Research Article

Stressors and Other Pandemic-related Predictors of Prospective Changes in Psychological Distress

Corinne R. Leach[a],*, Erika Rees-Punia[a], Christina C. Newton[a], Sicha Chantaprasopsuk[a], Alpa V. Patel[a], J. Lee Westmaas[a]

[a] Department of Population Science, American Cancer Society, Atlanta GA

A B S T R A C T

Background: Numerous studies have documented mental health challenges during the COVID-19 pandemic. Few studies included pre-pandemic levels of mental health or were comprehensive in assessing factors likely associated with longer-term mental health impacts.
Methods: Analyses used prospective data from a subset of participants in the nationwide Cancer Prevention Study-3 (CPS-3) United States cohort (N=2,359; 1,534 women; 825 men) who completed surveys in 2018 and during the COVID-19 pandemic (July-September 2020). Logistic regressions examined associations of pandemic-related stressors, sociodemographic and other predictors with (i) overall psychological distress (PD) and depression and anxiety separately during the COVID-19 pandemic and (ii) change in PD from 2018 to during the pandemic (low/low; high to low; low to high; high/high).
Findings: During the pandemic, 10% of participants reported moderate-to-severe PD and almost half (42%) reported at least mild PD. Pandemic PD levels were associated with pre-pandemic PD (female OR=5.65; male OR=9.70), financial stressors (female OR=2.48; male OR=3.68), and work/life balance stressors (female OR=3.03; male OR=3.33) experienced since the pandemic began. These stressors also predicted an escalation from low PD in 2018 to high PD during the pandemic. Factors associated with high PD at both time points included younger age, female sex, and financial stressors.
Interpretation: These results highlight the importance of regular mental health assessment and support among those with a history of mental health problems and those experiencing pandemic-related stressors, such as those with caregiving responsibilities or job changes.
Funding: The American Cancer Society funds the creation, maintenance, and updating of the CPS-3.

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Research in context

Evidence before this study

In order to identify existing studies assessing incidence, prevalence, change in, and factors associated with higher levels and/or change in mental health issues in the context of COVID-19 pandemic, we searched Pubmed using a combination of words referring to mental health or psychological distress or depression or anxiety and COVID-19. Multiple cross-sectional studies with data collection beginning after the onset of the COVID-19 pandemic documented rates of and factors associated with mental health issues during the pandemic. The few longitudinal studies that exist in this area examined differences in rates of mental health issues with data collection beginning after the start of the COVID-19 pandemic or used different samples to compare psychological distress before and during the pandemic.

Added value of this study

Our findings complement and extend the body of existing literature through use of prospective data from two waves, 2018 and July- September 2020, to characterize levels of psychological distress among U.S. men and women during the COVID-19 pandemic and to identify factors associated with persistent depression and anxiety symptoms, including sociodemographic characteristics, stressors, and comorbid conditions associated with increased risk for poor COVID-19 outcomes. A secondary aim is to examine the association of

* Corresponding Author: Dr. Corinne R. Leach, MS PHD MPH, American Cancer Society, Department of Population Science, 3380 Chastain Meadows Parkway, NW, Suite 200, Kennesaw, GA 30144, United States, Phone: +1 404-329-4453

E-mail address: corinne.leach@cancer.org (C.R. Leach).

these factors with longitudinal change in psychological distress.

Implications of all the available evidence

The available evidence suggests that adults are continuing to experience psychological distress beyond the initial, lockdown period of time. The results of this and prior studies support the importance of regular mental health assessment and subsequent mental health support among those with a history of mental health issues and those who may be isolating to keep themselves safe from COVID-19 or other infections. Results also highlight the importance of investigating the continued and long-term impact of the COVID-19 pandemic on mental health as social distancing, a factor previously associated with depression and anxiety, continues to be promoted over a year into the pandemic and as the world slowly opens again, potentially triggering different types of anxiety as people adjust to a new normal. Further, regular mental health assessment by healthcare professionals, including of life stressors, is needed to better provide support for those at risk of developing, or those already experiencing, anxiety and depression.

1. Introduction

The COVID-19 pandemic began globally in December 2019, with the first U.S. cases identified in January 2020, and the U.S. National Emergency declaration occurring mid-March 2020. Initial lockdowns throughout the world increased stress and fueled employment and financial uncertainty[1], work-life balance disruptions[2], and unequal access to and under-utilization of health care services[3,4]. Since then the pandemic has continued to disrupt life in multiple domains. Stressors related to previous natural and manmade disasters have been linked to declines in mental health not just during, but for many months to years following these events[5-7].

