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The mental health consequences of COVID-19: a nationally representative cross-sectional study of pandemic-related stressors and anxiety disorders in the United States.

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The mental health consequences of COVID-19: a nationally representative cross-sectional study of pandemic-related stressors and anxiety disorders in the United States.

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Abstract

Objective: to quantify the prevalence of anxiety disorders in the United States during the COVID-19 pandemic.

Design: cross-sectional analysis

Setting: a nationally representative sample in the United States between March 31 and April 12, 2020

Participants: 1450 English-speaking adult participants in the AmeriSpeak Panel. AmeriSpeak is a probability-based panel designed to be representative of households in the United States.

Main outcome measures: prevalence of probable generalized anxiety disorder (GAD) using the GAD-7 tool and probable post-traumatic stress symptoms (PTSS) using the 4-items PTSD checklist (PCL) tool. Both outcomes were adjusted for demographics and COVID-19 related stressors.

Results: the prevalence of GAD was 10.9% (95% CI: 9.1-13.2) and the prevalence of PTSS was 21.7% (95% CI: 19.1-24.6). Among participants reporting five or more COVID-19 related stressors, the prevalence of GAD was 20.5% (95% CI: 16.1-25.8) and the prevalence of PTSS was 35.7% (95% CI: 30.2-41.6). Reporting five or more COVID-19 related stressors was a predictor of both GAD (OR=4.5, 95% CI: 2.3-8.8) and PTSS (OR=3.3, 95% CI: 2.1-5.2).

Conclusions

The prevalence of anxiety disorders in the United States, as the COVID-19 pandemic and policies implemented to tackle it unfolded, is higher than estimates reported prior to the pandemic and estimates reported following other mass traumatic events. Exposure to COVID-19 related stressors is associated with higher prevalence of both GAD and PTSS, highlighting the role these stressors play in increasing the burden of anxiety disorders in the United States. Mitigation policies need to take into account the effect of pandemic-related stressors on the mental health of the United States population.

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Strengths and limitations of this study

- This analysis uses a nationally representative sample examining the burden of anxiety disorders in the United States
- The study was conducted within a short duration following the implementation of state-wide policies to tackle the COVID-19 pandemic and includes questions about a wide-range of COVID-19 related stressors
- To assess the burden of anxiety disorders, the study uses screening, rather than diagnostic tools. However, these are validated tools
- The use of a pre-selected panel of participants can lead to selection bias

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Introduction

The effect of the COVID-19 pandemic on the American public has been profound. By May 10th, more than 80,000 people have died from COVID-19 in the United States, and a number of unprecedented physical distancing policies, such as statewide shelter-in-place orders, continue to be implemented to halt the spread of the pandemic. These policies changed daily life for most people in the United States significantly and continue to have large scale social and economic consequences. The physical toll of COVID-19, coupled with the ubiquity and severity of these policies, distinguish the pandemic as a mass traumatic event, one that is associated with extensive loss of lives and financial strains that can lead to severe and lasting psychological effects, anxiety disorders in particular.[1–4]

Uncertainty, fear, economic and social costs, and disruptions to daily life all contribute to a high prevalence of anxiety disorders following mass traumatic events.[5,6] For example, a study assessing the mental health consequences of the Ebola epidemic in Sierra Leone found that, a year following the epidemic, 6% of participants reached the threshold for a combined anxiety-depression measure and 27% reached the threshold for post-traumatic stress disorder (PTSD).[7] Another study estimated that, following Hurricane Katrina, the 30-day prevalence of PTSD was 30.3% among residents of the New Orleans metropolitan area, which was severely affected by the hurricane.[8]

This previous work suggests that the COVID-19 pandemic will have a substantial effect on the prevalence of anxiety disorders in the United States. Early evidence from both China and the United States has found that COVID-19 pandemic is associated with adverse mental health consequences.[9–11] However, to our knowledge, the effects of COVID-19 and related stressors—both due to the pandemic and policies implemented to halt its spread—on the burden of anxiety disorders in the United States is yet to be documented.

We assessed the prevalence of anxiety disorders, generalized anxiety disorder (GAD) and post-traumatic stress symptoms (PTSS), as the COVID-19 pandemic unfolded in the United States. We also assessed the effects of COVID-19 related stressors on the burden of anxiety disorders following the implementation of wide-spread physical distancing policies in the United States.

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Methods

Data collection and sample

This analysis is based on data from our COVID-19 and Life stressors Impact on Mental Health and Well-being Study (CLIMB). We collected nationally representative data using a random sample of adult participants in the AmeriSpeak Panel between March 31 and April 12, 2020. AmeriSpeak is a probability-based panel designed to be representative of households in the United States. The panel is funded and operated by the National Opinion Research Center (NORC) at the University of Chicago and their sampling frame covers approximately 97% of households in the country. The survey was offered to English-speaking participants who had completed an AmeriSpeak survey in the last 6 months.

In total, 1470 participants completed the survey, 1385 online and 85 via the phone, representing 64.3% of invited panelists. From those 1470 participants, 20 had missing data on either GAD or PTSS questions, which were removed; the final analysis included 1450 participants from the CLIMB study. The institutional review boards of NORC and Boston University Medical Campus (H-39986) approved the study. NORC obtained written consent from study participants when they first enrolled in the AmeriSpeak Panel.

Exposure variables

Our structured survey included questions on demographic characteristics and whether the respondent had or knew anyone who had COVID-19. The primary exposure of interest was reporting COVID-19 related stressors. The stressor list included financial stressors, e.g. “losing a job” or “having problems paying rent,” and social and emotional stressors, e.g. “feeling along” or “having relationship problems.” We excluded stressors that were applicable to only a subset of the population, ultimately including 14 stressors in our analysis. We then created a cumulative stressor score and divided the score into three stressor categories, low (0-2 stressors), medium (3-4 stressors), and high (5-14 stressors).

Outcome variables

For psychological assessment, we used two validated anxiety disorders questionnaires. We used the GAD-7 to assess GAD.[12] The cutoff for probable GAD in our analysis was 15 score or more. We also

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conducted a sensitivity analysis with a cutoff of 10 score or more. We used the 4-items PTSD checklist (PCL) to screen for PTSS. The cutoff for PTSS was three score or more.[13]

Statistical analysis

We used STATA 16.1 to conduct the analysis for this study. We first calculated the overall prevalence of GAD and PTSS and the prevalence of each stratified by number of stressors. We conducted a bivariable analysis comparing GAD and PTSS prevalence across demographic characteristics, stressor score, and each type of stressor using a two-tailed chi-square test. We then constructed multiple logistic regression models to assess the predictors of each outcome. All analyses were weighted using complex survey weights to adjust for sample selection and post-stratification. We followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline for cross-sectional studies when designing and reporting on this analysis.

Patient and public involvement

Patients and the public were not involved in the developing the research question, design, or implementation of this analysis. This primarily because we did not have funding to support such involvement and our analysis was on a national level using validated assessment tools.

Results

Of the 1450 participants, 10.9% (95% CI: 9.1, 13.2) reached the threshold for probable GAD, using a score of 15 as a cutoff. When using 10 score as a cutoff point, 25% (95% CI: 22.2-28.0) reached the threshold for probable GAD. 21.7% (95% CI: 19.1-24.6) reported PTSS.

Table 1 shows the association between demographic characteristics and the two outcomes. In particular, female sex was associated with a higher prevalence of both GAD and PTSS in the bivariable analysis. The prevalence of GAD was 14.1% (95% CI: 11.2-17.6) among females compared to 7.6% (95% CI: 5.4-10.4) among males. The prevalence of PTSS was 26.1% (95% CI: 22.3-30.2) among females compared to 17% (95% CI: 13.5-21.2) among males. Other demographic variables associated with both outcomes were

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age and household savings. In the multivariable analysis, age and household savings were predictors of GAD while gender and old age were predictors of PTSS.

COVID-19 related stressors and anxiety disorders

Higher stressor score was associated with, and a predictor of, both GAD and PTSS. The prevalence of GAD was 4% (95% CI: 2.2-7.0) among participants with low stressor score, 8.6% (95% CI: 6.2-11.8) among participants with medium stressor score, and 20.5% (95% CI: 16.1-25.8) among participants with high stressor score. High stressor score was a predictor of GAD (OR=4.5, 95% CI: 2.3-8.8) compared to reporting a low stressor score.

The prevalence of PTSS was 12.4% (95% CI: 8.9-17.0) among participants with low stressor score, 17.4% (95% CI: 13.6-22.0) among participants with medium stressor score, and 35.7% (95% CI: 30.2-41.6) among participants with high stressor score. Reporting a high stressor score, compared to a low stressor score, was a predictor of PTSS (OR=3.3, 95% CI: 2.1-5.2) (Table 1).

Figure 1 shows that reporting any COVID-19 related stressor, except for experiencing travel restrictions, was associated with higher GAD prevalence. The greatest difference in GAD prevalence by COVID-19 stressor was between participants who reported having family or relationship problems (prevalence=27%, 95% CI: 19.6-36.1) compared to participants who did not report family or relationship problems (prevalence=8.7%, 95% CI: 6.9-10.9). Other stressors leading to a significant difference in GAD prevalence included feeling lonely, having difficulty paying the rent, losing a job, having financial problems, and a household member losing a job. Figure 2 shows that participants who reached the threshold for probable GAD reported, on average, experiencing a higher number of stressors compared to participants who did not reach the threshold for probable GAD.

Figure 3 shows that reporting any COVID-19 related stressor was associated with higher PTSS prevalence. The greatest significant difference in PTSS prevalence was between participants who reported having financial problems (prevalence=37.2%, 95% CI: 31.1-43.7) compared to participants who did not report having financial problems (prevalence=15.8%, 95% CI: 13.2-18.8). Other stressors leading to a significant difference in PTSS prevalence included feeling along, losing a job, and having difficulty

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paying the rent, among others. Figure 4 shows that participants who reached the threshold for PTSS reported, on average, experienced a higher number of stressors compared to participants who did not reach the threshold for PTSS.

Discussion

In a survey of a representative sample of adults in the United States conducted between March 31 and April 12, 10.9% reported a score indicative of probable GAD and 21% reported PTSS. These numbers are significantly higher than the expected prevalence of anxiety disorders in the United States. The National Comorbidity Survey replication estimated that the prevalence of GAD and PTSD in the United States were 3.1% and 3.5%, respectively.[14] Another analysis showed that the 12-month prevalence of GAD in United States in 2017 was 4%.[15]

COVID-19 related stressors were associated with participants reporting more symptoms of GAD or PTSS. The prevalence of GAD was four times higher among participants reporting five or more stressors compared to participants reporting two or fewer stressors. The prevalence of PTSS was about three times higher among participants reporting five or more stressors compared to participants reporting two or fewer COVID-19 related stressors. This reinforces the hypothesis that COVID-19 behaves like a mass traumatic event, wherein experiences related to COVID-19 and its consequences are directly linked to adverse mental health consequences.

Our study is consistent with existing literature showing higher prevalence of anxiety disorders following mass traumatic events, even if our results suggest the severity anxiety disorders due to the COVID-19 pandemic is greater than that previously recorded after other mass traumas.[1] Agyapong et al. reported that the prevalence of GAD after one month following a wildfire—which physically, emotionally, and economically affected the community—was 19.8%.[16] Their results were based on using a score of 10 points on the GAD-7 scale as the cutoff. Using the same cutoff, the prevalence of GAD in our analysis rises to 25%. Silver et al. found that 17% of the United States population that lives outside New York city reported PTSS two months after the September 11 terrorist attack.[17]

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Our study complements emerging studies from China showing that COVID-19 has led to adverse psychological consequences.[10,11] We add to the literature by quantifying the probable prevalence of GAD and PTSS as the COVID-19 pandemic unfolded in the United States. Our results also support analysis from Nelson et al. showing the widespread concerns and stressors due to COVID-19 in the United States.[9] Our work both describes the experience of particular stressors and quantifies their contribution to the burden of anxiety disorders in the country. In particular, we show that economic (e.g. having difficulty paying the rent) and emotional (e.g. feeling lonely) stressors contribute to higher rates of both GAD and PTSS, which aligns with existing literature.[6]

These results should be considered with the following limitations in mind. First, our study uses screeners for GAD and PTSS. A definitive diagnosis of either will require clinical assessment. However, both screening questionnaires in our analysis are validated tools used to approximate the prevalence of GAD and PTSS in the population.[12,13] Second, the use of a pre-specified panel can lead to selection bias. However, AmeriSpeak panel has been used reliably for years to provide representative samples of the United States.[18] Third, our post-only design suggests that we cannot directly link the epidemic, and the policies implemented to tackle it, to a subsequent increased burden of anxiety disorders. However, the specificity of stressors reported, and the high burden of reported anxiety disorders, consistent with previous knowledge and expectation, strongly suggest that we are observing reliable effects that can be further examined in subsequent longitudinal work.

Conclusion

The burden of anxiety disorders as the COVID-19 pandemic unfolded in the United States appears substantially higher than expected baseline prevalence and of the burden reported following other mass traumatic events. This potentially reflects the scale of the epidemic, the ubiquity of policies implemented to tackle it, and the economic and social consequences of both. Persons experiencing COVID-19 related stressors, particularly economic and emotional stressors, were more likely to report both GAD and PTSS indicating the driving role these stressors are playing in increasing the burden of anxiety disorders in the

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United States. COVID-19 mitigation policies need to take into account the effect of pandemic-related stressors on the mental health of the United States population.

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Data sharing: authors may share the data upon reasonable requests

Transparency statement: The lead authors affirm that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

Dissemination to participants and related patient and public communities: There are no immediate plans to directly disseminate the analysis results to directly to the participants o as this study analyzed deidentified data. However, we aim to widely disseminate the results through our institution website and social media outlets to reach the public.

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Table 1: Generalized anxiety disorder (GAD) and post-traumatic distress symptoms (PTSS) in adults 18 years and older in the U.S. by demographic characteristics and COVID-19 related stressors.

		Generalized anxiety disorder				Post-traumatic stress symptoms			
	N (%)	% (95% CI)	P-value	Odds ratio (95% CI)	P-value	% (95% CI)	P-value	Odds ratio (95% CI)	P-value
Overall	1450	10.9 (9.1 –13.2)				21.7 (19.1 – 24.6)			
Sex									
Male	725 (48.2)	7.6 (5.4 –10.4)	0.0018	ref		17 (13.5 – 21.2)	0.0017	ref	
Female	725 (51.8)	14.1 (11.2 –17.6)		1.57 (0.99–2.51)	0.055	26.1 (22.3 – 30.2)		1.5 (1.1 –2.1)	0.024
Age									
18-39 y	623 (38.1)	16.6 (13.0 –21.2)	<0.0001	ref		26.1 (21.1 – 31.3)	<0.0001	ref	
40-59 y	461 (32.0)	9.2 (6.6 –12.6)		0.6 (0.3 – 1.0)	0.035	25.5 (20.9 – 30.7)		1.0 (0.7 – 1.6)	0.850
≥60 y	366 (29.9)	5.6 (3.4 – 9.1)		0.50 (0.2 – 1.1)	0.078	12.0 (8.5 – 16.6)		0.6 (0.3 – 1.0)	0.050
Race/Ethnicity									
Non-Hispanic White	939 (62.9)	10.8 (8.6 – 13.5)	0.3468	ref		22.0 (18.9 – 25.4)	0.1914	ref	
Non-Hispanic Black	143 (11.9)	11.9 (6.8 – 20.1)		0.81 (0.4 – 1.8)	0.603	18.9 (12.5 – 27.6)		0.7 (0.4 – 1.2)	0.157
Hispanic	258 (16.7)	11.3 (6.8 – 18.3)		0.8 (0.4 – 1.3)	0.307	27.0 (19.5 – 36.2)		1.1 (0.7 – 1.8)	0.749
Non-Hispanic Asian	36 (3.1)	0.8 (0.1 – 5.5)		0.1 (0.0 – 0.7)	0.023	8.7 (2.4 – 26.8)		0.3 (0.1 – 1.5)	0.142
Other	74 (5.4)	15.1 (7.4 – 28.6)		1.1 (0.4 – 2.7)	0.919	15.8 (7.7 – 29.5)		0.6 (0.3 – 1.2)	0.131
Education									
No high school diploma	67 (9.9)	13.4 (6.2 – 26.5)	0.0230	1.3 (0.5 – 3.2)	0.643	19.7 (10.9 – 32.8)	0.3825	0.7 (0.4 – 1.5)	0.393
High school grad or GED	276 (27.9)	10.4 (6.8 – 15.4)		1.19 (0.6 – 2.4)	0.615	25.3 (19.5 – 32.2)		1.2 (0.7 – 1.9)	0.560
Some college	638 (27.6)	15.8 (12.4 – 20.0)		2.0 (1.2 – 3.4)	0.013	22.2 (18.48 – 26.49)		1.0 (0.7 – 1.5)	0.933
College grad or more	469 (34.6)	6.8 (4.7– 9.7)		ref		18.9 (15.16 – 23.33)		ref	
Marital status									
Married	716 (47.8)	7.6 (5.6– 10.3)	0.0016	ref		19.0 (15.8 – 22.8)	0.1686	ref	
Widowed, divorced, or separated	254 (18.8)	10.2 (6.8 – 15.1)		1.3 (0.7 – 2.6)	0.392	20.9 (15.3 – 27.9)		1.1 (0.7 – 1.9)	0.693
Never married	345 (24.1)	14.3 (10.0 – 20.2)		1.4 (0.8 – 2.6)	0.273	24.9 (19.0 – 31.9)		1.2 (0.7– 1.8)	0.566
Living with partner	135 (9.3)	20.8 (12.7 – 32.0)		1.5 (0.7 – 2.9)	0.286	28.6 (19.5 – 39.8)		0.97 (0.6 – 1.7)	0.925
Household income									
$0 - $19,999	251 (20.3)	16.9 (11.7 – 23.7)	0.0311	0.9 (0.4 – 1.9)	0.746	28.6 (21.7 – 36.8)	0.1188	1.2 (0.6 – 2.2)	0.660
$20,000 - $44,999	358 (25.7)	12.0 (8.4 – 17.0)		0.6 (0.3 – 1.3)	0.219	19.5 (15.1 – 24.8)		0.7 (0.4 – 1.2)	0.158
$45,000 - $74,999	356 (24.8)	9.0 (6.0 – 13.2)		0.6 (0.3 – 1.2)	0.138	22.0 (17.0 – 28.1)		0.9 (0.6 – 1.5)	0.688
≥$75,000	452 (29.2)	8.5 (5.7–12.6)		ref		19.7 (15.3 – 25.0)		ref	
Household savings									
$0 - $4,999	578 (42.9)	17.2 (13.6 – 21.6)	<0.0001	1.9 (1.2 – 3.1)	0.010	27.6 (23.2 – 32.6)	0.0011	1.2 (0.8 – 1.9)	0.349

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≥$5,000	827 (57.1)	6.9 (5.0 – 9.3)		ref		18.0 (14.8 – 21.8)		ref	
COVID-related stressor score									
Low	460 (31.2)	4.0 (2.2 – 7.0)	<0.0001	ref		12.4 (8.9 – 17.0)	<0.0001	ref	
Medium	544 (37.0)	8.6 (6.2 – 11.8)		2.0 (1.0 – 4.0)	0.046	17.4 (13.6 – 22.0)		1.4 (0.9 – 2.3)	0.139
High	446 (31.8)	20.5 (16.1 – 25.8)		4.5 (2.3 – 8.8)	<0.0001	35.7 (30.2 – 41.6)		3.3 (2.1 – 5.2)	<0.0001
Household size (mean)	3.2			1.0 (0.8– 1.1)	0.710			1.0 (0.9 – 1.1)	0.910

All percentages are weighted. Missing data: household income (n=33), household savings (n=45), and COVID-19 stressor score (n=3). GED is the general education diploma. COVID-19 stressor score calculated from stressor summation ranging from 0-13; categories represent low (score of 0-2), medium (score of 3-4), and high (score of 5-14) exposure to stressors due to COVID-19. GAD defined by a GAD-7 score ≥15. PTSS defined by a 4-item PTSD checklist (PCL) score ≥3. Two-tailed chi-square analysis conducted for significance testing.

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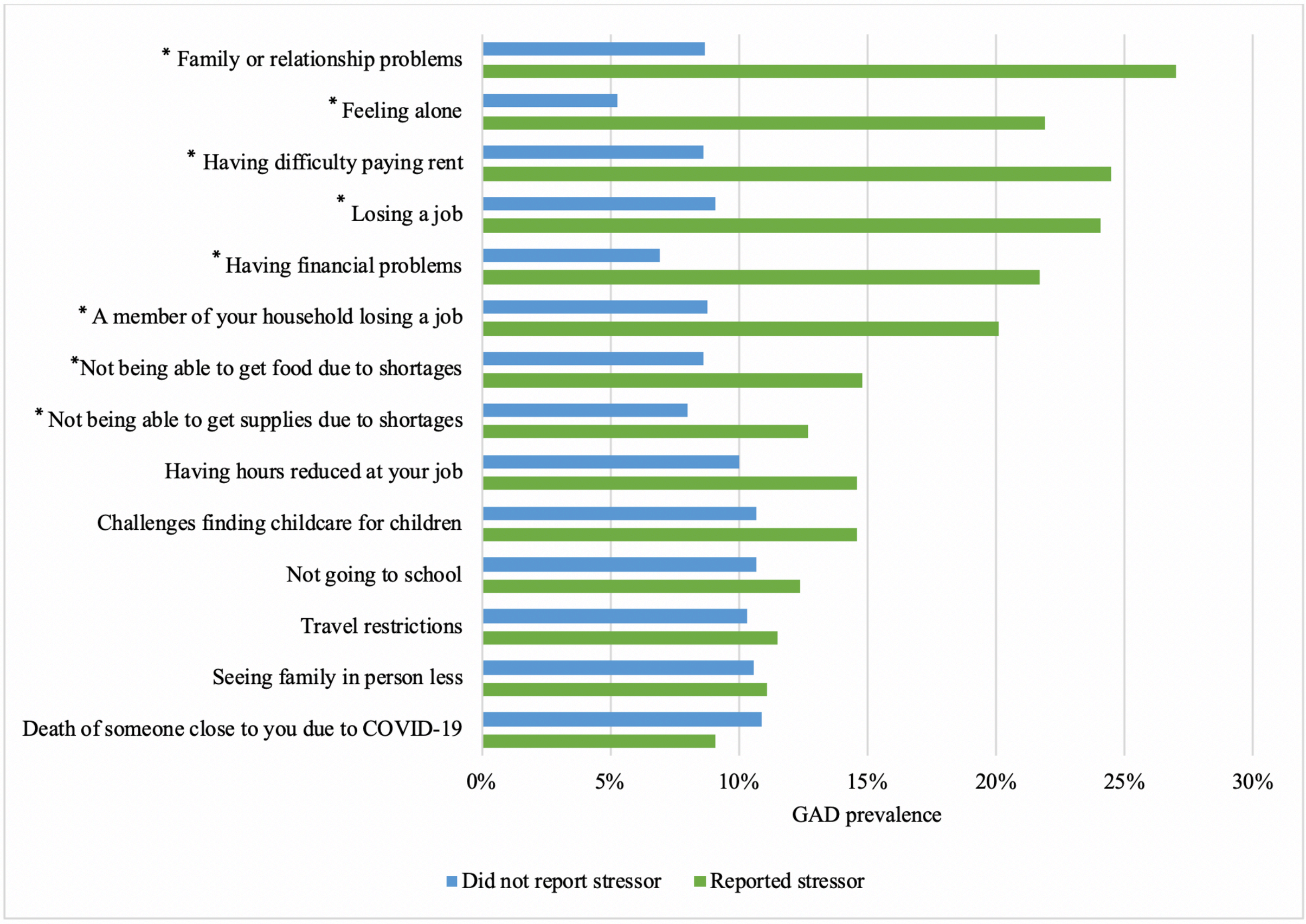
Figure 1: Prevalence of generalized anxiety disorder (GAD) for persons reporting different COVID-19 stressors



*P<0.05

GAD defined by a GAD-7 score ≥15. Percentages are weighted to the U.S. population. This analysis is based on data from our COVID-19 and Life stressors Impact on Mental Health and Well-being Study (CLIMB).

