Despair and resilience in the U.S.

Did the COVID pandemic worsen mental health outcomes?

Emily Dobson
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BROOKINGS GLOBAL WORKING PAPER #171
APRIL 2022

B | Global Economy and Development at BROOKINGS

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www.brookings.edu/global

Acknowledgements
The authors gratefully acknowledge the contributions of James Kunhardt to an earlier version of this paper, and of Ani Banerjee and Andrew Zahran to this version.

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Abstract

The COVID pandemic was an unprecedented shock to U.S. society at a time when the nation was already coping with a crisis of despair and related deaths from suicides, overdoses, and alcohol poisoning. COVID's impact was inequitable: Deaths were concentrated among the elderly and minorities working in essential jobs, groups who up to the pandemic had been reporting better mental health. Yet how the shock has affected society's well-being and mental health is not fully understood. Exploring the impact by comparing 2019 to 2020 as reflected in nationally representative data sets, we found a variety of contrasting stories. While data from the 2019 National Health Interview Survey (NHIS) and the 2020 Household Pulse Survey (HPS) show that depression and anxiety increased significantly, especially among young and low-income Americans in 2020, we found no such changes when analyzing alternative depression questions in the 2019–20 Behavioral Risk Factor Surveillance System (BRFSS). Nevertheless, for the same period determinants of mental health were similar in the NHIS, BRFSS, and HPS data.

We also explored whether the pandemic affected physical health and behaviors by examining Emergency Medical Services (EMS) data calls related to behavior, overdoses, suicide attempts, and gun violence. (Notably, gun violence and opioid overdose calls increased after lockdowns, but suicide-related calls decreased). Finally, we looked at whether over the long run there is a relationship between poor mental health and deaths of despair in a geographic area and found some support for that possibility. Our results highlight two findings: (1) Scholars investigating mental and behavioral health trends must be cautious about relying too heavily on a single dataset; results generated from different data may differ considerably. (2) High metropolitan rates of depression and anxiety may be correlated with higher rates of suicide and overdose years later.

Introduction

In the U.S. the COVID-19 pandemic caused unprecedented shocks to health, well-being, and the economy. Not only did high COVID incidence and deaths, lost jobs, and closed schools have society-wide effects, but societal well-being generally was also damaged by the uncertainty about the course of the virus: how long it would last, if an effective vaccine would become available, how damaging the economic shock would be, and the deep political divisions about mask-wearing and other behaviors necessary to mitigate its effects. One result was heightened public anxiety.[1] This occurred at a time that the nation was already coping with a crisis of despair and related deaths from suicides, overdoses (OD), and alcohol and other poisonings. Before the COVID shock, the U.S. saw an average of 70,000 deaths of despair a year.[2]

COVID's impact was inequitable: Deaths were concentrated among the elderly and minorities working in essential jobs. The inequity may have spread the COVID mental health shock to groups who had previously reported better mental health. The tragedy of the deaths—over 900,000 people by early 2022—by itself is overwhelming. All the effects of the shock to society's well-being and mental health have yet to be fully assessed.

The Present Research

We first drew on numerous nationally representative datasets to answer the following questions:

a) What was the mental health situation, as measured by depression and anxiety, in the United States during the pandemic? How did it vary socio-demographically? Did the pandemic worsen mental health in 2020 compared to 2019?
b) What were the sociodemographic determinants of anxiety and depression during this period?
c) Did the onset of the pandemic lead to a change in calls to emergency medical services (EMS) about overdoses (OD), suicide, mental and behavioral health, and gun violence?[3]
d) In subsequent years, was worse mental health predictive of higher rates of deaths from despair, and are such deaths predictive of worse societal mental health in future?

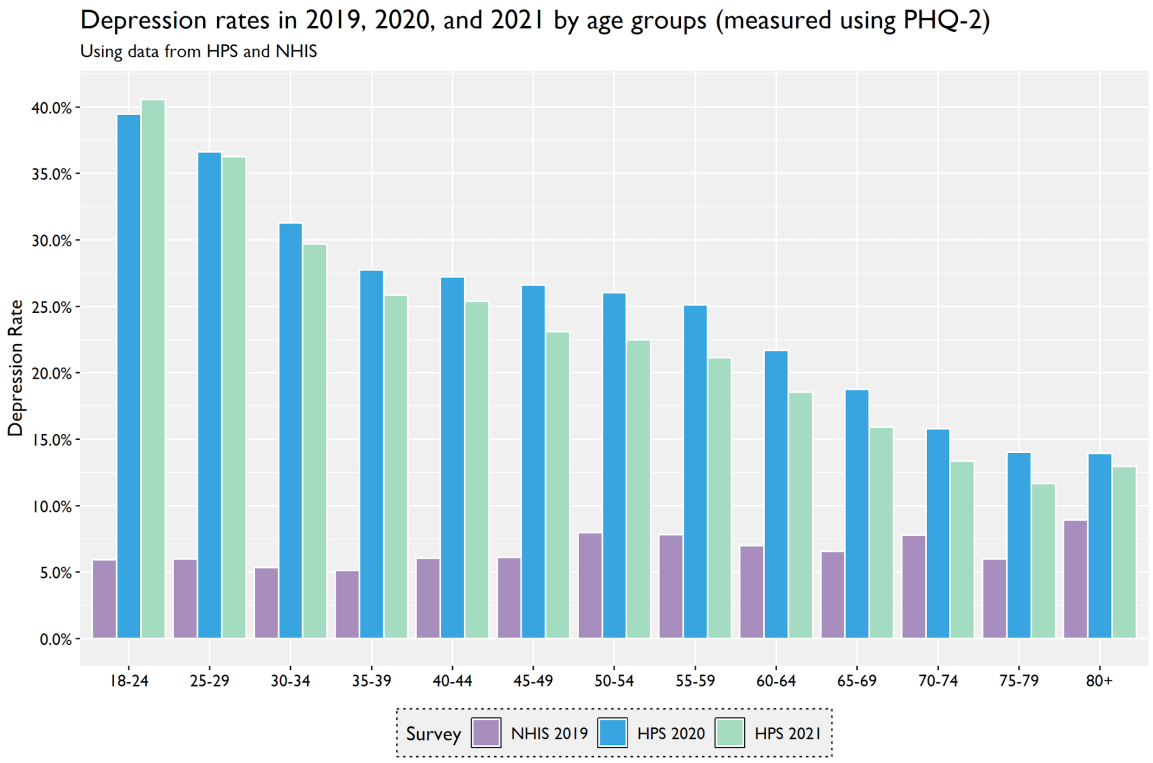
To answer the questions, we first examined trends in depression and anxiety in 2020 and 2021, as measured by the Patient Health Questionnaire 2-Item (PHQ-2) and the Generalized Anxiety Disorder 2-Item (GAD-2) questions—using the U.S. Census Bureau's Household Pulse Survey (HPS) and the differences by race, age, gender, income, and employment status. We then assessed whether differences we observe in 2020 and 2021 across these demographic groups were already present before the pandemic by comparing the incidence of depression and anxiety in 2020/2021 and in the 2019 National Health Interview Survey (NHIS), another U.S.-focused dataset that asks the same mental health questions. We found a large increase in depression and anxiety across all groups from 2019 to 2020/2021, especially among young and low-income individuals. However, when using the mental health indicators in both the Behavioral Risk Factor Surveillance System (BRFSS) and the NHIS that were asked

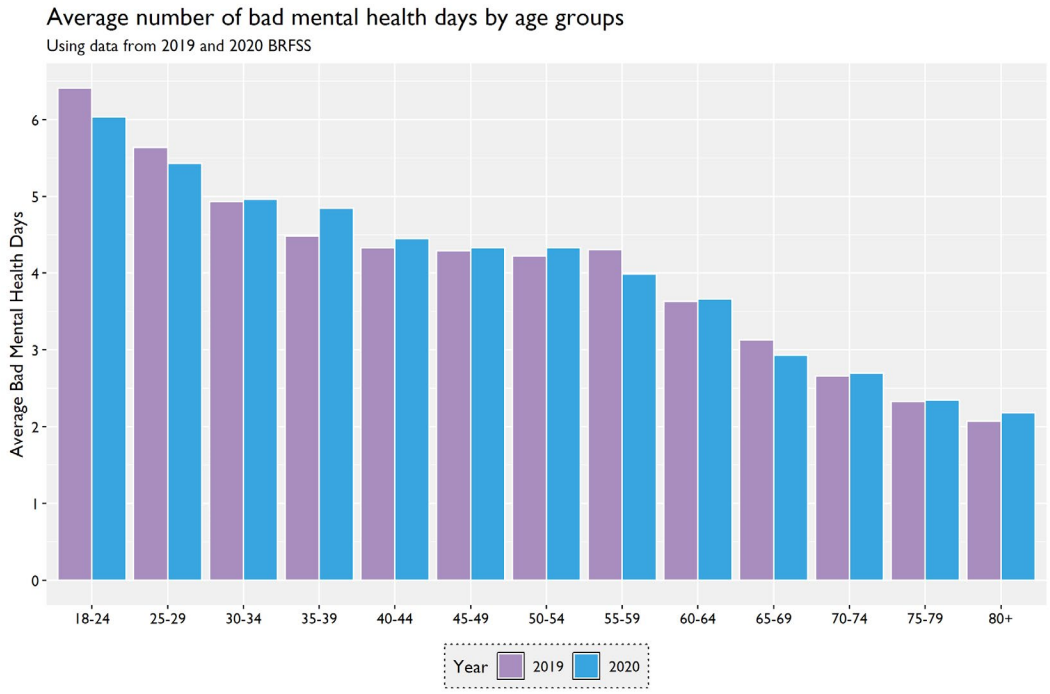
[1] For a detailed review of these, see Grinstein, Graham, and Lawlor 2022.
[2] See, for example, TFAH 2020.
[3] The behavioral calls include F41.9: Anxiety, NOS; F41.1: Generalized anxiety disorder; R41.82: Altered mental status, unspecified; F32.9: Major depression, NOS; F99: Mental disorder, NOS; R45.89: Other symptoms and signs involving emotional state; R45.7: State of emotional shock and stress, unspecified; R46.2: Strange and inexplicable behavior; R46: Symptoms and signs involving appearance and behavior; and R45.82: Worries.

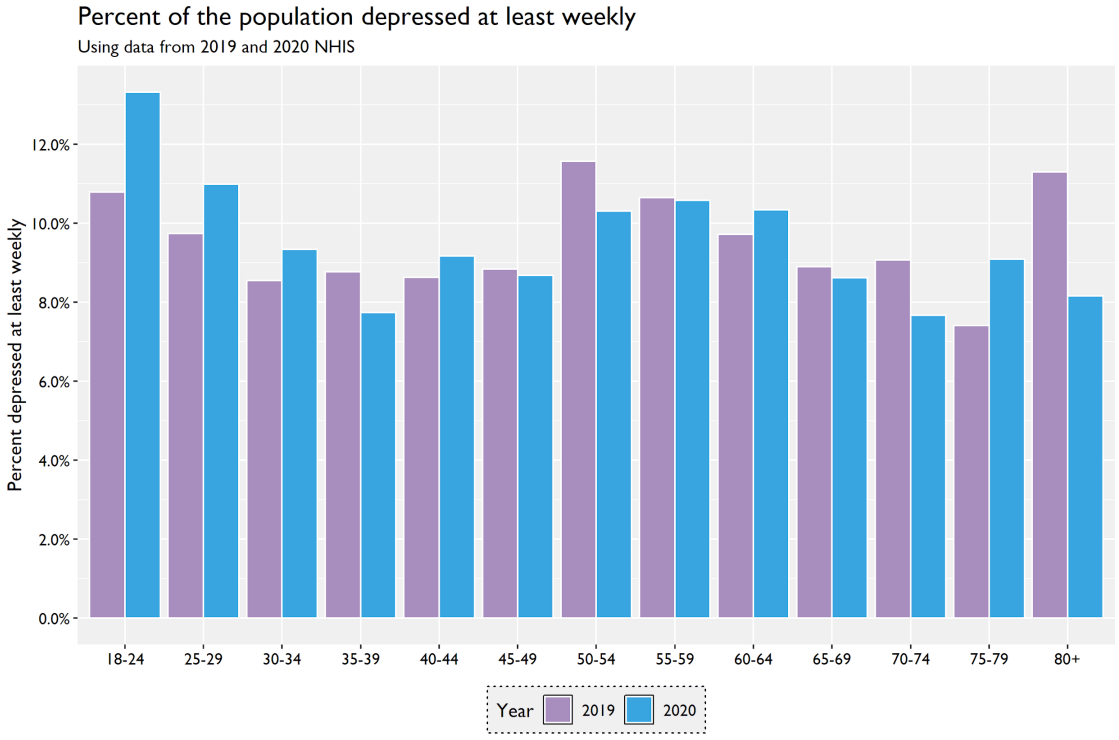
consistently in 2019 and 2020, we found no change when the pandemic began. This is the central puzzle this study identifies.

Figure 1: Change in measures of depression, 2019, 2020, and 2021 three datasets, 5-year age groups.

Note the jump when comparing 2019 NHIS and 2020 HPS and how the least depressed in 2019—the youngest—became the most depressed in 2020. This shift is completely absent in other datasets:







We then analyzed the determinants of mental health by data set and, using the HPS data, explored the associations with COVID mortality through October 11, 2021. Despite inconsistencies between data sets regarding the pandemic's effect on mental health, we found that the heterogeneity and the determinants

of mental health in 2020/2021—particularly the large age and income gradients—were consistent across datasets and indicators. It is also noteworthy that being unable to work for health reasons is the strongest correlate of a high number of bad mental health days in the previous month.

The next step was to see whether the onset of the pandemic led to physical health issues other than COVID by examining EMS data related to despair, such as deaths from ODs and suicide attempts, as well as calls related to mental and behavioral health. Using event study and difference-in-differences (DID) specifications, we found that the onset of the pandemic apparently led to a decrease in suicide and some OD-related calls but an increase in calls related to opioid ODs and gun violence.

Finally, we explored whether there is a temporal relationship between poor mental health and deaths of despair. We assessed whether poor mental health is predictive of higher rates of deaths of despair in subsequent years in a particular geographic area; and conversely if high numbers of deaths of despair are also predictive of worse mental health in later years. We found that high averages for anxiety and depression in a county or metropolitan statistical area are associated with increases in deaths of despair two to four years later.

In Section 1, we discuss the research context and the literature on mental health during the pandemic. Section 2 introduces the research questions, data sources, and empirical methods. The results are presented in Sections 3 through 6. Our findings and conclusions are discussed in Section 4.

1. **The COVID-19 Context**

Until 2018–19, trends in deaths of despair were consistent and reflected higher levels of despair and mortality among less than college educated Whites, compared to high levels of optimism and lower levels of these kinds of deaths among low-income minorities (Graham and Pinto 2019). In both 2018 and 2019, however, there was an uptick in these kinds of deaths among minorities, particularly among urban Black males (TFAH 2020).

A major reason for these changes was the steep increase in the availability of fentanyl, a synthetic and particularly lethal opioid that entered the black market on a major scale in 2017. The lethal nature of the drug also further blurred the already blurry line between non-intentional ODs and suicide, which can affect the accuracy of reports of such deaths. The previous demographic patterns that persisted from about 2005 to 2017, with drug-related deaths growing over the period, had already begun to change by 2018–19. With 2020 came the COVID shock to physical and (possibly) mental health, livelihoods, and established patterns of socializing.

Preliminary data for 2020 from the Centers for Disease Control and Prevention (CDC 2021) suggest that there were 30 percent more OD deaths in 2020 (about 93,331) than in 2019 (about 70,000). The death rates increased in every state but New Hampshire and South Dakota, with the most pronounced increases in the South and West. Equally stark was the fact that deaths rose for all races, with OD rates for Blacks and Hispanics—which for the previous decade had been significantly lower than for Whites—rising faster in 2020 than deaths of Whites, although the levels were still lower (Katz and Sanger-Katz 2021; CDC 2021). It is not clear whether this resulted from the COVID shocks to economic stability and mental health, the increasing availability of fentanyl, or a factor yet unidentified.

The Literature

Negative Markers of Well-Being

Numerous studies have already examined ill-being during the pandemic using the Census HPS. For example, Blanchflower and Bryson (2021) focused on the responses to questions about anxiety, worry, and depression that are incorporated into the GAD-2 and PHQ-2, the two mental health measures detailed in Appendix 1. Blanchflower and Bryson (2021) examined how ill-being measures are related to political views (Trump states v. Biden states) and vaccination attitudes. They found that anxiety, worry, and depression peaked in November 2020 but improved in 2021; anxiety was higher in Biden states. Using HPS, Twenge and Joiner (2020) compared rates of anxiety and depression (measured using PHQ-2 and GAD-2) in 2020 with those in the 2019 NHIS survey. They found that anxiety and depression rates had more than tripled in 2020.

Scholars have also used other datasets for such comparisons. Ettman et al. (2020) compared depression data from the 2017–18 NHANES with the annual survey administered through the NORC AmeriSpeak Panel that began in April 2020. They found a three-fold increase in depression (assessed by the PHQ-9 screening measure) among all demographic groups compared to 2017–18, with people who were poor and those impacted negatively by COVID-19 having the worst outcomes. Daly, Sutin, and Robinson (2021) compared the 2017–18 NHANES data to the depression levels found in the Understanding America Study for March-April 2020 based on PHQ-2. Depression rates jumped from 8.7 percent in the NHANES data to 10.6 percent in March 2020 and 14.4 percent in April.

Some studies have also examined related physical ill-being. Using the Kentucky State Ambulance Reporting System, Slavova et al. (2020) found that, after the Kentucky Governor declared an emergency on March 6, 2019, the number of opioid OD EMS calls leading to a patient being transported increased by 17 percent—but the number of such calls where the patient refused transportation increased by 71 percent, possibly due to fear of getting infected with COVID in the hospital.

Holland et al. (2021), leveraging the CDC National Syndromic Surveillance Program, which covers emergency department (ED) visits to about 70 percent of all U.S. ED visits, found that, as the total number of ED visits dropped below the number at the onset of COVID, the rates of ED visits for OD and suicides increased. The increase is especially notable for opioid ODs. Yet provisional data from the National Vital Statistics System showed that from 2019 to 2020, suicide deaths declined by 5.6 percent (Ahmad and Anderson 2021)—though here, too, it is not easy to disentangle intentional and non-intentional ODs; some OD increases may have replaced other forms of suicide. Another possible confounding factor is that suicides are higher in middle and older ages—and many in that age group were also over-represented in COVID-related deaths.[4]

Our study also sought to compare mental ill-being before and during the pandemic. It differs from previous studies in three significant ways: (1) We covered more well-being datasets—HPS, 2019 NHIS, 2020 NHIS, 2019 BRFSS, and 2020 BRFSS—than the other studies combined (HPS, 2019 NHIS, 2017–18 NHANES, AmeriSpeak Panel, and UAS). (2) We examined the association between demographic variables and ill-being in more detail; and (3) We explored the associations (a) between trends in ill-being/poor mental health and pre-pandemic deaths of despair and the associations (b) between EMS calls and ill-being during the pandemic.

[4] Suicide rates are highest for men over 75—40.2 per 100,00 people in 2019. While for females in general rates declined in 2020 compared to 2019, they increased for males 65 and over (see Curtin et al. 2021).

Measures of Positive Well-being

In contrast to the stark trends in ill-being, life satisfaction stayed relatively stable in most countries, including the U.S., for which there is less life-satisfaction data: For example, Share Care's Community Well-being Index report (2020) for the U.S. found that reported individual well-being actually increased in 2020 compared to 2019 in the physical, social, community, and purpose domains, though it did decline slightly in the financial domain, probably due to the economic uncertainty generated by the pandemic—even though generous support payments kept many from falling into poverty.[5] Possible reasons for the well-being increases are expectations adjusted in response to the virus and greater appreciation for the plight of others. It is important to note that positive life course evaluations can coexist with increases in negative emotions like anxiety, particularly during uncertain and stressful times like the pandemic.

The Share Care data also show that established trends for race groups hold in the 2020 data, with African Americans and Hispanics reporting more optimism and less stress than Whites or Asians, even though their levels of reported anxiety and depression had increased from previous years, having begun at much lower levels than Whites and Asians, as shown in other data sets and discussed below.

Another survey of 15,000 respondents in five waves from April 2020 through February 2021, conducted by a team of the Social Policy Institute at Washington University in St. Louis (of which one author of this study was a member) found that low-income Blacks were more optimistic than low-income Whites throughout COVID but also coexisted with increases in anxiety among Blacks in general during the pandemic (as measured by the NHIS and the HPS). This again suggests lack of a strong relation between positive well-being and stark increases in negative emotions during the pandemic (Graham et al. 2020). Research early in the pandemic also found that optimism remained higher among Blacks than among other racial groups during the first six months of the pandemic (Dobson, Graham, and Dodd 2021).

Using weekly data from YouGov in UK, Foa et al. (2020) found that negative affect reached a peak just before lockdowns were instituted. Negative affect then declined, suggesting that while the onset of the pandemic depressed well-being, subsequent lockdowns were associated with improvements in mental health. Looking at Google Trends data, the Foa team also found that their findings in the UK generalized to Canada, the U.S., and New Zealand. Analysis of tweets posted five weeks after the outbreak began showed a universal and significant increase in anxiety within all 20-some countries studied, an increase in sadness in 16 countries, including the United States, and a decrease in anger in 12, contrasted with relative stability in the number of positive-emotion tweets (Metzler et al. 2021).

All these studies demonstrate that trends in well-being and mental health during the pandemic were complex and at times contradictory. Our results highlight the complexity, identify some less well-known data problems, and emphasize the need for better and more consistent data for tracking well-being and mental health as a precursor to addressing a crisis before the pandemic.

[5] Sharecare and Gallup had previously collaborated on Gallup U.S. surveys but split in 2019.Since 2019 Sharecare data has been using the same data dictionary and sampling methods as in the previous years with Gallup.

2. Data description

2.1. Data on mental health

Household Pulse Survey

The most readily available measure of mental health during the pandemic is the data from the HPS, administered by the U.S. Census Bureau. Survey periods are grouped by phases, and as of December 2021 there have been six phases. Phases 1, 2, 3, 3.1, and 3.2 have been completed, and Phase 3.3 is underway. All phases use essentially the same questions and methodology. The most significant change came between phases 1 and 2 when the HPS added an additional survey response reminder and the survey period changed from 6 to 13 days. We refer to these survey periods as "pulse weeks." We studied data from phase s1 through 3.2, April 23, 2020, to October 11, 2021, which covered 39 pulse weeks.

HPS has two primary measures of mental health using clinically validated screening tools, both of which contain two questions. Each question is scored from zero to three and a score of three or higher after summing the two questions is coded as having anxiety for the GAD-2 and depression for the PHQ-2 (Kroenke 2007, 2003). Following, e.g., Cai et al. (2021) and Jia et al. (2021) we created binary variables indicating anxiety and depression instead of using the underlying questions. The details of GAD-2 and PHQ-2 phrasing can be found in Appendix 1. Of the 3.1 million observations in HPS, 2.7 million have non-missing values on both anxiety and depression. HPS also collects extensive sociodemographic information on respondents (e.g., age, gender, race, income, education, marital status, employment, and state of residence).

National Health Interview Survey

We use the 2019 and 2020 National Health Interview Survey (NHIS) to estimate levels of anxiety and depression before the pandemic in both the population as a whole and specific subgroups. The NHIS is also nationally representative, with over 50,000 responses across both years. We used two sets of mental health measures from NHIS. The first consists of the PHQ-2 and GAD-2 questions: Though available only for 2019, these are phrased in virtually the same way as the HPS (see Appendix 1). For consistency, we also created for the two surveys similar categorical variables for race, age, gender, education level, income, marital status, and employment.

The NHIS has the advantage of referring to another measure of depression and anxiety in both 2019 and 2020: "*How often do you feel depressed (worried, nervous, or anxious)? Would you say daily, weekly, monthly, a few times a year, or never?*" This allows us to decide whether assessment of the pandemic's effect on depression or anxiety depends on the survey instrument used to measure it. Using this question, we calculated the binary variable that indicates whether or not the respondent is anxious at least weekly and considered this as the alternative measure of depression and anxiety.

Behavioral Risk Factor Surveillance System

CDC's BRFSS is a telephone survey that conducts over 400,000 adult interviews every year (CDC 2014). It contains one question on the self-reported number of bad mental health days in the previous 30 days: "*Now, thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?*" In this paper we refer to the response o this question as "bad mental health days." We also defined the binary variable for extreme distress for respondents who reported 30 bad mental health days. We drew on the full BRFSS data for 2019 and 2020, and compared the "bad mental health days" variable for the two years.

On the part of this paper that measures the links between poor mental health and deaths of despair, we

use the Selected Metropolitan/Micropolitan Area Risk Trends (SMART) subset from 2005 to 2018. The SMART data includes individual geographic location at the metropolitan and micropolitan statistical areas (MMSA) level. The metro and micropolitan areas represented vary every year based on whether each year's sample contained a large enough population (500 respondents) to be representative of an area (CDC 2019). Because the BRFSS also collects extensive demographic information, to the extent possible we again created categorical variables analogous to those in HPS and NHIS. However, the way they are constructed in the BRFSS prevents them from being fully identical (for more detail, see Appendix 1).

2.2. Data on deaths of despair

National Vital Statistics System

We use mortality data from the NVSS through the CDC's National Center for Health Statistics (NCHS). The data record all U.S. deaths with details about the month of death, decedent's county of residence, cause of death coded according to ICD-10, and a range of demographic characteristics like age, gender, race, and country of birth. In combination with population data from the U.S. Census Bureau, we compute the rates of deaths of despair (defined as in Case and Deaton 2015) per 100,000 people, for those aged 35–64, for each MMSA, and for each year from 2005 through 2018. We then used MMSA codes to merge NVSS with the BRFSS SMART dataset.

2.3. Other datasets used

National Emergency Medical Services Information System (NEMSIS)

Since the deaths data from CDC are reported with a one-year lag, and because we wanted to see if the pandemic had had any immediate effects on non-COVID behaviors and health, we drew on 2019–20 first responder data from 47 states in the NEMSIS Public Release Research Dataset, a convenience sample of data submitted by participating EMS agencies.[6] NEMSIS allows us to compare trends in EMS calls in 2020 related to suicide, drug OD, mental and behavioral health, and gun violence and in 2019 EMS calls for agencies that reported throughout both years. Across the two years, there were 77,691,854 observations in daily first-responder reports from over 10,000 agencies. NEMSIS also collects data on caller age, gender, and race. Unfortunately, NEMSIS's most disaggregated geographic variable for callers is the census division that they reside in (there are nine such divisions across the U.S.), which imposes significant limitations in matching NEMSIS data with other datasets.

COVID-19 death data

We drew on COVID-19 data from the *New York Times* for regressions with HPS. Specifically, for every pulse week, we took the middle date and the fourteen-day rolling average of deaths per 100,000 residents on that date, as calculated by the *New York Times.* The major advantage of this dataset is that it accounts for reporting anomalies. For example, if during a week a state retracts a certain number of deaths due to misreporting, the rolling average would not take the retraction into account and would show a negative number of deaths on a certain day. (For a detailed description of the methodology and the dataset, see Almukhtar et al. 2022.)

[6] We thank Clay Manning at NEMSIS for the data approval process and for answering numerous questions.

