**Psychological Distress in North America during COVID-19: The Role of Pandemic-Related**

**Stressors**

by

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# Abstract

The COVID-19 pandemic has wreaked havoc on lives around the globe. In addition to the primary threat of infection, widespread secondary stressors associated with the pandemic have included social isolation, financial insecurity, resource scarcity, and occupational difficulties. The current study examined the impact of these disruptions on psychological distress during the initial adjustment phase to the pandemic in North America. A sample of 2463 residents of the US and Canada completed both baseline and follow-up surveys across several weeks between March and May 2020. Those participants perceiving stress related to higher levels of personal threat to health and to the well-being of family members at baseline reported higher levels of depressive symptoms at follow-up, even after controlling for baseline depressive symptoms. In addition, pandemic-related secondary stressors (social isolation, financial insecurity, occupational difficulty, and resource scarcity) were all independently associated with depressive symptoms at follow-up, controlling for both baseline depression and perceived health threats. The results were robust and held up after controlling for demographic factors. Women, young adults, and those who reported lower income were all at higher risk for subsequent depressive symptoms. Findings from the present study can help to identify key groups at risk for mental health problems during the pandemic and indicate actionable areas for targeted intervention.

# Lay Summary

The study aimed to study the impact of the COVID-19 impact on mental well-being. We found that those who were more fearful of contracting the COVID-19 virus reported more mental distress over time. Similarly, those who experienced disruptions to everyday life due to COVID-19 were also more likely to report more mental distress over time. The findings from our study suggest that these are key predictors of mental health problems and allow us to identify those who are in need of support during the COVID-19 pandemic.

# Preface

A version of this thesis has been published [Zheng, J., Morstead, T., Sin, N., Klaiber, P., Umberson, D., Kamble, S., & DeLongis, A. (2021). Psychological distress in North America during COVID-19: The role of pandemic-related stressors. Social Science & Medicine, 270, 113687]. Portions of the thesis are used with permission from Zheng et al. (2021) of which I am an author. The longitudinal study was launched by Anita DeLongis and Nancy Sin. Further distribution of the surveys was assisted by Debra Umberson and Shanmukh Kamble. All projects and associated methods were approved by the University of British Columbia's Research Ethics Board [certificate #H20-01061 and # H19-04073]. The publication manuscript was initially written by Talia Morstead and I followed by substantial contribution in the revision process by me. The data analysis, results, and figures were my original work. Anita DeLongis was the supervisory author on this paper and was involved throughout in concept formation and manuscript composition. Contributions to manuscript edits were also made by Patrick Klaiber, Nancy Sin, Debra Umberson, and Shanmukh Kamble.

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# Introduction

The COVID-19 pandemic has affected the lives of people all around the world, with over 45 million cases across more than 200 countries by November 2020, with rates of infection increasing. Beyond the direct threat to physical health, the life adjustments made due to COVID-19 have also had psychological, social, and economic repercussions (Nicola et al., 2020). With growing evidence that the prevalence of mental health issues has increased during the pandemic (Holmes et al., 2020; Vindegaard and Eriksen Benros, 2020), the identification of key stressors associated with these mental health problems may offer insight into understanding how we can both prevent and treat these mental health declines. This study aims to identify pandemic-related stressors that are associated with these declines in mental health early in the pandemic period.

## Primary stressors

Concerns for one's own health and for the health of family members are potentially significant and primary sources of stress during the COVID-19 pandemic, and have been associated with psychological distress (Choi et al., 2020; Dozois, 2020). In one review of 43 studies conducted in the early months of the COVID-19 pandemic, worry about family and friends becoming infected was identified as a key risk factor for adverse mental health in the context of the pandemic (Vindegaard & Benros, 2020). Although there are a growing number of cross-sectional studies examining the link between COVID-19 health threats and mental health, research using a repeated measures design is needed to address the question of whether the fear of COVID is associated with an increase in psychological distress, or whether the cross-sectional findings reflect those with pre-existing psychological distress feeling more threatened by the virus. Research has begun to address this issue. A Swiss study that followed young adults from

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pre-pandemic through early in the pandemic period found that pre-existing levels of anxiety and depression were the strongest predictors of psychological distress during the pandemic (Shanahan et al., 2020). Perceived COVID-19 threat to self and others was only weakly associated with psychological distress during the pandemic, whereas social and economic disruptions played a larger role in distress during the early stages of the pandemic (Shanahan et al., 2020). However, in a second study following Swiss students from before the pandemic into the crisis, greater worry about family and friends during the pandemic was associated with increases in depressive symptoms from pre-pandemic levels (Elmer et al., 2020). These studies are important in identifying those at risk for psychological distress based on pre-pandemic factors in a young Swiss population. Another study examining college students in China found that those who perceived a greater risk of COVID-19 infection had greater anxiety and heightened depressive symptoms after a two week period of nationwide confinement (H. Y. Li et al., 2020). However, there remains a need to identify sources of stress that arise during the pandemic, how these stressors vary across social and age groups, how these differentially relate to psychological distress as the pandemic transpires, and whether these findings generalize to the North American context.

