

“Is There a Relationship Between Welfare-State Policies and Suicide Rates? Evidence from the
U.S. States, 2000-2015”

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Highlights

- Combines economic strain and institutional theory to investigate welfare and suicide.
- Estimates the relationship across 50 U.S. states, 2000–2015.
- Uses two-way state and year fixed-effects.
- SNAP participation is associated with lower overall and male suicide rates.
- Increasing SNAP participation may reduce suicide during economic downturns.

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Abstract

Suicide is one of the leading causes of death in the United States. The rise in suicide rates is contributing to the recently observed decline in life expectancy. While previous research identified a solid association between economic strain and suicide, little attention has been paid to how specific welfare policies that are designed to alleviate economic strain may influence suicide rates. There is a growing body of research that is using an institutional approach to demonstrate the role of welfare-state policies in the distribution of health. However, this perspective has not been applied yet to the investigation of suicide. In this study, I combine these approaches to analyze the association between two specific policies, Supplemental Nutrition Assistance Program (SNAP) and Earned Income Tax Credit (EITC), and overall and gender-specific suicide rates across the 50 U.S. states between 2000 and 2015. I estimate two-way fixed-effects longitudinal models and find evidence of a robust association between one of these policies – SNAP – and overall and male suicide. After adjusting for a number of confounding factors, higher participation in SNAP is associated with lower overall and male suicide rates. Increasing SNAP participation by one standard deviation (4.5% of the state population) during the study period could have saved the lives of approximately 31,600 people overall and 24,800 men.

Keywords: suicide; health; social policy; food stamps; social determinants; panel data; fixed-effects.

1. Introduction

Suicide is one of the leading causes of death in the United States. It has increased constantly since 1999 and claimed more than 47,000 lives in 2017 alone. The rise in deaths by suicide is partially responsible for the decline in life expectancy recently observed in the United States (Murphy et al., 2018).

Much sociological research has highlighted the robust association between economic strain and suicide (Stack, 2000). Economically strained groups, such as poor and unemployed populations, face greater risk of suicide, both directly and indirectly. For instance, economic strain may encourage unhealthy coping mechanisms such as alcohol consumption and may erode social networks by increasing marital conflict or forcing people to relocate to areas where they can find employment (Stack, 2000). Evidence suggests that job loss is the most dangerous cause of strain, but that co-occurrence of more than one source of strain is typical (Stack and Wasserman, 2007).

This line of research has paid little attention to the relationship between social welfare and suicide. Scholars interested in studying how social welfare is related to health have recently developed a “social policy hypothesis” (Beckfield and Bambra, 2016) which aims to explain differences in health outcomes such as self-reported health, life expectancy, and infant mortality rate, across time and geographical areas (Beckfield and Krieger, 2009; Bergqvist et al., 2013). This approach uses an institutional lens that considers social welfare policies as the “rules of the game” influencing, among other things, the distribution of health (Beckfield et al., 2015).

The purpose of this study is to combine these two approaches by testing the relationship between two specific policies, Supplemental Nutrition Assistance Program (SNAP) and Earned Income Tax Credit (EITC), and overall and gender-specific suicide rates across the 50 U.S. states

between 2000 and 2015. I propose that welfare stinginess may be conceived as an additional source of economic strain. My findings show a robust association between one of these policies – SNAP – and overall and male suicide. Higher levels of SNAP participation, adjusted for confounding factors, are statistically significantly associated with lower suicide rates. Longitudinal models with state and year fixed-effects predict that an increase in SNAP participation by one standard deviation (4.5% of state population) during the study period could have reduced the overall number of deaths by suicide by approximately 31,600 and the number of male deaths by around 24,800.

2. Background

2.1 Suicide, Economic Strain, and Policy

For the first time in decades, life expectancy has recently decreased in the affluent world. This decline is particularly severe in the U.S., which has remarkably lower longevity than the rest of high-income countries. Among other factors influencing the recent drop in longevity in the U.S., the rise in suicide has primary importance (Murphy et al., 2018) and is the focus of the present study.

Researchers who have analyzed the recent worsening of health in affluent countries have stressed the importance of approaching the issue from a macro-level perspective: after all, “the macro-level mortality trends require macro-level explanations” (Zajacova and Montez, 2017, p. 991). These explanations should take advantage of the differences existing across U.S. states and focus on “understanding the disparities across states’ social, economic, and policy environments and their effect on mortality” (Zajacova and Montez, 2017, p. 991). This has been done on a number of morbidity and mortality measures, from self-reported health to mental health, to

obesity (Beckfield and Krieger, 2009; Borrell et al., 2014). Within this context, a group of researchers has embarked on a project to provide a coherent framework to analyze the impact of the welfare state on health (Beckfield et al., 2015). This new institutional theory of health inequalities looks at welfare-state policies as the rules of the game, which distribute health across the population. This perspective, which guides the present study, rarely intersects with the study of suicide.

