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Short communication

Depression reported by US adults in 2017–2018 and March and April 2020

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ABSTRACT

Background: Coronavirus disease 2019 (COVID-19) and the associated social distancing and lockdown restrictions are expected to have substantial and enduring mental health effects. In this study, we aimed to assess depression levels before and during the COVID-19 pandemic in the United States.

Methods: We used the Patient Health Questionnaire-2 (PHQ-2) brief screening instrument to detect probable depression in two nationally representative surveys of US adults. Pre-pandemic levels of depression were assessed in a sample of 5,075 adults from the 2017–2018 National Health and Nutrition Examination Survey (NHANES). Depression was assessed in March (N = 6,819) and April 2020 (N = 5,428) in the Understanding America Study, a representative sample of the US population.

Results: The percentage of US adults with depression increased significantly from 8.7% (95% CI[7.6%–9.8%]) in 2017–2018 to 10.6% (95% CI[9.6%–11.6%) in March 2020 and 14.4% (95% CI[13.1%–15.7%]) in April 2020. Statistically significant increases in depression levels were observed for all population subgroups examined with the exception of those aged 65+ years and Black participants. Young adults (aged 18–34) experienced a marked increase in depression of 13.4 percentage points (95% CI [9.5%–17.2%]) that was larger than any other age group. Additional analyses of depression trends in NHANES from 2007/2008–2017/2018 showed that the substantial increase in depression in April 2020 was unlikely to be due to typical year-to-year variation.

Conclusions: Our findings suggest that depression levels have risen substantially during the COVID-19 pandemic and reinforce recent findings indicating that young adults may be particularly vulnerable to the mental health effects of the pandemic.

1. Introduction

The COVID-19 crisis has impacted daily life for much of the world's population and this may have adversely affected mental health (Holmes et al., 2020). However, quantification of the impact that the COVID-19 crisis has had on mental health has been difficult as there has been an absence of large-scale nationally representative probability-based studies contrasting mental health before vs. during the COVID-19 pandemic (Pierce et al., 2020).

In the US, on March 16th the president requested that Americans limit non-essential travel, avoid bars and restaurants and gatherings of more than ten people, and recommended the closure of schools and universities. This was followed by announcements of mandatory stay-at-home orders from individual states commencing with California on March 19th and spreading to 73% (2355 of 3233) of counties across US states and territories by March 31st (Moreland et al., 2020). During this period there was a rapid rise in COVID-19 cases from under 10,000 confirmed cases on March 19th to 164,620 by March 31st (OWID, 2020). We suggest that the surge in cases coupled with the commencement of social lockdown restrictions towards the end of March may have adversely impacted mental health by April 2020.

Already a US study has utilized nationally representative samples to show that the prevalence of psychological distress was higher in April 2020 compared to 2018 (McGinty et al., 2020) and a similar increase in distress was observed in a longitudinal study of adults in the UK (Daly et al., 2020). Studies sampling young adults in China (Li et al., 2020) and Switzerland (Elmer et al., 2020) have also found an increase in depression during the early stages of the pandemic. In the current study, we examined two US probability-based samples to compare depression levels assessed in 2017–2018 with levels in March and April 2020 when the COVID-19 crisis was unfolding. We examined the magnitude of increases in depression during the pandemic and whether increases in depression varied across population subgroups.

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2. Methods

2.1. Sample

The Understanding America Study (UAS) is a national probability-based longitudinal internet panel study. Participants were recruited via address-based sampling using the US Postal Service Computerized Delivery Sequence file covering almost 100% of US households (Alattar et al., 2018). Those without internet access were provided with internet-connected tablets to ensure sample representativeness. In this study we conducted secondary analysis of the UAS anonymized microdata files which did not require institutional approval from the Maynooth University Social Research Ethics Sub-Committee.