## Secondary stressors

In addition to the primary stressor of fear of illness during a pandemic, COVID-19 has wrought a plethora of secondary stressors that were not prevalent with other recent infectious outbreaks such as H1N1, West Nile Virus or SARS. Social isolation, financial insecurity, occupational difficulty, and resource scarcity are all secondary sources of stress which, even in the absence of a pandemic, can adversely impact mental health (Pearlin & Bierman, 2013). For many, these psychosocial stressors have been exacerbated by the pandemic (Brooks et al., 2020;

Nicola et al., 2020) and worry about the socioeconomic costs of the crisis has been identified as a key source of COVID-19 related stress (Taylor et al., 2020). Identifying how these secondary stressors contribute to psychological distress during the early stages of the pandemic is of critical importance given that even subclinical levels of depression can severely impact quality of life and have negative implications for physical and mental health over time (Cuijpers et al., 2004; Cuijpers and Smit, 2002).

Social isolation is a source of stress that is particularly relevant in the context of the pandemic given the widespread public adoption of social distancing guidelines and implementation of stay-at-home orders (Brooks et al., 2020). The adverse physiological and psychological impacts of isolation and loneliness are also well established (Holt-Lunstad, 2017). Cross-sectional research has indicated an association between loneliness and depressive symptoms during the pandemic (Killgore et al., 2020; McQuaid et al., 2020). However, one of the few longitudinal studies examining this issue found that ratings of loneliness did not increase after stay-at-home orders were issued in the United States (Luchetti et al., 2020). A Swiss study found that undergraduate students reported increased social isolation during the early months of the pandemic, but the isolation was not associated with an increase in depressive symptoms (Elmer et al., 2020).

A second major source of secondary stress during the pandemic has been financial insecurity. Given the far-reaching economic impact of the pandemic, the implication this has for psychological distress is important to examine. Prior to the COVID-19 outbreak, financial insecurity was already well documented as a major source of life stress associated with increases in depressive symptoms (Sargent-Cox et al., 2011). Although the full fallout of the widespread financial insecurity caused by COVID-19 has yet to be assessed, cross-sectional associations

between financial stress and psychological distress during the early months of the pandemic were found in a Chinese study (J. Li et al., 2020). Longitudinal studies are also beginning to examine the issue with one Swiss study reporting an association between pandemic-related economic disruption and heightened emotional distress (Shanahan et al., 2020).

Third, occupational disruptions have a major source of stress during the COVID-19 pandemic. Unwanted changes in employment (Dooley et al., 2000), as well as chronic job stress (Stansfeld et al., 2012), have been found to increase risk of depression. The increased risk for depression posed by job insecurity has in some cases been shown to outstrip that posed by the stress of unemployment (Kim & von dem Knesebeck, 2016). One cross-sectional study found higher levels of depression and anxiety among those expressing concern over the inability to work from home during the COVID-19 pandemic (Choi et al., 2020). In another cross-sectional study, poorer mental health was found among students whose academic activities were delayed by the pandemic (Cao et al., 2020). Among a sample of Israeli participants, those placed on furlough during the pandemic had higher ratings of emotional distress compared to those who had been unemployed prior to the pandemic (Mimoun et al., 2020). Conversely, the ability to transition to working from home without a reduction in salary has been associated with lower levels of psychological distress (Solomou & Constantinidou, 2020).

A fourth source of secondary stress during COVID-19 has been resource scarcity, including food insecurity and concerns about access to basic necessities. These insecurities, especially when prolonged, can be extremely stressful and adversely impact mental health (Lund et al., 2010; Wutich and Brewis, 2014). Resource scarcity has been commonly reported in the context of the COVID-19 pandemic (Hamilton, 2020) and has been cited as a feature of the pandemic which could result in emotional distress (Pfefferbaum & North, 2020). One study of

over 10,000 Americans found that food insecurity had a robust cross-sectional association with depression in the early months of the pandemic (Fitzpatrick et al., 2020). Evidence of the impact of perceived resource scarcity on depressive symptoms over time in the context of the COVID-19 pandemic, however, remains scant.

Although a growing number of studies have examined the impact of these specific sources of pandemic-related stress on psychological distress during the crisis, knowledge of the impact of the pandemic on mental health is limited without an understanding of how these multiple stressors, taken together, impact psychological distress across time during this early period of the pandemic (Salari et al., 2020; Vindegaard & Eriksen Benros, 2020). One study found that after controlling for depression at the height of the pandemic in China, increases in general stress over the study period remained a significant predictor of depressive symptoms in subsequent months (Duan et al., 2020). One of the few studies to examine the impact of a range of pandemic-related stressors on mental health found that after controlling for emotional distress levels assessed two years prior, pandemic-related economic and psychosocial stressors predicted increases in psychological distress during the pandemic (Shanahan et al., 2020). However, as with a number of longitudinal studies reporting findings thus far during the pandemic (Elmer et al., 2020; Huckins et al., 2020; H. Y. Li et al., 2020), the participants were limited to young adults, in this case 22-year-olds. Multiple studies have found a disproportionate impact of the pandemic on the mental health of young adults (Bruine de Bruin, 2020; Duan et al., 2020; Findlay et al., 2020; Huang & Zhao, 2020; Minahan et al., 2020; Ozamiz-Etxebarria et al., 2020), with younger adults reporting lower coping efficacy (Klaiber et al., 2020). Whether this pandemic-related stress impact is limited to young adults remains to be seen.

