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Research paper

Prevalence, severity and distribution of depression and anxiety symptoms using observational data collected before and nine months into the COVID-19 pandemic

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ABSTRACT

Background: The COVID-19 pandemic has been accompanied by substantial increases in adverse mental health, particularly among the young. However, it remains unclear to what extent increases in population scores on mental health assessments are due to changes in prevalence, rather than severity of symptoms. Further, it is not obvious that widely used assessments of aggregate symptoms retain their typical interpretation during an event that directly disrupts behavior.

Methods: Pre-pandemic data on workers age 18-69y in the 2019 National Health Interview Survey are reweighted to match distributions of demographic characteristics of Duke University employees surveyed nine months into the pandemic. The latter population was at low risk of infection or economic insecurity. Prevalence, severity, and scores for each of nine symptoms are compared overall and by age group.

Outcomes: Elevated psychological distress is primarily driven by increases in prevalence of particular symptoms. Prevalence of trouble concentrating increased six-fold from 9.6% to 72.5%. Other symptoms increased by over one-third; feeling anxious, having little interest, feeling depressed, sleep problems and being irritable, while some symptoms rose only 10% or less. Severity also increased but magnitudes are small relative to prevalence changes. Escalation in prevalence and severity are greatest for the youngest.

Interpretation: Some of the least prevalent symptoms pre-pandemic became the most prevalent during the pandemic, affecting interpretation of indices validated pre-pandemic. Clinical and policy interventions should focus on specific symptoms that increased including trouble concentrating and anxiety.

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Research in context

Evidence before this study

Pubmed was searched for articles using the keywords "COVID-19", "coronavirus", "mental health", "anxiety", and "depression." Prior literature, including recent systematic reviews, reported substantial increases in anxiety and depression symptoms, as well as the share of individuals with clinically-significant levels of symptoms, during the COVID-19

pandemic. People with prior psychiatric illness, younger individuals, as well as people who often experienced disproportionate adverse mental health outcomes pre-pandemic, such as women and lower-education individuals, were likely to have the highest symptom levels during the pandemic. Further, prior literature from natural disasters and other emergencies suggests events often have specific symptoms associated with them. Several core gaps in the literature remain: increases in population symptom scores could be driven either by increases in severity or prevalence of symptoms, and it is not obvious that typical interpretations of aggregate symptoms indices validated pre-pandemic, such as "clinically-significant" levels of symptoms, retain the same interpretation during the pandemic.

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Added value of this study

This study provides evidence from matched cohorts of individuals prior to and during the COVID-19 pandemic. We disaggregate commonly used indices, and show that increases in scores are primarily due to greater prevalence, rather than greater severity. However, among young adults, increases in both prevalence and severity are large and potentially clinically-relevant. Further, we find that increases are concentrated among specific symptoms, and are not evenly distributed across the full depressive syndrome. Notably, trouble concentrating and feelings of anxiety have increased the most. Many of the least prevalent symptoms pre-pandemic have become the most prevalent.

Implications of all available evidence

The long persistence of adverse mental health during the COVID-19 pandemic, and prevalence in populations with minimal exposure to infection or economic insecurity, suggest that mental health will continue to be a challenge as the pandemic abates, particularly among the young. This work has further implications for future pandemics and public health emergencies, regarding the specific symptoms that may be most impacted. Mental health interventions should consider the specific symptoms that have been most affected, and research results from aggregated indices should be interpreted considering the changes in the relative weights of the symptoms that compose them.

1. Introduction

An epidemic of poor psychological health, including high levels of reported depression and anxiety symptoms, accompanied the onset of the COVID-19 pandemic [1–7]. Adverse mental health is now both persistent and widespread in the population; elevated depression symptoms continue and are not limited to the economically insecure or to those most vulnerable to COVID-19 infection and its sequela [8–11]. Despite these robust findings, there is little systematic evidence on the specific depression and anxiety symptoms most elevated during the pandemic and how symptomatology during the pandemic differs from typical patterns.

We assess the prevalence (proportion of respondents reporting a symptom) and severity (reporting greater symptom intensity) of particular symptoms before and during the COVID-19 pandemic. Delving into widely-used batteries of screener questions, we identify the key domains that are driving the rise in poor psychological health of the population. This assessment is imperative for at least two reasons.

First, by investigating specific symptoms, we are able to distinguish changes in prevalence from changes in severity for each symptom. Given the persistence of symptoms during the pandemic, the distinction between prevalence and severity is critical in predicting the longer-term consequences of the pandemic for both individual clinical treatment and for resuming work and education as COVID-19 case counts decline and lock-down policies are lifted.

Second, the study advances knowledge of mental health symptomatology and reporting in the wake of large-scale events such as pandemics and natural disasters. Previous research indicates mental health problems linked to an event are concentrated in specific domains rather than the full depressive syndrome, and these domains vary depending on the context [12–15]. We contribute to this literature by providing evidence in the context of the COVID-19 pandemic.

