers, K., Dejonckheere, E., Kalokerinos, E. K., Rummens, K., & Kuppens, P. (2020). mobileQ: A free user-friendly application for collecting experience sampling data. *Behavior Research Methods*, 43. https://doi.org/10.3758/s13428-019-01330-1

Morrissette, M. (2020). School Closures and Social Anxiety During the COVID-19 Pandemic. *Journal of the American Academy of Child and Adolescent Psychiatry*, *0*(0). https://doi.org/10.1016/j.jaac.2020.08.436

Myin-Germeys, I., Kasanova, Z., Vaessen, T., Vachon, H., Kirtley, O. J., Viechtbauer, W., & Reininghaus, U. (2018). Experience sampling methodology in mental health research: new insights and technical developments. *World Psychiatry*, *17*(2), 123–132. https://doi.org/10.1002/wps.20513

Nieto, I., Navas, J. F., & Vázquez, C. (2020). The quality of research on mental health related to the COVID-19 pandemic: A note of caution after a systematic review. *Brain, Behavior, & Immunity - Health*, *7*, 100123. https://doi.org/10.1016/j.bbih.2020.100123

Nitschke, J. P., Forbes, P. A. G., Ali, N., Cutler, J., Apps, M. A. J., Lockwood, P. L., & Lamm, C. (2021). Resilience during uncertainty? Greater social connectedness during COVID-19 lockdown is associated with reduced distress and fatigue. *British Journal of Health Psychology*, *26*(2), 553–569. https://doi.org/10.1111/bjhp.12485

O'Connor, R. C., Wetherall, K., Cleare, S., McClelland, H., Melson, A. J., Niedzwiedz, C. L., O'Carroll, R. E., O'Connor, D. B., Platt, S., Scowcroft, E., Watson, B., Zortea, T., Ferguson, E., & Robb, K. A. (2020). Mental health and well-being during the COVID-19 pandemic:

longitudinal analyses of adults in the UK COVID-19 Mental Health & Wellbeing study. *The British Journal of Psychiatry*, 1–8. https://doi.org/10.1192/bjp.2020.212

Orben, A. (2020). Teenagers, screens and social media: a narrative review of reviews and key studies. *Social Psychiatry and Psychiatric Epidemiology*. https://doi.org/10.1007/s00127-019-01825-4

Orben, A., & Przybylski, A. K. (2019). Screens, Teens, and Psychological Well-Being: Evidence From Three Time-Use-Diary Studies. *Psychological Science*, *30*(5), 682–696. https://doi.org/10.1177/0956797619830329

Orben, A., Tomova, L., & Blakemore, S.-J. (2020). The effects of social deprivation on adolescent development and mental health. *The Lancet Child & Adolescent Health*, *4*(8), 634–640. https://doi.org/10.1016/S2352-4642(20)30186-3

Pierce, M., Hope, H., Ford, T., Hatch, S., Hotopf, M., John, A., Kontopantelis, E., Webb, R., Wessely, S., McManus, S., & Abel, K. M. (2020). Mental health before and during the COVID-19 pandemic: a longitudinal probability sample survey of the UK population. *The Lancet Psychiatry*, *7*(10), 883–892. https://doi.org/10.1016/S2215-0366(20)30308-4

Raw, J., Waite, P., Pearcey, S., Creswell, P. C., Shum, A., & Patalay, P. (2021). Examining changes in parent-reported child and adolescent mental health throughout the UK's first COVID-19 national lockdown. https://doi.org/10.31234/OSF.IO/EXKTJ

Rens, E., Smith, P., Nicaise, P., Lorant, V., & Van den Broeck, K. (2021). Mental Distress and Its Contributing Factors Among Young People During the First Wave of COVID-19: A Belgian Survey Study. *Frontiers in Psychiatry*, *12*, 575553. https://doi.org/10.3389/fpsyt.2021.575553

Rubin, D. (1987). *Multiple imputation for nonresponse in surveys*. https://books.google.be/books?hl=nl&lr=&id=bQBtw6rx_mUC&oi=fnd&pg=PR24&dq=Rubin,+D.B.+(1987).+Multiple+Imputation+for+Nonresponse+in+Surveys&ots=8PpIcO1UhT&sig=7NgZDCCxa_Tw2aFx8JYExpcspqg

Scholte, E. M., & Van der Ploeg, J. D. (2013). Vragenlijst Psychosociale Vaardigheden (VPV). Handleiding.

