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Emotional responses to a global stressor: Average patterns and individual differences

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Abstract

Major stressors often challenge emotional well-being—increasing negative emotions and decreasing positive emotions. But how long do these emotional hits last? Prior theory and research contain conflicting views. Some research suggests that most individuals' emotional well-being will return to, or even surpass, baseline levels relatively quickly. Others have challenged this view, arguing that this type of resilient response is uncommon. The present research provides a strong test of resilience theory by examining emotional trajectories over the first 6 months of the COVID-19 pandemic. In two pre-registered longitudinal studies (total N =1147), we examined average emotional trajectories and predictors of individual differences in emotional trajectories across 13 waves of data from February through September 2020. The pandemic had immediate detrimental effects on average emotional well-being. Across the next 6 months, average negative emotions returned to baseline levels with the greatest improvements occurring almost immediately. Yet, positive emotions remained depleted relative to baseline levels, illustrating the limits of typical resilience. Individuals differed substantially around these average emotional trajectories and these individual differences were predicted by socio-demographic characteristics and stressor exposure. We discuss theoretical implications of these findings that we hope will contribute to more nuanced approaches to studying, understanding, and improving emotional well-being following major stressors.

Keywords
COVID-19, emotional well-being, individual differences, resilience, stress

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Major stressors often challenge individuals' emotional well-being—increasing negative emotions and decreasing positive emotions. If these emotional hits are short-lived, they are unlikely to cause lasting harm. However, sustained periods of high negative emotion and low positive emotion are likely to harm health, putting individuals at risk for mental health problems and physical illness (for reviews, see Boehm, 2018; Kring & Bachorowski, 1999). This leads to the question: is fast and complete emotional recovery following a major stressor the exception or the norm? Some resilience theorists suggest that adaptation is nearly universal, arguing that the most common outcome following major stressors is a stable trajectory of healthy functioning (Bonanno et al., 2011). However, findings supporting this view depend heavily on data analytic decisions and stringent statistical assumptions (e.g., how variance is modeled within and across resilience trajectories) (Infurna & Luthar, 2016, 2018), leaving open questions about average emotional responses to major stressors. Regardless of the average response, there are likely substantial individual differences in how people's emotions respond following major stressors. For example, some individuals may demonstrate resilience, with many others experiencing sustained periods of high negative emotions and low positive emotions.

The present research provides a strong test of resilience theory in the context of a global stressor—the COVID-19 pandemic—using an approach that can answer questions about both average emotional trajectories and individual differences in emotional trajectories. To investigate average emotional responses to this global stressor, we examined change in emotions at the onset of the pandemic and how quickly and completely emotions recovered across 6 months. To investigate individual differences in emotional responses, we examined socio-demographic characteristics (e.g., gender, age, racial and ethnic identity) and exposure to specific stressors (e.g., financial stress, frontline worker status) as predictors of

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individual differences in emotional trajectories. Before presenting findings from this research, we first review relevant theory and research.

Average responses to stress

Although negative emotions in response to stress are common and even functional (Harper et al., 2020; Keltner & Gross, 1999), the severity and persistence of negative emotions have important consequences for psychological and physical well-being (Almeida, 2005; Leger et al., 2018). Similarly, although stress tends to reduce positive emotions (Folkman, 1997), maintaining positive emotions can serve as a vital buffer against the harmful effects of stress (Fredrickson et al., 2008; Ong et al., 2006). Sustained high levels of negative emotion and low levels of positive emotion are central features of mood disorders, such as depression (Brown et al., 1998), with links between these emotion levels and worse physical health outcomes (Boehm, 2018; Chida & Steptoe, 2008; Cross et al., 2018), including susceptibility to viruses and respiratory illness (Cohen, 2020; Cohen et al., 2006). In sum, although emotional responses to stress are common, the ability to return to baseline levels following stress has implications for psychological and physical health.

The ability of emotions to recover following stress can be conceptualized as a form of resilience—that is, the capacity to maintain health and well-being (Bonanno, 2004) or to bounce back and recover fully (Masten, 2001; Rutter, 1987) in the face of adversity (Zautra et al., 2008). The concept of resilience originated in developmental literature, following the observation that some children adjusted unexpectedly well despite experiencing significant adversity (see Luthar, 2006 for a review). In the past 20 years, resilience in adults has been investigated in the context of bereavement (Bonanno et al., 2005), major life events such as divorce and job loss (e.g., Bonanno et al., 2011), physical disease (e.g., Johnston et al., 2015), and traumatic events such as terrorist attacks and natural disasters (Bonanno et al., 2006; Reich, 2006). Resilience has been observed in response to many different types of stressful events, but also for various kinds of health and well-being outcomes, including emotional well-being. Much of this prior research suggests that resilience following major stressors is common (e.g., Bonanno et al., 2011); however, this finding has been shown to depend heavily on data analytic decisions (Infurna & Luthar, 2016, 2018), highlighting the need for additional research on average responses to stress.

Individual differences in responses to stress

Regardless of average responses to stress, most research indicates that individuals differ in their responses to stress. For example, research shows substantial individual differences in the degree and rate of change in well-being following major life events (Fujita & Diener, 2005; Lucas et al., 2003). Identifying predictors of these individual differences can inform who is in greatest need of societal support, as well as the specific risk and protective factors that may be useful targets of interventions to promote emotional well-being. Research on such risk and protective factors suggests that responses to stress are multiply determined by a combination of person-level and societal-level factors (Bonanno, 2004; Hart et al., 2016; Zautra et al., 2008). Here, we focus on socio-demographic and stressor exposure predictors of emotional responses, rather than individual-level factors such as personality and emotion regulation. Given the broad scope of the COVID-19 pandemic, we believe that the former set of factors affords the greatest opportunity to increase support for the most impacted groups and to reduce the most impactful stressor exposures to promote resilience on a large scale.

Regarding socio-demographic predictors of resilience, prior research has found that men, older adults, and higher social class individuals are more likely to demonstrate resilient responses to stress (Bonanno et al., 2007, 2011). Meta-analytic estimates suggest that these characteristics are protective factors for post-traumatic stress disorder following loss and trauma (Brewin et al., 2000). Consistent with these meta-analytic findings, these same socio-demographic characteristics predicted resilience (i.e., few or no symptoms of psychopathology) in New Yorkers following the 9/11 terrorist attacks (Bonanno et al., 2007) and Floridians following the 2004 Florida hurricanes (Acierno et al., 2006). Gender and age are also associated with mood disorder prevalence more generally (Christensen et al., 1999; Girgus & Yang, 2015) and may predispose individuals to lower emotional well-being in response to stressful events. Additionally, social class may influence whether individuals have the resources necessary to respond to major stressors, and in turn, maintain emotional well-being (Murrell & Norris, 1983). In the context of the COVID-19 pandemic, racial and ethnic identity and political affiliation may also impact resilience, given the disproportionate impact of COVID-19 on racial and ethnic minority individuals and communities (Millett et al., 2020; Tessler et al., 2020) and different responses to the pandemic across political parties (Collins et al., 2020).

In addition to socio-demographic factors, the specific types of stressors that individuals experience may play an important role in emotional responses to the broader stressor. People who experience the same major stressor can be exposed to that stressor in different ways, and these different types of stressor exposure may influence emotional well-being. For example, resilience was relatively more common in individuals who witnessed the 9/11 terrorist attacks relative to individuals physically injured in the 9/11 attacks (Bonanno et al., 2006). In sum, a combination of socio-demographic factors and aspects of exposure to stressful experiences are likely to influence emotional responses to major stressors in general and to the COVID-19 pandemic in particular.

Empirical evidence in the context of the COVID-19 pandemic

Given the widespread and potentially severe nature of stress associated with the COVID-19 pandemic, concerns about the mental health consequences of the pandemic have been prevalent in the media (e.g., Carey, 2020), scientific research (e.g., Brooks et al., 2020), and in reports from global organizations such as the United Nations (e.g., United Nations, 2020). Consistent with these concerns, initial

declines in mental health and emotional well-being were observed at the beginning of the pandemic (Twenge & Joiner, 2020; Xiong et al., 2020). Initial evidence suggests older adults, men, and employed individuals tended to report better mental health during the COVID-19 pandemic compared to other groups (Xiong et al., 2020). These socio-demographic patterns mirror prior work conducted outside of the COVID-19 context, suggesting that in addition to providing a strong test of resilience theory, patterns of emotional well-being observed in responses to the COVID-19 pandemic may be broadly generalizable to other stressful contexts.

