Change in Mental Health Symptoms During the COVID-19 Pandemic:

The Role of Appraisals and Daily Life Experiences

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Abstract

Intro: When confronted with major threats such as the COVID-19 pandemic, people often experience (temporary) decline in well-being. The central purpose of this study was to identify mechanisms underlying stability and change of well-being in times of threat like the COVID-19 pandemic. We examined change in mental health symptoms and its relationships with appraisals of the pandemic and daily life experiences during the pandemic, including affective states, stress, and mindfulness.

Methods: We conducted a study across 3.5 weeks, including pretest, posttest, and a diary phase in-between. In this report, we worked with a sample of 460 adults, pre- and post-test information, as well as a total of 7189 observations from the diary phase.

Results: Results showed that less fortunate change in mental health symptoms across three weeks was predicted by more negative affect and less mindfulness, specifically less attention to the present moment, in daily life. Furthermore, less fortunate change in mental health symptoms was correlated with change towards less fortunate appraisals of the appraisals. Finally, we showed that more general views of the pandemic (i.e., appraisals) were interrelated to experiences in daily life, with more negative appraisals of the pandemic predicting more negative affect and stressor occurrence as well as less mindfulness.

Discussion: These findings speak to the dynamic nature of well-being and appraisals in times of threat, and they show how experiences in daily life matter for change in well-being.

Change in Mental Health Symptoms During the COVID-19 Pandemic:

The Role of Appraisals and Daily Life Experiences

Since early 2020, people worldwide have been forced to deal with the consequences of the COVID-19 pandemic, including losses of lives, quarantines, lockdowns, cuts of income, and worries regarding one's own health or that of loved ones. Under such stressful circumstances, well-being may decline and distress and psychopathological symptoms may rise (e.g., Nelson et al., 2020; Qiu et al., 2020). However, previous research has shown that for many individuals, well-being trajectories are only mildly disturbed by major life events or bounce back after some disruption (e.g., during bereavement, Bonanno et al., 2005). For example, a considerable number of survivors of the 2003 severe acute respiratory syndrome (SARS) epidemic in Hong Kong showed stability in well-being or relatively fast recovery (Bonanno et al., 2008). Given the crucial question of who is psychologically more or less affected by the COVID-19 pandemic, and more generally, which mechanisms underly the stability of well-being in times of serious threat, this study examines change in mental health symptoms during the time of the lockdown in Germany, as well as several predictors of this change: stress appraisals and daily life experiences.

Specifically, we investigated how changes in mental health symptoms were associated with appraisals of the pandemic and, importantly, with certain experiences in daily life: negative affect, stressor occurrence, and stress-reactivity, as well as one potential coping mechanism, mindfulness. We expected that global appraisals of the pandemic account for changes in mental health symptoms and for everyday experiences during the pandemic. Furthermore, we expected that people's feelings and behaviors in daily life matter for how they get through the pandemic.

Appraisals of the Pandemic: Their Relevance for Change in Mental Health and Daily Life Experiences

More Distal Consequences of Appraisals

The COVID-19 pandemic has been a major threat that requiring adaptation in individuals around the globe. Given the well-established association between critical life events and the onset of stress-

related disorders (e.g., depression; Kendler et al., 1999), the COVID-19 pandemic poses a risk to well-being and mental health. Yet, according to a transactional understanding of stress (Lazarus & Folkman, 1984), whether and to which degree individuals experience stress and hence are at risk depends on social cognitive processes, commonly referred to as appraisals (see also Kalisch et al., 2015). Individual-environment transactions appraised as stressful are those that (1) are perceived as threatening, harmful, or challenging (primary appraisal) and (2) are perceived as taxing or exceeding an individual's resources and ability to control and cope with the situation (secondary appraisal; Lazarus & Folkman, 1984). Appraising events as a threat may lead to increases in negative emotions, such as anxiety (e.g., Laux et al., 1981), and thus decreases in well-being. Accordingly, appraising (even minor) events in everyday life as more stressful has been shown to be associated with increases in depressed mood over time (Felsten, 2004). In contrast, positive appraisals such as perceived control are proposed to help maintaining mental health (Kalisch et al., 2015). Supporting this claim, more positive appraisals of the consequences of the Corona crisis were just shown to be associated with higher well-being in a large sample across Europe (Veer et al., 2020).

Given this background, the first aim of this study was to examine whether appraisals of the pandemic predict change in mental health symptoms across three weeks and thus to take a process-oriented view on the psychological effects of the COVID-19 pandemic. We hypothesized that higher levels of primary appraisals, indicating threat and challenge and thus relatively more need for adjustment, would predict a stronger increase in negative mental health symptoms. Secondary appraisals in the form of perceived resources to control and cope with the situation, are expected to be related to attenuated increases in negative mental health symptoms.

Proximal Consequences of Appraisals

Next to these more distal consequences of appraisals (i.e., change in mental health symptoms), global appraisals of the pandemic might also have proximal consequences: They likely matter also for

feelings and behaviors in everyday life. Appraisals are social-cognitive processes that can be distinct and relatively stable across situations and are thus viewed as trait-like individual differences characteristics, next to their status as states in the stress coping process (Cervone, 2005). Importantly, appraisals become “activated within the individual in the continuous stream of interactions with situations” (Mischel, 2004) and therefore constantly shape individuals’ momentary actions. In this sense, appraisals are stable behavioral tendencies, and they correspond to specific, reoccurring feelings and behaviors in daily life.

