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Institutional Failures as Structural Determinants of Suicide: The Opioid Epidemic and the Great Recession in the United States

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Abstract

We investigate recent trends in U.S. suicide mortality using a "structural determinants of health" framework. We access restricted-use multiple cause of death files to track suicide rates among U.S. Black, White, American Indian/Alaska Native, and Latino/a men and women between 1990 and 2017. We examine suicide deaths separately by poisonings and nonpoisonings to illustrate that (1) women's suicide rates from poisonings track strongly with increases in prescription drug availability and (2) nonpoisoning suicide rates among all adult Americans track strongly with worsening economic conditions coinciding with the financial crash and Great Recession. These findings suggest that institutional failures elevated U.S. suicide risk between 1990 and 2017 by increasing access to more lethal means of self-harm and by increasing both exposure and vulnerability to economic downturns. Together, these results support calls to scale up to focus on the structural determinants of U.S. suicide.

Keywords

Great Recession, opioids, social determinants of health, suicide, U.S. mortality

Suicide is a leading cause of death in the United States, and mortality rates from suicide among U.S. men and women increased consistently between 1999 and 2018 (Hedegaard, Curtin, and Warner 2020; Xu et al. 2020) and again in 2021 (Garnett and Curtin 2023). Most explanations of U.S. suicide trends have been dominated by psychiatric perspectives (e.g., Klonsky, May, and Saffer 2016), whereas sociologists have historically focused on social integration, regulation, and imitation to explain population differences in suicide rates (Baller and Richardson 2002; Bearman 1991; Durkheim [1897] 1951; Wray, Colen, and Pescosolido 2011). Some sociological studies on suicide have also focused on individual-level phenomena (e.g., ideation) and cohort-based trends in suicide patterns (Pampel 1998; Phillips and Nugent 2014). As such, many social scientists have understood recent upticks in U.S. suicide mortality to reflect long-term cohort-based trends in mental health and "despair" (Case and Deaton 2015). These trends are thought to be concentrated in disadvantaged communities (Monnat and Brown 2017) and most prevalent among socioeconomically disadvantaged groups (Case and Deaton 2015, 2017, 2020; Glei, Stokes, and Weinstein 2020; Goldman, Glei, and

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Weinstein 2018). Suicide rates also respond to acute changes in short-term material well-being, with research documenting strong pro-cyclical links between economic hardship and suicide risk (Oyesanya, Lopez-Morinigo, and Dutta 2015) and evidence documenting suicide increases during the Great Recession (Harper and Bruckner 2017; Phillips and Nugent 2014; Reeves et al. 2012). Much of this work has been shaped by biomedical, psychiatric, and public health research that apply individual-level theories (Millner, Robinaugh, and Nock 2020) and promote explanations that highlight individual-level risk factors such as access to means (e.g., gun availability), mental health traits (e.g., impulsivity and hopelessness), and suicidal behaviors (e.g., history of self-harm; Klonsky et al. 2016).

Although individual-level perspectives dominate contemporary U.S. suicide research and policy prescriptions, sociology has traditionally highlighted the importance of group- and societal-level processes. In these works, scholars often employ the social determinants of health (SDoH) framework (Braveman, Egerter, and Williams 2011; Marmot and Wilkinson 2005) that seeks to understand the "causes of the causes" of health disparities and often focuses on the attributes that may differentially expose populations to the "proximate" or direct biological and physical causes of poor health (Braveman et al. 2011). For example, the social patterning of suicide has been documented across geography (Barkan, Rocque, and Houle 2013; Denney et al. 2015), race-ethnicity (Spates and Slatton 2017), educational attainment (Phillips and Hempstead 2017), and gender, with higher suicide mortality rates documented in rural areas and among non-Hispanic White individuals, lower educated populations, and men (Garnett, Curtin and Stone 2022; Hedegaard et al. 2020; Pettrone and Curtin 2020). In this article, we embrace calls to "scale up" the SDoH framework (Bambra, Smith, and Pearce 2019) and argue that recent suicide trends are best understood through a *structural* determinants of health lens, which acknowledges the systems of power relations and institutional arrangements that shape population health (Krieger 2008). Structural determinants often refer to broader political (e.g., governance system), social (e.g., norms, race relations), and economic (e.g., welfare state support, inequality, housing instability) factors or institutions at national, regional, or international levels that may influence population health.

In the current study, we argue that institutions often act as structural determinants of suicide and highlight recent institutional failures by the U.S. federal government. Specifically, we contend that the U.S. federal government's weak regulatory oversight of the pharmaceutical industry and tattered social safety nets significantly shaped U.S. suicide risk in the 2000s and 2010s. First, we consider how the opioid epidemic has influenced U.S. women's poisoning-based suicide trends. Rapid changes to the U.S. drug environment in the 1990s spurred rising availability of more lethal poisoning methods (e.g., opioid-based pain relievers [OPRs], such as OxyContin in 1995, Norco in 1997, and Percocet in 1999, and benzodiazepines; Centers for Disease Control and Prevention and National Institute on Drug Abuse 2018, 2020). The opioid epidemic may have important consequences for U.S. suicide mortality trends given that poisoning is one of the leading methods of suicide among U.S. women (Centers for Disease Control and Prevention 2017). We contend that the Food and Drug Administration's (FDA) embrace of austerity and its lax regulation of the pharmaceutical industry represent an institutional failure by the federal government, which allowed the proliferation, mass marketing, and overprescription of OPRs and benzodiazepines (Van Zee 2009). The population health consequences of the U.S. opioid epidemic are most evident in the rising rates of abuse, addiction, and death rates from drug use (Ho 2019; National Academies of Sciences, Engineering, and Medicine [NASEM] 2021; Ruhm 2018), but the consequences likely also extend to risk of death from intentional self-harm in significantly gendered ways. Next, we examine how nonpoisoning suicide rates in the United States changed with the financial crises in the mid-2000s and subsequent Great Recession. For many Americans, economic insecurity was rising in the 1990s and 2000s, elevating their vulnerability to the economic and health consequences of the financial crises and Great Recession (Hacker et al. 2014). Indeed, the financialization of the U.S. economy had increased volatility and precarity before the Great Recession began, and once it hit, the U.S. government did little to protect Americans from the loss of material wealth and economic distress. These factors combined with the unequal recovery likely elevated suicide risk for many Americans (Yagan 2019).