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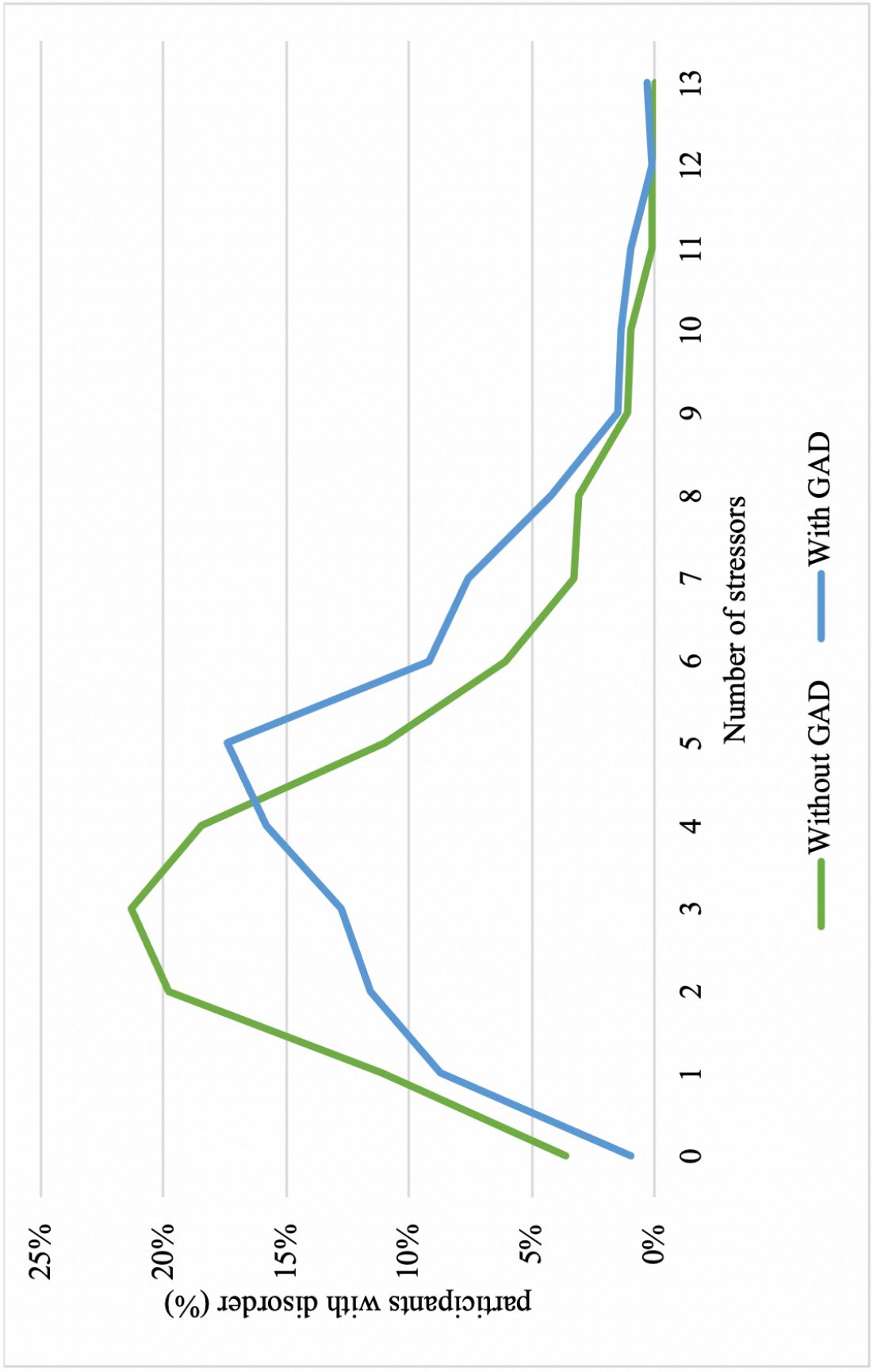
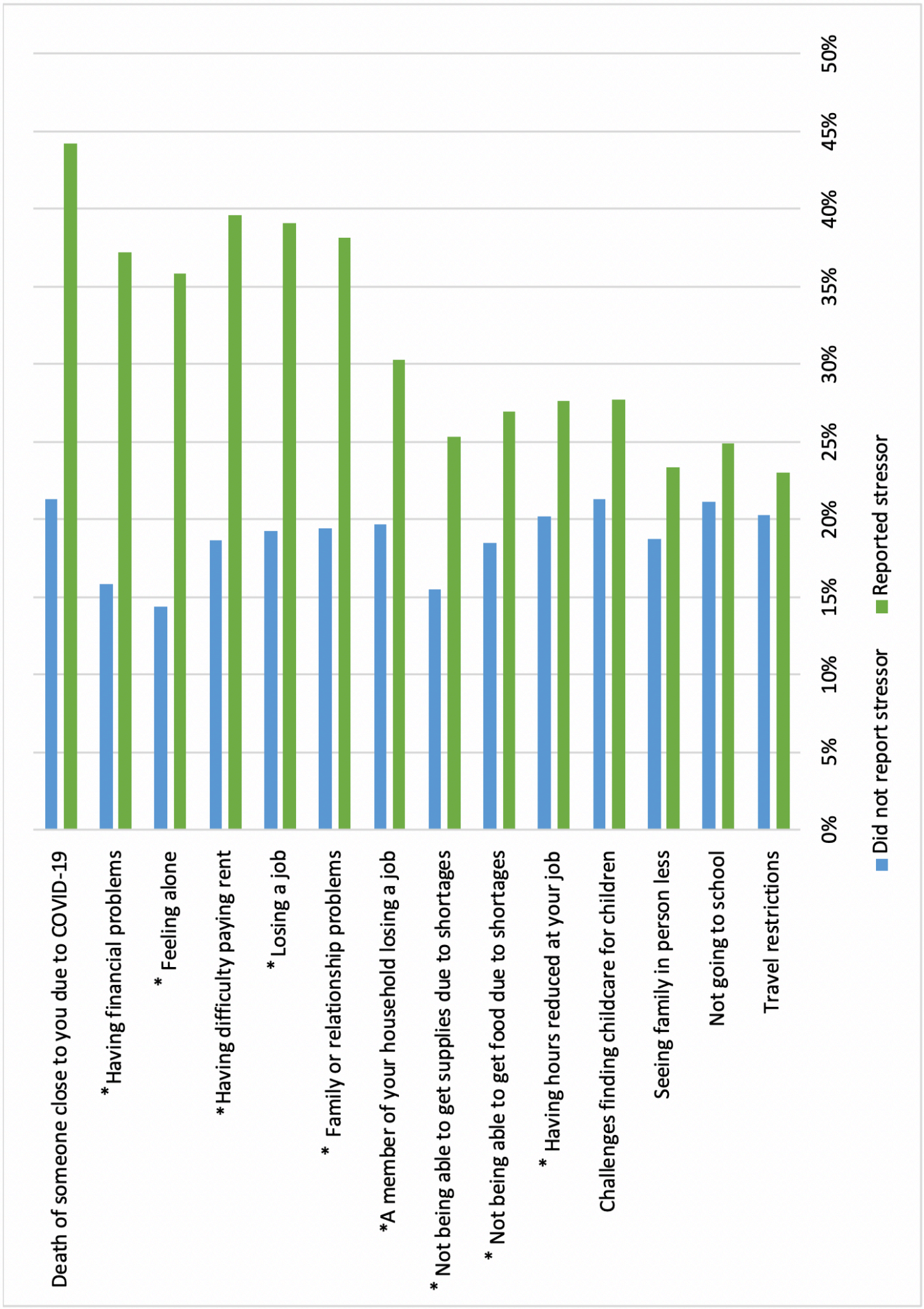
Figure 2: Distribution of total number of COVID-19 stressors by generalized anxiety disorder (GAD) status



GAD defined by a GAD-7 score ≥15. Percentages are weighted to the U.S. population. This analysis is based on data from our COVID-19 and Life stressors Impact on Mental Health and Well-being Study (CLIMB).

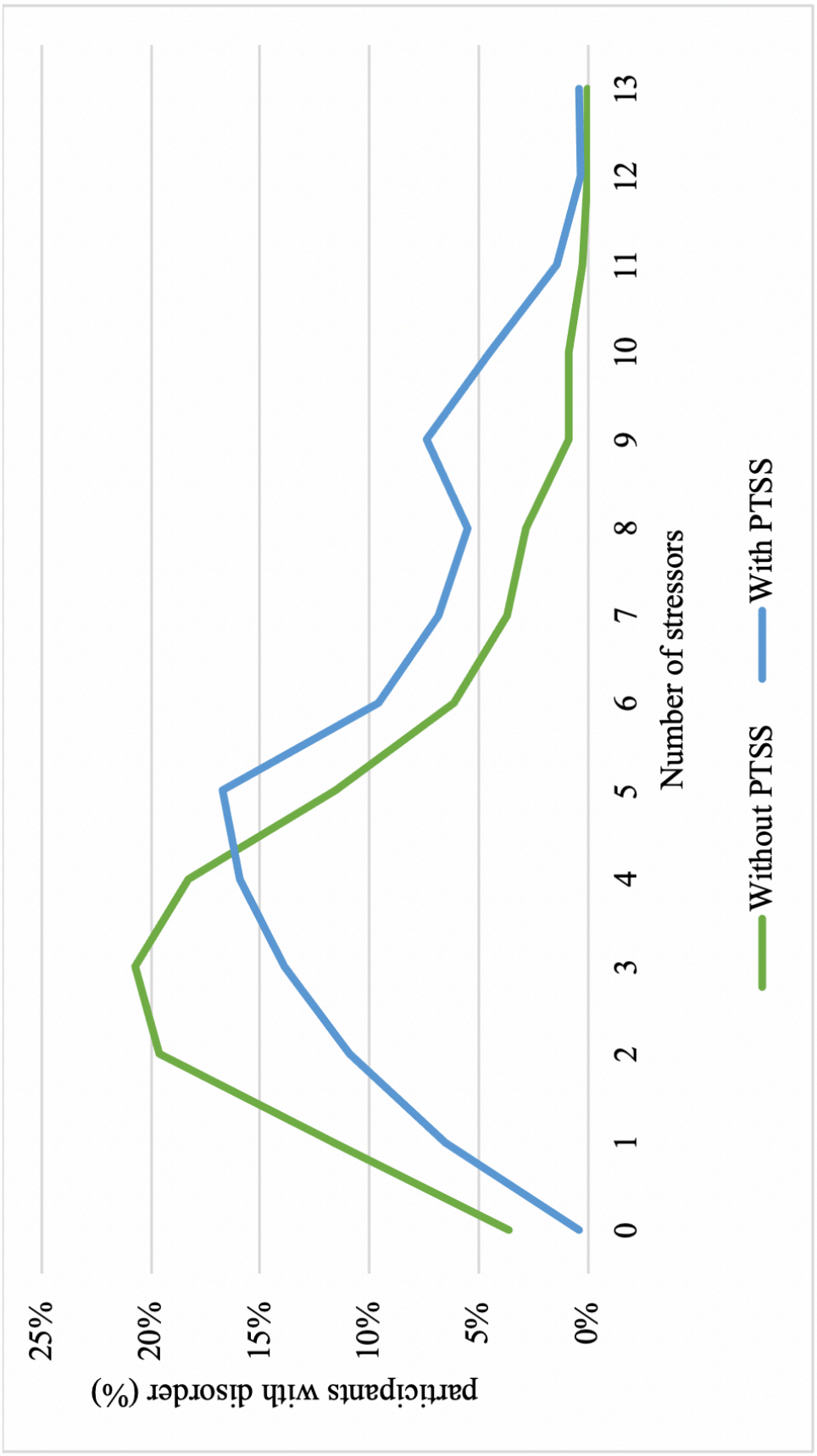
Figure 3: Prevalence of Post-traumatic stress symptoms (PTSS) for persons reporting different COVID-19 stressors



*P<0.05

PTSS defined by a 4-item PTSD checklist (PCL) score ≥3. Percentages are weighted to the U.S. population. This analysis is based on data from our COVID-19 and Life stressors Impact on Mental Health and Well-being Study (CLIMB).

Figure 4: Distribution of total number of COVOD-19 stressors by post-traumatic stress symptoms (PTSS) status



PTSS defined by a 4-item PTSD checklist (PCL) score ≥3. Percentages are weighted to the U.S. population. This analysis is based on data from our COVID-19 and Life stressors Impact on Mental Health and Well-being Study (CLIMB).

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The mental health consequences of COVID-19: a nationally representative cross-sectional study of pandemic-related stressors and anxiety disorders in the United States.

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Abstract

Objective: to quantify the prevalence of probable anxiety disorders in the United States during the COVID-19 pandemic.

Design: cross-sectional analysis

Setting: a nationally representative sample in the United States between March 31 and April 12, 2020

Participants: 1450 English-speaking adult participants in the AmeriSpeak Panel. AmeriSpeak is a probability-based panel designed to be representative of households in the United States.

Main outcome measures: prevalence of probable GAD using the GAD-7 tool and PTSS using the 4-items PTSD checklist (PCL) tool. Both outcomes were adjusted for demographics and COVID-19 related stressors.

Results: The majority of participants were female (51.8%), non-Hispanic white (62.9%), and have a household saving of $5000 or more. Those between the ages 18-29 years were the largest age group (38.1%) compared to 40-59 years (32%) and 60 years or more (29.9%). The probable prevalence of GAD was 10.9% (95% CI: 9.1-13.2) and the prevalence of PTSS was 21.7% (95% CI: 19.1-24.6). Among participants reporting five or more COVID-19 related stressors, the probable prevalence of GAD was 20.5% (95% CI: 16.1-25.8) and the prevalence of PTSS was 35.7% (95% CI: 30.2-41.6). Reporting five or more COVID-19 related stressors was a predictor of both probable GAD (OR=4.5, 95% CI: 2.3-8.8) and PTSS (OR=3.3, 95% CI: 2.1-5.2).

Conclusions: The prevalence of probable anxiety disorders in the United States, as the COVID-19 pandemic and policies implemented to tackle it unfolded, is higher than estimates reported prior to the pandemic and estimates reported following other mass traumatic events. Exposure to COVID-19 related stressors is associated with higher prevalence of both probable GAD and PTSS, highlighting the role these stressors play in increasing the risk of developing of anxiety disorders in the United States. Mitigation policies need to take into account the effect of pandemic-related stressors on the mental health of the population.

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Strengths and limitations of this study

- This analysis uses a nationally representative sample examining the risk of developing of anxiety disorders in the United States
- The study was conducted within a short duration following the implementation of state-wide policies to tackle the COVID-19 pandemic and includes questions about a wide-range of social and economic COVID-19 related stressors
- To assess the risk of developing of anxiety disorders, the study uses screening, rather than diagnostic tools. However, the screening tools have been validated for assessment of anxiety disorders
- The use of a pre-selected panel of participants can lead to selection bias

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Introduction

The effect of the COVID-19 pandemic on the American public has been profound. By September 22nd 2020, more than 200,000 people have died from COVID-19 in the United States, and a number of unprecedented physical distancing policies, such as statewide shelter-in-place orders, continue to be implemented to halt the spread of the pandemic. These policies changed daily life for most people in the United States significantly and continue to have large scale social and economic consequences. The physical toll of COVID-19, coupled with the ubiquity and severity of these policies, distinguish the pandemic as a mass traumatic event, one that is associated with extensive loss of lives and financial strains that can lead to severe and lasting psychological consequences, anxiety disorders in particular.[1–4] Uncertainty, fear, economic and social costs, and disruptions to daily life all contribute to a high prevalence of anxiety disorders following mass traumatic events.[5,6] For example, a study assessing the mental health consequences of the Ebola epidemic in Sierra Leone found that, a year following the epidemic, 6% of participants reached the threshold for a combined anxiety-depression measure and 27% reached the threshold for post-traumatic stress disorder (PTSD).[7] Another study estimated that, following Hurricane Katrina, the 30-day prevalence of PTSD was 30.3% among residents of the New Orleans metropolitan area, which was severely affected by the hurricane.[8]

This previous work suggests that the COVID-19 pandemic will have a substantial impact on the prevalence of anxiety disorders in the United States. Early evidence has found that COVID-19 pandemic is associated with adverse mental health consequences.[9–17] However, to our knowledge, the association between COVID-19 and related stressors—both due to the pandemic and policies implemented to halt its spread—on the risk of developing of anxiety disorders in the United States is yet to be fully documented. We assessed the prevalence of anxiety disorders, specifically probable generalized anxiety disorder (GAD) and post-traumatic stress symptoms (PTSS), as the COVID-19 pandemic unfolded in the United States. We also assessed the association between COVID-19 related stressors and the risk of developing of anxiety disorders following the implementation of wide-spread physical distancing policies in the United States.

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Methods

Data collection and sample

This analysis was based on data from our COVID-19 and Life stressors Impact on Mental Health and Well-being Study (CLIMB). We collected nationally representative data using a random sample of adult participants in the AmeriSpeak Panel between March 31 and April 12, 2020. AmeriSpeak is a probability-based panel designed to be representative of households in the United States. The panel is funded and operated by the National Opinion Research Center (NORC) at the University of Chicago and their sampling frame covers approximately 97% of households in the country. The survey was offered to English-speaking participants who had completed an AmeriSpeak survey in the last 6 months.

In total, 1470 participants completed the survey, 1385 online and 85 via the phone, representing 64.3% of invited panelists. From those 1470 participants, 20 had missing data on either GAD or PTSS questions, which were removed; the final analysis included 1450 participants from the CLIMB study. The institutional review boards of NORC and Boston University Medical Campus (H-39986) approved the study. NORC obtained written consent from study participants when they first enrolled in the AmeriSpeak Panel.

Exposure variables

Our structured survey included questions on demographic characteristics (gender, age, race, education, marital status, household income, household savings, and household size) and whether the respondent had or knew anyone who had COVID-19. The primary exposure of interest was reporting COVID-19 related stressors. The stressor list was based on prior analyses following traumatic events.[13,18] The stressor list included financial stressors (losing a job, having difficulty paying rent, having financial problems, a member of your family losing a job, and having hours reduced at your job) and social and emotional stressors (feeling along, having relationship problems, family or relationship problems, not being able to get food due to shortages, not being able to get supplies due to shortages, challenges finding childcare, not going to school, travel restrictions, seeing family less in person, and death of someone close to you due to COVID-19). We excluded stressors that were applicable to only a subset of the population, ultimately

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including 14 stressors in our analysis. We then created a cumulative stressor score and divided the score into three stressor categories, low (0-2 stressors), medium (3-4 stressors), and high (5-14 stressors). The score reflects the number of symptoms distribution in the sample with approximately one third of the sample in each category.

Outcome variables

For psychological assessment, we used two validated anxiety disorders questionnaires. We used the GAD-7 to assess GAD. The cutoff for probable GAD in our analysis was 15 score or more. This cutoff was based on the recommended cutoffs for GAD-7 to screen for GAD.[19] We also conducted a sensitivity analysis with a cutoff of 10 score or more. We used the 4-items PTSD checklist (PCL) to screen for PTSS. The cutoff for PTSS was three score or more.[20]

Statistical analysis

We used STATA 16.1 to conduct the analysis for this study. All analyses were weighted using complex survey weights to adjust for sample selection and post-stratification. We calculated the overall prevalence of probable GAD and PTSS and the prevalence of each outcome stratified by number of stressors. We then conducted a bivariable analysis comparing probable GAD and PTSS prevalence across demographic characteristics, stressor score, and each type of stressor using a two-tailed chi-square test. We used complete case analysis for the multivariable logistic regression models to estimate the odds ratios of the association between COVID-19 related stressor score and probable GAD and PTSS when controlling for gender, age, race, education, marital status, household income, household savings, and household size. We also constructed other multivariable logistic regression models with the number of stressors as a continuous variable and other models that divide the stressors into two continuous variables (financial stressors and social stressors) as sensitivity analyses. We followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline for cross-sectional studies when designing and reporting on this analysis.

Patient and public involvement

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Patients and the public were not involved in the developing the research question, design, or implementation of this analysis. This primarily because we did not have funding to support such involvement and our analysis was on a national level using validated assessment tools.

Results

Of the 1450 participants, 10.9% (95% CI: 9.1, 13.2) reached the threshold for probable GAD, using a score of 15 as a cutoff. When using 10 score as a cutoff point, 25% (95% CI: 22.2-28.0) reached the threshold for probable GAD. 21.7% (95% CI: 19.1-24.6) reported PTSS.

Table 1 shows the association between demographic characteristics and the two outcomes. In particular, female sex was associated with a higher prevalence of both probable GAD and PTSS in the bivariable analysis. The prevalence of probable GAD was 14.1% (95% CI: 11.2-17.6) among females compared to 7.6% (95% CI: 5.4-10.4) among males. The prevalence of probable PTSS was 26.1% (95% CI: 22.3-30.2) among females compared to 17% (95% CI: 13.5-21.2) among males. Other demographic variables associated with both outcomes were age and household savings. In the multivariable analysis, age and household savings were predictors of GAD while gender and old age were predictors of PTSS.

COVID-19 related stressors and anxiety disorders

Higher stressor score was associated with, and a predictor of, both probable GAD and PTSS. The prevalence of probable GAD was 4% (95% CI: 2.2-7.0) among participants with low stressor score, 8.6% (95% CI: 6.2-11.8) among participants with medium stressor score, and 20.5% (95% CI: 16.1-25.8) among participants with high stressor score. High stressor score was a predictor of probable GAD (OR=4.5, 95% CI: 2.3-8.8) compared to reporting a low stressor score. Including COVID-19 related stressors as a continuous variable in the multivariable model produced consistent results (OR=1.3, 95% CI: 1.2-1.4) (appendix table 1). Dividing COVID-19 related stressors into two continuous variables depending on the nature of the stressor in the multivariable model produced consistent results for financial stressors (OR=1.4, 95% CI: 1.2-1.6), and social and emotional stressors (OR=1.2, 95% CI: 1.1-1.5) (appendix table 2).

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The prevalence of PTSS was 12.4% (95% CI: 8.9-17.0) among participants with low stressor score, 17.4% (95% CI: 13.6-22.0) among participants with medium stressor score, and 35.7% (95% CI: 30.2-41.6) among participants with high stressor score. Reporting a high stressor score, compared to a low stressor score, was a predictor of PTSS (OR=3.3, 95% CI: 2.1-5.2) (Table 1). Including COVID-19 related stressors as a continuous variable in the multivariable model produced consistent results (OR=1.3, 95% CI: 1.2-1.4) (appendix table 1). Dividing COVID-19 related stressors into two continuous variables the multivariable model depending on the nature of the stressor produced consistent results for financial stressors (OR=1.3, 95% CI: 1.2-1.6), and social and emotional stressors (OR=1.3, 95% CI: 1.1-1.5) (appendix table 2).