Previous literature on mental health during the COVID-19 pandemic has documented elevated rates of both depression and anxiety

symptoms, including sleep disturbance. In line with risk factors prior to the pandemic, younger individuals, females, prior psychiatric illness, and those with lower socioeconomic status reported higher levels of depression symptoms as well as poorer sleep quality [1,2,16–19]. Risk factors for high levels of general anxiety were similar, though older adults had more anxiety about COVID-19 specifically [2,16,20].

These documented patterns indicate the magnitude of the pandemic's impact on mental health, and earlier work underscores the imperative to disaggregate these patterns. Specific domains of psychological health have been linked to worse performance in the labor market, at school and in care-giving and improved performance when they have been treated [21–24]. These include, for example, depression [22–24], anxiety [25,26], trouble sleeping [27,28] and trouble concentrating [29–31].

The mechanisms underlying links between the COVID-19 pandemic and psychological distress are not clear. Studies have suggested uncertainty and social isolation because of lockdowns as well as complex and changing health guidance are likely mechanisms. However, lack of independent variation in these potential contributing factors complicates identifying their independent impacts [2,3,5,8,32–35]. Moreover, psychological distress has persisted beyond the brunt of initial lockdowns [8,11]. Whereas studies have highlighted the roles of infection risk and economic insecurity, little is known about the mental health of populations protected from these direct effects of the pandemic [1,2,32]. This study focuses on such a population.

We examine depression and anxiety symptoms in samples from two populations of working adults from the same birth cohorts who are then re-weighted to match the joint distributions of gender, age, education, race and ethnicity so that estimates from the samples are comparable. The first sample was assessed in 2019, before the COVID-19 pandemic, and respondents in the second sample were assessed in late 2020, nine months into the pandemic.

For some depression and anxiety symptoms, the fraction of the samples reporting the symptoms during the pandemic is more than double the pre-pandemic level. The differences vary widely across symptoms. Most prominently, the fraction reporting trouble concentrating has increased over six-fold. Further, some of the least prevalent symptoms before the pandemic have become the most prevalent (trouble concentrating moved from least to 2nd-most prevalent) and, for those symptoms, there has been a marked steepening of the age gradient reflecting a greater increase in the fraction reporting them among younger adults. Severity has increased for the vast majority of symptoms, especially the most prevalent during the pandemic, but the effects on psychological health are dwarfed by the effect of the rise in prevalence.

These changes in symptomatology during the pandemic should be considered in discussions of aggregate indices of symptom scores and associated clinically-validated cutoffs. Commonly used depression and anxiety symptom screeners, such as the Patient Health Questionnaire (PHQ), the Center for Epidemiological Studies-Depression (CES-D) and the Generalized Anxiety Disorder scale (GAD-7) have been validated prior to the pandemic [36–39]. However, they may not retain the same psychometric interpretation during this large-scale, long-term public health disaster which has directly disrupted myriad family, social and working arrangements and caused elevated and prolonged fear and uncertainty. Clinical and policy interventions designed to address the specific symptoms that are elevated, particularly targeting younger adults, are likely to be the most effective at improving population health.

2. Methods

The two populations compared in this study are a sample of adults in the 2019 National Health Interview Survey (NHIS) enu-