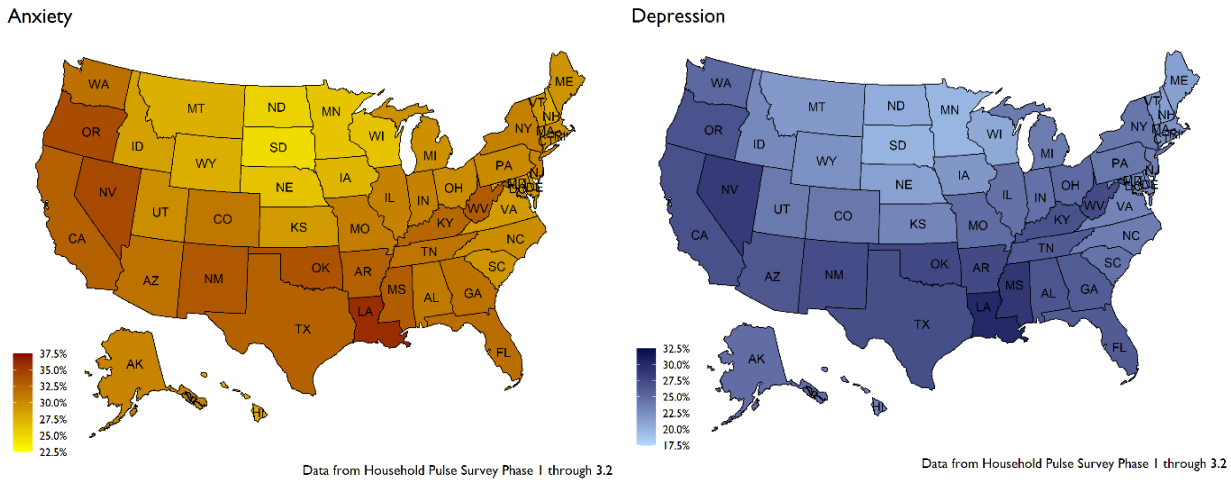
3. Study 1: Did the pandemic worsen mental health?

This section springs from the data puzzle on which this paper is centered. Using HPS we first looked at basic summary statistics for depression and anxiety during the pandemic, which not only helped illuminate this discussion but are important independently. We then compared ill-being before and during the pandemic, first using the incidence of anxiety and depression as measured by the GAD-2 and PHQ-2 in 2019, using NHIS data, and in 2020–21, using the HPS data; then using the alternative measure of depression and anxiety in the 2020 and 2019 NHIS; and finally looking at bad mental health days in the 2020 and 2019 BRFSS.

3.1. Summary statistics (HPS)

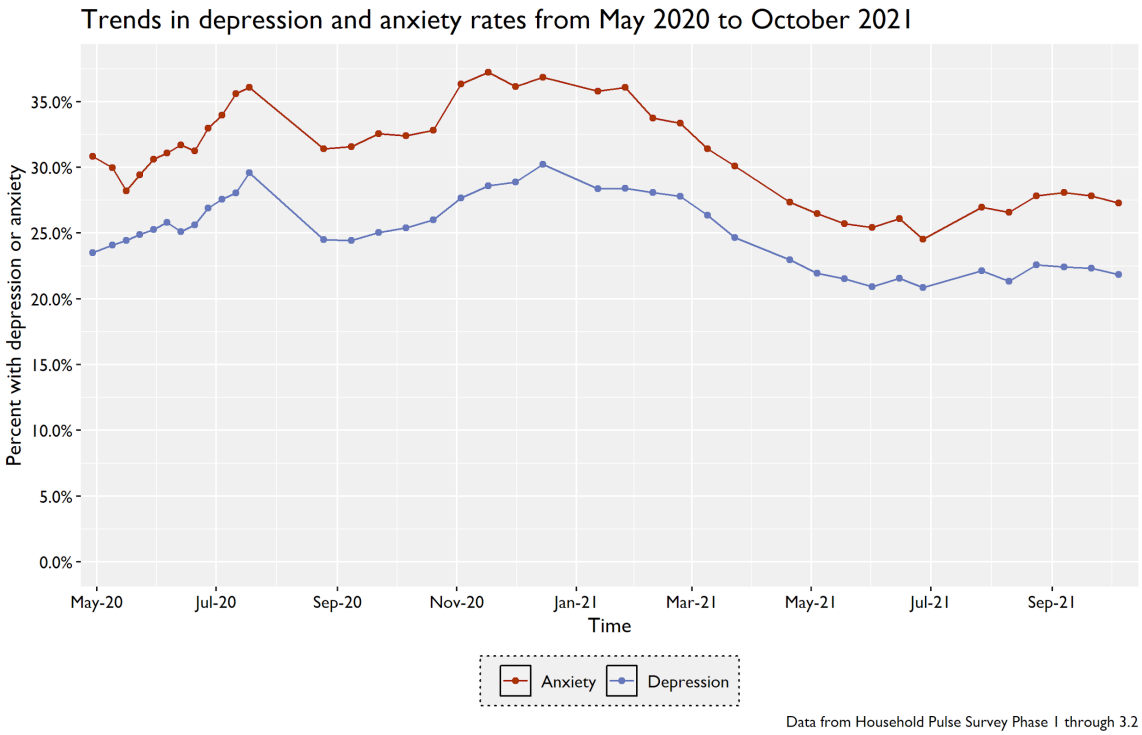
We first present the geographical and time trends in anxiety and depression for the period from April 2020 to October 2021. In Figure 1, we show the incidence of depression and anxiety at the state level, averaged across the whole period: Overall, incidence seems to be geographically correlated very positively, with states that have high incidence of depression also having high incidence of anxiety, and states with a low incidence of depression having a low incidence of anxiety.

Figure 2: U.S. states: incidence of depression and anxiety, April 2020–October 2021



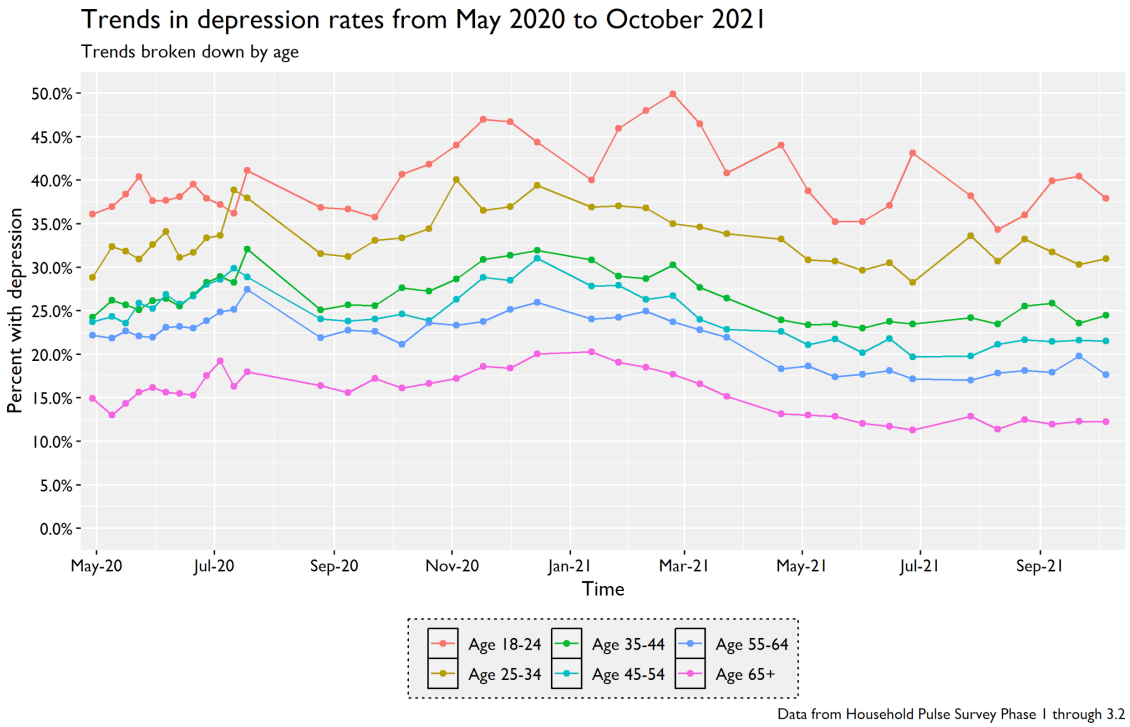
The incidence of both peaked first in about July 2020, and again in December 2020, after which came a sustained decline until June/July 2021.

Figure 3: Trends in incidence of anxiety and depression, May 2020–October 2021, Percent



Figures 3 and 4 show that the trends are very similar for both race and age groups, although for smaller demographic groups with smaller sample sizes the results are more variable, probably due to survey limitations. Although the trends are similar, the levels vary widely, with Black and Hispanic respondents having higher depression throughout the pandemic (Figure 3). The gaps are even larger across age groups: Incidence for 18–24–year-olds is consistently more than double the incidence for those 65+.

Figure 4: Trends in depression by age, April 2020–October 2021, Percent



3.2. Did the pandemic worsen mental health?

Part 1: Comparing the 2020 HPS with the 2019 NHIS

Here we assess whether the incidence of depression and anxiety, which was very high during the pandemic, was already high in 2019, or whether the pandemic worsened the problem. To do so, we again rely on the PHQ-2 and GAD-2 measures, since the 2019 NHIS[7] and the 2020/2021 HPS ask about them.

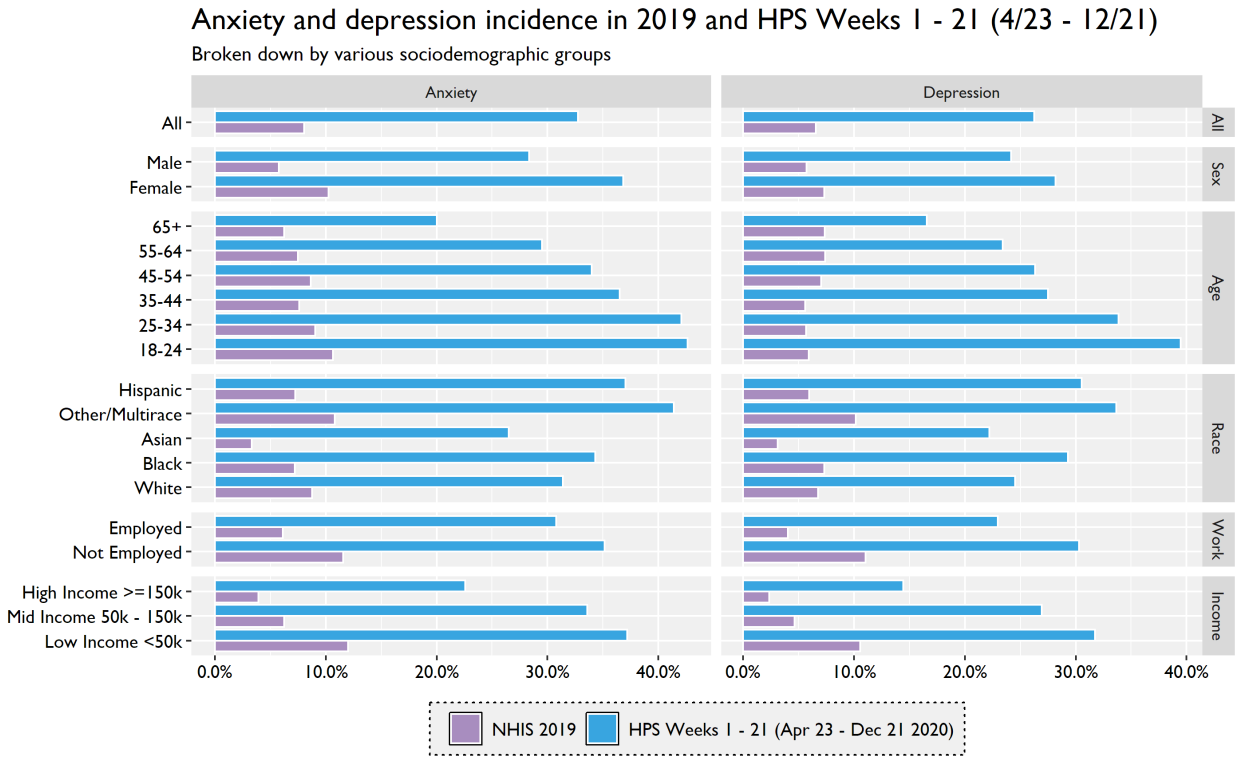
Figures 1 to 4 already illustrated the trajectories for depression and anxiety starting in April 2020. The next figures use the NHIS data for 2019 to demonstrate how the situation changed through October 2021. Figure 5 summarizes the striking magnitude of the changes: In 2020 anxiety and depression at least doubled in every subgroup, and in some, the incidence more than quadrupled; moreover, despite slight decreases in 2021, incidence remained more than three times higher than in 2019.

The age gradient in depression is particularly striking because it reversed what was present in 2019 when younger respondents were less depressed. The income gradient post-pandemic is also very large—though it was present in 2019, it was much less steep. Across race groups, the pandemic seems to have overturned trends in 2019, when White respondents had a higher incidence of anxiety than Blacks and Hispanics, but starting in 2020, the situation was reversed. Moreover, while in 2019 women were already more likely to report anxiety and depression, the gender gap widened in 2020. These changes seem to reflect the extent to which young, low-income people, women, and minorities seem to have suffered

[7] Ideally, we would compare the PHQ-2 and GAD-2 items within the same survey, but the 2020 round of the NHIS does not include those questions.

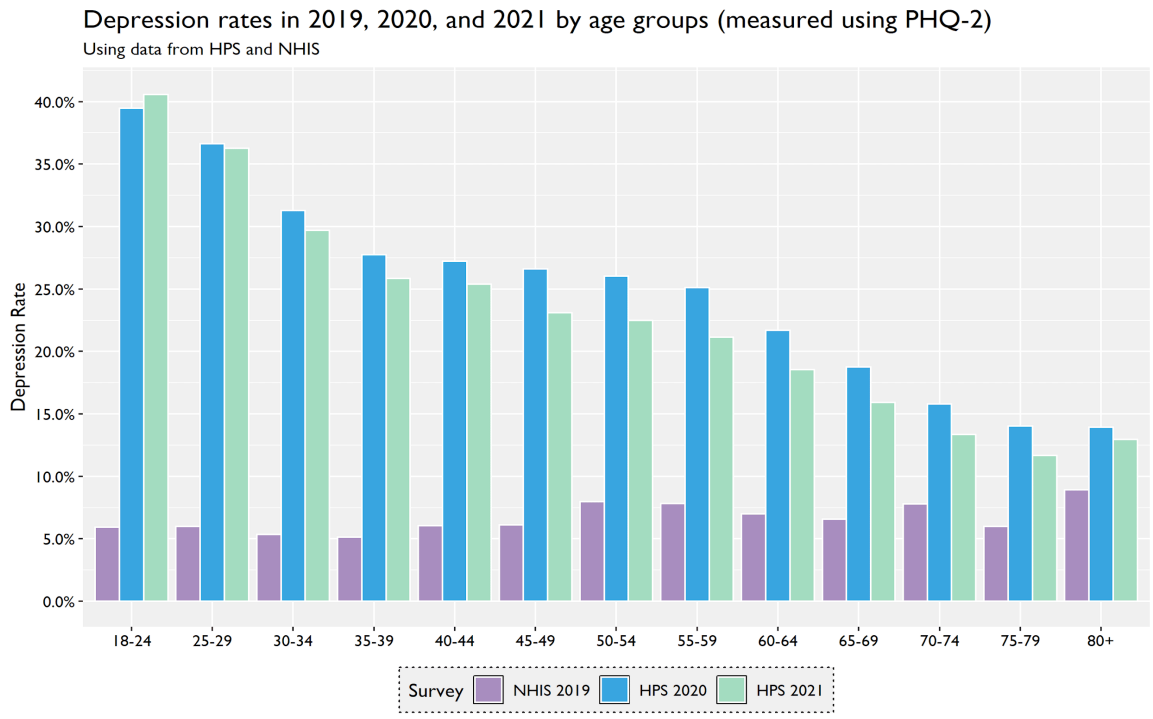
disproportionately from labor market uncertainty, the lack of social contact because of lockdowns and other policies to mitigate the pandemic, and possibly the increase in domestic workloads.

Figure 5a: Incidence of depression and anxiety, total and by sociodemographic group, 2019 and HPS weeks 4.23–12/21, 2021



In Figure 5b, we unpack the age gradient further by breaking the sample down into 5-year groups. For the oldest group (80+), the increase in depression incidence was only about 5 percentage points, but the for the youngest (18–24) its incidence surged from about 6 to 40 percent.

Figure 5b: Incidence of depression by 5-year age groups, 2019–October 2021, Percent



It appears that, based on PHQ-2, GAD-2, and the NHIS and HPS, the pandemic led to huge increases in depression and anxiety, and groups that were more disadvantaged to begin with were hit particularly hard.

However, a possible weakness is that the question asks only for a retrospective 1-week period in relation to PHQ-2 and GAD-2 items in HPS, except for the period between July 21 and October 11 in 2021 (Phase 3.2), when HPS switched to the same retrospective 2-week period as the 2019 NHIS (see Appendix 1 for details). Yet when we explored an alternative specification, where 2021 is treated as two periods, one up to the end of Phase 3.1 (July 5) and the other corresponding to Phase 3.2 (July 21 to October 11), we found little difference between the two, which suggests that there is still a substantial difference between values in Phase 3.2 and the 2019 NHIS is still substantial (see Appendix 2).

3.3. Did the pandemic worsen mental health?

Part 2: Comparing 2019 and 2020 NHIS using alternative measures of depression and anxiety

Although NHIS and HPS both use the same questions to measure anxiety and depression, they are still different surveys with different sample sizes, interview modes, sampling methods, and weighting methodologies. Here, we use alternative measures of depression and anxiety that the NHIS asks about consistently in both 2019 and 2020. These are questions that ask directly for respondent self-assessments: "*How often do you feel depressed? Would you say daily, weekly, monthly, a few times a year, or never?*" and "*How often do you feel worried, nervous or anxious? Would you say daily, weekly, monthly, a few times a year, or never?*" We create an indicator variable equal to one if the respondent was depressed daily or weekly, and zero otherwise. W create an analogous variable for anxiety. Following the guidance from CDC, we use the 2020 partial dataset and the partial weights for all analysis of the 2020 NHIS data. Figure 6a shows the difference for different demographic groups between 2019 and 2020.

Figure 6a: NHIS Trends in Depression and Anxiety, 2019–2020

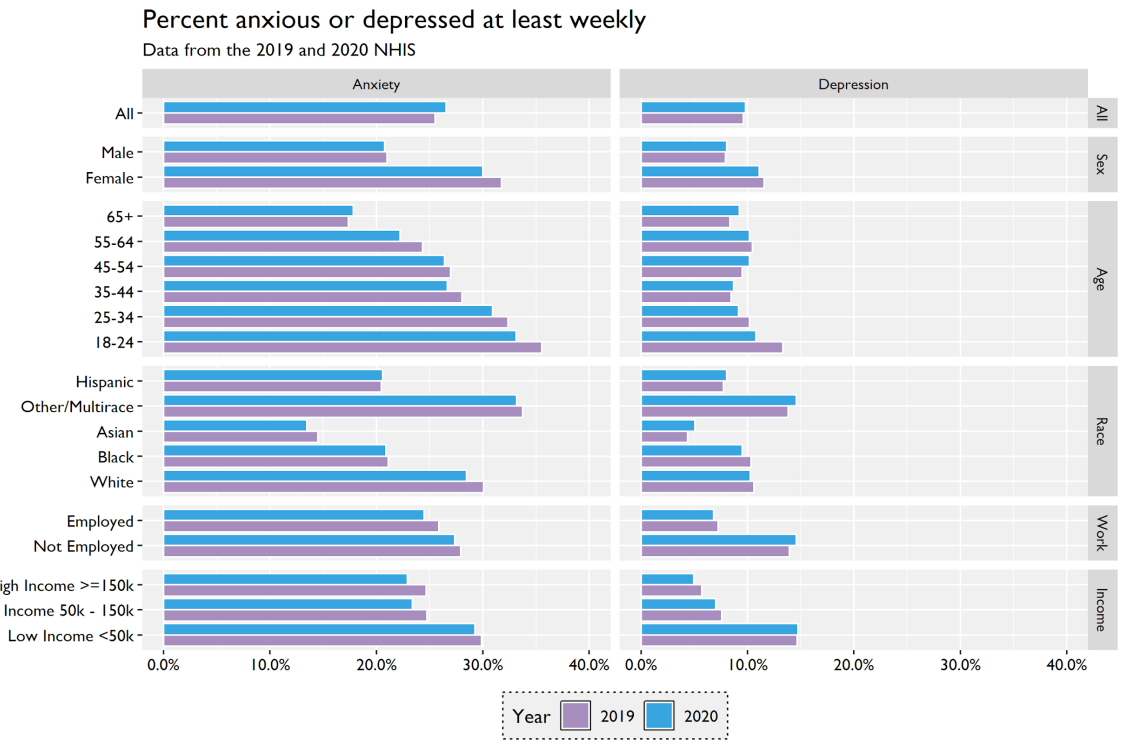
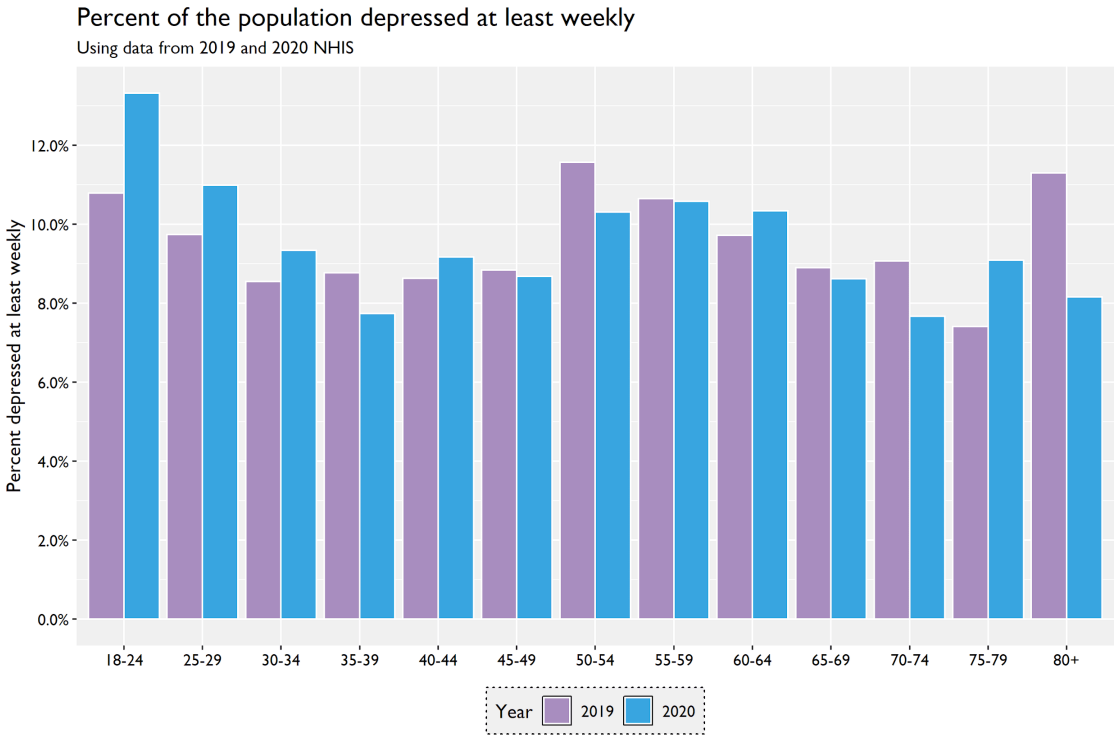


Figure 6b breaks down this alternative depression indicator by the five-year age groups used in Figure 1. The results are very different: the incidence is below 14 percent for every subgroup in either year and, more significantly, the year-on-year changes are small, not surpassing three percentage points in any subgroup, which clearly suggests major discrepancies depending on the data and the question asked.

Figure 6b: Incidence of depression by five-year age groups, 2019 and 2020, Percent



Source: Based on alternative depression question in NHIS.

Empirical Methodology

The empirical approach we adopt closely follows that of Leslie and Wilson (2020), who seek to assess the effect of the pandemic on domestic violence and estimate it based on event study and DID specifications. Equation (1) outlines the event study specification:

$$(1)\quad MH_{irqt} = \beta Year2020_t * \sum_{q=1}^{4} quarter_q + X_{irqt} + \gamma_{r,q} + \delta_{r,y} + \varepsilon_{isrt}$$

MH_{ist} is the mental health outcome of interest, i.e., the alternative indicator for depression or anxiety for individual *i*, in region *r*, quarter-of-the-year *q*, and year *t*. $Year2020_t$ is a binary variable taking the value of one in 2020 and zero in 2019. $\sum_{q=1}^{4} quarter_q$ is a set of four dummies representing each quarter. $Year2020_t * \sum_{q=1}^{4} quarter_i$ represents the exhaustive set of interaction terms between both quarters and years, the key variables of interest.

X_{irqt} is a vector of individual-level sociodemographic controls for age, race, gender, income, education, employment, and marital status. We include region-by-year ($\delta_{s,y}$), and region-by-quarter ($\gamma_{s,m}$) fixed effects to allow for region-specific trends in bad mental health days by year and quarter.