# Research Questions

The primary objective of our study was to examine the role of key sources of pandemic related stress in psychological distress across the early weeks of the pandemic in a North American community sample (age range 14-91). We hypothesized that 1) both primary pandemic stressors (threat to one's own and a loved one's well-being) and secondary pandemic stressors (social isolation, financial insecurity, occupational difficulty, and resource scarcity) would each predict increases in depressive symptoms in the early weeks of the COVID pandemic, and that 2) the associations of these pandemic stressors with depressive symptoms would be above and beyond effects of sociodemographic factors. Several sociodemographic factors have been found in prior research on disease outbreaks to be predictive of poor mental health outcomes, so these are important factors to control in examining the independent associations of stress with mental health during the current outbreak. For individuals quarantined during the SARS epidemic, being in a lower income bracket has been found to be associated with depressive symptoms (Hawryluck et al., 2004). Younger adults were also more likely to report depression in the years following a quarantine (Liu et al., 2012). Given known risk factors for depression, we expected women, participants who were younger, in worse health, with lower income, and belonging to racial/ethnic minority groups to report both higher levels of stress and greater psychological distress in the form of heightened depressive symptoms (Fitzpatrick et al., 2020; Salari et al., 2020), but that the associations of pandemic-related stressors with depressive symptoms would remain after controlling for these factors.

# Methods

## Data collection

We began online data collection on March 18, 2020 as part of a longitudinal study of the psychosocial and behavioral impact of the COVID-19 pandemic. Included here are data collected from the North American cohort before May 29, 2020, when we began analyses. Participants were initially recruited into the study through media that provided exposure for the study and linked the baseline survey. These media included social media (Instagram, Twitter), university dissemination via media contacts, research site webpages (https://delongis.psych.ubc.ca/covid-19-study/), and interviews given by either the third or last author to local or national media (radio, television, and print media). Participation in the study was voluntary and no compensation was offered for any part of the study. Participants were asked to leave an email address if they were willing to be recontacted for a follow-up survey, and for those who provided an email address, the follow-up survey was sent one week after completion of the baseline survey. The study is ongoing with now monthly follow-ups, with data from the first two surveys included here in order to report on the early pandemic impact on mental health. A subset of participants were invited to participate in an intensive longitudinal study (Bolger & Laurenceau, 2013), and those results have been reported elsewhere (Klaiber et al., 2020). The study protocol was approved by the UBC Behavioural Research Ethics Board.

## Participants

To be eligible for inclusion in analyses presented here, participants reported their country of residence to be Canada or the United States. A total of 4166 North American participants completed the baseline survey and 3210 completed a follow-up assessment. Participants who

completed the follow-up within 1 SD of the average completion time ($M$ = 15.76 days, SD = 9.80 days) were included in the follow-up analyses, resulting in 2712 participants, with listwise deletion of missing data yielding a final analytic sample of $N$ = 2463. The majority of participants in the analytic sample (see Table 1) were female (83.6%) and residing in Canada (72.4%). Participants ranged in age from 14 to 91 years with a mean age of 44.9. Participants were also predominantly white (88.4%) with above average income (42.9% reported an annual household income of $100,000 or above). The final analytic sample was significantly less depressed, older, healthier, and with higher mean incomes, less financial insecurity, smaller households and with a larger percentage identifying as non-Hispanic whites than those in the full baseline sample. There was no significant difference at baseline in the proportion of participants who scored above the published clinical cutoff for depression (Andresen et al., 1994; 72.7% in the baseline sample vs. 70.6% in the analytic sample).

## Measures

We adapted the survey from those we developed previously to assess psychological and behavioral responses to prior infectious disease outbreaks including SARS  Lee-Baggley et al., 2004), West Nile Virus (Puterman et al., 2009), and H1N1 (King et al., 2016). The baseline survey included questions assessing reactions to the COVID-19 pandemic as well as psychological distress.

### Psychological distress

As a measure of psychological distress, we assessed depressive symptoms at baseline and follow-up using the 10-item Center for Epidemiologic Studies Depression Scale (CESD-10; Andresen et al., 1994). The CESD-10 has been validated in previous studies and a cut-off score of 10 has been used to indicate clinically significant depressive symptoms in community samples

(Andresen et al., 1994; Bradley et al., 2010; González et al., 2017). Scores on the scale range from 0 to 30 with higher scores indicating a greater frequency of depressive symptoms. The scale includes statements such as "I felt depressed" and "I felt that everything I did was an effort," which were rated based on frequency of occurrence in the past week with 0 = "rarely or none of the time (less than one day)" to 3 = "all of the time (5-7 days)." The internal consistency of the scale was moderate at both timepoints ($\alpha$ = 0.73 at baseline and follow-up).