In fact, while research on suicide has often identified economic strain as a cause for suicide (Stack, 2000), analysis of the effect of social policy on suicide is scant. It is particularly important to fill this gap considering that suicide is rising in the U.S. but falling in most of Europe, including the U.K. (Stack, 2018). Furthermore, with only one exception (Gertner et al., 2019), research on social policy and suicide is relatively dated.

A recent review (Kim, 2018) identified seven studies that investigated the relationship between social policy and suicide in the U.S. (Cylus et al., 2014; Flavin and Radcliff, 2009; Minoiu and Andrés, 2008; Ross et al., 2012; Zimmerman, 2002, 1995, 1987). These studies present some mixed evidence but overall, they indicate that there is a negative relationship between various forms of social protection and suicide. Nonetheless, the theoretical and methodological limitations of these studies suggest that further investigation is warranted.

These analyses present several theoretical frameworks, which are neither mutually exclusive nor exhaustive. For instance, scholars alternatively advanced psychosocial and material explanations for the relationship between social policy and suicide, but these motives can cooccur. References to Durkheim's classical study of suicide (1897) have emphasized the influence of low levels of social integration (Zimmerman, 2002, 1995, 1987) and regulation (Flavin and Radcliff, 2009), pay little attention to the fact that high levels of integration and

regulation can also lead to suicidal behavior (Abrutyn and Mueller, 2018). The marriage of economic strain and institutional scholarship that I propose here provides a more comprehensive and parsimonious framework for understanding the relationship between social policy and suicide.

On a methodological and empirical level, three studies use a cross-sectional design that cannot estimate change (Flavin and Radcliff, 2009; Zimmerman, 1995, 1987). Only two studies include data after 2000 (Cylus et al., 2014; Ross et al., 2012), and neither of them analyze the longterm aftermath of the Great Recession. All but one study (Cylus et al., 2014) provide a one-dimensional operationalization of welfare based on expenditure levels, in spite of the fact that “there are aspects that should be considered in measuring programs other than the quantity of money spent” (Kim, 2018, p. 530).

In this regard, it is important to notice that scholars of social stratification have demonstrated that policy efficacy does not solely depend on levels of expenditure (Kenworthy, 2011; Kenworthy and Pontusson, 2005). For example, using net public and private social expenditures per person, Kenworthy noted that “The United States spends more money on social protection than is often thought, yet that spending does not do nearly as much to help America’s poor as we might like” (Kenworthy, 2011, p. 93). This finding confirms Esping-Andersen’s intuition that “It is difficult to imagine that anyone struggled for spending *per se*” (Esping-Andersen, 1990, p. 21).

Consistent with this perspective, recent scholarship has suggested that it is useful to consider specific welfare policies (Bergqvist et al., 2013). A recent and important contribution in this direction investigated the relationship between minimum wages and suicide rates across the U.S. states between 2006 and 2016 (Gertner et al., 2019). Using fixed-effects for states and

years, the researchers found that a “one-dollar increase in the real minimum wage was associated on average with a 1.9% decrease in the annual state suicide rate” (Gertner et al., 2019, p. 648). In the present study, I adopt a similar approach to test the impact of two welfare policies, SNAP and state EITC, on suicide rates for all 50 U.S. states between 2000 and 2015.

I chose to focus on this time period for a number of reasons. First, as said above, it is necessary to carry out an updated analysis of the American context with regard to suicide and social policy (Stack, 2018). Second, it is a practical decision based on the availability of comparable data on all the variables of interest. Third, it is interesting to analyze this relationship in a time when both suicide and economic inequalities are on the rise. Fourth, this time period includes the Great Recession, its aftermath, and the subsequent recovery. We know that rates of suicide increased after the 2008 crisis, especially where job loss was higher (Chang et al., 2013), thus it is particularly interesting to see the impact of social policies that are meant to alleviate economic hardship.

2.2 Choosing a Welfare Approach

Due to the complexity of the welfare state, researchers who aim to assess its relationship with population health must make two key decisions. The first one regards the overarching approach to the study of policy. Pega and colleagues (2013) identify three main approaches. The first two, more popular among social scientists, focus on the predictive power of welfare regime typologies (“the welfare regime approach”) and political traits that are known to be associated with policy outcomes (“the politics approach”). The third, less common, approach centers on the evaluation of “clearly defined” (Pega et al., 2013, p. 177) policies on individual or population health (“the individual policy approach”). Pega and colleagues call for “for greater attention and

application” (Pega et al., 2013, p. 179) of this approach, which is preferable because of its direct policy implications and informs the current study.