The U.S. declared a national emergency on March 13th, which corresponds to the end of quarter one. We then took quarter two as the first treated quarter and treat quarter one as the omitted/reference period in this specification. If the pandemic onset influenced the outcome of interest, the coefficients for the interaction terms should become significant from March onward. To further quantify average effects for the post-pandemic period, we rely on DID specification, as formalized in equation (2):

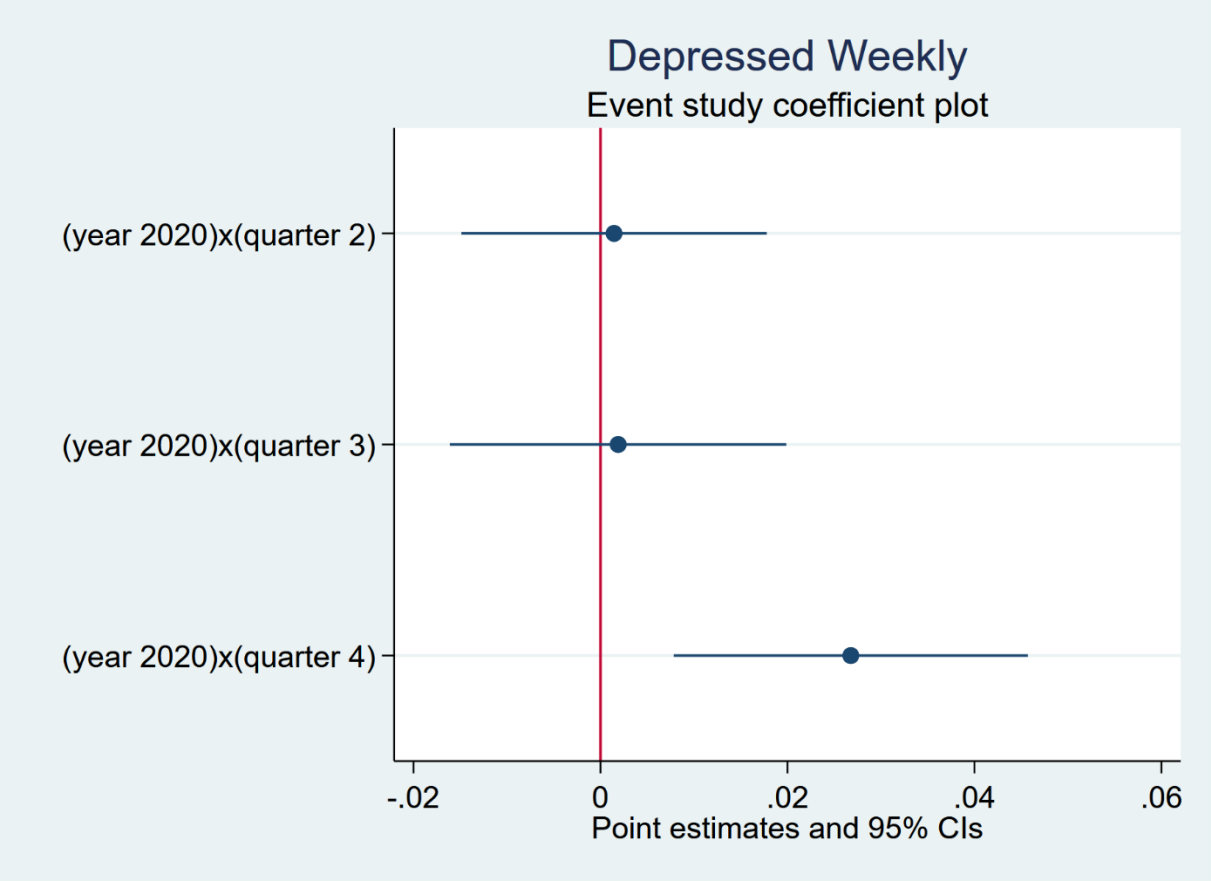
$$(2) \quad MH_{irqt} = \beta Year2020_t * Post_q + X_{irqt} + \gamma_{r,q} + \delta_{r,y} + \varepsilon_{isrt}$$

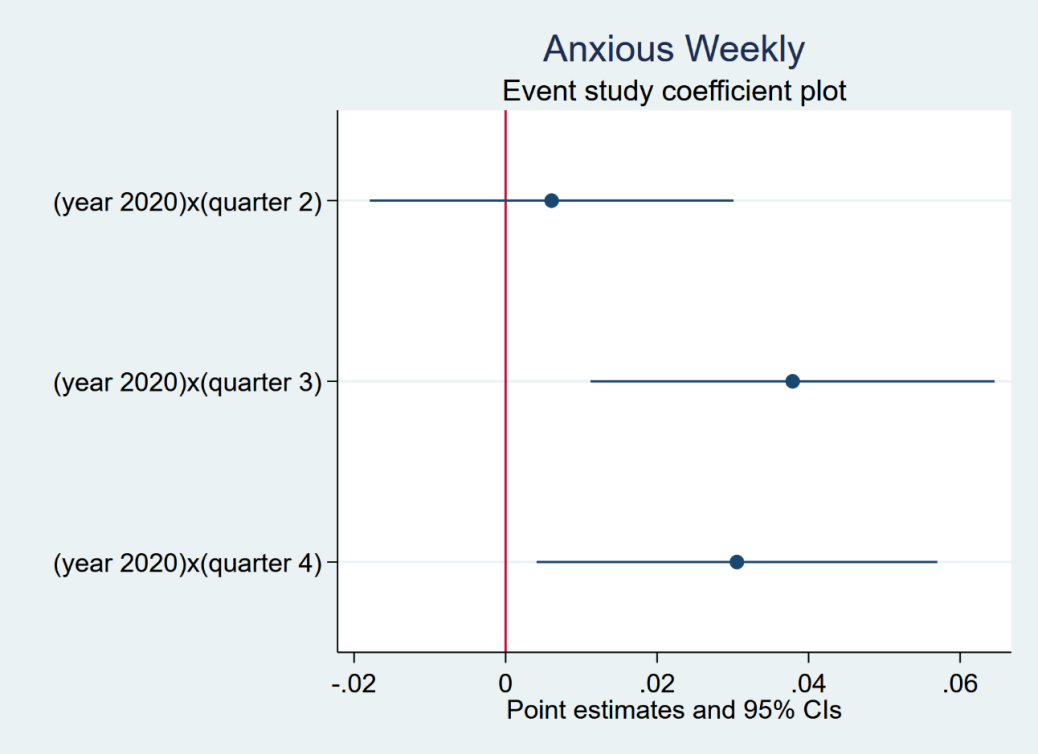
MH_{ismt}, $Year2020_{it}$, X_{irqt}, $\gamma_{r,q}$,and $\delta_{r,y}$ represent the same parameters as in (1). $Post_q$ is a binary variable that takes the value of one for every individual *i* who is interviewed in quarter two or later, regardless of year. The interaction term is the variable of interest, making β again the parameter of interest. This beta indicates the percentage-point increase in the probability that an individual was depressed (or anxious) during the pandemic period, defined as the last three quarters of 2020, compared to 2019 and early 2020.Across both specifications, robust standard errors are used, and all regressions are weighted using the NHIS sampling weights in 2019 and sample partial weights in 2020.

Results

Figure 7 shows the primary coefficients for our event study; see Appendix 8 for the full regression table. We can see that the proportion of individuals who are depressed or anxious weekly did not shift substantially from 2019 to 2020. The largest shift, which is statistically significant, is still less than five percentage points. These findings clearly contradict the HPS and NHIS comparisons. The DID results also confirm this finding.

Figure 7: Event study plot for alternative depression and anxiety indicators





Source: 2019 and 2020 NHIS data.

Table 1: DID estimates for the alternative depression and anxiety indicators

	(1)	(2)	(3)	(4)
	Depressed Weekly	**Depressed Weekly**	**Anxious Weekly**	**Anxious Weekly**
Year: 2020	−0.0064	−0.0055	−0.0083	−0.0071
	(0.0059)	(0.0056)	(0.0083)	(0.0081)
Interview Quarter 2-4	−0.0065	−0.0054	−0.0017	−0.0006
	(0.0048)	(0.0046)	(0.0069)	(0.0067)
Year: 2020 x Interview Quarter 2-4	0.0108	0.0101	0.0249**	0.0249**
	(0.0072)	(0.0070)	(0.0103)	(0.0100)
Constant	0.0968***	0.1894***	0.2519***	0.4512***
	(0.0056)	(0.0129)	(0.0081)	(0.0166)
Observations	52,155	50,990	52,217	51,023
R-squared	0.0004	0.0760	0.0014	0.0847
Region Interaction Fixed Effects	Y	Y	Y	Y
Sociodemographic Fixed Effects	N	Y	N	Y

Source: 2019 and 2020 NHIS data.

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

3.4. Did the pandemic worsen mental health?

Part 3: Comparing "bad mental health days" in 2019 and 2020 BRFSS

Here the approach is analogous to the one outlined in 3.3 but is based on BRFSS instead of NHIS data, with "bad mental health days" the main outcome variable. In addition to having more granular time intervals, the BRFSS is advantageous in two ways: (1) the sample size is about 10 times larger than that of NHIS; and (2) the BRFSS used phone interviews in both 2019 and 2020 while the NHIS switched from in-person interviews in 2019 to primarily phone interviews in 2020—a change that could affect how people answer questions and also the incidence results. As with the alternative indicators in section 3.3, the wording of the question about our outcome variable did not change between 2019 and 2020 (see Figure 8a).

Figure 8b breaks down this indicator by five-year age groups and again for every group there is a pattern of very small differences in incidence between 2019 and 2020; in many the incidence was lower in 2020.

Figure 8a: Average number of bad mental health days, BRFSS 2019 and 2020

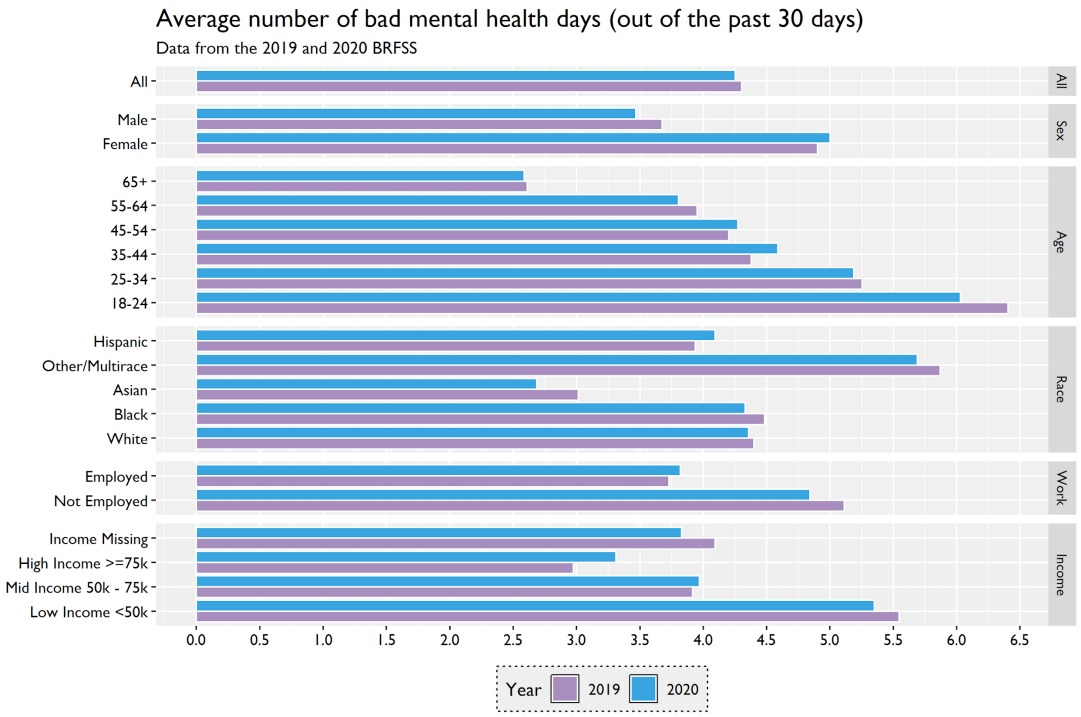
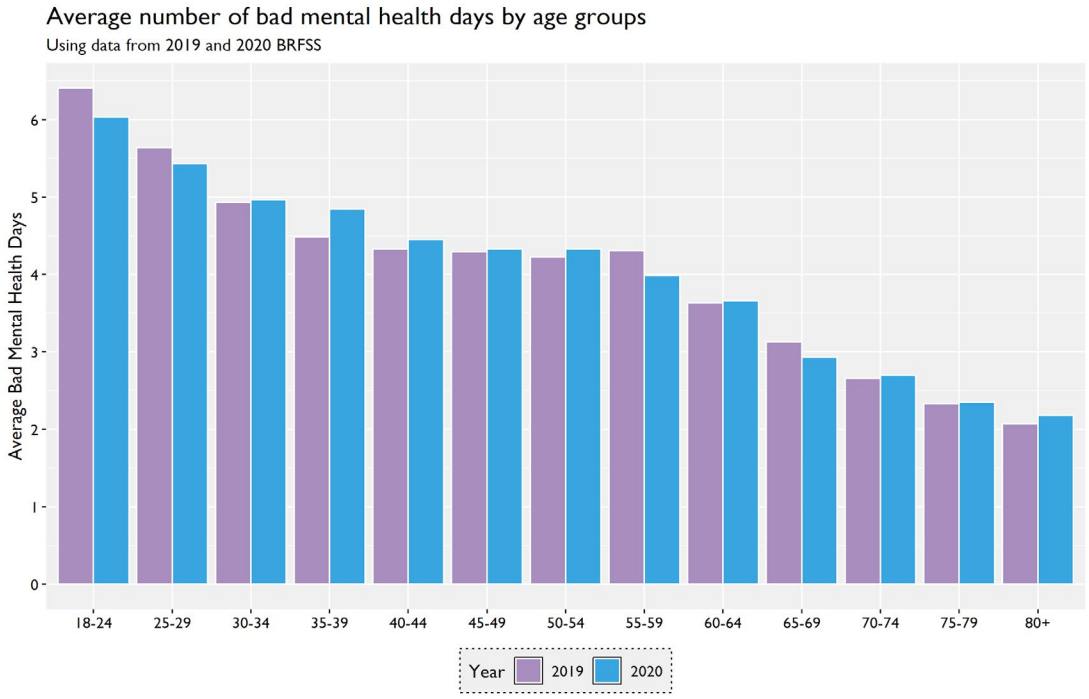


Figure 8b: Average number of bad mental health days (alternative indicator in BRFSS), by five-year age groups, 2019 and 2020



Empirical methodology and results

We follow an approach that is precisely analogous to that of section 3.3, with event study and DID specifications as outlined by equations (1) and (2). The only difference is that now the outcome of interest (MH_{ismt}) is the number of bad mental health days for individual *i*, in state *s*, month-of-the-year *m*, and year *t* (we also use "extreme distress" as an alternative outcome, defined as someone who had 30 days of bad mental health in the previous 30 days, as in Blanchflower and Oswald (2021). Robust standard errors clustered at the level of the interview date are used and all regressions are weighted by BRFSS sampling weights. Since the BRFSS data also contain more finely tuned time intervals, we substitute quarters for months. Our event study specification thus becomes:

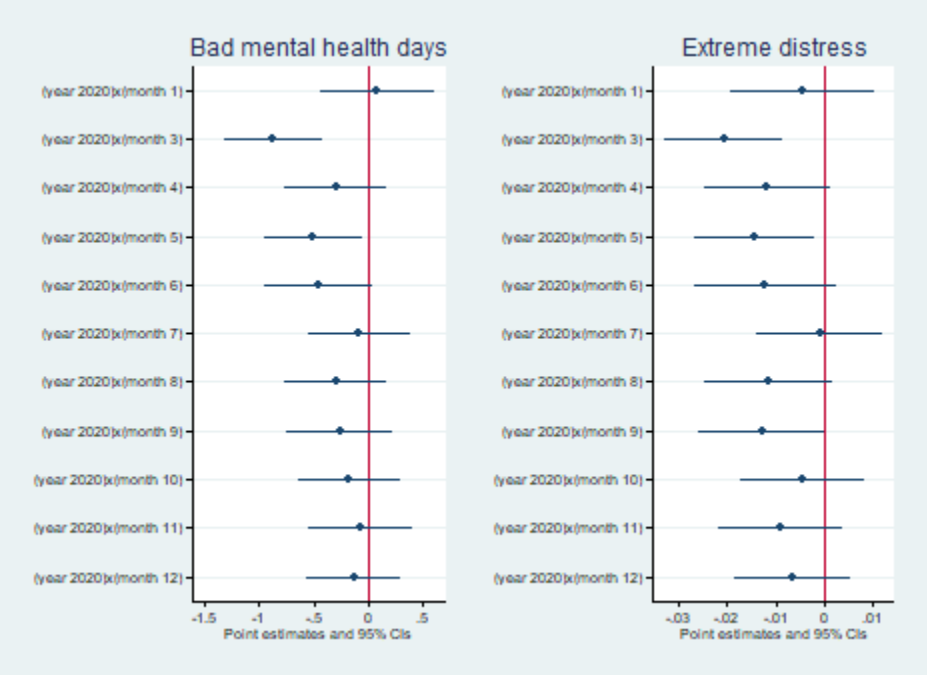
(1) $MH_{ismt} = \beta_1 Year2020_{it} * \sum_{m=1}^{12} month_i + X_{ismt} + \theta_{s,dow} + \gamma_{s,m} + \delta_{s,y} + \varepsilon_{ismt}$

Similarly, our DID specification using the BRFSS data is:

(2) $MH_{ismt} = \beta_1 Post_{it} * Year2020_{it} + X_{ismt} + \theta_{s,dow} + \gamma_{s,\mathrm{m}} + \delta_{s,y} + \varepsilon_{ismt}$

Figure 9 graphs the estimates we obtain for the coefficients of interest—those related to the interaction terms (because February is the reference month, the interaction with February is also the omitted one for the interaction), when including the most extensive set of fixed effects highlighted above. It shows that for both outcomes, if anything, the onset of the pandemic led to a decrease in the number of bad mental health days (Appendix 3 shows the corresponding regression results for the event study specification for both outcomes).

Figure 9: Event study plot for bad mental health days and extreme distress



Source: 2019 and 2020 BRFSS data.

Table 2 shows the estimates for the DID specification under both outcomes of interest. Although the magnitude of the coefficients decreases as we add more fixed effects and make the specification more flexible, even the specifications in columns (4) and (8) suggest that, if anything, mental health during the pandemic improved—again a very sharp contrast to what we find in sector 3.2 with the PHQ-2 and GAD-2 indicators.

Table 2: DID estimates for bad mental health days

Variables	**(1) Bad mental health days**	**(2) Bad mental health days**	**(3) Bad mental health days**	**(4) Bad mental health days**	**(5) Extreme distress**	**(6) Extreme distress**	**(7) Extreme distress**	**(8) Extreme distress**
March or later	0.451***	0.456***	0.426***		0.009***	0.008***	0.008***	
	(0.089)	(0.084)	(0.084)		(0.003)	(0.003)	(0.003)	
Year 2020	0.415***	0.418***	0.376***		0.009***	0.008**	0.007**	
	(0.120)	(0.116)	(0.114)		(0.003)	(0.003)	(0.003)	
(March or later) × (Year 2020)	-0.515***	-0.507***	-0.462***	-0.362**	-0.014***	-0.012***	-0.011***	-0.009**
	(0.129)	(0.125)	(0.123)	(0.153)	(0.004)	(0.004)	(0.004)	(0.004)

Observations	791,597	749,278	749,278	749,278	791,597	749,278	749,278	749,278
R-squared	0.000	0.086	0.088	0.091	0.000	0.040	0.042	0.044
Day of Week FEs	N	N	Y	Y	N	N	Y	Y
State FEs	N	N	Y	Y	N	N	Y	Y
State x Year FEs	N	N	N	Y	N	N	N	Y
State x Month FEs	N	N	N	Y	N	N	N	Y
State x Day of Week FEs	N	N	Y	Y	N	N	Y	Y
Socio-demographic controls	N	Y	Y	Y	N	Y	Y	Y

*** p<0.01; ** p<0.05; * p<0.1

Source: 2019 and 2020 BRFSS data.

Note: Robust standard errors, clustered by interview date. All specifications have year FEs and control for race, age, gender, income, education, marital status, and employment status.

3.5. Did the pandemic worsen mental health?

Part 4: Reconciling various measures.

We can see that different mental health measures lead to drastically different conclusions. For example, a comparison of HPS with NHIS data would show that the pandemic pushed up ill-being substantially. Looking at BRFSS, however, we reach the opposite conclusion. This makes it clear that we need better and more standardized ill-being and mental health measures.

One way to gain more insight into the conflicting measures is to look at the 2019 NHIS, which contained both the GAD-2/PHQ-2 and the depression/anxiety frequency questions. We present the unweighted two-way tables below. We first present the simplified tables with binary outcomes—the ones used in our regressions—then the more detailed tables with the GAD/PHQ score and the actual frequency of depression/anxiety as defined by NHIS.

Table 3a: Unweighted frequency table of NHIS 2019 responses to anxiety-related questions (binary coded):

	Not anxious at least weekly	Anxious at least weekly	Total
Does not have anxiety (GAD-2)	22,974	5,615	28,589
Has anxiety (GAD-2)	347	2,185	2,532
Total	23,321	7,800	31,121

(Correlation = 0.4205)

Table 3b: Unweighted frequency table of NHIS 2019 responses to anxiety-related questions:

	"How often do you feel worried, nervous or anxious? Would you say daily, weekly, monthly, a few times a year, or never?"					
	Daily	Weekly	Monthly	A few times a year	Never	Total
GAD-2 = 0	719	1,540	2,222	8,403	9,646	22,530
GAD-2 = 1	612	1,094	737	958	242	3,643
GAD-2 = 2	812	838	325	359	82	2,416

GAD-2 = 3	402	178	73	72	39	764
GAD-2 = 4	466	161	42	35	8	712
GAD-2 = 5	200	48	11	7	1	267
GAD-2 = 6	673	57	14	22	23	789
Total	3,884	3,916	3,424	9,856	10,041	31,121

Table 3c: Unweighted frequency table of NHIS 2019 responses to depression-related questions (binary coded):

	Not depressed at least weekly	Depressed at least weekly	Total
Does not have depression (PHQ-2)	27,242	1,778	29,020
Has depression (PHQ-2)	801	1,303	2,104
Total	28,043	3,081	31,124

(Correlation = 0.4691)

Table 3d: Unweighted frequency table of NHIS 2019 responses to depression-related questions:

	"How often do you feel depressed? Would you say daily, weekly, monthly, a few times a year, or never?"					
	Daily	Weekly	Monthly	A few times a year	Never	Total
PHQ-2 = 0	104	254	873	6,257	16,324	23,812
PHQ-2 = 1	141	381	576	1,249	691	3,038
PHQ-2 = 2	276	622	423	633	216	2,170
PHQ-2 = 3	176	149	111	188	155	779
PHQ-2 = 4	206	186	93	71	31	587
PHQ-2 = 5	105	46	16	18	4	189
PHQ-2 = 6	367	68	21	29	64	549
Total	17,485	1,375	1,706	2,113	8,445	31,124

These frequency tables clearly illustrate the different responses individuals have to the GAD-2 questions and the how often depressed/anxious questions. Note that if respondents say that they felt worried, nervous, or anxious daily, they are still more likely to *not* have anxiety (i.e., score two or lower on the GAD-2).

4. Study 2: Heterogeneity in depression and anxiety and its sociodemographic determinants

Empirical methodology

Here we return to anxiety and depression during the pandemic and examine its associations with various sociodemographic variables. We had already approached this topic in sections 3.1 and 3.2 but do so more formally here, taking a regression approach using a linear probability model.

Equation (3) represents the baseline specification:

(3) $Y_{ist} = \beta_0 + \beta_1 X_{ist} + \theta_s + \gamma_t + \varepsilon_{ist}$

where Y_i is the binary outcome of interest (depression as measured by PHQ-2 and anxiety by GAD-2) and X_i represents a vector of demographic variables (age, gender, race, income, education) for individual *i*,,

each executed as a vector of binary variables; θ_s and γ_t represent state and survey period/week fixed effects. Initially, each demographic variable is sequentially included as the sole demographic control, and in the last specification all are included simultaneously. Standard errors are clustered at the state level, and all regressions use the appropriate sampling weights.

We also examine the association between COVID-19 deaths and depression or anxiety. We first use the specification in equation (4) to look at COVID-19 death rates per 100,000 residents at the state-by-week level alone; we then augment equation (3) to include all of the demographic variables in equation (5).

(4) $Y_{ist} = \beta_0 + \beta_1 Z_{st} + \theta_s + \gamma_t + \varepsilon_{ist}$
(5) $Y_{ist} = \beta_0 + \beta_1 X_{ist} + \beta_2 Z_{st} + \theta_s + \gamma_t + \varepsilon_{ist}$

Results: HPS 2020 and 2021

Table 4 presents the results for depression[8] in 2020/2021, using HPS data. Section 3.2 already highlighted the large age and income gradients present in the 2020/2021 data and the fact that the gaps within groups typically widen considerably in 2020/2021. The main addition in Table 4 is a column at the end where all the socioeconomic controls and the COVID death rates are combined.

Table 4: Heterogeneity and determinants of depression in 2020/2021

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Race	**Sex**	**Age**	**Income**	**Education**	**Marital Status**	**Employ-ment**	**COVID deaths**	**All**
Race: Black	0.0412***								-0.0135***
	(0.0033)								(0.0028)
Race: Asian	-0.0270***								-0.0340***
	(0.0045)								(0.0031)
Race: Other/ Multirace	0.0947***								0.0472***
	(0.0043)								(0.0034)
Race: Hispanic	0.0529***								-0.0133***
	(0.0032)								(0.0034)
Sex: Male		-0.0376***							-0.0252***
		(0.0017)							(0.0014)

[8] The results for anxiety are similar to the ones reported in the main text for depression; they can be found in Appendix 4.

Age: 25–34			-0.0650***						-0.0165***
			(0.0045)						(0.0046)
Age: 35–44			-0.1317***						-0.0579***
			(0.0039)						(0.0037)
Age: 45–54			-0.1509***						-0.0756***
			(0.0050)						(0.0047)
Age: 55–64			-0.1796***						-0.1199***
			(0.0048)						(0.0047)
Age: 65+			-0.2437***						-0.2244***
			(0.0057)						(0.0058)
Income: 50,000 to 149,999				-0.0491***					-0.0274***
				(0.0023)					(0.0020)
Income: 150,000+				-0.1707***					-0.0905***
				(0.0027)					(0.0025)
Income: Missing				-0.0711***					-0.0662***
				(0.0030)					(0.0029)
Education: High school grad/GED					-0.0564***				-0.0380***
					(0.0148)				(0.0084)

Education: Some college					-0.0327***				-0.0267***
					(0.0136)				(0.0082)
Education: Associate's degree					-0.0715***				-0.0482***
					(0.0135)				(0.0090)
Education: Bachelor's degree					-0.1238***				-0.0863***
					(0.0140)				(0.0094)
Education: Graduate degree					-0.1703***				-0.0937***
					(0.0129)				(0.0088)
Marital status: Married						-0.1413***			-0.0881***
						(0.0021)			(0.0018)
Worked during last week: Yes							-0.0606***		-0.0917***
							(0.0031)		(0.0027)
COVID deaths per day per 100,000								0.0138***	0.0118***
								(0.0033)	(0.0035)
Constant	0.2358***	0.2680***	0.3979***	0.2975***	0.3209***	0.3339***	0.2808***	0.2400***	0.5253***
	(0.0052)	(0.0048)	(0.0065)	(0.0053)	(0.0138)	(0.0045)	(0.0052)	(0.0031)	(0.0114)
Observations	2,718,155	2,718,155	2,718,155	2,718,155	2,718,155	2,705,917	2,714,224	2,718,155	2,702,583

R-squared	0.0097	0.0077	0.0327	0.0186	0.0197	0.0318	0.0106	0.0059	0.0734
State FEs	Y	Y	Y	Y	Y	Y	Y	Y	Y
Week FEs	Y	Y	Y	Y	Y	Y	Y	Y	Y

Source: HPS data.

Note: Robust standard errors, clustered at the state level. The reference categories are white, female, ages 18-–24, total household income before taxes less than $50,000, less education than a high school diploma, not married, and did not work in the past week. All specifications include state and time fixed effects.

It is worth noting that in the last column, with all controls, the coefficients on age are nearly as large as they are in the naïve column (3), where only age is controlled for, whereas the coefficients for the income categories, also associated with a large magnitude in column (4), are about halved in column (9).

Another aspect of interest relates to the race groups: First, the naïve regression in column (1) shows that on average Blacks and Hispanics have worse mental health outcomes than Whites. However, after controlling for other covariates the coefficients switch signs in column (9). In other words, if we are comparing two respondents, one Black and the other White, the Black person is more likely to have depression. However, if the two respondents are in the same age, gender, and income brackets; have the same education, marital, and employment status; and reside in the same state, then the White respondent is more likely to have depression. This is consistent with the possibility that minorities are more resilient despite having worse material conditions (Graham and Pinto 2019).

Finally, state-week COVID-19 death rates remain positively associated with depression even after respondents' socioeconomic characteristics are accounted for. To give more context to the results, the standard deviation for daily COVID-19 deaths is 0.372157 (i.e., one increase in the standard deviation in COVID-19 deaths is associated with an 0.51 percentage point increase in the probability of having depression in the specification without sociodemographic variables).

Results: NHIS 2020 and BRFSS 2020

Given the data puzzle highlighted in section 3.2, the question is whether there is similar heterogeneity in determinants when using alternative measures of depression and anxiety. In this section, we replicate the procedure used in Table 4 (except for inclusion of the COVID death rates) but now based on NHIS and BRFSS data and the corresponding alternative indicators that were explored in sections 3.3 and 3.4. As the tables below show, unlike what we see in terms of the discrepancies in the results on changes in incidence, the heterogeneity in the determinants we obtain is consistent across the different mental health indicators. Table 5 displays results for the alternative depression measure in the 2020 NHIS, and the same regression for the alternative anxiety measure can be found in the Appendix.

Table 5: Heterogeneity and determinants of depression in 2020

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Race	**Sex**	**Age**	**Income**	**Education**	**Marital Status**	**Employment**	**All**
Race: Black	-0.0015							-0.0375***

	(0.0102)							(0.0103)
Race: Asian	-0.0618***							-0.0615***
	(0.0101)							(0.0106)
Race: Other/ Multirace	0.0322							-0.0021
	(0.0228)							(0.0230)
Race: Hispanic	-0.0283***							-0.0605***
	(0.0076)							(0.0087)
Sex: Male		-0.0363***						-0.0270***
		(0.0056)						(0.0056)
Age: 25–34			-0.0313**					0.0026
			(0.0143)					(0.0148)
Age: 35–44			-0.0483***					-0.0023
			(0.0137)					(0.0145)
Age: 45–54			-0.0380***					0.0018
			(0.0139)					(0.0145)
Age: 55–64			-0.0285**					-0.0057
			(0.0140)					(0.0147)
Age: 65+			-0.0497***					-0.0730***
			(0.0132)					(0.0147)

Income: 50,000 to 149,999				-0.0707***				-0.0487***
				(0.0066)				(0.0073)
Income: 150,000+				-0.0892***				-0.0579***
				(0.0076)				(0.0092)
Education: High school grad/GED					-0.0280**			-0.0270**
					(0.0128)			(0.0129)
Education: Some college					-0.0292**			-0.0280**
					(0.0133)			(0.0136)
Education: Associate's degree					-0.0509***			-0.0392***
					(0.0129)			(0.0132)
Education: Bachelor's degree					-0.0643***			-0.0410***
					(0.0121)			(0.0127)
Education: Graduate degree					-0.0839***			-0.0470***
					(0.0122)			(0.0128)
Marital Status: Married						-0.0596***		-0.0375***
						(0.0058)		(0.0063)
Worked during last week: Yes							-0.0670***	-0.0716***
							(0.0061)	(0.0078)

Constant	0.0968***	0.1071***	0.1252***	0.1415***	0.1332***	0.1216***	0.1327***	0.2684***
	(0.0074)	(0.0077)	(0.0139)	(0.0082)	(0.0125)	(0.0080)	(0.0083)	(0.0205)
Observations	20,794	20,793	20,745	20,794	20,694	20,381	20,390	20,219
R-squared	0.0049	0.0050	0.0039	0.0164	0.0080	0.0112	0.0133	0.0433
Region FEs	Y	Y	Y	Y	Y	Y	Y	Y
Quarter FEs	Y	Y	Y	Y	Y	Y	Y	Y

Source: NHIS data, alternative indicator.