**Threat of COVID-19 infection**

We assessed threat of COVID-19 infection using two items to capture both fear of contracting the virus oneself and anxiety for loved ones' well-being. We captured threat to oneself by having participants rate their worry of contracting COVID-19 on 5-point scale ranging from "1 = not at all worried" to "5 = extremely worried". We measured threat to others with a question previously developed to assess communal threat appraisal by asking participants to what extent "harm to a loved one's health, safety, or physical well-being" was of concern to them in the past week (Folkman et al., 1986; Pow et al., 2017, 2016). Participants rated their concern on a 4-point scale ranging from "1 = not at all" to "4 = a great deal."

**Financial insecurity**

We assessed financial insecurity by having participants rate on a 4-point scale the extent to which a strain on their financial resources had been of concern to them in the past week as they dealt with the threat of COVID-19.

**Social isolation**

We assessed social isolation by asking participants whether the statement "I felt socially isolated" applied to them in the past week as result of the COVID-19 outbreak.

**Resource scarcity**

We assessed resource scarcity as a dichotomous variable depending on whether participants endorsed the statement "I was concerned about getting basic necessities such as food and supplies" due to the COVID-19 outbreak over the past week.

**Occupational difficulty**

We assessed occupational difficulties using a single item. We asked participants whether they endorsed the statement "I found work/school more difficult" due to the COVID-19 outbreak over the past week.

**Covariates**

We assessed several demographic factors at baseline and included these as controls in the final model. These included household income (assessed from 1 = "Less than $50,000" to 5 = "$200,000 or more"; the modal income group was "$50,000 to $100,000"), age, country (USA or Canada), and household size. Country of residence was a binary variable coding (1 = USA and 0 = Canada). Time of baseline assessment was assessed as days elapsed between participants completing the baseline survey entry and the World Health Organization pandemic announcement (March 11, 2020; World Health Organization, 2020). Given the majority of the analytic sample reported their race/ethnicity as white (88.4%), other reported ethnicities were pooled such that we examined ethnicity as a binary variable comparing non-Hispanic white vs. others. We assessed gender (men, women, other) using effects coding, with "other" as the reference group. 14.7%, 83.6% and 1.7% identified as men, women, and other respectively. We assessed health with the general self-rated health question from the SF-36 Health Survey (Ware and Gandek, 1998) with scores ranging from 1 = "very poor" to 6 = "excellent". Similar single-

item measures have been used in prior research and have demonstrated utility in predicting a range of clinically-relevant health outcomes (Bowling, 2005; DeSalvo et al., 2005).

## Analytic strategy

Following examination of descriptive statistics and bivariate relationships, multiple hierarchical regression modelling was carried out to examine the role of both primary and secondary pandemic stressors in depressive symptoms across the early weeks of the pandemic. Our analytic model examined the association of depressive symptoms at follow-up with baseline depression, sociodemographic factors, and both primary and secondary pandemic stressors. We used hierarchical linear regression to enter variables in conceptual blocks with controls for baseline depression entered first, followed by sociodemographic controls, primary pandemic stressors (threats to the well-being of self and loved ones), and finally, secondary pandemic-related stressors (social isolation, occupational stress, financial insecurity, and resource insecurity). All statistics were computed in R (V3.6.1) and RStudio (V1.2.1335).

# Results

## Univariate statistics

Skew and kurtosis of all continuous variables were examined to assess normality; all variables fell within recommended limits (Skew < |2|, kurtosis < |7|; Curran et al., 1996) except for household size. Descriptive statistics and differences between the baseline sample and the final analytic sample are reported in Table 1. A paired *t*-test examined differences in depressive symptoms across time for the analytic sample; depressive symptoms at follow-up were significantly lower than at baseline, $t(2462) = -2.67$, $p = .008$. The primary pandemic stressors assessed (threats to one's own or a loved one's well-being) were reported as moderate on average (see Table 1). Secondary pandemic related stressors were reported frequently, with over half the sample reporting social isolation, resource scarcity, and occupational difficulty (see Table 1), with 72.2% reported experiencing at least some financial insecurity. Most commonly, participants reported experiencing multiple pandemic-related stressors at this early stage of the pandemic. Only 7.1% of participants reported experiencing none of the four secondary stressors assessed, while 16.3% reported the presence of one, 30.0% reported two, 29.0% reported three, and 17.6% reported experiencing all four of the secondary pandemic-related stressors assessed.