Figure 1 shows that reporting any COVID-19 related stressor, except for experiencing travel restrictions, was associated with higher probable GAD prevalence. The greatest difference in probable GAD prevalence by COVID-19 stressor was between participants who reported having family or relationship problems (prevalence=27%, 95% CI: 19.6-36.1) compared to participants who did not report family or relationship problems (prevalence=8.7%, 95% CI: 6.9-10.9). Other stressors leading to a significant difference in probable GAD prevalence included feeling lonely, having difficulty paying the rent, losing a job, having financial problems, and a household member losing a job. Figure 2 shows that participants who reached the threshold for probable GAD reported, on average, experiencing a higher number of stressors compared to participants who did not reach the threshold for probable GAD.

Figure 3 shows that reporting any COVID-19 related stressor was associated with higher PTSS prevalence. The greatest significant difference in PTSS prevalence was between participants who reported having financial problems (prevalence=37.2%, 95% CI: 31.1-43.7) compared to participants who did not report having financial problems (prevalence=15.8%, 95% CI: 13.2-18.8). Other stressors leading to a significant difference in PTSS prevalence included feeling along, losing a job, and having difficulty paying the rent, among others. Figure 4 shows that participants who reached the threshold for PTSS

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reported, on average, experienced a higher number of stressors compared to participants who did not reach the threshold for PTSS.

Discussion

In a survey of a representative sample of adults in the United States conducted between March 31 and April 12, 10.9% reported a score indicative of probable GAD and 21% reported PTSS. These numbers are significantly higher than the expected prevalence of anxiety disorders in the United States. The National Comorbidity Survey replication estimated that the prevalence of GAD and PTSD in the United States were 3.1% and 3.5%, respectively.[21] Another analysis showed that the 12-month prevalence of GAD in United States in 2017 was 4%.[22] However, our results are lower than a recent analysis by Twenge and Joiner, which found that, compared to 2019, adults in the United States were more than three times as likely to screen positive for anxiety (using GAD-2) between April 23-May 2020. The study reports that on the week of May 21, 2020 29.4% of participants screened positive for GAD.[14] The difference in results can potentially be due to the higher threshold for screening positive for probable GAD by our screening tool.

COVID-19 related stressors were associated with participants reporting more symptoms of GAD or PTSS. The prevalence of GAD was four times higher among participants reporting five or more stressors compared to participants reporting two or fewer stressors. The prevalence of PTSS was about three times higher among participants reporting five or more stressors compared to participants reporting two or fewer COVID-19 related stressors. This reinforces the hypothesis that COVID-19 behaves like a mass traumatic event, wherein experiences related to COVID-19 and its consequences are directly linked to adverse mental health consequences. These results are consistent with other epidemiologic analyses that studied COVID-19 stressors and mental health. For example, Fitzpatrick et al. found in a nationally representative sample that fear of COVID-19 was linked to both depression and anxiety, and that more than 25% of participants reported moderate to severe anxiety symptoms, which may warrant clinical treatment.[23] Another study found that between April 13 and May 19, young adults (18-20 years) reported high levels of GAD (45.4% with a 10 score cutoff) and PTSD symptoms (31.8% with a 45 PCL-C score

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cutoff).[12,23] Conditions associated with anxiety disorders often also lead to depression.[24] This is consistent with our analysis that found that the prevalence of depression symptoms has risen during the study period as well.[25]

Our study is consistent with existing literature showing higher prevalence of anxiety disorders following mass traumatic events, even if our results suggest the severity anxiety disorders due to the COVID-19 pandemic is greater than that previously recorded after other mass traumas.[1] Agyapong et al. reported that the prevalence of GAD after one month following a wildfire—which physically, emotionally, and economically affected the community—was 19.8%.[26] Their results were based on using a score of 10 points on the GAD-7 scale as the cutoff. Using the same cutoff, the prevalence of probable GAD in our analysis rises to 25%. Silver et al. found that 17% of the United States population that lives outside New York city reported PTSS two months after the September 11 terrorist attack.[27]

Our study complements emerging studies from China showing that COVID-19 has led to adverse psychological consequences.[9,28] We add to the literature by quantifying the probable prevalence of GAD and PTSS as the COVID-19 pandemic unfolded in the United States. Our results also support analysis from Nelson et al. showing the widespread concerns and stressors due to COVID-19 in the United States.[10] Our work both describes the experience of particular stressors and quantifies their contribution to the risk of developing of anxiety disorders in the country. In particular, we show that financial (e.g. having difficulty paying the rent) and social and emotional (e.g. feeling lonely) stressors contribute to higher rates of both probable GAD and PTSS, which aligns with existing literature.[6]

These results should be considered with the following limitations in mind. First, our study uses screeners for GAD and PTSS. A definitive diagnosis of either will require clinical assessment. As such, these results should be confirmed in a representative sample using diagnostic tools. However, both screening questionnaires in our analysis are validated tools used to approximate the prevalence of GAD and PTSS in the population.[19,20] Second, the use of a pre-specified panel can lead to selection bias. However, AmeriSpeak panel has been used reliably for years to provide representative samples of the United States.[29] Third, our post-only design, which does not allow for information on the mental health status of

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the participants, suggests that we cannot directly link the epidemic, and the policies implemented to tackle it, to a subsequent increased risk of developing of anxiety disorders. However, the specificity of stressors reported, and the high risk of developing of reported anxiety disorders, consistent with previous knowledge and expectation, strongly suggest that we are observing reliable associations that can be further examined in subsequent longitudinal work.

Conclusion

The risk of developing of anxiety disorders as the COVID-19 pandemic unfolded in the United States appears substantially higher than expected baseline prevalence and of the risk of developing reported following other mass traumatic events. This potentially reflects the scale of the epidemic, the ubiquity of policies implemented to tackle it, and the economic and social consequences of both. Persons experiencing COVID-19 related stressors, particularly financial, and social and emotional stressors, were more likely to report both probable GAD and PTSS indicating the driving role these stressors are playing in increasing the risk of developing of anxiety disorders in the United States. COVID-19 mitigation policies need to take into account the effect of pandemic-related stressors on the mental health of the United States population.

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Contributors: CKE and SMA developed the first draft of the survey. SG reviewed the survey. SMA conducted the data analysis and wrote the manuscript draft. CKE, GHC, and SG contributed to study conception and manuscript drafting. All authors acknowledge full responsibility for the analyses and interpretation of the report. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

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Competing interests: All authors have completed the ICMJE uniform disclosure form at http://www.icmje.org/coi_disclosure.pdf and declare: support from the Rockefeller Foundation-Boston University 3-D Commission; no financial relationships with any organisation that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

Data sharing: authors may share the data upon reasonable requests

Transparency statement: The lead authors affirm that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

Dissemination to participants and related patient and public communities: There are no immediate plans to directly disseminate the analysis results to directly to the participants o as this study analyzed deidentified data. However, we aim to widely disseminate the results through our institution website and social media outlets to reach the public.

Figure caption

Figure 1: Prevalence of probable generalized anxiety disorder (GAD) for persons reporting different COVID-19 stressors

Figure 2: Distribution of number of stressors among participants depending on whether they reported symptoms consistent with probable generalized anxiety disorder (GAD) status

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Figure 3: Prevalence of Post-traumatic stress symptoms (PTSS) for persons reporting different COVID-19 stressors

Figure 4: Distribution of number of stressors among participants depending on whether they reach the cut-off for post-traumatic stress symptoms (PTSS) status

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Table 1: Probable Generalized Anxiety Disorder (GAD) and post-traumatic stress symptoms (PTSS) in adults 18 years and older in the U.S. by demographic characteristics and COVID-19 related stressors.

		Probable Generalized Anxiety Disorder				Post-traumatic stress symptoms			
	N (%)	% (95% CI)	P-value	Odds ratio (95% CI)	P-value	% (95% CI)	P-value	Odds ratio (95% CI)	P-value
Overall	1450	10.9 (9.1 –13.2)				21.7 (19.1 – 24.6)			
Sex									
Male	725 (48.2)	7.6 (5.4 –10.4)	0.0018	ref		17 (13.5 – 21.2)	0.0017	ref	
Female	725 (51.8)	14.1 (11.2 –17.6)		1.6 (1.0–2.5)	0.055	26.1 (22.3 – 30.2)		1.5 (1.1 –2.1)	0.024
Age									
18-39 y	623 (38.1)	16.6 (13.0 –21.2)	<0.0001	ref		26.1 (21.1 – 31.3)	<0.0001	ref	
40-59 y	461 (32.0)	9.2 (6.6 –12.6)		0.6 (0.3 – 1.0)	0.035	25.5 (20.9 – 30.7)		1.0 (0.7 – 1.6)	0.850
≥60 y	366 (29.9)	5.6 (3.4 – 9.1)		0.50 (0.2 – 1.1)	0.078	12.0 (8.5 – 16.6)		0.6 (0.3 – 1.0)	0.050
Race/Ethnicity									
Non-Hispanic White	939 (62.9)	10.8 (8.6 – 13.5)	0.3468	ref		22.0 (18.9 – 25.4)	0.1914	ref	
Non-Hispanic Black	143 (11.9)	11.9 (6.8 – 20.1)		0.8 (0.4 – 1.8)	0.603	18.9 (12.5 – 27.6)		0.7 (0.4 – 1.2)	0.157
Hispanic	258 (16.7)	11.3 (6.8 – 18.3)		0.8 (0.4 – 1.3)	0.307	27.0 (19.5 – 36.2)		1.1 (0.7 – 1.8)	0.749
Non-Hispanic Asian	36 (3.1)	0.8 (0.1 – 5.5)		0.1 (0.0 – 0.7)	0.023	8.7 (2.4 – 26.8)		0.3 (0.1 – 1.5)	0.142
Other	74 (5.4)	15.1 (7.4 – 28.6)		1.1 (0.4 – 2.7)	0.919	15.8 (7.7 – 29.5)		0.6 (0.3 – 1.2)	0.131
Education									
No high school diploma	67 (9.9)	13.4 (6.2 – 26.5)	0.0230	1.3 (0.5 – 3.2)	0.643	19.7 (10.9 – 32.8)	0.3825	0.7 (0.4 – 1.5)	0.393
High school grad or GED	276 (27.9)	10.4 (6.8 – 15.4)		1.19 (0.6 – 2.4)	0.615	25.3 (19.5 – 32.2)		1.2 (0.7 – 1.9)	0.560
Some college	638 (27.6)	15.8 (12.4 – 20.0)		2.0 (1.2 – 3.4)	0.013	22.2 (18.5 – 26.5)		1.0 (0.7 – 1.5)	0.933
College grad or more	469 (34.6)	6.8 (4.7– 9.7)		ref		18.9 (15.2 – 23.3)		ref	
Marital status									
Married	716 (47.8)	7.6 (5.6– 10.3)	0.0016	ref		19.0 (15.8 – 22.8)	0.1686	ref	
Widowed, divorced, or separated	254 (18.8)	10.2 (6.8 – 15.1)		1.3 (0.7 – 2.6)	0.392	20.9 (15.3 – 27.9)		1.1 (0.7 – 1.9)	0.693
Never married	345 (24.1)	14.3 (10.0 – 20.2)		1.4 (0.8 – 2.6)	0.273	24.9 (19.0 – 31.9)		1.2 (0.7– 1.8)	0.566
Living with partner	135 (9.3)	20.8 (12.7 – 32.0)		1.5 (0.7 – 2.9)	0.286	28.6 (19.5 – 39.8)		1.0 (0.6 – 1.7)	0.925
Household income									
$0 - $19,999	251 (20.3)	16.9 (11.7 – 23.7)	0.0311	0.9 (0.4 – 1.9)	0.746	28.6 (21.7 – 36.8)	0.1188	1.2 (0.6 – 2.2)	0.660
$20,000 - $44,999	358 (25.7)	12.0 (8.4 – 17.0)		0.6 (0.3 – 1.3)	0.219	19.5 (15.1 – 24.8)		0.7 (0.4 – 1.2)	0.158
$45,000 - $74,999	356 (24.8)	9.0 (6.0 – 13.2)		0.6 (0.3 – 1.2)	0.138	22.0 (17.0 – 28.1)		0.9 (0.6 – 1.5)	0.688
≥$75,000	452 (29.2)	8.5 (5.7–12.6)		ref		19.7 (15.3 – 25.0)		ref	
Household savings									

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$0 - $4,999	578 (42.9)	17.2 (13.6 – 21.6)	<0.0001	1.9 (1.2 – 3.1)	0.010	27.6 (23.2 – 32.6)	0.0011	1.2 (0.8 – 1.9)	0.349
≥$5,000	827 (57.1)	6.9 (5.0 – 9.3)		ref		18.0 (14.8 – 21.8)		ref	
COVID-related stressor score									
Low	460 (31.2)	4.0 (2.2 – 7.0)	<0.0001	ref		12.4 (8.9 – 17.0)	<0.0001	ref	
Medium	544 (37.0)	8.6 (6.2 – 11.8)		2.0 (1.0 – 4.0)	0.046	17.4 (13.6 – 22.0)		1.4 (0.9 – 2.3)	0.139
High	446 (31.8)	20.5 (16.1 – 25.8)		4.5 (2.3 – 8.8)	<0.0001	35.7 (30.2 – 41.6)		3.3 (2.1 – 5.2)	<0.0001
Household size (mean)	3.2			1.0 (0.8– 1.1)	0.710			1.0 (0.9 – 1.1)	0.910

All percentages are weighted. Missing data: household income (n=33), household savings (n=45), and COVID-19 stressor score (n=3). GED is the general education diploma. COVID-19 stressor score calculated from stressor summation ranging from 0-13; categories represent low (score of 0-2), medium (score of 3-4), and high (score of 5-14) exposure to stressors due to COVID-19. GAD defined by a GAD-7 score ≥15. PTSS defined by a 4-item PTSD checklist (PCL) score ≥3. Two-tailed chi-square analysis conducted for significance testing.

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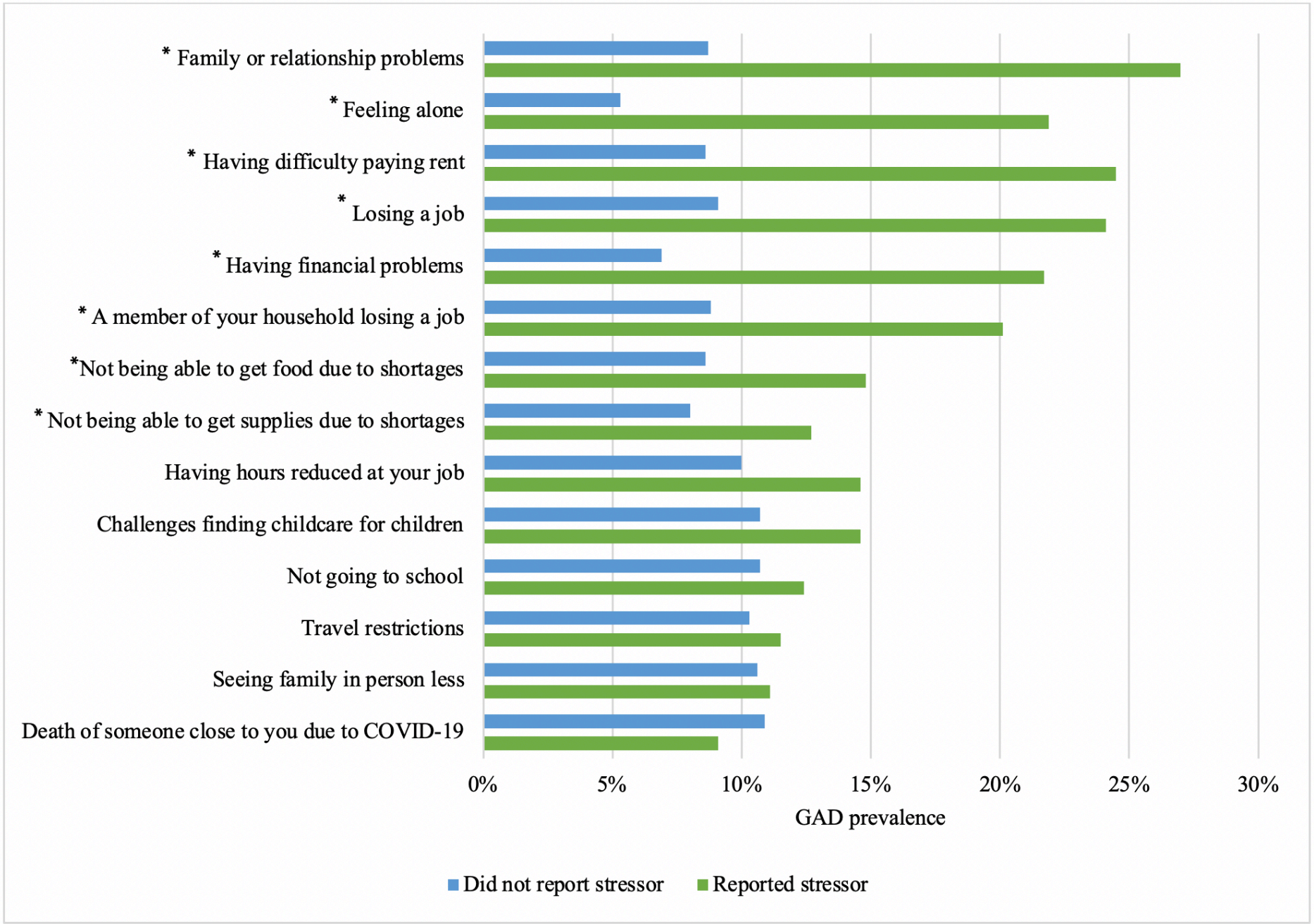
Figure 1: Prevalence of probable generalized anxiety disorder (GAD) for persons reporting different COVID-19 stressors



*P<0.05

GAD defined by a GAD-7 score ≥15. Percentages are weighted to the U.S. population. This analysis is based on data from the COVID-19 and Life stressors Impact on Mental Health and Well-being Study (CLIMB).

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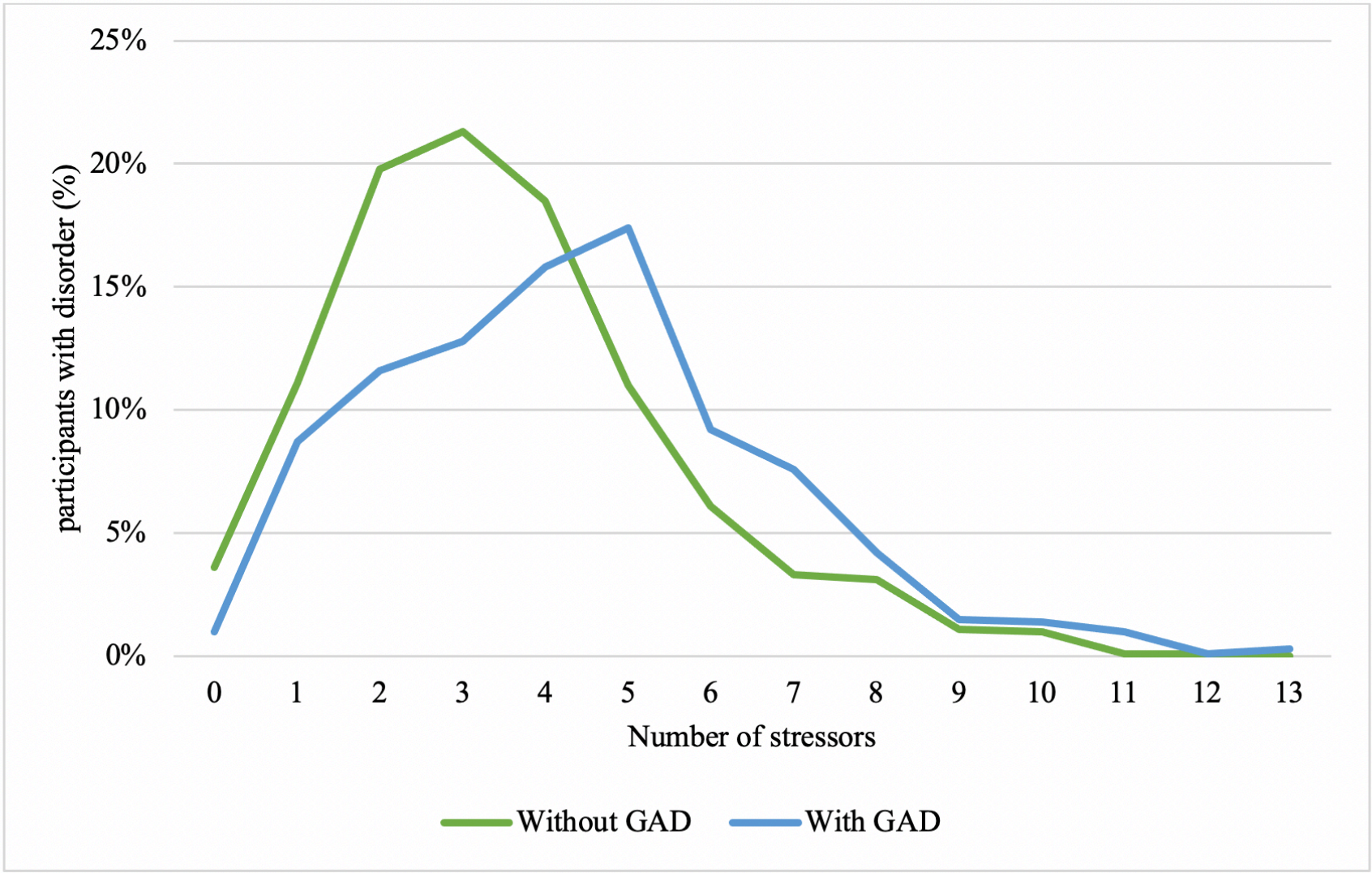
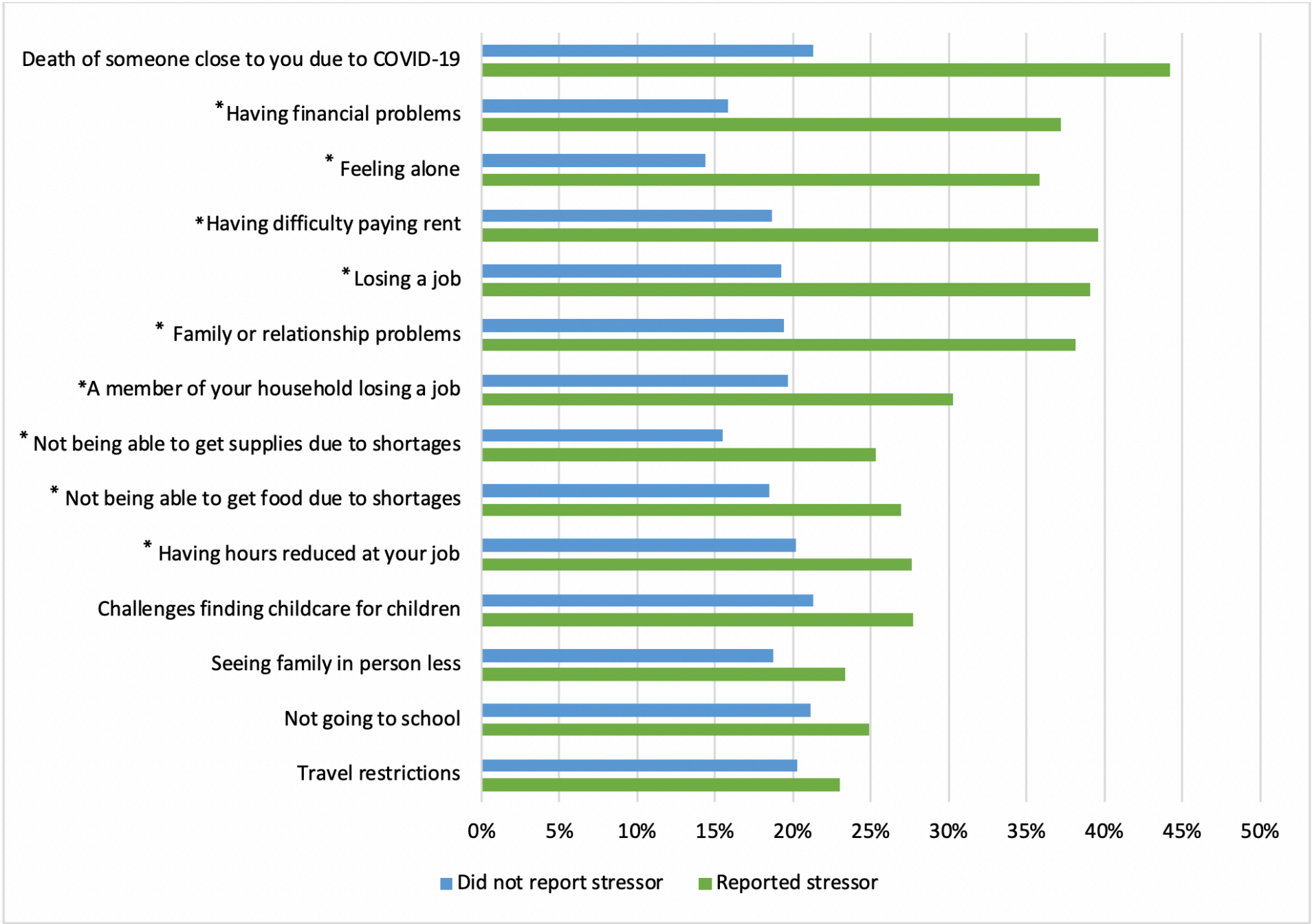
Figure 2: Distribution of total number of COVID-19 stressors by probable generalized anxiety disorder (GAD) status



GAD defined by a GAD-7 score ≥15. Percentages are weighted to the U.S. population. This analysis is based on data from the COVID-19 and Life stressors Impact on Mental Health and Well-being Study (CLIMB).