Numerous studies have documented the mental health impact of the COVID-19 pandemic on healthcare workers, vulnerable patient populations, and more general populations, particularly during strict lockdown phases of the pandemic[8-11]. Most of these studies were cross-sectional, as detailed in a recent systematic review.[10] A smaller number of studies were longitudinal analyses from the UK using data collected after the onset of the pandemic[12,13] or included different samples to compare psychological distress before and during the pandemic[14-16]. These studies suggested that depression and anxiety symptoms were highest during lockdown periods, plateaued approximately four months into the pandemic[13] at higher than pre-pandemic levels[17], then increased slightly from August 2020 to February 2021[12].

Studies suggest several factors were associated with higher risk of depression, anxiety, or other psychological symptoms during the COVID-19 pandemic. These factors include being female, younger (particularly those under 35 years of age), Hispanic, and having lower education or financial resources[9,12-16,18]. Pre-existing mental health conditions and living alone or with children were associated with elevated levels of anxiety and/or depression early in the pandemic[13,14]. Physical health conditions associated with poor COVID-19 infection outcomes were also associated with psychological distress in one study[14], but were limited to obesity and asthma; the full list of medical conditions identified by the Centers for Disease Control and Prevention (CDC)[19] were not included. Stressors[15], such as job loss[15] or economic hardship[14,15], and working in occupations with lower earnings potential and skill levels[20] were also associated with greater depression and anxiety during the pandemic. Few studies, however, included pre-pandemic levels of mental health, or were compre-

hensive in assessing stressors or medical conditions that increase the risk of poor COVID-19 outcomes that are likely associated with longer-term mental health impacts of the pandemic. Assessing change in psychological distress from pre-pandemic levels would help determine the effects of the pandemic on distress independently of the effect of pre-existing symptoms. Moreover, including a range of pandemic-associated stressors and other variables (e.g., medical conditions that increase risk of death if infected with COVID, etc.) in analyses would help identify which stressors or factors are of greatest importance in driving escalations in psychological distress during a pandemic.

Using prospective data from two waves, 2018 and July- September 2020, this study aims to characterize levels of psychological distress among U.S. men and women during the COVID-19 pandemic and to identify factors associated with persistent depression and anxiety symptoms, including sociodemographic characteristics, stressors, and comorbid conditions associated with increased risk for poor COVID-19 outcomes. A secondary aim is to examine the association of these factors with longitudinal change in psychological distress. Due to the findings of prior studies on sex differences on psychological distress[21] and differences in how men and women used time during the pandemic[22], all models are stratified by sex.

2. Methods and Materials

2.1. Study population and design

The Cancer Prevention Study-3 (CPS-3) is a prospective study of cancer incidence and mortality initiated by the American Cancer Society in 2006[23]. Over 304,000 participants throughout the US aged 30 to 65 years with no history of cancer (except for basal or squamous cell skin cancer) were enrolled at fundraising events or community enrollment drives between 2006 and 2013. CPS-3 participants completed a baseline survey at enrollment and additional surveys every three years beginning in 2015. The CPS-3 study protocol was approved by the institutional review boards of Emory University.

In June 2020, 13,052 participants who completed the most recent (2018) CPS-3 survey were sent an email invitation to join an online participant portal, with the first 3,000 respondents granted access to register for the portal. Among those who registered, 2,429 participants completed a COVID-19 focused questionnaire, referred to as the COVID-19 survey, that sought to determine how the pandemic affected their physical and mental health, health behaviors, health care and employment status, health insurance, and financial security.

Measures

2.1.1. Outcomes

Pandemic Psychological Distress: The 4-item Patient Health Questionnaire (PHQ-4) is a general screening measure for assessing psychological distress (based on total score).[24] The PHQ-4's two subscales (of 2 items each) are also valid screeners for depression and/or anxiety disorders.[24] Items are rated on a Likert scale (0=not at all, 1=several days, 2=more than half the days, 3=nearly every day)[25]. We adapted the PHQ to align with the timing of the pandemic by modifying the leading question to assess how often each problem bothered them "since the start of the COVID-19 pandemic" (e.g., "feeling nervous, anxious, or on edge," "feeling down, depressed, or hopeless"). Consistent with prior literature[25], items were summed to create a total score, with psychological distress categorized as normal (0-2), mild (3-5), moderate (6-8), and severe (9-12). Two dichotomous variables were also created based on the sum of ratings of the two depression and two anxiety items.