## Bivariate statistics

Zero order correlations (Table 2) indicated that elevated depressive symptoms at follow-up were significantly associated with elevated depressive symptoms at baseline, younger age, worse self-reported health, and lower income. Higher levels of depressive symptoms at follow-up were also associated with elevated baseline assessments of perceived threat of COVID-19 to oneself and others, financial insecurity, as well as to reports of social isolation, occupational difficulty, and resource scarcity. As indicated in Table 2, exposure to each secondary stressor at

baseline was negatively associated with age such that older adults were less likely to report socioeconomic stress exposure. Those in worse health were significantly more likely to report social isolation, resource scarcity, and higher levels of financial insecurity. Participants from lower income brackets were significantly more likely to report higher levels of financial insecurity and were significantly more likely to report social isolation and occupational difficulties. Non-Hispanic white participants were significantly more likely than those in minority groups to report experiencing social isolation. An analysis of variance examining gender differences in depressive symptoms indicated significant differences at both baseline ($F(2, 2460) = 32.51$, $p < .001$) and follow-up ($F(2, 2460) = 28.77$, $p < .001$). Post-hoc Tukey tests showed at both baseline and follow-up that those identifying as women reported significantly higher depressive symptoms than did those identifying as men, and participants identifying as other gender showed significantly higher depressive symptoms than those identifying as either men or women.

## Multiple regression analyses

At step 1, baseline depressive symptoms accounted for 53.5% of the variance in follow-up depressive symptoms (Table 3). Sociodemographic covariates on step 2 further explained 1.3% of the variance in depressive symptoms at follow-up, $F(9,2452) = 7.76$, $p < .001$. Among the covariates, age, self-reported health, income, gender, and time were all significantly and independently related to depressive symptoms at follow-up. Participants who were younger, reported worse health, had lower income, identified as other relative to males, and completed the baseline earlier during the pandemic time all predicted greater depressive symptoms at follow-up. Adding in baseline assessments of the primary stressors (COVID-19 threat to self and threat to others) on step 3 explained a significant additional .4% of the variance $F(2,2450) =$

10.58, $p < .001$. We found significant independent effects for both self- and other-threat of COVID, with being more afraid of contracting COVID and being more worried about loved ones at baseline associated with greater depressive symptoms at follow-up. In step 4, the addition of secondary stressors (financial insecurity, social isolation, resource scarcity, and occupational difficulty) to the model explained an additional .9% of the variance and this change in $R^2$ was significant, $F(4,2446) = 12.83$, $p < .001$. We found significant independent effects for all four pandemic-related stressors; participants who reported experiencing social isolation, resource scarcity, or occupation difficulties as well as greater financial insecurities at baseline reported significantly higher levels of depressive symptoms at follow-up.

# Discussion

In this study we examined the relationship between pandemic-related stressors and subsequent psychological distress as assessed by depressive symptoms across the early weeks of the COVID-19 outbreak in North America. Our findings suggest that those participants who reported higher levels of personal threat to their own health and to the well-being of family members were at increased risk for both concurrent and subsequent depressive symptoms. Interestingly, both perceived threat to a loved one's well-being and perceived threat to one's own health were associated with elevated depressive symptoms. This is particularly important for understanding the mental health impact of the pandemic given multiple studies indicating that concern for relatives has been a common fear during the COVID-19 crisis (Dozois, 2020; Germani et al., 2020; Petzold et al., 2020; Wang et al., 2020a), and this is consistent with our findings on the prevalence of both fears for one's own and loved one's well-being during the crisis. In addition, social isolation, financial insecurity, occupational difficulty, and resource scarcity assessed at baseline were all independently associated with depressive symptoms, both concurrently, and at follow-up in our multivariate models, even after controlling for both baseline depressive symptoms and perceived threats to one's own health and the health of loved ones (see Table 3). Our findings suggest that stress related to the sociocultural and socioeconomic implications of the pandemic increase risk of depressive symptoms over and above risk posed by fear of oneself or family members contracting the virus. The independent effects of these stressors on depressive symptoms also held after controlling for a range of sociodemographic factors (i.e., age, gender, race/ethnicity, income, self-reported health, and household size).

Each stressor we examined had a significant independent association with depressive symptoms both concurrently and over the first few weeks of the pandemic, suggesting that experiencing even one of these prevalent pandemic-related stressors can increase the risk of depressive symptoms. For example, social isolation was associated with significantly higher depressive symptoms regardless of financial insecurity or occupational difficulties. The majority of our sample (76.5%), however, reported experiencing more than one secondary pandemic-related source of stress. Our findings suggest that each additional stressor has an independent and cumulative impact on psychological distress during the early phases of the COVID-19 pandemic.