Figure 3: Prevalence of Post-traumatic stress symptoms (PTSS) for persons reporting different COVID-19 stressors



*P<0.05

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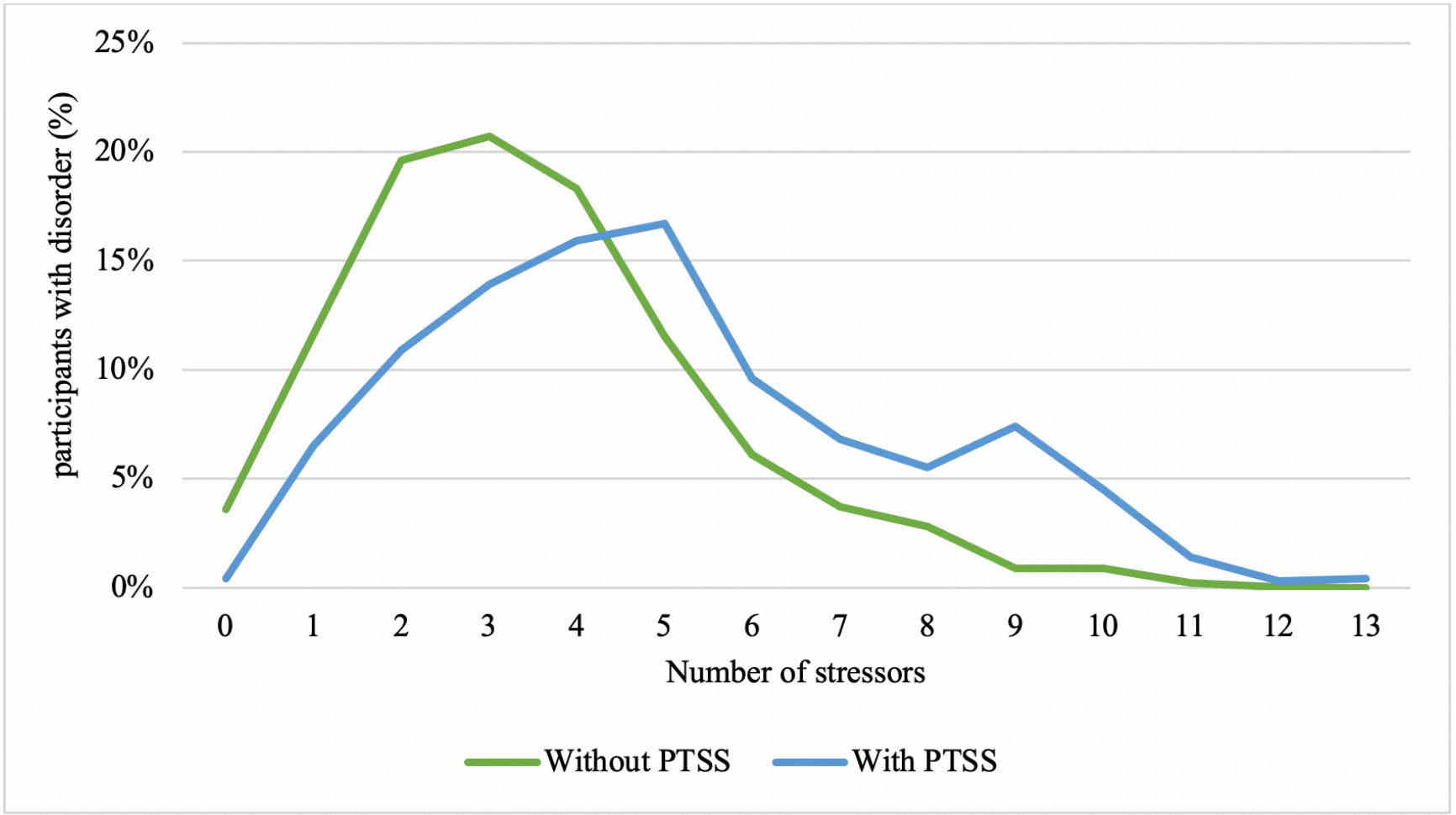
PTSS defined by a 4-item PTSD checklist (PCL) score ≥3. Percentages are weighted to the U.S. population. This analysis is based on data from our COVID-19 and Life stressors Impact on Mental Health and Well-being Study (CLIMB).

Figure 4: Distribution of total number of COVOD-19 stressors by post-traumatic stress symptoms (PTSS) status



PTSS defined by a 4-item PTSD checklist (PCL) score ≥3. Percentages are weighted to the U.S. population. This analysis is based on data from the COVID-19 and Life stressors Impact on Mental Health and Well-being Study (CLIMB).

Appendix table 1: multivariable regression model of probable generalized anxiety disorder (GAD) and post-traumatic distress symptoms (PTSS) in adults 18 years and older in the U.S. by demographic characteristics and COVID-19 related stressors (continuous variable).

	Probable GAD		PTSS	
	Odds ratio (95% CI)	**P-value**	**Odds ratio (95% CI)**	**P-value**
Gender				
Male	ref		ref	
Female	1.5 (1.0 – 2.4)	0.076	1.5 (1.0 – 2.1)	0.034
Age				
18-39 y	ref		ref	
40-59 y	0.6 (0.3 – 1.0)	0.047	1.1 (0.7 – 1.6)	0.805
≥60 y	0.50 (0.2 – 1.1)	0.100	0.6 (0.3 – 1.1)	0.082
Race				
Non-Hispanic White	ref		ref	
Non-Hispanic Black	0.8 (0.3 – 1.9)	0.583	0.7 (0.4 – 1.2)	0.163
Hispanic	0.7 (0.4 – 1.3)	0.229	1.0 (0.6 – 1.7)	0.882
Non-Hispanic Asian	0.1 (0.0 – 0.6)	0.017	0.3 (0.1 – 1.4)	0.126
Other Race – Including Multi-Racial	1.0 (0.4 – 2.5)	0.971	0.5 (0.2 – 1.1)	0.084
Education				
No high school diploma	1.1 (0.4 – 3.1)	0.860	0.7 (0.3 – 1.4)	0.288
High school graduate or equivalent	1.1 (0.5 – 2.2)	0.818	1.1 (0.7 – 1.8)	0.708
Some college	1.8 (1.0 – 3.1)	0.034	1.0 (0.6 – 1.4)	0.822
College grad or more	ref		ref	
Marital status				
Married	ref		ref	
Widowed, divorced, or separated	1.3 (0.7 – 2.6)	0.424	1.1 (0.6 – 1.9)	0.758
Never married	1.3 (0.7 – 2.5)	0.402	1.1 (0.7 – 1.7)	0.753
Living with partner	1.4 (0.7 – 3.0)	0.322	0.9 (0.5 – 1.6)	0.777
Household income				
$0 - $19,999	0.9 (0.4 – 1.9)	0.767	1.2 (0.6 – 2.2)	0.652
$20,000 - $44,999	0.7 (0.3 – 1.4)	0.295	0.7 (0.4 – 1.2)	0.193

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$45,000 - $74,999	0.6 (0.3 – 1.2)	0.162	0.9 (0.6 – 1.5)	0.717
≥$75,000	ref		ref	
Household savings				
$0 - $4,999	2.0 (1.2 – 3.2)	0.008	1.3 (0.8 – 1.9)	0.290
≥$5,000		ref	ref	
Household size	1.0 (0.8 – 1.1)	0.631	1.0 (0.9 – 1.1)	0.962
COVID-related stressors	1.3 (1.2 – 1.4)	<0.001	1.3 (1.2 – 1.4)	<0.001

All percentages are weighted. Missing data: household income (n=33), household savings (n=45), and COVID-19 stressor score (n=3). GED is the general education diploma. GAD defined by a GAD-7 score ≥15. PTSS defined by a 4-item PTSD checklist (PCL) score ≥3.

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Appendix table 2: multivariable regression model of probable generalized anxiety disorder (GAD) and post-traumatic distress symptoms (PTSS) in adults 18 years and older in the U.S. by demographic characteristics and COVID-19 related economic and social stressors.

	Probable GAD		PTSS	
	Odds ratio (95% CI)	**P-value**	**Odds ratio (95% CI)**	**P-value**
Gender				
Male	ref		ref	
Female	1.6 (1.0 – 2.5)	0.064	1.5 (1.0 – 2.6)	0.032
Age				
18-39 y	ref		ref	
40-59 y	0.6 (0.3 – 1.0)	0.043	1.0 (0.3 – 1.0)	0.818
≥60 y	0.5 (0.2 – 1.1)	0.105	0.6 (0.2 – 1.1)	0.084
Race				
Non-Hispanic White	ref		ref	
Non-Hispanic Black	0.8 (0.3 – 1.8)	0.581	0.6 (0.3 – 1.8)	0.162
Hispanic	0.7 (0.4 – 1.2)	0.180	1.0 (0.4 – 1.2)	0.900
Non-Hispanic Asian	0.1 (0.0 – 0.6)	0.016	0.3 (0.0 – 0.6)	0.120
Other Race – Including Multi-Racial	1.0 (0.4 – 2.4)	0.937	0.5 (0.4 – 2.4)	0.084
Education				
No high school diploma	1.1 (0.4 – 3.0)	0.907	0.6 (0.4 – 3.0)	0.278
High school graduate or equivalent	1.1 (0.5 – 2.1)	0.892	1.1 (0.5 – 2.1)	0.728
Some college	1.8 (1.0 – 3.0)	0.041	1.0 (1.0 – 3.0)	0.809
College grad or more	ref		ref	
Marital status				
Married	ref		ref	
Widowed, divorced, or separated	1.3 (0.7 – 2.6)	0.416	1.1 (0.7 – 2.6)	0.755
Never married	1.3 (0.7 – 2.4)	0.420	1.1 (0.7 – 2.4)	0.764
Living with partner	1.4 (0.7 – 3.0)	0.327	0.9 (0.7 – 3.0)	0.772
Household income				
$0 - $19,999	0.9 (0.4 – 1.9)	0.738	1.2 (0.4 – 1.9)	0.668

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$20,000 - $44,999	0.7 (0.3 – 1.4)	0.276	0.7 (0.3 – 1.4)	0.195
$45,000 - $74,999	0.6 (0.3 – 1.2)	0.160	0.9 (0.3 – 1.2)	0.713
≥$75,000	ref		ref	
Household savings				
$0 - $4,999	2.0 (1.2 – 3.2)	0.008	1.3 (1.2 – 3.2)	0.290
≥$5,000	ref		ref	
Household size	1.0 (0.8– 1.1)	0.627	1.0 (0.8– 1.1)	0.956
COVID-related financial stressors	1.4 (1.2 – 1.6)	<0.001	1.3 (1.2 – 1.6)	<0.001
COVID-related social and emotional stressors	1.2 (1.1 – 1.5)	0.011	1.3 (1.1 – 1.5)	<0.001

All percentages are weighted. Missing data: household income (n=33), household savings (n=45), and COVID-19 stressor score (n=3). GED is the general education diploma. GAD defined by a GAD-7 score ≥15. PTSS defined by a 4-item PTSD checklist (PCL) score ≥3. Financial stressors included losing a job, having difficulty paying rent, having financial problems, a member of your family losing a job, and having hours reduced at your job. Social and emotional stressors included feeling along, having relationship problems, family or relationship problems, not being able to get food due to shortages, not being able to get supplies due to shortages, challenges finding childcare, not going to school, travel restrictions, seeing family less in person, and death of someone close to you due to COVID-19.

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The mental health consequences of COVID-19: a nationally representative cross-sectional study of pandemic-related stressors and anxiety disorders in the United States.

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The mental health consequences of COVID-19: a nationally representative cross-sectional study of pandemic-related stressors and anxiety disorders in the United States.

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Abstract

Objective: to document the prevalence of probable anxiety disorders in the United States during the COVID-19 pandemic.

Design: cross-sectional analysis

Setting: a nationally representative sample in the United States between March 31 and April 13, 2020

Participants: 1450 English-speaking adult participants in the AmeriSpeak Panel. AmeriSpeak is a probability-based panel designed to be representative of households in the United States.

Main outcome measures: prevalence of probable generalized anxiety disorder (GAD) using the GAD-7 and post-traumatic stress symptoms (PTSS) using the 4-items PTSD checklist (PCL). Both outcomes were adjusted for demographics and COVID-19 related stressors.

Results: The majority of participants were female (51.8%), non-Hispanic white (62.9%), and reported a household saving of $5000 or more. Those between 18-29 years old were the largest age group (38.1%) compared to 40-59 years (32.0%) and 60 years or more (29.9%). The prevalence of probable GAD was 10.9% (95% CI: 9.1-13.2) and the prevalence of PTSS was 21.7% (95% CI: 19.1-24.6). Among participants reporting five or more COVID-19 related stressors, the prevalence of probable GAD was 20.5% (95% CI: 16.1-25.8) and the prevalence of PTSS was 35.7% (95% CI: 30.2-41.6). Reporting five or more COVID-19 related stressors was a predictor of both probable GAD (OR=4.5, 95% CI: 2.3-8.8) and PTSS (OR=3.3, 95% CI: 2.1-5.2).

Conclusions: The prevalence of probable anxiety disorders in the United States, as the COVID-19 pandemic and policies implemented to tackle it unfolded, is higher than estimates reported prior to the pandemic and estimates reported following other mass traumatic events. Exposure to COVID-19 related stressors is associated with higher prevalence of both probable GAD and PTSS, highlighting the role these stressors play in increasing the risk of developing of anxiety disorders in the United States. Mitigation policies should take into account the effect of pandemic-related stressors on the mental health of the population.

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Strengths and limitations of this study

- This analysis uses a nationally representative sample examining the risk of developing of anxiety disorders in the United States.
- The study was conducted within a short duration following the implementation of state-wide policies to tackle the COVID-19 pandemic and includes questions about a wide-range of social and economic COVID-19 related stressors.
- To assess the risk of developing of anxiety disorders, the study uses screening, rather than diagnostic tools. However, these screening tools have been validated extensively for assessment of anxiety disorders in general populations.
- The use of a pre-selected panel of participants can lead to selection bias.

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Introduction

The effect of the COVID-19 pandemic on the American public has been profound. More than 600,000 people have died from COVID-19 in the United States, and a number of unprecedented physical distancing policies, continue to be in place to limit the spread of the pandemic. These policies changed daily life for most people in the United States significantly and continue to have large scale social and economic consequences. The physical toll of COVID-19, coupled with the ubiquity and severity of these policies, distinguish the pandemic as a mass traumatic event, one that is associated with extensive loss of lives and financial strains that can lead to severe and lasting psychological consequences, anxiety disorders in particular.[1–4]

Uncertainty, fear, economic and social costs, and disruptions to daily life all contribute to a high prevalence of anxiety disorders following mass traumatic events.[5,6] For example, a study assessing the mental health consequences of the Ebola epidemic in Sierra Leone found that, a year following the epidemic, 6% of participants reached the threshold for a combined anxiety-depression measure and 27% reached the threshold for post-traumatic stress disorder (PTSD).[7] Another study estimated that, following Hurricane Katrina, the 30-day prevalence of PTSD was 30.3% among residents of the New Orleans metropolitan area, which was severely affected by the hurricane.[8]

This previous work suggests that the COVID-19 pandemic will have a substantial impact on the prevalence of anxiety disorders in the United States. Early evidence has found that COVID-19 pandemic is associated with adverse mental health consequences.[9–17] However, to our knowledge, the association between COVID-19 and related stressors—both due to the pandemic and policies implemented to halt its spread—on the risk of developing of anxiety disorders in the United States has yet to be fully documented.

We assessed the prevalence of anxiety disorders, specifically probable generalized anxiety disorder (GAD) and post-traumatic stress symptoms (PTSS), as the COVID-19 pandemic unfolded in the United States. We also assessed the association between COVID-19 related stressors and the risk of developing

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anxiety disorders following the implementation of wide-spread physical distancing policies in the United States.

Methods

Data collection and sample

This analysis was based on data from our COVID-19 and Life stressors Impact on Mental Health and Well-being Study (CLIMB). We collected nationally representative data using a random sample of adult participants in the AmeriSpeak Panel between March 31 and April 13, 2020. AmeriSpeak is a probability-based panel designed to be representative of households in the United States. The panel is funded and operated by the National Opinion Research Center (NORC) at the University of Chicago and their sampling frame covers approximately 97% of households in the country. The survey was offered to English-speaking participants who had completed an AmeriSpeak survey in the last 6 months.

In total, 1470 participants completed the survey, 1385 online and 85 via the phone, representing 64.3% of invited panelists. From those 1470 participants, 20 had missing data on either GAD or PTSS questions, which were removed; the final analysis included 1450 participants from the CLIMB study. The institutional review boards of NORC and Boston University Medical Campus (H-39986) approved the study. NORC obtained written consent from study participants when they first enrolled in the AmeriSpeak Panel.

Exposure variables

Our structured survey included questions on demographic characteristics (sex, age, race and ethnicity, education, marital status, household income, household savings, and household size) and whether the respondent had or knew anyone who had COVID-19. The primary exposure of interest was reporting COVID-19 related stressors. The stressor list was based on prior analyses following traumatic events.[13,18] The list included financial stressors (e.g., losing a job, having difficulty paying rent, having financial problems, a member of your family losing a job, and having hours reduced at your job) and social and emotional stressors (e.g., feeling along, having relationship problems, family or relationship problems, not being able to get food due to shortages, not being able to get supplies due to shortages, challenges

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finding childcare, not going to school, travel restrictions, seeing family less in person, and death of someone close to you due to COVID-19). We excluded stressors that were applicable to only a subset of the population, ultimately including 14 stressors in our analysis. We then created a cumulative stressor score and divided the score into three stressor categories, low (0-2 stressors), medium (3-4 stressors), and high (5-14 stressors). The score reflects the symptoms distribution in the sample with approximately one third of the sample in each category.

Outcome variables

For psychological assessment, we used two validated anxiety disorders questionnaires. We used the GAD-7 to assess GAD. The cutoff for probable GAD in our analysis was a score of 15 or more. This cutoff was based on the recommended cutoffs for GAD-7 to screen for GAD.[19] We also conducted a sensitivity analysis with a cutoff score of 10 or more. We used the 4-items PTSD checklist (PCL) to screen for PTSS. The cutoff for PTSS was three score or more.[20]

Statistical analysis

We used STATA 16.1 to conduct the analysis for this study. All analyses were weighted using complex survey weights to adjust for sample selection and post-stratification. We calculated the overall prevalence of probable GAD and PTSS and the prevalence of each outcome stratified by number of stressors. We then conducted a bivariable analysis comparing probable GAD and PTSS prevalence across demographic characteristics, stressor score, and each type of stressor using a two-tailed chi-square test. We used complete case analysis for the multivariable logistic regression models to estimate the odds ratios of the association between COVID-19 related stressor score and probable GAD and PTSS when controlling for gender, age, race, education, marital status, household income, household savings, and household size. We also constructed other multivariable logistic regression models with the number of stressors as a continuous variable and other models that divide the stressors into two continuous variables (financial stressors and social stressors) as sensitivity analyses. We followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting

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guideline for cross-sectional studies when designing and reporting on this analysis.

Patient and public involvement

Patients and the public were not involved in the developing the research question, design, or implementation of this analysis. This is primarily because we did not have funding to support such involvement and our analysis was on a national level using validated assessment tools.

Results

Of the 1450 participants, 10.9% (95% CI: 9.1, 13.2) reached the threshold for probable GAD, using a score of 15 as a cutoff. When using a score of 10 as a cutoff point, 25% (95% CI: 22.2-28.0) reached the threshold for probable GAD. In terms of PTSS, 21.7% (95% CI: 19.1-24.6) reached the threshold.

Table 1 shows the association between demographic characteristics and the two outcomes. In particular, female sex was associated with a higher prevalence of both probable GAD and PTSS in the bivariable analysis. The prevalence of probable GAD was 14.1% (95% CI: 11.2-17.6) among females compared to 7.6% (95% CI: 5.4-10.4) among males. The prevalence of probable PTSS was 26.1% (95% CI: 22.3-30.2) among females compared to 17% (95% CI: 13.5-21.2) among males. Other demographic variables associated with both outcomes in the bivariable analysis were age and household savings. In the multivariable analysis, reporting household savings of less than $5,000 was a predictor of GAD (OR= 1.9, 95% CI: 1.2 – 3.1).

COVID-19 related stressors and anxiety disorders

Higher stressor score was positively associated with, and a predictor of, both probable GAD and PTSS. The prevalence of probable GAD was 4% (95% CI: 2.2-7.0) among participants with low stressor score, 8.6% (95% CI: 6.2-11.8) among participants with medium stressor score, and 20.5% (95% CI: 16.1-25.8) among participants with high stressor score. High stressor score was a predictor of probable GAD (OR=4.5, 95% CI: 2.3-8.8) compared to reporting a low stressor score. Including COVID-19 related stressors as a continuous variable in the multivariable model produced consistent results (OR=1.3, 95% CI: 1.2-1.4) (Appendix Table 1). Dividing COVID-19 related stressors into two continuous variables

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depending on the nature of the stressor in the multivariable model produced consistent results for financial stressors (OR=1.4, 95% CI: 1.2-1.6), and social and emotional stressors (OR=1.2, 95% CI: 1.1-1.5) (Appendix Table 2).