Longitudinal evidence for how emotional well-being has changed across time during the COVID-19 pandemic has produced somewhat mixed results. For example, one study found that subjective well-being (i.e., life satisfaction, positive emotions, and low negative emotions) decreased from March to May 2020 in a German sample (Zacher & Rudolph, 2021). However, initial reports from a large-scale longitudinal study spanning multiple countries suggest that "distress" was lower 3 months into the pandemic compared to the beginning of the pandemic (Slatcher, 2020). These findings may be explained by differences in the samples used and outcomes assessed, but they may also be due to differences in initial emotional responses to the pandemic relative to patterns of recovery across time. To distinguish between initial changes in emotional well-being and rates of decline or recovery across time, it is necessary to compare negative and positive emotions *before* the pandemic (i.e., baseline levels) to negative and positive emotions *during* the pandemic across multiple timepoints spanning at least several months.

The present research

The present research addressed two aims: (1) To examine average emotional responses to a global stressor and (2) to examine individual differences in emotional responses to a global stressor. We pre-registered our research questions and analytic strategy but we did not make specific hypotheses.

The COVID-19 pandemic has several unique characteristics that make it a powerful context in which to test these aims. First, because the pandemic is a severe and chronic stressor experienced by everyone, we can address currently unanswered questions about how people respond to major stressors without confounding factors related to who is exposed to the stressor. Most prior research on resilience could not be conducted within a general population, because inclusion criteria require participants to have experienced a specific stressor that is not shared by the general population (e.g., military service, disease diagnosis, bereavement). Second, although everyone experienced the pandemic in some way, individuals differed in their relative exposure to health threats, financial loss, changes to daily routines, and COVID-19–related restrictions, allowing us to test whether different types of stressor exposure predict different emotional responses.

To increase the generalizability of our findings, we investigated both aims in two large U.S. samples that were diverse with respect to age, gender, racial and ethnic identity, and political affiliation. To address Aim 1, we examined negative and positive emotions in February 2020 prior to the World Health Organization (WHO) declaring COVID-19 a pandemic and from March to September 2020 across the first 6 months of the WHO-declared pandemic. We focus on the WHO-declared onset of the pandemic because this coincided with when widespread outbreaks and lockdowns began in the U.S. (where data were collected). To gain a better understanding of how the pandemic impacted emotions, we examined both emotions *in general* and emotions *about COVID-19*. Whereas the majority of prior research on resilience has examined a single outcome (see Infurna & Luthar, 2018 for review), the four outcomes included in the present study cover a broader conceptual space, including aspects of positive functioning (i.e., positive emotions) and negative functioning (i.e., negative emotions), as well as responses to the stressor (i.e., emotions *about COVID-19*) and more general indices of well-being (i.e., emotions *in general*).

To address Aim 1, we conceptualized average emotional responses to stress in three ways: First, how substantially were emotions impacted at the onset of the WHO-declared pandemic (from February to March 2020) on average? Second, did emotional well-being increase or decrease on average across the first 6 months of the WHO-declared pandemic (March to September), and to what extent? Third, how did emotions 6 months into the WHO-declared pandemic (September) compare to emotions at baseline (February) on average?

To address Aim 2, we examined the degree of individual differences in emotional responses and predictors of those individual differences. We adopted a continuous and descriptive approach to quantifying individual differences in emotional responses, rather than categorizing individuals as "resilient" or "not resilient." The results of such categorical approaches are heavily dependent on specific data analytics decisions and do not take into account important nuances in individuals' responses to stressors (Infurna & Luthar, 2016). For example, individuals may experience relatively faster or slower rates of recovery across time or may experience resilience for one outcome (e.g., negative emotions), but not for another outcome (e.g., positive emotions) (Hart et al., 2016; Infurna & Luthar, 2018). Next, we examined socio-demographic characteristics (i.e., gender, age, social class, racial and ethnic identity, and political affiliation) and the experience of specific stressors (i.e., financial stress, frontline worker status, loss of childcare, COVID-19–related restrictions) as predictors of individual differences in emotional responses. Together, findings from the present research will address debates about whether resilience is the exception or the norm and will inform interventions to improve emotional well-being in the face of exposure to major stressors.

Method

Participants

Two different U.S. samples of participants (Sample A and Sample B) were recruited from Amazon's Mechanical Turk: Sample A was recruited to be diverse with respect to racial

and ethnic identity and Sample B was recruited to be diverse with respect to political affiliation. The goal of our sampling strategy was to have large enough subgroups of particular sociocultural variables so that we could feasibly examine these variables as predictors of individual differences in emotional responses. For example, the larger proportion of participants identifying as African or African American in Sample A—an understudied population in psychology research (Roberts et al., 2020) and a racial group that has borne a disproportionate impact of the COVID-19 pandemic (Millett et al., 2020)—allowed us to examine emotional responses among African and African American individuals.

We took several steps to ensure data quality. First, participants were required to have a 95% approval rating and to have completed at least 100 HITs on the Mechanical Turk platform. Second, two attention checks were included at Time 1 and participants who failed either attention check (N = 134 in Sample A; N = 94 in Sample B) were excluded and were not invited to continue in the study. Third, data were excluded from subsequent timepoints with one or more failed attention check (N = 7–71 across timepoints). Two attention checks were included at each monthly timepoint and one attention check was included at each weekly timepoint, with the exception of T1a (which had none). Multiple types of attention checks were included: (1) instructing participants to select a specific response option and (2) a multiple-choice question about the purpose of the study. Third, the second author reviewed all open-ended responses (collected for purposes outside the scope of the present research) to confirm data quality.

Sample A included 742 participants. Participants with at least one measurement occasion of emotion *after Time 1* were included in analyses (*N*=710) and ranged from 18 to 75 years old (M = 36.9, *SD* = 11.2) and were 53.1% women, 43.7 men, 0.7% nonbinary, with 2.5% not reporting gender; 29.7% African or African American, 22.2% East Asian or East Asian American, 33.7% European American/White/Caucasian, 11.8% other racial or ethnic identities, with 2.5% not reporting their racial and ethnic identity; and 50.0% Democrats, 15.5% Republicans, 30 % Independents, 2% other political affiliation, with 2.5% not reporting their political affiliation. Participants rated their subjective social class relative to people in the United States using the MacArthur ladder (Adler et al., 2000). Response options ranged from 1 (lowest social class) to 10 (highest social class) with a mean of 5.0 (SD = 1.7). Sample size was based on an a priori goal to recruit at least 200 people from three different racial and ethnic backgrounds, which was met.

Sample B was a new sample of 842 participants. Participants with at least one measurement occasion of emotion *after Time 1* were included in analyses (*N*=546) and ranged from 20 to 81 years old (M = 43.2, *SD* = 13.2) and were 50.4% women, 49.1 men, 0.4% nonbinary, with 0.2% not reporting gender; 83.0% European American/White/Caucasian, 16.8% other racial and ethnic identities, with 0.2% not reporting their racial or ethnic identity; and 50.5% Democrats, 49.3% Republicans, with 0.2% not reporting their political affiliation. Participants rated their subjective social class relative to people in the United States using the MacArthur ladder (Adler et al., 2000). Response options ranged from 1 (lowest social class) to 10 (highest social class) with a mean of 5.2 (SD = 1.6). Sample size was based on an a priori goal to recruit at least 300 people from the two dominant U.S. political parties, which was met.

Procedure

The present research is part of a large, ongoing longitudinal study aimed at understanding how psychosocial factors influence individuals' responses to the COVID-19 pandemic. Figure 1 displays the temporal sequencing of each wave of data collection, including when emotions were assessed in Sample A and B. Data from the first 13 waves of data collection are included in the present study. At Time 1 (i.e., T1) (mid-February to early March), participants were invited to complete a 15-minute survey about current events and health. Sample A completed T1 between February 25 and March 4. Sample B completed T1 between February 14 and February 21. Participants were compensated $2 for their time and were told that they could earn a bonus by participating in additional follow-up surveys. Participants who passed attention checks at T1 were invited to participate in future waves of the study. Participants were invited to complete longer monthly surveys in late March, late April, late May, late June, late July, and late August (T2, T3, T4, T5, T6, T7) and shorter weekly surveys in March (T1a, T1b, and T1c) and April (T2a, T2b, and T2c). Participants in Sample B did not complete T1a, T1b, or T1c. The longer monthly surveys ranged from ∼30 to 35 minutes, with participants compensated between $4.50 and $5.00 for their time, depending on survey length. The shorter weekly surveys ranged from ∼1 minute to ∼20 minutes, with participants compensated between $0.25 and $3.50 for their time, depending on survey length (effective median hourly rate ∼ $9 USD). All procedures complied with APA ethical standards and were approved by the research ethics board at the University of Toronto (protocol #33962).