Sciensano. (2020). COVID-19-WEKELIJKS EPIDEMIOLOGISCH BULLETIN VAN 15 MEI 2020. https://epistat.wiv-isp.be/covid.

Shanahan, L., Steinhoff, A., Bechtiger, L., Murray, A. L., Nivette, A., Hepp, U., Ribeaud, D., & Eisner, M. (2020). Emotional Distress in Young Adults during the COVID-19 Pandemic: Evidence of Risk and Resilience from a Longitudinal Cohort Study. *Psychological Medicine*. https://doi.org/10.1017/S003329172000241X

Singh, S., Roy, D., Sinha, K., Parveen, S., Sharma, G., & Joshi, G. (2020). Impact of COVID-19 and lockdown on mental health of children and adolescents: A narrative review with recommendations. In *Psychiatry Research* (Vol. 293, p. 113429). Elsevier Ireland Ltd. https://doi.org/10.1016/j.psychres.2020.113429

Smetana, J. G., Campione-Barr, N., & Metzger, A. (2006). Adolescent Development in Interpersonal and Societal Contexts. *Annual Review of Psychology*, *57*(1), 255–284. https://doi.org/10.1146/annurev.psych.57.102904.190124

Snyder-Mackler, N., Burger, J. R., Gaydosh, L., Belsky, D. W., Noppert, G. A., Campos, F. A., Bartolomucci, A., Yang, Y. C., Aiello, A. E., O'Rand, A., Harris, K. M., Shively, C. A., Alberts, S. C., & Tung, J. (2020). Social determinants of health and survival in humans and other animals. In *Science* (Vol. 368, Issue 6493). American Association for the Advancement of Science. https://doi.org/10.1126/science.aax9553

Solmi, M., Radua, J., Olivola, M., Croce, E., Soardo, L., Salazar de Pablo, G., Il Shin, J., Kirkbride, J. B., Jones, P., Kim, J. H., Kim, J. Y., Carvalho, A. F., Seeman, M. V., Correll, C. U., & Fusar-Poli, P. (2021). Age at onset of mental disorders worldwide: large-scale meta-analysis of 192 epidemiological studies. *Molecular Psychiatry*, *17*, 22. https://doi.org/10.1038/s41380-021-01161-7

Stieger, S., Lewetz, D., & Swami, V. (2021). Emotional Well-Being Under Conditions of Lockdown: An Experience Sampling Study in Austria During the COVID-19 Pandemic. *Journal of Happiness Studies*. https://doi.org/10.1007/s10902-020-00337-2

Sun, Y., Wu, Y., Bonardi, O., Krishnan, A., He, C., Boruff, J. T., Rice, D. B., Wang, Y., Jiang, X., Li, K., Markham, S., Levis, B., Azar, M., Thombs-Vite, I., Neupane, D., Dal Santo, T., Tasleem, A., Yao, A., Agic, B., … Thombs, B. D. (2021). Comparison of Mental Health Symptoms prior to and during COVID-19: Evidence from a Living Systematic Review and Meta-analysis. *MedRxiv*, 2021.05.10.21256920. https://doi.org/10.1101/2021.05.10.21256920