The prevalence of PTSS was 12.4% (95% CI: 8.9-17.0) among participants with low stressor score, 17.4% (95% CI: 13.6-22.0) among participants with medium stressor score, and 35.7% (95% CI: 30.2-41.6) among participants with high stressor score. Reporting a high stressor score, compared to a low stressor score, was a predictor of PTSS (OR=3.3, 95% CI: 2.1-5.2) (Table 1). Including COVID-19 related stressors as a continuous variable in the multivariable model produced consistent results (OR=1.3, 95% CI: 1.2-1.4) (appendix table 1). Dividing COVID-19 related stressors into two continuous variables the multivariable model depending on the nature of the stressor produced consistent results for financial stressors (OR=1.3, 95% CI: 1.2-1.6), and social and emotional stressors (OR=1.3, 95% CI: 1.1-1.5) (Appendix Table 2).

Figure 1 shows that reporting any COVID-19 related stressor, except for experiencing travel restrictions, was associated with higher probable GAD prevalence. The greatest difference in probable GAD prevalence by COVID-19 related stressor was between participants who reported having family or relationship problems (prevalence=27%, 95% CI: 19.6-36.1) compared to participants who did not report family or relationship problems (prevalence=8.7%, 95% CI: 6.9-10.9). Other stressors leading to a significant difference in probable GAD prevalence included feeling lonely, having difficulty paying the rent, losing a job, having financial problems, and a household member losing a job. Figure 2 shows that participants who reached the threshold for probable GAD reported, on average, experiencing a higher number of stressors compared to participants who did not reach the threshold for probable GAD.

Figure 3 shows that reporting any COVID-19 related stressor was associated with higher PTSS prevalence. The greatest significant difference in PTSS prevalence was between participants who reported having financial problems (prevalence=37.2%, 95% CI: 31.1-43.7) compared to participants who did not report having financial problems (prevalence=15.8%, 95% CI: 13.2-18.8). Other stressors leading to a

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significant difference in PTSS prevalence included feeling along, losing a job, and having difficulty paying the rent. Figure 4 shows that participants who reached the threshold for PTSS reported, on average, experienced a higher number of stressors compared to participants who did not reach the threshold for PTSS.

Discussion

In a survey of a representative sample of adults in the United States conducted between March 31 and April 13, 2020, 10.9% of adults reported a score indicative of probable GAD and 21% reported PTSS. These numbers are significantly higher than the expected prevalence of anxiety disorders in the United States. For example, the National Comorbidity Survey replication estimated that the prevalence of GAD and PTSD in the United States were 3.1% and 3.5%, respectively (collected before COVID-19).[21] Another analysis showed that the 12-month prevalence of GAD in United States in 2017 was 4%.[22] However, our results are lower than a recent analysis by Twenge and Joiner, which found that, compared to 2019, adults in the United States were more than three times as likely to screen positive for anxiety (using GAD-2) between April 23-May 2020. The study reports that on the week of May 21, 2020 29.4% of participants screened positive for GAD.[14] The difference in results can potentially be due to the higher threshold for screening positive for probable GAD by our screening tool.

We also found that COVID-19 related stressors were associated with participants reporting more symptoms of GAD or PTSS. The prevalence of GAD was four times higher among participants reporting five or more stressors compared to participants reporting two or fewer stressors. The prevalence of PTSS was about three times higher among participants reporting five or more stressors compared to participants reporting two or fewer COVID-19 related stressors. This reinforces the hypothesis that COVID-19 behaves like a mass traumatic event, wherein experiences related to COVID-19 and its consequences are directly linked to adverse mental health consequences. These results are consistent with other epidemiologic analyses that studied COVID-19 stressors and mental health. For example, Fitzpatrick et al. found in a nationally representative sample that fear of COVID-19 was linked to both depression and anxiety, and that more than 25% of participants reported moderate to severe anxiety symptoms, which

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may warrant clinical treatment.[23] Another study found that between April 13 and May 19, 2020, young adults (18-20 years) reported high levels of GAD (45.4% with a 10 score cutoff) and PTSD symptoms (31.8% with a 45 PCL-C score cutoff).[12,23] Conditions associated with anxiety disorders often also lead to depression.[24] This is consistent with our analysis that found that the prevalence of depression symptoms has risen during the study period as well.[25]

Our study is consistent with existing literature showing higher prevalence of anxiety disorders following mass traumatic events, even if our results suggest the severity of anxiety disorders due to the COVID-19 pandemic is greater than that previously recorded after other mass traumas.[1] Agyapong et al. reported that the prevalence of GAD after one month following a wildfire—which physically, emotionally, and economically affected the community—was 19.8%.[26] Their results were based on using a score of 10 points on the GAD-7 scale as the cutoff. Using the same cutoff, the prevalence of probable GAD in our analysis rises to 25%. Silver et al. found that 17% of the United States population that lives outside New York city reported PTSS two months after the September 11 terrorist attack.[27]

Our study complements studies from China showing that COVID-19 has led to adverse psychological consequences.[9,28] We add to the literature by quantifying the probable prevalence of GAD and PTSS as the COVID-19 pandemic unfolded in the United States. Our results also support analysis from Nelson et al. showing the widespread concerns and stressors due to COVID-19 in the United States.[10] Our work both describes the experience of particular stressors and quantifies their contribution to the risk of developing of anxiety disorders in the country. In particular, we show that financial (e.g., having difficulty paying rent) and social and emotional (e.g., feeling lonely) stressors contribute to higher rates of both probable GAD and PTSS, which aligns with existing literature.[6]

These results should be considered with the following limitations in mind. First, our study uses screeners for GAD and PTSS. A definitive diagnosis of either will require clinical assessment. As such, these results should be confirmed in a representative sample using diagnostic tools. However, both screening questionnaires in our analysis are validated tools used extensively to assess the prevalence of GAD and PTSS in the population.[19,20] Second, the use of a pre-specified panel can lead to selection bias. However,

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the AmeriSpeak Panel has been used reliably for years to provide representative samples of the United States.[29] Third, there are a large number of other covariates—including features of context like, for example, estimates of pandemic severity—that could be considered to more fully assess the determinants of anxiety disorders in this study. This is beyond the scope of the paper but potentially a fruitful direction for future work. Fourth, our post-only design, which does not allow for information on the mental health status of the participants prior to the pandemic, suggests that we cannot causally link the pandemic, and the policies implemented to tackle it, to a subsequent increased risk of developing of anxiety disorders. However, the specificity of stressors reported, and the high risk of developing of reported anxiety disorders, consistent with previous knowledge and expectation, strongly suggest that we are observing reliable associations that can be further examined in subsequent longitudinal work.

Conclusion

The prevalence of anxiety disorders as the COVID-19 pandemic unfolded in the United States is substantially higher than the expected baseline prevalence in the United States and of the burden reported following other mass traumatic events. This potentially reflects the scale of the pandemic, the ubiquity of the impact of the policies implemented to tackle it, and the economic and social consequences of both. Persons experiencing COVID-19 related stressors, particularly financial, and social and emotional stressors, were more likely to report both probable GAD and PTSS indicating the critical role these stressors are play in increasing the risk of developing of anxiety disorders in the United States. COVID-19 mitigation policies should take into account the effect of pandemic-related stressors on the mental health of the United States population.

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Patient consent for publication: Not required.

Ethics approval: The institutional review boards of NORC and Boston University Medical Campus (H-39986) approved the study. NORC obtained written consent from study participants when they first enrolled in the AmeriSpeak Panel.

Data sharing: authors may share the data upon reasonable requests

Transparency statement: The lead authors affirm that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

Dissemination to participants and related patient and public communities: There are no immediate plans to directly disseminate the analysis results to directly to the participants o as this study analyzed deidentified data. However, we aim to widely disseminate the results through our institution website and social media outlets to reach the public.

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Figure caption

Figure 1: Prevalence of probable generalized anxiety disorder (GAD) for persons reporting different COVID-19 stressors

Figure 2: Distribution of number of stressors among participants depending on whether they reported symptoms consistent with probable generalized anxiety disorder (GAD) status

Figure 3: Prevalence of Post-traumatic stress symptoms (PTSS) for persons reporting different COVID-19 stressors

Figure 4: Distribution of number of stressors among participants depending on whether they reach the cut-off for post-traumatic stress symptoms (PTSS) status

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Table 1: Generalized anxiety disorder (GAD) and post-traumatic distress symptoms (PTSS) in adults 18 years and older in the U.S. by demographic characteristics and COVID-19 related stressors.

		Generalized anxiety disorder				Post-traumatic stress symptoms			
	N (%)	% (95% CI)	P-value	Odds ratio (95% CI)	P-value	% (95% CI)	P-value	Odds ratio (95% CI)	P-value
Overall	1450	10.9 (9.1 –13.2)				21.7 (19.1 – 24.6)			
Sex									
Male	725 (48.2)	7.6 (5.4 –10.4)	0.0018	ref		17 (13.5 – 21.2)	0.0017	ref	
Female	725 (51.8)	14.1 (11.2 –17.6)		1.57 (0.99–2.51)	0.055	26.1 (22.3 – 30.2)		1.5 (1.1 –2.1)	0.024
Age									
18-39 y	623 (38.1)	16.6 (13.0 –21.2)	<0.0001	ref		26.1 (21.1 – 31.3)	<0.0001	ref	
40-59 y	461 (32.0)	9.2 (6.6 –12.6)		0.6 (0.3 – 1.0)	0.035	25.5 (20.9 – 30.7)		1.0 (0.7 – 1.6)	0.850
≥60 y	366 (29.9)	5.6 (3.4 – 9.1)		0.50 (0.2 – 1.1)	0.078	12.0 (8.5 – 16.6)		0.6 (0.3 – 1.0)	0.050
Race/Ethnicity									
Non-Hispanic White	939 (62.9)	10.8 (8.6 – 13.5)	0.3468	ref		22.0 (18.9 – 25.4)	0.1914	ref	
Non-Hispanic Black	143 (11.9)	11.9 (6.8 – 20.1)		0.81 (0.4 – 1.8)	0.603	18.9 (12.5 – 27.6)		0.7 (0.4 – 1.2)	0.157
Hispanic	258 (16.7)	11.3 (6.8 – 18.3)		0.8 (0.4 – 1.3)	0.307	27.0 (19.5 – 36.2)		1.1 (0.7 – 1.8)	0.749
Non-Hispanic Asian	36 (3.1)	0.8 (0.1 – 5.5)		0.1 (0.0 – 0.7)	0.023	8.7 (2.4 – 26.8)		0.3 (0.1 – 1.5)	0.142
Other	74 (5.4)	15.1 (7.4 – 28.6)		1.1 (0.4 – 2.7)	0.919	15.8 (7.7 – 29.5)		0.6 (0.3 – 1.2)	0.131
Education									
No high school diploma	67 (9.9)	13.4 (6.2 – 26.5)	0.0230	1.3 (0.5 – 3.2)	0.643	19.7 (10.9 – 32.8)	0.3825	0.7 (0.4 – 1.5)	0.393
High school grad or GED	276 (27.9)	10.4 (6.8 – 15.4)		1.19 (0.6 – 2.4)	0.615	25.3 (19.5 – 32.2)		1.2 (0.7 – 1.9)	0.560
Some college	638 (27.6)	15.8 (12.4 – 20.0)		2.0 (1.2 – 3.4)	0.013	22.2 (18.48 – 26.49)		1.0 (0.7 – 1.5)	0.933
College grad or more	469 (34.6)	6.8 (4.7– 9.7)		ref		18.9 (15.16 – 23.33)		ref	
Marital status									
Married	716 (47.8)	7.6 (5.6– 10.3)	0.0016	ref		19.0 (15.8 – 22.8)	0.1686	ref	
Widowed, divorced, or separated	254 (18.8)	10.2 (6.8 – 15.1)		1.3 (0.7 – 2.6)	0.392	20.9 (15.3 – 27.9)		1.1 (0.7 – 1.9)	0.693
Never married	345 (24.1)	14.3 (10.0 – 20.2)		1.4 (0.8 – 2.6)	0.273	24.9 (19.0 – 31.9)		1.2 (0.7– 1.8)	0.566
Living with partner	135 (9.3)	20.8 (12.7 – 32.0)		1.5 (0.7 – 2.9)	0.286	28.6 (19.5 – 39.8)		0.97 (0.6 – 1.7)	0.925
Household income									
$0 - $19,999	251 (20.3)	16.9 (11.7 – 23.7)	0.0311	0.9 (0.4 – 1.9)	0.746	28.6 (21.7 – 36.8)	0.1188	1.2 (0.6 – 2.2)	0.660
$20,000 - $44,999	358 (25.7)	12.0 (8.4 – 17.0)		0.6 (0.3 – 1.3)	0.219	19.5 (15.1 – 24.8)		0.7 (0.4 – 1.2)	0.158
$45,000 - $74,999	356 (24.8)	9.0 (6.0 – 13.2)		0.6 (0.3 – 1.2)	0.138	22.0 (17.0 – 28.1)		0.9 (0.6 – 1.5)	0.688
≥$75,000	452 (29.2)	8.5 (5.7–12.6)		ref		19.7 (15.3 – 25.0)		ref	
Household savings									
$0 - $4,999	578 (42.9)	17.2 (13.6 – 21.6)	<0.0001	1.9 (1.2 – 3.1)	0.010	27.6 (23.2 – 32.6)	0.0011	1.2 (0.8 – 1.9)	0.349

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≥$5,000	827 (57.1)	6.9 (5.0 – 9.3)		ref		18.0 (14.8 – 21.8)		ref	
COVID-related stressor score									
Low	460 (31.2)	4.0 (2.2 – 7.0)	<0.0001	ref		12.4 (8.9 – 17.0)	<0.0001	ref	
Medium	544 (37.0)	8.6 (6.2 – 11.8)		2.0 (1.0 – 4.0)	0.046	17.4 (13.6 – 22.0)		1.4 (0.9 – 2.3)	0.139
High	446 (31.8)	20.5 (16.1 – 25.8)		4.5 (2.3 – 8.8)	<0.0001	35.7 (30.2 – 41.6)		3.3 (2.1 – 5.2)	<0.0001
Household size (mean)	3.2			1.0 (0.8– 1.1)	0.710			1.0 (0.9 – 1.1)	0.910

All percentages are weighted. Missing data: household income (n=33), household savings (n=45), and COVID-19 stressor score (n=3). GED is the general education diploma. COVID-19 stressor score calculated from stressor summation ranging from 0-13; categories represent low (score of 0-2), medium (score of 3-4), and high (score of 5-14) exposure to stressors due to COVID-19. GAD defined by a GAD-7 score ≥15. PTSS defined by a 4-item PTSD checklist (PCL) score ≥3. Two-tailed chi-square analysis conducted for significance testing. This analysis is based on data from our COVID-19 and Life stressors Impact on Mental Health and Well-being Study (CLIMB).

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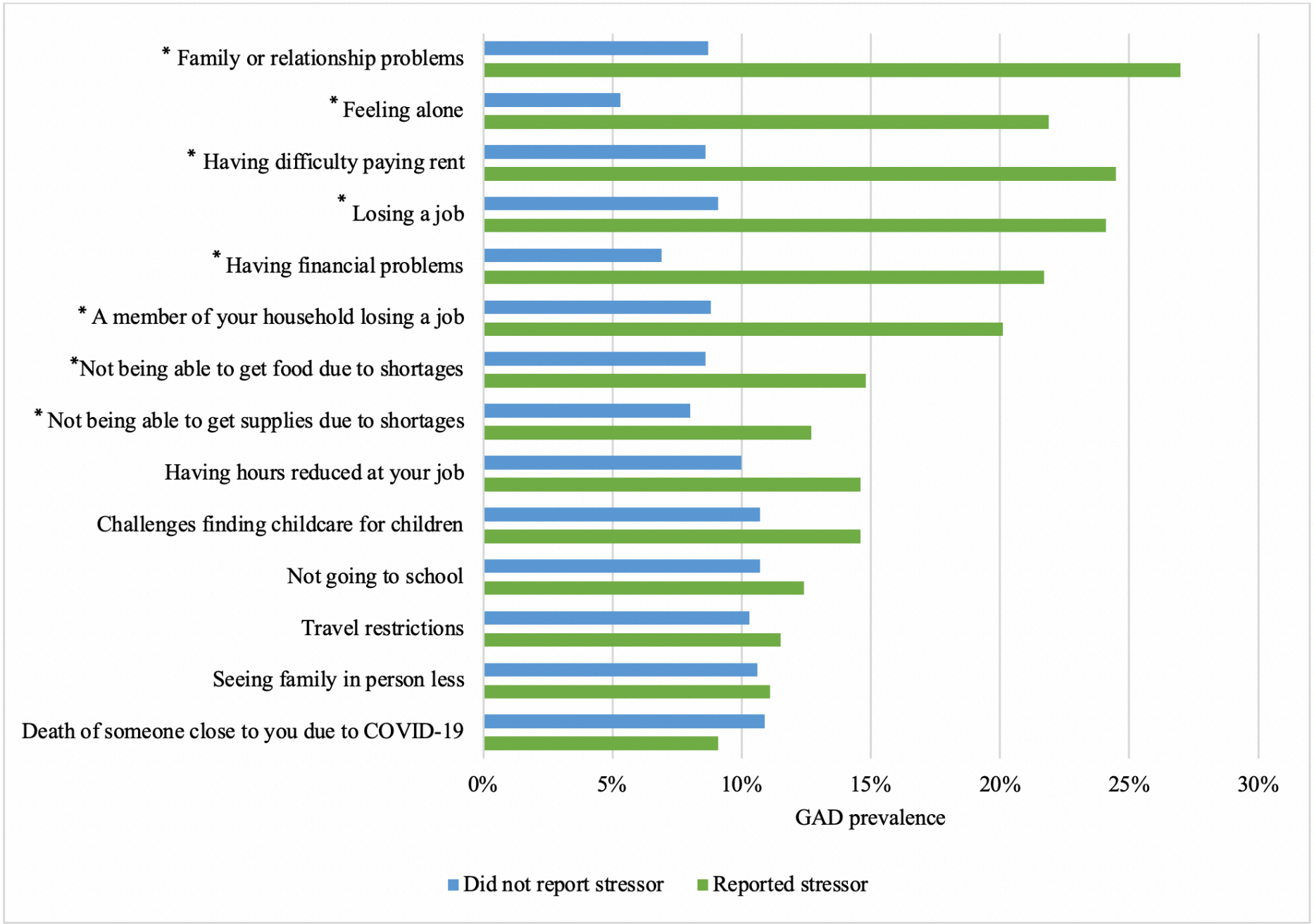
Figure 1: Prevalence of probable generalized anxiety disorder (GAD) for persons reporting different COVID-19 stressors



*P<0.05

GAD defined by a GAD-7 score ≥15. Percentages are weighted to the U.S. population. This analysis is based on data from the COVID-19 and Life stressors Impact on Mental Health and Well-being Study (CLIMB).

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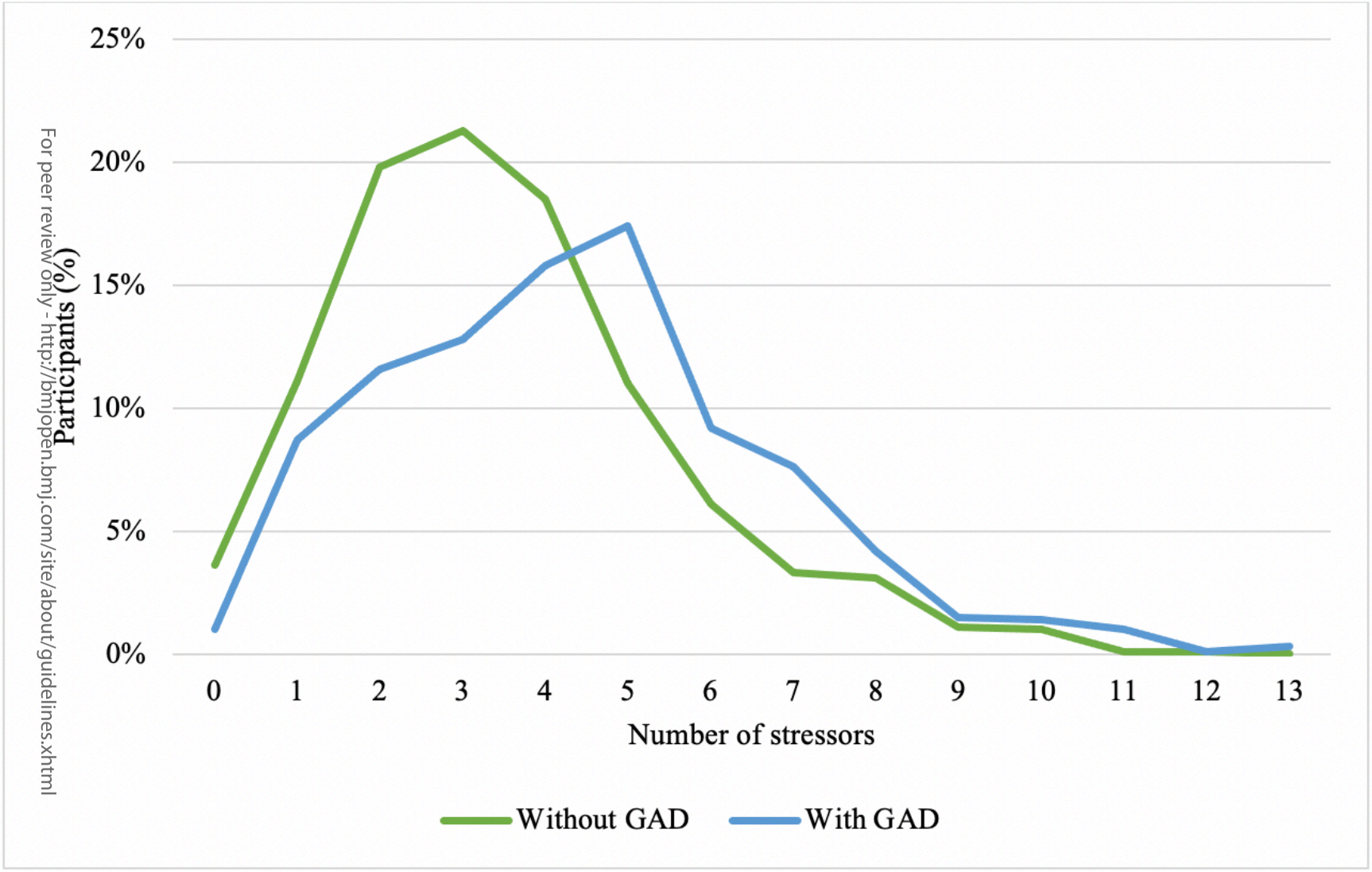
Figure 2: Distribution of COVID-19 stressors by generalized anxiety disorder (GAD) status



GAD defined by a GAD-7 score ≥15. Percentages are weighted to the U.S. population. This analysis is based on data from the COVID-19 and Life stressors Impact on Mental Health and Well-being Study (CLIMB).