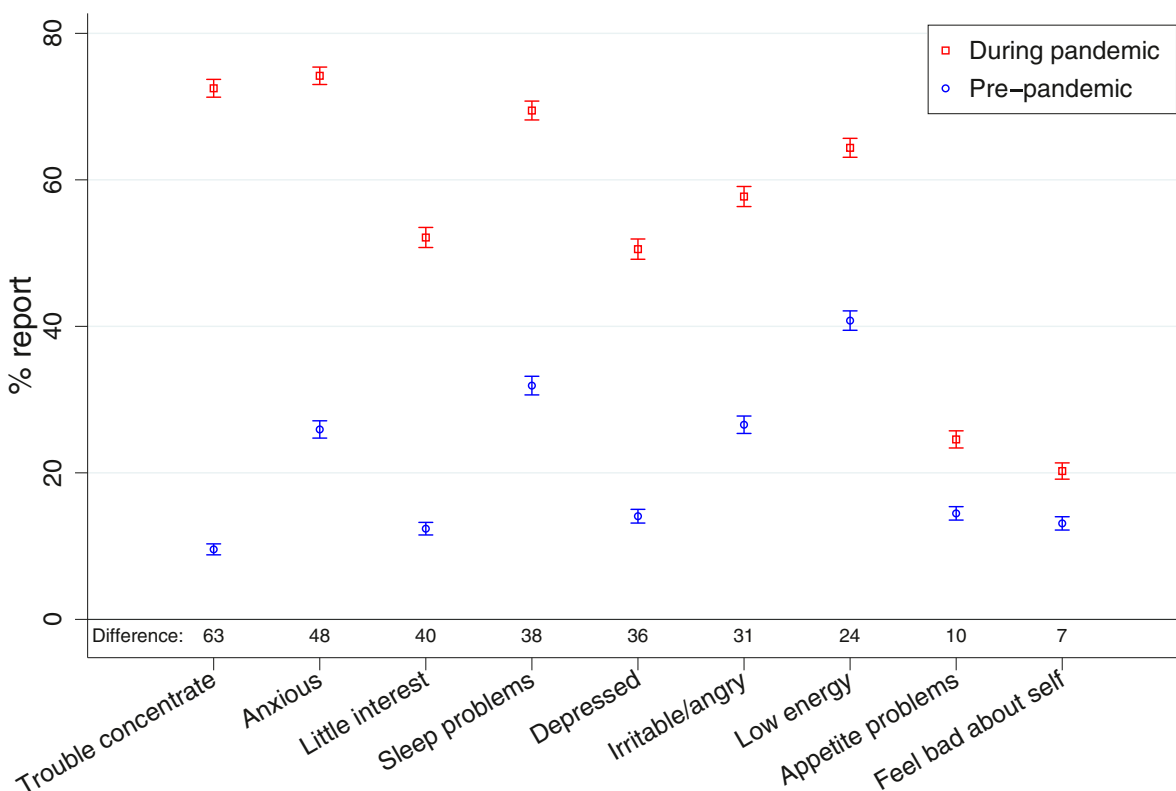


Fig 1. % report problem, by item

merated before the pandemic, and respondents in a study we conducted of employees of Duke University about nine months into the pandemic, Reopen Our University Safely and Effectively (ROUSE). To assure comparability of the samples, the NHIS sample is first restricted to adults in the same birth cohorts as ROUSE who are working for an employer; the NHIS sample is then re-weighted so that the joint distributions of gender, age, education, race and ethnicity are matched to the ROUSE distributions. Approved by the Duke University Institutional Review Board, ROUSE used individual-specific email invitations to recruit Duke University faculty, staff, and student employees engaged in research and/or teaching. All ROUSE participants provided electronic informed consent at the beginning of the survey. Results are reported in accordance with the STROBE guidelines [40].

2.1. Populations

2.1.1. Pre-pandemic sample

Public use data from the 2019 wave of NHIS provides the basis for constructing a pre-pandemic comparison sample (NCHS, 2020). NHIS is selected because it provides a large nationally-representative sample with easily comparable mental health assessments: the Patient Health Questionnaire-9 (PHQ-9) and Generalized Anxiety Disorder-7 (GAD-7). One randomly selected adult over the age of 18 is interviewed per sampled household, either face-to-face or by telephone. To be comparable with the ROUSE sample assessed during the pandemic, described next, the NHIS sample is restricted to 16,462 respondents age 18 to 69y in 2019 who were working for an employer at the time of the interview, and completed the PHQ-9 and GAD-7. The NHIS sample is re-weighted to match the joint distributions of demographic characteristics of the ROUSE sample.

2.1.2. During-pandemic sample

All Duke University faculty, staff and students engaged in research and/or teaching were invited to participate in ROUSE with an individual-specific email in October 2020 along with three follow-up invitations over the next four weeks. Data were collected until December 2020. Outreach efforts to encourage survey participation included specific follow-up emails, social media, posters, and a website. (See Thomas et al., 2021.) Of 6,938 respondents, 4,992 (72%) reported depression and anxiety symptoms, including the Center for Epidemiological Studies-Depression (CES-D) assessment 4,909 respondents age 19 to 70y in 2020 from the sample assessed during the pandemic so that the same birth cohorts are compared pre and during the pandemic.

2.2. Depression and Anxiety Symptoms

Nine depression and anxiety symptoms are examined. Seven depression symptoms in the PHQ-9 (in NHIS) have been matched with symptoms in the 20-item CES-D battery (in ROUSE). Two anxiety symptoms in the GAD-7 assessment in the NHIS are also assessed in ROUSE. Respondents were asked about each symptom during the prior week in ROUSE and two weeks in NHIS on a 4-point Likert scale, where 0 indicates rarely/none of the time in the CES-D or not at all in the PHQ-9, and 3 indicates all or almost all the time in the CES-D or nearly every day in the PHQ-9. (The items and sources are in Appendix Table 1.) Prior literature has demonstrated that the CES-D and PHQ-9 cover similar domains and assess depressive symptoms similarly, although emotional recall is thought to be better for one week relative to longer time horizons [41,42]. The difference in recall periods in the two samples is unlikely to be important and potentially understates the differences between the samples.