Townsend, E., Nielsen, E., Allister, R., & Cassidy, S. A. (2020). Key ethical questions for research during the COVID-19 pandemic. In *The Lancet Psychiatry* (Vol. 7, Issue 5, pp. 381–383). Elsevier Ltd. https://doi.org/10.1016/S2215-0366(20)30150-4

van Buuren, S., & Groothuis-Oudshoorn, K. (2011). mice: Multivariate imputation by chained equations in R. *Journal of Statistical Software*, *45*(3), 1–67. https://doi.org/10.18637/jss.v045.i03

van Ginkel, J. R., Linting, M., Rippe, R. C. A., & van der Voort, A. (2020). Rebutting Existing Misconceptions About Multiple Imputation as a Method for Handling Missing Data. *Journal of Personality Assessment*, *102*(3), 297–308. https://doi.org/10.1080/00223891.2018.1530680

Van Sonderen, E. (2012). Het meten van sociale steun met de Sociale Steun Lijst -Interacties (SSL-I) en Sociale Steun Lijst -Discrepanties (SSL-D): Een handleiding. 2nd ed: UMCG / Rijksuniversiteit Groningen, Research Institute SHARE.

Veer, I. M., Riepenhausen, A., Zerban, M., Wackerhagen, C., Puhlmann, L. M. C., Engen, H., Köber, G., Bögemann, S. A., Weermeijer, J., Uściłko, A., Mor, N., Marciniak, M. A., Askelund, A. D., Al-Kamel, A., Ayash, S., Barsuola, G., Bartkute-Norkuniene, V., Battaglia, S., Bobko, Y., … Kalisch, R. (2021). Psycho-social factors associated with mental resilience in the Corona lockdown. *Translational Psychiatry*, *11*(1), 15. https://doi.org/10.1038/s41398-020-01150-4

Waite, P., Pearcey, S., Shum, A., Raw, J. A. L., Patalay, P., & Creswell, C. (2021). How did the mental health symptoms of children and adolescents change over early lockdown during the COVID-19 pandemic in the UK? *JCPP Advances, 1*(1). https://doi.org/10.1111/jcv2.12009

Widnall, E., Winstone, L., Mars, B., Haworth, C., & Kidger, J. (2020). Young People's Mental Health during the COVID-19 Pandemic: Initial findings from a secondary school survey study in South West England (Issue August 24th). https://sphr.nihr.ac.uk/wp-content/uploads/2020/08/Young-Peoples-Mental-Health-during-the-COVID-19-Pandemic-Report-Final.pdf

Zimet, G. D., Dahlem, N. W., Zimet, S. G., & Farley, G. K. (1988). The Multidimensional Scale of Perceived Social Support. *Journal of Personality Assessment, 52*(1), 30–41. https://doi.org/10.1207/s15327752jpa5201_2

Tables

Table 1: Descriptives of all included variables at both waves

Variables	**T0 sample (n = 173)**			**T1 sample (n = 173)**		
	Mean (SD)	*Median*	*Range*	*Mean (SD)*	*Median*	*Range*
Age	14.2 (1.8)	14.0	11.0 - 18.0	16.0 (1.9)	16.0	13.0 - 20.0
Gender (%girls)	88.4			89.0		
Interpersonal skills (VPV)	69.4 (7.5)	69.0	53.0 - 90.0	-	-	-
Social support (T0: SSL-I-12; T1: MSPSS)	22.8 (6.0)	23.0	5.0 - 36.	59.7 (14.6)	60.0	12.0 - 84.0
Bullying	1.3 (1.3)	1.0	0.0 - 4.0	-	-	-
Trauma	6.3 (4.9)	5.0	0.0 - 19.0	-	-	-
COVID-19-related stressors	-	-	-	10.1 (2.6)	10.0	1.0 - 16.0
Posttraumatic growth	-	-	-	24.5 (9.3)	23.0	10.0 - 55.0
Resilience	-	-	-	62.9 (12.2)	64.0	17.0 - 85.0
Depression	1.0 (1.0)	0.7	0.0 - 3.50	1.2 (1.0)	0.8	0.0 - 4.0
Anxiety	1.0 (0.8)	0.8	0.0 - 3.3	0.9 (0.8)	0.6	0.0 - 3.3
Psychoticism	0.9 (0.8)	0.6	0.0 - 3.2	0.9 (0.9)	0.6	0.0 - 3.4
Psychopathology - total	1.0 (0.7)	0.9	0.0 - 3.4	1.0 (0.7)	0.8	0.0 - 2.9

Table 2: Descriptives of the included momentary (aggregated within-person) variables.