Scores of 3 or higher on each subscale indicated depression or anxiety[25].

Pre-pandemic Psychological Distress: The 2018 CPS-3 survey included a single-item from the Patient-Reported Outcomes Measurement Information System (PROMIS)[26] that assessed "how often have you been bothered by emotional problems such as anxiety, feeling depressed, or irritable?" Responses were dichotomized, based on alignment with the PHQ-4 items, as never/rarely/sometimes ("0") vs. often/always ("1").

Change in Psychological Distress. A variable indicating change in psychological distress from 2018 to during the pandemic was created based on responses from the 2018 PROMIS item and the PHQ4 total score from the COVID-19 survey. The four categories were 1) low psychological distress at both assessments, 2) increase in distress from 2018 to during the pandemic, 3) decrease in distress from 2018 to during the pandemic, and 4) high psychological distress at both time points.

2.1.2. Predictors

Constructs that in previous research have been associated with mental health were selected for inclusion as predictors.

COVID-19 complications: Based on CDC guidance, participants were categorized in one of 3 risk categories based on their most recent responses to previous CPS-3 surveys. They were defined as "high risk" of COVID-19 complications if they reported a history of cancer, kidney disease, COPD, type 2 diabetes, heart attack, stroke, heart bypass surgery, being obese (body mass index $\geq$30 kg/m^2) or being a current smoker. Participants were categorized as "might be at increased risk" for COVID-19 complications if they reported asthma, HIV, type 1 diabetes, hypertension, liver disease, or being overweight (body mass index $\geq$25 kg/m^2 and $<$ 30 kg/m^2). If none of these conditions were ever reported, they were categorized as "low risk" for COVID-19 complications.

Stressors: A principal components analysis (PCA) with varimax rotation was used to identify four domains of stressors from the fourteen pandemic-linked stressors included in the COVID-19 survey (which were themselves based on the life stressor literature and similar to a recent mental health and COVID-19 publication[15]). Because several of the individual stressors were continuously-scaled and had non-normal distributions, all continuously-scaled items were first dichotomized (e.g., 0="Never true," 1="Sometimes true," or "Often true") and subjected to the PCA along with the remaining (dichotomized) stressors. Items loading > .40 on any factor, and that loaded significantly lower on other factors (i.e., more than .25 difference), were retained as potential indicators of that factor.

The PCA yielded four factors with eigenvalues greater than 1 that accounted for 56% of total variance (after first removing an item that loaded similarly on 3 of the factors). Stressor domains based on the PCA results were: 1) employment stressors (worked fewer hours/shifts; salary/benefits were cut/decreased; temporarily furloughed; laid off/lost a job permanently), 2) financial stressors ("worried about not being able to pay the: 1: medical costs of a serious illness or accident; 2: medical costs for normal or routine healthcare; and 3: not being able to afford basic household expenses such as rent/mortgage or utilities), 3) food insecurity stressors (1: "I worried whether my food would run out before I got money to buy more" and 2: "The food that I bought just didn't last, and I didn't have money to get more"), and 4) work/life balance stressors (1: difficulty managing your work-life balance; 2: decreased time for leisure activities; and 3: decreased productivity at work). Scores for each stressor are number of events experienced within each category: employment (0, 1, 2 or more), financial (0, 1 or more), food insecurity (0, 1 or more), and work/life balance (0, 1, 2 or more) (Cronbach's α = .53, .77, .72, .58, respectively). Although two of the stressor categories had internal consistency reliability bordering on adequate (employment, work/life balance stressors), the items within each stressor category were more strongly correlated with each other than to items assigned to the remaining 3 categories of stressors (as determined by the PCA). In addition, items within the employment and work/life balance stressors category were conceptually very similar to each other.

Sociodemographic factors: Demographic information, including age (at the time of COVID-19 survey completion), biological sex, and race/ethnicity (non-Hispanic White vs. Other), were assessed at baseline (2006-2013).