In case of the COVID-19 pandemic, the everyday consequences of appraisals should be manifold. According to the transactional stress model, an imbalance of primary and secondary appraisals of the global situation (i.e., viewing the pandemic as a challenge and threat without confidence in the self and one’s control over the situation) should be associated with more negative affective experiences in daily life (e.g., Lazarus & Folkman, 1984). Supporting such reasoning, Schilling and Diehl (2014) found that stressors’ pile-up over the course of a week – which we think likely increased threat and challenge appraisals -- led to increases in negative affect above and beyond the effect of the concurrent stressor. Moreover, when experiencing threat and loss of control, negative events commonly not perceived as stressors might gain in relevance and then be perceived as such, and everyday stressful situations might appear more difficult to handle, which may result in higher stress reactivity. Supporting this notion, reduced levels of control and mastery beliefs (and, hence, lower secondary appraisals) were repeatedly found to be associated with higher stress reactivity (e.g., Neupert et al., 2007).

Besides these consequences on stress and affective well-being in daily life, we also targeted daily mindfulness. Mindfulness is referred to as an adaptive coping mechanism that may be particularly beneficial in times of threat and has been discussed as one central coping mechanism during the COVID-19 pandemic (Polizzi et al., 2020). Crucial to a mindful state is the regulation of attention to the present moment as well as the acceptance of present-moment experiences (Bishop et al., 2004; Blanke et al.,

2018). Mindfulness is related to well-being and health (e.g., Carpenter et al., 2019; Grossman et al., 2004) and it is associated with better affective well-being at the momentary level (Blanke et al., 2018). The experience of mindfulness may, however, be impaired during times of threat such as the COVID-19 pandemic. Specifically, appraising the pandemic as a threat and challenge may reduce the experience of mindfulness because these appraisals indicate a need for adjustment and action while lacking control over the situation. Worry and rumination may be the consequence instead of remaining in a mindful state (Blanke et al., 2019). Being able to have positive secondary appraisals of the pandemic, instead, should be positively related to mindfulness in daily life: A positive self-view in the sense of perceiving personal resources and feeling in control over the situation—common secondary appraisals—may be relevant for not judging one's actions and feelings and may allow to pay attention to the present moment.

Together, the second aim of this study was to examine the relationships between appraisals of the COVID-19 pandemic and daily life's experiences. We expected that higher levels of primary appraisals (high threat and challenge appraisals) predict lower levels of mindfulness in daily life, as well as enhanced negative affect, stressor occurrence, and stress reactivity (i.e., enhanced levels of negative affect on days when stressors occurred; Brose et al., 2011). More positive secondary appraisals instead should predict higher levels of mindfulness as well as reduced negative affect, stressor occurrence, and stress reactivity.

Experiences in Daily Life and Their Relevance for Changes in Mental Health Symptoms

Experiences in daily life, just described as an outcome of more global appraisals, may also be a predictor of changes in mental health symptoms during the COVID-19 pandemic. This idea is in accordance with recent theories on personality development, which emphasize the role of personality states or short-term processes such as experiences in daily life for changes in more stable dispositions (e.g., Geukes et al., 2018; Wrzus & Roberts, 2017). It is also in accordance with the proposition that

changes in well-being and the process of maladjustment have precursors in daily life (Nelson et al., 2017), and that “reinforcing loops between momentary states may alter the course of mental health towards either a more or less healthy state” (Wichers, 2014, p. 1). Empirical research has provided first support for these notions. For example, an increase in depressive symptoms could be prospectively predicted by the persistence of negative emotional states across time (Kuppens et al., 2010). Relatedly, stress reactivity in daily life was found to predict changes in affective distress, physical health, and mortality, years later (Charles et al., 2013; Mroczek et al., 2015; Piazza et al., 2013).

The third aim of this study was therefore to examine whether experiences in daily life during the pandemic-related lockdown predict longer-term changes in mental health during the course of the lockdown. We hypothesized that high levels of mindfulness and low levels of negative affect, stressor occurrence, and stress reactivity would be beneficial for mental health change during the pandemic.

The Present Study

We examined the effects of appraisals of the COVID-19 pandemic on change in mental health symptoms (Aim 1) and on affect, stress, and mindfulness in daily life (Aim 2). We also examined whether these experiences in daily life predict change in mental health symptoms (Aim 3). The hypotheses established above were approached with the Psychological Adjustment to the COVID-19 Pandemic (PACO) study (Neubauer et al., 2020, May 20). This online study combined a pretest-posttest design with a diary phase of 21 days in-between. Participants enrolled in the study between March 27th and May 2nd 2020. During this time, a lockdown all over Germany was in place during which citizens should only go outside for justified reasons (e.g., work) and only with not more than one other person and/or the core family. Schools, public buildings, and leisure places were closed, and employees were asked to work in home office, if possible. Given this background, our study design should be well-suited to examine change in mental health symptoms and establish relations between this change and everyday experiences.

Method

The central purpose of the PACO study was to examine how parents of school children adjusted to the restrictions imposed to prevent further spread of the Coronavirus. Therefore, study participants were selected in that only adults who lived in the same household with at least one child were included in the study (see below for further participants' characteristics). In this report, we only describe the measures relevant for the present work. Detailed information on the study and all study variables can be found here: https://osf.io/6gfrw/?view_only=394379785bd94091a60ff79b057246f1. The study was approved by the local Ethics committee.

Participants and Procedure

Study participants (inclusion criteria: parents of school children living in the same household) were invited via social media platforms, a press release by the authors' institution, e-mails to schools and members of parent-teacher associations, and word-of-mouth marketing. They provided informed consent to participate in the pretest of the study, and, if interested, also in the 21-day diary phase and posttest. Different numbers of participants participated in the different parts of the study. Essential for this report is that 460 participants (88% female, $M_{\text{age}}=42.9$, $SD_{\text{age}}=6.0$, range=25-63) provided complete ratings on all variables under analyses (pretest, posttest, and diary reports). Marital status of these participants was as follows: 67.8% married, 13.1% in a permanent relationship, 5.9% single, 11.5% separated / divorced, 1.7% widowed. Their employment status in March 2020 was reported to be full-time employed (34.4%), part-time employed (51.7%), unemployed (1.7%), housewife/ househusband (7.2%), or other (5.0%). Monthly net household income was reported to be >4000€ (50.9%), between 3000€ and 4000€ (19.3%), <3,000€ (22.8%), and 7% of the participants did not provide information on income.