Type 1 and Type 2 error control

Due to the large number of tests (18 primary tests in each sample in Aim 1 and 180 primary tests in each sample in Aim 2), we aimed to balance Type 1 and Type 2 error rates. If we used an uncorrected alpha level of .05, we would expect approximately 20 false positive findings, making it difficult to differentiate true effects from false positives. At the same time, we also wanted to limit the number of false negatives, given the risks associated with missing important risk and protective factors. To address both issues, we preregistered that we would use False Discovery Rate (FDR) correction to interpret statistical significance (Benjamini & Liu, 1999). FDR correction compares the largest *p* value to the set alpha level (i.e., .05) and then compares each descending *p* value to an increasingly smaller alpha level. FDR correction applies a less stringent Type 1 (false positive) control than family-wise error controls (such as Bonferroni corrections) by limiting the total number of Type 1 errors relative to significant effects, rather than limiting the probability of at least one Type 1 error. We selected the critical *p* value from each test (e.g., the effect of

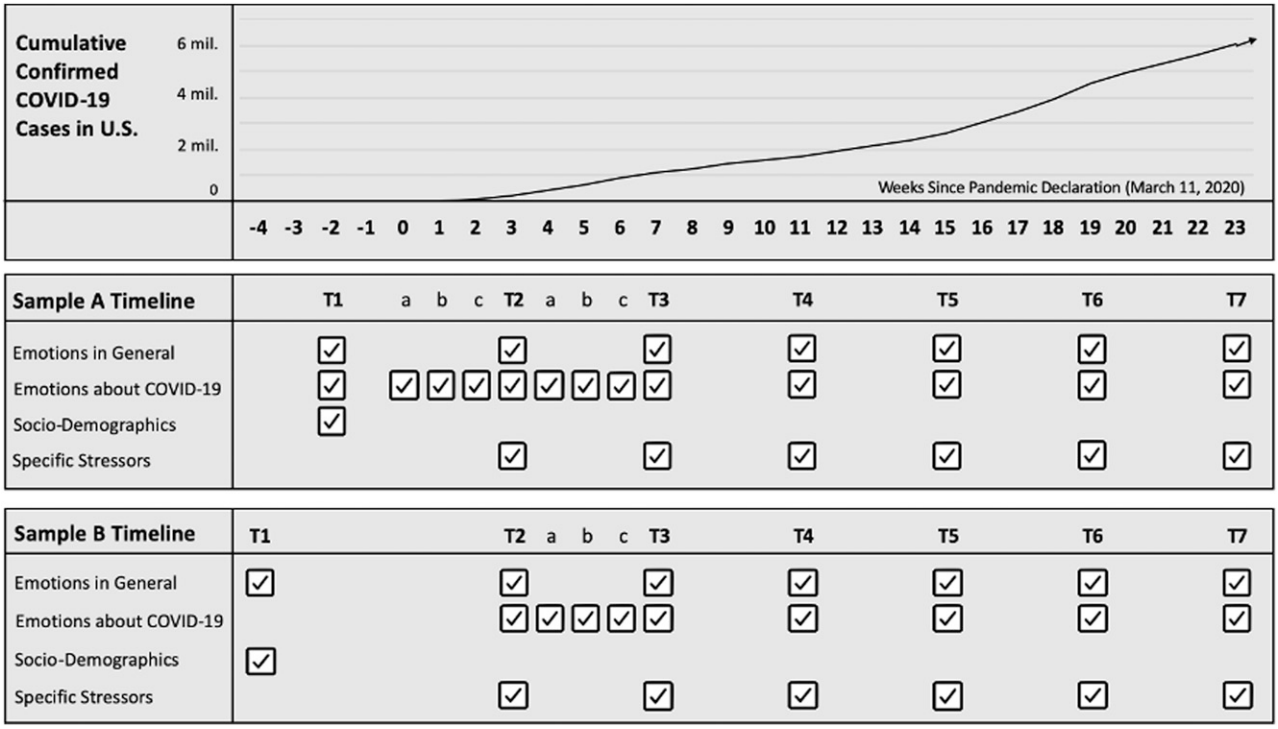

Figure 1. Broader COVID-19 Context and Study Measurement Summary.

time squared in quadratic models; the interaction term in moderation models) and applied FDR correction to the 18 *p* values within each sample in Aim 1 and the 180 *p* values within each sample in Aim 2. The *p* values from sensitivity analyses were not included in the correction procedure. In addition, we report uncorrected *p* values and 95% confidence intervals for all results. Effects that do not reach statistical significance but have uncorrected *p* values under the traditional alpha level of .05 (95% CIs that do not contain 0) are considered suggestive and warrant further study.

Measures

Emotions. In both samples, we assessed emotions *in general* at each monthly timepoint (T1 to T7). In Sample A, we assessed emotions *about COVID-19* at each monthly timepoint (T1 to T7) and each weekly timepoint (T1a, T1b, T1c, T2a, T2b, T2c). Sample B was originally recruited for a different study and thus did not receive COVID-19 related questions until T2. Thus, in Sample B, we assessed emotions *about COVID-19* at each monthly and weekly timepoint beginning at T2 (T2, T2a, T2b, T2c, T3, T4, T5, T6, T7). To assess emotions *in general*, participants responded to the prompt, "To what extent have you felt the following emotions during the past 4 weeks?"[1] To assess emotions *about COVID-19,* participants responded to the prompt, "In the past day or two, to what extent have you felt these emotions when thinking about the outbreak?" Response options ranged from 0 ("Not at all") to 6 ("Extremely").[2]

We assessed up to 24 emotion items at each timepoint for emotions *in general* and emotions *about COVID-19* but focused on the items that were assessed at all available timepoints.[3] To assess negative emotions, we used the six item triplets and one single-item emotion: "worried, nervous, fearful," "angry, frustrated, annoyed," "sad, downhearted, unhappy," "disgust, distaste, revulsion," "despair, hopelessness, sorrow," "ashamed, humiliated, embarrassed," and "morally outraged" (alpha = .86 - .91). To assess positive emotions, we used two item triplets and one item couplet: "hopeful, optimistic, encouraged," "glad, happy, joyful," and "amused, entertained" (alpha = .75 - .87). Descriptive statistics are displayed in Table 1.

Time. Discrete time was modeled in weeks, with 1 week between each weekly timepoint and 4 weeks between each monthly timepoint. Time was grand-mean-centered, so intercepts reflect average levels of emotion at the study midpoint. Time squared was computed by squaring the centered time variable.

Socio-demographics characteristics. Participants reported their gender, age,[4] social class, racial and ethnic identity, and political affiliation at baseline (T1). To assess social class, we used the MacArthur ladder (Adler et al., 2000); participants responded to the prompt "Think of this ladder as representing where people stand in the United States...Please select the number associated with the rung where you think you stand at this time in your life, relative to other people in the United States." Response options ranged from 1 (lowest social class) to 10 (highest social class).

To assess racial and ethnic identity, participants responded to the question, "What ethnicity do you identify with most?" Response options were: African or African American, East Asian or East Asian American, South Asian

Table 1. Descriptive statistics of outcome variables.