Our findings regarding pandemic-related stressors are consistent with findings from previous studies conducted prior to the onset of COVID-19, outside of the context of global health crises, examining the impact of these sources of psychosocial and socioeconomic stress on mental health (Pearlin & Bierman, 2013). In the last few months a literature has emerged examining the relationship between pandemic stressors and adverse mental health outcomes in the context of COVID-19 (Bruine de Bruin, 2020; Choi et al., 2020; Dozois, 2020; Fitzpatrick et al., 2020; Germani et al., 2020; Mazza et al., 2020), and our findings replicate and extend these findings within a Canadian and American context. A recent survey of nearly 2000 Canadians found that social isolation, resource insecurity, and concern about oneself or a loved one becoming ill were perceived to be contributing to worsening mental health during the pandemic (Dozois, 2020). Our findings support these perceptions, indicating that these stressors indeed appear to have implications for mental health, with increasing stress exposure associated with higher levels of depressive symptoms during the early phases of the pandemic. Although few studies have yet to examine the longitudinal impact of pandemic-related stressors on mental health, a Chinese study found that pandemic stress was associated with increased depressive

symptoms at follow-up (Duan et al., 2020). One of the few longitudinal studies to examine the impact of multiple sources of stress during the pandemic also found that psychosocial and socioeconomic stressors predicted emotional distress (Shanahan et al., 2020). The study was however limited to young adults. Our findings expand on these studies by highlighting how a range of pandemic-related stressors each contribute independently to the risk of developing depressive symptoms during the early months of the pandemic. Further, our study delineates the impact of such stressors on depressive symptoms across adulthood.

Overall, we found elevated levels of depressive symptoms in our sample (see Table 1). The mean CESD-10 score at both baseline and follow-up exceeded the cutoff typically used to identify individuals at risk for clinical depression (Andresen et al., 1994). This finding is consistent with the conclusion of a recent systematic review (Vindegaard & Eriksen Benros, 2020) indicating elevated depression levels in the general population across multiple regions. The same review also pointed to one study (Wang et al., 2020b) indicating that the rise in depressive symptoms leveled off early in the pandemic. Other studies, however, have reported group-level increases in depressive symptoms across the pandemic (Duan et al., 2020; H. Y. Li et al., 2020). Mean levels of depressive symptoms in our sample significantly decreased from baseline across the short period of weeks to follow-up, although still remaining above the clinical cut-offs.

It is noteworthy that our sample is not representative of the larger population, with those volunteers participating in the study over-representing relatively privileged groups.  However, these more privileged groups would be expected to be *least* likely to experience significant stress and depression, suggesting that the problems identified in the present study of widespread pandemic stress and significant depressive symptoms may indeed be common across North

America. Our sample likely does not include those most adversely impacted by the pandemic. Although our findings suggest that pandemic-related stressors have implications for mental health and that these effects hold regardless of SES and race/ethnicity, those who would be expected to be most at risk are underrepresented in our sample.

The expected association between gender and depressive symptoms emerged at the bivariate level with women being at higher risk for depressive symptoms. This finding is consistent with research on gender and depression both pre-pandemic (Salk et al., 2017) and during the pandemic (Connor et al., 2020; Salari et al., 2020; Vindegaard & Eriksen Benros, 2020). Age, health status, and income all showed significant independent associations with depressive symptoms, even after controlling for depressive symptoms at baseline. Consistent with the findings from an intensive longitudinal study examining affective reactivity to everyday stress among a subset of our sample (Klaiber et al., 2020) as well as with several other studies (Bruine de Bruin, 2020; Duan et al., 2020; Findlay et al., 2020; Huang & Zhao, 2020; Minahan et al., 2020; Ozamiz-Etxebarria et al., 2020), younger adults tended to report greater psychological distress during the COVID-19 pandemic.

In demonstrating how diverse sources of stress increase one's risk for developing depressive symptoms, our findings provide insight into areas for targeted intervention. Consistent with prior literature, we found that poor self-reported health was a predictor of depressive symptoms (Ambresin et al., 2014). Importantly, the impact of health on subsequent depressive symptoms remained when perceived COVID threat was added to the model. This suggests that independent of having worse health, feeling worried about the virus increased risk of developing depressive symptoms. This finding suggests that reducing perceived threat of disease might reduce the risk of depression. Even if someone is in a high-risk group due to their

age and pre-existing health conditions, steps taken to reduce risk (e.g., social distancing, face masks, handwashing) may result in feeling safer and less threatened by the virus, which in turn could decrease the risk of psychological distress during the pandemic.

## Limitations

As indicated above, a key limitation of the study was our limited representation of the North American population. Our sample was disproportionately represented by college-educated white women with above average incomes, with these sample characteristics more pronounced among those who accepted our invitation to participate in the follow-up assessment. This sample bias likely arose due to our priority of getting the study out quickly into the field and relying on media to get the word out about the study. This allowed us to get into the field within a week of the WHO declaring the COVID-19 crisis a pandemic, but did not facilitate access to hard to reach populations. In accepting interview requests from a multitude of media outlets, including radio, television, and internet-based, we had no direct control over where to broadcast. Given this the sample bias may be a reflection of the news outlets that chose to broadcast our study. We therefore have low power to detect associations of stressor exposure and mental health with race or ethnicity. Participants from minority racial/ethnic groups and those with lower incomes were also less likely to complete the follow-up. These factors may explain why race/ethnicity was not found to be a significant predictor of mental health outcomes in our study, despite prior research demonstrating higher levels of depression among ethnic minorities both in the context of the COVID-19 pandemic (Fitzpatrick et al., 2020) and more generally (Dunlop et al., 2003). The limited representation of racial/ethnic minority groups within our sample as well as the high average income is also a significant limitation given the role of intersectionality in mental health outcomes (Rosenfield, 2012). Minority groups are often disproportionately impacted by stress