Note: Robust standard errors, clustered at the state level. The reference categories are White, female, ages 18–24, annual family income less than $50,000, less education than a high school diploma, not married, and not employed. All specifications include region and quarter fixed effects.

Table 5 shows the results based on BRFSS data, with bad mental health days as the outcome of interest (all regressions are weighted using BRFSS sampling weights, have state and week fixed effects, and standard errors are robust and clustered at the state level).

The results are very similar to those in Table 3: Age and income gradients are particularly strong, although the latter is considerably reduced when all the controls are included in column (8), which is not the case in Table 4. Similarly, although the naïve regression in column (1) shows that Whites, Blacks, and Hispanics have the same incidence of bad mental health days as the population at large, which changes for column (8) where we account for their socioeconomic status: Then, White respondents report having had more than one additional bad mental health day over the previous month.

One additional characteristic is striking: in every subgroup, the largest coefficient is that associated with respondents who are "unable to work," and that does not meaningfully change once the remaining characteristics in column (8) are accounted for. This is consistent with the particularly low subjective well-being levels found by Graham and Pinto (2021) for this group in the U.S.

Table 6: Heterogeneity and determinants of bad mental health days in 2020

	(1) Bad mental health days (0-30)	**(2) Bad mental health days (0-30)**	**(3) Bad mental health days (0-30)**	**(4) Bad mental health days (0-30)**	**(5) Bad mental health days (0-30)**	**(6) Bad mental health days (0-30)**	**(7) Bad mental health days (0-30)**	**(8) Bad mental health days (0-30)**
Race: Black	-0.047							-1.170***
	(0.080)							(0.066)

Race: Hispanic	-0.014				-1.280***
	(0.127)				(0.114)
Race: Asian	-1.452***				-2.011***
	(0.239)				(0.228)
Race: Other/Multirace	1.453***				0.386**
	(0.236)				(0.190)
Gender: Male		-1.560***			-1.454***
		(0.094)			(0.097)
Age: 25-34			-0.835***		-0.459***
			(0.145)		(0.165)
Age: 35-44			-1.423***		-0.831***
			(0.148)		(0.153)
Age: 45-54			-1.720***		-1.366***
			(0.151)		(0.180)
Age: 55-64			-2.302***		-2.434***
			(0.124)		(0.166)
Age: 65+			-3.462***		-3.568***
			(0.153)		(0.263)
Income: $50k-$75k				-1.449***	-0.780***
				(0.105)	(0.076)
Income: >$75k				-2.056***	-1.152***
				(0.152)	(0.133)
Income: missing				-1.389***	-1.087***

				(0.105)				(0.121)
Education: HS graduate/GED					-0.638***			-0.382***
					(0.196)			(0.137)
Education: Some college/Technical school					-0.181			0.250**
					(0.158)			(0.111)
Education: College graduate and above					-1.455***			-0.281*
					(0.188)			(0.141)
Marital status: Married or unmarried couple						-1.915***		-0.949***
						(0.058)		(0.087)
Emp. status: Unemployed							2.503***	1.910***
							(0.199)	(0.169)
Emp. status: Unable to work							5.590***	5.474***
							(0.225)	(0.217)
Emp. status: Retired							-1.238***	0.355***
							(0.065)	(0.094)
Emp. status: Student							2.193***	0.572***
							(0.179)	(0.209)
Emp. status: Homemaker							0.295*	-0.024
							(0.169)	(0.159)
Observations	360,478	360,478	360,478	360,478	360,478	360,478	360,478	360,478
R-squared	0.007	0.014	0.023	0.016	0.009	0.018	0.046	0.079

Source: BRESS data, alternative indicator.

Note: Robust standard errors, clustered at the state level. The reference categories are White, female, ages 18-24, annual income less than $50,000, less than a high school diploma, not married, and employed for wages. All specifications include state and week fixed effects. *** p<0.01; ** p<0.05; * p<0.1.

5. Study 3: Did the pandemic have other, non-COVID, health consequences?

After analyzing COVID-era anxiety and depression, we turned to trends in other health outcomes as measured by EMS calls for suicide attempts,[9] ODs, behavioral and mental health, and gun violence.

Empirical Methods

As in sections 3.3 and 3.4, here we rely on an event study and a DID design and closely follow Leslie and Wilson (2020). Equation (6) outlines the event study specification:

$$(6)\quad EMS_{adwt} = \beta_1(Year2020_t) * \sum_{k=1}^{52} week_k + \theta_{a,t} + \gamma_{a,w} + \delta_{a,dow} + \varepsilon_{adwt}$$

EMS_{adwt} is the number of EMS calls related to attempted suicide, OD, behavioral and mental health, or gun violence for agency *a* on day *d* in week *w* and year *t*. We use this outcome both in levels and under an inverse hyperbolic sine (IHS) transformation to adjust for outliers without dropping agencies with zero calls of a given type on a particular day (Johnson 1949, Leslie and Wilson 2020).

$Year2020_t$ is an indicator variable; $(Year2020_t) * \sum_{k=1}^{52} week_k$, the interaction term between year and week, represents our variables of interest. If COVID affected the number of EMS calls, these interaction terms should become significant from week 12 forward. (Week 12 corresponds to the first week after Friday, March 13th, the date COVID was declared a national emergency in the United States.) We include fixed effects for agency-by-year ($\theta_{a,y}$), agency-by-week ($\gamma_{a,w}$), and agency-by-day-of-week ($\delta_{a,dow}$) to allow for nonlinear agency-level time trends in EMS calls.

To assess the average effect throughout the post-pandemic period in 2020, we also use a DID specification, as outlined in Equation (7):

$$(7)\quad EMS_{adwt} = \beta_1 Post_{at} * Year2020_{at} + \theta_{a,t} + \gamma_{a,w} + \delta_{a,dow} + \varepsilon_{adwt}$$

Here, the coefficient of interest is again the interaction term $Post_{at} * Year2020_{at}$. $Post_{at}$ is a binary variable that takes the value of one for weeks 12–52. All the remaining variables have the same referents as in equation (6).

Results

The various panels of Figure 10 summarize the results we obtain for the event study specifications (for the corresponding regression tables, see Appendix 5). Note that behavioral calls plummeted at the beginning of the pandemic but had rebounded to pre-pandemic levels by the end of June; however, these results need to be viewed with care, since the event study plot suggests that the parallel trends assumption is violated for this outcome.

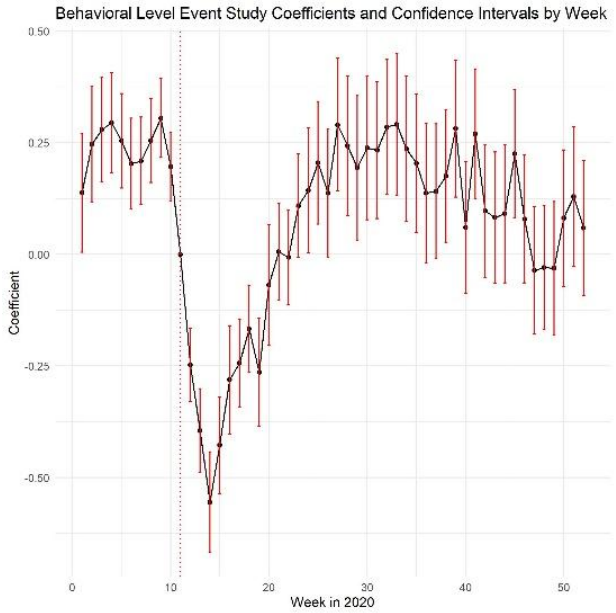
For the remaining three metrics (OD, suicide, and gun violence), the parallel assumption trend seems to hold, but there is little pandemic effect. Interestingly, immediately after the pandemic both OD and suicide calls diminish, though both seem to have reverted to the baseline within 10 weeks. The opposite seems to happen with gun violence calls, which rise as the pandemic begins and stay higher through the rest of the year.

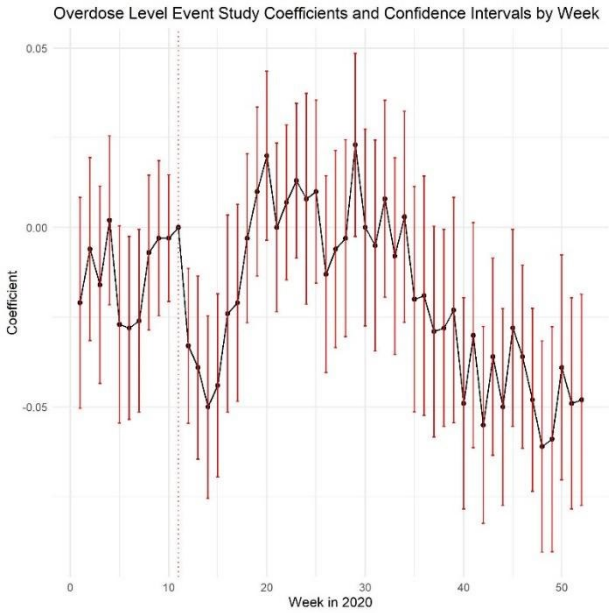
After controlling for agency-level time trends, the plots shown in Figure 10 display the correlation coefficients between numbered weeks and the number of EMS calls related to a given outcome category.

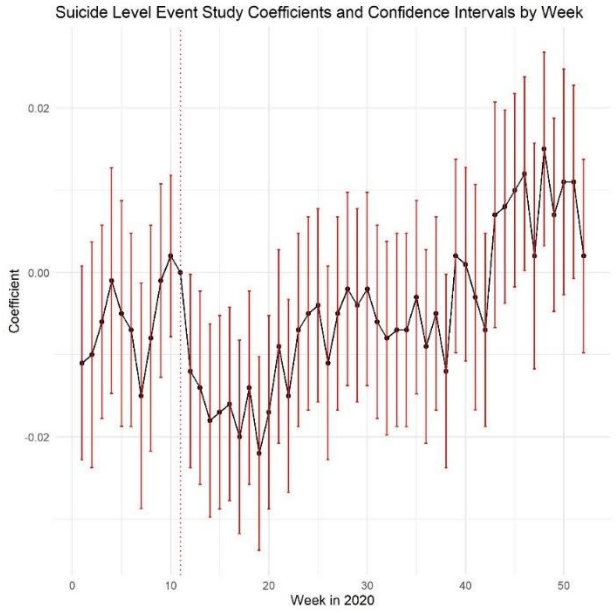
[9] **Suicide attempt code:** T14.91: This is only for attempted suicide; it does not include intentional self-harm of other types (see, for example, https://www.cdc.gov/nchs/data/nhsr/nhsr108.pdf).

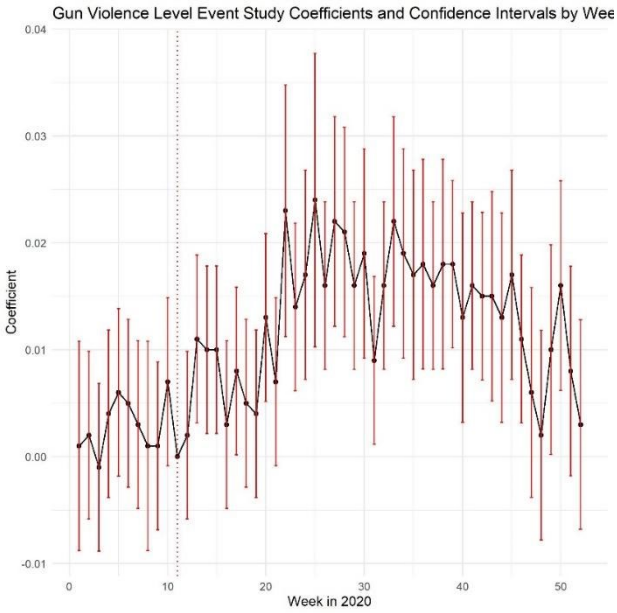
For example, a coefficient of three would indicate that EMS agencies received an average of three more calls daily related to the outcome variable in the week specified, compared to the average for all of 2020.

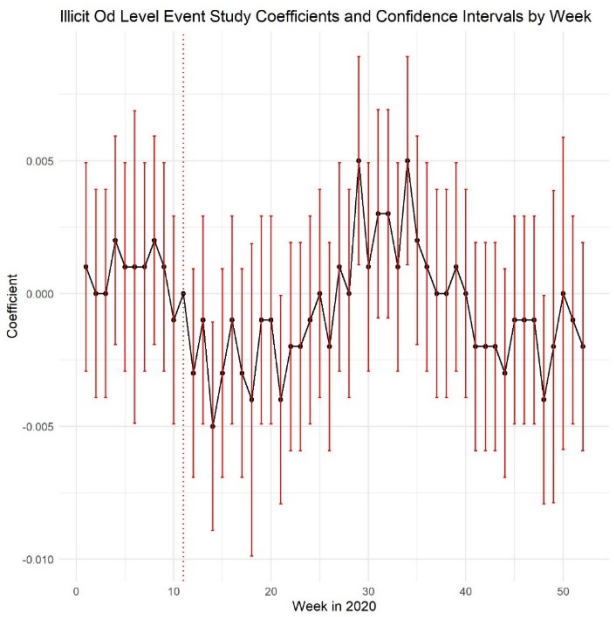
Figure 10: Event study plots for each NEMSIS outcome (in levels)

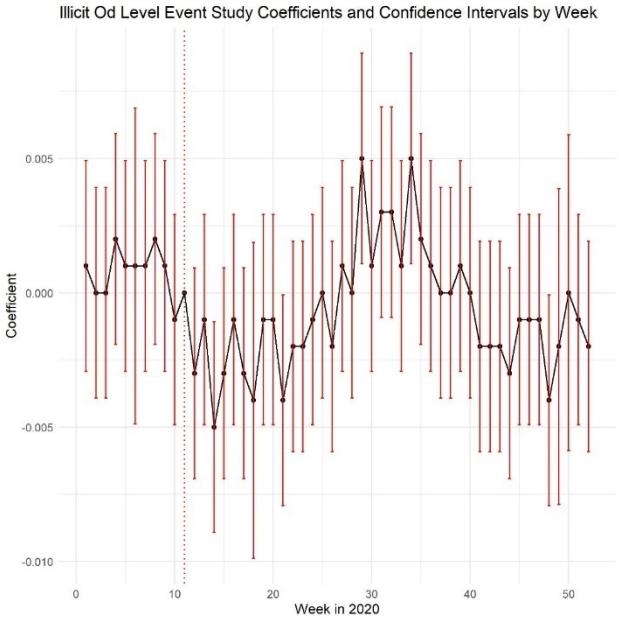


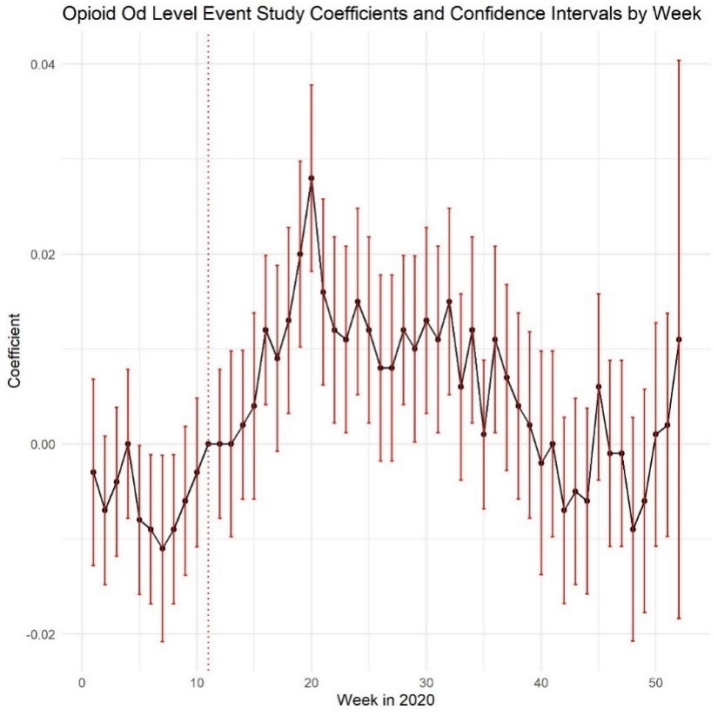







Illicit Od Level Event Study Coefficients and Confidence Intervals by Week
Coefficient
0.005
0.000
-0.005
-0.010
0
10
20
30
40
50
Week in 2020


Illicit Od Level Event Study Coefficients and Confidence Intervals by Week
Coefficient
0.005
0.000
-0.005
-0.010
0
10
20
30
40
50
Week in 2020


Opioid Od Level Event Study Coefficients and Confidence Intervals by Week
Coefficient
0.04
0.02
0.00
-0.02
0
10
20
30
40
50
Week in 2020

Controlling for outliers using the IHS transformation, we get the same results as above: A huge drop in behavioral calls at the start of the pandemic (though again hinting at a failure of the parallel trends assumption), but no significant changes in other outcomes (see Appendix 5).

Table 7 presents the DID estimates when the outcomes are defined in levels. They suggest that there was a statistically significant increase of 0.011 in gun violence-related EMS calls per day, per agency, after the pandemic began (column 6). Opioid OD calls also increased, by 0.012 calls per day, per agency (column 4). These results remain significant when the outcomes of interest incur the IHS transformation (see Appendix 5). The behavioral calls seem to decrease, but again those results may be unreliable given the failure of the parallel trends assumption. The remaining outcomes do not seem to be affected.

One explanation for the increase in opioid ODs while other ODs and illicit ODs were unchanged may be the rise of opioid overdose deaths, largely due to fentanyl, a usually illicit and highly lethal synthetic opioid. Another plausible explanation is a substitution effect, with prescription opioids replacing illicit drug use during the pandemic as many people stayed home and limited contact with outsiders.

Table 7: DID estimates (outcomes in levels)

	(1) Suicide	(2) Overdose	(3) Illicit OD	(4) Opioid OD	(5) Behavioral	(6) Gun violence
Post 2020 × Year 2020	0.000	-0.006	-0.002	0.012***	-0.174***	0.011***
	(0.002)	(0.010)	(0.002)	(0.003)	(0.049)	(0.002)
Constant	0.079***	0.284***	0.012***	0.050***	4.256***	0.048***
	(0.001)	(0.005)	(0.001)	(0.001)	(0.022)	(0.001)
Observations	2,170,873	2,170,873	2,170,873	2,170,873	2,170,873	2,170,873
R-squared	0.556	0.771	0.427	0.642	0.934	0.466
Year FEs	Y	Y	Y	Y	Y	Y
Week FEs	Y	Y	Y	Y	Y	Y
Day of Week FEs	Y	Y	Y	Y	Y	Y
Agency FEs	Y	Y	Y	Y	Y	Y
Agency × Year FEs	Y	Y	Y	Y	Y	Y
Agency × Week FEs	Y	Y	Y	Y	Y	Y
Agency × Day of Week FEs	Y	Y	Y	Y	Y	Y

Note: *** p<0.01; ** p<0.05; * p<0.1. Robust standard errors are clustered at the agency level.

After controlling for outliers in the outcomes of interest with an IHS transformation, our coefficients can be interpreted as a log transformation (for the regression tables, see Appendix 5).[10] Our results for this specification indicate that gun violence and opioid OD calls are both an average of 0.7 percent higher per day, per agency, during the pandemic period (relative to the assumed counterfactual). As before, suicide, OD, and illicit OD calls were not statistically significant.

[10] Happening during the pandemic period corresponds to a [coefficient * 100] percent change in the number of calls per day, per agency, for a given outcome.

6. Study 4: Connections between well-being and deaths of despair before and during the pandemic

Here, we build on previous research and ask (1) whether there were increases in deaths of despair or mental health problems, and (2) do we expect one to be associated with the other?

An important related question is whether despair was already increasing in the U.S. before COVID. Many markers suggest that was indeed the case. For example, in 2017 reported pain was higher in the U.S. than in 30 other countries, many of them less wealthy than the U.S. Meanwhile, for almost 20 years in the U.S. despair has been increasing for those who have less education than college (Blanchflower and Oswald 2019; 2020). U.S. pain reports are primarily driven by middle-aged Whites. who are far more likely to report pain than minorities, thus countering the pattern typical in most countries, where pain increases linearly with age (Graham and Pinto 2019; Stone et al. (2020). These results suggest that there is psychological in addition to physical pain.

We used the BRFSS data, also used by Blanchflower and Oswald (2019, 2020), to explore whether rates of deaths of despair at the micro and metropolitan statistical area (MMSA) levels) are predictive of poor mental health in subsequent years and the inverse, whether poorer mental health rates are predictive of higher rates of death in subsequent years. In line with earlier work (Graham and Pinto 2019) in which we matched trends of ill-being and well-being with those in deaths of despair, we took a longer-term look at the contemporaneous relationship between such deaths and mental health, based on the NVSS mortality data and the BRFSS for 2005–18. This analysis not only adds to the literature but also adds context to our analysis (section 5.2), which uses data collected during the pandemic.

Empirical methodology

Equation (8) describes the specification where we look at contemporaneous mental health and rates of deaths of despair (as in section 3.4, our main outcome variable is bad mental health days):

$$(8)\ Y_{ijt} = \alpha + \beta_1 ln\left(D_{jt}\right) + X_{ijt} + \gamma_t + \theta_j + \epsilon_{ijt}$$

where Y_{ijt} represents the number of bad mental health days for individual i, who lives in the j^{th} MMSA, in year t; with alternative specifications, it also represented extreme distress—a binary variable equal to 1 when someone reported having had 30 bad days in the previous 30 days. D_{jt} represents the rate of deaths of despair among those aged 35–64 per 100,000 residents in MMSA j and in year t; X_{ijt} represents the individual demographic controls; γ_t represent the year and θ_j represents MMSA fixed effects.

We also tested (1) whether deaths of despair are predictive of worse mental health in later years, and (2) whether poor mental health is predictive of later increases in deaths of despair. Equations (9) and (10) describe these specifications:

$$(9)\qquad Y_{ijt} = \alpha + \beta_1\ ln\ ln\left(D_{j(t-x)}\right) + X_{ijt} + \gamma_t + \theta_j + \epsilon_{ijt}$$

The only difference between this and equation (8) is that we add a lag variable, $D_{j(t-x)}$, that ranges from $(\mathrm{t}-1)$ to $(\mathrm{t}-6)$. In other words, we ran the regression six times for death rates from one to six years ago. We ran the analysis twice in each year, once with bad mental health days as the dependent variable and once with extreme distress. Appendix 6 gives the full results for these specifications.

Examining whether poor mental health is predictive of future increases in deaths of despair is slightly more complicated. The outcome variable—the deaths—is recorded not at the individual but at the MMSA level. Thus, we looked at the average number of bad mental health days per MMSA per year. We also created binary variables for every demographic category, which we then collapsed at the MMSA and year levels. For example, we have a variable that gives the proportion of those aged 35–44 in a given MMSA

during a given year. This allows us to examine whether the average number of bad mental health days in a given MMSA several years ago has any association with the rate of deaths of despair for the same demographic group living in a given MMSA today. This gives us the following regression:

$$(10) \qquad ln\ (D_{jt}) = \alpha + \beta_1 M_{j(t-x)} + X_{jt} + \gamma_t + \theta_j + \epsilon_{ijt}$$

where D_{jt} represents deaths of despair among 35–44-year-olds per 100,000 residents, in MMSA j and in year t; $M_{j(t-x)}$ is the average number of bad mental health days in the j^{th} MMSA in year $t - x$, with x ranging from zero to six.

Results

Table 8 shows the estimates we obtained from equation (8). As for the HPS regressions, the reference groups are White, ages 18–24, women, less than a high school education, not married, not employed, income below $50,000, and from 2005. As we can see, there is no significant association between contemporaneous mental health and the yearly rates of deaths of despair in the MMSA. In this section, we report only the coefficient for the main independent variable (see Appendix 6 for the full regression output.)

Table 8: Contemporaneous mental health and MMSA-level rates of deaths of despair.

	(1)	(2)
	Bad Mental Health Days	**Extreme Distress**
ln(deaths of despair rates, MMSA)	0.0811	-0.0838
	(0.115)	(0.235)
Observations	3,271,975	3,271,975
R-squared	0.091	0.052

Note: *** p<0.01; ** p<0.05; * p<0.1. Robust standard errors are clustered at the MMSA level. Both regressions use sampling weights and control for age, race, gender, education, employment status, marital status, and income, as well as year and MMSA fixed effects.

We then looked at the associations between mental health (at the individual level) and deaths of despair (measured at the MMSA level) in previous years, as formalized by equation (9). Table 9 summarizes the results we obtained when using lagged death rates. Each coefficient in Table 9 comes from a separate regression, using the same controls and fixed effects as Table 8; Appendix 6 shows the full regression results.

Table 8 shows that bad mental health days are positively associated with 2-to-4 year lagged deaths of despair rates, after controlling for demographic variables and for time and space fixed effects. In contrast, the extreme distress outcomes were not significant. It is possible that respondents who are already very depressed or in extreme distress are less likely to respond to events unrelated to their immediate concerns (Graham et al. 2011). The result could also relate to the construction of the variables: There is much more variance in the *number* of bad mental health days variable than there is for those reporting that all the previous month's days were bad.

Table 9: Mental health and lagged MMSA rates of deaths of despair

	Bad Mental Health Days	Extreme Distress
Lagged deaths: 6 years	0.229	0.373
	(0.168)	(0.343)
Lagged deaths: 5 years	0.214	-0.212
	(0.196)	(0.340)
Lagged deaths: 4 years	0.407***	0.417
	(0.145)	(0.326)
Lagged deaths: 3 years	0.340**	0.285
	(0.141)	(0.330)
Lagged deaths: 2 years	0.219**	0.185
	(0.102)	(0.263)
Lagged deaths: 1 years	0.0668	-0.0715
	(0.119)	(0.249)

Note: *** p<0.01; ** p<0.05; * p<0.1. Robust standard errors are clustered at the MMSA level. Each coefficient in each row comes from a separate regression with the column heading as the dependent variable. All regressions use sampling weights and include controls for age, race, gender, education, employment status, marital status, income, and year and MMSA fixed effects.

Table 10 shows the estimates we obtained from equation (10). Here, we used the death of despair rates as the outcome (in logs) and collapsed the data at the MMSA level. The two-to-three-year lagged MMSA average of bad mental health days is associated with deaths of despair.

Table 10: MMSA-level rates of deaths of despair and mental health

	ln(deaths of despair per 100,000 among 35–64-year-olds)
Avg. Bad mental health days	−0.00571
	(0.0117)
Avg. Bad mental health days: 1 year ago	−0.00221
	(0.0118)
Avg. Bad mental health days: 2 years ago	0.0276**
	(0.0136)
Avg. Bad mental health days: 3 years ago	0.0293**
	(0.0143)
Avg. Bad mental health days: 4 years ago	−0.0139
	(0.0174)
Avg. Bad mental health days: 5 years ago	−0.00937
	(0.0178)
Avg. Bad mental health days: 6 years ago	−0.0127
	(0.0215)

Note: *** p<0.01; ** p<0.05; * p<0.1. Robust standard errors are clustered at the MMSA level. Each coefficient in each row is coming from a separate regression, with the column heading as the dependent variable. All regressions include controls for the proportion of the age, race, gender, education, employment status, marital status, and income categories used in the regressions in Tables 7 and 8, as well as year and MMSA fixed effects.