	Positive Emotions *in general* Mean *(SD)*	Positive Emotions *about COVID-19* Mean *(SD)*	Negative Emotions *in general* Mean *(SD)*	Negative Emotions *about COVID-19* Mean *(SD)*
Time 1	3.46 (*1.33*)/3.68 (*1.26*)	1.12 (*1.19*)/–	1.88 (*1.36*)/1.44 (*1.09*)	2.11 (*1.39*)/–
Time 1a	–	1.27 (*1.22*)/–	–	2.30 (*1.36*)/–
Time 1b	–	1.52 (*1.32*)/–	–	2.32 (*1.35*)/–
Time 1c	–	1.61 (*1.33*)/–	–	2.36 (*1.38*)/–
Time 2	2.36 (*1.40*)/2.76 (*1.31*)	1.81 (*1.42*)/2.06 (*1.40*)	2.21 (*1.32*)/2.16 (*1.24*)	2.15 (*1.40*)/2.13 (*1.36*)
Time 2a	–	1.98 (*1.44*)/2.23 (*1.48*)	–	1.93 (*1.31*)/1.93 (*1.36*)
Time 2b	–	2.15 (*1.47*)/2.36 (*1.41*)	–	1.77 (*1.32*)/1.73 (*1.30*)
Time 2c	–	2.11 (*1.52*)/2.35 (*1.50*)	–	1.80 (*1.35*)/1.71 (*1.31*)
Time 3	2.53 (*1.42*)/2.85 (*1.32*)	2.18 (*1.50*)/2.45 (*1.52*)	1.90 (*1.31*)/1.77 (*1.26*)	1.75 (*1.39*)/1.64 (*1.38*)
Time 4	2.74 (*1.39*)/2.94 (*1.32*)	2.30 (*1.59*)/2.48 (*1.58*)	1.89 (*1.36*)/1.79 (*1.34*)	1.74 (*1.46*)/1.72 (*1.43*)
Time 5	2.77 (*1.42*)/2.95 (*1.35*)	2.04 (*1.59*)/2.17 (*1.64*)	1.88 (*1.37*)/1.86 (*1.27*)	1.96 (*1.45*)/1.91 (*1.44*)
Time 6	2.80 (*1.34*)/3.07 (*1.32*)	2.06 (*1.60*)/2.28 (*1.61*)	1.89 (*1.37*)/1.76 (*1.25*)	1.98 (*1.50*)/1.81 (*1.39*)
Time 7	2.82 (*1.36*)/3.02 (*1.32*)	2.14 (*1.64*)/2.42 (*1.60*)	1.82 (*1.39*)/1.76 (*1.24*)	1.81 (*1.48*)/1.71 (*1.38*)

Note. SD = standard deviation. Sample A/Sample B.

Table 2. Descriptive statistics of stressor exposure variables.

	Financial Stress %	Frontline Worker %	Lost Childcare %	Shelter-in-Place Order %	Restrictions Sum (0-6) M/SD
Time 2	39.6/40.6	7.4/8.5	9.0/10.7	–/–	–/–
Time 3	43.5/44.0	7.1/8.9	11.2/11.4	82.8/–	3.8 (1.2)/–
Time 4	40.6/41.4	5.6/8.1	12.2/12.3	48.9/–	3.3 (1.4)/–
Time 5	37.6/36.5	6.1/8.5	10.1/13.0	21.4/15.7	2.8 (1.3)/2.7 (1.3)
Time 6	37.3/39.0	7.8/9.1	10.9/9.1	20.9/14.8	3.0 (1.3)/2.9 (1.2)
Time 7	38.4/38.5	6.9/11.4	10.5/9.9	19.6/14.1	3.0 (1.3)/2.9 (1.2)

Note. Sample A/Sample B.

or South Asian American, European American/White/Caucasian, Middle Eastern American, Latino/Hispanic/Mexican American, and Native American. A limitation of this measurement approach is that the survey question only asked about ethnicity and not race; however, because the response options include both racial and ethnic identities, we refer to this construct as racial and ethnic identity throughout. We compared the three largest racial and ethnic groups in Sample A (African or African American, East Asian or East Asian American, and European American/White/Caucasian). Because Sample B was predominately White (83%), we compared participants of color to White participants. This approach is not ideal as it cannot account for racial and ethnic diversity among participants of color, but we did not have sufficient statistical power to compare specific racial and ethnic identities in Sample B.

To assess political affiliation, participants responded to the question "With which political party do you identify?" Responses options were: Republican, Democrat, Independent, and Other. Independents and other political affiliation were combined for political affiliation analyses in Sample A. Sample B included only Republicans and Democrats. Descriptive statistics for socio-demographic characteristics are reported in the Participants section.

Stressor exposure. Descriptive statistics for stressor exposure variables are reported in Table 2. We assessed whether or not participants experienced three types of stressors (i.e., frontline worker status, financial stress, and loss of childcare) at T2, T3, T4, T5, T6, and T7. Each stressor was considered as a binary time-varying predictor. To assess financial stress, participants endorsed or did not endorse four items: "My wages or work hours were reduced," "The wages or work hours of another member of my household were reduced," "I lost my job," and "a member of my household lost their job." Participants who endorsed at least one of the four items were considered to have experienced financial stress. To assess frontline worker status, participants endorsed or did not endorse the item "For my current job, I interact with people who may be sick with the coronavirus." To assess whether or not people lost childcare, participants endorsed or did not endorse the item "I lost the childcare I typically use for my children (e.g., daycare, school, etc.)"

In addition, during the peer review process, reviewers highlighted the importance of considering aspects of the local pandemic context as potential predictors. Thus, we included an additional aspect of the pandemic experience, which was not pre-registered: local and state pandemic-related restrictions. Participants responded to the question "What restrictions are you currently being asked to follow by your local or state officials?" and selected from the following list: shelter-in-place, self-isolate after travel, wear face masks in public, avoid non-essential travel, physical distance in public, and "other." To avoid introducing too many additional statistical tests, we focused on the shelter-

in-place item specifically, as well as a sum score of all six restrictions. Restrictions were assessed at T3, T4, T5, T6, and T7 in Sample A and T5, T6, and T7 in Sample B and were treated as time-varying predictors.

Analytic strategy

We report unstandardized effect sizes and 95% confidence intervals (CIs) for all growth curve models. 95% CIs that do not contain 0 will be interpreted as suggestive. However, due to the large number of tests, we used False Discovery Rate (FDR) correction to interpret statistical significance (see **Type 1 and Type 2 Error Control** above for more detail).

Average emotional trajectories and individual differences in emotional trajectories. To examine the pandemic's immediate impact on emotions, we used paired sample t-tests to compare emotions prior to the onset of the WHO-declared pandemic (February) to emotions after the onset of the WHO-declared pandemic (March). Specifically, for emotions *about COVID-19*, we compared February (T1) to mid-March (T1a). For emotions *in general* (which were not assessed in the weekly timepoints), we compared February (T1) to late March (T2).[5]

To examine the trajectory of emotions across the first 6 months of the WHO-declared pandemic, we modeled trajectories of emotions from mid to late March (T1a/T2) to early September (T7). To examine average linear trajectories, we used random-intercept, random-slope multilevel models predicting emotions from linear time. Discrete time was modeled in weeks, and both random[6] and fixed effects were included for time. The inclusion of a random intercept allowed participants to vary in their average level of emotion. The inclusion of a random effect of time allowed participants to vary in the trajectory of their emotions across time. Next, quadratic growth models were fit to assess nonlinear change. We squared the mean-centered time-metric and included time and time squared in each model. Results of sensitivity analyses adjusting for baseline emotions are displayed in Supplementary Tables S3 and S4.

Predictors of individual differences in levels of emotional well-being. To investigate predictors of average *levels* of emotional well-being across the first 6 months of the pandemic, we used a series of random-intercept multilevel models predicting emotion from each predictor variable. Each predictor was dummy-coded (for categorical predictors) or z-scored (for continuous predictors) and modeled in a separate multilevel model. We tested the effects of five socio-demographic characteristics (gender, age, social class, racial and ethnic identity, and political affiliation) and five specific stressors (frontline worker status, loss of childcare, financial stress, shelter-in-place order, and local- and state-mandated restrictions). In sensitivity analyses, we adjusted for baseline levels of emotions by including T1 emotions as a predictor in each model.

Predictors of individual differences in change in emotional well-being. To examine predictors of *change* in emotional well-being across the first 6 months of the pandemic, we modeled a separate random-intercept, random-slope multilevel model predicting emotion from the focal predictor,[7] the time variable(s), and interaction(s) between the focal predictor and the time variable(s) (i.e., slopes-as-outcomes models). Each predictor was dummy-coded (for categorical predictors) or z-scored (for continuous predictors) and modeled in a separate multilevel model. Discrete time was modeled in weeks and both random and fixed effects of time were included. We tested both linear and quadratic time models for all predictors. In sensitivity analyses, we adjusted for baseline levels of emotions by including T1 emotions as a predictor in each model.