For the weighted sample, 8502 UAS participants were invited to take part in the UAS COVID-19 Tracking Survey and 6819 (80%) took part between March 10–31. Over 80% of March assessments were completed between March 10th and 18th prior to the introduction of statewide lockdown measures. In contrast, lockdown measures were in place for the majority of the US population during the April 1–17 survey period (Morehead et al., 2020). Further, COVID-19 cases and related deaths increased markedly during this period with the total number of cases rising from 164,620 at the end of March to 671,331 by April 17th and the total number of deaths rising from 3,170 to 33,284 over the same period (OWID, 2020). The sample size for the portion of the longitudinal study sample followed up in the April survey wave (N = 5432) was smaller than for the March wave (N = 6819). However, depression in March was unrelated to participation in the April wave of the UAS in a logistic regression model examining attrition (OR = 0.93, 95% CI[0.71–1.20], p = .57).

Depression levels in the UAS were contrasted with levels in the National Health and Nutrition Examination Survey (NHANES) 2017–2018 wave (Chen et al., 2020), a second nationally representative probability-based sample of the US population (N = 5075) including identical depression items. In addition, we examined recent trends in depression using six waves of NHANES data (2007/2008, 2009/2010, 2011/2012, 2013/2014, 2015/2016, 2017/2018) spanning the period from 2007 to 2018 (N = 31,551).

The NHANES and UAS samples were comparable on gender, household income, and Hispanic, White, and Black ethnicity. The NHANES sample included a larger portion of individuals classified as 'other race/ethnicity' and was slightly younger and included a lower portion of college educated participants. These sample composition differences between NHANES and UAS were adjusted for in all analyses.

3. Measures

3.1. Demographic characteristics

In both surveys, participants reported their age (grouped into 18–34, 35–54, 55–64, & 65+ for depression comparisons), sex (male, female), and race/ethnicity (White, Hispanic, Black, other race/ethnicity), and their education (college degree, no degree), and household income levels. In NHANES household income was assessed using income brackets ranging from 1 = $0–$4999 to 12 = ≥$100,000 and in the UAS income brackets ranged from 1 = $0–$4999 to 16 = ≥$150,000. To generate a comparable continuous household income variable across samples participants were assigned the value of each income bracket mid-point (e.g. $0–$4999 assigned a value of $2500) or the highest income level assessed if applicable. Income data was missing for a notable portion of the NHANES sample (13.8%) and this group were assigned the mean income value and a dummy variable was included to adjust for differences in depression between those with/without available income data.

3.2. Depression

Depression was measured using the Patient Health Questionnaire–2 (PHQ-2) a reliable short screening tool for assessing depression levels in the general population (Kroenke et al., 2003). Participants were asked "Over the last 2 weeks, how often have you been bothered by the following problems?" and responded to two items ("Feeling down, depressed, or hopeless" and "Little interest or pleasure in doing things") on a scale with the response options "not at all", "several days", "more than half the days", and "nearly every day", that are scored as 0,1,2, and 3, respectively. This gives a score from 0 to 6 and scores of ≥3 are the validated threshold for detecting probable cases of depression (Carey et al., 2016; Lowe et al., 2010; Kroenke et al., 2003). This threshold has been shown to optimally balance sensitivity (0.91) and specificity (0.78) for identifying probable cases of depression (Carey et al., 2016). A 2016 aggregate-data diagnostic meta-analysis examined the ≥3 cut-off in 19 studies and found a sensitivity level of 0.76 and specificity level of 0.87 (Manea et al., 2016).

In NHANES 2017–2018 the PHQ-2 items formed the first two items of the PHQ-9 (Carey et al., 2016). In this sample, 8.9% (95% CI [7.8%−10.1%]) of the sample were classified as experiencing depression using the PHQ-2 and 8.6% (95% CI[7.5%−9.7%]) when using the PHQ-9 with the recommended cut-off of ≥10 for moderate depression (Carey et al., 2016). The correlation between the PHQ-2 and PHQ-9 total scores was very strong (r = 0.83, 95% CI[0.81–0.84]), supporting the validity of the PHQ-2 as a measure of depression in this sample.

3.3. Analytical strategy

First, we examined the demographic characteristics and depression levels of the NHANES and UAS March and April 2020 samples. We then merged the NHANES and UAS datasets and used logistic regression analysis to estimate whether depression levels during the pandemic were statistically different to baseline levels in 2017–2018 after adjustment for any differences in demographic characteristics between the samples. Estimates were calculated first for the entire sample and then for each population subgroup examined. To estimate differences in the predicted probability of depression across time-points and subgroups we used the Stata margins and lincom postestimation commands (Long and Freese, 2014). Predicted probabilities were multiplied by 100 to generate percentage point estimates. Finally, to contextualize our estimates we drew on six waves of NHANES data (2007/2008, 2009/2010, 2011/2012, 2013/2014, 2015/2016, 2017/2018) to examine typical levels of depression and changes in depression over the period from 2007 to 2018.