The second decision regards the identification of one or more specific policies, which I pursued following two criteria. Any given choice is inherently limited and, to some extent, arbitrary if one accepts that “all policy is health policy” (Dow et al., 2010, p. 240). However, it is exactly this consideration that guides my first criterion to focus on broader social policies that extend “beyond the healthcare sector” (Gkiouleka et al., 2018, p. 95) and are designed to alleviate economic strain rather than health-specific policies designed, for instance, to expand coverage and access to care. The second criterion rests on the peculiar attitude Americans hold about welfare, which reveals a diffuse distrust of welfare recipients and an attempt to draw a distinction between the “deserving” and the “undeserving” poor (Gilens, 1999). Thus, I selected two social policies that effectively support low-income individuals and households and present varying degrees of social stigmatization.

As explained above, this approach has an additional merit insofar as it explores dimensions of policy that are not limited to mere spending. Nonetheless, I used a comprehensive measure of spending to test whether data are compatible with this assumption. I provide below a brief review of the policies here analyzed.

2.3 SNAP and EITC

My focal policies are specifically designed to support the lower and lower middle class (Bartfeld et al., 2015; Moffitt, 2013; Tiehen et al., 2013): Supplemental Nutrition Assistance Program (SNAP) and Earned Income Tax Credit (EITC). Both of these measures exhibit an increase during the time considered (2000-2015), which is consistent with states’ typical

response to economic downturns like the Great Recession which started in December 2007 (Moffitt, 2013).

The Supplemental Nutrition Assistance Program (SNAP), formerly known as the Food Stamp Program, helps people living in the U.S. with low income or no income purchase food. Introduced as part of the War on Poverty by President Lyndon B. Johnson in 1964, SNAP is one of the flagship programs of American welfare. It is a relatively cheap program (approximately 2% of the federal budget), very cost effective (93% of the total cost of SNAP is for food purchase), and it generates economic activity that outweighs its cost (Center on Budget and Policy Priorities, 2017). Despite these numbers, contentious narratives on SNAP abound, and they intensified following the program's expansion under the Obama administration. Conservative media characterized this expansion as "Obama's Food Stamp Economy" (Robbins, 2011), suggesting that "Welfare is the new work" (Moore, 2016), while conservative politicians –admittedly resting on "anecdotal and perceived abuses" (Opoien, 2015) – attempted to pass bills to police the use of SNAP and ban the purchase of unhealthy items such as cookies, chips, and soft drinks, as well as items perceived to be luxurious, such as steak or seafood (Ferdman, 2015). These sentiments were encapsulated by Newt Gingrich's description of President Obama as "the most successful food stamp president in American history" (Elliott, 2012).

I focus on participation in the SNAP program because states have a great deal of discretion in determining eligibility and access to welfare programs. States have access to a number of restrictions and practices which they may or may not enforce, from requiring work activity to imposing drug testing (Bjorklund et al., 2018). For instance, states can increase the limit for gross income eligibility for SNAP to above 130% of the poverty line (Klein, 2012; Rosenbaum, 2010), as 30 states did after 2007. All of these practices are highly influential: in

fact, participation may decline not because fewer households are eligible, but because fewer eligible households access their benefits (Bjorklund et al., 2018; Loprest, 2012). Participation in SNAP increased following the Great Recession: in 2002, 43% of low-income working families participated in SNAP; in 2010, this figure increased to 65% (Rosenbaum, 2010). Progress can still be made, and some states are making efforts in this direction. Utah, for instance, developed a software that matches data across state and federal databases, streamlines application processes, and minimizes errors and fraud; the software is available to other states free of charge but, to my knowledge, no other state has adopted it (Rosenbaum, 2010). It is not possible to measure all of the decisions that states can make to limit or expand access, but total participation is the final function of these decisions. Once participation is adjusted for economic conditions and population size and composition, it can be considered an effective measure of states' openness to welfare.

The Earned Income Tax Credit (EITC) provides tax credits to working individuals and couples with low and moderate incomes. The EITC is meant to encourage and reward work: it starts with the first earned dollar, it increases as earnings increase, and it flattens when it reaches the maximum (CBPP, 2018). For instance, in 2018, a married couple with two children earning \$1,000 would have a federal EITC of \$410; the EITC would increase up to \$5,710 for households earning \$14,290. Currently, 29 states plus DC provide their own EITC supplement as a varying percent of the federal EITC (CBPP, 2018).