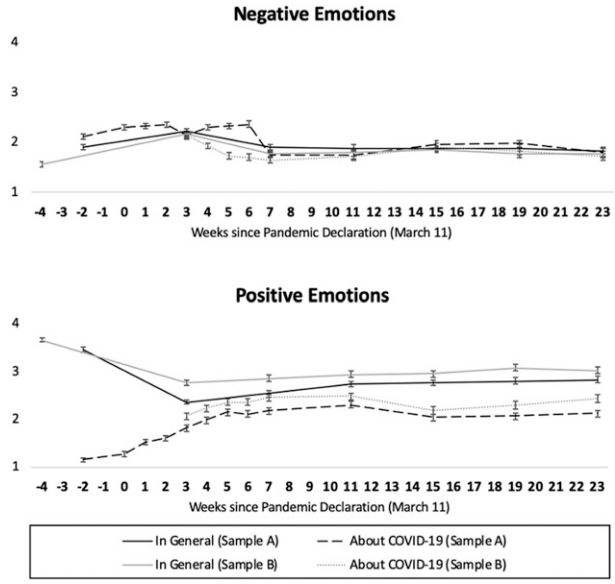

Figure 2. Observed average trajectories of negative and positive emotions. The y axis for emotions is truncated (i.e., emotions ranged from 0-6 rather than 1-4). Observed means and standard errors at each timepoint are plotted. We plotted observed rather than model-estimated trajectories so that we could show all timepoints (including baseline which was not included in the trajectory models in primary analyses and was included as a covariate in sensitivity analyses).

Transparency and openness

Analyses were conducted in R version 4.0.4 and the nlme, effsize, and psych packages (Pinheiro et al., 2021; Revelle, 2021; Torchiano, 2020). This study is part of a larger study that included additional measures not reported here. However, we reported all measures used to address the present research question in the Measures section, consistent with our pre-registered analytic plan. We report how sample size was determined as well as all data exclusions. We report descriptive statistics, effect sizes, exact *p* values, and 95% confidence intervals for all results.

Results

Average emotional trajectories

Figure 2 displays observed emotional trajectories. from mid-February through early September 2020. Model fit

Table 3. Quadratic growth curve models predicting emotions from March through September, 2020.

	Negative Emotions							
	Sample A (N=669)				Sample B (N=544)			
Emotions in general	b	95% CI	SE	*p*	b	95% CI	SE	*p*
intercept	1.921	1.821, 2.021	0.051	<.001	1.849	1.744, 1.955	0.054	<.001
time	−0.012	−0.016, −0.008	0.002	<.001	−0.011	−0.016, −0.006	0.003	<.001
time^2	0.001	0.001, 0.002	0.000	**< .001**	0.001	0.000, 0.002	0.000	**.004**
Random effects	Var	Corr			Var	Corr		
Intercept	1.471	Intercept	Time		1.336	Intercept	Time	
Time	0.001	0.260			0.002	0.162		
Time2	0.000	−0.266	−0.623		0.000	−0.378	−0.630	
Residual	0.387				0.337			
Emotions about COVID-19	Sample A (N=709)				Sample B (N=546)			
	b	95% CI	SE	*p*	b	95% CI	SE	*p*
intercept	2.000	1.910, 2.092	0.047	<.001	1.783	1.675, 1.891	0.055	<.001
time	−0.028	−0.034, −0.023	0.003	<.001	−0.009	−0.014, −0.005	0.002	<.001
time^2	0.002	0.001, 0.002	0.000	**< .001**	0.002	0.001, 0.002	0.000	**< .001**
Random effects	Var	Corr			Var	Corr		
Intercept	1.338	Intercept	Time		1.441	Intercept	Time	
Time	0.002	0.148			0.000	0.226		
Time2	0.000	−0.250	−0.615		0.000	−0.285	−0.857	
Residual	0.616				0.513			
	Positive Emotions							
Emotions in general	Sample A (N=669)				Sample B (N=544)			
	b	95% CI	SE	*p*	b	95% CI	SE	*p*
intercept	2.788	2.686, 2.890	0.052	<.001	2.954	2.845, 3.063	0.056	<.001
time	0.023	0.018, 0.028	0.002	<.001	0.014	0.009, 0.019	0.003	<.001
time^2	−0.002	−0.002, −0.001	0.000	**< .001**	−0.001	−0.002, −0.000	0.000	.039
Random effects	Var	Corr			Var	Corr		
Intercept	1.497	Intercept	Time		1.408	Intercept	Time	
Time	0.001	0.055			0.001	0.199		
Time2	0.000	−0.367	−0.668		0.000	−0.329	−0.709	
Residual	0.445				0.387			
Emotions about COVID-19	Sample A (N=710)				Sample B (N=546)			
	b	95% CI	SE	*p*	b	95% CI	SE	*p*
intercept	2.223	2.118, 2.329	0.054	<.001	2.370	2.250, 2.491	0.062	<.001
time	0.056	0.049, 0.063	0.004	<.001	0.010	0.003, 0.017	0.003	.003
time^2	−0.005	−0.005, −0.004	0.000	**< .001**	−0.001	−0.002, −0.001	0.000	**.001**
Random effects	Var	Corr			Var	Corr		
Intercept	1.778	Intercept	Time		1.762	Intercept	Time	
Time	0.005	0.590			0.002	0.398		
Time2	0.000	−0.604	−0.798		0.000	−0.518	−0.741	
Residual	0.684				0.695			

Note. Uncorrected *p* values are shown. The critical *p* value from each model (i.e., the time^2 parameter) was also subjected to FDR correction; critical *p* values that remained statistically significant after FDR correction are bolded. b = unstandardized coefficient. CI = confidence interval. SE = standard error. Var = variance. Corr = correlation.

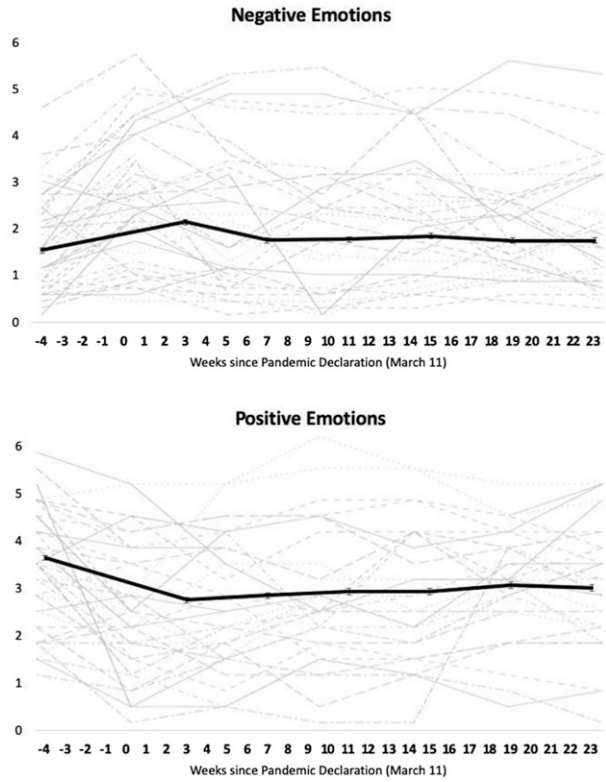

Figure 3. Individual differences in emotional trajectories. Each grey line depicts the observed trajectory of emotions *in general* for an individual participant. Trajectories are shown for a randomly selected 10% of participants in Sample B. The bold black line depicts the observed trajectory of emotions *in general* for all participants in Sample B. We plotted observed rather than model-estimated trajectories so that we could show all timepoints (including baseline which was not included in the trajectory models in primary analyses and was included as a covariate in sensitivity analyses).

statistics and likelihood ratio tests comparing the linear and quadratic models can be found in Supplementary Table S1. Table 3 displays results from growth curve models predicting emotions from time and time^2. Supplementary Table S2 displays linear models, without the inclusion of a time^2 parameter. We considered an effect to replicate if it was statistically significant ($p < .05$ *after* FDR correction) in one sample and either statistically significant ($p < .05$ *after* FDR correction) or suggestive ($p < .05$ *before* FDR correction) in the other sample.

Negative emotions. Negative emotions *in general* increased at the onset of the WHO-declared pandemic relative to pre-pandemic levels (Sample A: $t(570) = 7.59$, $p < .001$, $d = 0.28$; Sample B: $t(531) = 15.18$, $p < .001$, $d = 0.62$; medium to large effects; Funder & Ozer, 2019). Negative emotions *about COVID-19* also increased slightly at the onset of the pandemic, but to a lesser extent than negative emotions *in general* (baseline assessed in Sample A only: $t(498) = 3.49$, $p < .001$, $d = 0.13$; small effect; Funder & Ozer, 2019). Across the first 6 months of the WHO-declared pandemic, negative emotions *in general* followed a quadratic trajectory, first decreasing and then stabilizing near baseline levels. Negative emotions *about COVID-19* followed a similar quadratic trajectory as negative emotions *in general*, first decreasing and then stabilizing below baseline levels.