All comparisons and analyses were weighted to account for the complex survey design of both studies and to produce nationally representative estimates. In both NHANES and the UAS COVID-19 survey base weights are first calculated to account for differential probabilities of selection and for oversampling of certain demographic groups where present. Adjustments for non-response and post-stratification adjustments were then made to align the sample with the distribution of demographic characteristics in the US civilian population In the UAS separate weights are produced for the March and April 2020 assessments to ensure both waves are representative of the US population. A comprehensive account of the weighting methodologies can be found in Angrisani et al. (2019) and Chen et al. (2020).

4. Results

An examination of the descriptive trends in the data showed that between 2017-2018 and April 2020 the PHQ-2 total score increased by 0.4 points from 0.69 (SD = 1.25) to 1.08 (SD = 1.56) an increase of 0.32 standard deviations using 2017–2018 as a benchmark (see Table 1). The percentage of US adults who reported depression (based on the PHQ-2 cut-off of ≥3) was 8.9% in 2017–2018 and subsequently

Table 1
Demographic characteristics and depression levels in the NHANES 2017–2018 sample (N = 5075) and the March (N = 6819) and April (N = 5428) waves of the Understanding America Study.

Year / Wave	2017–2018	March 2020[a]	April 2020[a]
N	5075 Mean (SD) /%	6819 Mean (SD) /%	5428 Mean (SD) /%
Age, years	47.2 (17.6)	48.4** (16.6)	48.4* (16.3)
Female	51.8	51.6	51.7
Race/ethnicity			
Hispanic	15.7	16.2	16.8
White	63.0	65.9	65.9
Black	11.2	12.0	11.8
Other race/ethnicity	10.1	6.0***	5.6***
College degree	30.3	34.1**	34.1**
High income household ($)	62,139 (30,804)	62,051 (42,159)	61,933 (41,924)
Depression (mean levels)	.69 (1.25)	0.82*** (1.42)	1.08*** (1.56)
Depression (%)	8.9	10.5*	14.2***

Note: Weighted values are reported.

[a] Simple linear regression analysis was used to test for differences in age, income, and depression (mean levels) between study 2017–2018 and March and April, 2020 waves. Binary and multinomial logistic regression analyses were used to test for differences in sex, race/ethnicity, education, and depression (%) between 2017-2018 and March and April, 2020 waves.

* $p < .05$. ** $p < .01$. *** $p < .001$.

increased to 10.5% in March 2020 and 14.2% in April 2020, as shown in Table 1.

Our logistic regression analyses showed that after adjustment for differences in demographic characteristics between the two samples depression increased from 8.7% (95% CI[7.6%−9.8%]) in 2017–2018 to 10.6% (95% CI[9.6%−11.6%) in March 2020 and 14.4% (95% CI [13.1%−15.7%]) in April 2020 (Table 2). The 1.9 percentage point (95% CI[0.3%−3.5%]) increase in depression from 2017-2018 to March 2020 was statistically significant at the $p < .05$ level and the 5.7 percentage point (95% CI[3.9%−7.5%]) increase from 2017-2018 to April 2020 was statistically significant at the $p < .001$ level.

Statistically significant increases in the probability of depression from 2017 to 2018 to April 2020 were identified for all population subgroups examined with the exception of those aged 65 years and over and Black participants (see final column of Table 2). Depression levels rose most sharply amongst younger adults aged 18–34 years increasing from a baseline of 7.8% (95% CI[6.0%−9.7%]) in 2017–2018 to 21.2% (95% CI[17.8%−24.6%]) in April 2020, a statistically significant difference of 13.4% (95% CI [9.5%−17.2%]) (see Table 2). Additional analyses showed that this substantial increase was significantly larger than the increase in depression experienced by other age groups (Table S1).