We analyze restricted-use multiple cause of death files from the National Vital Statistics System (NVSS) to track national- and state-level trends in method-specific suicide rates among U.S. men and women (total and by racial-ethnic group) between 1990 and 2017. We separate U.S. suicide rates by

poisonings and nonpoisonings to demonstrate that (1) among all U.S. women, rates from poisonings increased alongside rising availability of OPRs and benzodiazepines in the late 1990s and 2000s and (2) among all U.S. adults, changes in nonpoisoning suicide rates tracked strongly with worsening economic conditions coinciding with the financial crises and Great Recession. In the end, we suggest that these trends are best understood through a "structural determinants of health" lens that situates rising suicide mortality rates in the context of an increasingly volatile, precarious, and lethal period of American life, due in part to institutional failures within the U.S. government.

BACKGROUND

The Social Determinants of Suicide

Suicide has been central to sociology since Durkheim ([1897] 1951) illustrated how the individual act of ending one's life is influenced by societal factors such as social integration and regulation. Social integration pertains to individuals' sense of belonging and inclusion and the strength of social ties in a population. Relatedly, social regulation concerns how these social ties monitor and provide oversight or guidance for social action. According to Durkheim ([1897] 1951), integration and regulation make up the structural elements of social relationships, and he argued that suicide rates were tied to the structure of a population's social relationships. Durkheim went on to illustrate that excess or deficient social integration and regulation could largely explain the social patterning and differences in suicide across society.

Scholars since Durkheim have built on this work and have consistently documented differences in suicide rates along social lines. Hedegaard et al. (2020) report age differences in suicide mortality because it represents the second leading cause of death for those age 10 to 34 and the fourth leading cause for those age 35 to 54. Suicide attempts and death rates differ considerably by gender as well (Pampel 1998; Wray et al. 2011), with men's rates more than 3 times higher than women's rates (Garnett and Curtin 2023). Racial patterns in U.S. suicide are complex, with some marginalized groups (e.g., American Indian/Alaska Native [AI/AN]) having higher rates of suicide than White Americans but Black and Latino Americans having lower rates (Centers for Disease Control and Prevention 2017). Systematic underreporting and death certificate misclassification (Rockett et al. 2010) account for some of these differences, but social ties and religious connections (Spates and Slatton 2017) and the importance of perceived status (Wadsworth and Kubrin 2007) also likely matter. Scholars have also examined U.S. suicide rates by socioeconomic status (SES), family relationships, and geographic locations. Existing work suggests an increased risk of suicide for those with lower levels of education and income (Clouston et al. 2014) and those living in places characterized by socioeconomic disadvantage (Denney et al. 2015).

Suicide mortality also differs across U.S. geographic contexts (Baller and Richardson 2002). For example, rates are consistently higher in rural areas than in urban areas (Hedegaard et al. 2020; Pettrone and Curtin 2020) and vary considerably by region as well. Rates are lowest in the Northeast and highest in the West, the latter sometimes referred to as the U.S. "Suicide Belt" (Harper, Yang, and Lynch 2008). Yet variation in access to firearms, incidence of mental illness, and rurality do not explain the West's higher mortality rates (Baller and Richardson 2002; Harper et al. 2008). Instead, high migration and residential instability in the West may weaken social ties and institutions via population turnover (Barkan et al. 2013).

The social patterning of American suicide builds on the sociological foundation established by Durkheim ([1897] 1951) and illustrates how a SDoH framework can be useful for understanding differences in U.S. suicide by gender, racial-ethnic identity, SES, and geography. Rather than investigating these social determinants of suicide, we focus instead on U.S. institutional and structural factors that have likely shaped recent suicide trends in the United States. By scaling up the SDoH framework, we illustrate how government policies, such as failing to adequately regulate prescription drugs or failing to shore up social safety nets in a recession, can shape suicide patterns.

Scaling up: Structural Determinants of Changes in U.S. Suicide

The case of the U.S. opioid epidemic. Drug-related mortality is an important driver of recent poor trends in U.S. life expectancy, with nearly half a million deaths attributable to drug use between 1999 and 2018 (Currie and Schwandt 2020; Dyer 2018; Ho 2019; NASEM 2021). Although some scholars point to demand factors such as psychological distress, chronic pain, and despair as a result of social,

cultural, and economic changes (Case and Deaton 2015, 2017, 2020), our focus on institutional failures is more consistent with scholarship implicating the dramatic increases in prescription and abuse of OPRs, heroin, and synthetic opioids (e.g., fentanyl; Centers for Disease Control and Prevention and National Institute on Drug Abuse 2020; Hansen, Netherland, and Herzberg 2023; Ho 2019; Masters, Tilstra, and Simon 2018; Ruhm 2018, 2019; Van Zee 2009). Indeed, the increases in drug-related mortality strongly coincide with the rising availability, overprescription, and misuse of OPRs in the late 1990s and the subsequent heroin and fentanyl epidemics in the 2010s (National Center for Injury Prevention and Control 2020). These changes in the U.S. drug environment likely also have influenced U.S. suicide trends. For example, although suicide rates from all poisonings increased between 1999 and 2015, non-drug-poisoning suicides did not increase, indicating that increases in rates of poisoning suicide were driven entirely by drug-based poisonings (Kegler, Stone, and Holland 2017).

Several forces led to the dramatic increase in prescriptions and abuse of OPRs. First, persistent lobbying efforts in the 1980s and 1990s succeeded in designating pain as the "fifth vital sign," and physicians were subsequently encouraged to aggressively treat pain (Manchikanti et al. 2012; Quinones 2015). Relatedly, the FDA approved OxyContin in 1995, and prescription rates soared across the late 1990s. Indeed, OxyContin transformed the prescription drug landscape because it assured physicians a long-acting formulation of oxycodone. Purdue Pharma, the producer of the drug, aimed to make OxyContin the drug of choice for physicians treating any type of pain. To accomplish this and expand into noncancer pain markets, OxyContin was aggressively marketed as the safest OPR in history (Kolodny et al. 2015). In fact, the FDA-approved label stated that "delayed absorption as provided by OxyContin tablets, is believed to reduce the abuse liability of a drug," based only on a letter to the editor in the *New England Journal of Medicine* that claimed the risk of addiction among opioid users was less than 1% (Porter and Jick 1980).

With FDA approval in hand and a label promoting the safety of the drug, Purdue Pharma employed aggressive marketing techniques aimed at family care physicians, pain-related programs and conferences, and advertisements in medical journals. These efforts paid off, as OxyContin sales grew from $48 million in 1996 to over $1 billion in 2000 and then $3.1 billion in 2010 (IMS Institute for Healthcare Informatics 2011). And OxyContin was not the only OPR shaping the U.S. drug environment in the late 1990s and 2000s, given that Norco (hydrocordone) and Percocet (oxycodone) also received FDA approval in 1997 and 1999, respectively. Even as the population health consequences of OPR overprescribing became evident in the 2010s, the FDA continued to approve additional requests by pharmaceutical manufacturers. Indeed, the FDA approval of Zohydro (pure form hydrocodone) in 2013 was publicly condemned by multiple U.S. senators for the public health risks it posed (Gillibrand et al. 2013; Kaine 2014).