Positive emotions. Positive emotions *in general* decreased at the onset of the WHO-declared pandemic relative to pre-pandemic levels (Sample A: $t(570) = 19.14$, $p < .001$, $d = 0.79$; Sample B: $t(531) = 17.81$, $p < .001$, $d = 0.72$; large effects; Funder & Ozer, 2019). In contrast, positive emotions *about COVID-19* increased at the onset of the pandemic (baseline assessed in Sample A only: $t(498) = 5.05$, $p < .001$, $d = 0.20$; small effect; Funder & Ozer, 2019). Across the first 6 months of the WHO-declared pandemic, positive emotions *in general* followed a quadratic trajectory, first increasing and then plateauing, but never returning to baseline levels. Positive emotions *in general* remained 0.40 standard deviations below baseline levels in Sample A and 0.54 standard deviations below baseline levels in Sample B at the end of the 6-month period (i.e., approximately two-thirds of a scale point on a 7-point scale). Positive emotions *about COVID-19* followed a similar quadratic trajectory as positive emotions *in general*, first increasing and then stabilizing.

Individual differences in emotional trajectories

Figure 3 illustrates the wide range of individual differences in average *levels* of emotional well-being (i.e., emotions *in general*) and in *change* in emotional well-being across 6 months. The range of individual differences in average *levels* of emotion can be seen in the spread of individual trajectories across the y axis. Specifically, individuals' negative and positive emotion levels spanned the full 0–6 range. The range of individual differences in emotion *change* can be seen by the varying slopes of the individual emotional trajectories. Some individuals' emotions were relatively stable across the 6 months, but other individuals' emotions—both negative and positive—decreased or increased to varying degrees.

Predictors of individual differences in emotion

levels. We display the results of all models predicting individuals' average levels of negative emotions across available measurement points in Table 4 and average levels of positive emotions in Table 5. Results of sensitivity analyses adjusting for baseline emotions are displayed in Supplementary Table S6 and S7. We only describe effects that were statistically significant in at least one sample in the text. In Sample A, racial and ethnic identity and political affiliation had more than 2 categories. Only the p value for the family-wise ANOVA is shown in the tables. Parameter estimates for each pairwise comparison are described in text for statistically significant effects.

To approximate standardized effect sizes in text, we used t-to-r transformation (Page-Gould et al., 2019); rs between 0.10 and 0.19 were considered small; rs between 0.20 and 0.29 were considered medium, and rs of .30 and larger were considered large (Funder & Ozer, 2019).

Table 4. Predictors of individual differences in levels of negative emotions.

	Negative Emotions in General							
	Sample A				Sample B			
	b	SE	95% CI	p	b	SE	95% CI	p
Demographics								
Women	0.309	0.096	0.121, 0.497	**.001**	0.315	0.098	0.123, 0.507	**.001**
Age	−0.131	0.047	−0.224, −0.039	**.006**	−0.236	0.048	−0.330, −0.141	**<.001**
Social class	−0.068	0.048	−0.162, 0.026	.155	−0.131	0.049	−0.227, −0.034	.008
Racial and Ethnic Identity	–	–	–	.628	−0.143	0.209	−0.552, 0.267	.494
Political Party	–	–	–	**.003**	0.483	0.096	0.294, 0.672	**< .001**
Stressor Exposure								
Financial Stress	0.073	0.044	−0.014, 0.160	.099	0.013	0.045	−0.075, 0.101	.772
Frontline Workers	0.102	0.075	−0.044, 0.249	.171	−0.082	0.059	−0.198, 0.035	.170
Lost Childcare	−0.131	0.074	−0.276, 0.014	.077	0.030	0.070	−0.108, 0.168	.668
Shelter-in-place	0.005	0.034	−0.061, 0.072	.873	0.079	0.082	−0.081, 0.239	.334
Restrictions Sum	−0.001	0.014	−0.029, 0.027	.960	0.034	0.024	−0.013, 0.082	.155
	Negative Emotions about COVID-19							
	Sample A				Sample B			
	b	SE	95% CI	p	b	SE	95% CI	p
Demographics								
Women	0.271	0.089	0.097, 0.446	**.002**	0.370	0.101	0.171, 0.569	**< .001**
Age	−0.131	0.044	−0.218, −0.045	**.003**	−0.238	0.050	−0.337, −0.139	**< .001**
Social Class	−0.013	0.044	−0.100, 0.074	.765	−0.171	0.051	−0.270, −0.071	**< .001**
Racial and Ethnic Identity	–	–	–	.389	−0.153	0.218	−0.581, 0.274	.482
Political Party	–	–	–	**< .001**	0.585	0.099	0.390, 0.780	**< .001**
Stressor Exposure								
Financial Stress	0.152	0.055	0.044, 0.260	**.006**	0.080	0.054	−0.026, 0.186	.140
Frontline Workers	0.196	0.095	0.010, 0.382	.039	0.140	0.073	−0.004, 0.283	.056
Lost Childcare	−0.035	0.091	−0.214, 0.144	.702	0.030	0.086	−0.138, 0.198	.728
Shelter-in-place	0.152	0.046	0.061, 0.242	**.001**	0.243	0.109	0.029, 0.456	.026
Restrictions Sum	0.051	0.019	0.013, 0.088	**.008**	0.009	0.032	−0.053, 0.072	.771

Note. Uncorrected *p* values are shown. The critical *p* value from each model (i.e., the effect of the predictor) was also subjected to FDR correction; critical *p* values that remained statistically significant after FDR correction are bolded. In Sample A, racial and ethnic identity and political affiliation had more than 2 levels. Only the *p* value for the family-wise ANOVA is shown; – is shown for the b value because these models have a separate parameter estimate for each level of the predictor. Results of pairwise comparisons are described in text for statistically significant effects. In Sample B, racial and ethnic identity was coded such that 0 = Participants of color and 1 = White participants. In Sample B, political affiliation was coded such that 0 = Republican and 1 = Democrat. b = unstandardized coefficient. SE = standard error. CI = confidence interval.

Negative emotions. Men, older adults, and Republicans tended to report lower levels of negative emotions *in general* and lower levels of negative emotions *about COVID-19* in both samples. Individuals living under shelter-in-place orders tended to report higher levels of negative emotions *about COVID-19* in Sample A (and the effect was suggestive in Sample B). In Sample A only, individuals who experienced financial stressors and who were living under more COVID-19–related restrictions also tended to report higher levels of negative emotions *about COVID-19*.

Effect sizes for gender were small for both types of negative emotion and in both samples, .12–.15. Effect sizes for age ranged from small for both types of negative emotion in Sample A, .11, to medium for both types of negative emotion in Sample B, .20–.21. Effect sizes for political affiliation ranged from small in Sample A, .09–.11, to medium in Sample B, 0.21–.23. Effect sizes for shelter-in-place orders were very small in both samples, .08–.09. The effect size for financial stress, .06, and the effect size for restrictions, .06, were very small in Sample A.

When adjusting for baseline levels, the effects of gender, political affiliation, and shelter-in-place orders remained statistically significant, but the effect of age was no longer statistically significant. When adjusting for baseline emotions, the effects of financial stress and restrictions in Sample A were suggestive. These results suggest that the effects of gender, political affiliation, shelter-in-place orders, and possibly restrictions and financial stress were unique to the stressful context experienced throughout the study period. In contrast, the effect of age could be attributable to pre-existing differences in negative emotions rather than to the stressful context specifically.

Positive emotions. Individuals who identified as higher social class and individuals who did not experience financial stressors tended to report higher levels of positive emotions *in general* in both samples. Effect sizes ranged from small to medium for social class across samples, .18–.24, and were

Table 5. Predictors of individual differences in levels of positive emotions.