Variable	*T0 (n=168)*				*T1 (n=110)*			
	Available n	Mean (SD)	Median	Range	Available n	Mean (SD)	Median	Range
Number of completed ESM prompts (out of 60)	168	30.8 (12.7)	32.0	5 - 59	110	27.7 (16.2)	27.0	1 - 59
Quantity of face-to-face interactions^a	168	.73 (.17)	.72	.29 - 1.00	110	.44 (.25)	.42	0.00 - 1.00
Quantity of face-to-face family interactions^b	168	.33 (.17)	.34	.00 - .69	109	.60 (.29)	.67	0.00 - 1.00
Quantity of face-to-face peer interactions^b	168	.81 (.19)	.86	.25 - 1.00	109	.08 (.15)	.00	.00 - .80
Quantity of all online interactions^a	168	.26 (.24)	.19	.00 - 1.00	110	.44 (.27)	.39	.00 - 1.00
Quantity of online family interactions^c	-	-	-	-	106	.03 (.09)	.00	.00 - .80
Quantity of online peer interactions^c	-	-	-	-	106	.65 (.29)	.71	.00 - 1.00
Quality of all face-to-face interactions	168	5.89 (.87)	6.02	3.11 - 7.00	103	5.96 (1.15)	6.42	2.08 - 7.00
Quality of face-to-face	156	6.20 (.94)	6.51	2.67 - 7.00	101	5.94 (1.21)	6.33	1.00 - 7.00

family interactions								
Quality of face-to-face peer interactions	168	5.69 (1.03)	5.91	2.74 - 7.00	44	5.90 (1.49)	6.50	1.00 - 7.00
Quality of online interactions	144	6.03 (1.01)	6.26	2.00 - 7.00	106	5.77 (1.07)	6.00	1.00 - 7.00
Quality of online family interactions	-	-	-	-	17	5.84 (1.47)	6.22	1.00 - 7.00
Quality of online peer interactions	-	-	-	-	90	5.63 (1.49)	6.10	1.00 - 7.00

a. *As % of all compliant ESM prompts*

b. *As % of all offline interactions*

c. *As % of all online interactions*

Table 3: Linear regression analyses results, on the changes in psychopathology from T0 to T1. Significant p-values following Holm's multiple comparison correction are displayed in bold.

	Depression		**Anxiety**		**Psychoticism**		**Total score (GSI)**	
	β (SE)	*p*	*β (SE)*	*p*	*β (SE)*	*p*	*β (SE)*	*p*
T1 - T0 change)	-.66 (.57)	.25	-1.77 (.50)	<.001	-.51 (.43)	.24	-.21 (.07)	.003

Table 4: Two separate linear regression model results: first, predicting total psychopathology (GSI) during the COVID-19 pandemic from a set of contemporaneous risk factors; second, predicting GSI from T0 total psychopathology, and from a set of T0 risk factors. Significant p-values following Holm's multiple comparison correction are displayed in bold.

		T1 GSI	
		β (SE)	*p*
T1	Resilience	-.03 (.00)	<.001
	Social support	-.00 (.00)	.55
	Posttraumatic growth	.01 (.01)	.12
	COVID-19 stressors	.08 (.02)	<.001
T0	GSI	.54 (.08)	<.001
	Trauma	-.00 (.00)	.74
	Bullying	-.00 (.00)	.58
	Social support	-.00 (.01)	.39
	Interpersonal skills	.00 (.01)	.70

Table 5: Logistic multilevel regression results, indicating changes in the quantity of social interactions from T0 to T1.