The daily diary phase started within two days following the pretest. During this phase, participants received an e-mail at 7pm each day with a link to the questionnaire. They were asked to

provide answers before going to bed, and questionnaires could be accessed until 5am the next morning. On average, the sample of the current report completed 15.6 diary questionnaires (range 2-21). The total number of daily assessments was 7189 (compliance rate: 74.4%). On the first day after the diary phase, participants received an e-mail with a link to the posttest questionnaire. Participation in pretest as well as in diary and posttest combined was reimbursed with tickets to a lottery with vouchers and iPads as prizes. The more questionnaires participants answered during the daily diary phase, the more tickets to the lottery they got. Participation was voluntary and could be cancelled any time without giving reasons.

Measures

Pre-and Posttest Measures

Appraisals. To measure appraisals of the COVID-19 pandemic, we used the German questionnaire Primary Appraisal Secondary Appraisal (PASA; Gaab, 2009). The PASA consists of 16 items, with four items covering each of four subscales measuring threat (e.g., “I do not feel threatened by the situation”; reversely coded item), challenge (e.g., “The situation is important to me”), self-concept of own abilities (“In this situation, I know what I can do”), and control expectancy (e.g., “I am able to determine a great deal of what happens in this situation myself”). These dimensions can be further subsumed to primary and secondary appraisal. Primary appraisal refers to the perception of the situation (mean of threat and challenge) and secondary appraisal to the perceived resources (mean of self-concept and control). Items were answered on a 7-point scale ranging from 1 – not at all to 7 – very much. For analyses, we computed the mean for primary and secondary appraisals-items (reliability: $\alpha_{\text{primary}} = .80$; $\alpha_{\text{secondary}} = .80$).

Mental health symptoms. We used three indicators of mental health symptoms that are commonly examined as outcomes in research on critical life events and resilience (e.g., Helmreich et al., 2017), namely depressive symptoms, anxiety, and perceived stress. Depressive symptoms were

measured using the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977, German translation by Hautzinger, 1988), which consists of 20 items answered on a 4-point (from 0 = hardly or not at all, to 3 = most of the time, always). Anxiety was measured using the 20 items representing state anxiety from the State Trait Anxiety Inventory (STAI; Spielberger et al., 1970; German translation by Laux et al., 1981). STAI items were answered on a 4-point scale ranging from 1 – not at all to 4 – very much. Perceived stress was measured using the 10-item version of the Perceived Stress Scale (PSS; Cohen et al., 1983; German translation of the items as retrieved from Sheldon Cohen’s website, last retrieved on April 22, <https://www.cmu.edu/dietrich/psychology/stress-immunity-disease-lab/scales/index.html>). The PSS items were answered on a 7-point scale ranging from 1 – do not agree at all to 7 – agree completely. All distress scales referred to the time frame of the last week (STAI and PSS were adjusted accordingly). Each scales’ responses were averaged (reliability: $\alpha_{\text{CESD}} = .90$; $\alpha_{\text{STAI}} = .95$; $\alpha_{\text{PSS}} = .88$) and then used as indicators of the mental health factor in the analyses, implying that higher values on the mental health factors reflect worse mental health.

Daily Measures

Negative affect. Participants rated to what extent they had experienced four negative affective states that day (afraid, angry, sad, worried), using a 7-point scale ranging from 1 – *not at all* to 7 – *very*. The items were selected because they reflect different quadrants of the affect circumplex (Russel, 1980), and because they measure states of different affect content domains (Zevon & Tellegen, 1982). The average across items was used for analyses (reliability: $\omega_{\text{within}} = .68$; $\omega_{\text{between}} = .89$).

Mindfulness. Four items were adapted from the Multidimensional State Mindfulness Questionnaire (Blanke & Brose, 2017) to measure two facets of mindfulness, present-moment attention (e.g., “Today, I focused my attention on the present moment”) and nonjudgmental acceptance (e.g., “Today, I sometimes thought I could have acted more appropriately at certain times”). Items were rated on a 7-point scale ranging from 1 – *do not agree at all* to 7 – *agree completely* and averaged per facet

(reliability attention: $\alpha_{\text{within}} = .71$; $\text{corr}_{\text{between}} = .90$; reliability acceptance: $\alpha_{\text{within}} = .52$; $\text{corr}_{\text{between}} = .81$).

Stressor occurrence. Participants were asked to indicate whether any of 8 negative events had occurred that day (0 – *no*, 1 – *yes*). Based on previous work by Almeida et al. (2002) and Brose et al. (2011), the list of negative events included: argument or disagreement; negative event involving a friend or family member; negative health-related event; negative work-related event; negative event in the household; negative event during leisure time; negative event involving financial problems; any other negative event. We worked with a dichotomous variable, indicating whether any (combination) of the eight stressors had occurred (coded as 1) or not (coded as 0).

Stress reactivity. Stress reactivity was conceptualized as the difference in negative affect between days when stressors were reported versus when no stressors were reported. The variable reflecting participants' stress reactivity was derived from multilevel models (i.e., random effects of Level-1 slopes; please see the following section).