It is important to understand how the FDA, the very institution designed to protect Americans from potentially abusing OPRs like OxyContin, failed in its most central mission. One explanation is the growing influence of the pharmaceutical industry on the FDA itself (Light 2010). In 1992, Congress passed the Prescription Drug User Fee Act that allowed the FDA to collect fees from drug manufacturers to help cover staffing costs and expedite drug approvals. Although this undoubtedly sped up the approval process for life-saving drugs, it also created conflicts of interest because the FDA is now partially funded by the industries they are tasked with regulating (Zelenay 2005). The "Great Risk Shift" and deregulation efforts in the 1980s and 1990s expand on this explanation (Hacker 2019; Light 2010). Specifically, with dramatic cuts and underfunded Congressional budgets in the 1990s, the FDA found itself lacking the resources to thoroughly review all drug patent applications and effectively protect consumers from risk. Instead, these risks were privatized and "shifted" to individual doctors, patients, and states (Light 2010).

As the federal government and institutions such as the FDA shifted risk downstream, the importance of state laws and local protections increased. To illustrate, take the case of state triplicate prescription programs, which were some of the earliest prescription drug monitoring programs, enacted well before OxyContin's arrival. Triplicate programs mandated that when prescribing Schedule II controlled substances, physicians fill out and retain one copy of a state-issued triplicate form, and patients were required to provide two copies to their pharmacy—one to be kept and another to be sent to the state's drug monitoring agency (Alpert, Dykstra, and Jacobson 2020). Internal documents from Purdue Pharma indicate that less marketing and drug distribution were aimed at states with these safeguards in place. As a result, triplicate states had significantly slower growth in OPR abuse and

overdose deaths compared to states without these protections (Alpert et al. 2020). This highlights the importance of states' public health laws and drug environments following the risk shift from institutions such as the FDA to lower levels of social life such as states and individual physicians and consumers.

These changes in the U.S. drug environment had important effects on suicide mortality, especially for women due to the gendered nature of OPR prescription, use, and method of suicide. Women are more likely than men to be prescribed drugs of all type, especially opioid analgesics, antidepressants, and benzodiazepines (Zhong et al. 2013). Furthermore, the U.S. female population was especially vulnerable to the opioid epidemic given that women already exhibited higher opioid use and were more likely to combine opioids with sedative-hypnotic drugs (Campbell et al. 2010). In fact, women's benzodiazepine use was nearly twice that of men (Olfson, King, Schoenbaum 2015). As such, the gendered differences in OPR prescription and abuse made women especially vulnerable to the dramatic shifts in the drug environment during the U.S. opioid epidemic. Self-poisoning is one of the most common methods of suicide among women, and 90% of U.S. female poisoning suicides involve medications (Centers for Disease Control and Prevention 2017). Thus, in our first set of hypotheses, we anticipate that the institutional failures that led to the increased lethality of poisoning methods during the opioid epidemic reflect a structural determinant of suicide that intersects with the social patterning of suicide by gender.

> *Hypothesis 1:* Death rates from poisoning suicide increased after 1996, coinciding with period-based changes in the lethality of poison-based methods of self-harm.
> *Hypothesis 1a:* Given existing gendered differences in methods of self-harm, increases in death rates from poisoning suicide after 1996 are relatively larger in the U.S. female population than in the U.S. male population.
> *Hypothesis 1b:* Increases in death rates from poisoning suicide are associated with measures of U.S. states' drug environments.

The case of the U.S. financial crises and Great Recession. Economic recessions often increase risk of suicide, detrimentally affect mental health, and exacerbate stress-related health outcomes (Modrek et al. 2013; Suhrcke and Stuckler 2012), yet the population-level health consequences of these effects are often influenced by government interventions (Stuckler and Basu 2013). For example, in Sweden, suicide and alcohol-related deaths did not increase during a massive economic crash between 1990 and 1994 because the Swedish government (re)invested in social safety net programs to minimize the health effects of financial strain and economic distress (Stuckler and Basu 2013). Likewise, although U.S. suicide rates initially rose at the onset of the Great Depression in the 1930s, rates decreased following the passage of the New Deal in 1933. The legislation's "relief, recovery, and reform" had clear population health benefits. For example, the New Deal put Americans back to work on construction projects (e.g., Works Progress Administration), provided food vouchers (e.g., Food Stamp Program), protected consumers from foreclosure (e.g., Home Owners Loan Corporation), and lifted senior citizens out of poverty through the Social Security Act. By contrast, no such relief was provided to the average American during the housing and financial crises in 2006 to 2007, during the Great Recession 2007 to 2009, or during the slow and unequal recovery since (Yagan 2019; see Appendices A–C in the online version of the article). Instead of investing in social programs for the many, the U.S. government prioritized market stabilization and protected large financial sectors. In fact, following Congress's $2 trillion financial bailout of the banking industry (after decades of deregulation and high-risk borrowing strategies), Congress cut funding for Housing and Urban Development programs by $3.8 billion in 2011 (Stuckler and Basu 2013).

As such, Americans were especially vulnerable to the immediate stressors brought about by the loss of wealth and material well-being through the housing and financial crashes (2006–2007), the continued hardships during the Great Recession (2007–2009), and the long-term consequences of these economic challenges during the recovery period (2010+). During the Great Recession, unemployment exceeded 10% (Reeves et al. 2012), and between 2005 and 2010, 15 million U.S. homes were foreclosed on. The hardship was widespread, as many households lost a significant portion of their wealth given the depreciation of home values and equity leading up to and following the Great Recession (Wolff 2016). Economic downturns are associated with suicide (Modrek et al. 2013; Ruhm 2003), and rates increased during the foreclosure crisis (Fowler et al. 2015), especially among White men (Houle and Light 2017).

With levels of income inequality not seen since the Great Depression (Desilver 2013), ongoing cuts to social welfare programs, and an austere federal response to the Great Recession, states were important actors in shaping population health (Montez, Hayward, and Zajacova 2021; Woolf and Schoomaker 2019). Some evidence indicates that state-level policies (e.g., SNAP, minimum wage laws, gun control) affect suicide rates (Ghiani, Hawkins, and Baum 2019; Kaufman et al. 2020; Rambotti 2020). Therefore, we also investigate how recent trends in death rates from intentional self-harm among American men and women are associated with changes in U.S. states' economic environments. The following hypotheses leverage state-based variation in economic environments to examine the suicide impacts of a second structural determinant—the failure of the U.S. government to protect Americans before, during, and after the financial crash and Great Recession:

> *Hypothesis 2:* Death rates from nonpoisoning suicides significantly increased between 2007 and 2017, coinciding with the U.S. financial crisis, Great Recession, and slow economic recovery.
> *Hypothesis 2a:* Relative increases in death rates from nonpoisoning suicides between 2007 and 2017 are similar across all U.S. male and female racial-ethnic populations.
> *Hypothesis 2b:* Changes in U.S. states' death rates from nonpoisoning suicide are associated with long-term and cyclical changes in U.S. states' economic measures.