2.2. Statistical Analysis

Participants were excluded from analyses if they were missing responses to any of the items used to calculate the PHQ-4 score (n=70), leaving 2,359 participants in the analytic cohort. No differences were found among those excluded from analyses compared to those included in analyses with the exception of two variables with limited variability; those who self-reported other race/ethnicity (compared to non-Hispanic White) and those reporting food insecurities were slightly more likely to be missing PHQ-4 outcomes and therefore excluded from the study. Multivariate ordinal logistic regression models were used to estimate odds ratios (OR) and 95% confidence intervals (CI) for predictors of psychological distress severity during COVID-19. Potential predictors of psychological distress (categories: normal, mild, moderate, and severe) were age, race/ethnicity, risk of complications if diagnosed with COVID-19, pre-pandemic psychological distress, employment stressors, financial stressors, food insecurity stressors, and work/life balance stressors. Models did not violate the proportional odds assumption and predictors were tested for multicollinearity with no issues detected. Similar analyses using binary logistic regression models estimated the association between these predictors and anxiety and depression during the COVID-19 pandemic.

Polytomous logistic regression models examined the association of predictors with change in psychological distress from pre-pandemic to during the pandemic. All models were stratified by sex and analyses were performed in SAS 9.4.

Role of the funding source: The American Cancer Society funds the creation, maintenance, and updating of the CPS-3.

3. Results

3.1. Sample Characteristics

Participant characteristics are shown in Table 1. More participants were female (65%) than male, married (78%), and non-Hispanic White (76%). On average they were 57 years old (SD=9.7). Approximately a quarter were categorized as low risk (27%), a third who might be at high risk (36%), and more than a third at increased risk (37%) for COVID-19 complications. Among the different types of stressors, work/life balance stressors were most common, with half of respondents endorsing at least one, followed by employment stressors (27% endorsed one or more).

3.2. Pandemic Levels of Psychological Distress

Pre-pandemic psychological distress, assessed on the 2018 CPS-3 survey, was not common (6.3%). The proportion experiencing each level of psychological distress pre-pandemic were: 58% normal, 32% mild, 7% moderate, and 3% severe. During the pandemic, 15% of participants met criteria for anxiety and 10% met criteria for depression, with females more likely to be classified as anxious or depressed (19%, 12%, respectively) compared to males (7%, 6%, respectively).

Table 1
Participant Characteristics

Characteristic	Overall	By Sex	
		Women	Men
	N=2,359	N=1,534	N=825
	N (%)	N (%)	N (%)
Race			
Non-Hispanic White	1,793 (76.0)	1,089 (71.0)	704 (85.3)
Other	566 (24.0)	445 (29.0)	121 (14.7)
Smoking status			
Never	1,716 (72.7)	1,126 (73.4)	590 (71.5)
Current	31 (1.3)	23 (1.5)	8 (1.0)
Former	612 (25.9)	385 (25.1)	227 (27.5)
Body mass index (kg/m^2)			
Normal (<25)	949 (40.2)	661 (43.1)	288 (34.9)
Overweight (25-<30)	768 (32.6)	427 (27.8)	341 (41.3)
Obese (≥30)	642 (27.2)	446 (29.1)	196 (23.8)
History of cancer	159 (6.7)	100 (6.5)	59 (7.2)
Kidney disease	9 (0.4)	6 (0.4)	3 (0.4)
COPD	27 (1.1)	17 (1.1)	10 (1.2)
Type 2 diabetes	125 (5.3)	71 (4.6)	54 (6.5)
Heart attack, stroke, or heart bypass surgery	68 (2.9)	27 (1.8)	41 (5.0)
Asthma	309 (13.1)	237 (15.4)	72 (8.7)
HIV	3 (0.1)	1 (0.1)	2 (0.2)
Type 1 diabetes	5 (0.2)	4 (0.3)	1 (0.1)
Hypertension	614 (26)	349 (22.8)	265 (32.1)
Liver Disease	4 (0.2)	1 (0.1)	3 (0.4)
Risk of COVID complications			
Low risk	639 (27.1)	448 (29.2)	191 (23.2)
Might be at increased risk	844 (35.8)	510 (33.2)	334 (40.5)
Increased risk	876 (37.1)	576 (37.5)	300 (36.4)
Employment stressors			
0	1,721 (73)	1,101 (71.8)	620 (75.2)
1	407 (17.3)	266 (17.3)	141 (17.1)
2	231 (9.8)	167 (10.9)	64 (7.8)
Financial stressors			
0	1,943 (82.4)	1,207 (78.7)	736 (89.2)
1	416 (17.6)	327 (21.3)	89 (10.8)
Food insecurity stressors			
0	2,241 (95)	1,446 (94.3)	795 (96.4)
1	118 (5.0)	88 (5.7)	30 (3.6)
Work/life balance stressors			
0	1,176 (49.9)	752 (49)	424 (51.4)
1	607 (25.7)	389 (25.4)	218 (26.4)
2	576 (24.4)	393 (25.6)	183 (22.2)
Psychological Distress (2018 PROMIS depression/anxiety)			
Never, Rarely, Sometimes	2,211 (93.7)	1,429 (93.2)	782 (94.8)
Often, Always	148 (6.3)	105 (6.8)	43 (5.2)
Psychological Distress (2020 PHQ-4)			
Normal (0-2)	1,372 (58.2)	794 (51.8)	578 (70.1)
Mild (3-5)	746 (31.6)	540 (35.2)	206 (25.0)
Moderate (6-8)	171 (7.2)	138 (9.0)	33 (4.0)
Severe (9-12)	70 (3.0)	62 (4.0)	8 (1.0)
Anxiety (from PHQ4)			
Not anxious (0-2)	2,015 (85.4)	1,245 (81.2)	770 (93.3)
Anxious (3-6)	344 (14.6)	289 (18.8)	55 (6.7)
Depression (from PHQ4)			
Not depressed (0-2)	2,126 (90.1)	1,352 (88.1)	774 (93.8)
Depressed (3-6)	233 (9.9)	182 (11.9)	51 (6.2)
Change in Psychological Distress (2018 to 2020)			
Low/low	2,031 (86.1)	1,277 (83.2)	754 (91.4)
High to low	87 (3.7)	57 (3.7)	30 (3.6)
Low to high	180 (7.6)	152 (9.9)	28 (3.4)
High/high	61 (2.6)	48 (3.1)	13 (1.6)
	Mean (SD)	Mean (SD)	Mean (SD)
Age at time of COVID portal survey	57.4 (9.65)	56.6 (9.67)	58.9 (9.45)