The nine symptoms are selected so that the questions in the two surveys cover the same domains and thus make it possible to

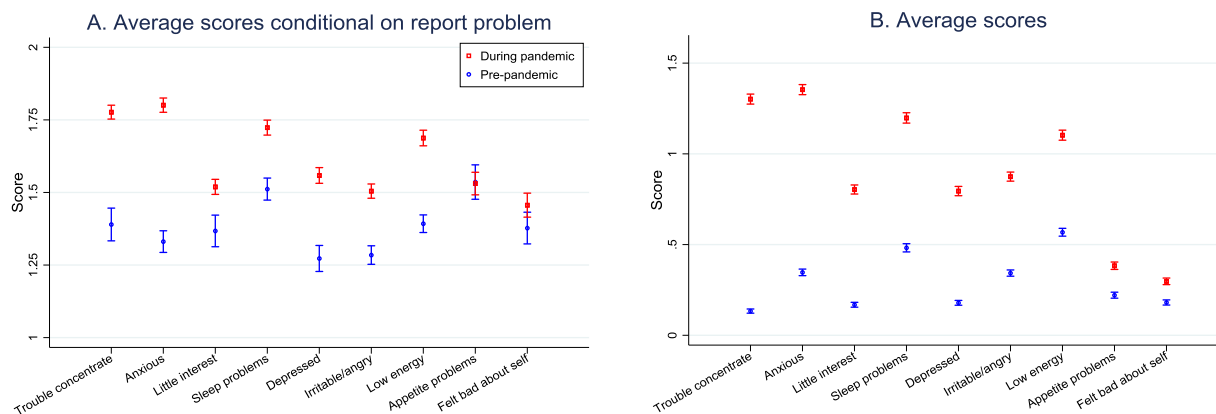


Fig 2. Scores, by item

study how the pandemic affected different domains. For example, pandemic-related uncertainty about the future could affect trouble concentrating, anxiety, depression and trouble sleeping, more than it may affect feeling bad about oneself. The time frame for each question is the same in the two surveys but the wording of questions is not identical. The wording matches very well for six items. The wording for two items (having low energy and feeling bad about self) are less well matched; the NHIS question about interest in doing things is matched to the ROUSE question covering the most similar domain but the wording is different (though the results are robust to alternative questions). The results need to be interpreted with these caveats in mind.

2.3. Statistical Analysis

The pre-pandemic NHIS sample and during-pandemic ROUSE sample cover the same birth cohorts. The NHIS is restricted to respondents who were working for an employer (since all ROUSE respondents were employees) and then raked to match distributions of the characteristics of ROUSE respondents. Specifically, the NHIS sample is re-weighted so that the joint distributions of five socio-demographic indicators match the joint distributions in the ROUSE sample [43]. These indicators are age (measured in years at last birthday, categorized into six groups), three race groups (African American, white and other), Hispanic ethnicity, gender (male, non-male) and three education groups (not completed college; completed college but no doctorate; completed doctorate or equivalent).¹ Without weighting, the samples match on age and race but the ROUSE sample has more females and the respondents are better educated than in the NHIS. As shown in columns 2 and 3 of Appendix Table 2, the weighted samples match very closely.

We start by comparing the percentage reporting any problems for each item in the pre-pandemic and during-pandemic samples to measure prevalence of each symptom. Severity is measured by the average score, among those who report experiencing each symptom. The average score for all respondents in each survey summarizes levels of symptoms in the entire population pre- and during the pandemic. (It is simply the product of preva-

¹ Rates of missing data in ROUSE and NHIS are very low for all variables used in the analyses. Specifically, in ROUSE, 0.08% of respondents are missing education, 1.98% are missing age, 0.02% are missing gender, 0.86% are missing race, and 0.20% are missing ethnicity. In NHIS, none is missing education, 0.22% are missing age, 0.01% are missing gender, 3.61% are missing race, and none is missing ethnicity. Missing values for age have been assigned the sample median, not completed college for education, non-male for gender, other for race and not Hispanic for ethnicity. Dropping the 2.5% of ROUSE respondents and 3.8% of NHIS respondents for whom any of these variables is missing does not change any of the main results or conclusions.

lence and severity). Analyses of prevalence and severity are examined for four age groups (18-29y, 30-39y, 40-54y, 55-69y as of 2019). All pre-pandemic estimates are weighted and all estimates are calculated at the mean age (for the sample or age group). All confidence intervals and p-values are based on Huber-White heteroskedasticity-consistent estimates of variance. Critical values that take into account multiple testing following Hochberg (1988) are also reported [44]. Analyses were conducted in STATA/SE v16.

Data and statistical programs used in this paper are available from the corresponding author. Financial support was provided by Trinity College of Arts and Sciences and the Social Science Research Institute, both of Duke University. The funders had no role in the design of this study, analysis or interpretation of the data, writing of the manuscript or decision to submit it for publication.