Finally, we repeated the analysis for 2020 using HPS and NEMSIS data and replacing bad mental health days with anxiety and depression (as defined by HPS) and actual deaths of despair with EMS calls. Almost all key coefficients are insignificant. The NEMSIS data are aggregated by Census subdivision, rather than at the much more geographically disaggregated MMSAs, which leads to much less variation and could contribute to the non-significant results. Nonetheless, Appendix 7 reports our empirical methodology and results.

7. Discussion

We analyzed several data sets to explore trends in well- and ill-being and in deaths of despair before and after the onset of the COVID pandemic. Two main findings stand out.

(1) Researchers investigating mental and behavioral health trends must be cautious about relying too heavily on a single dataset; results generated from different data and using different questions may vary considerably.
(2) On some measures, high rates of depression and anxiety are correlated with high levels of suicide and OD years later. Once we have consistent data, identifying high levels of poor mental health may serve as an effective warning sign and enable communities to address needs before depression and anxiety result in a crisis of deaths of despair.

The arrival of COVID may have affected these findings, and there may have been important changes during and related to the course of the pandemic. However, the trends in HPS we observe over time are not as striking as those across race, income, gender, and age categories. However, as noted, these conclusions depend on the measures and the data set used; they are not seen in the BRFSS or the NHIS.

Note, however, that the demographic changes are more likely to last well beyond the life of the virus and illustrate the inequities in our health and other systems. The difference in the findings on trends by race—and the higher rates of increased anxiety and depression for minorities (who started at a lower level pre-pandemic) than for Whites likely reflect the higher burden of COVID-19 on them—especially lower income minorities—and the burden on the young, both psychologically and in terms of labor market outcomes. At the same time, the flip in the coefficients to relatively lower effects for minorities than for Whites once we control for income, age, and education, reflects their historical resilience (when comparing, for example, low-income Blacks to low-income Whites).[11]

Preliminary CDC data for 2020 on "excess" deaths of despair (suicide, OD, mental and behavioral) across the years due to the pandemic suggest a 30 percent increase in ODs: 93,000 for 2020 compared to 70,000 for 2019. Our analysis of first responder data, which shows no significant change in the rate of OD or suicide activations, does show an increase in opioid ODs in one of our two econometric specifications.

The discrepancy between our findings and the CDC data suggests that people may have been less likely to call an ambulance when an OD occurred during the pandemic. For example, it is likely that more ODs occurred when someone was alone, or there was more anxiety about getting medical care. Also, because it is difficult to disentangle intentional from unintentional ODs, there may be a substitution effect for

[11] One issue that we cannot resolve but likely affects our findings, is different norms of health for different races and cultures, with minorities much less likely to report depression and traditionally with lower rates of suicide than Whites, in part because of stigma against suicide. These issues are discussed in Assari (2017) and Graham et al. (2011).

suicide deaths from overdoses versus those stemming from other methods.[12] In mid-March there was a significant drop in the rate of mental and behavioral EMS calls, corresponding with the start of pandemic lockdowns, although the frequency of calls had rebounded to pre-pandemic levels by the beginning of June. In addition, these kinds of calls must be observed by another person to be reported, something that was also less likely to be possible during lockdowns.

Our examination of historical trends found that two- to four-year lagged poor mental health days are significant in later years for patterns in deaths of despair. Again, using the lagged specifications, we also found that previous rates of deaths of despair rates were also associated with an increase in poor mental health days.

A more nuanced and notable trend that we report but did not study in detail is that throughout the pandemic increases in ill-being coexisted with continued high levels of life satisfaction and hope for the future, particularly among minorities. While for most there were temporary decreases at the start of the March 2020 lockdowns, they went back down within a month for most population cohorts. It may well be that positive life evaluation measures were less affected by the uncertainties the pandemic brought, recalibration of expectations, and an empathy effect for the many others that fared much worse.

This study is a first step in understanding the complex interactions between our twin public health pandemics and their effects on our society's mental health. Our work yields a worrisome picture of these trends, with despair spreading to new population cohorts and more places, but it also draws attention to the need to collect consistent data and to improve tracking also of well-being metrics. Central to these efforts is systematic treatment for those dealing with mental health issues before it is too late.

[12] The percent of suicides attributable to opioid overdoses varies, both across states and according to different estimates. According to the CDC, of the 44,965 suicides in the U.S. in 2016, 50 percent were by gun violence and 15 percent by opioid overdose, although that percentage may have increase along with the steep rise in overdoses in 2018–20 (Oquendo and Volkow 2018).

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Appendix 1: Questionnaire wording and construction of key variables

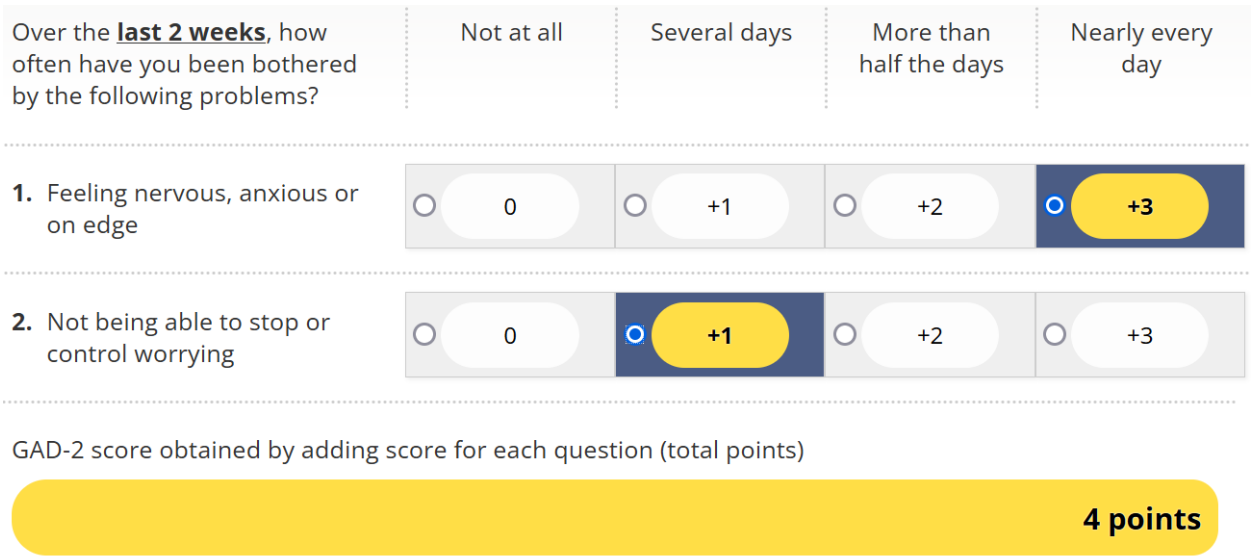
1) Dependent variables: Measures of anxiety and depression in the HPS and NHIS based on the GAD-2 and PHQ-2

Anxiety and depression in the HPS and the NHIS are measured using the Generalized Anxiety Disorder 2-Item (GAD-2) and the Patient Health Questionnaire 2-Item (PHQ-2) scales. GAD-2 and PHQ-2 are the first two questions on the longer GAD-7 and PHQ-9. The NHIS contains the longer versions, but the HPS does not. Thus, for consistency across datasets we used the shorter measures. Anxiety and depression are both coded as binary variables, where 1 represents having anxiety or depression and 0 otherwise.

Anxiety

The GAD-2 questions start with "*Over the last 2 weeks,*[13] *how often have you been bothered by the following problems…*". For the GAD-2, the two problems are "*Feeling nervous, anxious, or on edge*", and "*Not being able to stop or control worrying.*" Participants are then asked about how often the problems occur: "*Would you say not at all, several days, more than half the days, or nearly every day?*" "*Not at all*" is coded as zero, "*several days*" as one, "*more than half the days*" as two, and "*nearly every day*" as three. Adding up the responses from the two questions gives us the GAD-2 score, and a score larger than or equal to three is coded as corresponding to a respondent who has anxiety; that cutoff is commonly used. The survey example below, from the National HIV curriculum, shows how the GAD-2 is calculated.

Example 1: How the GAD-2 score was calculated:



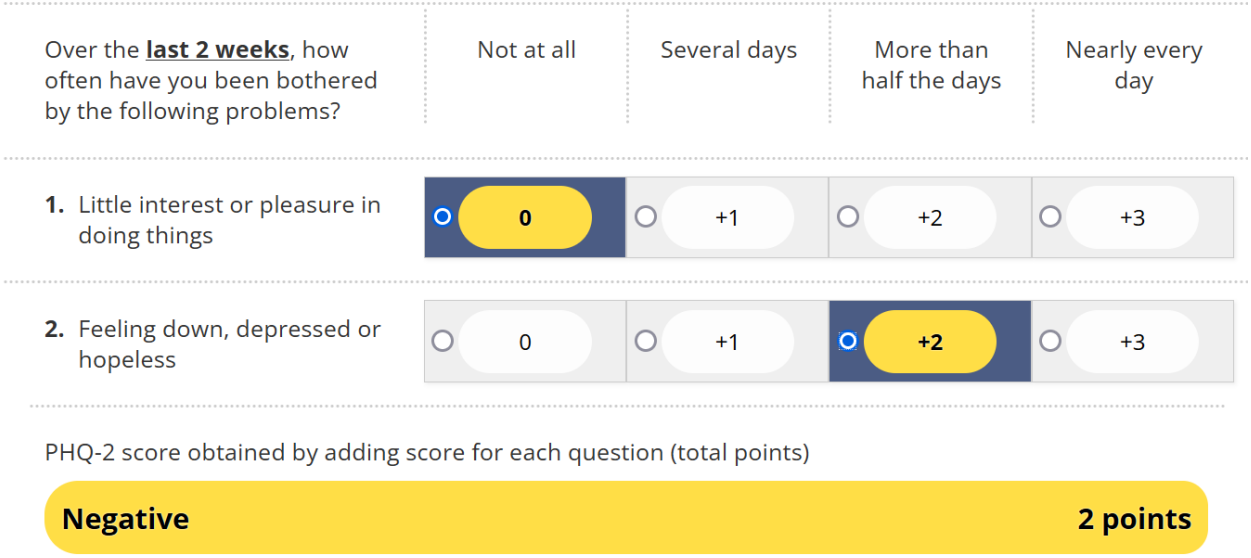
In this case, the respondent would be coded as having anxiety.

[13] In the HPS, for phases 1 through 3.1 the question is phrased as "*Over the last 7 days (…)*" instead of the past two weeks. Phase 3.2 uses "*Over the last 2 weeks (…).*" In the NHIS the retrospective period is two weeks.

Depression

Like the GAD-2, the PHQ-2 asks about the prevalence of certain symptoms over the past two weeks,[14] with the same frequency options, scoring system, and cutoff at three points. The problems surveyed in the PHQ-2 are "*Little interest or pleasure in doing things*" and "*Feeling down, depressed or hopeless,*" Here is the example from the National HIV Curriculum, where this respondent has a PHQ-2 score of two (2021b):

Example 2: How the total PHQ-2 was calculated:



Thus, this respondent would be coded as not having depression and assigned a zero.

Here's an example of one of the questions asked in the questionnaire in Phase 3.0 of HPS:

Q32 Over the **last 7 days**, how often have you been bothered by the following problems ... Feeling nervous, anxious, or on edge? Would you say not at all, several days, more than half the days, or nearly every day? *Select only one answer.*

- ○ Not at all (1)
- ○ Several days (2)
- ○ More than half the days (3)
- ○ Nearly every day (4)

(*Source*: U.S. Census Bureau, 2021)

[14] Once again, HPS uses "Over the last 7 days."

2) Dependent variables: Measures of depression and anxiety in the NHIS and BRFSS not based on the PHQ-2

In addition to the PHQ-2 and GAD-2, we also used indicators of mental health that either the BRFSS or the NHIS fielded consistently during 2019 and 2020. For the BRFSS, we used the following question: "*Now, thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?*" This variable was used both in its default 0–30 format and by converting it into a binary "*extreme distress*" that takes the value of one for the respondents who report 30 days of poor mental health and zero if fewer or none.

3) Dependent variables: NEMSIS overdose, suicide, and behavioral calls

Our dataset covered the universe of EMS calls reported by agencies that submitted data to NEMSIS in both 2019 and 2020. Since NEMSIS uses the ICD-10 medical coding system, we identified ICD-10 codes that corresponded to our variables of interest:

> ***Overdose* codes:** T36 T37 T38 T39 T40 T41 T42 T43 T44 T45 T46 T47 T48 T49 T50 X40 X41 X42 X43 X44 X60 X61 X62 X63 X64 X85 Y10 Y11 Y12 Y13 Y14
>
> These ICD-10 codes are drawn from Table 2: All Drug Poisoning in ICD-10 Codes Related to Poisoning and Pain. (CDC, 2013).
>
> ***Suicide attempt* code:** T14.91
>
> ***Gun violence* codes:** W32 W33 W34 X72 X73 X74 X93 X94 X95 Y22 Y23 Y24
>
> These codes are drawn from WHO (2012), https://www.gunpolicy.org/firearms/citation/quotes/6107.
>
> **Behavioral health codes:** F41.9 F41.1 R41.82 F32.9 F99 R45.89 R45.7 R46.2 R46 R45.8 (Handberry et al. 2021)

We then searched the following fields for relevant ICD-10 codes:

- Primary impression (fields eSituation_11) or secondary impression (eSituation_12),
- Primary (eSituation_09) or additional (eSituation_10) symptoms, and
- Cause of injury (eInjury_01).

An EMS call was coded as being an OD, suicide, gun violence, or behavioral health call if any of the fields contained an ICD-10 code from our definition lists. A call could be coded as of more than one type; for instance, in these data suicide attempt and OD are not mutually exclusive.

We then aggregated the number of calls per HPS week and Census Division and normalized to the 1,000,000 population level.

4) Independent variables in HPS, NHIS, and BRFSS

Variable used only in HPS:

COVID-19 deaths per 100,000 residents	This is the 14-day average daily COVD-19 deaths per 100,000 in the state of the respondent in the middle of each survey week as calculated by the New York Times.

Variables used in HPS, NHIS, and BRFSS

Race	Race was coded into five categories: White and non-Hispanic, Black and non-Hispanic, Asian and non-Hispanic, Other/Multiracial and non-Hispanic, and Hispanic.
Gender	Female and male—the only two options in Pulse and NHIS. For consistency, we used the gender assigned at birth variable for Pulse phase 3.2
Age	Coded into 6 age groups: 18–24, 25–34, 35–44, 45–54, 55–64, and 65+.
Household income	For HPS and NHIS, it is coded into four categories: $0–49,999 (low-income), $50,000–149,999 (mid-income), $150,000 and more (high-income), and missing. We included the missing category because a substantial number of individuals (7 percent+) who have anxiety and depression in HPS had missing income, and we did not want to omit them from the analysis. There are no missing incomes in NHIS. For BRFSS, the underlying income groups prevent us from coding it in the same way, so we use the following groups: $0–49,999 (low-income), $50,000–74,999 (Mid-income), $75,000 and more (high-income), and missing. In HPS, the question asked for income is: “In [year] what was your total household income before taxes?” The year is 2019 for phases 1 to 3.1, and 2020 for phase 3.2. In NHIS, the question asked is “What is your best estimate of [total income] from all sources, before taxes, in [last year]”

Education	For HPS and NHIS, it is coded into five categories: Less than or some high school, high school degree or GED, some college, associate degree, bachelor's degree, or graduate degree. For BRFSS, it is coded into four categories: Less than high school, high school degree or GED, some college or technical school, and bachelor's degree and above.
Marital status	Coded as either married, which also included unmarried cohabiting couples; or not married.
Employment	In HPS and NHIS, coded as 1 if the respondent worked last week, and zero otherwise. In BRFSS, coded in 6 categories: employed, unemployed, unable to work, retired, homemaker, and student.

Independent variables used only in HPS:

	The fourteen-day average daily COVD-19 deaths per 100,000 in the state of the respondent in the middle of each survey week as calculated by the *New York Times*.

Appendix 1 References:

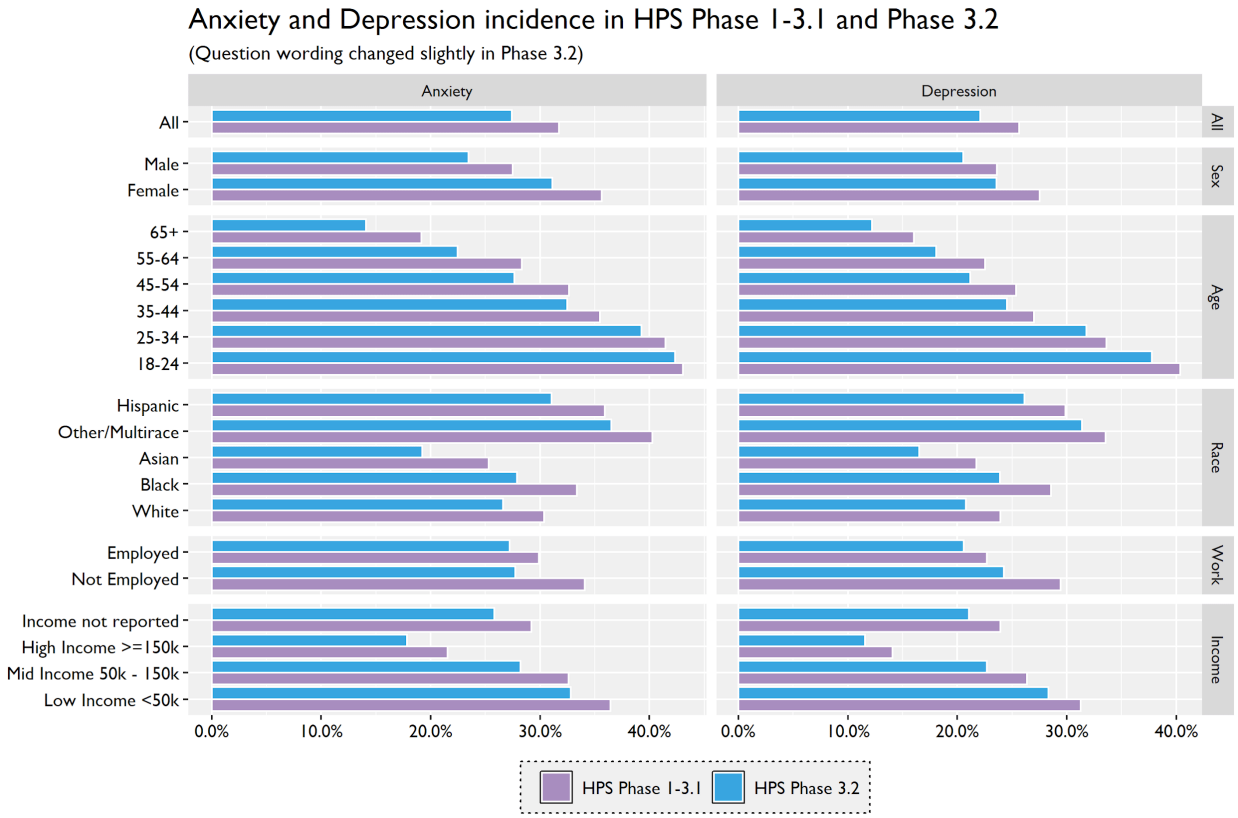
National HIV Curriculum. 2021a. “Generalized Anxiety Disorder 2-Item (GAD-2).” 2021. https://www.hiv.uw.edu/page/mental-health-screening/gad-2.

———. 2021b. “Patient Health Questionnaire-2 (PHQ-2).” 2021. https://www.hiv.uw.edu/page/mental-health-screening/phq-2.

Appendix 2: NHIS and HPS with identically-worded PHQ-2 and GAD-2 questions

As noted for the main text and Appendix 1, until Phase 3.2 HPS uses a shorter retrospective period in its PHQ and GAD items. To ensure that this difference is not what is driving the major change in incidence in 2020/2021, we generate a version of Figure 5 that treats 2021 as having two periods: (1), from May 1 through the end of Phase 3.1 on July 5, and (2) the Phase 3.2 period, July 21 to October 11.

Figure A2.1: Incidence of depression and anxiety, overall and by sociodemographic characteristic, Jan 2019–Oct-2021, with 2021 data coded in two periods



Appendix 3: Event study and DID regression results for bad mental health days and extreme distress, BRFSS 2019 and 2020

Table A3.1: Event study estimates for bad mental health days and extreme distress

Variables	(1) Bad mental health days	(2) Bad mental health days	(3) Bad mental health days	(4) Bad mental health days	(5) Extreme distress	(6) Extreme distress	(7) Extreme distress	(8) Extreme distress
(Year 2020) x (January)	-0.056	0.089	0.082	0.083	-0.005	-0.006	-0.006	-0.005
	(0.235)	(0.234)	(0.228)	(0.266)	(0.007)	(0.007)	(0.007)	(0.008)
(Year 2020) x (March)	-1.132***	-0.973***	-0.923***	-0.869***	-0.026***	-0.023***	-0.022***	-0.021***
	(0.202)	(0.202)	(0.201)	(0.229)	(0.006)	(0.006)	(0.006)	(0.006)
(Year 2020) x (April)	-0.360*	-0.401*	-0.344*	-0.300	-0.012**	-0.014**	-0.012**	-0.012*
	(0.207)	(0.207)	(0.207)	(0.239)	(0.006)	(0.006)	(0.006)	(0.007)
(Year 2020) x (May)	-0.634***	-0.625***	-0.574***	-0.507**	-0.018***	-0.018***	-0.016***	-0.014**
	(0.208)	(0.201)	(0.196)	(0.226)	(0.006)	(0.006)	(0.006)	(0.006)
(Year 2020) x (June)	-0.608***	-0.542**	-0.504**	-0.457*	-0.017***	-0.016**	-0.014**	-0.012*
	(0.232)	(0.231)	(0.225)	(0.250)	(0.006)	(0.007)	(0.007)	(0.007)
(Year 2020) x (July)	-0.188	-0.165	-0.195	-0.088	-0.002	-0.003	-0.004	-0.001
	(0.209)	(0.206)	(0.205)	(0.238)	(0.006)	(0.006)	(0.006)	(0.007)
(Year 2020) x (August)	-0.389*	-0.431**	-0.405*	-0.296	-0.010*	-0.011*	-0.012*	-0.011*
	(0.214)	(0.215)	(0.209)	(0.238)	(0.006)	(0.006)	(0.006)	(0.007)
(Year 2020) x (September)	-0.341	-0.374*	-0.374*	-0.263	-0.013**	-0.014**	-0.014**	-0.013**
	(0.225)	(0.220)	(0.219)	(0.249)	(0.006)	(0.006)	(0.006)	(0.006)
(Year 2020) x (October)	-0.288	-0.301	-0.227	-0.177	-0.009	-0.009	-0.006	-0.005
	(0.213)	(0.212)	(0.209)	(0.237)	(0.006)	(0.006)	(0.006)	(0.006)
(Year 2020) x (November)	-0.312	-0.182	-0.115	-0.074	-0.015***	-0.012**	-0.009	-0.009
	(0.217)	(0.212)	(0.211)	(0.241)	(0.006)	(0.006)	(0.006)	(0.006)

(Year 2020) x (December)	-0.380*	-0.277	-0.235	-0.132	-0.011**	-0.010*	-0.007	-0.006
	(0.210)	(0.202)	(0.199)	(0.218)	(0.006)	(0.006)	(0.006)	(0.006)
Observations	791,597	749,278	749,278	749,278	791,597	749,278	749,278	749,278
R-squared	0.001	0.087	0.089	0.091	0.000	0.040	0.042	0.044
Day of Week FEs	N	N	Y	Y	N	N	Y	Y
State FEs	N	N	Y	Y	N	N	Y	Y
State x Year FEs	N	N	N	Y	N	N	N	Y
State x Month FEs	N	N	N	Y	N	N	N	Y
State x Day of Week FEs	N	N	Y	Y	N	N	Y	Y
Socio-demographic controls	N	Y	Y	Y	N	Y	Y	Y

Note: Robust standard errors, clustered by interview date. All specifications have year and month Fes. *** p<0.01; ** p<0.05; * p<0.1

Appendix 4: Heterogeneity and determinants of anxiety in HPS and NHIS

Table A4.1: Heterogeneity and determinants of anxiety, 2020/2021

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Variables	**Race**	**Sex**	**Age**	**Income**	**Education**	**Marital Status**	**Employment**	**COVID deaths**	All
Race: Black	0.0246***								-0.0316***
	(0.0040)								(0.0032)
Race: Asian	-0.0583***								-0.0773***
	(0.0059)								(0.0039)
Race: Other/ Multirace	0.0954***								0.0439***
	(0.0047)								(0.0045)
Race: Hispanic	0.0469***								-0.0185***
	(0.0042)								(0.0043)
Sex: Male		-0.0809***							-0.0704***
		(0.0021)							(0.0019)
Age: 25–34			-0.0172***						0.0146***
			(0.0051)						(0.0051)
Age: 35--44			-0.0775***						-0.0228***
			(0.0043)						(0.0044)
Age: 45–54			-0.1096***						-0.0525***
			(0.0054)						(0.0054)
Age: 55-==–64			-0.1538***						-0.1117***
			(0.0079)						(0.0079)

Age: 65+			-0.2442***						-0.2413***
			(0.0086)						(0.0092)
Income: 50,000 to 149,999				-0.0383***					-0.0256***
				(0.0024)					(0.0024)
Income: 150,000+				-0.1494***					-0.0946***
				(0.0035)					(0.0030)
Income: Missing				-0.0690***					-0.0659***
				(0.0028)					(0.0033)
Education: High school grad/GED					-0.0579***				-0.0391***
					(0.0139)				(0.0078)
Education: Some college					-0.0183				-0.0152*
					(0.0130)				(0.0086)
Education: Associate's degree					-0.0479***				-0.0335***
					(0.0128)				(0.0092)
Education: Bachelor's degree					-0.0850***				-0.0572***
					(0.0139)				(0.0104)
Education: Graduate degree					-0.1239***				-0.0548***
					(0.0125)				(0.0091)
Marital status: Married						-0.1223***			-0.0693***
						(0.0020)			(0.0016)
Worked during							-0.0343***		-0.0811***

last week: Yes									
							(0.0029)		(0.0025)
COVID deaths per day per 100,000								0.0118***	0.0098***
								(0.0032)	(0.0033)
Constant	0.2990***	0.3474***	0.4256***	0.3482***	0.3646***	0.3820***	0.3265***	0.3005***	0.5687***
	(0.0054)	(0.0053)	(0.0090)	(0.0064)	(0.0158)	(0.0057)	(0.0049)	(0.0047)	(0.0173)
Observations	2,719,905	2,719,905	2,719,905	2,719,905	2,719,905	2,707,606	2,715,910	2,719,905	2,704,224
R-squared	0.0113	0.0152	0.0397	0.0165	0.0138	0.0247	0.0089	0.0076	0.0724
State Fes	Y	Y	Y	Y	Y	Y	Y	Y	Y
Week Fes	Y	Y	Y	Y	Y	Y	Y	Y	Y

Source: HPS data.