The EITC is regarded as highly successful in encouraging people to leave welfare to work, encouraging low-income earners to work more hours, and lifting families with children out of poverty (CBPP, 2018). The EITC is essentially linked to working and it is characterized as an *earned* benefit: for this reason, it is usually considered to be “relatively nonstigmatizing” (Martin

and Prasad, 2014, p. 334), and its narratives differ from those about SNAP insofar as they lack the contentious overtones. Qualitative research based on in-depth interviews with 115 EITC recipients shows that “the EITC is an unusual type of government transfer,” perceived as a “just reward for work, which legitimizes a temporary increase in consumption” (Sykes et al., 2015, p. 243). During the period under investigation, the EITC expanded substantially, becoming “one of the largest federal antipoverty programs in the United States” (Martin and Prasad, 2014, p. 334).

Consistent with the theoretical arguments advanced in this study, which combine insights on the relationships between economic strain and suicide on the one hand (Stack, 2000), and state policies and population health on the other hand (Beckfield et al., 2015), I hypothesize that *increasing state welfare generosity, measured as participation in the SNAP program and proportion of state EITC, will be associated with decreasing suicide rates after adjusting for confounding factors.*

3. Data and Methods

3.1 Outcome

The outcome of this study is the *overall and gender-specific state-level suicide rate*, obtained from the National Vital Statistics System (Centers for Disease Control and Prevention, n.d.), and defined as age-adjusted deaths due to suicide/intentional self-harm (per 100,000 population). The rate is calculated using intentional self-harm codes including U03, X60-X84, and Y87.0.

3.2 Focal Independent Variables

The Supplemental Nutrition Assistance Program (SNAP) is available at the UKCPR National Welfare Data (University of Kentucky Center for Poverty Research, 2016), and it is

measured as *average monthly persons receiving Food Stamps*. Initially expressed as the raw number of participants, I present it here as the percent of state population participating in the program.

I extracted the data on the state EITC from the UKCPR National Welfare Data (University of Kentucky Center for Poverty Research, 2016). The variable measures the extent to which states increase the credit received by working families from the Federal government. Specifically, here the state EITC is expressed as the *percentage of Federal Credit*.

I extracted *public welfare spending* from the Correlates of State Policy Project (Jordan and Grossmann, 2017). The variable measures the state government public welfare expenditures as a percent of total state income (Sorens et al., 2008).

3.3 Covariates

I include a number of correlates that are relevant to the association between structural socio-economic conditions and suicide. The first measure is income inequality. I extracted the *Gini coefficient* from the World Inequality Database (Alvaredo et al., n.d.; Frank et al., 2015). The coefficient (whose range is 0-1, where 0 represents perfect equality and 1 represents perfect inequality) is based on individual tax filing data available from the Internal Revenue Service, is aggregated at the state level, and covers the time period 2000-2015. *Poverty rate* is available at the U.S. Census and is expressed as % of the population living below the Federal Poverty Line. Per capita real *GDP by state*, for all industry and chained at 2009 dollars, was collected from the U.S. Bureau of Economic Analysis. *Unemployment rate* is provided by the U.S. Bureau of Labor Statistics.

Because education is a crucial determinant of population health (Mirowsky and Ross, 2015), I collected individual-level data on *educational attainment* from IPUMS USA (Ruggles et

al., 2017), which I weighted and aggregated at the state level as the % of people above the age of 25 with at least a bachelor's degree. Suicide rates can also be sensitive to household composition and various risk factors. Using IPUMS USA data, I computed the *% of single-person households*, the *average household size*, and the *male/female ratio*. For all of these measures, I weighted individual level data and aggregated them at the state level. I collected data on *adult binge drinking* by state which is defined as males having at least five drinks and females having at least four drinks on one occasion. The source is the Behavioral Risk Factor Surveillance System (BRFSS) Prevalence & Trends Data.

Finally, I gathered data on state *population*, *% Black*, and *% Hispanic* in order to adjust for population size and racial-ethnic composition. Population size is available at the U.S. Census Bureau, while individual data on self-identification as Black or African-American, and as Hispanic of any ethnicity were collected from IPUMS USA, weighted, and aggregated at the state level. All of the variables are available from 2000 to 2015.

3.4 Analytical Strategy

Consistent with the large body of literature on economic inequalities and health, I use a pooled cross-sectional design with two-way fixed-effects for states and years (Beckfield, 2004; Gertner et al., 2019; Hill and Jorgenson, 2018). Fixed-effects coefficients estimate whether the within-state deviation from the mean for predictors is correlated with the within-state deviation from the mean for the outcome over a given time period.