Trends in the factors associated with psychological distress during the pandemic, shown in Table 2, were similar for men and women though the magnitude of the point estimates were different. Compared to those who did not report any financial stressors, reporting one or more financial stressors was associated with more than double the odds of psychological distress among both women (OR=2.48, 95% CI: 1.91-3.21) and men (OR=3.68, 95% CI: 2.29-5.90).

Compared to those who did not report any work/life balance stressors, reporting only one work/life balance stressor increased the odds of psychological distress among both women (OR=1.44, 95% CI: 1.11-1.85) and men (OR=1.78, 95% CI: 1.19-2.7); reporting two or more work/life balance stressors was somewhat more strongly associated with the odds of psychological distress among men (OR=3.33, 95% CI: 2.13-5.20) than among women (OR=3.03, 95% CI: 2.31-3.98).

Table 2

Predictors of Psychological Distress Severity Stratified by Sex: Ordinal Logistic Regression*

Predictor	WomenOR (95% CI)	MenOR (95% CI)
Age (continuous)	1.00 (0.99-1.01)	0.99 (0.97-1.01)
Race		
Non-Hispanic White	1.00 (ref)	1.00 (ref)
Other	0.89 (0.71-1.11)	0.66 (0.41-1.05)
Risk of COVID complications		
Low risk	1.00 (ref)	1.00 (ref)
Might be at increased risk	1.04 (0.80-1.34)	1.41 (0.92-2.16)
Increased risk	1.12 (0.87-1.43)	1.32 (0.85-2.07)
Employment stressors		
0	1.00 (ref)	1.00 (ref)
1	0.96 (0.74-1.26)	0.89 (0.58-1.38)
2	1.20 (0.87-1.66)	1.15 (0.65-2.04)
Financial stressors		
0	1.00 (ref)	1.00 (ref)
1	2.48 (1.91-3.21)	3.68 (2.29-5.90)
Food insecurity stressors		
0	1.00 (ref)	1.00 (ref)
1	0.76 (0.49-1.19)	1.85 (0.87-3.93)
Work/life balance stressors		
0	1.00 (ref)	1.00 (ref)
1	1.44 (1.11-1.85)	1.78 (1.19-2.65)
2	3.03 (2.31-3.98)	3.33 (2.13-5.20)
Pre-pandemic psychological distress**		
Never, Rarely, Sometimes	1.00 (ref)	1.00 (ref)
Often, Always	5.65 (3.85-8.28)	9.70 (5.15-18.3)

* All predictors are included in an ordinal logistic regression model with PHQ-4 score as the outcome modeled as 4 increasing levels of reported psychological distress- normal, mild, moderate, and severe.