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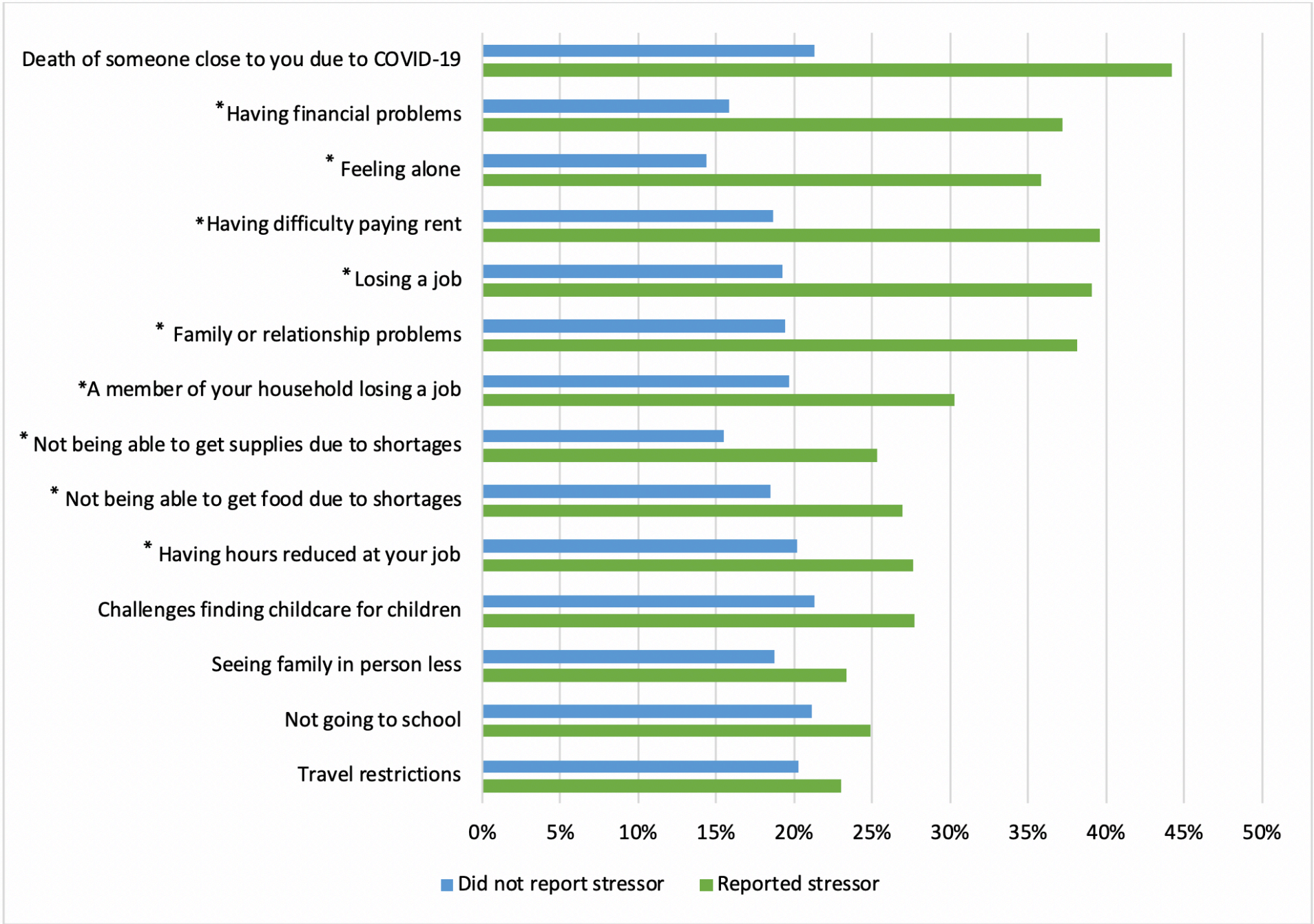
Figure 3: Prevalence of Post-traumatic stress symptoms (PTSS) for persons reporting different COVID-19 stressors



*P<0.05

PTSS defined by a 4-item PTSD checklist (PCL) score ≥3. Percentages are weighted to the U.S. population. This analysis is based on data from our COVID-19 and Life stressors Impact on Mental Health and Well-being Study (CLIMB).

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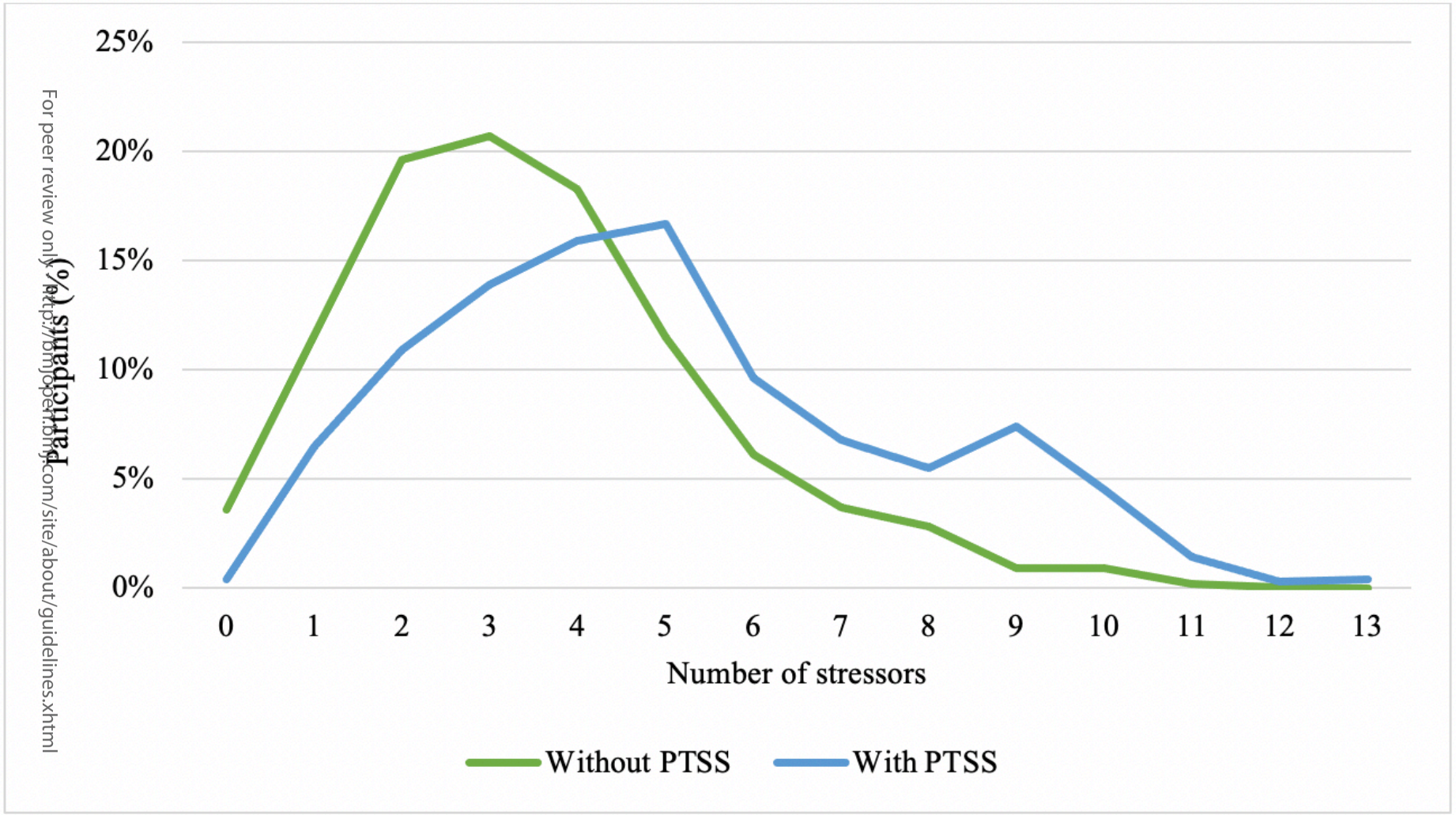
Figure 4: Distribution of COVOD-19 stressors by post-traumatic stress symptoms (PTSS) status



PTSS defined by a 4-item PTSD checklist (PCL) score ≥3. Percentages are weighted to the U.S. population. This analysis is based on data from the COVID-19 and Life stressors Impact on Mental Health and Well-being Study (CLIMB).

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Appendix table 1: multivariable regression model of probable generalized anxiety disorder (GAD) and post-traumatic distress symptoms (PTSS) in adults 18 years and older in the U.S. by demographic characteristics and COVID-19 related stressors (continuous variable).

	Probable GAD		PTSS	
	Odds ratio (95% CI)	**P-value**	**Odds ratio (95% CI)**	**P-value**
Gender				
Male	ref		ref	
Female	1.5 (1.0 – 2.4)	0.076	1.5 (1.0 – 2.1)	0.034
Age				
18-39 y	ref		ref	
40-59 y	0.6 (0.3 – 1.0)	0.047	1.1 (0.7 – 1.6)	0.805
≥60 y	0.50 (0.2 – 1.1)	0.100	0.6 (0.3 – 1.1)	0.082
Race				
Non-Hispanic White	ref		ref	
Non-Hispanic Black	0.8 (0.3 – 1.9)	0.583	0.7 (0.4 – 1.2)	0.163
Hispanic	0.7 (0.4 – 1.3)	0.229	1.0 (0.6 – 1.7)	0.882
Non-Hispanic Asian	0.1 (0.0 – 0.6)	0.017	0.3 (0.1 – 1.4)	0.126
Other Race – Including Multi-Racial	1.0 (0.4 – 2.5)	0.971	0.5 (0.2 – 1.1)	0.084
Education				
No high school diploma	1.1 (0.4 – 3.1)	0.860	0.7 (0.3 – 1.4)	0.288
High school graduate or equivalent	1.1 (0.5 – 2.2)	0.818	1.1 (0.7 – 1.8)	0.708
Some college	1.8 (1.0 – 3.1)	0.034	1.0 (0.6 – 1.4)	0.822
College grad or more	ref		ref	
Marital status				
Married	ref		ref	
Widowed, divorced, or separated	1.3 (0.7 – 2.6)	0.424	1.1 (0.6 – 1.9)	0.758
Never married	1.3 (0.7 – 2.5)	0.402	1.1 (0.7 – 1.7)	0.753
Living with partner	1.4 (0.7 – 3.0)	0.322	0.9 (0.5 – 1.6)	0.777
Household income				
$0 - $19,999	0.9 (0.4 – 1.9)	0.767	1.2 (0.6 – 2.2)	0.652
$20,000 - $44,999	0.7 (0.3 – 1.4)	0.295	0.7 (0.4 – 1.2)	0.193

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$45,000 - $74,999	0.6 (0.3 – 1.2)	0.162	0.9 (0.6 – 1.5)	0.717
≥$75,000	ref		ref	
Household savings				
$0 - $4,999	2.0 (1.2 – 3.2)	0.008	1.3 (0.8 – 1.9)	0.290
≥$5,000		ref	ref	
Household size	1.0 (0.8 – 1.1)	0.631	1.0 (0.9 – 1.1)	0.962
COVID-related stressors	1.3 (1.2 – 1.4)	<0.001	1.3 (1.2 – 1.4)	<0.001

All percentages are weighted. Missing data: household income (n=33), household savings (n=45), and COVID-19 stressor score (n=3). GED is the general education diploma. GAD defined by a GAD-7 score ≥15. PTSS defined by a 4-item PTSD checklist (PCL) score ≥3.

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Appendix table 2: multivariable regression model of probable generalized anxiety disorder (GAD) and post-traumatic distress symptoms (PTSS) in adults 18 years and older in the U.S. by demographic characteristics and COVID-19 related economic and social stressors.

	Probable GAD		PTSS	
	Odds ratio (95% CI)	**P-value**	**Odds ratio (95% CI)**	**P-value**
Gender				
Male	ref		ref	
Female	1.6 (1.0 – 2.5)	0.064	1.5 (1.0 – 2.6)	0.032
Age				
18-39 y	ref		ref	
40-59 y	0.6 (0.3 – 1.0)	0.043	1.0 (0.3 – 1.0)	0.818
≥60 y	0.5 (0.2 – 1.1)	0.105	0.6 (0.2 – 1.1)	0.084
Race				
Non-Hispanic White	ref		ref	
Non-Hispanic Black	0.8 (0.3 – 1.8)	0.581	0.6 (0.3 – 1.8)	0.162
Hispanic	0.7 (0.4 – 1.2)	0.180	1.0 (0.4 – 1.2)	0.900
Non-Hispanic Asian	0.1 (0.0 – 0.6)	0.016	0.3 (0.0 – 0.6)	0.120
Other Race – Including Multi-Racial	1.0 (0.4 – 2.4)	0.937	0.5 (0.4 – 2.4)	0.084
Education				
No high school diploma	1.1 (0.4 – 3.0)	0.907	0.6 (0.4 – 3.0)	0.278
High school graduate or equivalent	1.1 (0.5 – 2.1)	0.892	1.1 (0.5 – 2.1)	0.728
Some college	1.8 (1.0 – 3.0)	0.041	1.0 (1.0 – 3.0)	0.809
College grad or more	ref		ref	
Marital status				
Married	ref		ref	
Widowed, divorced, or separated	1.3 (0.7 – 2.6)	0.416	1.1 (0.7 – 2.6)	0.755
Never married	1.3 (0.7 – 2.4)	0.420	1.1 (0.7 – 2.4)	0.764
Living with partner	1.4 (0.7 – 3.0)	0.327	0.9 (0.7 – 3.0)	0.772
Household income				
$0 - $19,999	0.9 (0.4 – 1.9)	0.738	1.2 (0.4 – 1.9)	0.668

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$20,000 - $44,999	0.7 (0.3 – 1.4)	0.276	0.7 (0.3 – 1.4)	0.195
$45,000 - $74,999	0.6 (0.3 – 1.2)	0.160	0.9 (0.3 – 1.2)	0.713
≥$75,000	ref		ref	
Household savings				
$0 - $4,999	2.0 (1.2 – 3.2)	0.008	1.3 (1.2 – 3.2)	0.290
≥$5,000	ref		ref	
Household size	1.0 (0.8– 1.1)	0.627	1.0 (0.8– 1.1)	0.956
COVID-related financial stressors	1.4 (1.2 – 1.6)	<0.001	1.3 (1.2 – 1.6)	<0.001
COVID-related social and emotional stressors	1.2 (1.1 – 1.5)	0.011	1.3 (1.1 – 1.5)	<0.001

All percentages are weighted. Missing data: household income (n=33), household savings (n=45), and COVID-19 stressor score (n=3). GED is the general education diploma. GAD defined by a GAD-7 score ≥15. PTSS defined by a 4-item PTSD checklist (PCL) score ≥3. Financial stressors included losing a job, having difficulty paying rent, having financial problems, a member of your family losing a job, and having hours reduced at your job. Social and emotional stressors included feeling along, having relationship problems, family or relationship problems, not being able to get food due to shortages, not being able to get supplies due to shortages, challenges finding childcare, not going to school, travel restrictions, seeing family less in person, and death of someone close to you due to COVID-19.

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STROBE (Strengthening The Reporting of OBservational Studies in Epidemiology) Checklist

A checklist of items that should be included in reports of observational studies. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

Section and Item	Item No.	Recommendation	Reported on Page No.
Title and Abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1, 2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/Rationale	2	Explain the scientific background and rationale for the investigation being reported	
Objectives	3	State specific objectives, including any prespecified hypotheses	4, 5
Methods			
Study Design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	5
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5, 6

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Section and Item	Item No.	Recommendation	Reported on Page No.
Data Sources/ Measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5, 6
Bias	9	Describe any efforts to address potential sources of bias	N/A
Study Size	10	Explain how the study size was arrived at	N/A
Quantitative Variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5, 6
Statistical Methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	6
		(*b*) Describe any methods used to examine subgroups and interactions	6
		(*c*) Explain how missing data were addressed	5
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	N/A
		(*e*) Describe any sensitivity analyses	6
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive Data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7
		(b) Indicate number of participants with missing data for each variable of interest	5
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	
Outcome Data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	7, 8

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Section and Item	Item No.	Recommendation	Reported on Page No.
Main Results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	7, 8
		(*b*) Report category boundaries when continuous variables were categorized	7, 8
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other Analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	7, 8
Discussion			
Key Results	18	Summarise key results with reference to study objectives	9, 10
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	10, 11
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	11
Generalisability	21	Discuss the generalisability (external validity) of the study results	11
Other Information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	12

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

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The mental health consequences of COVID-19: a nationally representative cross-sectional study of pandemic-related stressors and anxiety disorders in the United States.

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Primary Subject Heading:	Mental health
Secondary Subject Heading:	Public health, Epidemiology
Keywords:	MENTAL HEALTH, COVID-19, Anxiety disorders < PSYCHIATRY

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The mental health consequences of COVID-19: a nationally representative cross-sectional study of pandemic-related stressors and anxiety disorders in the United States.

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Keywords: COVID-19, mental health, anxiety, generalized anxiety disorder, post-traumatic stress symptoms, economic stressors

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Abstract

Objective: to document the prevalence of probable anxiety disorders in the United States during the COVID-19 pandemic.

Design: cross-sectional analysis

Setting: a nationally representative sample in the United States between March 31 and April 13, 2020

Participants: 1450 English-speaking adult participants in the AmeriSpeak Panel. AmeriSpeak is a probability-based panel designed to be representative of households in the United States.

Main outcome measures: prevalence of probable generalized anxiety disorder (GAD) using the GAD-7 and post-traumatic stress symptoms (PTSS) using the 4-items PTSD checklist (PCL). Both outcomes were adjusted for demographics and COVID-19 related stressors.

Results: The majority of participants were female (51.8%), non-Hispanic white (62.9%), and reported a household saving of $5000 or more. Those between 18-29 years old were the largest age group (38.1%) compared to 40-59 years (32.0%) and 60 years or more (29.9%). The prevalence of probable GAD was 10.9% (95% CI: 9.1-13.2) and the prevalence of PTSS was 21.7% (95% CI: 19.1-24.6). Among participants reporting five or more COVID-19 related stressors, the prevalence of probable GAD was 20.5% (95% CI: 16.1-25.8) and the prevalence of PTSS was 35.7% (95% CI: 30.2-41.6). Reporting five or more COVID-19 related stressors was a predictor of both probable GAD (OR=4.5, 95% CI: 2.3-8.8) and PTSS (OR=3.3, 95% CI: 2.1-5.2).

Conclusions: The prevalence of probable anxiety disorders in the United States, as the COVID-19 pandemic and policies implemented to tackle it unfolded, is higher than estimates reported prior to the pandemic and estimates reported following other mass traumatic events. Exposure to COVID-19 related stressors is associated with higher prevalence of both probable GAD and PTSS, highlighting the role these stressors play in increasing the risk of developing of anxiety disorders in the United States. Mitigation and recovery policies should take into account the mental health toll the pandemic had on United States population.

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Strengths and limitations of this study

- This analysis uses a nationally representative sample examining the risk of developing of anxiety disorders in the United States.
- The study was conducted within a short duration following the implementation of state-wide policies to tackle the COVID-19 pandemic and includes questions about a wide-range of social and economic COVID-19 related stressors.
- To assess the risk of developing of anxiety disorders, the study uses screening, rather than diagnostic tools. However, these screening tools have been validated extensively for assessment of anxiety disorders in general populations.
- The use of a pre-selected panel of participants can lead to selection bias.

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Introduction

The effect of the COVID-19 pandemic on the American public has been profound. More than 600,000 people have died from COVID-19 in the United States, and a number of unprecedented physical distancing policies, continue to be in place to limit the spread of the pandemic. These policies changed daily life for most people in the United States significantly and continue to have large scale social and economic consequences. The physical toll of COVID-19, coupled with the ubiquity and severity of these policies, distinguish the pandemic as a mass traumatic event, one that is associated with extensive loss of lives and financial strains that can lead to severe and lasting psychological consequences, anxiety disorders in particular.[1–4]

Uncertainty, fear, economic and social costs, and disruptions to daily life all contribute to a high prevalence of anxiety disorders following mass traumatic events.[5,6] For example, a study assessing the mental health consequences of the Ebola epidemic in Sierra Leone found that, a year following the epidemic, 6% of participants reached the threshold for a combined anxiety-depression measure and 27% reached the threshold for post-traumatic stress disorder (PTSD).[7] Another study estimated that, following Hurricane Katrina, the 30-day prevalence of PTSD was 30.3% among residents of the New Orleans metropolitan area, which was severely affected by the hurricane.[8]

This previous work suggests that the COVID-19 pandemic will have a substantial impact on the prevalence of anxiety disorders in the United States. Early evidence has found that COVID-19 pandemic is associated with adverse mental health consequences.[9–21] However, to our knowledge, the association between COVID-19 and related stressors—both due to the pandemic and policies implemented to halt its spread—on the risk of developing of anxiety disorders in the United States has yet to be fully documented.

We assessed the prevalence of anxiety disorders, specifically probable generalized anxiety disorder (GAD) and post-traumatic stress symptoms (PTSS), as the COVID-19 pandemic unfolded in the United States. We also assessed the association between COVID-19 related stressors and the risk of developing

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anxiety disorders following the implementation of wide-spread physical distancing policies in the United States.

Methods

Data collection and sample

This analysis was based on data from our COVID-19 and Life stressors Impact on Mental Health and Well-being Study (CLIMB). We collected nationally representative data using a random sample of adult participants in the AmeriSpeak Panel between March 31 and April 13, 2020. AmeriSpeak is a probability-based panel designed to be representative of households in the United States. The panel is funded and operated by the National Opinion Research Center (NORC) at the University of Chicago and their sampling frame covers approximately 97% of households in the country. The survey was offered to English-speaking participants who had completed an AmeriSpeak survey in the last 6 months.

In total, 1470 participants completed the survey, 1385 online and 85 via the phone, representing 64.3% of invited panelists. From those 1470 participants, 20 had missing data on either GAD or PTSS questions, which were removed; the final analysis included 1450 participants from the CLIMB study. The institutional review boards of NORC and Boston University Medical Campus (H-39986) approved the study. NORC obtained written consent from study participants when they first enrolled in the AmeriSpeak Panel.

Exposure variables

Our structured survey included questions on demographic characteristics (sex, age, race and ethnicity, education, marital status, household income, household savings, and household size) and whether the respondent had or knew anyone who had COVID-19. The primary exposure of interest was reporting COVID-19 related stressors. The stressor list was based on prior analyses following traumatic events.[16,23] The list included financial stressors (e.g., losing a job, having difficulty paying rent, having financial problems, a member of your family losing a job, and having hours reduced at your job) and social and emotional stressors (e.g., feeling along, having relationship problems, family or relationship problems, not being able to get food due to shortages, not being able to get supplies due to shortages, challenges

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finding childcare, not going to school, travel restrictions, seeing family less in person, and death of someone close to you due to COVID-19). We excluded stressors that were applicable to only a subset of the population, ultimately including 14 stressors in our analysis. We then created a cumulative stressor score and divided the score into three stressor categories, low (0-2 stressors), medium (3-4 stressors), and high (5-14 stressors). The score reflects the symptoms distribution in the sample with approximately one third of the sample in each category.

Outcome variables

For psychological assessment, we used two validated anxiety disorders questionnaires. We used the GAD-7 to assess GAD. The cutoff for probable GAD in our analysis was a score of 15 or more. This cutoff was based on the recommended cutoffs for GAD-7 to screen for GAD.[24] We also conducted a sensitivity analysis with a cutoff score of 10 or more. We used the 4-items PTSD checklist (PCL) to screen for PTSS. The cutoff for PTSS was three score or more.[25]

Statistical analysis

We used STATA 16.1 to conduct the analysis for this study. All analyses were weighted using complex survey weights to adjust for sample selection and post-stratification. We calculated the overall prevalence of probable GAD and PTSS and the prevalence of each outcome stratified by number of stressors. We then conducted a bivariable analysis comparing probable GAD and PTSS prevalence across demographic characteristics, stressor score, and each type of stressor using a two-tailed chi-square test. We used complete case analysis for the multivariable logistic regression models to estimate the odds ratios of the association between COVID-19 related stressor score and probable GAD and PTSS when controlling for gender, age, race, education, marital status, household income, household savings, and household size. In sensitivity analysis, we included concern about COVID-19 in the multivariable logistic regression model. We also constructed other multivariable logistic regression models with the number of stressors as a continuous variable and other models that divide the stressors into two continuous variables (financial stressors and social stressors) as sensitivity analyses. We followed the Strengthening the Reporting of

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Observational Studies in Epidemiology (STROBE) reporting guideline for cross-sectional studies when designing and reporting on this analysis.