Statistical Analyses

Our hypotheses were tested using latent change score modeling (McArdle, 2009) and multilevel structural equation modeling (Muthén, 1994). Specifically, to examine whether appraisals of the COVID-19 pandemic predict change in mental health symptoms ([Aim 1](#)), we set up a latent change score model (LCSM; McArdle, 2009; Figure 1a), with depressive symptoms, anxiety, and perceived stress being indicators of the mental health factor. Prior to testing change in mental health symptoms, we tested for measurement invariance of mental health symptoms. We could establish strong measurement invariance across pre- and posttest (RMSEA = 0.055; CFI = 0.996; SRMR = 0.013), indicating that the same construct was measured across time (see Supplement S1 for all parameter estimates). To test the effects of appraisals on change in mental health symptoms, the latent change variable of the LCSM was then regressed on primary and secondary appraisals of the pandemic. Of note, the latent change

variable was also regressed on mental health symptoms at pretest, turning the model into a change regression model (McArdle, 2009). Moreover, appraisals were modeled to be correlated with mental health at pretest, and appraisals and mental health symptoms at pretest were centered around the means of these variables.

To examine whether appraisals of the pandemic predicted experiences in daily life (Aim 2), we used a multilevel structural equation model (ML-SEM). In this model, all daily life variables of interest were modeled simultaneously at Level 1, and their Level-2 components were regressed on primary and secondary appraisals (Figure 2a). In more detail, attention to the present moment and nonjudgmental acceptance (i.e., the two mindfulness facets) were simultaneously modeled as outcome variables of empty models at Level 1 (i.e., no predictors). Their Level-2 components, reflecting unobserved mean levels across time, were included as latent variables. Furthermore, we modeled the Level-1 association between stressors and negative affect, the latter being the outcome variable. This provides an average stress reactivity coefficient as well as a mean level (i.e., intercept) of negative affect, both included as latent variables at Level 2. We also modeled random variances of these four latent variables. All four latent variables, reflecting average levels of behaviors in daily life, were then regressed on primary and secondary appraisals. Of note, we worked with a person-mean centered stressor variable in this model, centered around person-specific proportions of days with stressors across observations. Furthermore, we included this Level-2 indicator of individual differences in stressor occurrence as an additional variable in the ML-SEM and also regressed it onto appraisals. Finally, we modelled correlations among the three outcome variables (NA, attention, and acceptance), and correlations between stressors and the two mindfulness facets at Level-1, and among all unobserved Level-2 variables and the proportion of stressor days. These correlations are not shown in Figure 1b.

The effects of experiences in daily life on changes in mental health symptoms (Aim 3) were modeled by integrating the LCSM and the ML-SEM (Figure 2b). That is, the LCSM of mental health

(described in the context of Aim 1) and the ML-SEM (described in the context of Aim 2) that provided Level-2 components of the variables measured in daily life, were now combined into one model. Importantly, the Level-2 components of the variables measured during the diary (attention, acceptance, negative affect, stress reactivity), and the Level-2 variable proportion of stressor days, were now modeled as predictors of change in mental health symptoms. Given the daily life variables' likely associations with pretest scores in mental health symptoms, we also modeled these correlations (i.e., the Level-2 components of the variables assessed in the diary were correlated with pretest mental health symptoms). Mental health symptoms at pretest as well as the Level-2 latent predictor variables were centered around their means.

All analyses were run using Mplus 8.3. To test our hypotheses, we used the conventional alpha level of .05 (two-tailed).

Results

Descriptive Statistics

Descriptive statistics on all study variables, including those that were used in follow-up analyses explained below, are reported in Table 1. Table 2 provides correlations among all study variables on the between-person level.

Appraisals as a Predictor of Change in Mental Health Symptoms (Aim 1)

A complete list of parameter estimates of the models referred to in this as well as the following sections can be found in supplements, S2 to S12; related data and Mplus codes are provided here:

https://osf.io/6gfrw/?view_only=394379785bd94091a60ff79b057246f1. The LCSM without any predictors (S2) was fitting well (RMSEA = 0.055; CFI = 0.996; SRMR = 0.013). It revealed that on average and when adjusting for mental health symptoms at pretest, mental health symptoms slightly decreased across time, $\Delta = -0.059$, $SE = 0.02$, $p = .004$. Importantly, individuals differed in change, as indicated by the significant variance of the latent change variable, $var_{\Delta} = 0.142$, $SE = 0.011$, $p < .001$. Next, we tested

whether appraisals predict between-person variation in change in mental health symptoms (Table 3; S3). Contrary to expectations, neither primary nor secondary appraisals predicted change, Δ on primary appraisals: $b = -0.013$, $p = .528$;

Δ on secondary appraisals: $b = -0.011$, $p = .597$.

Given there was some instability in appraisals across the three weeks (see Table 2), we followed up this analysis exploring whether change in appraisals from pre- to posttest was associated with change in mental health symptoms across this period. We did so by means of bivariate LCSMs, that is, by combining the LCSM of mental health symptoms described above with LCSMs of primary and secondary appraisals (see Figure 1b). Essentially, we were interested in whether the latent change factors were correlated. The result of the first model (Table 3; S4) revealed that a positive change in mental health symptoms (more mental health symptoms across time) was associated with positive change in primary appraisals (more threat and challenge appraisals across time)¹, $r = .372$, $p < .001$. The second model (Table 3; S5) revealed that more mental health symptoms across time were also associated with negative change in secondary appraisals (less positive appraisals of control and the self across time), $r = -.472$, $p < .001$.

Together, pretest appraisals did not predict change in mental health symptoms across the three weeks. Exploratory follow-up analyses showed, however, that a change towards less (more) fortunate appraisals across three weeks was associated with a change towards more (less) mental health symptoms across the same time.