DATA AND METHODS

Data

Mortality data were from restricted-use multiple cause of death files from the National Center for Health Statistics and were composed of single-year death counts from intentional self-harm among U.S. Hispanic (Latino/a) and non-Hispanic AI/AN, Black, and White men and women ages 25 to 64 for all years 1990 to 2017. For years 1990 through 1998, we used ICD-9 codes E.950.0 to E.959.9 to identify suicide deaths. For years 1999 through 2017, we classified deaths as suicide using ICD-10 codes U03 to U039, X60 to X84.9, and Y87.0. We further classified suicide deaths as poisoning and nonpoisoning (NP). We coded a suicide death as a poisoning if (a) the underlying cause of death was ICD-9 codes E950.0 to 950.9 (1990–1998) or ICD-10 codes X60 to X69 (1999–2017) or (b) the immediate cause of death listed on the multiple cause of death file was drug use and suicide was determined to be the underlying cause of death.

We obtained county-level population counts for all U.S. men and women and for U.S. Latino/a, AI/AN, Black, and White men and women ages 25 to 64 for all years 1990 to 2017 via the National Cancer Institute's Surveillance, Epidemiology, and End Results Program (2022). We combined population and suicide deaths into state-level and national-level analytic samples of five-year age-specific (25–29, . . . , 60–64 years) and age-standardized suicide rates (25–64 years) by race-ethnicity and gender for all years 1990 to 2017.

We obtained time-varying measures of state poverty rates, unemployment rates, average weekly wages, and mean and median incomes from the U.S. Census Bureau's Small Area Income and Poverty Estimates Program (https://www.census.gov/programs-surveys/saipe/data/datasets.All.html) and Bureau of Labor Statistics (https://www.bls.gov/cew/datatoc.htm). We obtained single-year measures of each state's housing price index (standardized to 1990 levels) from the St. Louis Federal Reserve Economic Data (https://fred.stlouisfed.org/). We used the Hodrick-Prescott filter with a smoothing parameter of 1,600 to decompose each economic measure into a trend component and a cyclical component (Ravn and Uhlig 2002), and estimates were robust to various filter methods (see Appendix D in the online version of the article).

Methods and Analytical Strategy

We tested each set of hypotheses through a number of analyses. First, we fitted Poisson models to suicide rates by poisoning and NP among all U.S. men and women separately for five-year age groups 25 to 29, . . . , 60 to 64 years. We fitted these baseline models to national-level data to estimate trends in U.S. men's and women's age-specific suicide rates by method. We then extended our national-level analyses by identifying a break in poisoning suicide trends among U.S. women in 1996–1997 and a break in the NP suicide trends for both U.S. men and women in 2006–2007. The locations of these cut points correspond to the onset of the opioid epidemic and the housing/financial crises in the United States, respectively (see Appendices E–G in the online version of the article). We fitted models separately by sex and race-ethnicity to poisoning suicides between 1990 and 1996 and 1997 and 2017 to test for differences in trends in poisoning suicides

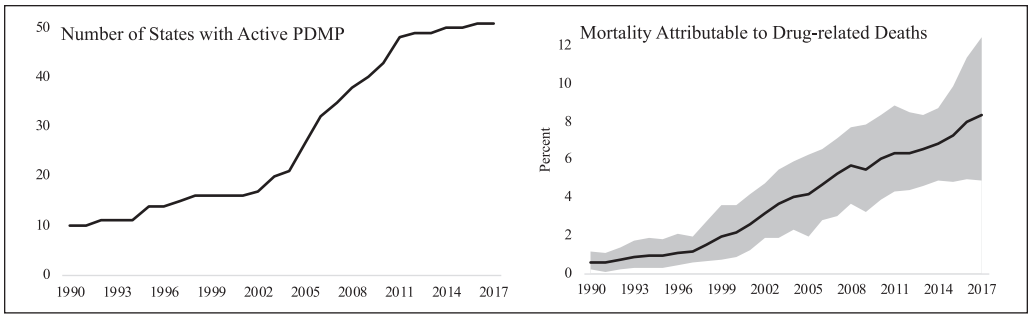

Figure 1. Indicators of U.S. States' Drug Environments, 1990 to 2017.
Note: Shaded area around mortality attributable to drug-related deaths indicates range between 10th and 90th percentiles. Mortality data source is the restricted-use multiple cause of death files from the National Center for Health Statistics. PDMP data source is the Prescription Drug Monitoring Program Training and Technical Assistance Center (https://www.pdmpassist.org/State). $N = 1{,}428$ state-years. PDMP = prescription drug monitoring program.

prior to the availability of OPRs (i.e., 1990–1996) and during a period when their availability increased (i.e., 1997–2017; Hypothesis 1a). Additionally, we fitted models to NP suicides separately by sex and race-ethnicity between 1990 and 2006 and 2007 and 2017 to test for differences in trends in NP suicides before and after the onset of the financial crisis (Hypothesis 2).

Next, we tested the influence of states' drug environments on women's suicide trends by fitting within-estimator regression models on states' female poisoning suicide death rates by including yearly time fixed effects and state fixed effects (Halaby 2004). We included in these models two time-varying indicators of states' "drug environments" (Ruhm 2019) to assess the extent to which trends in U.S. women's suicide rates from poisonings were associated with trends in states' drug environments. First, the proportion of the age-standardized death rate among U.S. women attributable to drug-related deaths approximate the extent to which each U.S. state's yearly mortality rate among its working-age population was affected by drug-related deaths. Second, we included a time-varying indicator of whether a state had in place an operational prescription drug monitoring program (PDMP). Cumulative counts of states with an active PDMP in each year are plotted in the left panel of Figure 1, and the average percentage of the age-standardized death rate attributable to drug-related deaths in each year is plotted in the right panel of Figure 1. We included the 10th and 90th percentiles to indicate state-based variation in the percentage of working-age U.S. mortality attributable to drug use and to also illustrate that the U.S. drug environment expanded in all states in similar ways across this time.

To illustrate the associations between trends in states' drug environments and trends in U.S. female poisoning suicides, we contrasted the conditional margins (i.e., expected age-standardized suicide death rate from poisoning) estimated from the baseline model and estimated from the drug environment model assuming that states have a PDMP in place, and the all-cause death rate and percentage of deaths attributable to drug use are both held at the average 1990 levels (for model specifics, see Appendix H in the online version of the article).