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A4.2: Heterogeneity and determinants of anxiety, 2020

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables:	Race	Sex	Age	Income	Education	Marital Status	Employment	All
Race: Black	-0.0836***							-0.1290***
	(0.0134)							(0.0137)
Race: Asian	-0.1548***							-0.1738***
	(0.0143)							(0.0151)
Race: Other/ Multirace	0.0376							-0.0114
	(0.0301)							(0.0297)

Race: Hispanic	-0.0938***							-0.1345***
	(0.0116)							(0.0127)
Sex: Male		-0.1081***						-0.1050***
		(0.0081)						(0.0081)
Age: 25–34			-0.0307					-0.0111
			(0.0199)					(0.0200)
Age: 35–44			-0.0738***					-0.0407**
			(0.0192)					(0.0194)
Age: 45–54			-0.0852***					-0.0555***
			(0.0193)					(0.0194)
Age: 55–64			-0.1115***					-0.1087***
			(0.0187)					(0.0189)
Age: 65+			-0.1811***					-0.2340***
			(0.0177)					(0.0188)
Income: 50,000 to 149,999				-0.0524***				-0.0514***
				(0.0091)				(0.0100)
Income: 150,000+				-0.0515***				-0.0674***
				(0.0122)				(0.0145)
Education: High school grad/GED					0.0086			-0.0131
					(0.0161)			(0.0160)
Education: Some college					0.0611***			0.0288
					(0.0176)			(0.0177)
Education: Associate's degree					0.0211			0.0071

					(0.0175)			(0.0177)
Education: Bachelor's degree					0.0291*			0.0207
					(0.0160)			(0.0168)
Education: Graduate degree					0.0283*			0.0464**
					(0.0170)			(0.0181)
Marital Status: Married						-0.0795***		-0.0452***
						(0.0083)		(0.0088)
Worked during last week: Yes							-0.0214**	-0.0738***
							(0.0085)	(0.0104)
Constant	0.2752***	0.2979***	0.3377***	0.2816***	0.2213***	0.2892***	0.2612***	0.5228***
	(0.0106)	(0.0110)	(0.0185)	(0.0118)	(0.0166)	(0.0113)	(0.0117)	(0.0248)
Observations	20,814	20,813	20,766	20,814	20,714	20,393	20,400	20,230
R-squared	0.0161	0.0181	0.0210	0.0063	0.0052	0.0113	0.0038	0.0712
Region FEs	Y	Y	Y	Y	Y	Y	Y	Y
Quarter FEs	Y	Y	Y	Y	Y	Y	Y	Y
1								

Source: NHIS data.

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.

Appendix 5: NEMSIS Event Study and IHS full regression results and graphs

Table A5.1: Event Study estimates (outcome in levels)

Variables	(1) Suicide	(2) Overdose	(3) Illicit_OD	(4) Opioid_OD	(5) Behavioral	(6) gun_violence
2020.year#1.week	-0.011*	-0.021	0.001	-0.003	0.138**	0.001
	(0.006)	(0.015)	(0.002)	(0.005)	(0.068)	(0.005)
2020.year#2.week	-0.010	-0.006	0.000	-0.007	0.247***	0.002
	(0.007)	(0.013)	(0.002)	(0.004)	(0.066)	(0.004)
2020.year#3.week	-0.006	-0.016	0.000	-0.004	0.279***	-0.001
	(0.006)	(0.014)	(0.002)	(0.004)	(0.060)	(0.004)
2020.year#4.week	-0.001	0.002	0.002	0.000	0.295***	0.004
	(0.007)	(0.012)	(0.002)	(0.004)	(0.057)	(0.004)
2020.year#5.week	-0.005	-0.027*	0.001	-0.008*	0.254***	0.006
	(0.007)	(0.014)	(0.002)	(0.004)	(0.054)	(0.004)
2020.year#6.week	-0.007	-0.028**	0.001	-0.009**	0.203***	0.005
	(0.006)	(0.013)	(0.003)	(0.004)	(0.052)	(0.004)
2020.year#7.week	-0.015**	-0.026**	0.001	-0.011**	0.209***	0.003
	(0.007)	(0.013)	(0.002)	(0.005)	(0.050)	(0.004)
2020.year#8.week	-0.008	-0.007	0.002	-0.009**	0.255***	0.001
	(0.007)	(0.011)	(0.002)	(0.004)	(0.048)	(0.005)
2020.year#9.week	-0.001	-0.003	0.001	-0.006	0.305***	0.001
	(0.006)	(0.011)	(0.002)	(0.004)	(0.045)	(0.004)
2020.year#10.week	0.002	-0.003	-0.001	-0.003	0.196***	0.007
	(0.005)	(0.009)	(0.002)	(0.004)	(0.039)	(0.004)
2020o.year#11b.week	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
2020.year#12.week	-0.012**	-0.033***	-0.003	-0.000	-0.248***	0.002
	(0.006)	(0.011)	(0.002)	(0.004)	(0.042)	(0.004)
2020.year#13.week	-0.014**	-0.039***	-0.001	-0.000	-0.395***	0.011**
	(0.006)	(0.013)	(0.002)	(0.005)	(0.048)	(0.004)
2020.year#14.week	-0.018***	-0.050***	-0.005**	0.002	-0.555***	0.010***
	(0.006)	(0.013)	(0.002)	(0.004)	(0.057)	(0.004)
2020.year#15.week	-0.017***	-0.044***	-0.003	0.004	-0.428***	0.010**
	(0.006)	(0.013)	(0.002)	(0.005)	(0.055)	(0.004)
2020.year#16.week	-0.016***	-0.024*	-0.001	0.012***	-0.281***	0.003
	(0.006)	(0.014)	(0.002)	(0.004)	(0.062)	(0.004)
2020.year#17.week	-0.020***	-0.021	-0.003	0.009*	-0.244***	0.008**
	(0.006)	(0.014)	(0.002)	(0.005)	(0.050)	(0.004)
2020.year#18.week	-0.014**	-0.003	-0.004	0.013***	-0.167***	0.005
	(0.006)	(0.012)	(0.003)	(0.005)	(0.050)	(0.004)
2020.year#19.week	-0.022***	0.010	-0.001	0.020***	-0.264***	0.004
	(0.006)	(0.012)	(0.002)	(0.005)	(0.062)	(0.004)

2020.year#20.week	-0.017***	0.020*	-0.001	0.028***	-0.069	0.013***
	(0.006)	(0.012)	(0.002)	(0.005)	(0.069)	(0.004)
2020.year#21.week	-0.009	0.000	-0.004	0.016***	0.006	0.007
	(0.006)	(0.012)	(0.002)	(0.005)	(0.055)	(0.004)
2020.year#22.week	-0.015**	0.007	-0.002	0.012**	-0.007	0.023***
	(0.006)	(0.011)	(0.002)	(0.005)	(0.054)	(0.006)
2020.year#23.week	-0.007	0.013	-0.002	0.011**	0.109*	0.014***
	(0.006)	(0.011)	(0.002)	(0.005)	(0.059)	(0.004)
2020.year#24.week	-0.005	0.008	-0.001	0.015***	0.143**	0.017***
	(0.006)	(0.015)	(0.002)	(0.005)	(0.071)	(0.005)
2020.year#25.week	-0.004	0.010	-0.000	0.012**	0.205***	0.024***
	(0.006)	(0.013)	(0.002)	(0.005)	(0.070)	(0.007)
2020.year#26.week	-0.011*	-0.013	-0.002	0.008*	0.137*	0.016***
	(0.006)	(0.014)	(0.002)	(0.005)	(0.073)	(0.004)
2020.year#27.week	-0.005	-0.006	0.001	0.008	0.290***	0.022***
	(0.006)	(0.014)	(0.002)	(0.005)	(0.076)	(0.005)
2020.year#28.week	-0.002	-0.003	-0.000	0.012***	0.243***	0.021***
	(0.006)	(0.014)	(0.002)	(0.004)	(0.080)	(0.005)
2020.year#29.week	-0.004	0.023*	0.005**	0.010**	0.194**	0.016***
	(0.006)	(0.013)	(0.002)	(0.005)	(0.083)	(0.004)
2020.year#30.week	-0.002	0.000	0.001	0.013***	0.238***	0.019***
	(0.006)	(0.014)	(0.002)	(0.005)	(0.082)	(0.005)
2020.year#31.week	-0.006	-0.005	0.003	0.011**	0.233***	0.009**
	(0.006)	(0.015)	(0.002)	(0.005)	(0.078)	(0.004)
2020.year#32.week	-0.008	0.008	0.003	0.015***	0.285***	0.016***
	(0.006)	(0.014)	(0.002)	(0.005)	(0.077)	(0.004)
2020.year#33.week	-0.007	-0.008	0.001	0.006	0.291***	0.022***
	(0.006)	(0.014)	(0.002)	(0.005)	(0.081)	(0.005)
2020.year#34.week	-0.007	0.003	0.005**	0.012**	0.236***	0.019***
	(0.006)	(0.015)	(0.002)	(0.005)	(0.083)	(0.005)
2020.year#35.week	-0.003	-0.020	0.002	0.001	0.204***	0.017***
	(0.006)	(0.016)	(0.002)	(0.004)	(0.079)	(0.005)
2020.year#36.week	-0.009	-0.019	0.001	0.011**	0.137*	0.018***
	(0.006)	(0.017)	(0.002)	(0.005)	(0.080)	(0.005)
2020.year#37.week	-0.005	-0.029**	-0.000	0.007	0.141*	0.016***
	(0.006)	(0.015)	(0.002)	(0.005)	(0.077)	(0.004)
2020.year#38.week	-0.012*	-0.028**	-0.000	0.004	0.175**	0.018***
	(0.006)	(0.014)	(0.002)	(0.005)	(0.076)	(0.005)
2020.year#39.week	0.002	-0.023	0.001	0.002	0.281***	0.018***
	(0.006)	(0.016)	(0.002)	(0.005)	(0.078)	(0.004)
2020.year#40.week	0.001	-0.049***	0.000	-0.002	0.060	0.013***
	(0.006)	(0.015)	(0.002)	(0.006)	(0.075)	(0.005)
2020.year#41.week	-0.003	-0.030*	-0.002	0.000	0.270***	0.016***
	(0.007)	(0.016)	(0.002)	(0.005)	(0.074)	(0.004)
2020.year#42.week	-0.007	-0.055***	-0.002	-0.007	0.097	0.015***
	(0.006)	(0.014)	(0.002)	(0.005)	(0.076)	(0.004)

2020.year#43.week	0.007	-0.036***	-0.002	-0.005	0.082	0.015***
	(0.007)	(0.014)	(0.002)	(0.005)	(0.075)	(0.005)
2020.year#44.week	0.008	-0.050***	-0.003	-0.006	0.091	0.013***
	(0.006)	(0.014)	(0.002)	(0.005)	(0.079)	(0.005)
2020.year#45.week	0.010	-0.028*	-0.001	0.006	0.225***	0.017***
	(0.006)	(0.014)	(0.002)	(0.005)	(0.073)	(0.005)
2020.year#46.week	0.012*	-0.036***	-0.001	-0.001	0.079	0.011***
	(0.006)	(0.013)	(0.002)	(0.005)	(0.073)	(0.004)
2020.year#47.week	0.002	-0.048***	-0.001	-0.001	-0.036	0.006
	(0.007)	(0.013)	(0.002)	(0.005)	(0.073)	(0.005)
2020.year#48.week	0.015**	-0.061***	-0.004*	-0.009	-0.030	0.002
	(0.006)	(0.015)	(0.002)	(0.006)	(0.071)	(0.005)
2020.year#49.week	0.007	-0.059***	-0.002	-0.006	-0.031	0.010**
	(0.006)	(0.016)	(0.003)	(0.006)	(0.076)	(0.005)
2020.year#50.week	0.011	-0.039**	0.000	0.001	0.081	0.016***
	(0.007)	(0.016)	(0.003)	(0.006)	(0.078)	(0.005)
2020.year#51.week	0.011*	-0.049***	-0.001	0.002	0.129	0.008
	(0.006)	(0.015)	(0.002)	(0.006)	(0.080)	(0.005)
2020.year#52.week	0.002	-0.048***	-0.002	0.011	0.059	0.003
	(0.006)	(0.015)	(0.002)	(0.015)	(0.077)	(0.005)
Constant	0.082***	0.291***	0.012***	0.053***	4.130***	0.046***
	(0.003)	(0.005)	(0.001)	(0.002)	(0.027)	(0.002)
Observations	2,170,873	2,170,873	2,170,873	2,170,873	2,170,873	2,170,873
R-squared	0.557	0.771	0.427	0.642	0.935	0.466
Year FEs	Y	Y	Y	Y	Y	Y
Week FEs	Y	Y	Y	Y	Y	Y
Day of Week FEs	Y	Y	Y	Y	Y	Y
Agency FEs	Y	Y	Y	Y	Y	Y
Agency x Year FEs	Y	Y	Y	Y	Y	Y
Agency x Week FEs	Y	Y	Y	Y	Y	Y
Agency x Day of Week FEs	Y	Y	Y	Y	Y	Y

Source: NEMSIS and IHHS data.

Note: *** p<0.01; ** p<0.05; * p<0.1

Table A5.2: Event Study estimates (outcome part of IHS transformation)

Variables	(1) Suicide	(2) Overdose	(3) Illicit_OD	(4) Opioid_OD	(5) Behavioral	(6) Gun_violence
2020.year#1.week	-0.011*	-0.021	0.001	-0.003	0.138**	0.001
	(0.006)	(0.015)	(0.002)	(0.005)	(0.068)	(0.005)
2020.year#2.week	-0.010	-0.006	0.000	-0.007	0.247***	0.002
	(0.007)	(0.013)	(0.002)	(0.004)	(0.066)	(0.004)

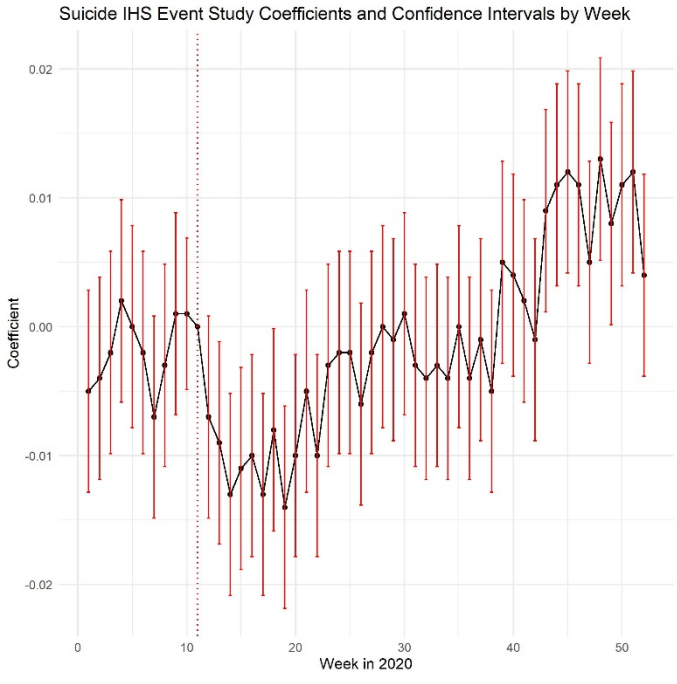
2020.year#3.week	-0.006	-0.016	0.000	-0.004	0.279***	-0.001
	(0.006)	(0.014)	(0.002)	(0.004)	(0.060)	(0.004)
2020.year#4.week	-0.001	0.002	0.002	0.000	0.295***	0.004
	(0.007)	(0.012)	(0.002)	(0.004)	(0.057)	(0.004)
2020.year#5.week	-0.005	-0.027*	0.001	-0.008*	0.254***	0.006
	(0.007)	(0.014)	(0.002)	(0.004)	(0.054)	(0.004)
2020.year#6.week	-0.007	-0.028**	0.001	-0.009**	0.203***	0.005
	(0.006)	(0.013)	(0.003)	(0.004)	(0.052)	(0.004)
2020.year#7.week	-0.015**	-0.026**	0.001	-0.011**	0.209***	0.003
	(0.007)	(0.013)	(0.002)	(0.005)	(0.050)	(0.004)
2020.year#8.week	-0.008	-0.007	0.002	-0.009**	0.255***	0.001
	(0.007)	(0.011)	(0.002)	(0.004)	(0.048)	(0.005)
2020.year#9.week	-0.001	-0.003	0.001	-0.006	0.305***	0.001
	(0.006)	(0.011)	(0.002)	(0.004)	(0.045)	(0.004)
2020.year#10.week	0.002	-0.003	-0.001	-0.003	0.196***	0.007
	(0.005)	(0.009)	(0.002)	(0.004)	(0.039)	(0.004)
2020o.year#11b.week	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
2020.year#12.week	-0.012**	-0.033***	-0.003	-0.000	-0.248***	0.002
	(0.006)	(0.011)	(0.002)	(0.004)	(0.042)	(0.004)
2020.year#13.week	-0.014**	-0.039***	-0.001	-0.000	-0.395***	0.011**
	(0.006)	(0.013)	(0.002)	(0.005)	(0.048)	(0.004)
2020.year#14.week	-0.018***	-0.050***	-0.005**	0.002	-0.555***	0.010***
	(0.006)	(0.013)	(0.002)	(0.004)	(0.057)	(0.004)
2020.year#15.week	-0.017***	-0.044***	-0.003	0.004	-0.428***	0.010**
	(0.006)	(0.013)	(0.002)	(0.005)	(0.055)	(0.004)
2020.year#16.week	-0.016***	-0.024*	-0.001	0.012***	-0.281***	0.003
	(0.006)	(0.014)	(0.002)	(0.004)	(0.062)	(0.004)
2020.year#17.week	-0.020***	-0.021	-0.003	0.009*	-0.244***	0.008**
	(0.006)	(0.014)	(0.002)	(0.005)	(0.050)	(0.004)
2020.year#18.week	-0.014**	-0.003	-0.004	0.013***	-0.167***	0.005
	(0.006)	(0.012)	(0.003)	(0.005)	(0.050)	(0.004)
2020.year#19.week	-0.022***	0.010	-0.001	0.020***	-0.264***	0.004
	(0.006)	(0.012)	(0.002)	(0.005)	(0.062)	(0.004)
2020.year#20.week	-0.017***	0.020*	-0.001	0.028***	-0.069	0.013***
	(0.006)	(0.012)	(0.002)	(0.005)	(0.069)	(0.004)
2020.year#21.week	-0.009	0.000	-0.004	0.016***	0.006	0.007
	(0.006)	(0.012)	(0.002)	(0.005)	(0.055)	(0.004)
2020.year#22.week	-0.015**	0.007	-0.002	0.012**	-0.007	0.023***
	(0.006)	(0.011)	(0.002)	(0.005)	(0.054)	(0.006)
2020.year#23.week	-0.007	0.013	-0.002	0.011**	0.109*	0.014***
	(0.006)	(0.011)	(0.002)	(0.005)	(0.059)	(0.004)
2020.year#24.week	-0.005	0.008	-0.001	0.015***	0.143**	0.017***
	(0.006)	(0.015)	(0.002)	(0.005)	(0.071)	(0.005)
2020.year#25.week	-0.004	0.010	-0.000	0.012**	0.205***	0.024***
	(0.006)	(0.013)	(0.002)	(0.005)	(0.070)	(0.007)

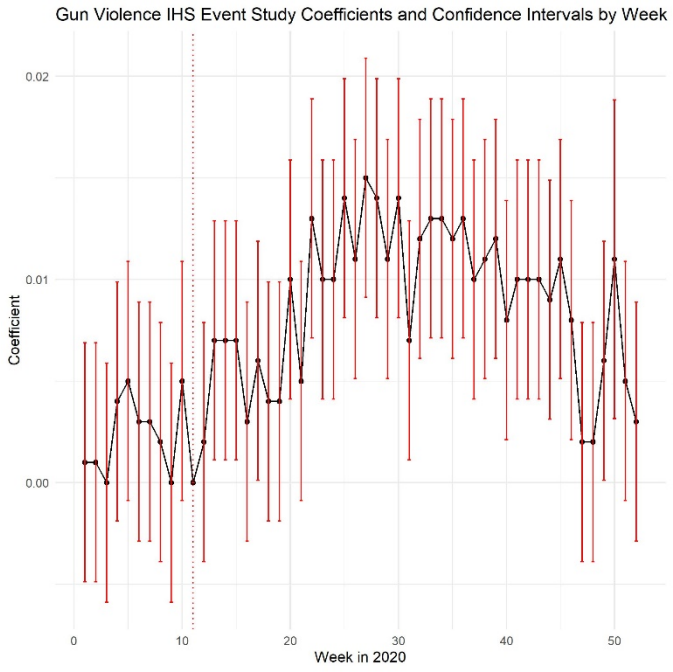
2020.year#26.week	-0.011*	-0.013	-0.002	0.008*	0.137*	0.016***
	(0.006)	(0.014)	(0.002)	(0.005)	(0.073)	(0.004)
2020.year#27.week	-0.005	-0.006	0.001	0.008	0.290***	0.022***
	(0.006)	(0.014)	(0.002)	(0.005)	(0.076)	(0.005)
2020.year#28.week	-0.002	-0.003	-0.000	0.012***	0.243***	0.021***
	(0.006)	(0.014)	(0.002)	(0.004)	(0.080)	(0.005)
2020.year#29.week	-0.004	0.023*	0.005**	0.010**	0.194**	0.016***
	(0.006)	(0.013)	(0.002)	(0.005)	(0.083)	(0.004)
2020.year#30.week	-0.002	0.000	0.001	0.013***	0.238***	0.019***
	(0.006)	(0.014)	(0.002)	(0.005)	(0.082)	(0.005)
2020.year#31.week	-0.006	-0.005	0.003	0.011**	0.233***	0.009**
	(0.006)	(0.015)	(0.002)	(0.005)	(0.078)	(0.004)
2020.year#32.week	-0.008	0.008	0.003	0.015***	0.285***	0.016***
	(0.006)	(0.014)	(0.002)	(0.005)	(0.077)	(0.004)
2020.year#33.week	-0.007	-0.008	0.001	0.006	0.291***	0.022***
	(0.006)	(0.014)	(0.002)	(0.005)	(0.081)	(0.005)
2020.year#34.week	-0.007	0.003	0.005**	0.012**	0.236***	0.019***
	(0.006)	(0.015)	(0.002)	(0.005)	(0.083)	(0.005)
2020.year#35.week	-0.003	-0.020	0.002	0.001	0.204***	0.017***
	(0.006)	(0.016)	(0.002)	(0.004)	(0.079)	(0.005)
2020.year#36.week	-0.009	-0.019	0.001	0.011**	0.137*	0.018***
	(0.006)	(0.017)	(0.002)	(0.005)	(0.080)	(0.005)
2020.year#37.week	-0.005	-0.029**	-0.000	0.007	0.141*	0.016***
	(0.006)	(0.015)	(0.002)	(0.005)	(0.077)	(0.004)
2020.year#38.week	-0.012*	-0.028**	-0.000	0.004	0.175**	0.018***
	(0.006)	(0.014)	(0.002)	(0.005)	(0.076)	(0.005)
2020.year#39.week	0.002	-0.023	0.001	0.002	0.281***	0.018***
	(0.006)	(0.016)	(0.002)	(0.005)	(0.078)	(0.004)
2020.year#40.week	0.001	-0.049***	0.000	-0.002	0.060	0.013***
	(0.006)	(0.015)	(0.002)	(0.006)	(0.075)	(0.005)
2020.year#41.week	-0.003	-0.030*	-0.002	0.000	0.270***	0.016***
	(0.007)	(0.016)	(0.002)	(0.005)	(0.074)	(0.004)
2020.year#42.week	-0.007	-0.055***	-0.002	-0.007	0.097	0.015***
	(0.006)	(0.014)	(0.002)	(0.005)	(0.076)	(0.004)
2020.year#43.week	0.007	-0.036***	-0.002	-0.005	0.082	0.015***
	(0.007)	(0.014)	(0.002)	(0.005)	(0.075)	(0.005)
2020.year#44.week	0.008	-0.050***	-0.003	-0.006	0.091	0.013***
	(0.006)	(0.014)	(0.002)	(0.005)	(0.079)	(0.005)
2020.year#45.week	0.010	-0.028*	-0.001	0.006	0.225***	0.017***
	(0.006)	(0.014)	(0.002)	(0.005)	(0.073)	(0.005)
2020.year#46.week	0.012*	-0.036***	-0.001	-0.001	0.079	0.011***
	(0.006)	(0.013)	(0.002)	(0.005)	(0.073)	(0.004)
2020.year#47.week	0.002	-0.048***	-0.001	-0.001	-0.036	0.006
	(0.007)	(0.013)	(0.002)	(0.005)	(0.073)	(0.005)
2020.year#48.week	0.015**	-0.061***	-0.004*	-0.009	-0.030	0.002
	(0.006)	(0.015)	(0.002)	(0.006)	(0.071)	(0.005)

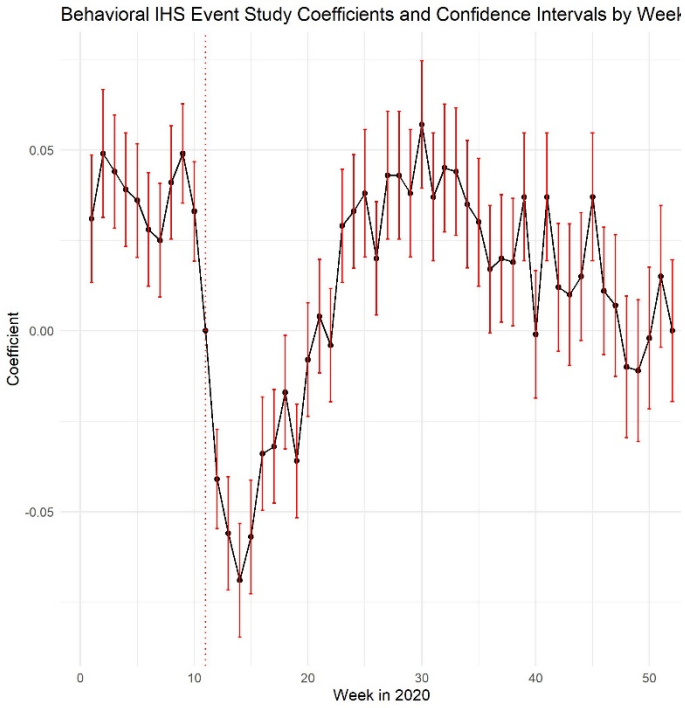
2020.year#49.week	0.007	-0.059***	-0.002	-0.006	-0.031	0.010**
	(0.006)	(0.016)	(0.003)	(0.006)	(0.076)	(0.005)
2020.year#50.week	0.011	-0.039**	0.000	0.001	0.081	0.016***
	(0.007)	(0.016)	(0.003)	(0.006)	(0.078)	(0.005)
2020.year#51.week	0.011*	-0.049***	-0.001	0.002	0.129	0.008
	(0.006)	(0.015)	(0.002)	(0.006)	(0.080)	(0.005)
2020.year#52.week	0.002	-0.048***	-0.002	0.011	0.059	0.003
	(0.006)	(0.015)	(0.002)	(0.015)	(0.077)	(0.005)
Constant	0.082***	0.291***	0.012***	0.053***	4.130***	0.046***
	(0.003)	(0.005)	(0.001)	(0.002)	(0.027)	(0.002)
Observations	2,170,873	2,170,873	2,170,873	2,170,873	2,170,873	2,170,873
R-squared	0.557	0.771	0.427	0.642	0.935	0.466
Year FEs	Y	Y	Y	Y	Y	Y
Week FEs	Y	Y	Y	Y	Y	Y
Day of Week FEs	Y	Y	Y	Y	Y	Y
Agency FEs	Y	Y	Y	Y	Y	Y
Agency × Year FEs	Y	Y	Y	Y	Y	Y
Agency × Week FEs	Y	Y	Y	Y	Y	Y
Agency × Day of Week FEs	Y	Y	Y	Y	Y	Y

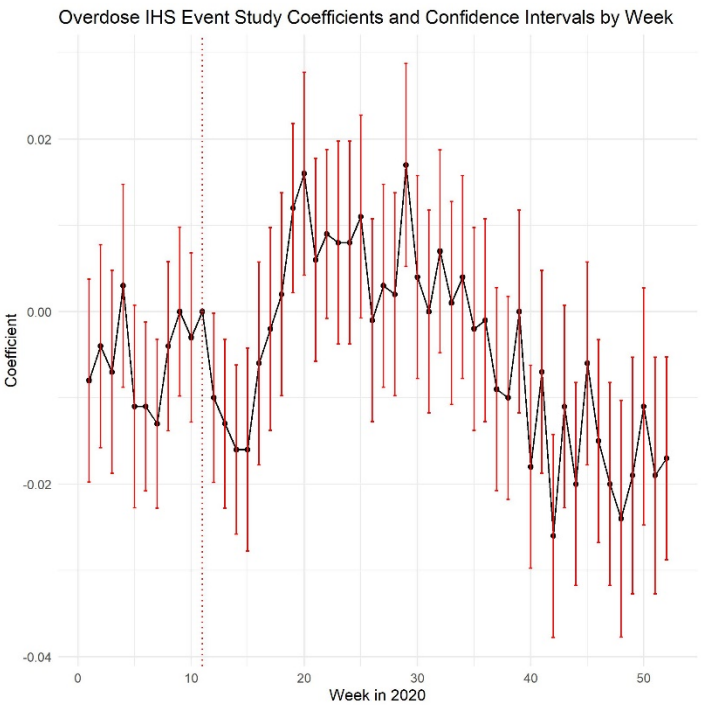
Note *** p<0.01; ** p<0.05; * p<0.1

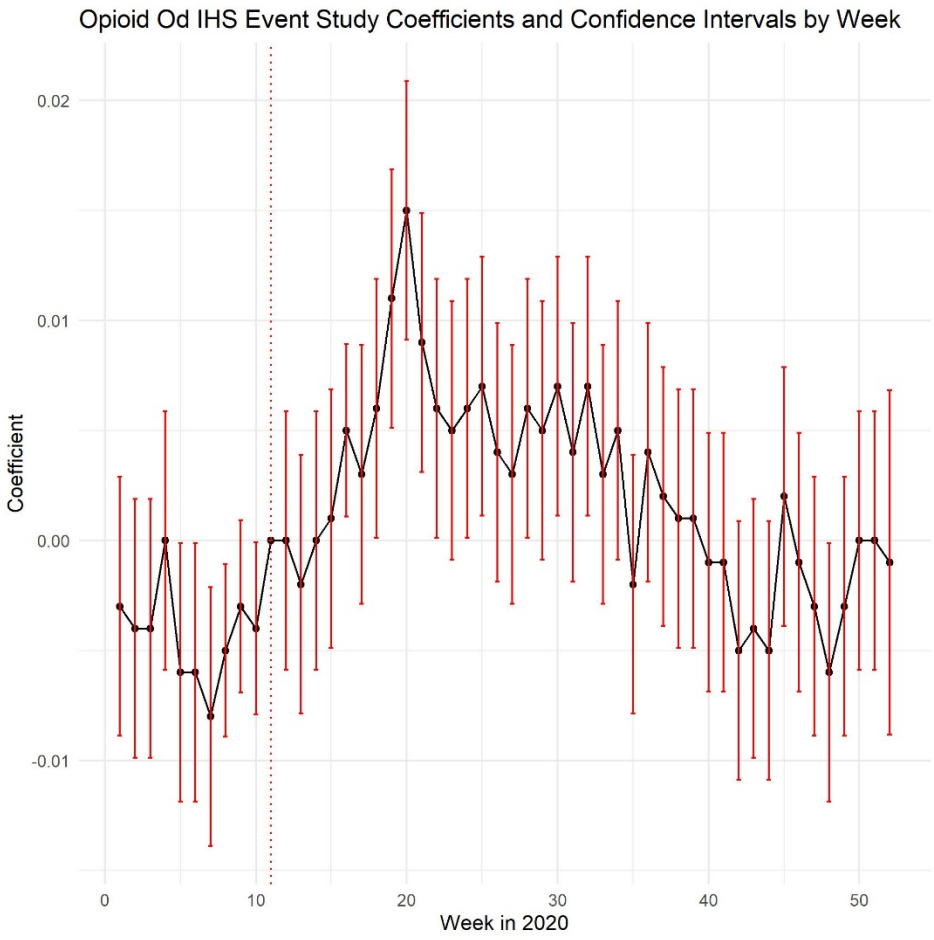
Figure A5.1: Event study plots for each of the NEMSIS outcomes (part of IHS transformation).