3. Results

3.1. Prevalence and severity of each symptom pre vs. during the pandemic

Figure 1 displays the percentage of working adults who report any symptoms during the prior week for each of the 9 items pre-pandemic (blue) and during-pandemic (red) along with bars representing 95% confidence intervals. Estimates and confidence intervals are reported in panel A of Appendix Table 3. The p-values for differences between the pre- and during-pandemic estimates are also reported.

For every symptom, prevalence is higher during-pandemic relative to pre-pandemic. While all of the differences are statistically significant, there is substantial variation across symptoms. Two symptoms stand out as having exceptionally large increases: trouble concentrating and anxiety. As shown in the first column of Figure 1, about 10 percent of the sample reported having trouble concentrating pre-pandemic; during the pandemic, over 70 percent of the sample report having trouble concentrating. This is a 63 percentage point increase (shown in the panel at the bottom of the figure). Pre-pandemic, anxiety was reported by a much larger fraction (about one-quarter) but that fraction tripled (to almost three-quarters) during-pandemic, a 49 percentage point increase.

There is around a 40 percentage point difference in the rate of reporting the next three symptoms, having little interest, sleep problems and feeling depressed. Over half the during-pandemic sample reports each of these symptoms. The base is about the same for having little interest and feeling depressed (between 12 and 14 percent pre-pandemic) and so the difference represents an over three-fold increase. Sleep problems are reported by about one-third of the pre-pandemic sample and the fraction is more

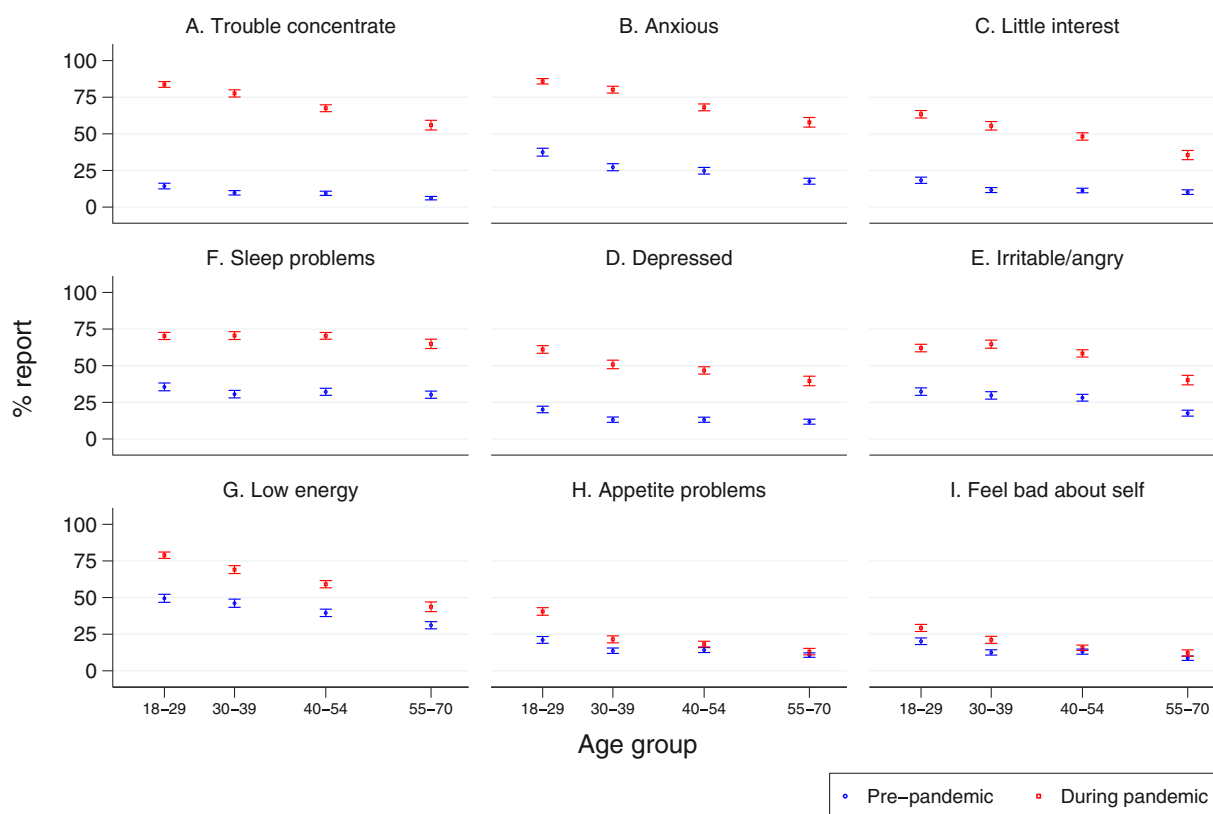


Fig 3. % report problem, by item and age group

than double for the during-pandemic sample. The same pattern characterizes feeling irritable or angry. The fraction reporting each of these symptoms is more than double during the pandemic relative to before.