	Quantity of Face-to-face interactions (overall)		**Quantity of Face-to-face interactions (peers)**		**Quantity of Face-to-face interactions (family members)**		**Quantity of Online interactions (overall)**	
	β (SE)	*p*	*β (SE)*	*p*	*β (SE)*	*p*	*β (SE)*	*p*
T1 - T0 change	-1.22 (.09)	<.001	-4.88 (.18)	<.001	1.45 (.09)	<.001	.74 (.12)	<.001

Table 6: Linear multilevel regression results, indicating changes in the quality of social interactions from T0 to T1.

	Quality of Face-to-face interactions (overall)		**Quality of Face-to-face interactions (peers)**		**Quality of Face-to-face interactions (family members)**		**Quality of Online interactions (overall)**	
	β (SE)	*p*	*β (SE)*	*p*	*β (SE)*	*p*	*β (SE)*	*p*
T1 - T0 change	.21 (.08)	.005	.41 (.14)	.004	-.09 (.08)	.23	-.15 (.09)	.09

Table 7: Multilevel logistic regressions indicating the associations between BSI total psychopathology and the quantity of social interactions, all as assessed at T1 (Model 1); and multilevel logistic regressions, predicting the quantity of different types of social interactions from time point (representing the difference pre- to early-pandemic), BSI (general psychopathology), the interaction between time point and BSI (indicating the difference in the relationship between BSI and social outcome T1 vs. T0), and the covariates of age and gender (Model 2)..

		Quantity of Face-to-face interactions (overall)		**Quantity of Face-to-face interactions (peers)**		**Quantity of Face-to-face interactions (family members)**		**Quantity of Online interactions (overall)**		**Quantity of Online interactions (peers)**		**Quantity of Online interactions (family members)**	
		β (SE)	*p*	*β (SE)*	*p*	*β (SE)*	*p*	*β (SE)*	*p*	*β (SE)*	*p*	*β (SE)*	*p*
Model 1	T1 GSI	-.35 (.15)	.018	-.05 (.30)	.86	-.42 (.19)	.026	.38 (.17)	.026	.11 (.22)	.62	.40 (.38)	.30
Model 2	T1 - T0 change	-1.35 (.13)	<.001	-5.59 (.23)	<.001	1.50 (.14)	<.001	.66 (.16)	<.001	-	-	-	-
	GSI	-.40 (.09)	<.001	-.17 (.16)	.29	-.37 (.10)	.001	.53 (.10)	<.001	-	-	-	-
	GSI * Change	.04 (.09)	.64	.58 (.16)	<.001	-.10 (.10)	.32	.14 (.10)	.15	-	-	-	-

Table 8: Multilevel linear regressions indicating the associations between BSI total psychopathology and the quality of social interactions, all as assessed at T1 (Model 1); and multilevel linear regressions, predicting the quality of different types of social interactions from time point (representing the difference pre- to early-pandemic), BSI (general psychopathology), the interaction between time point and BSI (indicating the difference in the relationship between BSI and social outcome pre- to early-pandemic), and the covariates of age and gender (Model 2).

		Quality of Face-to-face interactions (overall)		**Quality of Face-to-face interactions (peers)**		**Quality of Face-to-face interactions (family members)**		**Quality of Online interactions (overall)**		**Quality of Online interactions (peers)**		**Quality of Online interactions (family members)**	
		β (SE)	*p*	*β (SE)*	*p*	*β (SE)*	*p*	*β (SE)*	*p*	*β (SE)*	*p*	*β (SE)*	*p*
Model 1	T1 GSI	-.92 (.11)	<.001	-1.32 (.23)	<.001	-.92 (.13)	<.001	-.51 (.12)	<.001	-1.04 (.17)	<.001	-1.01 (.49)	.051
Model 2	T1 - T0 change	.28 (.10)	.004	.77 (.21)	<.001	.14 (.10)	.17	-.16 (.13)	.20	-	-	-	-
	GSI	-.65 (.08)	<.001	-1.15 (.16)	<.001	-.69 (.08)	<.001	-.36 (.08)	<.001	-	-	-	-
	GSI * Change	-.16 (.07)	.025	-.56 (.16)	<.001	-.32 (.07)	<.001	-.04 (.09)	.74	-	-	-	-