Fixed-effects models present some considerable advantages when used with panel data, insofar as they are able to address omitted variable bias and unobserved heterogeneity (Baltagi, 1995; Petersen, 1993), that is, the possibility that unmeasured differences between states are associated with observed variables of interest. While fixed-effects models are not immune to

unobserved time-varying characteristics, they can account for time-invariant characteristics, such as aspects of culture that are resistant to change (Hill et al., 2019).

Like other forms of regression analyses, fixed-effects models can be subject to heteroscedasticity (nonconstant error of variance) and autocorrelation (the correlation between errors is higher over adjacent years than over more separated years). I use robust standard errors clustered by state to account for these issues (Hoechle, 2007).

While two-way fixed-effects are a standard choice when researchers use pooled cross-sectional data (Hill et al., 2019), I performed two tests to adjudicate between alternative model specifications: the robust Hausman test (Arellano, 1993) which suggested that state fixed-effects are preferred to state random-effects, and the post-estimation Wald test for linearity which determined that year fixed-effects are necessary.

I present my findings in two ways. First, I report bivariate models that show the unadjusted coefficients of the key predictors, followed by fully adjusted models which include all of the covariates. Second, I show coefficient plots (Jann, 2014) which provide a synthetic visualization of the findings and allow for comparisons between simple-unadjusted and multiple-adjusted models for all the independent variables. In order to facilitate interpretations, I report standardized coefficients, which are independent of the predictors' scale.

Finally, I present a predictive margins plot to facilitate substantive and practical interpretation of the results (Williams, 2012). The margins plot shows how the predicted values of an outcome vary on different levels of the predictors.

4. Findings

Table 1 shows the descriptive statistics of the measures used in my analysis. The variables show important variation. Let us closely look at the outcome and the key predictors. During the time period considered, the average suicide death rate is 13.36 per 100,000 people, varying between 5.90 and 29.60. Suicide is more prevalent among men (average rate: 21.85; range: 9.33–48.24) than among women (average rate: 5.49; range: 1.68–13.69). Female suicide rate presents 43 missing observations because the CDC suppresses state-level counts and rates based on fewer than 10 deaths. The CDC also warns against the use of rates based on 20 or fewer deaths, which I discarded. SNAP participation varies between 2.83% and 22.35% of the state population, with an average of 10.46%. The State EITC is on average 6% of the Federal EITC, ranging between 0% and 33%. Welfare spending varies between 1.08% and 7.30% of total state income, with an average of 3.59%. The correlation coefficients among the variables are visible in figure A1, available as a supplemental file.

[Table 1 about here]

I report in table 2 the two-way fixed-effects regression models predicting overall suicide death rate. Model 1 shows the standardized regression coefficient of SNAP participation. Consistent with my expectations, the association between SNAP and the suicide death rate is negative and statistically significant: a one standard deviation increase in SNAP participation is associated with a 0.22 standard deviation reduction of the suicide death rate. In model 2, I report the coefficient of state EITC. There is again a statistically significant and negative association between the policy measure and the outcome, but the coefficient of EITC is smaller than that of

SNAP: a one standard deviation increase in state EITC is associated with a 0.10 standard deviation reduction in suicide death rate. Model 3 shows the association between public welfare spending and suicide rate which is not statistically significant.

[Table 2 about here]

Model 4 shows the standardized coefficients predicting suicide after adjusting for all the covariates. The association between participation in SNAP and overall suicide rate remains statistically significant and negative in the adjusted full model, although its magnitude is slightly reduced: a one standard deviation increase in SNAP participation translates to a 0.17 standard deviation reduction in suicide. This result suggests that accounting for economic factors, such as rising poverty and unemployment rates which followed the Great Recession, and population size and composition only partially explains the association between participation in SNAP and suicide. The association between state EITC and suicide rate, instead, disappears when adjusting for socioeconomic factors and population size and characteristics. As in the bivariate model, public welfare spending is statistically nonsignificant in model 4. Three other variables are statistically associated with the outcome: the % of single-person households (positive association) and the percentage of Black and Hispanic population (negative association).

Table 3 reports the findings for male suicide rate, which are highly consistent with the overall suicide rate. The only welfare measure that presents a statistically significant association with male suicide rate in the fully adjusted model is SNAP participation: a one standard deviation increase the program is associated with a 0.17 standard deviation reduction in male suicide.

[Table 3 about here]

Table 4 shows the results relative to female suicide rate. Unlike what previously observed, no measure of welfare policy presents a statistically significant association with the outcome.