Appraisals as a Predictor of Experiences in Daily Life (Aim 2)

Results are reported in Table 4 (see also S6). As expected, high levels of primary appraisals (threat and challenge appraisals) were associated with higher levels of negative affect and stressor

¹ We assumed the same level of measurement invariance for the appraisal factors as we did for the mental health factors (strong measurement invariance). Model fit indices for the two bivariate latent change models indicated good fit: CFI (primary appraisal / secondary appraisal) = .989 / .987, RMSEA = .055 / .060, SRMR = .026 / .030; the residual variance of one secondary appraisal indicator was fixed to 0.

occurrence in daily life, $b = 0.395$, $p < .001$, and $b = 0.055$, $p < .001$, respectively. Moreover, high primary appraisals were associated with lower levels of nonjudgmental acceptance, $b = -0.119$, $p = .015$. Primary appraisals were not statistically meaningfully related to attention to the present moment or stress reactivity. Also, as expected, secondary appraisals (control and self-concept) were associated with lower levels of negative affect, $b = -0.116$, $p = 0.011$, and with higher levels of attention to the present moment, $b = 0.198$, $p < .001$. Secondary appraisals were not statistically significantly related to nonjudgmental acceptance, stressor occurrence, or stress reactivity.

Experiences in Daily Life as Predictors of Change in Mental Health Symptoms (Aim 3)

Results are reported in Table 5 (see also S7 to S11). Given that all daily life measures were correlated, we first analyzed the relevance of each variable for change in mental health symptoms separately. Results of five models revealed the following effects: change was predicted by negative affect, $b = 0.273$, $p < .001$, stressor occurrence, $b = 0.294$, $p < .001$; attention to the present moment, $b = -0.107$, $p < .001$; nonjudgmental acceptance, $b = -0.113$, $p < .001$; but not stress reactivity, $b = 2.085$, $p = .158$. That is, four out of five daily life variables were related to change in well-being to a statistically significant extent, with effects being in the expected directions.

In the combined models including all daily life variables simultaneously (S12), two of these variables remained statistically significant predictors of change in well-being. High levels of attention to the present moment and low levels of negative affect in daily life were associated with more decline in mental health symptoms across the three weeks, $b = -0.069$, $p = .002$, and $b = 0.236$, $p < .001$, respectively. The other variables (i.e., nonjudgmental acceptance, stressor occurrence, and stress reactivity) did not uniquely predict change in mental health symptoms. That is, the daily life measures share predictive variance on change in mental health symptoms, to the degree that not all uniquely predicted change across the three weeks. This model also revealed significant correlations of daily life experiences with pretest mental health symptoms: Higher levels of mental health symptoms were

associated with lower levels of both mindfulness facets and higher levels of negative affect, stressor occurrence, and stress reactivity. Of note, the results of this model did not change when only using the first 14 days of the diary phase to predict change in well-being. The posttest measures of mental health symptoms referred to the symptoms throughout the last week. With the analysis of the first 14 days of the diary, the overlapping time in assessments was eliminated.

Discussion

This study adds to the quickly emerging findings on the psychological correlates of the COVID-19 crisis in various ways. It establishes links between appraisals of the pandemic and experiences in daily life, and it sheds light onto factors that are associated with more and less fortunate change in mental health symptoms across three weeks during lockdown imposed during the pandemic in Germany. Specifically, less fortunate appraisals at pretest (more threat and challenge appraisals, lower levels of perceived control and self-concept of own abilities) were related to more negative affect, more frequent stressor occurrence, and less mindfulness in daily life. Moreover, this study showed that these experiences in daily life, particularly high levels of negative affect and low levels of attention to the present moment, were related to relatively more mental health symptoms across three weeks during the COVID-19-related lockdown in Germany. In addition, exploratory analyses revealed that change in mental health symptoms (relatively more anxiety, depressive symptoms, and perceived stress across time) was also related to change in appraisals of the pandemic (higher threat and challenge appraisals, lower levels of perceived control and self-concept of own abilities across time). Together, these findings point at longer-term, within-person dynamics in aspects of well-being and stress during this threatening time, and they show how these longer-term dynamics are intertwined and related to experiences in daily life.

Appraisals and Change in Mental Health Symptoms

Findings on changes in well-being and psychological symptoms during the COVID-19 pandemic

are accumulating from different countries, some of which found increases in distress (e.g., Elmer et al., 2020; Twenge & Joiner, 2020), whereas others did not (e.g., Fried, 2020; Weinstein & Nguyen, 2020). While we found small decrease in mental health symptoms on average², our central interest pertained to individual differences in change in mental health symptoms across the study period. In accordance with theory and prior findings (e.g., Kalisch et al., 2015; Veer et al., 2020), we hypothesized that appraisals of the pandemic as stressful (higher primary appraisals) and difficult to handle (lower positive secondary appraisals) would be associated with increases in mental health symptoms. Other than expected, appraisals at pretest did not predict longer-term change in mental health symptoms across three weeks. However, appraisals were not stable across time, as indicated by the pretest–posttest correlation among appraisals. Possibly, some participants habituated to the new situation, which made them perceive the pandemic as less threatening and easier to cope with, while others became more worried. In exploratory follow-up analyses, we thus analyzed whether change in appraisals were associated with change in mental health symptoms and found that more negative appraisals across time (i.e., an increase in threat and challenge appraisals as well as a decrease in perceived control and lower self-concept of own abilities) were associated with less fortunate change in mental health symptoms. This indicates the dynamic nature of psychological well-being and stress appraisals during the COVID-19 crisis, and suggests that appraisals and well-being are dynamically linked. Of note, the direction of effects between change in appraisals and change in mental health symptoms is not clear in these follow-up analyses. Effects in both directions are plausible: Coping with fear of the crisis and regaining a sense of control might lead to a rehabilitation of well-being, just as experiencing a decrease in mental health symptoms could lead to changing appraisals of the pandemic and its consequences.

² This average decrease might have the following reasons. First, the consequences of the pandemic were less fatal in terms of deaths per 100K of the population than in other European countries (<https://coronavirus.jhu.edu/data/mortality>), which might have resulted in a relief of worst fears throughout the course of the study. Moreover, the study began after the anti-corona measures were already in place, and it might be that decrease in mental health symptoms occurred after some initial increase. Such a trajectory of initial increase and following decline was recently found by Buecker et al. (2020), who examined changes in loneliness during the first four weeks of the Covid-19 lockdown in Germany.