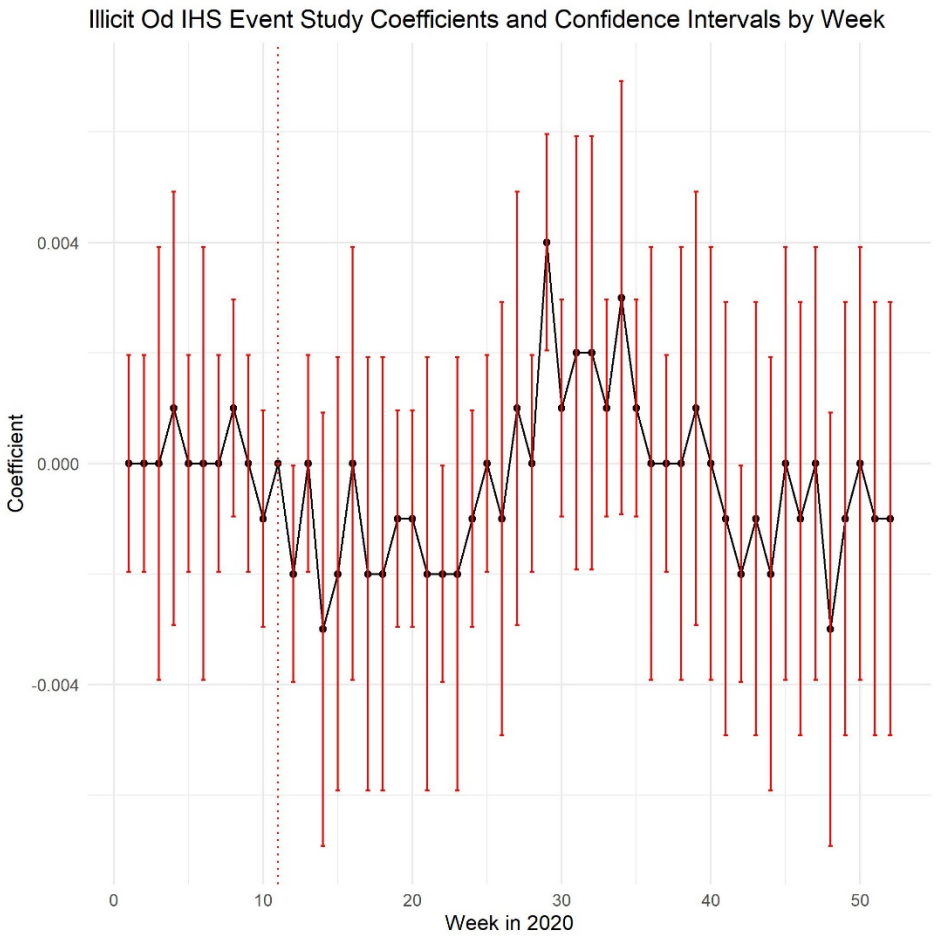





Behavioral IHS Event Study Coefficients and Confidence Intervals by Week
Coefficient
0.05
0.00
-0.05
0
10
20
30
40
50
Week in 2020


Overdose IHS Event Study Coefficients and Confidence Intervals by Week
Coefficient
0.02
0.00
-0.02
-0.04
0
10
20
30
40
50
Week in 2020


Opioid Od IHS Event Study Coefficients and Confidence Intervals by Week
0.02
0.01
0.00
-0.01
Coefficient
0
10
20
30
40
50
Week in 2020


Illicit Od IHS Event Study Coefficients and Confidence Intervals by Week
Coefficient
0.004
0.000
-0.004
0
10
20
30
40
50
Week in 2020

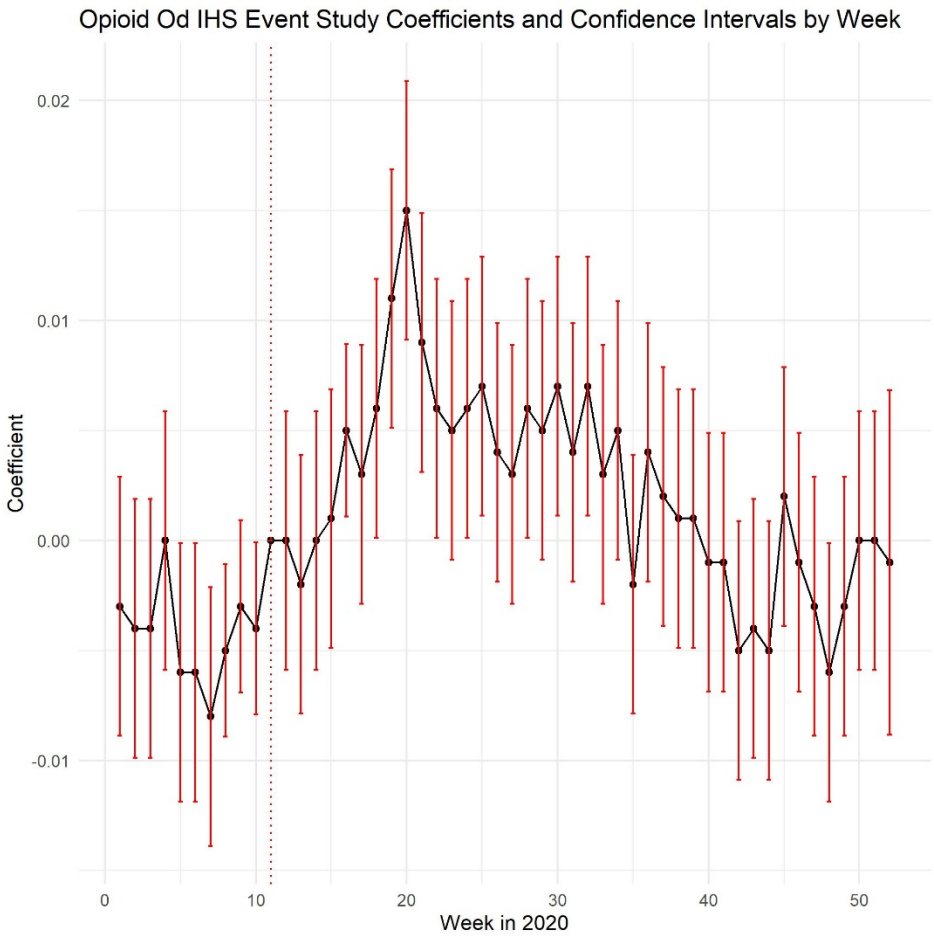


Table A5.3: DID estimates (outcomes under IHS transformation)

Variables	(1) Suicide	(2) his OD	(3) ihsillicit_od	(4) ihsopioid_od	(5) ihsbehavioral	(6) ihsgun_violence
1.post#1.year_2020	0.001	0.003	-0.000	0.007***	-0.013***	0.007***
	(0.001)	(0.003)	(0.001)	(0.001)	(0.004)	(0.001)
Constant	0.068***	0.159***	0.008***	0.031***	1.544***	0.034***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.002)	(0.000)
Observations	2,171,621	2,171,621	2,171,621	2,171,621	2,171,621	2,171,621
R-squared	0.392	0.612	0.381	0.551	0.791	0.376
Year FEs	Y	Y	Y	Y	Y	Y
Week FEs	Y	Y	Y	Y	Y	Y
Day of Week FEs	Y	Y	Y	Y	Y	Y
Agency FEs	Y	Y	Y	Y	Y	Y

Agency x Year FEs	Y	Y	Y	Y	Y	Y
Agency x Week FEs	Y	Y	Y	Y	Y	Y
Agency x Day of Week FEs	Y	Y	Y	Y	Y	Y

Note: *** p<0.01; ** p<0.05; * p<0.1

Appendix 6: BRFSS and NVSS Tables

Table A6.1: ***Lagged Deaths of Despair and Bad Mental Health Days***

	(1)	(2)
	Bad Mental Health Days	**Extreme Distress**
Ln(Deaths of despair rates, MMSA)	0.0811	-0.0838
	(0.115)	(0.235)
Age: 25–34	0.0716**	1.449***
	(0.0356)	(0.104)
Age: 35–44	-0.0144	1.693***
	(0.0489)	(0.142)
Age: 45–54	-0.180***	1.845***
	(0.0543)	(0.149)
Age: 55–64	-0.837***	0.834***
	(0.0830)	(0.190)
Age: 65+	-2.126***	-1.394***
	(0.116)	(0.300)
Race: Black	-0.806***	-1.560***
	(0.0598)	(0.160)
Race: Asian	-1.139***	-1.712***
	(0.0703)	(0.208)
Race: Other/ Multirace	0.642***	1.694***
	(0.0698)	(0.216)
Race: Hispanic	-0.988***	-1.771***
	(0.0663)	(0.149)
Sex: Male	-0.996***	-1.213***
	(0.0333)	(0.0752)
Year: 2006	0.0863	0.262
	(0.0584)	(0.192)
Year: 2007	0.0953*	0.287
	(0.0565)	(0.179)
Year: 2008	0.141**	0.473***
	(0.0638)	(0.150)
Year: 2009	0.135**	0.365***
	(0.0599)	(0.139)
Year: 2010	0.196***	0.338***
	(0.0600)	(0.124)
Year: 2011	0.236***	0.377***
	(0.0636)	(0.127)
Year: 2012	0.232***	0.462**
	(0.0621)	(0.195)

Year: 2013	0.150**	0.400***
	(0.0638)	(0.141)
Year: 2014	0.120*	0.408**
	(0.0675)	(0.171)
Year: 2015	0.224***	0.400*
	(0.0810)	(0.207)
Year: 2016	0.282***	0.682***
	(0.0804)	(0.220)
Year: 2017	0.497***	0.905***
	(0.111)	(0.178)
Year: 2018	0.622***	1.196***
	(0.0922)	(0.205)
Education: High school grad/GED	-0.644***	-1.484***
	(0.0651)	(0.211)
Education: One to three years of college or technical school	-0.501***	-1.465***
	(0.0742)	(0.240)
Education: College graduate with four or more years of college	-1.207***	-2.997***
	(0.0794)	(0.231)
Employ = 2, Self-employed	0.179***	0.530***
	(0.0235)	(0.0754)
Employ = 3, Out of work for 1 year or more	3.027***	7.075***
	(0.126)	(0.344)
Employ = 4, out of work for less than 1 year	2.222***	4.639***
	(0.0765)	(0.223)
Employ = 5, Homemaker	0.101**	0.576***
	(0.0485)	(0.111)
Employ = 6, Student	0.383***	-0.0472
	(0.0437)	(0.132)
Employ = 7, Retired	0.468***	1.352***
	(0.0404)	(0.137)
Employ = 8, Unable to work	7.467***	17.54***
	(0.132)	(0.394)
Marital status: Married	-0.900***	-1.589***
	(0.0267)	(0.0583)
Income: 50,000–74,999	-0.927***	-1.182***
	(0.0260)	(0.109)
Income: 75,000 or more	-0.699***	-1.532***
	(0.0485)	(0.113)
Income: Missing	-1.117***	-2.083***
	(0.0551)	(0.118)

Constant	5.419***	7.310***
	(0.443)	(0.965)
Observations	3,271,975	3,271,975
R-squared	0.091	0.052

Note: *** p<0.01; ** p<0.05; * p<0.1. Robust standard errors are clustered at the MMSA level.

Table A6.2 Lagged deaths and Bad mental health days:

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	**Average Bad Mental Health Days at Time Zero**					
Lagged deaths: 6 years	0.229					
	(0.168)					
Lagged deaths: 5 years		0.214				
		(0.196)				
Lagged deaths: 4 years			0.407***			
			(0.145)			
Lagged deaths: 3 years				0.340**		
				(0.141)		
+Lagged deaths: 2 years					0.219**	
					(0.102)	
Lagged deaths: 1 years						0.0668
						(0.119)
Age: 25–34	-0.0448	0.000533	0.0509	0.0757*	0.0959**	0.0921**
	(0.0566)	(0.0572)	(0.0480)	(0.0439)	(0.0391)	(0.0369)
Age: 35–44	-0.214***	-0.150**	-0.0791	-0.0327	-0.00448	-0.00928
	(0.0684)	(0.0707)	(0.0601)	(0.0561)	(0.0520)	(0.0537)
Age: 45–54	-0.424***	-0.349***	-0.259***	-0.207***	-0.191***	-0.188***
	(0.0757)	(0.0706)	(0.0687)	(0.0689)	(0.0625)	(0.0604)
Age: 55–64	-1.118***	-1.027***	-0.938***	-0.891***	-0.850***	-0.840***
	(0.108)	(0.103)	(0.0958)	(0.0937)	(0.0911)	(0.0894)
Age: 65+	-2.348***	-2.276***	-2.201***	-2.155***	-2.123***	-2.123***
	(0.140)	(0.130)	(0.127)	(0.130)	(0.125)	(0.125)
Race: Black	-0.921***	-0.892***	-0.854***	-0.838***	-0.828***	-0.824***
	(0.0675)	(0.0678)	(0.0679)	(0.0628)	(0.0607)	(0.0637)
Race: Asian	-1.192***	-1.182***	-1.154***	-1.161***	-1.154***	-1.151***
	(0.100)	(0.0889)	(0.0853)	(0.0789)	(0.0810)	(0.0754)

Race: Other/ Multirace	0.678***	0.671***	0.688***	0.626***	0.622***	0.653***
	(0.0841)	(0.0850)	(0.0836)	(0.0778)	(0.0739)	(0.0695)
Race: Hispanic	-1.122***	-1.070***	-1.031***	-1.017***	-0.996***	-0.983***
	(0.0798)	(0.0734)	(0.0698)	(0.0699)	(0.0678)	(0.0673)
Sex: Male	-1.012***	-1.008***	-1.001***	-0.998***	-0.986***	-0.992***
	(0.0401)	(0.0384)	(0.0376)	(0.0367)	(0.0355)	(0.0348)
Education: High school grad/GED	-0.694***	-0.703***	-0.658***	-0.655***	-0.635***	-0.628***
	(0.0637)	(0.0638)	(0.0660)	(0.0663)	(0.0677)	(0.0662)
Education: One to three years of college or technical school	-0.538***	-0.550***	-0.517***	-0.512***	-0.497***	-0.492***
	(0.0779)	(0.0762)	(0.0759)	(0.0752)	(0.0754)	(0.0738)
Education: College graduate with four or more years of college	-1.250***	-1.266***	-1.226***	-1.218***	-1.200***	-1.198***
	(0.0811)	(0.0779)	(0.0797)	(0.0809)	(0.0827)	(0.0795)
Employ = 2, Self-employed	0.0968**	0.120***	0.137***	0.153***	0.149***	0.164***
	(0.0465)	(0.0429)	(0.0368)	(0.0296)	(0.0247)	(0.0261)
Employ = 3, Out of work for 1 year or more	3.050***	3.011***	2.995***	2.998***	3.018***	3.017***
	(0.126)	(0.124)	(0.128)	(0.123)	(0.132)	(0.127)
Employ = 4, out of work for less than 1 year	2.161***	2.136***	2.135***	2.161***	2.186***	2.199***
	(0.0981)	(0.0960)	(0.0903)	(0.0817)	(0.0803)	(0.0842)
Employ = 5, Homemaker	0.0545	0.0452	0.0489	0.0672	0.0791	0.0947*
	(0.0587)	(0.0564)	(0.0583)	(0.0534)	(0.0495)	(0.0507)
Employ = 6, Student	0.357***	0.380***	0.367***	0.357***	0.361***	0.373***
	(0.0612)	(0.0630)	(0.0567)	(0.0508)	(0.0471)	(0.0450)
Employ = 7, Retired	0.496***	0.494***	0.474***	0.463***	0.459***	0.474***
	(0.0506)	(0.0475)	(0.0484)	(0.0473)	(0.0453)	(0.0432)
Employ = 8, Unable to work	7.467***	7.466***	7.444***	7.435***	7.440***	7.473***
	(0.135)	(0.129)	(0.133)	(0.137)	(0.133)	(0.130)

Marital status: Married	-0.900***	-0.900***	-0.889***	-0.894***	-0.894***	-0.900***
	(0.0318)	(0.0276)	(0.0278)	(0.0272)	(0.0282)	(0.0274)
Income: Missing	-0.913***	-0.931***	-0.948***	-0.941***	-0.937***	-0.932***
	(0.0389)	(0.0400)	(0.0359)	(0.0311)	(0.0307)	(0.0305)
Income: 50,000–74,999	-0.664***	-0.676***	-0.706***	-0.697***	-0.696***	-0.694***
	(0.0678)	(0.0636)	(0.0626)	(0.0560)	(0.0543)	(0.0536)
Income: 75,000 or more	-1.108***	-1.125***	-1.158***	-1.147***	-1.145***	-1.129***
	(0.0637)	(0.0614)	(0.0564)	(0.0555)	(0.0538)	(0.0554)
Year: = 2007						0.0107
						(0.0612)
Year: = 2008					0.0357	0.0549
					(0.0516)	(0.0867)
Year: = 2009				-0.0233	0.0228	0.0496
				(0.0496)	(0.0471)	(0.0764)
Year: = 2010			0.0362	0.0215	0.0805	0.111
			(0.0369)	(0.0533)	(0.0519)	(0.0766)
Year: 2011		0.0320	0.0642	0.0614	0.123**	0.153*
		(0.0459)	(0.0462)	(0.0444)	(0.0556)	(0.0830)
Year: 2012	-0.0122	0.0214	0.0552	0.0566	0.116**	0.148*
	(0.0515)	(0.0490)	(0.0496)	(0.0659)	(0.0540)	(0.0759)
Year: 2013	-0.0980**	-0.0610	-0.0266	-0.0260	0.0308	0.0683
	(0.0379)	(0.0434)	(0.0455)	(0.0537)	(0.0606)	(0.0826)
Year: 2014	-0.125*	-0.0869	-0.0584	-0.0628	0.000133	0.0398
	(0.0650)	(0.0747)	(0.0597)	(0.0639)	(0.0624)	(0.0949)
Year: 2015	-0.0189	0.0174	0.0339	0.0365	0.101	0.144
	(0.0420)	(0.0578)	(0.0574)	(0.0579)	(0.0640)	(0.0971)
Year: 2016	0.0427	0.0742	0.0913*	0.0917	0.159***	0.206**
	(0.0649)	(0.0737)	(0.0550)	(0.0603)	(0.0510)	(0.0919)
Year: 2017	0.258***	0.293***	0.301***	0.301***	0.370***	0.422***
	(0.0721)	(0.0778)	(0.0631)	(0.0689)	(0.0717)	(0.128)
Year: 2018	0.375***	0.409***	0.411***	0.410***	0.474***	0.542***
	(0.0881)	(0.0989)	(0.0784)	(0.0791)	(0.0732)	(0.108)
Constant	5.375***	5.340***	4.455***	4.656***	5.009***	5.552***
	(0.627)	(0.717)	(0.572)	(0.524)	(0.394)	(0.423)
Observations	1,911,456	2,165,680	2,407,263	2,641,049	2,885,461	3,076,964
R-squared	0.094	0.094	0.093	0.092	0.092	0.092

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

The reference groups from both regressions are White, female, ages 18–24, annual income less than $50,000, education less than a high school diploma, not married, employed for wages, and from the earliest year possible (i.e., since we have data from 2005–18, for a six-year lag the reference group is from 2011). All specifications include mmsa fixed effects and conducted using the reghfe command in stata.

Table A6.3 Lagged Deaths and Extreme Distress

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	**Percent in extreme distress (1 = 1)**					
Lagged deaths: 6 years	0.373					
	(0.343)					
Lagged deaths: 5 years		-0.212				
		(0.340)				
Lagged deaths: 4 years			0.417			
			(0.326)			
Lagged deaths: 3 years				0.285		
				(0.330)		
Lagged deaths: 2 years					0.185	
					(0.263)	
Lagged deaths: 1 years						-0.0715
						(0.249)
Age: 25–34	1.235***	1.369***	1.397***	1.459***	1.482***	1.477***
	(0.144)	(0.144)	(0.133)	(0.121)	(0.105)	(0.102)
Age: 35–44	1.352***	1.494***	1.579***	1.682***	1.730***	1.697***
	(0.193)	(0.195)	(0.169)	(0.164)	(0.149)	(0.157)
Age: 45–54	1.403***	1.578***	1.697***	1.823***	1.839***	1.817***
	(0.193)	(0.186)	(0.178)	(0.186)	(0.161)	(0.153)
Age: 55–64	0.227	0.458**	0.611***	0.707***	0.804***	0.810***
	(0.235)	(0.232)	(0.211)	(0.198)	(0.193)	(0.194)
Age: 65+	-1.921***	-1.753***	-1.656***	-1.542***	-1.441***	-1.430***
	(0.329)	(0.318)	(0.298)	(0.305)	(0.305)	(0.306)
Race: Black	-1.837***	-1.783***	-1.714***	-1.681***	-1.664***	-1.611***
	(0.206)	(0.195)	(0.193)	(0.177)	(0.166)	(0.173)
Race: Asian	-1.872***	-1.856***	-1.825***	-1.826***	-1.770***	-1.738***
	(0.258)	(0.237)	(0.233)	(0.224)	(0.224)	(0.216)
Race: Other/ Multirace	1.807***	1.804***	1.849***	1.723***	1.688***	1.728***
	(0.249)	(0.263)	(0.261)	(0.249)	(0.238)	(0.205)

Race: Hispanic	-2.066***	-1.991***	-1.909***	-1.903***	-1.830***	-1.785***
	(0.175)	(0.151)	(0.155)	(0.153)	(0.148)	(0.149)
Sex: Male	-1.198***	-1.202***	-1.200***	-1.205***	-1.179***	-1.204***
	(0.0941)	(0.0910)	(0.0855)	(0.0809)	(0.0778)	(0.0772)
Education: high school grad/GED	-1.608***	-1.598***	-1.474***	-1.458***	-1.423***	-1.420***
	(0.206)	(0.205)	(0.213)	(0.214)	(0.218)	(0.213)
Education: One to three years of college or technical school	-1.624***	-1.597***	-1.487***	-1.467***	-1.428***	-1.411***
	(0.246)	(0.235)	(0.238)	(0.238)	(0.235)	(0.232)
Education: College graduate with four or more years of college	-3.232***	-3.186***	-3.056***	-3.036***	-2.991***	-2.970***
	(0.227)	(0.217)	(0.225)	(0.232)	(0.237)	(0.227)
Employ = 2, Self-employed	0.401***	0.418***	0.447***	0.459***	0.435***	0.490***
	(0.0958)	(0.0803)	(0.0772)	(0.0701)	(0.0719)	(0.0757)
Employ = 3, Out of work for 1 year or more	7.131***	6.992***	6.937***	6.929***	7.032***	7.050***
	(0.352)	(0.347)	(0.369)	(0.349)	(0.364)	(0.343)
Employ = 4, Out of work for less than 1 year	4.614***	4.514***	4.508***	4.571***	4.600***	4.598***
	(0.273)	(0.267)	(0.232)	(0.223)	(0.228)	(0.242)
Employ = 5, Homemaker	0.592***	0.506***	0.518***	0.567***	0.590***	0.597***
	(0.156)	(0.148)	(0.145)	(0.122)	(0.113)	(0.111)
Employ = 6, Student	-0.183	-0.0962	-0.108	-0.121	-0.0940	-0.0661
	(0.188)	(0.186)	(0.163)	(0.153)	(0.138)	(0.137)
Employ = 7, Retired	1.507***	1.468***	1.428***	1.399***	1.349***	1.383***
	(0.156)	(0.149)	(0.148)	(0.147)	(0.152)	(0.144)
Employ = 8, Unable to work	17.47***	17.43***	17.36***	17.39***	17.40***	17.52***
	(0.387)	(0.376)	(0.378)	(0.395)	(0.401)	(0.390)
Marital status: Married	-1.509***	-1.534***	-1.507***	-1.545***	-1.564***	-1.577***
	(0.0886)	(0.0726)	(0.0677)	(0.0650)	(0.0660)	(0.0611)