[Table 4 about here]

Readers may be interested in seeing the bivariate associations between the covariates and suicide. Figure 1 is a synthetic coefficient plot which shows the coefficient estimate and the confidence interval of the independent variables for all three outcomes, both in unadjusted simple and in adjusted multiple models. Population size and % of Black and Hispanic respondents are omitted due to their large coefficients and confidence intervals, which would make the plot nearly unreadable.

[Figure 1 about here]

GDP by state is statistically significantly associated with the outcomes. The association is positive, that is, increasing GDP is associated with increased suicide rates. However, as in Gertner et al. (2019), the association ceases to be statistically significant once the model is adjusted by socioeconomic factors and population characteristics. The percentage of single-person households has a statistically significant and positive association with all the outcomes in

the unadjusted models. When models are fully adjusted, this association persists only for overall and male suicide rate.

Figure 2 shows the magnitude of the statistical effect of SNAP participation. To understand the realworld implications of these findings, I calculated the predicted margins of overall and male suicide rate for an increase in SNAP participation by one standard deviation (4.5% of the state population). I used the coefficient estimates for SNAP in the fully adjusted models in tables 3 and 4: respectively, the models predict about 31,612 fewer suicides overall and 24,811 fewer male suicides for a standard deviation increase in SNAP participation during the study period.

[Figure 2 about here]

5. Discussion

In this study, I analyzed the association between suicide rates and two measures of welfare social policy, participation in SNAP and state EITC, in all 50 U.S. states between 2000-2015, a 16-year period that includes the 2008 Great Recession and the subsequent recovery. The findings of this study show a clear and negative association between one of these measures, SNAP participation, and overall and male suicide rates. Longitudinal models with state and year fixed-effects show that higher rates of participation in SNAP are associated with lower rates of suicide.

Overall, these findings are consistent with the large body of literature which identifies in social welfare policies the “rules of the game” which ultimately distribute population health (Beckfield et al., 2015). To my knowledge, no prior study has explicitly used this framework to

assess the distribution of suicide. Among the analyses of social protection and suicide, only a fraction focused on aspects of welfare other than mere expenditure levels. Cylus and colleagues (2014) find that higher unemployment insurance benefits moderate the detrimental effects of unemployment. Gertner and colleagues (2019) show a negative association between state minimum wage and suicide rates. My analysis contributes to this line of research, which pinpoints several specific policies aimed to support low income individuals and households that are associated with reduced suicidal behavior.

This study also presents some interesting null findings. For example, no other economic factor is significantly associated with suicide. Previous research pointed out the apparent paradox that suicide tends to be more common in “happier” and more equal places (Daly et al., 2011; Mellor and Milyo, 2001). However, in my analysis, income inequality has no stastically significant association with suicide. This is consistent with one study which explored this relationship across a set of rich countries (Leigh and Jencks, 2007), and with the majority of longitudinal research on income inequality and health—see Hill and Jorgenson (2018) for a comprehensive review. As for welfare spending, scholars have also failed to find a statistically significant association with suicide (Flavin and Radcliff, 2009; Ross et al., 2012). Studies that do find a negative association between welfare spending and suicide analyze older time periods (Minoiu and Andrés, 2008; Zimmerman, 2002), which predate or coincide with the early stages of U.S. welfare stagnation which started in the mid-1980s (Kenworthy, 2017).

Notably, no key predictor (or confounder, with the predictable exception of the share of Black and Hispanic population) is statistically significantly associated with female suicide. This is consistent with previous literature (Minoiu and Andrés, 2008; Ross et al., 2012). Although recent evidence suggests that suicide rate is increasing faster among women than men

(Hedegaard et al., 2018; Ruch et al., 2019), the gap is still sizeable. In addition to being less prevalent, it is possible that female suicide may be less sensitive to macroeconomic factors. Cultural norms related to masculinity may also be relevant (Adinkrah, 2012; Cleary, 2012). Abrutyn and Mueller argue that “in many corners of the United States, masculinity is the only or most dominant identity” (2018, p. 60), and this may make men particularly vulnerable to feelings of shame or failure. Unemployment, financial loss, and inability to fulfill a breadwinning role may plausibly trigger such feelings.

The share of single-person households is positively associated with overall and male suicide. Social isolation is a powerful predictor of mortality (Pantell et al., 2013), but it is still unclear whether and to what extent living alone coincides with being socially isolated and feeling lonely (Klinenberg, 2016). Evidence shows that the typical American who lives alone is socially involved with friends, neighbors, and civic organizations (Klinenberg, 2012). However, the results of my analysis suggest that living alone and isolation likely overlap to some extent. Since living alone is increasingly common, its implications for health, including suicide, deserve additional scrutiny.