Appraisals and Experiences in Daily Life

As expected, primary and secondary appraisals of the COVID-19 pandemic at pretest were associated with experiences in daily life. In line with the hypotheses, higher primary appraisals (pertaining to threat and challenge) were associated with higher negative affect and more frequent stressor occurrence. Perceiving the pandemic as a threat may thus potentially have led individuals to perceive aspects of everyday life as stressors and/or as more negative. Additionally, higher primary appraisals were associated with lower nonjudgmental acceptance, but not with attention to the present moment. This result is in line with previous research suggesting that the nonjudgmental acceptance facet of mindfulness seems to be vital when it comes to dealing with negative experiences (Blanke et al., 2018). Supporting this notion, a recent study on perceived stress in students showed that higher nonjudgmental acceptance was correlated with higher threat appraisals in the context of academic education (Hoffmann & Geisler, 2020). This was not the case for present-moment attention (referred to as observing by Hoffmann & Geisler, 2020), which was only associated with lower threat appraisals when acceptance was high.

More positive secondary appraisals (pertaining to self-concept and control expectancy) were associated with lower negative affect and higher attention to the present moment, over and above the effects of primary appraisals. This may suggest that individuals who generally felt more capable to deal with the COVID-19 pandemic also felt more capable to cope with new challenges in daily life, which may have led to lower negative affect in turn. Similarly, feeling in control and able to cope may have enabled individuals to stay attentive in the present moment (without ruminating about the past or worrying about the future), potentially also paying attention to the more positive aspects of the present-moment experience (Blanke et al., 2018).

Together, these findings establish a link between global social-cognitive processes (appraisals) and experiences in daily life, specifically, the experience of stressors and negative affect, and

mindfulness. However, appraisals were not associated with stress reactivity (i.e., stressor-related negative affect). This unexpected result may be due to differing levels of specificity of appraisals and stress reactivity: appraisals were assessed specifically for the COVID-19 pandemic, while stress reactivity was assessed as participants' negative affect in response to everyday stressors.

Experiences in Daily Life and Change in Mental Health Symptoms

Experiences in daily life predicted change in mental health symptoms in accordance with our assumptions. The model with all predictors (Table 5) revealed that individuals with higher levels of negative affect across the diary phase also showed less favorable change in mental health symptoms. Moreover, higher present-moment attention was associated with stronger decrease in mental health symptoms. Stressor occurrence, stress reactivity, and nonjudgmental acceptance, instead, had no predictive effects on change in mental health above and beyond the other predictors. Of note, all daily life measures were associated with pretest levels of mental health symptoms, such that higher levels of symptoms were related to higher negative affect, stressor occurrence, and stress reactivity as well as lower levels of both mindfulness facets. When examined separately, all measures of daily life experiences except stress reactivity predicted change in mental health symptoms: more negative affect and stressor occurrence were associated with more health symptoms across time in mental health symptoms, and more attention to the present moment and nonjudgmental acceptance were associated with stronger decreases across time.

These findings highlight the interplay between daily life experiences and longer-term development—they are in accordance with the view that experiences in daily life are among the building blocks of the emergence of more stable individual differences (Wichers, 2014). Moreover, the findings indicate the interrelatedness among the daily life measures under investigation in this study, which is to be expected from prior research: negative affect was repeatedly shown to be enhanced in the context of stressors (e.g., Brose et al., 2011), and it is negatively associated with present-moment attention and

nonjudgmental acceptance, both at the trait (e.g., Schroevers & Bradsma, 2010) and state level (e.g., Blanke et al., 2018). It would be an exciting endeavor of future research to determine the processes by which negative affect, stressor occurrence, attention to the present moment, and nonjudgmental acceptance conjointly impact change in mental health symptoms. Effects among these variables are likely bidirectional, with lower mindfulness, for example, leading to higher negative affect and the other way around (e.g., Brockman et al., 2017). In the longer run, when some threat like the COVID-19 pandemic persists, the ties among variables may become stronger and well-being may decline, for example because the positive functions of mindfulness are suppressed in the ongoing presence of negative affect.

The reasons why negative affect and attention to the present moment were the only significant predictors of change in mental health symptoms in the joint analysis of daily life measures as predictors of change might be the following. Negative affect seems to be the most proximal correlate of mental health symptoms, operationally defined as depressive symptoms, anxiety, and perceived stress in this study. Moreover, nonjudgmental acceptance is more strongly related to negative affect than present-moment attention (e.g., Blanke et al., 2018), and its predictive validity might therefore be fully captured by negative affect and the other mindfulness facet, attention to the present moment. Moreover, attention to the present moment might have been a particularly important state during the lockdown for maintaining well-being as it indicates the ability to appreciate the (likely sometimes monotonous) moments during this time.

Limitations and Outlook

This study made use of a relatively large adult sample (with schoolchildren in their households), combined different types of data (global and daily reports), and applied timely methods to analyze this rich data. Still, it is not without limitations. First, we did not measure mental health symptoms before the pandemic, or directly at the moment of the lockdown, but shortly after that. The ideal study design

to get at changes in well-being would have started before the pandemic, and examined change in the well-being trajectory after onset of the pandemic. This would have allowed comparing levels of mental health symptoms before, during, and after the crisis and in relation to events during the crisis such as the lockdown. As a consequence, it remains unclear whether the crisis or lockdown have caused change, nor does one know at which stage in some adaptation process (e.g., reactivity, recovery, pile-up; see Smyth et al., 2018) study participants were during our study.

Second, this was a German convenience sample with relatively high levels of education and household income. It is possible that our participants were not as affected by the pandemic as individuals with a lower socio-economic status, who, beside stressors such as home schooling their children, may have experienced more severe economic strain and less comforting home environments during the lockdown. Our results may thus underestimate change in mental health symptoms in comparison to less WEIRD (Henrich et al., 2010) samples.