** Pre-pandemic psychological distress was measured using the PROMIS depression/anxiety item from the 2018 survey

Although confidence intervals were wide, pre-pandemic psychological distress was also associated with a 9-fold increase in the odds of pandemic psychological distress among men (OR=9.70, 95% CI: 5.15-18.3) and a more than 5-fold increase in the odds for women (OR=5.65, 95% CI: 3.85-8.28). Age, race/ethnicity, COVID-19 complication risk, employment stressors, and food insecurity stressors were not significantly associated with psychological distress during the pandemic.

Predictors of anxiety and depression during the pandemic, stratified by sex, are shown in Table 3. Among women only, the odds of depression were greater for those who were at increased risk for COVID-19 complications (OR=1.75; 95% CI: 1.13-2.71). For both men and women the odds of depression or anxiety were greater for those who reported financial stressors, work/life balance stressors, and pre-pandemic psychological distress. Age, race/ethnicity, employment stressors, and food insecurity stressors were not significantly associated with pandemic depression and anxiety.

3.3. Change in Psychological Distress

Most of the sample reported low psychological distress at both timepoints (86.1%) and approximately 8% were categorized as having more psychological distress during the pandemic compared to pre-pandemic, with females (10%) more likely to fall into this category than males (3%). Factors associated with an escalation in psychological distress from pre-pandemic to during the pandemic are shown in Table 4 (stratified by sex, low psychological distress at both time points as reference category) included financial stressors (women OR=3.00, 95% CI: 2.07-4.33; men OR=6.18, 95% CI: 2.70-14.2) and work/life balance stressors (women OR=2.81, 95% CI: 1.86-4.26; men OR=3.34, 95% CI: 1.16-9.61). Factors associated with sustained high levels of psychological distress over time include younger age (women OR=0.96, 95% CI: 0.92-0.99; men OR=0.91,

95% CI: 0.85-0.98), and, among women, having financial stressors (OR=3.31, 95% CI:1.81-6.07).

4. Discussion

The current prospective study assessed psychological distress both pre-pandemic and during the pandemic. In addition, this study assessed the role of a range of factors (medical, sociodemographic, stressors etc.) that prior research has implicated in mental health, enabling an investigation of the unique contribution of each factor in predicting psychological distress. Results suggest that almost half of participants across the United States were experiencing at least mild psychological distress half a year into the COVID-19 pandemic, and 10% were experiencing moderate to severe anxiety or depression. These results are consistent with previous research from NHIS data[17] indicating that levels of persistent mental health issues were higher during the pandemic compared to monthly rates in 2019 (9.5% to 11.7% were anxious and/or depressed). Our rates of psychological distress during the pandemic were also similar to those from two recent studies[12,15] of U.S. adults that also used a version of the PHQ.

Several factors were associated with higher levels of psychological distress half a year into the pandemic. Consistent with prior research, females[9,12-16] were more likely than males to report higher psychological distress during the pandemic, especially anxiety, and higher levels of psychological distress prior to the pandemic was associated with a higher likelihood of psychological distress during the pandemic[13,14]. Notably in this study, having elevated psychological distress pre-pandemic was associated with an eleven-fold increase in depression for men. An additional predictor of depression among women during the pandemic included being at increased risk for COVID-19 complications due to pre-existing health conditions; this is similar to recent literature suggesting that during the pandemic those with a history of cancer reported a high level of worries about treatment delays and being

Table 3
Predictors of Anxiety and Depression Stratified by Sex: Logistic Regression*

Predictor	Anxiety**		Depression***	
	WomenOR (95% CI)	MenOR (95% CI)	WomenOR (95% CI)	MenOR (95% CI)
Age (continuous)	0.99 (0.97-1.00)	0.97 (0.93-1.00)	1.01 (1.00-1.03)	0.96 (0.93-1.00)
Race				
Non-Hispanic White	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Other	0.86 (0.64-1.17)	0.65 (0.27-1.54)	1.12 (0.78-1.59)	1.02 (0.44-2.39)
Risk of COVID complications				
Low risk	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Might be at increased risk	1.15 (0.80-1.65)	1.27 (0.56-2.85)	1.29 (0.81-2.07)	2.10 (0.80-5.51)
Increased risk	1.24 (0.88-1.76)	1.48 (0.65-3.38)	1.75 (1.13-2.71)	2.47 (0.93-6.57)
Employment stressors				
0	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
1	0.79 (0.54-1.15)	1.39 (0.66-2.92)	0.77 (0.49-1.23)	1.45 (0.64-3.27)
2	1.08 (0.71-1.64)	1.17 (0.45-3.06)	1.21 (0.74-1.97)	1.32 (0.49-3.57)
Financial stressors				
0	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
1	2.64 (1.92-3.65)	2.94 (1.44-5.99)	2.50 (1.71-3.66)	2.92 (1.36-6.28)
Food security stressors				
0	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
1	0.69 (0.39-1.22)	0.93 (0.27-3.18)	0.80 (0.43-1.50)	1.27 (0.39-4.16)
Work/life balance stressors				
0	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
1	1.78 (1.24-2.55)	3.18 (1.24-8.15)	2.24 (1.44-3.49)	2.12 (0.89-5.05)
2	3.11 (2.16-4.47)	6.26 (2.43-16.1)	3.58 (2.28-5.62)	2.59 (1.03-6.50)
Pre-pandemic psychological distress**				
Never, Rarely, Sometimes	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Often, Always	4.66 (3.00-7.23)	4.90 (2.18-11.0)	6.61 (4.17-10.5)	11.5 (5.32-24.8)