The study presents some limitations. First, despite the fact that fixed-effects models are becoming increasingly prominent in social sciences and are often regarded as the “gold standard” for causal inference with longitudinal data (Bell and Jones, 2015), the observational (that is, non-experimental) nature of such data should prevent readers from interpreting the associations as causal. Furthermore, fixed-effects models are not without limitations. For example, they are not useful to estimate the effect of variables that do not vary over time, and they are exposed to omitted variable bias for time-varying unobserved characteristics (Hill et al., 2019). An additional limitation of this study is the ecological nature of the data. For instance, it is

impossible to affirm that participation in SNAP prevented *recipients* from completing suicide without committing an ecological fallacy. Unfortunately, to my knowledge, no data set links individual social welfare usage to death by suicide.

Despite these limitations, the study makes a number of important contributions. First, it strengthens the emerging literature on economic strain and suicide by assessing the impact of specific social welfare policies. In doing so, it integrates two theoretical perspectives, that is, economic strain (Stack and Wasserman, 2007) and the emerging institutional theory of health inequalities that centers on the role of welfare (Beckfield et al., 2015). Suicide scholars may find it useful to more systematically incorporate and address the role of social welfare policy in the economic strain literature. Finally, this study provides a needed update on the relationship between structural factors and suicide in the American context.

With regard to the practical implications of this study, it is important to notice that the measures of policies considered here (including spending) are not equivalent in terms of suicide reduction. In this sense, it appears that SNAP – despite the stigmatized narrative that surrounds its administration and participants – is particularly successful at alleviating economic strain, and may possibly hinder the co-occurrence of multiple sources of strain which are typical of suicide (Stack and Wasserman, 2007).

I quantified that increasing SNAP participation by one standard deviation (4.5% of the state population) is associated with 31,600 fewer deaths overall and 24,800 fewer male deaths, during the study period. In other words, a 1% increase in SNAP participation could have saved approximately 7,000 lives (5,500 of which are men's lives). This is a substantial association that encourages specific policy recommendations. First, states can raise the limits for SNAP participation, for instance by increasing gross income eligibility above 130% of poverty (Klein,

2012; Rosenbaum, 2010). Second, states can streamline the application process in order to increase participation of already eligible households. As mentioned above, SNAP is one of the most effective welfare policies in the U.S.: it is cheap, cost-effective, and its benefits outweigh its costs (Center on Budget and Policy Priorities, 2017). In the context of a steady rise in suicides across the nation, which could be exacerbated in case of future economic downturns, it is important that policymakers pursue feasible initiatives that can plausibly save lives.

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Table 1: Descriptive Statistics

Variables	N	Mean	SD	Min	Max
Suicide	800	13.36	3.81	5.90	29.60
Male Suicide Rate	800	21.85	5.91	9.33	48.24
Female Suicide Rate	757	5.49	1.85	1.68	13.69
SNAP Recipients (% Pop.)	800	10.46	4.50	2.83	22.35
State EITC (% Fed. Credit)	800	0.06	0.10	0.00	0.33
Public Welfare Spend. (% Inc.)	800	3.59	1.00	1.08	7.30
Gini Coefficient	800	0.60	0.04	0.52	0.71
Poverty Rate	800	12.63	3.36	4.50	23.10
GDP	800	45,910.07	8,520.97	28,953.00	74,289.00
Unemployment Rate	800	5.85	2.01	2.30	13.70
Education	800	0.27	0.05	0.15	0.42
% Household Size=1	800	0.12	0.02	0.05	0.18
Average Household Size	800	3.27	0.21	2.86	4.22
Male/Female Ratio	800	0.99	0.03	0.93	1.15
Adult Binge Drinking	800	15.66	3.29	6.60	26.35
Population	800	6,032,502.21	6,656,196.18	494,300	39,144,818
% Black	800	0.11	0.10	0.00	0.39
% Hispanic	800	0.10	0.10	0.01	0.48

Table 2: State & Year Fixed-Effects Models Predicting Suicide Death Rate 2000-15

	(1)	(2)	(3)	(4)
SNAP Recipients (% Pop.)	-.22** (.07)			-.17* (.07)
State EITC (% Fed. Credit)		-.10** (.03)		-.04 (.03)
Public Welfare Spend. (% Inc.)			-.07 (.05)	.02 (.03)
Gini Coefficient				.00 (.03)
Poverty Rate				-.02 (.03)
GDP				.04 (.06)
Unemployment Rate				.07 (.04)
Education				-.10 (.10)
% Household Size=1				.14** (.05)
Average Household Size				.07 (.06)
Male/Female Ratio				.01 (.05)
Adult Binge Drinking				-.05 (.03)
Population (log)				.92 (.71)
% Black				-.85** (.30)
% Hispanic				-.98*** (.25)
Observations	800	800	800	800
R-squared	.59	.57	.57	.63
Number of States	50	50	50	50
State FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Notes: *** p<.001, ** p<.01, * p<.05; Standardized Coefficients; Robust SE clustered by State in parentheses.