Income: Missing	-1.139***	-1.185***	-1.276***	-1.259***	-1.256***	-1.221***
	(0.124)	(0.135)	(0.128)	(0.115)	(0.117)	(0.123)
Income: 50,000–to 74,999	-1.430***	-1.470***	-1.564***	-1.551***	-1.565***	-1.543***
	(0.161)	(0.152)	(0.144)	(0.125)	(0.119)	(0.120)
Income: 75,000 or more	-2.080***	-2.117***	-2.188***	-2.160***	-2.170***	-2.127***
	(0.133)	(0.129)	(0.124)	(0.118)	(0.111)	(0.117)
Year: = 2007						0.0257
						(0.143)
Year: = 2008					0.175	0.213
					(0.143)	(0.208)
Year: = 2009				-0.119	0.0624	0.108
				(0.182)	(0.149)	(0.156)
Year: = 2010			-0.0524	-0.158	0.0295	0.0792
			(0.106)	(0.174)	(0.157)	(0.145)
Year: 2011		0.0407	-0.0331	-0.128	0.0622	0.114
		(0.111)	(0.112)	(0.167)	(0.135)	(0.164)
Year: 2012	0.0738	0.143	0.0473	-0.0435	0.145	0.202
	(0.146)	(0.136)	(0.148)	(0.209)	(0.163)	(0.157)
Year: 2013	0.0173	0.0943	-0.00735	-0.102	0.0793	0.140
	(0.106)	(0.106)	(0.102)	(0.174)	(0.141)	(0.151)
Year: 2014	0.0293	0.108	-0.00260	-0.103	0.0826	0.148
	(0.144)	(0.153)	(0.156)	(0.230)	(0.195)	(0.197)
Year: 2015	0.0174	0.102	-0.0271	-0.120	0.0681	0.140
	(0.118)	(0.144)	(0.154)	(0.219)	(0.168)	(0.193)
Year: 2016	0.289**	0.389**	0.242	0.149	0.336**	0.417**
	(0.141)	(0.172)	(0.157)	(0.229)	(0.165)	(0.195)
Year: 2017	0.503***	0.619***	0.452***	0.360*	0.548***	0.642***
	(0.142)	(0.132)	(0.136)	(0.217)	(0.191)	(0.238)
Year: 2018	0.782***	0.912***	0.728***	0.638***	0.823***	0.938***
	(0.137)	(0.163)	(0.157)	(0.226)	(0.175)	(0.215)
Constant	6.467***	8.504***	5.998***	6.499***	6.605***	7.507***
	(1.424)	(1.343)	(1.220)	(1.123)	(0.951)	(0.915)
Observations	1,911,456	2,165,680	2,407,263	2,641,049	2,885,461	3,076,964
R-squared	0.053	0.053	0.052	0.052	0.052	0.052

Note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Table A6.4. Association between MMSA-rates of deaths of despair and mental health

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variables	**Log(Deaths of despair per 100,000, among 35-64 year olds)**						
Avg. Bad mental health days	-0.00571						
	(0.0117)						
Avg. Bad mental health days: 1 year ago		-0.00221					
		(0.0118)					
Avg. Bad mental health days: 2 years ago			0.0276**				
			(0.0136)				
Avg. Bad mental health days: 3 years ago				0.0293**			
				(0.0143)			
Avg. Bad mental health days: 4 years ago					-0.0139		
					(0.0174)		
Avg. Bad mental health days: 5 years ago						-0.00937	
						(0.0178)	
Avg. Bad mental health days: 6 years ago							-0.0127
							(0.0215)
Proportion age 25–34	0.140	0.0774	0.0706	-0.0280	-0.317	-0.209	-0.681
	(0.350)	(0.360)	(0.412)	(0.444)	(0.553)	(0.692)	(0.993)
Prop age 35–44	-0.158	0.0250	-0.0400	-0.516	-1.209	-2.579***	-6.725***
	(0.535)	(0.660)	(0.664)	(0.636)	(0.776)	(0.962)	(2.222)

Prop age 45–54	-0.815	-1.178	-0.730	-1.992	-2.925	-3.730*	-7.452***
	(1.244)	(1.385)	(1.475)	(1.616)	(1.799)	(2.109)	(2.309)
Prop age 55–64	3.313**	4.810***	5.636***	6.464***	6.204**	6.545**	6.378
	(1.398)	(1.441)	(1.735)	(2.095)	(2.461)	(2.766)	(3.874)
Prop age 65+	0.449	-0.104	-0.499	-0.260	0.0187	-1.009	-5.257*
	(1.375)	(1.425)	(1.623)	(1.768)	(2.016)	(2.185)	(2.787)
Prop male	5.830***	5.206**	6.401**	5.537**	4.715	4.920	3.617
	(2.029)	(2.283)	(2.802)	(2.732)	(3.748)	(3.555)	(4.276)
Prop Black	0.0451	0.274	0.251	0.317	-0.0700	-0.113	-0.738
	(0.353)	(0.359)	(0.388)	(0.472)	(0.497)	(0.566)	(0.694)
Prop Asian	-0.813	-0.640	-0.783	-0.643	-0.591	0.332	-0.887
	(0.552)	(0.604)	(0.695)	(0.769)	(0.766)	(0.921)	(1.329)
Prop Other/Multirace	-0.468	-0.517	-0.609	-0.591	-0.294	-0.0806	-3.073**
	(0.426)	(0.454)	(0.514)	(0.593)	(0.764)	(0.726)	(1.314)
Prop Hispanic	-0.253	-0.193	-0.390	-0.377	-0.203	0.148	-0.655
	(0.331)	(0.332)	(0.343)	(0.354)	(0.377)	(0.434)	(1.007)
Prop income: Missing	-0.166	-0.153	-0.159	-0.232	-0.201	-0.220	-0.134
	(0.217)	(0.230)	(0.230)	(0.218)	(0.241)	(0.265)	(0.275)
Prop income: 50,000–less than75,000	-0.128	-0.0599	-0.203	-0.304	-0.402	-0.202	-0.136
	(0.331)	(0.372)	(0.374)	(0.376)	(0.419)	(0.567)	(0.619)
Prop income: above 75,000	-0.234	-0.254	-0.411	-0.636**	-0.482	-0.710**	-0.655*
	(0.243)	(0.248)	(0.271)	(0.272)	(0.330)	(0.343)	(0.391)
Prop: High school graduation the highest educational level	0.451	0.450	0.413	0.485	0.432	0.530	0.796
	(0.331)	(0.347)	(0.348)	(0.433)	(0.470)	(0.558)	(0.627)
Prop: some college the highest educational level	0.174	0.156	0.0562	0.0278	0.0659	0.260	0.233
	(0.349)	(0.371)	(0.392)	(0.419)	(0.482)	(0.523)	(0.565)

Prop: bachelor's or more as the highest educational level	0.587	0.744**	0.639	0.793*	0.883*	1.299**	0.884
	(0.373)	(0.369)	(0.390)	(0.424)	(0.471)	(0.562)	(0.648)
Prop. Self-employed	0.263	0.186	0.0656	0.126	-0.105	-0.174	-0.0391
	(0.401)	(0.413)	(0.418)	(0.428)	(0.489)	(0.528)	(0.582)
Prop. Out of work for 1 year or more	0.566	0.334	-0.320	0.282	0.280	0.664	0.622
	(0.491)	(0.505)	(0.577)	(0.635)	(0.715)	(0.726)	(0.808)
Prop. Out of work for less than 1 year	-0.834	-0.788	-0.626	-0.620	-0.659	-1.379*	-0.787
	(0.532)	(0.585)	(0.618)	(0.639)	(0.746)	(0.771)	(0.975)
Prop. Homemaker	0.368	0.0515	-0.144	-0.0195	0.226	0.432	0.460
	(0.498)	(0.479)	(0.488)	(0.505)	(0.595)	(0.671)	(0.656)
Prop. Student	-0.382	-0.197	0.0610	0.115	0.0990	0.0635	-0.184
	(0.469)	(0.443)	(0.449)	(0.479)	(0.525)	(0.513)	(0.534)
Prop. Retired	0.499	0.497	0.242	0.00494	-0.180	-0.0617	0.535
	(0.594)	(0.626)	(0.665)	(0.660)	(0.762)	(0.777)	(0.691)
Prop. Unable to work	0.307	0.126	-0.0799	0.116	0.424	0.967	0.0440
	(0.468)	(0.496)	(0.528)	(0.571)	(0.654)	(0.722)	(0.767)
Prop: Married	-0.521**	-0.620***	-0.573**	-0.382	-0.417	-0.260	-0.296
	(0.222)	(0.225)	(0.249)	(0.303)	(0.294)	(0.298)	(0.329)
Year: 2006	0.0440**						
	(0.0219)						
Year: 2007	0.100***	0.0518**					
	(0.0266)	(0.0249)					
Year: 2008	0.135***	0.0747***	0.0165				
	(0.0315)	(0.0250)	(0.0226)				
Year: 2009	0.122***	0.0586	-0.00975	-0.0288			
	(0.0399)	(0.0374)	(0.0354)	(0.0266)			
Year: 2010	0.131***	0.0665	0.0110	-0.0257	-0.00799		
	(0.0472)	(0.0435)	(0.0392)	(0.0317)	(0.0254)		
Year: 2011	0.144***	0.0778	0.0199	-0.00789	0.0160	0.0473	
	(0.0505)	(0.0479)	(0.0534)	(0.0525)	(0.0560)	(0.0531)	
Year: 2012	0.144**	0.0636	0.00323	-0.0347	-0.0240	-0.0140	-0.0708
	(0.0589)	(0.0581)	(0.0628)	(0.0604)	(0.0609)	(0.0624)	(0.0455)
Year: 2013	0.179***	0.103	0.0407	0.00169	0.00822	0.0156	-0.0586

	(0.0641)	(0.0635)	(0.0715)	(0.0667)	(0.0684)	(0.0701)	(0.0576)
Year: 2014	0.197***	0.116*	0.0555	0.00492	0.0117	0.0194	-0.0288
	(0.0638)	(0.0627)	(0.0694)	(0.0694)	(0.0714)	(0.0733)	(0.0713)
Year: 2015	0.239***	0.160**	0.106	0.0536	0.0588	0.0634	0.0172
	(0.0721)	(0.0715)	(0.0769)	(0.0821)	(0.0890)	(0.0878)	(0.0905)
Year: 2016	0.304***	0.222***	0.181**	0.133	0.132	0.135	0.0942
	(0.0761)	(0.0767)	(0.0843)	(0.0880)	(0.0964)	(0.0984)	(0.104)
Year: 2017	0.344***	0.263***	0.219**	0.172*	0.160	0.175*	0.159
	(0.0819)	(0.0818)	(0.0898)	(0.0973)	(0.104)	(0.104)	(0.120)
Year: 2018	0.321***	0.243***	0.204**	0.155	0.155	0.170	0.162
	(0.0846)	(0.0865)	(0.0957)	(0.104)	(0.114)	(0.113)	(0.129)
Constant	0.618	0.895	0.353	0.860	1.718	1.707	4.926*
	(1.317)	(1.435)	(1.618)	(1.643)	(2.064)	(2.171)	(2.695)
Observations	2,055	1,781	1,552	1,350	1,160	983	821
R-squared	0.789	0.792	0.798	0.819	0.827	0.841	0.862
MSA FE	Y	Y	Y	Y	Y	Y	Y

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Appendix 7. Connections between mental health and deaths of despair. HPS and NEMSIS, 2020

Here we replicate the BRFSS analysis on the effects of lagged mental health and lagged deaths of despair using 2020 data. Since we did not have death data from the CDC, we combined NEMSIS and HPS data to examine the connections between mental health and deaths of despair in 2020. Because the BRFSS responses are separated by months, HPS gives us more datapoints when we collapse the dataset into the 22 pulse weeks rather than 12 months.

Empirical methods

We conducted a very similar analysis with the BRFSS, first using anxiety and depression as an outcome variable.

$$Y_{ijt} = \alpha + \beta_1 D_{jt} + X_{ijt} + \gamma_t + \theta_j + \epsilon_{ijt}$$

with Y_{ijt} as a binary variable indicating whether individual i of the j^{th} Metropolitan/Micropolitan Statistical Area (MMSA) had anxiety or depression during the t^{th} pulse week. D_{jt} represents suicide. behavioral, or overdose calls per million residents per day in the given census subdivision during the given week, X_{ijt} represents the individual demographic controls, θ_j is subdivision fixed effects, and γ_t is week fixed effects.

We also conducted the analysis with EMS calls as the dependent variable by collapsing the dataset at the pulse week-census subdivision level. Like BRFSS, we include demographic controls as the proportion of individuals belonging to a certain demographic category, yielding the following specification:

$$D_{jt} = \alpha + \beta_1 M_{jt} + X_{jt} + \gamma_t + \theta_j + \epsilon_{ijt}$$

M_{jt} here represents the anxiety or depression rates in a given subdivision at a given pulse week.

Results

Possibly due to the lack of geographical stratification, most coefficients on the variables of interest are statistically insignificant. Nonetheless, we report the results of equation (X) and (Y) in Table A7.1.

Table A7.1. *Pulse Mental Health Trends and NEMSIS Calls*

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	**Anxiety**	**Depression**	**Anxiety**	**Depression**	**Anxiety**	**Depression**
Overdoes calls per day per capita	-0.00655*	-0.00152				
	(0.00388)	(0.00217)				
Suicide calls per day per capita			-0.0136	0.0189*		
			(0.0146)	(0.0104)		
Behavioral calls per day per capita					-0.000496	0.000390

					(0.000529)	(0.000302)
Race: Black	-0.0325***	-0.0147***	-0.0325***	-0.0147***	-0.0325***	-0.0147***
	(0.00403)	(0.00378)	(0.00403)	(0.00378)	(0.00403)	(0.00378)
Race: Asian	-0.0750***	-0.0348***	-0.0750***	-0.0348***	-0.0750***	-0.0348***
	(0.00488)	(0.00454)	(0.00488)	(0.00454)	(0.00488)	(0.00454)
Race: Other/ Multi-race	0.0458***	0.0410***	0.0458***	0.0410***	0.0458***	0.0410***
	(0.00537)	(0.00528)	(0.00537)	(0.00527)	(0.00537)	(0.00528)
Race: Hispanic	-0.0183***	-0.0153***	-0.0183***	-0.0153***	-0.0183***	-0.0153***
	(0.00366)	(0.00410)	(0.00366)	(0.00410)	(0.00366)	(0.00410)
Sex: Male	-0.0744***	-0.0272***	-0.0744***	-0.0272***	-0.0744***	-0.0272***
	(0.00271)	(0.00199)	(0.00271)	(0.00199)	(0.00271)	(0.00199)
Age: 25–34	0.0261***	-0.00716	0.0261***	-0.00717	0.0261***	-0.00717
	(0.00711)	(0.00680)	(0.00711)	(0.00680)	(0.00711)	(0.00680)
Age: 35–44	-0.00809	-0.0459***	-0.00808	-0.0459***	-0.00808	-0.0459***
	(0.00636)	(0.00508)	(0.00636)	(0.00509)	(0.00636)	(0.00509)
Age: 45–54	-0.0320***	-0.0565***	-0.0320***	-0.0565***	-0.0320***	-0.0565***
	(0.00685)	(0.00580)	(0.00685)	(0.00581)	(0.00685)	(0.00581)
Age: 55–64	-0.0917***	-0.101***	-0.0917***	-0.101***	-0.0917***	-0.101***
	(0.0101)	(0.00700)	(0.0101)	(0.00700)	(0.0101)	(0.00700)
Age: 65+	-0.225***	-0.211***	-0.225***	-0.211***	-0.225***	-0.211***
	(0.0116)	(0.00766)	(0.0116)	(0.00766)	(0.0116)	(0.00766)
Income: 50,000–149,999	-0.0234***	-0.0257***	-0.0234***	-0.0257***	-0.0233***	-0.0257***
	(0.00329)	(0.00305)	(0.00328)	(0.00305)	(0.00329)	(0.00305)
Income: 150,000+	-0.0943***	-0.0913***	-0.0943***	-0.0913***	-0.0943***	-0.0913***
	(0.00365)	(0.00298)	(0.00365)	(0.00297)	(0.00365)	(0.00297)
Income: Missing	-0.0682***	-0.0652***	-0.0682***	-0.0652***	-0.0682***	-0.0652***
	(0.00341)	(0.00447)	(0.00341)	(0.00446)	(0.00341)	(0.00446)
Education: High school grad/GED	-0.0385***	-0.0395***	-0.0385***	-0.0395***	-0.0385***	-0.0395***
	(0.00626)	(0.00791)	(0.00624)	(0.00791)	(0.00625)	(0.00791)
Education: Some college	-0.0174**	-0.0293***	-0.0174**	-0.0293***	-0.0174**	-0.0293***
	(0.00832)	(0.00964)	(0.00831)	(0.00965)	(0.00832)	(0.00964)
Education: Associate's degree	-0.0364***	-0.0509***	-0.0364***	-0.0509***	-0.0364***	-0.0509***
	(0.00846)	(0.00912)	(0.00845)	(0.00913)	(0.00846)	(0.00912)
Education: Bachelor's degree	-0.0540***	-0.0860***	-0.0539***	-0.0861***	-0.0540***	-0.0860***

	(0.00894)	(0.00973)	(0.00892)	(0.00974)	(0.00894)	(0.00973)
Education: Graduate degree	-0.0525***	-0.0940***	-0.0525***	-0.0940***	-0.0525***	-0.0939***
	(0.00822)	(0.00897)	(0.00821)	(0.00897)	(0.00822)	(0.00897)
Marital status: Married	-0.0646***	-0.0853***	-0.0646***	-0.0853***	-0.0646***	-0.0852***
	(0.00253)	(0.00254)	(0.00253)	(0.00254)	(0.00253)	(0.00254)
Worked during last week: Yes	-0.0842***	-0.0984***	-0.0842***	-0.0984***	-0.0842***	-0.0984***
	(0.00337)	(0.00355)	(0.00337)	(0.00355)	(0.00337)	(0.00355)
Constant	0.584***	0.527***	0.559***	0.506***	0.571***	0.502***
	(0.0298)	(0.0186)	(0.0178)	(0.0127)	(0.0312)	(0.0205)
Observations	1,641,229	1,640,482	1,641,229	1,640,482	1,641,229	1,640,482
R-squared	0.066	0.069	0.066	0.069	0.066	0.069
State FE	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table A7.1=2. NEMSIS Calls and HPS Reported Depression and Anxiety

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	**Overdose Calls Per Day Per Capita**		**Suicide Calls Per Day Per Capita**		**Behavioral Calls Per Day Per Capita**	
Anxiety coded	-3.877**		-0.431		-4.754	
	(1.784)		(0.528)		(11.93)	
Depression coded		-1.108		0.722		20.42
		(2.515)		(0.585)		(17.49)
Prop. 25–34	-0.121	-0.664	0.0590	-0.160	21.86	17.11
	(4.259)	(4.411)	(0.990)	(0.990)	(29.63)	(30.16)
Prop. 35–44	1.247	1.611	0.896	1.030	58.05	60.91
	(5.944)	(6.081)	(1.376)	(1.367)	(42.71)	(42.97)
Prop. 45–54	-2.767	-2.715	-0.705	-0.793	7.349	4.985
	(7.757)	(7.871)	(1.752)	(1.744)	(61.70)	(61.52)
Prop. 55–64	-2.650	-1.311	1.193	1.532	71.56	78.09
	(7.352)	(7.345)	(1.810)	(1.834)	(52.55)	(52.90)
Prop. 65+	3.604	3.086	4.454**	4.152*	68.10	61.18
	(8.367)	(8.142)	(2.040)	(2.101)	(61.09)	(60.55)
Prop. Black	7.815	9.006	1.138	1.724	-41.33	-28.18

	(15.18)	(15.41)	(3.564)	(3.584)	(112.8)	(113.0)
Prop. Asian	1.115	2.679	1.397	1.863	-11.26	-1.829
	(16.09)	(16.18)	(3.807)	(3.908)	(116.0)	(118.2)
Prop. Other/Multirace	1.577	4.236	2.491	3.193	41.07	54.78
	(15.96)	(15.90)	(3.969)	(4.097)	(117.8)	(119.6)
Prop. Hispanic	-1.989	-0.672	-1.385	-0.331	-84.66	-59.67
	(9.869)	(10.34)	(2.423)	(2.529)	(67.98)	(72.81)
Prop. Middle income	-0.00889	0.406	0.105	0.0919	9.271	8.256
	(2.427)	(2.531)	(0.610)	(0.600)	(18.63)	(19.09)
Prop. High income	3.334	3.793	1.693	1.743	51.96	52.49
	(4.970)	(4.967)	(1.201)	(1.153)	(37.89)	(37.49)
Prop. Income missing	2.392	2.782	-0.469	-0.373	3.940	5.771
	(2.968)	(2.898)	(0.782)	(0.765)	(21.86)	(21.35)
Prop. High school grad	-1.738	-1.667	1.077*	1.220*	4.907	8.479
	(2.955)	(3.069)	(0.641)	(0.648)	(24.81)	(24.93)
Prop. Some college	21.74	14.77	0.846	-1.131	51.45	11.97
	(22.43)	(22.97)	(5.719)	(5.478)	(179.1)	(177.9)
Prop. Associate degree	29.93	23.29	1.253	-0.657	76.46	38.15
	(23.33)	(23.72)	(5.667)	(5.452)	(182.5)	(181.5)
Prop. Bachelor's degree'	328.7**	308.7**	37.81	31.66	206.5	81.04
	(135.2)	(137.8)	(30.69)	(31.34)	(918.7)	(927.5)
Prop. Graduate degree	341.8**	323.2**	40.39	34.63	279.6	161.9
	(133.8)	(136.4)	(30.49)	(31.14)	(905.7)	(914.3)
Prop. Employed	-3.344*	-2.412	-0.712	-0.402	-0.846	5.601
	(1.875)	(1.860)	(0.438)	(0.412)	(14.01)	(13.89)
Prop. Married	0.236	0.654	-0.260	-0.0365	-7.157	-2.097
	(2.474)	(2.621)	(0.583)	(0.585)	(16.94)	(17.66)
Constant	-130.1**	-123.4**	-15.78	-13.76	-117.4	-76.35
	(52.60)	(53.60)	(11.68)	(12.04)	(350.9)	(355.6)
Observations	189	189	189	189	189	189
R-squared	0.956	0.955	0.961	0.961	0.936	0.937
Subdiv FE	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Appendix 8: Event Study Table, 2019/2020

	(1)	(2)	(3)	(4)
	Depressed Weekly	**Depressed Weekly**	**Anxious Weekly**	**Anxious Weekly**
Year: 2020	-0.0079	-0.0065	-0.0030	-0.0069
	(0.0094)	(0.0091)	(0.0137)	(0.0133)
Interview quarter = 2, Quarter 2	-0.0081	-0.0098	0.0018	-0.0004
	(0.0103)	(0.0102)	(0.0159)	(0.0154)
Interview quarter = 3, Quarter 3	0.0063	-0.0006	-0.0111	-0.0179
	(0.0122)	(0.0120)	(0.0173)	(0.0168)
Interview quarter = 4, Quarter 4	-0.0185	-0.0197*	-0.0125	-0.0146
	(0.0119)	(0.0114)	(0.0176)	(0.0169)
2020.year#2.intv_qrt	0.0047	0.0015	0.0054	0.0061
	(0.0087)	(0.0083)	(0.0126)	(0.0123)
2020.year#3.intv_qrt	0.0011	0.0019	0.0386***	0.0379***
	(0.0093)	(0.0092)	(0.0139)	(0.0136)
2020.year#4.intv_qrt	0.0267***	0.0268***	0.0309**	0.0305**
	(0.0100)	(0.0097)	(0.0141)	(0.0135)
race = 3, Black (nh)		-0.0456***		-0.1314***
		(0.0062)		(0.0084)
race = 4, Asian (nh)		-0.0480***		-0.1668***
		(0.0066)		(0.0094)
race = 7, Other/multirace (nh)		-0.0016		-0.0163
		(0.0137)		(0.0175)
race = 8, Hispanic		-0.0503***		-0.1259***
		(0.0052)		(0.0078)
Sex of Sample Adult = 1, Male		-0.0295***		-0.1030***
		(0.0035)		(0.0050)
age = 1, 25–34		-0.0110		-0.0239*
		(0.0091)		(0.0127)
age = 2, 35–44		-0.0171*		-0.0639***
		(0.0090)		(0.0125)
age = 3, 45–54		-0.0169*		-0.0845***
		(0.0091)		(0.0126)
age = 4, 55–64		-0.0363***		-0.1487***
		(0.0092)		(0.0124)
age = 5, 65+		-0.0573***		-0.2013***
		(0.0098)		(0.0133)
income = 2, mid-income		-0.0398***		-0.0433***
		(0.0044)		(0.0061)
income = 3, high-income		-0.0477***		-0.0546***
		(0.0057)		(0.0090)
educ = 3, High school grad/GED		-0.0175**		-0.0114

		(0.0077)		(0.0098)
educ = 4, Some college		-0.0106		0.0366***
		(0.0081)		(0.0107)
educ = 5, Associate’s degree		-0.0191**		0.0096
		(0.0080)		(0.0109)
educ = 6, Bachelor's degree		-0.0261***		0.0259**
		(0.0076)		(0.0104)
educ = 7, Graduate degree		-0.0296***		0.0405***
		(0.0078)		(0.0112)
employ = 0, Not working: Other		0.0164**		0.0038
		(0.0078)		(0.0116)
employ = 3, Unemployed: Looking for work		0.0993***		0.0979***
		(0.0173)		(0.0210)
employ = 4, Retired		0.0331***		0.0074
		(0.0057)		(0.0080)
employ = 5, Student		-0.0314**		-0.0337*
		(0.0135)		(0.0204)
employ = 6, Not working for health reasons		0.2631***		0.2956***
		(0.0113)		(0.0122)
married = 1, Yes		-0.0296***		-0.0266***
		(0.0039)		(0.0054)
Household region = 2, Midwest	0.0122	0.0012	0.0232	0.0004
	(0.0110)	(0.0108)	(0.0160)	(0.0156)
Household region = 3, South	0.0073	-0.0046	-0.0006	-0.0117
	(0.0098)	(0.0096)	(0.0142)	(0.0138)
Household region = 4, West	-0.0083	-0.0102	-0.0060	-0.0005
	(0.0105)	(0.0101)	(0.0154)	(0.0151)
2.region#2.intv_qrt	-0.0069	-0.0024	-0.0307	-0.0273
	(0.0134)	(0.0131)	(0.0200)	(0.0195)
2.region#3.intv_qrt	-0.0071	-0.0064	0.0219	0.0213
	(0.0157)	(0.0155)	(0.0225)	(0.0219)
2.region#4.intv_qrt	0.0099	0.0131	0.0103	0.0124
	(0.0157)	(0.0150)	(0.0228)	(0.0219)
3.region#2.intv_qrt	0.0016	0.0047	-0.0001	0.0031
	(0.0121)	(0.0119)	(0.0181)	(0.0177)
3.region#3.intv_qrt	-0.0251*	-0.0127	-0.0024	0.0125
	(0.0140)	(0.0139)	(0.0201)	(0.0195)
3.region#4.intv_qrt	0.0135	0.0125	0.0154	0.0176
	(0.0141)	(0.0135)	(0.0203)	(0.0195)
4.region#2.intv_qrt	0.0036	0.0082	0.0120	0.0139
	(0.0127)	(0.0123)	(0.0196)	(0.0189)
4.region#3.intv_qrt	0.0065	0.0212	0.0085	0.0246
	(0.0152)	(0.0151)	(0.0216)	(0.0213)

4.region#4.intv_qrt	0.0132	0.0196	0.0283	0.0350*
	(0.0145)	(0.0139)	(0.0218)	(0.0210)
2.region#2020.year	0.0051	0.0000	0.0146	0.0137
	(0.0111)	(0.0108)	(0.0162)	(0.0157)
3.region#2020.year	-0.0002	-0.0008	-0.0154	-0.0052
	(0.0100)	(0.0098)	(0.0146)	(0.0142)
4.region#2020.year	0.0026	0.0057	-0.0108	-0.0048
	(0.0105)	(0.0103)	(0.0157)	(0.0152)
Constant	0.0978***	0.1933***	0.2534***	0.4584***
	(0.0083)	(0.0143)	(0.0123)	(0.0190)
Observations	52,155	50,990	52,217	51,023
R-squared	0.0013	0.0769	0.0023	0.0854

Source: NHIS data.

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

1775 MASSACHUSETTS AVE NW
WASHINGTON, D.C. 20036

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