The remaining three symptoms, having low energy, appetite problems and feeling bad about oneself, are about 0.6 to 0.7 times higher in the during-pandemic sample. While the increases are statistically significant they are substantially smaller than the other symptoms.

The upper panel of Figure 2 displays the average scores among respondents who report the symptom (Estimates are in panel B of Appendix Table 3). For each symptom, apart from appetite problems, there is a statistically significant increase in severity with the increase being greatest for trouble concentrating and anxiety, the two symptoms for which prevalence has increased the most. The conditional score is about one-third higher during the pandemic relative to pre-pandemic. Increases for the other symptoms are smaller, ranging between 7 and 23 percent.

Combining the prevalence with severity into the overall average score for each item, before and during the pandemic is displayed in the lower panel of Figure 2. (Estimates are in panel C of Appendix Table 3.) Among symptoms for which prevalence and severity are higher during the pandemic, the differences in the overall average are even larger in proportionate terms. As an example, the average score on trouble concentrating is nine times higher during the pandemic relative to before the pandemic.

Taking into account multiple testing following the method of Hochberg (1988), the critical p-value is 0.025 for the nine comparisons in each panel of Figures 1 and 2 and Appendix Table 3. None of our inferences is amended with this adjustment: all of the estimated differences are statistically significant apart from severity of appetite problems which showed no increase and was not statistically significant taken alone.

3.2. Prevalence and severity by age group before and during the pandemic

For males and females, differences in symptoms pre-pandemic and nine months into the pandemic are very similar and gender-specific analyses yield no new conclusions. In contrast, there are substantively important differences by age.

The percentage reporting each symptom, stratified by age group, is displayed in Figure 3 (and Appendix Table 4). In general, the percentage reporting a symptom declines with age and for almost all symptoms, the difference in the pre vs during pandemic percentage also declines with age so that the age gradient is steeper during the pandemic. For example, whereas 14% of the 18-29y olds (as of 2019) report trouble concentrating before the pandemic, 85% of the same cohort report trouble concentrating during the pandemic, a 70 percentage point higher prevalence. Among the oldest respondents, 6% report the symptom pre-pandemic and 56% during the pandemic, a 50 percentage point higher prevalence.² The pattern for anxiety is very similar (starting from a higher base pre-pandemic) and also for little interest, feeling depressed, having low energy and appetite problems. The percentage point difference in sleep problems and feeling irritable or angry does not vary with age indicating a shift upward across the entire age distribution for these symptoms.

Severity indicated by the average score, conditional on reporting, is displayed by age group in Figure 4 (and Appendix Table 5). Whereas before the pandemic, there is little evidence of an age gradient in severity, during the pandemic, an age gradient emerges

² In a regression relating incidence of trouble concentrating to age, each year of age is associated with -0.2 and -0.8 rate of change in incidence pre- and during the pandemic, respectively. The difference, -0.6, with 95% CI(-0.5, -0.7) is statistically significant.