Other groups that experienced notable increases in depression were: Hispanic (8.3%, 95% CI[3.9–12.7]) and other ethnicity/race participants (10%, 95% CI[3.5–16.6), those with a college degree (8.6%, 95% CI[5.0–12.1), and females (6.1%, 95% CI[3.7–8.6]). However, the difference in the increase in depression between Hispanic and other ethnicity/race participants and White participants was not statistically significant, nor was the difference in the increase between males and females or those with a college degree and participants without a degree, as shown in Table S1.

4.1. Previous wave-to-wave changes in depression levels in NHANES

In NHANES depression (assessed using the PHQ-2) varied little across previous waves and was lowest in magnitude in 2007–2008 (7.6%) and highest in 2013–2014 (9.1%). A logistic regression analysis (N = 31,551; Table S2) showed that there was no evidence of a statistically significant difference in depression levels between 2007 and 2008 (baseline: 7.6%, 95% CI[6.1%−9.1%]) and subsequent survey waves (2009–2010 = 7.8%, 2011–2012 = 7.7%, 2013–2014 = 9.1%, 2015–2016 = 8.3%, 2017–2018 = 9%). Similarly, depression levels assessed using the PHQ-9 did not vary markedly from 2007 to 2018 (min. = 7.4%, max. = 8.6%) and levels in 2007–2008 were not significantly different to those observed in subsequent survey waves (Table S2). These analyses indicated that estimates of the population prevalence of depression in the US as gauged using the PHQ-2 or PHQ-9 were highly stable in the years preceding the COVID-19 crisis.

5. Discussion

Depression increased substantially from 2017-2018 to April 2020 following the emergence of the COVID-19 pandemic and rises in depression were particularly pronounced in younger adults, which corroborates other emerging studies (Daly et al., 2020; McGinty et al., 2020). The increase in depression observed among young adults in the present study are broadly comparable to that observed in studies of young adults in China and Switzerland (Li et al., 2020; Elmer et al., 2020).

Young adults are also disproportionally more likely to work in sectors of the economy that were shut down during the pandemic (e.g. retail, restaurants, leisure facilities) (Joyce and Xu, 2020). The associated financial insecurity and job loss experienced by many young people may have contributed to the sustained rise in depression levels observed in this study (Paul and Moser, 2009). As many young adults may be experiencing mental health difficulties for the first time during the pandemic, both prevention and early treatment of mental health in the community remains important during the COVID-19 pandemic (Holmes et al., 2020). In contrast, those aged 65+ and Black participants reported low levels of depression during the pandemic. A recent study (Czeisler et al., 2020) found a small increase in the likelihood of trauma and stress-related disorder associated with the pandemic among non-Hispanic Black groups compared to non-Hispanic Whites during the COVID-19 pandemic. In this study we identified a small decrease in depression among non-Hispanic Black participants from 2017-2018 to April 2020. Further research examining the role of race/ethnicity and mental health during COVID-19 will be valuable to better understand such unexpected findings.

A strength is that we drew on nationally representative probability-based samples that included the same measure of depression at both time-points enabling meaningful estimates of population prevalence to be generated. In addition, we tested whether the pandemic is likely to have disproportionately affected specific population subgroups. By examining PHQ-2 scores from 2007 to 2018 we also demonstrate that variation in population depression levels is typically minimal and contrasts sharply with the large increase observed during the pandemic.

It is important to note that whilst both the NHANES and UAS utilize probability-based samples they differ in their sampling and mode of administration which may bias contrasts between cohorts. The UAS also included a larger portion of participants with a college degree and a smaller portion from ethnic/racial minority groups than the NHANES sample. However, we were able to adjust for these differences in sample characteristics and also show that an increase in depression was evident from March to April 2020 when the UAS sample alone was examined.

In addition, our analyses of prior depression trends suggest that the change in depression levels is atypical and unlikely to be explained fully by these differences. Whilst the PHQ-2 is a reliable and well-validated screening instrument for detecting probable depression, longer scales would yield insight into the robustness of the trends examined. It will also be important to understand mental health trends as the COVID-19 pandemic progresses and to understand how these trends are modified by differences in COVID-19 infection and mortality rates and differences in the timing of stay-at-home orders across US states.