which may result in these groups being hit hardest by the sociocultural and economic repercussions of the pandemic (Lund, 2020). Indeed, our study did not capture specific race-related stressors, such as institutionalized racism, which can compound and exacerbate the impact of the stressors we examined (Williams, 2018). However, our findings do suggest that even those who would be expected to be least vulnerable to the negative socioeconomic effects of the pandemic are still significantly impacted, which warrants future research on how these pandemic stressors can affect the mental health of more vulnerable groups. Additional limitations include the reliance on brief, sometimes single item indicators, of key variables and the short follow up period.

# Conclusion

Our study provides evidence of the role of a range of pandemic-related stressors in mental health during the early stages of the COVID-19 pandemic. It adds to the body of work emerging on the mental health impact of the pandemic and addresses a gap in the literature pertaining to the specific conditions that leave individuals at risk. By examining the independent effects of various psychosocial and socioeconomic stressors on depressive symptoms over a short period early in the pandemic, our findings identify key risk factors related to higher risk of psychological distress during the pandemic. Those with elevated depressive symptoms at baseline continue to be at greatest risk for depressive symptoms across the early weeks of the pandemic. Pandemic related stressors, both the primary stress related to fears to health and wellbeing, and secondary stressors including social isolation, work stress, and resource insecurities are all important targets for possible preventative interventions that may help those who are coping with depression due to the COVID pandemic.

# Tables

## Table 1 Summary statistics

| Variables | Full Baseline Sample Mean (SD) or % | Final Analytic Sample Mean (SD) or % | $p$ $(t/\chi^2)$ |
|---|---|---|---|
| Depressive symptoms | | | |
| Baseline Depressed (CESD-10 ≥10) | 72.7% | 70.6% | .075 |
| Follow-up Depressed (CESD-10 ≥10) | – | 69.8% | |
| Baseline CESD-10 | 13.50 (5.51) | 13.12 (5.44) | .007 |
| Follow-up CESD-10 | – | 12.91 (5.29) | |
| Age | 42.66 (15.42) | 44.94 (15.32) | < .001 |
| Health | 4.59 (0.97) | 4.65 (0.95) | .017 |
| Income | 2.43 (1.24) | 2.47 (1.23) | .203 |
| Gender | | | .405 |
| Men | 14.5% | 14.6% | |
| Women | 75.9% | 83.6% | |
| Other | 1.8% | 1.7% | |
| Missing | 7.8% | – | |
| Ethnicity | | | .004 |
| White | 84.0% | 88.4% | |
| Other | 16.0% | 11.6% | |
| Household Size | 2.56 (1.39) | 2.48 (1.37) | .011 |
| Countries | | | .526 |
| Canada | 71.7% | 72.4% | |
| USA | 28.3% | 27.6% | |
| Primary stressors | | | |
| Self-threat | 3.20 (0.91) | 3.22 (0.89) | .441 |
| Other-threat | 2.86 (1.09) | 2.83 (1.07) | .233 |
| Secondary stressors | | | |
| Financial Insecurity | 2.45 (1.09) | 2.39 (1.09) | .030 |
| Occupational difficulty | 54.3% | 52.2% | .098 |
| Social Isolation | 55.4% | 53.4% | .124 |
| Resource Scarcity | 53.1% | 53.8% | .651 |
| Time at baseline | 24.11 (17.69) | 23.48 (15.93) | .134 |

**Table 1 Summary statistics**

Comparisons between North American baseline sample (N = 4166) and the analytic sample (N = 2463). *t*-test was used with continuous variables and chi-square test with categorical variables. Time of baseline assessment was assessed as days elapsed between participants completing the baseline survey entry and the World Health Organization pandemic announcement (March 11, 2020; World Health Organization, 2020)