* All predictors are included in a multivariate logistic regression model with anxiety or depression as the outcome based on responses to the PHQ-4.
** Anxiety was measured by using the 2-item subscale of the PHQ-4
*** Depression was measured by using the 2-item subscale of the PHQ-4
**** Pre-pandemic psychological distress was measured using the PROMIS depression/anxiety item from the 2018 survey

at higher risk of poor outcomes if infected with COVID-19 compared to those without a history of cancer[27]. Higher levels of work/life balance stressors were more strongly associated with depression for women and anxiety for men; however higher levels of financial stressors were more strongly associated with depression among men. Regular mental health assessment by healthcare professionals, including of life stressors, is needed to better provide support for those at risk of developing, or those already experiencing, anxiety and depression. These results support the importance of regular mental health assessment and subsequent mental health support among those with a history of mental health issues, especially men, and those who may be isolating to keep themselves safe from COVID-19 or other infections. Results also highlight the importance of investigating the continued and long-term impact of the COVID-19 pandemic on mental health as social distancing, a factor previously associated with depression and anxiety[16], continues to be promoted over a year into the pandemic and as the world slowly opens again, potentially triggering different types of anxiety as people adjust to a new normal.

Using prospective cohort data to classify participants by change in psychological distress pre-pandemic to during the pandemic, several factors were associated with increases in or sustained high levels of psychological distress. Similar to the main analysis, financial stressors and work/life balance stressors were significantly associated with an escalation in psychological distress, especially among men. Factors associated with sustained high levels of psychological distress over time included younger age, and, among women only, being socially isolated or having financial stressors (potentially due to fewer men in that analysis). These findings suggest the importance of mental health support for those at increased risk of becoming psychologically distressed, such as individuals who already feel stressed about being able to pay for healthcare and basic household costs, have work or other responsibilities that decrease time for leisure activities, or those for whom

caregiving responsibilities can be compounded during large-scale disasters.

Several limitations exist for this study. The CPS-3 cohort used a different measure of psychological distress pre-pandemic (PROMIS) compared to during the pandemic (PHQ-4). Therefore, this study was not able to provide specific change scores in anxiety and depression and instead categorized participant psychological distress as high or low at both timepoints, lower during the pandemic or higher during the pandemic. The pandemic survey also did not explicitly ask the cause of respondents' distress during the pandemic. Higher or lower levels of psychological distress may have been due to a reason other than the pandemic, such as the death of a loved one. On average, CPS-3 participants have a higher socioeconomic status and have better access to healthcare than the US population[23]; this may have led to lower rates of psychological distress in this sample compared to other studies and may limit generalizability. Lastly, the stressor variables had some limitations. While the Cronbach alpha for items grouped within the employment and work-life balance stressor categories bordered on adequate, the items within each category were conceptually similar, as expected from the results of a PCA. Despite the less-than-optimal level of internal reliability, obtaining significant effects for these two measures suggests that the effects obtained with these measures may be even stronger than observed.

Despite the limitations, this study used a prospective cohort design that included pre-pandemic information on psychological distress and other important yet understudied predictors, such as comorbid conditions associated with increased risk of hospitalization and death if infected with COVID-19, and stressors linked to the pandemic. This study also included men and women of varying ages across the United States. In addition, this study used data from later into the pandemic after strict lockdowns ended in the U.S., to examine persistent psychological distress; most other studies focused on earlier responses when strict lockdowns occurred.