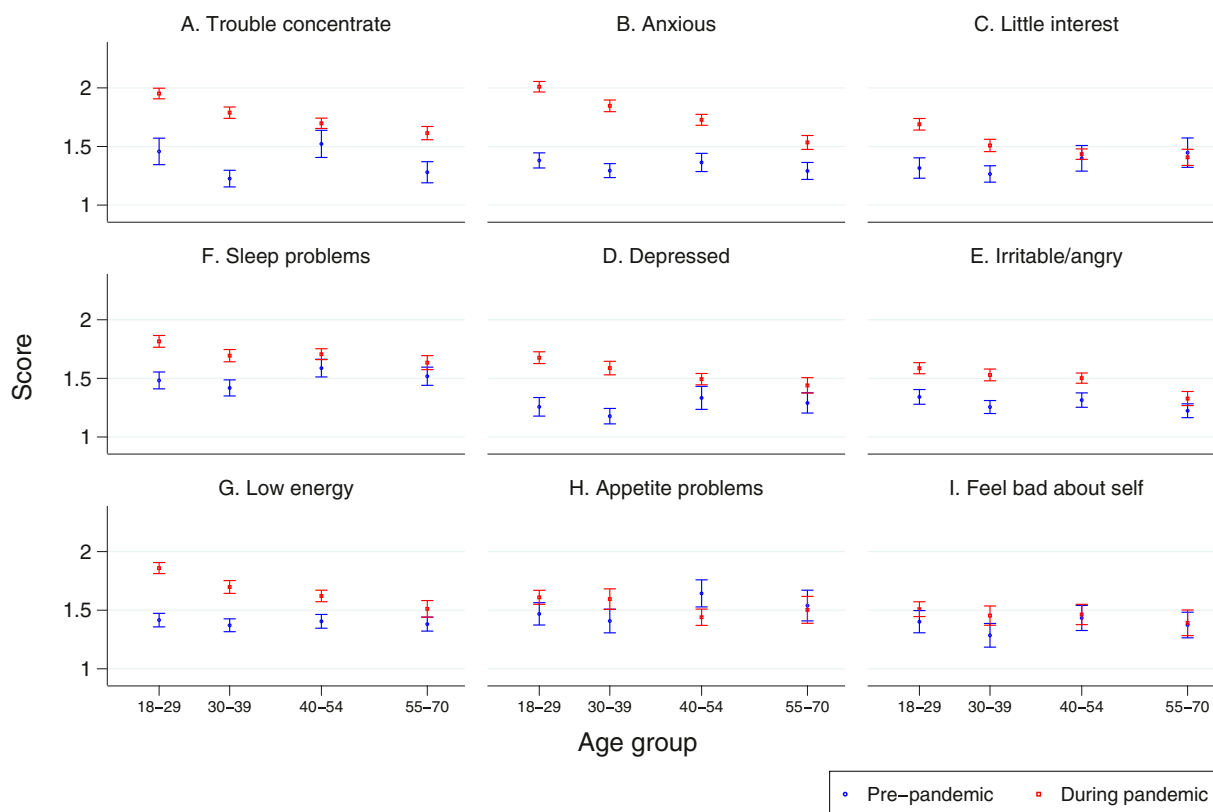


Fig 4. Average scores if report problem, by item and age group

with the youngest reporting the more severe symptoms, particularly in the domains for which the pre vs during gaps in the fraction reporting the symptom is greatest.

None of the inferences regarding increases in prevalence for any of the four age groups (Figure 3) is affected after adjusting for multiple testing. With respect to increases in severity (Figure 4), we have highlighted results for the two youngest age groups for whom none of the inferences is affected after adjusting for multiple testing. The only inferences that do differ are severity increases among the two older age groups which are significant for nine of the estimates using classical statistics and for seven of the estimates adjusting for multiple testing.

4. Discussion

Studies have documented elevated rates of psychological distress at the onset of the COVID-19 pandemic [1,2]; this distress persisted at least nine months into the pandemic and affected populations at very low risk of infection or economic insecurity [8]. We document increases in depression and anxiety symptoms that are primarily driven by extremely large increases in the fractions of the population reporting each symptom and these increases vary substantially across symptoms.

Two symptoms stand out: trouble concentrating and feeling anxious. About three-quarters of the study population report each symptom nine months into the pandemic. Furthermore, the age gradient for these symptoms is steeper; about 5 out of every 6 of those in the youngest age group (18-29y) report each symptom nine months into the pandemic. Further, the large increases in prevalence for these symptoms are accompanied by substantial increases in severity, particularly for the young, for whom severity increases by approximately 40%.

There are also large increases in the prevalence of having little interest, sleep problems, feeling depressed and feeling irritable or angry and over half the respondents report these symptoms nine months into the pandemic. Differences in age gradients are less clear for these symptoms. While the rise in severity for these symptoms is muted relative to the rise in prevalence, severity tends to be increased most among the youngest.

Taken together, these results raise questions about comparing and interpreting indices measured before and during the pandemic. Indices are an average of item-specific scores and so the weight of each item is the product of prevalence and severity of that item. As the distribution of prevalence has dramatically shifted during COVID-19, the weight of each item in an index has also changed. As an example, using the 7 items from PHQ-9 reported here, trouble concentrating contributes 7% to the total score of 1.9 pre-pandemic, but 22% of the total score of 5.9 during-pandemic. Appetite problems contribute 11% pre-pandemic and 6% during-pandemic.

While the psychometric properties of indices validated prior to the pandemic for use during the pandemic has not been established, it is clear that individual symptoms have been adversely affected. Understanding how specific items have changed in prevalence and severity is critical; interventions that target the aspects of psychological distress most elevated during the pandemic are likely to have the greatest impact on population health and well-being now and possibly into the future.

In particular, assessing specific symptoms is critical because the literature suggests some symptoms are likely to have longer-term deleterious consequences beyond psychological and physical health. For example, trouble concentrating has been implicated in reduced productivity in the home, at school and in the labor market. Several studies using rigorous randomized controlled trials in low-income settings have established that the cognitive bur-

den arising from difficulty concentrating results in choices that are less than ideal, leading to reduced levels of health and well-being for individuals and their families [29–31]. The extremely high rates of trouble concentrating during the pandemic are likely to have impacted productivity of these people. Our results indicate the longer-term impacts are likely to be greatest for the youngest cohorts who are in the process of establishing their career trajectories.