	Positive Emotions in General							
	Sample A				Sample B			
	b	SE	95% CI	p	b	SE	95% CI	p
Demographics								
Women	−0.300	0.098	−0.492, −0.109	**.002**	−0.111	0.102	−0.311, 0.089	.276
Age	−0.008	0.048	−0.103, 0.086	.861	0.038	0.051	−0.062, 0.138	.455
Social class	0.227	0.048	0.133, 0.321	**< .001**	0.288	0.049	0.190, 0.385	**< .001**
Racial and Ethnic Identity	–	–	–	**< .001**	0.306	0.215	−0.116, 0.729	.155
Political Party	–	–	–	.078	−0.531	0.099	−0.726, −0.337	**< .001**
Stressor Exposure								
Financial Stress	−0.102	0.048	−0.196, −0.008	.033	−0.161	0.047	−0.253, −0.068	**< .001**
Frontline Workers	0.010	0.081	−0.149, 0.170	.899	−0.010	0.063	−0.133, 0.113	.876
Lost Childcare	0.156	0.080	−0.001, 0.313	.052	0.00	0.074	−0.145, 0.146	.996
Shelter-in-place	−0.203	0.036	−0.275, −0.132	**< .001**	−0.015	0.087	−0.186, 0.156	.864
Restrictions Sum Score	−0.047	0.015	−0.077, −0.017	**.002**	−0.001	0.026	−0.052, 0.049	.959
	Positive Emotions about COVID-19							
	Sample A				Sample B			
	b	SE	CI	p	b	SE	CI	p
Demographics								
Women	−0.388	0.091	−0.566, −0.210	**< .001**	−0.366	0.109	−0.580, −0.152	**< .001**
Age	−0.068	0.045	−0.157, 0.021	.135	−0.038	0.055	−0.146, 0.070	.489
Social Class	0.260	0.045	0.172, 0.348	**< .001**	0.317	0.053	0.212, 0.421	**< .001**
Racial and Ethnic Identity	–	–	–	**< .001**	0.303	0.233	−0.154, 0.760	.193
Political Party	–	–	–	.013	−0.549	0.107	−0.760, −0.339	**< .001**
Stressor Exposure								
Financial Stress	−0.069	0.057	−0.182, 0.043	.226	−0.097	0.061	−0.216, 0.022	.108
Frontline Workers	−0.041	0.098	−0.233, 0.151	.675	0.094	0.082	−0.067, 0.255	.252
Lost Childcare	0.243	0.096	0.056, 0.431	.011	0.089	0.095	−0.097, 0.276	.349
Shelter-in-place	0.034	0.046	−0.057, 0.125	.461	0.062	0.118	−0.169, 0.293	.601
Restrictions Sum Score	−0.007	0.019	−0.045, 0.031	.711	0.016	0.035	−0.053, 0.084	.650

Note. Uncorrected *p* values are shown. The critical *p* value from each model (i.e., the effect of the predictor) was also subjected to FDR correction; critical *p* values that remained statistically significant after FDR correction are bolded. In Sample A, racial and ethnic identity and political affiliation had more than 2 levels. Only the *p* value for the family-wise ANOVA is shown; – is shown for the b value because these models have a separate parameter estimate for each level of the predictor. Results of pairwise comparisons are described in text for statistically significant effects. In Sample B, racial and ethnic identity was coded such that 0 = Participants of color and 1 = White participants. In Sample B, political affiliation was coded such that 0 = Republican and 1 = Democrat. b = unstandardized coefficient. SE = standard error. CI = confidence interval.

very small for financial stress across samples, .04–.07. Men and individuals who identified as higher social class tended to report higher levels of positive emotions *about COVID-19* in both samples. Effect sizes were small for gender, .14–.16, and were medium for social class, .22–.25. In Sample A only, which had greater racial and ethnic diversity, individuals who identified as African or African American tended to report lower levels of positive emotions *in general* and *about COVID-19* compared to White participants (.16, small effects) and compared to East Asian or East Asian American participants (.14–.17, small effects). In Sample B only, which was more diverse in terms of political affiliation, Republicans (compared to Democrats) tended to report higher levels of positive emotions *in general* and *about COVID-19* (.22, medium effects). In Sample A only, individuals under shelter-in-place orders and with more COVID-19–related restrictions tended to report lower positive emotions *in general* (.07–.13, very small to small effects). When adjusting for baseline levels of positive emotion, all effects described above remained statistically significant or suggestive. This result suggests that these effects were unique to the stressful context experienced across the study period and were not wholly attributable to pre-existing differences in positive emotions.

Predictors of individual differences in emotion

Trajectories. We display the results of all models predicting *change* in emotional well-being in Supplementary Tables S7-S10 and only describe effects that were statistically significant in at least one sample in the text. We considered an effect to replicate if it was statistically significant ($p < .05$ *after* FDR correction) in one sample and either statistically significant ($p < .05$ *after* FDR correction) or suggestive ($p < .05$ *before* FDR correction) in the other sample.

Negative emotions. No consistent predictors of change in negative emotion emerged. In Sample A only, younger

adults and individuals who identified as higher social class experienced steeper decreases in negative emotions *about COVID-19* across time. Also in Sample A, individuals identifying as East Asian or East Asian American experienced steeper decreases in negative emotions *about COVID-19* across time. In addition, social class moderated the quadratic trajectory of negative emotions in Sample A. Individuals who identified as higher class experienced slower attenuations in the rate of negative emotion declines across time.

Positive emotions. No consistent predictors of change in positive emotion emerged. In Sample A only, individuals who identified as higher social class experienced less steep decreases in positive emotions *about COVID-19* across time. Also in Sample A only, people living under shelter-in-place orders experienced greater accentuation of the decreases in positive emotions *about COVID-19* across time.

Discussion

The present research addressed two questions that are foundational to our understanding of emotional responses to stress: First, how do people's emotions respond to a major stressor on average? And second, how do people differ in patterns of emotional responses to a major stressor? We investigated these questions in the context of the COVID-19 pandemic, a severe and chronic stressor experienced at a global scale, providing a strong test of resilience theory. Next, we discuss the broader theoretical implications of the present investigation, focusing on three: (1) Responses to stress depend on the outcome and the context. (2) Individual differences in responses to stress are large and complex, suggesting that broad claims that resilience is "ubiquitous" or "rare" may not be useful. (3) Responses to stress are multiply determined and embedded within societal contexts that influence who experiences stress as well as who has access to resources to respond to stress.

Responses to stress depend on the outcome and the context

Is resilience the exception or the norm? This is perhaps *the* central question of resilience research (e.g., Bonnano, 2004; Infurna & Luthar, 2016; Lucas, 2007). Yet, the present investigation suggests that this question is incomplete. A better question might be: Is resilience the exception or the norm for a *given outcome* of interest in a *given context*? On average, people demonstrated resilience when considering negative, but not positive, emotions *in general*. After an initial increase in negative emotions *in general*, negative emotions decreased across 6 months with the greatest improvements happening almost immediately. Interestingly, this initial period of elevated negative emotion occurred during the period of time in which the U.S. issued nationwide guidance to stay at home to reduce the spread of COVID-19 (mid-March, 2020 through April 30, 2020). This suggests that the initial elevation in negative emotion may have been relieved upon the lifting of the stay-at-home guidance. This interpretation is speculative and complicated by different state and local guidelines, as well as individual differences.

Although negative emotions *in general* largely recovered after this initial period of elevation, positive emotions *in general* were still severely impacted after 6 months, with average scores remaining approximately half of a standard deviation below pre-pandemic levels (i.e., approximately two-thirds of a scale point on a 7-point scale). This pattern was driven by a greater initial decrease in positive emotions at the onset of the pandemic; the rate of recovery for average negative and positive emotions was comparable. In other words, on average, individuals simply lost more positive emotions and in turn, had more positive emotions to recover in order to return to baseline levels. This initial steep decline in average positive emotions may have been driven in part by a steep drop-off in close social contact, a common source of positive emotion, as individuals were encouraged to maintain social distance from anyone outside of their household (CDC, 2020). The observed asymmetrical pattern of results for negative compared to positive emotion is consistent with prior work in other stressful contexts. For example, prior research considering the bereavement context has found that negative versus positive emotion are differentially predicted (Moskowitz et al., 1996), further suggesting that negative and positive emotions do not simply reflect opposite ends of a single dimension in the context of recovery from major stressors. This asymmetry is also consistent with a recent review of resilience research which found that when multiple outcomes were assessed, patterns of resilience tended to differ across those outcomes (Infurna & Luthar, 2018).

Taken together, the pattern of results observed in the present investigation demonstrates an important principle of stress responses: Resilience for one outcome cannot be generalized to resilience for other outcomes. Future research should examine the extent to which patterns of resilience are generalizable across outcomes and across contexts. Specifically, to avoid missing important nuances like those observed in the present research, resilience researchers should examine multiple indicators of resilience, report results separately for each outcome, and be cautious about generalizing findings beyond the outcomes assessed. In the present research, we examined two important aspects of stress responses, positive and negative emotions *about COVID-19,* as well as two important aspects of well-being, positive and negative emotions *in genera*l, providing a tractable starting point. Future research should directly compare patterns of resilience for other important outcomes, such as life satisfaction, psychological well-being, mental health symptomatology, and relational and occupational functioning. Furthermore, future research should examine the extent to which patterns of resilience for specific outcomes are generalizable across stressful contexts.