Table 4
Predictors of Change in Psychological Distress 2018 to COVID Survey, Stratified by Sex: Polytomous Logistic Regression*

Predictor	Women				Men			
	Low at both times(N=1277)	Lower during pandemic than 2018(N=57)	Higher during pandemic than 2018(N=152)	High at both times(N=48)	Low at both times(N=754)	Lower during pandemic than 2018(N=30)	Higher during pandemic than 2018(N=28)	High at both times(N=13)
Age (cont)	1.00 (ref)	0.97 (0.94-1.00)	0.99 (0.97-1.01)	0.96 (0.93-0.99)	1.00 (ref)	0.96 (0.92-1.01)	0.98 (0.94-1.02)	0.91 (0.85-0.98)
Race								
Non-Hispanic White	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Other	1.00 (ref)	0.70 (0.38-1.31)	1.00 (0.69-1.45)	0.80 (0.42-1.53)	1.00 (ref)	0.95 (0.35-2.60)	0.35 (0.08-1.56)	0.99 (0.25-3.96)
Risk of COVID complications								
Low risk	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Might be or at increased risk	1.00 (ref)	1.40 (0.74-2.64)	1.17 (0.78-1.75)	1.44 (0.70-2.95)	1.00 (ref)	1.37 (0.54-3.48)	4.66 (1.05-20.6)	1.36 (0.35-5.30)
Employment stressors								
0	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
1 & 2	1.00 (ref)	1.69 (0.97-2.94)	1.16 (0.80-1.68)	0.81 (0.42-1.57)	1.00 (ref)	1.11 (0.49-2.52)	2.41 (1.06-5.46)	0.18 (0.02-1.44)
Financial stressors								
0	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
1 & 2	1.00 (ref)	2.03 (1.13-3.65)	3.00 (2.07-4.33)	3.31 (1.81-6.07)	1.00 (ref)	3.23 (1.34-7.83)	6.18 (2.70-14.2)	3.57 (0.99-12.9)
Work/life balance stressors								
0	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
1 & 2	1.00 (ref)	0.91 (0.50-1.64)	2.81 (1.86-4.26)	1.55 (0.79-3.03)	1.00 (ref)	1.46 (0.61-3.48)	3.34 (1.16-9.61)	5.78 (0.68-49.3)

* All predictors are included in a polytomous logistic regression model with combined anxiety/depression reported on 2018 and on the COVID survey as the outcome

Overall, these sex-stratified findings suggest that many men and women in the United States continued to experience psychological distress, depression, and anxiety, half a year into the pandemic.

Several learning opportunities for how to improve population mental health during and after pandemics, natural disasters, or other life-altering events have been created by the COVID-19 pandemic. These data in particular will help clinicians identify populations vulnerable to persistent mental health and other long-term issues. Health professionals should screen patients, especially those with prior mental health issues and life stressors, to identify those struggling with psychological distress to provide earlier clinical support. As many of these relevant stressors may persist due to the continued impact of the pandemic on job losses, continued fear about the virus and emerging variants, and other factors, it is plausible to hypothesize that mental health issues may not simply be acute. In a time where in-person social interactions and health appointments have been limited, digital support tool development and telemedicine has been even more important to support those struggling with mental health issues, sometimes as the result of social distancing which keeps them physically safe. Ensuring equitable access and appropriate level of support based on digital health literacy will be essential in order to decrease disparities in mental healthcare. Finally, as identified by a recent position paper[28], data collected from this pandemic can improve coordinated health messaging and clinical support by health systems so we are better prepared to support population mental health during future disasters.

5. Contributors

Corinne Leach: conceptualization of paper, literature search, study design, data analysis, data interpretation, writing; Erika Rees-Punia: literature search, study design, data interpretation, writing; Christina Newton: led data analysis, study design, data collection, data interpretation, writing; Sicha Chantaprasopsuk: study design, data collection, data interpretation, writing; Alpa Patel: CPS-3 study PI, study design, data collection, data interpretation, writing; J. Lee Westmaas: literature search, study design, data analysis of stressors, data interpretation, writing

The authors assume full responsibility for all analyses and interpretation of results. The views expressed here are those of the authors and do not necessarily represent the American Cancer Society or the American Cancer Society – Cancer Action Network.

6. Data Statement

Data are available upon request following the guidelines stated at https://www.cancer.org/content/dam/cancer-org/research/epidemiology/cancer-prevention-study-data-access-policies.pdf.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.lana.2021.100069.

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