Patient and public involvement

Patients and the public were not involved in the developing the research question, design, or implementation of this analysis. This is primarily because we did not have funding to support such involvement and our analysis was on a national level using validated assessment tools.

Results

Of the 1450 participants, 10.9% (95% CI: 9.1, 13.2) reached the threshold for probable GAD, using a score of 15 as a cutoff. When using a score of 10 as a cutoff point, 25% (95% CI: 22.2-28.0) reached the threshold for probable GAD. In terms of PTSS, 21.7% (95% CI: 19.1-24.6) reached the threshold.

Table 1 shows the association between demographic characteristics and the two outcomes. In particular, female sex was associated with a higher prevalence of both probable GAD and PTSS in the bivariable analysis. The prevalence of probable GAD was 14.1% (95% CI: 11.2-17.6) among females compared to 7.6% (95% CI: 5.4-10.4) among males. The prevalence of probable PTSS was 26.1% (95% CI: 22.3-30.2) among females compared to 17% (95% CI: 13.5-21.2) among males. Other demographic variables associated with both outcomes in the bivariable analysis were age and household savings. In the multivariable analysis, reporting household savings of less than $5,000 was a predictor of GAD (OR= 1.9, 95% CI: 1.2 – 3.1).

COVID-19 related stressors and anxiety disorders

Higher stressor score was positively associated with, and a predictor of, both probable GAD and PTSS. The prevalence of probable GAD was 4% (95% CI: 2.2-7.0) among participants with low stressor score, 8.6% (95% CI: 6.2-11.8) among participants with medium stressor score, and 20.5% (95% CI: 16.1-25.8) among participants with high stressor score. High stressor score was a predictor of probable GAD (OR=4.5, 95% CI: 2.3-8.8) compared to reporting a low stressor score (Table 1). High stressor score remained a predictor of probable GAD (OR=3.5, 95% CI: 1.8-6.9) compared to reporting a low stressor

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score after including concern about COVID-19 in the model (Appendix Table 1). In the models that Included COVID-19 related stressors as a continuous variable the OR of probable GAD was 1.3 (95% CI: 1.2-1.4) (Appendix Table 2). Dividing COVID-19 related stressors into two continuous variables depending on the nature of the stressor in the multivariable model produced consistent results for financial stressors (OR=1.4, 95% CI: 1.2-1.6), and social and emotional stressors (OR=1.2, 95% CI: 1.1-1.5) (Appendix Table 3).

The prevalence of PTSS was 12.4% (95% CI: 8.9-17.0) among participants with low stressor score, 17.4% (95% CI: 13.6-22.0) among participants with medium stressor score, and 35.7% (95% CI: 30.2-41.6) among participants with high stressor score. Reporting a high stressor score, compared to a low stressor score, was a predictor of PTSS (OR=3.3, 95% CI: 2.1-5.2) (Table 1). High stressor score remained a predictor of PTSS (OR=2.7, 95% CI: 1.7-4.3) compared to reporting a low stressor score after including concern about COVID-19 in the model (Appendix Table 1). In the models that Included COVID-19 related stressors as a continuous variable the OR was 1.3 (95% CI: 1.2-1.4) (Appendix Table 2). Dividing COVID-19 related stressors into two continuous variables the multivariable model depending on the nature of the stressor produced consistent results for financial stressors (OR=1.3, 95% CI: 1.2-1.6), and social and emotional stressors (OR=1.3, 95% CI: 1.1-1.5) (Appendix Table 3).

Figure 1 shows that reporting any COVID-19 related stressor, except for experiencing travel restrictions, was associated with higher probable GAD prevalence. The greatest difference in probable GAD prevalence by COVID-19 related stressor was between participants who reported having family or relationship problems (prevalence=27%, 95% CI: 19.6-36.1) compared to participants who did not report family or relationship problems (prevalence=8.7%, 95% CI: 6.9-10.9). Other stressors leading to a significant difference in probable GAD prevalence included feeling lonely, having difficulty paying the rent, losing a job, having financial problems, and a household member losing a job. Figure 2 shows that participants who reached the threshold for probable GAD reported, on average, experiencing a higher number of stressors compared to participants who did not reach the threshold for probable GAD.

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Figure 3 shows that reporting any COVID-19 related stressor was associated with higher PTSS prevalence. The greatest significant difference in PTSS prevalence was between participants who reported having financial problems (prevalence=37.2%, 95% CI: 31.1-43.7) compared to participants who did not report having financial problems (prevalence=15.8%, 95% CI: 13.2-18.8). Other stressors leading to a significant difference in PTSS prevalence included feeling along, losing a job, and having difficulty paying the rent. Figure 4 shows that participants who reached the threshold for PTSS reported, on average, experienced a higher number of stressors compared to participants who did not reach the threshold for PTSS.

Discussion

In a survey of a representative sample of adults in the United States conducted between March 31 and April 13, 2020, 10.9% of adults reported a score indicative of probable GAD and 21% reported PTSS. These numbers are significantly higher than the expected prevalence of anxiety disorders in the United States. For example, the National Comorbidity Survey replication estimated that the prevalence of GAD and PTSD in the United States were 3.1% and 3.5%, respectively (collected before COVID-19).[26] Another analysis showed that the 12-month prevalence of GAD in United States in 2017 was 4%.[27] However, our results are lower than a recent analysis by Twenge and Joiner, which found that, compared to 2019, adults in the United States were more than three times as likely to screen positive for anxiety (using GAD-2) between April 23-May 2020. The study reports that on the week of May 21, 2020 29.4% of participants screened positive for GAD.[17] The difference in results can potentially be due to the higher threshold for screening positive for probable GAD by our screening tool.

We also found that COVID-19 related stressors were associated with participants reporting more symptoms of GAD or PTSS. The prevalence of GAD was four times higher among participants reporting five or more stressors compared to participants reporting two or fewer stressors. The prevalence of PTSS was about three times higher among participants reporting five or more stressors compared to participants reporting two or fewer COVID-19 related stressors. This reinforces the hypothesis that COVID-19 behaves like a mass traumatic event, wherein experiences related to COVID-19 and its consequences are

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directly linked to adverse mental health consequences. These results are consistent with other epidemiologic analyses that studied COVID-19 stressors and mental health. For example, Fitzpatrick et al. found in a nationally representative sample that fear of COVID-19 was linked to both depression and anxiety, and that more than 25% of participants reported moderate to severe anxiety symptoms, which may warrant clinical treatment.[28] Another study found that between April 13 and May 19, 2020, young adults (18-20 years) reported high levels of GAD (45.4% with a 10 score cutoff) and PTSD symptoms (31.8% with a 45 PCL-C score cutoff).[15,28] Conditions associated with anxiety disorders often also lead to depression.[29] This is consistent with our analysis that found that the prevalence of depression symptoms has risen during the study period as well.[30]

Our study is consistent with existing literature showing higher prevalence of anxiety disorders following mass traumatic events, even if our results suggest the severity of anxiety disorders due to the COVID-19 pandemic is greater than that previously recorded after other mass traumas.[1] Agyapong et al. reported that the prevalence of GAD after one month following a wildfire—which physically, emotionally, and economically affected the community—was 19.8%.[31] Their results were based on using a score of 10 points on the GAD-7 scale as the cutoff. Using the same cutoff, the prevalence of probable GAD in our analysis rises to 25%. Silver et al. found that 17% of the United States population that lives outside New York city reported PTSS two months after the September 11 terrorist attack.[32]

Our study complements studies from China showing that COVID-19 has led to adverse psychological consequences.[9,33] We add to the literature by quantifying the probable prevalence of GAD and PTSS as the COVID-19 pandemic unfolded in the United States. Our results also support analysis from Nelson et al. showing the widespread concerns and stressors due to COVID-19 in the United States.[10] Our work both describes the experience of particular stressors and quantifies their contribution to the risk of developing of anxiety disorders in the country. In particular, we show that financial (e.g., having difficulty paying rent) and social and emotional (e.g., feeling lonely) stressors contribute to higher rates of both probable GAD and PTSS, which aligns with existing literature.[6]

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These results should be considered with the following limitations in mind. First, our study uses screeners for GAD and PTSS. A definitive diagnosis of either will require clinical assessment. As such, these results should be confirmed in a representative sample using diagnostic tools. However, both screening questionnaires in our analysis are validated tools used extensively to assess the prevalence of GAD and PTSS in the population.[24,25] Second, the use of a pre-specified panel can lead to selection bias. However, the AmeriSpeak Panel has been used reliably for years to provide representative samples of the United States.[34] Third, there are a large number of other covariates—including features of context like, for example, estimates of pandemic severity—that could be considered to more fully assess the determinants of anxiety disorders in this study. This is beyond the scope of the paper but potentially a fruitful direction for future work. Fourth, our post-only design, which does not allow for information on the mental health status of the participants prior to the pandemic, suggests that we cannot causally link the pandemic, and the policies implemented to tackle it, to a subsequent increased risk of developing of anxiety disorders. However, the specificity of stressors reported, and the high risk of developing of reported anxiety disorders, consistent with previous knowledge and expectation, strongly suggest that we are observing reliable associations that can be further examined in subsequent longitudinal work.

Conclusion

The prevalence of anxiety disorders as the COVID-19 pandemic unfolded in the United States is substantially higher than the expected baseline prevalence in the United States and of the burden reported following other mass traumatic events. This potentially reflects the scale of the pandemic, the ubiquity of the impact of the policies implemented to tackle it, and the economic and social consequences of both. Persons experiencing COVID-19 related stressors, particularly financial, and social and emotional stressors, were more likely to report both probable GAD and PTSS indicating the critical role these stressors are play in increasing the risk of developing of anxiety disorders in the United States. Mitigation and recovery policies should take into account the mental health toll the pandemic had on United States population.

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Contributors: CKE and SMA developed the first draft of the survey. SG reviewed the survey. SMA conducted the data analysis and wrote the manuscript draft. CKE, GHC, and SG contributed to study conception and manuscript drafting. All authors acknowledge full responsibility for the analyses and interpretation of the report. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

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Patient consent for publication: Not required.

Ethics approval: The institutional review boards of NORC and Boston University Medical Campus (H-39986) approved the study. NORC obtained written consent from study participants when they first enrolled in the AmeriSpeak Panel.

Data sharing: authors may share the data upon reasonable requests

Transparency statement: The lead authors affirm that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

Dissemination to participants and related patient and public communities: There are no immediate plans to directly disseminate the analysis results to directly to the participants o as this study analyzed deidentified data. However, we aim to widely disseminate the results through our institution website and social media outlets to reach the public.

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Figure caption

Figure 1: Prevalence of probable generalized anxiety disorder (GAD) for persons reporting different COVID-19 stressors

Figure 2: Distribution of number of stressors among participants depending on whether they reported symptoms consistent with probable generalized anxiety disorder (GAD) status

Figure 3: Prevalence of Post-traumatic stress symptoms (PTSS) for persons reporting different COVID-19 stressors

Figure 4: Distribution of number of stressors among participants depending on whether they reach the cut-off for post-traumatic stress symptoms (PTSS) status

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Table 1: Generalized anxiety disorder (GAD) and post-traumatic distress symptoms (PTSS) in adults 18 years and older in the U.S. by demographic characteristics and COVID-19 related stressors.

		Generalized anxiety disorder				Post-traumatic stress symptoms			
	N (%)	% (95% CI)	P-value	Odds ratio (95% CI)	P-value	% (95% CI)	P-value	Odds ratio (95% CI)	P-value
Overall	1450	10.9 (9.1 –13.2)				21.7 (19.1 – 24.6)			
Sex									
Male	725 (48.2)	7.6 (5.4 –10.4)	0.0018	ref		17 (13.5 – 21.2)	0.0017	ref	
Female	725 (51.8)	14.1 (11.2 –17.6)		1.6 (0.99–2.51)	0.055	26.1 (22.3 – 30.2)		1.5 (1.1 –2.1)	0.024
Age									
18-39 y	623 (38.1)	16.6 (13.0 –21.2)	<0.0001	ref		26.1 (21.1 – 31.3)	<0.0001	ref	
40-59 y	461 (32.0)	9.2 (6.6 –12.6)		0.6 (0.3 – 1.0)	0.035	25.5 (20.9 – 30.7)		1.0 (0.7 – 1.6)	0.850
≥60 y	366 (29.9)	5.6 (3.4 – 9.1)		0.50 (0.2 – 1.1)	0.078	12.0 (8.5 – 16.6)		0.6 (0.3 – 1.0)	0.050
Race/Ethnicity									
Non-Hispanic White	939 (62.9)	10.8 (8.6 – 13.5)	0.3468	ref		22.0 (18.9 – 25.4)	0.1914	ref	
Non-Hispanic Black	143 (11.9)	11.9 (6.8 – 20.1)		0.8 (0.4 – 1.8)	0.603	18.9 (12.5 – 27.6)		0.7 (0.4 – 1.2)	0.157
Hispanic	258 (16.7)	11.3 (6.8 – 18.3)		0.8 (0.4 – 1.3)	0.307	27.0 (19.5 – 36.2)		1.1 (0.7 – 1.8)	0.749
Non-Hispanic Asian	36 (3.1)	0.8 (0.1 – 5.5)		0.1 (0.0 – 0.7)	0.023	8.7 (2.4 – 26.8)		0.3 (0.1 – 1.5)	0.142
Other	74 (5.4)	15.1 (7.4 – 28.6)		1.1 (0.4 – 2.7)	0.919	15.8 (7.7 – 29.5)		0.6 (0.3 – 1.2)	0.131
Education									
No high school diploma	67 (9.9)	13.4 (6.2 – 26.5)	0.0230	1.3 (0.5 – 3.2)	0.643	19.7 (10.9 – 32.8)	0.3825	0.7 (0.4 – 1.5)	0.393
High school grad or GED	276 (27.9)	10.4 (6.8 – 15.4)		1.19 (0.6 – 2.4)	0.615	25.3 (19.5 – 32.2)		1.2 (0.7 – 1.9)	0.560
Some college	638 (27.6)	15.8 (12.4 – 20.0)		2.0 (1.2 – 3.4)	0.013	22.2 (18.48 – 26.49)		1.0 (0.7 – 1.5)	0.933
College grad or more	469 (34.6)	6.8 (4.7– 9.7)		ref		18.9 (15.16 – 23.33)		ref	
Marital status									
Married	716 (47.8)	7.6 (5.6– 10.3)	0.0016	ref		19.0 (15.8 – 22.8)	0.1686	ref	
Widowed, divorced, or separated	254 (18.8)	10.2 (6.8 – 15.1)		1.3 (0.7 – 2.6)	0.392	20.9 (15.3 – 27.9)		1.1 (0.7 – 1.9)	0.693
Never married	345 (24.1)	14.3 (10.0 – 20.2)		1.4 (0.8 – 2.6)	0.273	24.9 (19.0 – 31.9)		1.2 (0.7– 1.8)	0.566
Living with partner	135 (9.3)	20.8 (12.7 – 32.0)		1.5 (0.7 – 2.9)	0.286	28.6 (19.5 – 39.8)		0.97 (0.6 – 1.7)	0.925
Household income									
$0 - $19,999	251 (20.3)	16.9 (11.7 – 23.7)	0.0311	0.9 (0.4 – 1.9)	0.746	28.6 (21.7 – 36.8)	0.1188	1.2 (0.6 – 2.2)	0.660
$20,000 - $44,999	358 (25.7)	12.0 (8.4 – 17.0)		0.6 (0.3 – 1.3)	0.219	19.5 (15.1 – 24.8)		0.7 (0.4 – 1.2)	0.158
$45,000 - $74,999	356 (24.8)	9.0 (6.0 – 13.2)		0.6 (0.3 – 1.2)	0.138	22.0 (17.0 – 28.1)		0.9 (0.6 – 1.5)	0.688
≥$75,000	452 (29.2)	8.5 (5.7–12.6)		ref		19.7 (15.3 – 25.0)		ref	
Household savings									
$0 - $4,999	578 (42.9)	17.2 (13.6 – 21.6)	<0.0001	1.9 (1.2 – 3.1)	0.010	27.6 (23.2 – 32.6)	0.0011	1.2 (0.8 – 1.9)	0.349

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≥$5,000	827 (57.1)	6.9 (5.0 – 9.3)		ref		18.0 (14.8 – 21.8)		ref	
COVID-related stressor score									
Low	460 (31.2)	4.0 (2.2 – 7.0)	<0.0001	ref		12.4 (8.9 – 17.0)	<0.0001	ref	
Medium	544 (37.0)	8.6 (6.2 – 11.8)		2.0 (1.0 – 4.0)	0.046	17.4 (13.6 – 22.0)		1.4 (0.9 – 2.3)	0.139
High	446 (31.8)	20.5 (16.1 – 25.8)		4.5 (2.3 – 8.8)	<0.0001	35.7 (30.2 – 41.6)		3.3 (2.1 – 5.2)	<0.0001
Household size (mean)	3.2			1.0 (0.8– 1.1)	0.710			1.0 (0.9 – 1.1)	0.910

All percentages are weighted. Missing data: household income (n=33), household savings (n=45), and COVID-19 stressor score (n=3). GED is the general education diploma. COVID-19 stressor score calculated from stressor summation ranging from 0-13; categories represent low (score of 0-2), medium (score of 3-4), and high (score of 5-14) exposure to stressors due to COVID-19. GAD defined by a GAD-7 score ≥15. PTSS defined by a 4-item PTSD checklist (PCL) score ≥3. Two-tailed chi-square analysis conducted for significance testing. This analysis is based on data from our COVID-19 and Life stressors Impact on Mental Health and Well-being Study (CLIMB).

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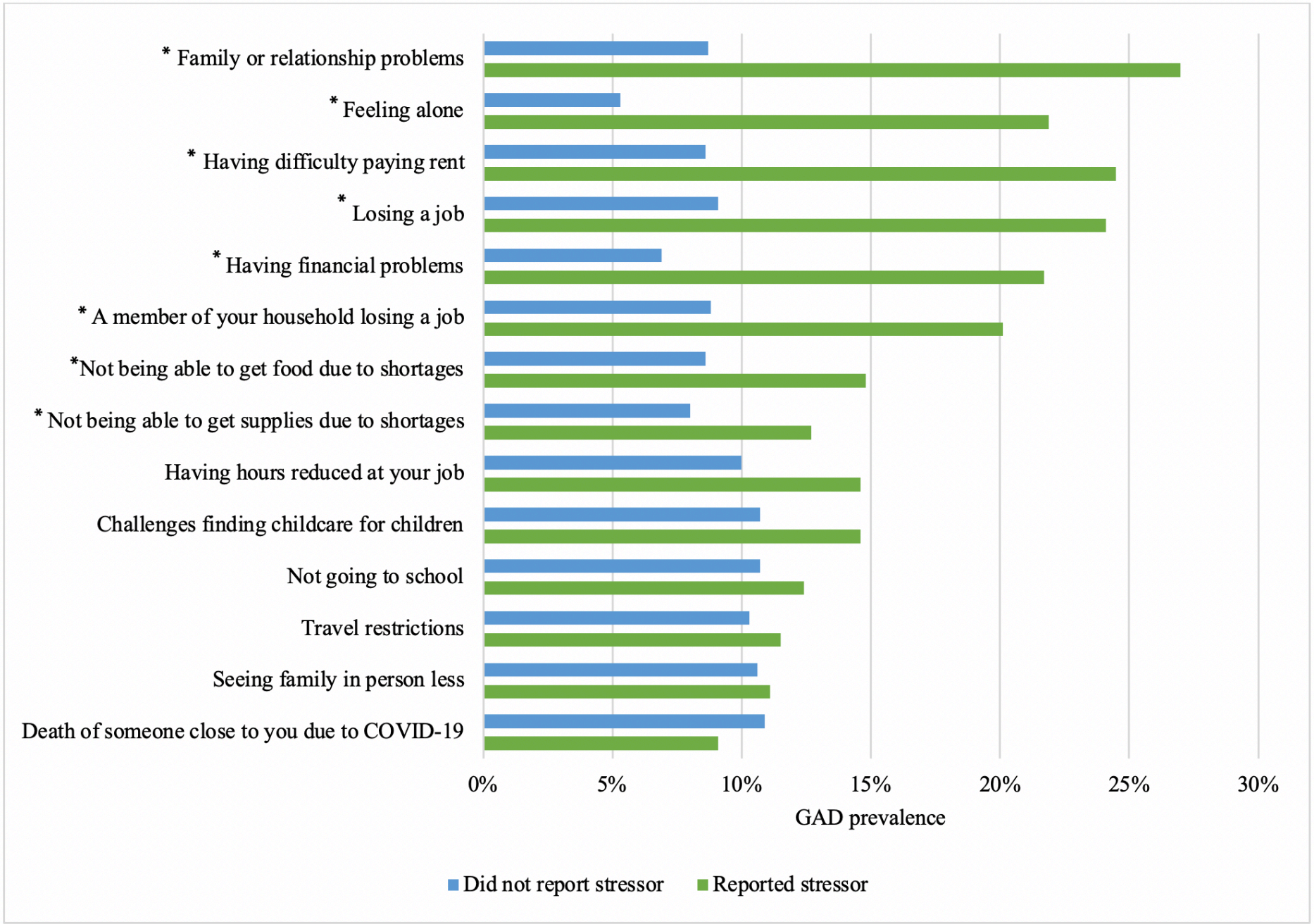
Figure 1: Prevalence of probable generalized anxiety disorder (GAD) for persons reporting different COVID-19 stressors



*P<0.05

GAD defined by a GAD-7 score ≥15. Percentages are weighted to the U.S. population. This analysis is based on data from the COVID-19 and Life stressors Impact on Mental Health and Well-being Study (CLIMB).