Third, we have only limited knowledge on the direction of the obtained effects. For example, less favorable appraisals at pretest predicted relatively more subsequent negative experiences in daily life (e.g., higher stressor exposure, less mindfulness). Yet, despite the temporal order of these variables, it is still possible that experiences in daily life have shaped appraisals at pretest to begin with. That is, it is possible that individuals with overall more stressful lives, who experienced more negative affect and less mindfulness in everyday life before the pandemic, also viewed the pandemic more negatively. More measurement occasions across longer time frames or using a measurement burst design (Nesselroade, 1991) would be needed, however, to get at such reciprocal effects.

Despite its limitations, our results point towards appraisals and experiences in daily life underlying longer-term changes in mental health symptoms. These results further strengthen the proposition that interventions targeting appraisals (e.g., Wang et al., 2020) and mindfulness (e.g., Polizzi et al., 2020) to reduce affective distress in daily life may help to alleviate the impact of crises such as

COVID-19 pandemic on mental health symptoms. Such interventions may be brief and mass-delivered at individuals' homes (Gruber et al., 2020). This is especially important given that many other behavioral interventions that improve well-being, such as engaging in social contact or taking part in enjoyable activities, are difficult to implement during lockdown and social distancing (Gruber et al., 2020).

Conclusion

This study provided evidence for the relevance of global appraisals of the COVID-19 pandemic for change in mental health symptoms and experiences in daily life. Besides, it established relations between change in mental health symptoms occurring on a longer time scale (i.e., weeks) with both, more stable social-cognitive variables (i.e., appraisals) as well as with experiences in daily life during the time of change (i.e., affective experiences, stress occurrence, and mindfulness). While having examined specific phenomena during a specific crisis, these findings are also noteworthy because they establish relations between processes occurring on different time scales: between psychological change occurring across weeks and psychological states emerging in daily life during the time of change. Recent theories on developmental change in more stable aspects of the person (e.g., traits; Geukes et al., 2018; well-being; Röcke & Brose, 2013) have emphasized these dependencies between states and change in traits, and our study can be viewed as a sample case of such emerging views.

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Table 1*Descriptive Statistics*

Variable	<i>M</i>	<i>SD</i>	Min	Max	Stability
<i>Pre- and posttest measures</i>					
anxiety pre	2.30	0.62	1	3.90	
anxiety post	2.22	0.61	1	4	0.72
depr sympt pre	1.78	0.50	1	3.75	
depr sympt post	1.75	0.49	1	3.75	0.72
Perceived stress pre	3.80	1.28	1	7	
Perceived stress post	3.72	1.26	1	7	0.62
pasa threat pre	4.59	1.49	1	7	
pasa threat post	4.27	1.49	1	7	0.70
pasa chall pre	5.87	0.90	3	7	
pasa chall post	5.79	1.03	2.25	7	0.56
pasa control pre	4.53	1.15	1.50	7	
pasa control post	4.62	1.25	1	7	0.60
pasa sc pre	4.56	1.27	1	7	
pasa sc post	4.75	1.23	1	7	0.59
pasa prim app pre	5.23	1.06	2.38	7	
pasa prim app post	5.03	1.11	1.75	7	0.68
pasa sec app pre	4.54	1.08	1.88	7	
pasa sec app post	4.69	1.11	1.38	7	0.63
<i>Diary measures</i>					
mean attention	5.32	0.97	1.31	7.00	
mean acceptance	5.69	1.02	1.77	7.00	
mean neg affect	2.48	1.01	1.00	6.69	
mean stressor occurrence	0.44	0.27	0.00	1.00	

Table 2*Correlations Among Study Variables*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
anxiety pre	.72	.86	.65	.81	.65	.55	.50	.40	.29	-.23	-.23	-.44	-.35	.55	.47	-.38	-.32	.62	.22	-.43	-.39
(1) anxiety po		.65	.86	.58	.81	.41	.51	.27	.32	-.20	-.31	-.36	-.49	.40	.49	-.32	-.44	.70	.28	-.43	-.43
(2) depr pre			.72	.78	.59	.48	.43	.31	.21	-.22	-.18	-.46	-.37	.47	.38	-.39	-.31	.64	.23	-.40	-.41
(3) depr po				.56	.78	.36	.43	.20	.25	-.13	-.26	-.36	-.47	.34	.41	-.28	-.41	.70	.29	-.43	-.45
(4) stress pre					.62	.47	.45	.38	.30	-.30	-.30	-.47	-.37	.49	.44	-.44	-.37	.54	.26	-.39	-.36
(5) stress po						.37	.50	.29	.36	-.23	-.35	-.38	-.50	.39	.51	-.35	-.48	.61	.34	-.41	-.40
(6) threat pre							.70	.56	.35	-.31	-.27	-.46	-.33	.94	.63	-.44	-.33	.49	.22	-.23	-.17
(7) threat po								.44	.52	-.31	-.37	-.40	-.45	.67	.92	-.40	-.46	.55	.28	-.23	-.22
(8) chall pre									.56	-.19	-.22	-.26	-.17	.82	.55	-.26	-.22	.30	.15	-.06	-.07
(9) chall po										-.16	-.25	-.21	-.29	.48	.82	-.21	-.30	.26	.22	-.06	-.06
(10)control pre											.59	.59	.44	-.30	-.28	.88	.57	-.15	-.04	.16	.04
(11)control po												.40	.61	-.28	-.37	.55	.90	-.24	-.16	.21	.05
(12)self-concept pre													.60	-.43	-.37	.90	.56	-.36	-.10	.30	.15
(13)self-concept po														-.30	-.44	.59	.90	-.38	-.14	.28	.18
(14)prim app pre															.68	-.41	-.33	.47	.22	-.19	-.15
(15)prim app po																-.37	-.45	.49	.29	-.18	-.18
(16)sec app pre																	.63	-.29	-.08	.26	.11
(17)sec app po																		-.34	-.16	.27	.13
(18)mean na																			.43	-.43	-.54
(19)mean stress																				-.18	-.36
(20)mean attent																					.35
(21)mean accept																					

Note. Correlations | > .08 | are significant ($p < .05$); pre = pretest, po = posttest, depr = depressive symptoms, stress = perceived stress, threat = threat appraisals, chall = challenge appraisals, control = control appraisals, self-concept = self-concept appraisals, prim / sec app = primary / secondary appraisals, na = negative affect, stress = proportion stressor days, attent = attention to present moment, accept = nonjudgmental acceptance.