Table 2
Regression estimates of depression levels in the NHANES 2017–2018 sample (N = 5075) and the Understanding America Study March (N = 6819) and April 2020 assessments (N = 5428) and percentage point differences in depression between the study samples.

Year / Wave	2017–2018	March 2020	Difference[a]	April 2020	Difference[a]
	% [95% CI]	% [95% CI]	% [95% CI]	% [95% CI]	% [95% CI]
Adults ≥ 18 y	8.7 [7.6–9.8]	10.6 [9.6–11.6]	1.9* [0.3–3.5]	14.4 [13.1–15.7]	5.7*** [3.9–7.5]
Age group, y					
18 – 34	7.8 [6.0–9.7]	15.2 [12.7–17.8]	7.4*** [4.2–10.6]	21.2 [17.8–24.6]	13.4*** [9.5–17.2]
35 – 54	11.6 [9.0–14.2]	11.7 [10.0–13.5]	0.01 [−3.0–3.3]	16.1 [13.8–18.4]	4.5* [1.0–8.0]
55 – 64	6.7 [4.9–8.6]	7.7 [5.9–9.6]	1.0 [−1.6–3.6]	10.0 [7.6–12.4]	3.5* [0.4–6.6]
65+	7.8 [5.8–9.7]	5.6 [4.2–7.0]	−2.1 [−4.6–0.2]	7.0 [5.1–8.9]	−0.8 [−3.4–1.9]
Male	7.7 [6.2–9.2]	10.1 [8.5–11.6]	2.4* [0.2–4.6]	12.8 [10.9–14.8]	5.2*** [2.7–7.7]
Female	9.6 [8.0–11.2]	11.1 [9.8–12.4]	1.5 [−0.6–3.6]	15.7 [13.9–17.6]	6.1*** [3.7–8.6]
Hispanic	7.3 [5.7–8.9]	8.6 [6.2–11.0]	1.3 [−1.6–4.2]	15.6 [11.5–19.7]	8.3*** [3.9–12.7]
White	9.4 [7.7–11.1]	12.3 [11.0–13.6]	2.9** [0.7–5.0]	15.8 [14.2–17.4]	6.4*** [4.0–8.7]
Black	8.6 [6.9–10.4]	6.0 [3.8–8.1]	−2.6 [−5.4–0.1]	5.5 [3.2–7.8]	−3.1* [−6.1 - −0.2]
Other	8.1 [5.7–10.4]	10.9 [6.4–15.4]	2.8 [−2.2–8.0]	18.1 [11.9–24.2]	10.0** [3.5–16.6]
No college degree	9.4 [8.2–10.6]	10.8 [9.6–12.0]	1.4 [−0.4–3.2]	14.0 [12.4–15.7]	4.6*** [2.6–6.7]
College degree	6.7 [4.2–9.2]	10.0 [8.2–11.9]	3.3* [0.2–6.4]	15.3 [12.8–17.8]	8.6*** [5.0–12.1]
Low income ($25,000)	13.3 [11.4–15.1]	14.8 [13.1–16.5]	1.5 [−1.0–3.9]	18.1 [16.1–20.2]	4.8** [2.0–7.5]
High income ($75,000)	6.4 [5.0–7.9]	8.5 [7.4–9.5]	2.0* [0.2–3.9]	12.9 [11.5–14.3]	6.4*** [4.4–8.5]

Note: Estimates are from marginal effects calculated after logistic regression analysis adjusting for the covariates shown in the table.
[a] Column displays the magnitude and statistical significance of the difference in depression levels between 2017-2018 and March and April, 2020 assessments.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

6. Conclusions

Our findings indicate that depression increased by over 60% from pre-pandemic levels of under 9% in 2017–2018 to over 14% in April 2020 among US adults, and provide further evidence that young adults may be most vulnerable to the mental health effects of the pandemic.

Author contribution statement

Dr Daly had access to the data used in the study and takes responsibility for accuracy of the data analysis. MD, ER, & ARS designed the research, MD analyzed data, & MD and ER and AS performed research and wrote the paper.

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Ethical standards

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

Declaration of Competing Interest

None.

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Supplementary materials

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