While studies have documented associations between productivity and anxiety, poor sleep and depression, the underlying causal pathways are not well understood. To the extent elevated rates in these symptoms further contribute to reduced productivity, broadly defined, the epidemic of psychological distress will have long-lasting effects on population well-being. These long-lasting indirect effects are, moreover, likely to be greatest for the youngest adults, who were at very low risk for the direct health effects of hospitalization or death due to COVID-19. Interventions targeted to specific symptoms and the population sub-groups most deleteriously impacted have the potential to be effective at mitigating the impacts of COVID on psychological distress and its sequelae.

A limitation of the study is that the same respondents are not interviewed before and during the pandemic. The pre-pandemic sample has been matched to the socio-demographic characteristics of the sample of well-educated workers assessed during the pandemic. A key advantage of this latter sample is that the respondents were at very low risk of infection or economic insecurity. It is possible that this sample is more privileged than the re-weighted pre-pandemic sample. To assess the importance of this concern, we have conducted two robustness exercises. First, some ROUSE respondents will ultimately complete more education; we have restricted the pre-pandemic sample to age-eligible workers who have completed a college degree. The item-specific scores are very slightly smaller than for the pre-pandemic sample used in the analyses reported above, primarily because of lower severity. The second robustness exercise restricts the pre-pandemic sample to age-eligible workers in high income households (annual income > \$100,000). For every item, prevalence and severity are lower than for the sample without this extra restriction and so each of the differences between the pre- and during pandemic are larger using this more restricted pre-pandemic sample. Results for both of these sets of analyses are reported in Appendix Table 6. We conclude that our estimates of increases in depression and anxiety symptoms during the pandemic based on the matched pre-pandemic sample are likely to be conservative. (We experimented with reweighting the sample assessed during the pandemic to match the pre-pandemic sample. Estimates of prevalence and severity during the pandemic are almost identical and none of our conclusions is affected. None of the results is affected by whether we match the surveys based on birth cohort or age.) Using all NHIS respondents from 2019 assures the matched samples are extremely close (as shown in Appendix Table 2); the match is not as close using only respondents from 2019Q4. Since the estimates and conclusions are not different, we report results with the larger sample.

A second limitation is that the wording of questions is different in the two surveys. However, the magnitudes of the symptom changes are so large that the differences are unlikely to be driven by question wording differences. Since the pre-pandemic sample reports using two week recalls and the during-pandemic sample uses one week recall, the increases are, at worst, understated. Given the magnitude of the differences, this is unlikely to be important. It is important to underscore that the questions are drawn from widely-used and well-validated screener batteries that are not designed for diagnostic purposes and should not be interpreted as depression or anxiety diagnoses.

A third limitation is that the sample assessed during the pandemic is drawn from a population of people working for a single employer who live in the same metropolitan area. It is important to recognize that this may affect the generalizability of results.

5. Conclusions

Whereas the burden of COVID-19 mortality has fallen most heavily on older adults, the burden of psychological distress has affected people of all ages including those at low risk of infection. Increases are not distributed evenly across all symptoms, but are concentrated in a sub-set of domains with rises in trouble concentrating and feeling anxious being particularly disturbing. Indices based on clinically-validated psychometric screeners need to be interpreted with this in mind.

Observed increases in depression and anxiety symptoms during the pandemic have been driven primarily by a steep rise in the fraction reporting the symptoms: over 5 out of 6 people reporting trouble concentrating and feeling anxious. This epidemic of psychological distress has the potential to have persistent and far-reaching impacts on population health and well-being, broadly defined, with the youngest adults at being at greatest risk of deleterious impacts reaching well into their futures. Interventions targeting specific symptoms may be high-value, particularly for younger populations.

Contributors

Thomas contributed to the initial conceptualization of the study, design of the study, development of the instrument, deployment of the instrument, collection of the data, analysis and verification of the data, write-up of the original draft and revision of the manuscript, and approval of the final manuscript.

Lawton contributed to the development of the instrument, collection of the data, analysis and verification of the data, write-up of the original draft and revision of the manuscript, and approval of the final manuscript.

Brown contributed to the development of the instrument, deployment of the instrument, revision of the manuscript, and approval of the final manuscript.

Kranton contributed to the initial conceptualization of the study, design of the study, development of the instrument, deployment of the instrument, collection of the data, revision of the manuscript, and approval of the final manuscript.

Declaration of interests

All authors are employed by Duke University. Financial support was provided by Trinity College of Arts and Sciences and the Social Science Research Institute, both of Duke University. Funders had no role in the study design, analysis or interpretation of the data, writing of the manuscript or decision to submit it for publication.

Data sharing

Data and statistical programs used in this paper will be available from the corresponding author, Duncan Thomas (dthomas@econ.duke.edu) upon publication of the manuscript.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.lana.2021.100009](https://doi.org/10.1016/j.lana.2021.100009).

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