**Table 2 Zero order correlations**

| | Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Follow-up CESD-10 | | | | | | | | | | | | | |
| 2 | Baseline CESD-10 | .73** | | | | | | | | | | | | |
| 3 | Age | -.27** | -.29** | | | | | | | | | | | |
| 4 | Health | -.19** | -.18** | -.04 | | | | | | | | | | |
| 5 | Income | -.10** | -.08** | .01 | .19** | | | | | | | | | |
| 6 | Race/Ethnicity | .01 | .02 | .14** | .02 | .00 | | | | | | | | |
| 7 | Household Size | .03 | .05** | -.23** | .05** | .29** | -.04* | | | | | | | |
| 8 | USA vs Canada | .11** | .17** | -.06** | .00 | .02 | .04 | -.01 | | | | | | |
| 9 | Self-threat | .25** | .27** | -.06** | -.09** | -.02 | .02 | .04* | .01 | | | | | |
| 10 | Other-threat | .24** | .26** | .04* | -.26** | -.01 | -.02 | .05** | .02 | .35** | | | | |
| 11 | Financial Insecurity | .27** | .27** | -.11** | -.11** | -.15** | -.03 | .07** | -.06** | .18** | .21** | | | |
| 12 | Social Isolation | .40** | .49** | -.19** | -.07** | -.07** | .05* | -0.02 | .14** | .10** | .10** | .17** | | |
| 13 | Occupational Difficulty | .29** | .31** | -.43** | .03 | .07** | -.03 | .08** | .15** | .10** | .04* | .11** | .21** | |
| 14 | Resource Scarcity | .22** | .21** | -.08** | -.12** | -.03 | .00 | .05* | -.01 | .17** | .25** | .23** | .15** | .08** |

Phi coefficients for relations between dichotomous variables; point–biserial correlations for relations between a dichotomous and a continuous variable; Pearson correlations for relations between two continuous variables; $N = 2463$.

*p < .05; **p < .01; ***p < .001.

# Table 3 Hierarchical multiple regression

| Variables | Standardized coefficients β | Unstandardized coefficients B | Std. error | $R^2$ change | p |
|---|---|---|---|---|---|
| **Step 1** | | | | .54 | <.001 |
| Baseline CESD-10 | 0.73 | 0.71 | 0.01 | | <.001 |
| **Step 2** | | | | .01 | <.001 |
| Baseline CESD-10 | 0.70 | 0.68 | 0.01 | | <.001 |
| Age | -0.07 | -0.02 | 0.01 | | <.001 |
| Health | -0.06 | -0.35 | 0.08 | | <.001 |
| Income | -0.03 | -0.13 | 0.06 | | .033 |
| Men | -0.09 | -0.48 | 0.23 | | .035 |
| Women | -0.05 | -0.28 | 0.20 | | .157 |
| Race/Ethnicity | 0.03 | 0.16 | 0.23 | | .481 |
| Household Size | -0.01 | -0.04 | 0.06 | | .440 |
| Country of Residence | 0.03 | 0.16 | 0.20 | | .425 |
| Time at baseline | 0.00 | -0.02 | 0.01 | | .002 |
| **Step 3** | | | | .00 | <.001 |
| Baseline CESD-10 | 0.68 | 0.66 | 0.02 | | <.001 |
| Age | -0.07 | -0.03 | 0.01 | | <.001 |
| Health | -0.05 | -0.28 | 0.08 | | <.001 |
| Income | -0.03 | -0.14 | 0.06 | | .024 |
| Men | -0.08 | -0.44 | 0.23 | | .050 |
| Women | -0.06 | -0.29 | 0.20 | | .143 |
| Race/Ethnicity | 0.03 | 0.18 | 0.23 | | .433 |
| Household size | -0.02 | -0.06 | 0.06 | | .294 |
| Country of Residence | 0.02 | 0.11 | 0.20 | | .572 |
| Time at baseline | 0.00 | -0.01 | 0.01 | | .014 |
| Self-threat | 0.04 | 0.21 | 0.09 | | .018 |
| Other-threat | 0.05 | 0.23 | 0.08 | | .003 |

# Table 3 Hierarchical multiple regression

| Step 4 | | | | .01 | <.001 |
|---|---|---|---|---|---|
| Baseline CESD-10 | 0.63 | 0.61 | 0.02 | | <.001 |
| Age | -0.04 | -0.02 | 0.01 | | .006 |
| Health | -0.05 | -0.28 | 0.08 | | <.001 |
| Income | -0.03 | -0.13 | 0.06 | | .042 |
| Men | -0.09 | -0.50 | 0.22 | | .026 |
| Women | -0.05 | -0.26 | 0.20 | | .191 |
| Race/Ethnicity | 0.03 | 0.14 | 0.23 | | .548 |
| Household Size | -0.01 | -0.05 | 0.06 | | .328 |
| Country of Residence | 0.01 | 0.05 | 0.20 | | .806 |
| Time at baseline | 0.00 | -0.01 | 0.01 | | .026 |
| Self-threat | 0.03 | 0.18 | 0.09 | | .039 |
| Other-threat | 0.03 | 0.16 | 0.08 | | .036 |
| Financial Insecurity | 0.05 | 0.22 | 0.07 | | .002 |
| Social Isolation | 0.11 | 0.57 | 0.17 | | .001 |
| Occupational Difficulty | 0.12 | 0.64 | 0.16 | | <.001 |
| Resource Scarcity | 0.07 | 0.39 | 0.15 | | .011 |

Depressive symptoms at follow-up was predicted from pandemic stressors, controlling for baseline depression and sociodemographic factors, $N = 2463$ after listwise deletion. For all continuous variables, higher scores reflect higher standing on the variable; all continuous predictor variables are standardized.

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