We then fitted within-estimator regression models on states' male and female NP suicide rates by including time and state fixed effects with time-varying indicators of states' economic conditions.

The average cyclical component of states' unemployment rates, median income, and adult poverty rates are plotted as *z* scores in Figure 2. Positive values indicate unemployment rates, poverty rates, and incomes above the average trends in these economic indicators between 1990 and 2017, and negative values indicate these economic indicators at *z* scores below the average trends. We show that positive cyclical values of both poverty and unemployment track strongly with the timing of official U.S. recessions (i.e., early 1990s, early 2000s, and the Great Recession). We also observe that average income for Americans grew quickly in the early 2000s but then plummeted with the housing and financial crises between 2006 and 2008 and remained below average trends for several years during the Great Recession.

The average trend and the cyclical component of housing price index (HPI) are plotted in Figure 3. Patterns in the HPI cycle track strongly with income, consistent with evidence suggesting that

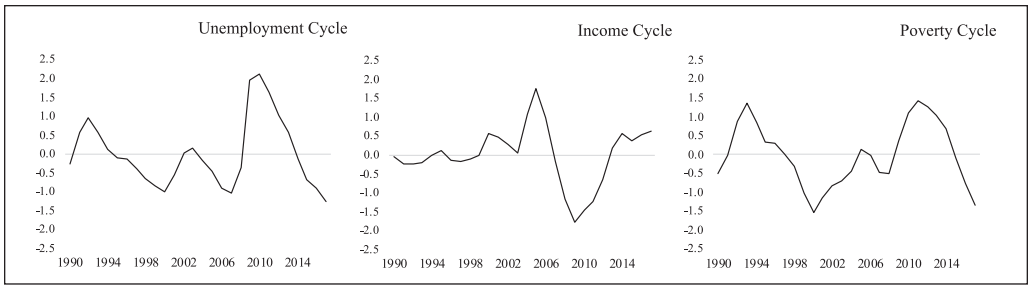

Figure 2. Average Cyclical Components of U.S. States' Unemployment Rate, Median Income, and Adult Poverty Rate, 1990 to 2017.
Source: Authors' own calculations using data from U.S. Census Bureau's Small Area Income and Poverty Estimates Program state and county estimates for 1989 to 2017 (poverty rate and median household income) and using data from U.S. Bureau of Labor Statistics's average annual unemployment rates by state for 1980 to 2017.
Note: $N = 1{,}428$ state-years. Values on *y*-axis indicate *z* score deviation from trend.

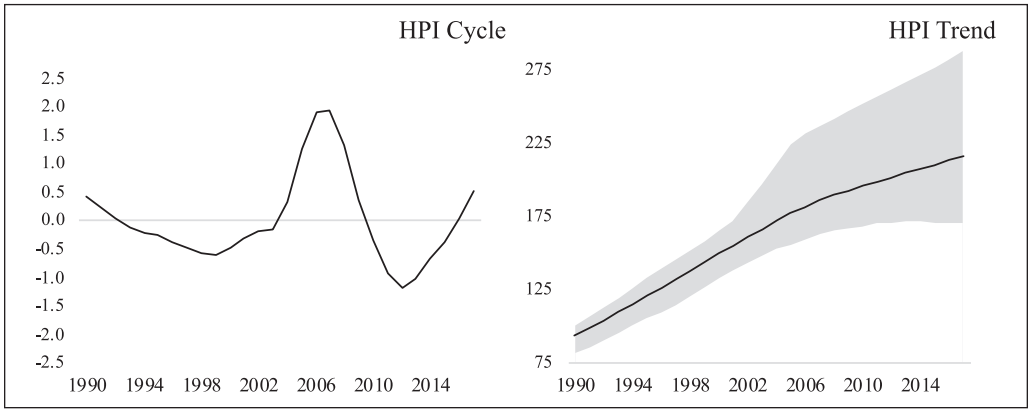

Figure 3. Average Cyclical Component and Trend Component of U.S. States' Housing Price Index, 1990 to 2017.
Source: Authors' own calcualtions using state-level data obtained from the Economic Research division of Federal Reserve Bank of St. Louis (https://research.stlouisfed.org).
Note: Values on *y*-axis of HPI cycle indicate *z* score deviation from HPI trend; values on *y*-axis of HPI trend indicate average U.S. states' housing price index in 1990 dollar amount; shaded area around HPI trend indicates range between 10th percentile and 90th percentile. $N = 1{,}428$ state-years. HPI = housing price index.

U.S. households' net worth became increasingly associated with real estate value during the 1990s and 2000s (Federal Reserve of the United States and Board of Governors of the Federal Reserve System 2020; see Appendix A in the online version of the article). These long-term trends whereby American's economic well-being were increasingly tied to cyclical markets likely increased Americans' vulnerability to economic downturns. We included the 10th and 90th percentiles of the HPI trend component to illustrate widening between-state variability in housing costs, which indicates variability in risk to economic downturns from unstable housing markets and real estate values (i.e., housing bubbles). As a result of this increased volatility and precarity, the economic and health consequences of the Great Recession were likely amplified compared to prior economic downturns, especially among the lower socioeconomic classes in the United States (Federal Reserve of the United States and Board of Governors of the Federal Reserve System 2020; Foote and Ryan 2015; Pew Research Center 2016; Yagan 2019; see Appendix C in the online version of the article). In some part, the amplification was likely also due to the U.S. government's regulatory retreat from speculation in