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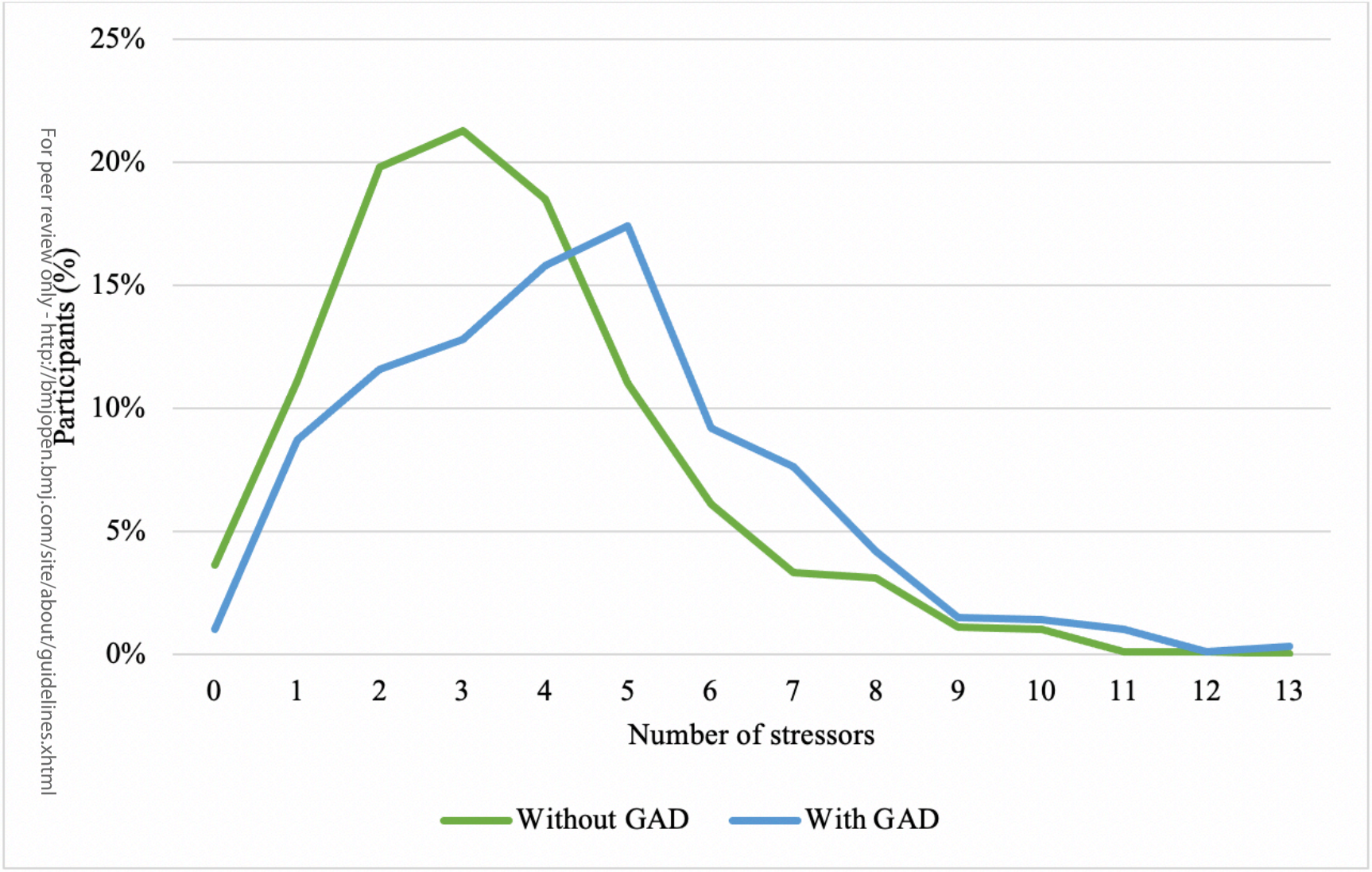
Figure 2: Distribution of COVID-19 stressors by generalized anxiety disorder (GAD) status



GAD defined by a GAD-7 score ≥15. Percentages are weighted to the U.S. population. This analysis is based on data from the COVID-19 and Life stressors Impact on Mental Health and Well-being Study (CLIMB).

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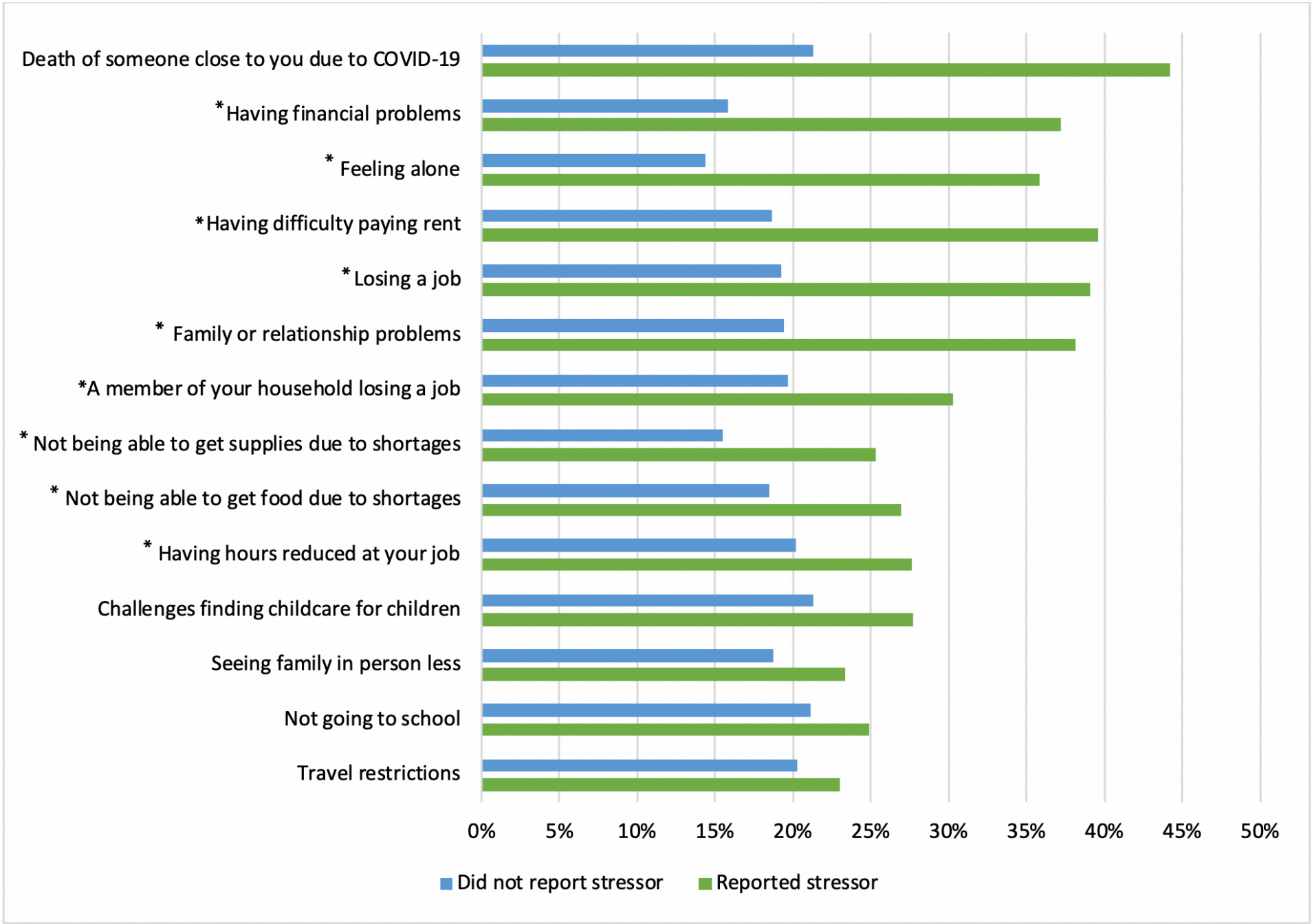
Figure 3: Prevalence of Post-traumatic stress symptoms (PTSS) for persons reporting different COVID-19 stressors



*P<0.05

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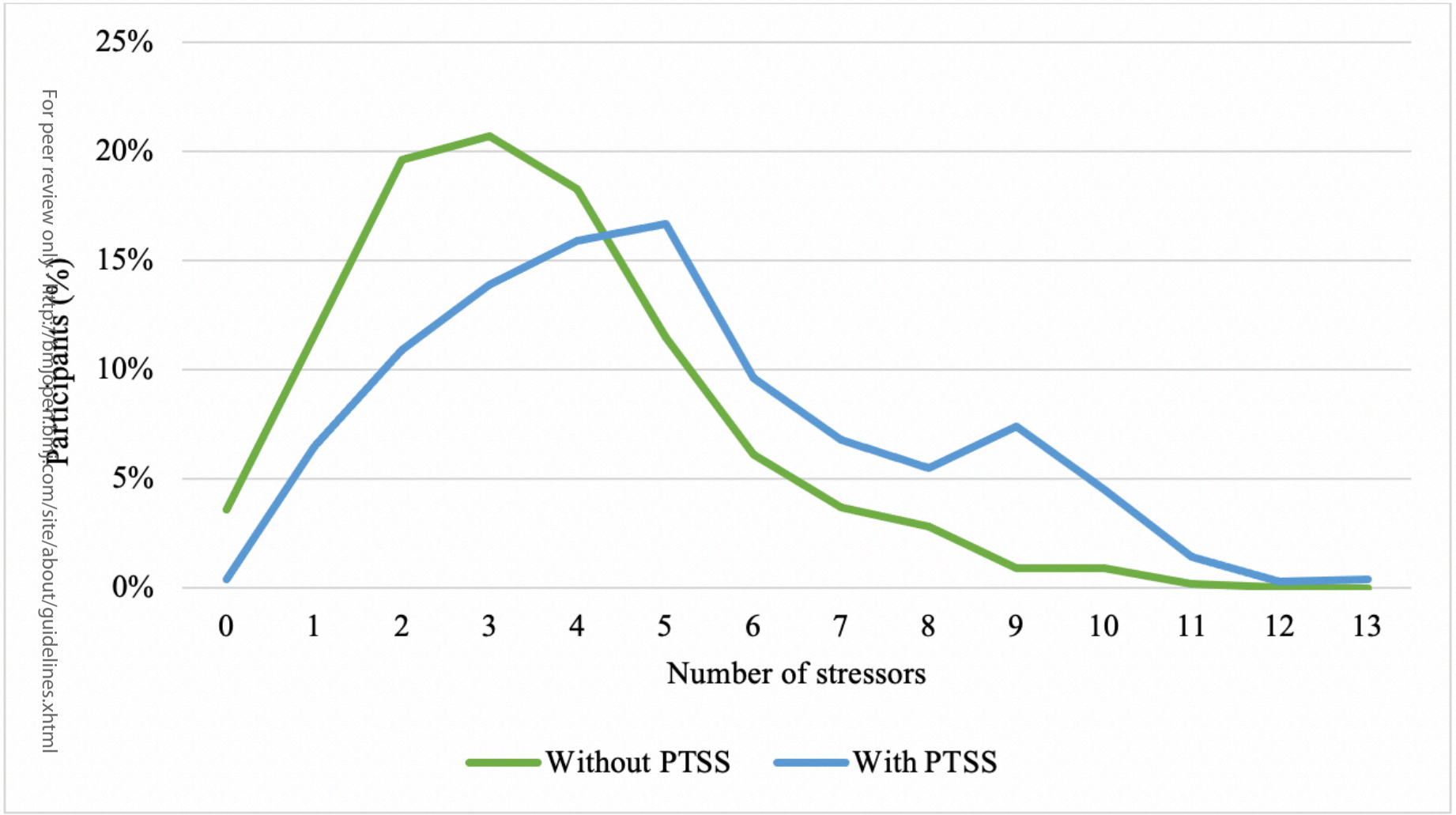
PTSS defined by a 4-item PTSD checklist (PCL) score ≥3. Percentages are weighted to the U.S. population. This analysis is based on data from our COVID-19 and Life stressors Impact on Mental Health and Well-being Study (CLIMB).

Figure 4: Distribution of COVOD-19 stressors by post-traumatic stress symptoms (PTSS) status



PTSS defined by a 4-item PTSD checklist (PCL) score ≥3. Percentages are weighted to the U.S. population. This analysis is based on data from the COVID-19 and Life stressors Impact on Mental Health and Well-being Study (CLIMB).

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Appendix Table 1: multivariable regression model of probable generalized anxiety disorder (GAD) and post-traumatic distress symptoms (PTSS) in adults 18 years and older in the U.S. by demographic characteristics and concern for COVID-19.

	Probable GAD		PTSS	
	Odds ratio (95% CI)	**P-value**	**Odds ratio (95% CI)**	**P-value**
Gender				
Male	ref		ref	
Female	1.6 (1.0-2.6)	0.048	1.6 (1.1-2.6)	0.014
Age				
18-39 y	ref		ref	
40-59 y	1.5 (0.3-0.9)	0.012	1.0 (0.7-1.5)	0.949
≥60 y	0.4 (0.2-0.9)	0.028	0.5 (0.3-1.0)	0.028
Race				
Non-Hispanic White	ref		ref	
Non-Hispanic Black	0.6 (0.2-1.5)	0.267	0.5 (0.3-1.0)	0.054
Hispanic	0.7 (0.4-1.2)	0.208	1.0 (0.6-1.7)	0.945
Non-Hispanic Asian	0.1 (0.01-0.7)	0.024	0.3 (0.1-1.4)	0.138
Other Race – Including Multi-Racial	1.2 (0.4-3.1)	0.764	0.6 (0.2-1.1)	0.160
Education				
No high school diploma	1.1 (0.4-3.1)	0.830	0.7 (0.3-1.5)	0.365
High school graduate or equivalent	1.0 (0.5-2.0)	0.985	1.1 (0.7-1.8)	0.711
Some college	1.9 (1.1-3.3)	0.023	1.0 (0.7-1.5)	0.838
College grad or more	ref		ref	
Marital status				
Married	ref		ref	
Widowed, divorced, or separated	1.3 (0.7-2.7)	0.405	1.1 (0.6-1.9)	0.849
Never married	1.5 (0.8-2.8)	0.229	1.1 (0.7-1.8)	0.585
Living with partner	1.4 (0.7-3.1)	0.356	1.0 (0.5-1.7)	0.918
Household income				
$0 - $19,999	1.0 (0.5-2.2)	0.975	1.2 (0.7-2.4)	0.509
$20,000 - $44,999	0.7 (0.3-1.4)	0.290	0.7 (0.4-1.2)	0.230
$45,000 - $74,999	0.7 (0.3-1.4)	0.278	1.0 (0.6-1.7)	0.938
≥$75,000	ref		ref	
Household savings				
$0 - $4,999	2.2 (1.3-3.6)	0.003	1.3 (0.8-2.0)	0.255

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≥$5,000	ref		ref	
Household size	1.0 (0.8-1.1)	0.662	1.0 (0.9-1.1)	0.926
COVID-related stressor score				
Low	ref		ref	
Medium	1.8 (0.9-3.6)	0.100	1.3 (0.8-2.0)	0.347
High	3.5 (1.8-6.9)	<0.0001	2.7 (1.7-4.3)	<0.0001
Concern about COVID-19				
Very concerned	4.1 (1.4-12.4)	0.012	5.3 (1.9-14.6)	0.004
Moderately concerned	2.7 (0.9-8.2)	0.086	4.0 (1.5-11.0)	0.014
A little concerned	0.3 (0.1-1.3)	0.112	1.3 (0.4-3.9)	0.784
Not at all concerned	ref		ref	

All percentages are weighted. Missing data: household income (n=33), household savings (n=45), and COVID-19 stressor score (n=3). GED is the general education diploma. COVID-19 stressor score calculated from stressor summation ranging from 0-13; categories represent low (score of 0-2), medium (score of 3-4), and high (score of 5-14) exposure to stressors due to COVID-19. GAD defined by a GAD-7 score ≥15. PTSS defined by a 4-item PTSD checklist (PCL) score ≥3. This analysis is based on data from our COVID-19 and Life stressors Impact on Mental Health and Well-being Study (CLIMB).

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Appendix Table 2: multivariable regression model of probable generalized anxiety disorder (GAD) and post-traumatic distress symptoms (PTSS) in adults 18 years and older in the U.S. by demographic characteristics and COVID-19 related stressors (continuous variable).

	Probable GAD		PTSS	
	Odds ratio (95% CI)	**P-value**	**Odds ratio (95% CI)**	**P-value**
Gender				
Male	ref		ref	
Female	1.5 (1.0 – 2.4)	0.076	1.5 (1.0 – 2.1)	0.034
Age				
18-39 y	ref		ref	
40-59 y	0.6 (0.3 – 1.0)	0.047	1.1 (0.7 – 1.6)	0.805
≥60 y	0.50 (0.2 – 1.1)	0.100	0.6 (0.3 – 1.1)	0.082
Race				
Non-Hispanic White	ref		ref	
Non-Hispanic Black	0.8 (0.3 – 1.9)	0.583	0.7 (0.4 – 1.2)	0.163
Hispanic	0.7 (0.4 – 1.3)	0.229	1.0 (0.6 – 1.7)	0.882
Non-Hispanic Asian	0.1 (0.0 – 0.6)	0.017	0.3 (0.1 – 1.4)	0.126
Other Race – Including Multi-Racial	1.0 (0.4 – 2.5)	0.971	0.5 (0.2 – 1.1)	0.084
Education				
No high school diploma	1.1 (0.4 – 3.1)	0.860	0.7 (0.3 – 1.4)	0.288
High school graduate or equivalent	1.1 (0.5 – 2.2)	0.818	1.1 (0.7 – 1.8)	0.708
Some college	1.8 (1.0 – 3.1)	0.034	1.0 (0.6 – 1.4)	0.822
College grad or more	ref		ref	
Marital status				
Married	ref		ref	
Widowed, divorced, or separated	1.3 (0.7 – 2.6)	0.424	1.1 (0.6 – 1.9)	0.758
Never married	1.3 (0.7 – 2.5)	0.402	1.1 (0.7 – 1.7)	0.753
Living with partner	1.4 (0.7 – 3.0)	0.322	0.9 (0.5 – 1.6)	0.777
Household income				
$0 - $19,999	0.9 (0.4 – 1.9)	0.767	1.2 (0.6 – 2.2)	0.652
$20,000 - $44,999	0.7 (0.3 – 1.4)	0.295	0.7 (0.4 – 1.2)	0.193

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$45,000 - $74,999	0.6 (0.3 – 1.2)	0.162	0.9 (0.6 – 1.5)	0.717
≥$75,000	ref		ref	
Household savings				
$0 - $4,999	2.0 (1.2 – 3.2)	0.008	1.3 (0.8 – 1.9)	0.290
≥$5,000	ref		ref	
Household size	1.0 (0.8 – 1.1)	0.631	1.0 (0.9 – 1.1)	0.962
COVID-related stressors	1.3 (1.2 – 1.4)	<0.001	1.3 (1.2 – 1.4)	<0.001

All percentages are weighted. Missing data: household income (n=33), household savings (n=45), and COVID-19 stressor score (n=3). GED is the general education diploma. GAD defined by a GAD-7 score ≥15. PTSS defined by a 4-item PTSD checklist (PCL) score ≥3. This analysis is based on data from our COVID-19 and Life stressors Impact on Mental Health and Well-being Study (CLIMB).

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Appendix Table 3: multivariable regression model of probable generalized anxiety disorder (GAD) and post-traumatic distress symptoms (PTSS) in adults 18 years and older in the U.S. by demographic characteristics and COVID-19 related financial and social stressors.

	Probable GAD		PTSS	
	Odds ratio (95% CI)	**P-value**	**Odds ratio (95% CI)**	**P-value**
Gender				
Male	ref		ref	
Female	1.6 (1.0 – 2.5)	0.064	1.5 (1.0 – 2.6)	0.032
Age				
18-39 y	ref		ref	
40-59 y	0.6 (0.3 – 1.0)	0.043	1.0 (0.3 – 1.0)	0.818
≥60 y	0.5 (0.2 – 1.1)	0.105	0.6 (0.2 – 1.1)	0.084
Race				
Non-Hispanic White	ref		ref	
Non-Hispanic Black	0.8 (0.3 – 1.8)	0.581	0.6 (0.3 – 1.8)	0.162
Hispanic	0.7 (0.4 – 1.2)	0.180	1.0 (0.4 – 1.2)	0.900
Non-Hispanic Asian	0.1 (0.0 – 0.6)	0.016	0.3 (0.0 – 0.6)	0.120
Other Race – Including Multi-Racial	1.0 (0.4 – 2.4)	0.937	0.5 (0.4 – 2.4)	0.084
Education				
No high school diploma	1.1 (0.4 – 3.0)	0.907	0.6 (0.4 – 3.0)	0.278
High school graduate or equivalent	1.1 (0.5 – 2.1)	0.892	1.1 (0.5 – 2.1)	0.728
Some college	1.8 (1.0 – 3.0)	0.041	1.0 (1.0 – 3.0)	0.809
College grad or more	ref		ref	
Marital status				
Married	ref		ref	
Widowed, divorced, or separated	1.3 (0.7 – 2.6)	0.416	1.1 (0.7 – 2.6)	0.755
Never married	1.3 (0.7 – 2.4)	0.420	1.1 (0.7 – 2.4)	0.764
Living with partner	1.4 (0.7 – 3.0)	0.327	0.9 (0.7 – 3.0)	0.772
Household income				
$0 - $19,999	0.9 (0.4 – 1.9)	0.738	1.2 (0.4 – 1.9)	0.668
$20,000 - $44,999	0.7 (0.3 – 1.4)	0.276	0.7 (0.3 – 1.4)	0.195

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$45,000 - $74,999	0.6 (0.3 – 1.2)	0.160	0.9 (0.3 – 1.2)	0.713
≥$75,000	ref		ref	
Household savings				
$0 - $4,999	2.0 (1.2 – 3.2)	0.008	1.3 (1.2 – 3.2)	0.290
≥$5,000	ref		ref	
Household size	1.0 (0.8– 1.1)	0.627	1.0 (0.8– 1.1)	0.956
COVID-related financial stressors	1.4 (1.2 – 1.6)	<0.001	1.3 (1.2 – 1.6)	<0.001
COVID-related social and emotional stressors	1.2 (1.1 – 1.5)	0.011	1.3 (1.1 – 1.5)	<0.001

All percentages are weighted. Missing data: household income (n=33), household savings (n=45), and COVID-19 stressor score (n=3). GED is the general education diploma. GAD defined by a GAD-7 score ≥15. PTSS defined by a 4-item PTSD checklist (PCL) score ≥3. Financial stressors included losing a job, having difficulty paying rent, having financial problems, a member of your family losing a job, and having hours reduced at your job. Social and emotional stressors included feeling along, having relationship problems, family or relationship problems, not being able to get food due to shortages, not being able to get supplies due to shortages, challenges finding childcare, not going to school, travel restrictions, seeing family less in person, and death of someone close to you due to COVID-19. This analysis is based on data from our COVID-19 and Life stressors Impact on Mental Health and Well-being Study (CLIMB).

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STROBE (Strengthening The Reporting of OBservational Studies in Epidemiology) Checklist

A checklist of items that should be included in reports of observational studies. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

Section and Item	Item No.	Recommendation	Reported on Page No.
Title and Abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1, 2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/Rationale	2	Explain the scientific background and rationale for the investigation being reported	
Objectives	3	State specific objectives, including any prespecified hypotheses	4, 5
Methods			
Study Design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	
		Case-control study—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls	
		Cross-sectional study—Give the eligibility criteria, and the sources and methods of selection of participants	5
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed	
		Case-control study—For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5, 6

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Section and Item	Item No.	Recommendation	Reported on Page No.
Data Sources/ Measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5, 6
Bias	9	Describe any efforts to address potential sources of bias	N/A
Study Size	10	Explain how the study size was arrived at	N/A
Quantitative Variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5, 6
Statistical Methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	6
		(*b*) Describe any methods used to examine subgroups and interactions	6
		(*c*) Explain how missing data were addressed	5
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	N/A
		(*e*) Describe any sensitivity analyses	6
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive Data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7
		(b) Indicate number of participants with missing data for each variable of interest	5
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	
Outcome Data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	7, 8

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Section and Item	Item No.	Recommendation	Reported on Page No.
Main Results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	7, 8
		(*b*) Report category boundaries when continuous variables were categorized	7, 8
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other Analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	7, 8
Discussion			
Key Results	18	Summarise key results with reference to study objectives	9, 10
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	10, 11
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	11
Generalisability	21	Discuss the generalisability (external validity) of the study results	11
Other Information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	12

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Once you have completed this checklist, please save a copy and upload it as part of your submission. DO NOT include this checklist as part of the main manuscript document. It must be uploaded as a separate file.

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