Individual differences in responses to stress are large and complex

Beyond average emotional responses to stress, how do individuals differ in their emotional responses to stress? As illustrated in Figure 3, individuals differed in (a) their starting points, (b) their ending points, (c) the direction of change, (d) the rate of change, and (e) the extent to which responses

followed a linear (or quadratic) trajectory. Crucially, individuals differed substantially along all of these dimensions. Resilience research would benefit from greater attention to the magnitude and complexity of these individual differences. In particular, the range and magnitude of individual differences in emotional responses to stress suggests that broad claims that resilience is "ubiquitous" or "rare" may not be useful. Instead, resilience research should seek to understand the full range of resilience, as well as when, for whom, and in what contexts resilience is most and least likely.

To investigate the full range of individual differences in responses to stress, it is necessary to be able to measure and summarize these individual differences. In the present investigation, we used random effect growth curve models. This approach disentangles individual differences in level of the outcome variable (i.e., random intercepts) from individual differences in the direction and rate of change in the outcome variable (i.e., random slopes). Alternatively, growth mixture models provide a means of categorizing individuals into one of several groups that differ according to level and direction and rate of change in the outcome variable. This latter approach allows for succinct summaries of individual differences, but at the cost of over-simplifying the continuous nature of individual differences in resilience. Results of such categorical approaches are highly dependent on data analytic decisions and assumptions (Infurna & Luthar, 2016) and often result in illusory subgroups that do not reflect natural subgroups or do not replicate (Bauer, 2007). Thus, resilience research would benefit from new approaches to characterizing individual differences that appreciate their continuous nature, consider the myriad of ways that individuals can differ (see points a–e in the previous paragraph), and allow for meaningful and easily interpretable summaries. Idiographic approaches may be particularly well-suited, given that they do not impose group-level assumptions and instead allow individuals to differ on all characteristics of their trajectories (see Conner et al., 2009).

Individual differences in responses to stress are embedded in societal contexts

Finally, the present research illustrates the importance of considering the societal contexts within which individual differences in responses to stress are embedded. Societal contexts influence who is exposed to particular stressors and who has access to resources to deal with that stressor exposure, both of which are likely to influence responses to stress. In turn, these aspects of the societal context reflect actionable targets for interventions to promote resilience at a large scale. For example, in the present research, individual differences in emotional responses were predicted by specific types of stressor exposure and socio-demographic characteristics. When considering specific types of stressor exposure, individuals who experienced financial stress tended to report higher levels of negative emotion and lower levels of positive emotion. Inequities in the types of jobs that were lost during the pandemic (Parker et al., 2020) influence who experiences financial stressors and in turn, who experiences declines in emotional well-being. Moreover, pre-existing economic inequalities influence the resources that individuals have to deal with financial stressors, and in turn, have the potential to influence patterns of emotional responses.

When considering socio-demographic characteristics, although these characteristics describe the individual, they cannot and should not be divorced from the broader societal context. In the present research, African and African American individuals, women, and individuals who identify as lower social class tended to report worse emotional well-being during the pandemic, even when adjusting for baseline levels. The lower levels of average emotional well-being observed for these groups are likely driven in part by the exacerbation of existing inequities (Bowleg, 2020; Warren & Bordoloi, 2020), as well as the disproportionate impact of COVID-19 for particular groups, such as Black and African American individuals (Millett et al., 2020), women (Madgavkar et al., 2020), and women of color in particular (Madgavkar et al., 2020). Interventions to increase resilience should focus on addressing these inequities, rather than simply influencing individuals' responses to them. This can be achieved and strengthened with a social justice approach, as described by Hart et al. (2016).

Limitations and constraints on generalizability

The following limitations should be considered when drawing conclusions from the current investigation and when generalizing to other contexts. First, we used two samples from Amazon's Mechanical Turk (MTurk) that were recruited to be diverse with respect to racial and ethnic identity (Sample A) and political affiliation (Sample B). This sampling approach allowed for time-sensitive data collection, beginning before COVID-19 was declared a pandemic, and to have large enough group sizes to test for the effects of racial and ethnic identity and political affiliation, among other socio-demographic characteristics. However, this sampling approach means that the present samples were not nationally representative and were limited to MTurk users, who are representative of the general population for many but not all psychosocial characteristics (McCredie & Morey, 2019).

Second, the present study focused on the COVID-19 pandemic and the time period from February to September 2020. Several aspects of this context and time period should be considered when drawing conclusions from the present results. Specifically, the pandemic persisted across the study period and as a result, the specific characteristics of the stressor also evolved across the study period. Although we partially addressed this in our analyses by including time-varying predictors for local pandemic-related restrictions, we were not able to fully account for changing features of the pandemic context. In addition to the evolving pandemic context, the present study cannot fully disentangle pandemic effects from effects of other events during the same time period. The pandemic context also differs from previous investigations of resilience in important ways, and these differences should be considered when comparing the present results to these prior studies. Specifically, everyone in the population was exposed to the pandemic at least to some extent, whereas most prior investigations of resilience have focused on subsets of individuals within the population who were exposed to a specific unshared stressor.

Finally, the present research did not examine specific psychological mechanisms that might account for

individual differences in resilience. As has been noted in prior work (Infurna & Luthar, 2018), the identification of causal mechanisms that lead to resilience will provide useful targets for intervention efforts. In the current research, we focused on predictors of emotional responses to stress that would inform which social groups are in the most need of support and that had the potential to inform societal-level interventions. However, prior research suggests that individual-level factors such as social support and coping skills may also be important (Luthar & Eisenberg, 2017; Infurna & Luthar, 2018; Zautra et al., 2008).

Concluding comment

The present investigation tested key questions about emotional responses to stress in the context of an ongoing global stressor, the COVID-19 pandemic. We believe that findings from the present research offer important insights about emotional responses to stress that can be generalized beyond the pandemic context. First, emotional resilience was observed on average for negative emotions but not for positive emotions, suggesting that resilience for one outcome does not necessarily imply resilience for all outcomes. Second, individual differences in emotional responses to stress were large and complex, suggesting that broad claims that resilience is either "ubiquitous" or "rare" may be overstated. Third, individual differences in emotional responses to stress were multiply determined and should be considered within the larger societal contexts in which they are embedded. We hope that these insights contribute to more nuanced approaches to studying, understanding, and improving emotional well-being following major stressors.

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Data Accessibility Statement

This article earned Open data and Pre-Registered through The data, analysis scripts, and pre-registration are permanently and openly accessible on the Open Science Framework (https://osf.io/xqsd4/). The analysis pre-registration, analysis scripts, and data can be found at https://osf.io/xqsd4/.

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Supplemental Material

Supplemental material for this article is available online.

Notes

1. At T1 in Sample B, participants rated their emotions *in general* during the past two, rather than four, weeks.
2. At T1 in Sample B, response options ranged from 1 to 7 instead of 0–6. One was subtracted from each composite score so that the resulting variable was on the same 0–6 scale as the other timepoints.
3. Social positive emotions (i.e., "love, closeness, trust," "inspired, uplifted, elevated," and "grateful, appreciative, thankful") were introduced beginning at T1b in Sample A and beginning at T2 in Sample B. Because social positive emotions were not assessed at baseline (T1), we examined them separately from general positive emotions and report results in the Supplementary Online Materials.
4. We also tested quadratic effects of age, based on a reviewer's recommendation. There were no statistically significant quadratic effects of age on emotion levels or change, *ps* > .202.
5. This analysis was not pre-registered.
6. The random effect of quadratic time was dropped from one trajectory model to achieve convergence.
7. In addition to testing effects of stressor exposure variables on emotion levels, we also tested lagged effects of stressor exposure variables at one timepoint predicting emotions at the next timepoint, based on a reviewer's recommendation. For each type of stressor exposure, we included person-mean stressor exposure and lagged person-centered stressor exposure into a random-intercept random-slope multilevel model predicting emotions. We dropped the random slope from several models to achieve model convergence. We did not observe any replicable lagged effects. In Sample A, living under a shelter-in-place order predicted higher positive emotions *about COVID-19* at the next timepoint (b = 0.26, p = .005) and lower negative emotions *about COVID-19* at the next timepoint (b = –0.20, p = .013); Also in Sample A, more restrictions predicted higher positive emotions *about COVID-19* at the next timepoint (b = 0.06, p = .012). In Sample B, loss of childcare predicted higher positive emotions *in general* at the next timepoint (b = 0.31, p = .001).

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