Table 3*Primary and Secondary Appraisals Predicting Change in Mental Health Symptoms*

	Estimate	CI		p-value
LCSM, change reg. on appraisals				
intercept change mental health	-0.059	-0.098	-0.020	.004
variance change mental health	0.142	0.120	0.164	<.001
mental health (pretest) → change	-0.250	-0.332	-0.168	<.001
primary appraisals (pretest) → change	-0.014	-0.057	0.029	.528
secondary appraisals (pretest) → change	-0.011	-0.050	0.028	.597
Follow-up, bivariate LCSM, primary appraisals				
intercept change mental health	-0.060	-0.101	-0.019	.003
variance change mental health	0.143	0.121	0.165	<.001
intercept change primary appraisals	-0.133	-0.182	-0.084	<.001
variance primary appraisals	0.162	0.113	0.211	<.001
covariance between latent change factors	0.059	0.035	0.079	<.001
Follow-up, bivariate LCSM, secondary appraisals				
intercept change mental health	-0.058	-0.097	-0.019	.004
variance change mental health	0.14	0.118	0.162	<.001
intercept change secondary appraisals	0.187	0.087	0.287	<.001
variance secondary appraisals	0.759	0.608	0.910	<.001
covariance between latent change factors	0.154	0.115	0.193	<.001

Note. CI = confidence interval, reg. = regressed, LCSM = latent change score model, estimates are unstandardized coefficients.

Table 4*Effects of Appraisals on Daily Life Measures*

	Estimate	<i>CI</i>		<i>p</i> -value
Effects of primary appraisals on				
attention to the present moment	-0.086	-0.178	0.006	.067
nonjudgmental acceptance	-0.119	-0.215	-0.023	.015
negative affect	0.395	0.315	0.475	<.001
stressor occurrence	0.055	0.030	0.081	<.001
stress reactivity	0.048	-0.011	0.107	.102
Effects of secondary appraisals on				
attention to the present moment	0.198	0.118	0.278	<.001
nonjudgmental acceptance	0.062	-0.030	0.154	.181
negative affect	-0.116	-0.206	-0.026	.011
stressor occurrence	0.003	-0.023	0.029	.844
stress reactivity	-0.028	-0.083	0.027	.301

Note. *SE* = standard error; effects were obtained with multilevel structural equation models in which three daily life measures (attention to the present moment, nonjudgmental acceptance, and negative affect) were estimated means across the diary phase, stress reactivity was the estimated within-person association between stressors and negative affect, and stressor occurrence was the computed proportion of stressor days across the diary phase; estimates are unstandardized coefficients.

Table 5*Effects of Daily Life Measures on Change in Mental Health Symptoms*

	Estimate	CI		p-value
Residualized change				
change mental health	-0.065	-0.112	-0.018	.005
variance change mental health	0.099	0.079	0.119	<.001
mental health (pretest) → change	-0.617	-0.717	-0.517	<.001
Daily life reg. on change mental health				
attention to the present moment → change	-0.069	-0.112	-0.026	.002
nonjudgmental acceptance → change	-0.031	-0.076	0.014	.171
negative affect → change	0.236	0.177	0.295	<.001
stressor occurrence → change	-0.019	-0.168	0.130	.802
stress reactivity → change	0.117	-0.081	0.315	.244

Note. CI = confidence interval, reg. = regressed, LCSM = latent change score model.

Figures 1a and 1b

Schematic Latent Change Score Model (LCSM) in Which Appraisals Affect Change in Mental Health

Symptoms (a) and Schematic Bivariate LCSM in Which Change in Appraisals are Correlated with Change in Mental Health Symptoms (b)

Note. Figure 1a: appraisal refer to both, primary and secondary appraisals as indicated by the averages across threat and challenge items (primary appraisals) and the averages across self-concept and control items (secondary appraisals); Figure 1b: appraisals refer to either primary appraisals, with indicators being the averages across threat (app1) and challenge items (app2), or secondary appraisals, with indicators being the averages across self-concept (app1) or control (app2) items; Δ = change, CESD = Center of Epidemiological Studies Depression Scale, STAI = State Trait Anxiety Inventory, PSS = Perceived Stress Scale.

Figures 2a and 2b

Schematic Multilevel Structural Equation Model in Which Appraisals Predict Daily Life Experiences:

Affect, Stressor Occurrence, Stress Reactivity and Mindfulness (a) and Schematic Latent Change Score

Model in Which Experiences in Daily Life Predict Change in Mental Health Symptoms (b)

Note. Figure 2a: appraisals refer to both, primary and secondary appraisals as indicated by the averages across threat and challenge items (primary appraisals) and the averages across self-concept and control items (secondary appraisals); *M* = estimated means, NA = negative affect; circles at Level-1 denote the estimation of corresponding Level-2 variables: means of negative affect (NA), nonjudgmental acceptance (acceptance / accept), attention to the present moment (attention / attent), as well as stress reactivity (react); Δ = change, CESD = Center of Epidemiological Studies Depression Scale, STAI = State Trait Anxiety Inventory, PSS = Perceived Stress Scale; note that additional correlations among variables were estimated but not drawn in figures for simplicity.