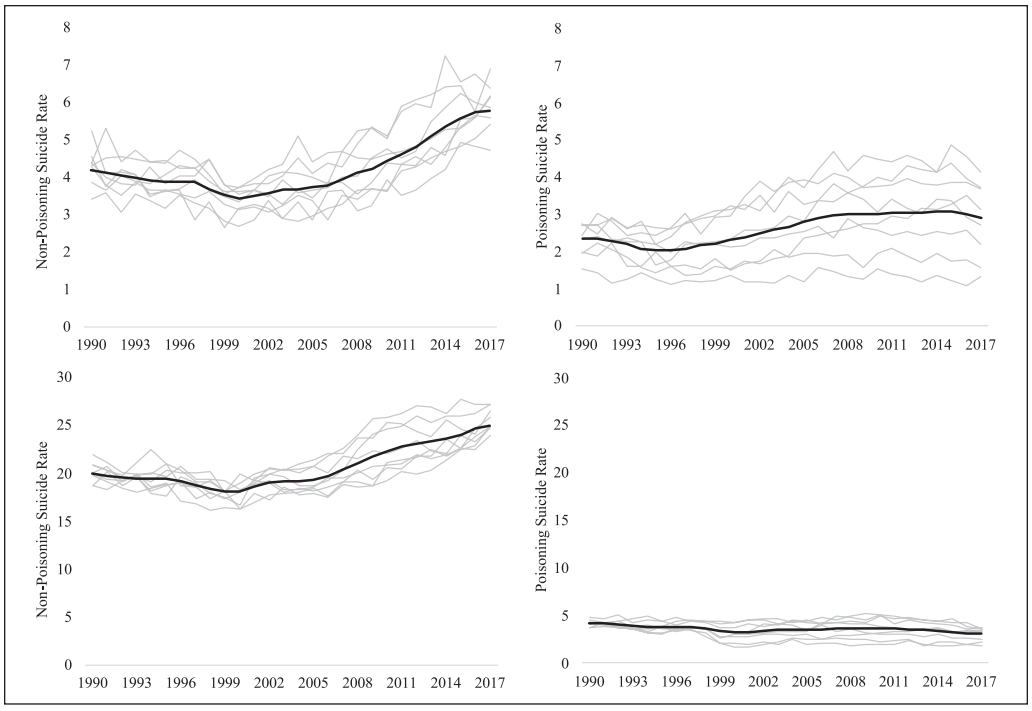

Figure 4. Age-Specific Suicide Mortality Rates from Nonpoisoning (Left) and Poisoning (Right) among U.S. Women (Top) and U.S. Men (Bottom).

Note: Black lines indicate average suicide mortality rates. Data source is the restricted-use multiple cause of death files from the National Center for Health Statistics. $N = 32$ separate analytic samples composed of 140 five-year age by 28 single-year cells.

financial markets and curtailment of the welfare state (Krippner 2011). The degree of this amplification and the economic and health consequences of the downturns might also have varied by state (Montez et al. 2021; seeAppendix I in the online version of the article).

Using the time-varying economic indicators in Figures 2 and 3, we estimated the role of state economic environments on trends in deaths from NP suicides by fitting separate within-estimator regression models to states' male and female NP suicide rates with time and state fixed effects models. To illustrate the associations between trends in states' economic conditions and trends in U.S. male and female NP suicides, we contrasted the conditional margins estimated from a baseline model and estimated from the economic conditions model assuming that the all-cause mortality rates, housing price trend, and cyclical components of the poverty rate, unemployment rate, median income, and housing price are held at the average 1990 levels (for model specifics, see Appendix J in the online version of the article).

RESULTS

Figure 4 plots age-specific suicide rates from poisonings and nonpoisonings among U.S. women and men aged 25 to 64. Among both men and women and for all age groups, NP suicide rates were relatively stable across the 1990s and early 2000s but increased during the late 2000s and 2010s. Suicide rates from intentional poisonings among U.S. men remained low and stable across the entire time period but began to increase among U.S. women in the late 1990s. The trends in suicide rates by method indicate that between 1996 and 2006, increases in U.S. women's suicide rates were due to rising rates of poisonings among middle-age populations. Unlike the increases in NP suicides across the late 2000s, the increases in rates of self-poisonings among U.S. women differed by age, with the greatest increases observed at ages 40 to 55 years.

Table 1 reports the annual proportionate change in age-standardized mortality rates from NP suicides and poisoning suicides for U.S. women and men by race-ethnicity. The proportionate changes

Table 1. Proportionate Change in Age-Standardized Mortality Rates from Suicide per Change in Single Year by Time, Method, Gender, and Race-Ethnicity among U.S. Adults Ages 25–64, 1990–2017.

	Nonpoisoning Suicide			Intentional Poisoning		
	1990–2006	2007–2017		1990–1996	1997–2017	
	Yearly %Δ	Yearly %Δ	Difference	Yearly %Δ	Yearly %Δ	Difference
Women						
Black	*−2.0*	*4.2*	6.3***	*−4.4*	*.8*	5.2**
White	−.2	*4.9*	5.1***	*−2.2*	*2.4*	4.5***
AI/AN	2.0	*9.7*	7.7***	−.8	1.5	2.3
Latina	*−2.2*	*5.8*	8.0***	−3.5	*1.4*	5.0*
All	*−.8*	*4.3*	5.1***	*−2.9*	*1.6*	4.5***
Men						
Black	*−1.4*	*1.9*	3.3***	−.4	*−2.3*	−1.9
White	*.6*	*2.5*	1.9***	*−1.0*	*.3*	1.2**
AI/AN	*1.7*	*5.9*	4.2***	3.2	0	−3.2
Latino	*−2.0*	*2.0*	3.9***	*−4.4*	*−2.0*	2.5
All	−.2	*1.9*	2.1***	*−1.6*	*−.6*	1.1***

Note: Italicized number indicates that the estimated slope is significantly different from .0 at .01 α level. Changes for the "all" group were estimated from the entire U.S. population. Mortality data source is the restricted-use multiple cause of death files from the National Center for Health Statistics. AI/AN = American Indian/Alaska Native.
*$p < .05$. **$p < .01$. ***$p < .001$.

in rates of poisoning suicides are estimated separately for 1990 to 1996 and 1997 to 2017, and the proportionate changes in rates of NP suicides are estimated separately for 1990 to 2006 and 2007 to 2017.

On the left side of Table 1, the average annual proportionate changes in NP suicide rates among U.S. female populations prior to the financial crisis are shown to have been either negative (e.g., among Black and Latina women) or nondifferent from zero (e.g., among White and AI/AN women), and the average change among all U.S. women was a .8% decline per year. After the financial crash in 2007, the average annual change in NP suicide rates significantly increased by over 4% per year among each U.S. female population. In all racial-ethnic female populations examined, the annual proportionate changes in NP suicide rates between 2007 and 2017 were substantively and significantly greater than those between 1990 and 2006.

Similar trends in NP suicide rates are observed in the U.S. male populations. Overall, NP suicide rates among all U.S. men between 1990 and 2006 declined .2% per year, although they increased among White and AI/AN male populations. Between 2007 and 2017, the average annual change in NP suicide rates significantly increased for all groups, with the greatest increases observed among the AI/AN population. The annual proportionate changes among all four racial-ethnic U.S. male populations between 2007 and 2017 were substantively and significantly larger than in the period prior to the financial crisis and Great Recession.

Average annual proportionate changes in rates of poisoning suicides among U.S. female populations prior to the onset of the opioid epidemic in 1996 were negative (e.g., among Latina, Black, and White women) or nondifferent from zero (e.g., among AI/AN women), and the average change among all U.S. women was a 2.9% decline per year. However, between 1997 and 2017, the average annual change in rates of poisoning suicide significantly increased by 1.6% per year among U.S. women overall. Thus, among U.S. women, the difference in proportionate changes in poisoning suicides from 1997 to 2017 compared with 1990 to 1996 was nearly 5 percentage points, with nonsignificant differences in the changes between White, Black, and Latina women.

These results provide support for Hypothesis 1 and Hypothesis 1a. Prior to 1997, rates of poisoning suicides were declining among the U.S. male and

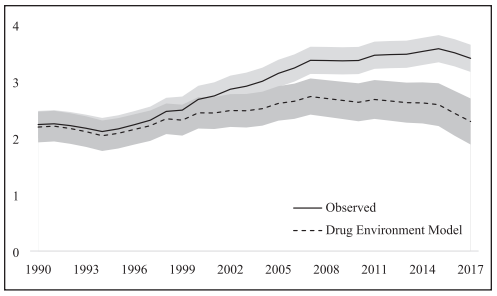

Figure 5. Estimated Trends in Age-Standardized Mortality Rates from Poisoning among U.S. Women Ages 25 to 64, Baseline Model (i.e., Observed Rates) versus Drug Environment Model.
Note: Shaded areas indicate 95% confidence intervals. Data source is the restricted-use multiple cause of death files from the National Center for Health Statistics. *N* = 1,428 state-years.

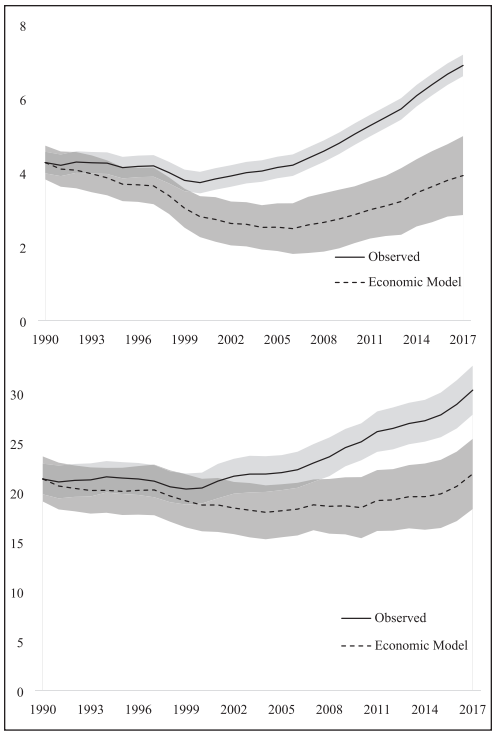

Figure 6. Estimated Trends in Age-Standardized Mortality Rates from Nonpoisoning Suicides among U.S. Women (Top) and Men (Bottom) Ages 25 to 64, Baseline Model (i.e., Observed Rates) versus Economic Model.
Note: Shaded areas indicate 95% confidence intervals. Data source is the restricted-use multiple cause of death files from the National Center for Health Statistics. *N* = 1,428 state-years.

female populations but significantly increased between 1997 and 2017 among U.S. women. The timing of the changes in poisoning suicides, the gendered nature of the trends, and the age-based variability shown in Figure 4 are consistent with our suggestion that a change in the lethality of methods (i.e., increased availability and use of OPRs and benzodiazepines) was likely associated with poisoning suicide trends among U.S. women. Our results also provide evidence in support of Hypothesis 2 and Hypothesis 2a. Prior to 2007, rates of NP suicide were declining or stable among the U.S. female and male populations but significantly increased between 2007 and 2017 with the onset of the financial crisis. The relative increases in the rates were significant for all U.S. racial-ethnic male and female populations and were estimated to be significantly different than the estimated linear trends between 1990 and 2006. Results were also robust when estimated using dynamic models (available on request).

Figure 5 plots age-standardized death rates from poisoning suicide among U.S. women between 1990 and 2017 estimated from the baseline and drug environment within-estimator models. The results presented in this figure support Hypothesis 1b. Specifically, increases in states' female suicide death rates from intentional poisonings were associated with changes in U.S. states' drug environments. Results from the drug environment model suggest that changes in the percentage of states' female all-cause mortality attributable to drug use were significantly and positively associated with changes in rates of poisoning suicide (see Appendix K in the online version of the article). If the percentage remained at the 1990 levels and a PDMP were in place, Figure 5 suggests that the estimated age-standardized mortality rate from poisoning suicide is expected to have been significantly lower than the observed rate and nonsignificantly different from the 1990 rates.

Figure 6 displays age-standardized NP suicide rates among U.S. women (top) and U.S. men (bottom) between 1990 and 2017 estimated from the baseline and economic within-estimator models. We observe that increases in NP suicide rates among U.S. men and women were strongly associated with changes in states' economic trends and cycles. Results from the economic model suggest that states' rates of NP suicides were strongly and positively associated with unemployment cycles

and long-term trends in HPI and strongly and negatively associated with HPI cycles (see Appendices L and M in the online version of the article). Associations between NP suicide rates and income and poverty cycles were attenuated and nonsignificant because the variables are highly correlated with each other. Overall, if the cyclical components of unemployment, median income, poverty rates, and HPI remained at 1990 levels (i.e., were stable around the average, see Figure 2) and HPI remained constant, Figure 6 suggests that the age-standardized female and male suicide rates from NP methods would have been significantly lower than the observed rates and nonsignificantly different from the rates in 1990. The results support Hypothesis 2b and suggest that changes in states' economic environments were strongly associated with the suicide increases observed with the onset of the financial crash and Great Recession in the mid- to late 2000s.

DISCUSSION

Rising suicide rates in the United States are concerning for U.S. population health, especially because the trends appear widespread (Hedegaard et al. 2020) and increased again in 2021 (Garnett and Curtin 2023), following small declines in 2019 and 2020 (Garnett et al. 2022). Explanations that emphasize social factors have largely focused on despair (Case and Deaton 2015, 2017, 2020; Glei et al. 2020; Monnat and Brown 2017), access to lethal means (Campbell et al. 2010; Ghiani et al. 2019; Serdarevic, Striley, and Cottler 2017), or the impacts of the Great Recession on material well-being (Harper and Bruckner 2017; Oyesanya et al. 2015; Phillips and Nugent 2014; Reeves et al. 2012). In this study, we focus on the time period preceding the COVID-19 pandemic and highlight the importance of structural determinants of suicide through two case studies—the opioid epidemic and the Great Recession—to demonstrate how institutional failures can elevate population-level suicide risk. The results in this study have profound theoretical implications for the sociology of suicide and for how suicide prevention is conceptualized and implemented, which we describe in turn.

Our first case study examined trends in poisoning suicides before and after the onset of the opioid epidemic, which significantly changed the U.S. drug environment following the FDA's approval, mass marketing campaigns, and rising availability of OxyContin (1995). The subsequent availability and widespread prescription of additional OPRs such as Norco (1997) and Percocet (1999) coupled with the rising prescriptions of benzodiazepines further increased the lethality of the U.S. drug environment. We demonstrate that prior to 1997, rates of poisoning suicides were declining among both U.S. male and female populations but significantly increased between 1997 and 2017 among U.S. women. The relative increases were significant for all racial-ethnic female populations except AI/AN. Furthermore, we observed strong associations between changes in state-level drug environments and the rising rates of poisoning suicide among U.S. women. These trends coincide with the increased prescription and availability of OPRs (Masters et al. 2018; Ruhm 2019; Van Zee 2009) and are highly gendered given that poisoning is a far more common method of suicide among U.S. women (Centers for Disease Control and Prevention 2017). Indeed, results suggest that state drug environments (Alpert et al. 2020; Ruhm 2018, 2019; Seltzer 2020) have significantly shaped recent trends in U.S. women's poisoning-based suicides.

Our second case study of institutional failures focused on NP suicides during the periods before and after the U.S. housing and financial crises and Great Recession. Although the trends are driven by other suicide methods (i.e., nonpoisonings), the results are consistent with our contention that institutional failures by the U.S. government constitute a structural determinant of these suicides. Drawing on a host of economic indicators at the national (e.g., assets-to-liabilities ratio) and state levels (e.g., housing price indices), we find that death rates from NP self-harm began to increase in 2007, coinciding with the onset of the housing and financial crises. These upward trends continued during and after the Great Recession. Furthermore, relative increases from NP suicides were observed for all race-gender populations examined and, importantly, were significantly associated with changes in states' economic trends. Just as the opioid epidemic laid bare the implications of an increasingly lethal American society resulting from institutional failures, these results suggest just some of the health consequences of financialization. That is, the financialization of the U.S. economy created volatility and precarity for most Americans (Hacker 2019), which, in turn, likely amplified the negative health consequences of economic downturns.

Taken together, these results have important implications for the sociology of suicide. In recent years, sociological scholarship on suicide has made important advancements in theory, such as revisiting the role of social regulation and culture to illustrate the potentially harmful role of social relationships in exposing adolescents to suicidality (Abrutyn and Mueller 2014; Abrutyn, Mueller, and Osborne 2020;

Mueller and Abrutyn 2016). However, recent scholarship has also increasingly focused on individual experiences of ideation (Wray et al. 2011) and social relationships (Gibbs 2000; Maimon and Kuhl 2008; Stockard and O'Brien 2002). Although important, we echo calls for sociologists to move beyond Durkheim ([1897] 1951) in understanding U.S. suicide trends and patterns (Mueller et al. 2021). That is, much of the traditional sociology of suicide has focused on social relationships given Durkheim's ([1897] 1951) conceptualization of integration and regulation. Yet the results presented here suggest that there are structural determinants of suicide and that they need not be tied to social relationships. We highlighted how institutional failure as one type of structural determinant can elevate societal risk of suicide. Specifically, we argued that failures by the U.S. government exacerbated the health consequences of the opioid epidemic and the Great Recession. Thus, one theoretical implication of this study is that sociological theories of suicide ought to better account for structural determinants of suicide given that structural determinants (e.g., government policy) may not fit neatly into Durkheim's ([1897] 1951) theory of suicide and the importance of social relations.

This study also provides a second theoretical contribution to the sociology of suicide. That is, the social patterning of suicide (e.g., by gender, race, SES) is not merely due to social differences between groups or individuals. Rather, structural determinants can differentially impact risk across these social categories. In this study, we highlight gender and document the significant rise in poisoning-based suicides among U.S. women beginning in 1997. Although others have shown gendered differences in cultural scripts surrounding suicide (Canetto 1997), this study is unique in demonstrating how a social identity by which individuals are assigned (i.e., gender) can impact suicide through structural factors such as the dramatic change to the U.S. drug environment following FDA approval of OPRs and their rapidly increasing yet highly gendered availability.

This study may also inform medical sociology and research on U.S. mortality more broadly. To date, most national-level mortality scholarship has considered suicide alongside other "deaths of despair" (DOD; i.e., deaths from suicide, drug use, and alcohol use). Among medical sociologists and social epidemiologists, much of this work has sought to define and measure despair (see Gutin et al. 2023), with much attention on the social conditions that generate economic distress (Glei et al. 2020; Monnat and Brown 2017). Although scholars have raised concerns about the complicated task of attributing recent trends in U.S. DOD mortality to psychological distress (Cherlin 2018) and in the validity of a composite DOD measure (Simon and Masters 2021; Tilstra 2023), this study illustrates how gender differences in suicide trends can originate from changes in self-harm methods alone. Additionally, our state-level analyses highlight the downstream impacts of the "Great Risk Shift" as the federal government retreated from its duty to protect individuals from risk (Hacker 2019) and gutted social safety nets, leaving Americans vulnerable to changes in the social, economic, and drug environments across the country.

The contributions of this study must be understood alongside several limitations. First, we do not have individual-level data on the links between exposures (e.g., individual or household financial stressors experienced during the Great Recession) and outcomes. By relying on official mortality statistics, we are able only to analyze state- and national-level trends in cause-specific suicide mortality and their associations with changes in state-level indicators of drug and economic environments. Second, this study does not examine how the associations between state-level drug and economic environments and cause-specific suicide mortality vary by occupation, SES, region, or other social factors. Data permitting, future work should explore these important connections. Additionally, our study uses official death records, which present some challenges in parsing drug overdose deaths from suicide (Rockett, Kapusta, and Coben 2014) and may underestimate suicide poisoning trends (Rockett et al. 2018). To best account for this, we rely on the multiple cause of death files, which enable the disaggregation of suicides into general poisoning (suicide by poisoning, including suicide with drug use listed as an underlying cause) and nonpoisoning (suicides from all NP methods and where drugs were not listed) groups.

Despite these limitations, the results presented here support calls to scale up the SDoH perspective and contribute to a small but growing body of evidence demonstrating the role of structural factors in shaping population health patterns and suicide mortality trends (e.g., Muller et al. 2020). Finally, this study should also inform future suicide prevention efforts. Namely, given the importance of the structural factors documented here, the results from this study are most consistent with previous calls for suicide prevention efforts to move "upstream" to consider how policies and institutional practices increase suicidal exposures and vulnerabilities (Mueller et al. 2021). We echo these calls and urge

policy makers and other stakeholders to recognize government regulations, economic interventions, and social safety net investments as vital suicide prevention tools to complement existing efforts at the individual level.

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SUPPLEMENTAL MATERIAL

Appendices A through M are available in the online version of the article.

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