Table 3: State & Year Fixed-Effects Models Predicting Male Suicide Death Rate 2000-15

	(1)	(2)	(3)	(4)
SNAP Recipients (% Pop.)	-.22** (.07)			-.17* (.07)
State EITC (% Fed. Credit)		-.10** (.03)		-.05 (.04)
Public Welfare Spend. (% Inc.)			-.08 (.05)	.00 (.04)
Gini Coefficient				.00 (.03)
Poverty Rate				-.03 (.03)
GDP				.01 (.05)
Unemployment Rate				.05 (.05)
Education				-.08 (.10)
% Household Size=1				.13* (.06)
Average Household Size				.07 (.07)
Male/Female Ratio				.02 (.05)
Adult Binge Drinking				-.03 (.04)
Population (log)				.29 (.71)
% Black				-.71* (.32)
% Hispanic				-.83** (.29)
Observations	800	800	800	800
R-squared	.42	.41	.41	.47
Number of States	50	50	50	50
State FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

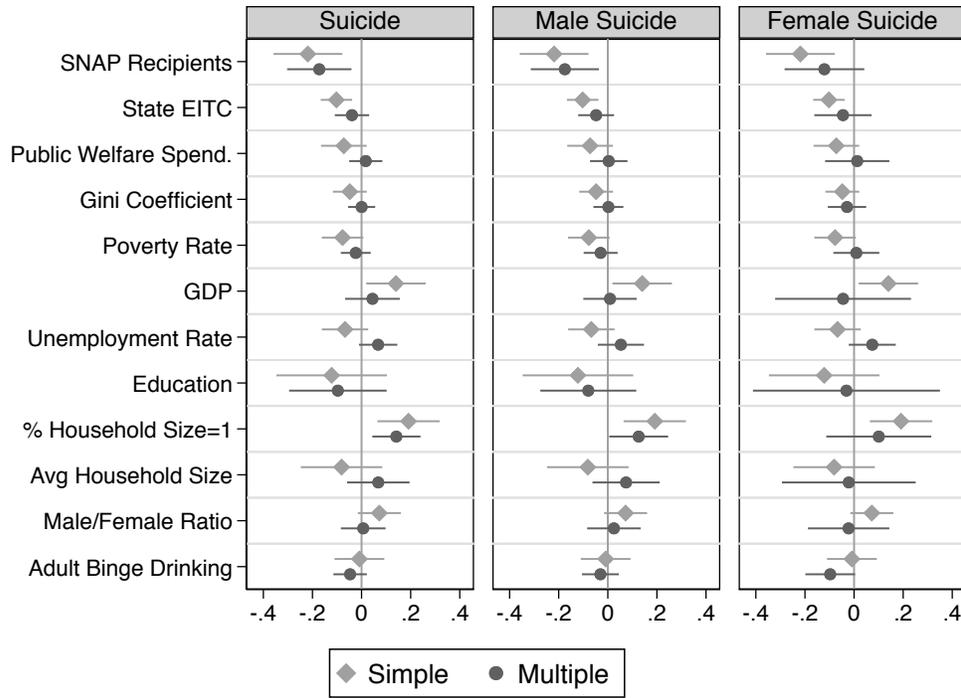
Notes: *** p<.001, ** p<.01, * p<.05; Standardized Coefficients; Robust SE clustered by State in parentheses.

Table 4: State & Year Fixed-Effects Models Predicting Female Suicide Death Rate 2000-15

	(1)	(2)	(3)	(4)
SNAP Recipients (% Pop.)	-.12 (.10)			-.12 (.08)
State EITC (% Fed. Credit)		-.11 (.07)		-.05 (.06)
Public Welfare Spend. (% Inc.)			-.04 (.08)	.01 (.07)
Gini Coefficient				-.03 (.04)
Poverty Rate				.01 (.05)
GDP				-.04 (.14)
Unemployment Rate				.07 (.05)
Education				-.03 (.19)
% Household Size=1				.10 (.11)
Average Household Size				-.02 (.14)
Male/Female Ratio				-.02 (.08)
Adult Binge Drinking				-.10 (.05)
Population (log)				2.17 (1.26)
% Black				-1.37* (.52)
% Hispanic				-.98** (.36)
Observations	757	757	757	757
R-squared	.52	.52	.52	.55
Number of States	50	50	50	50
State FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

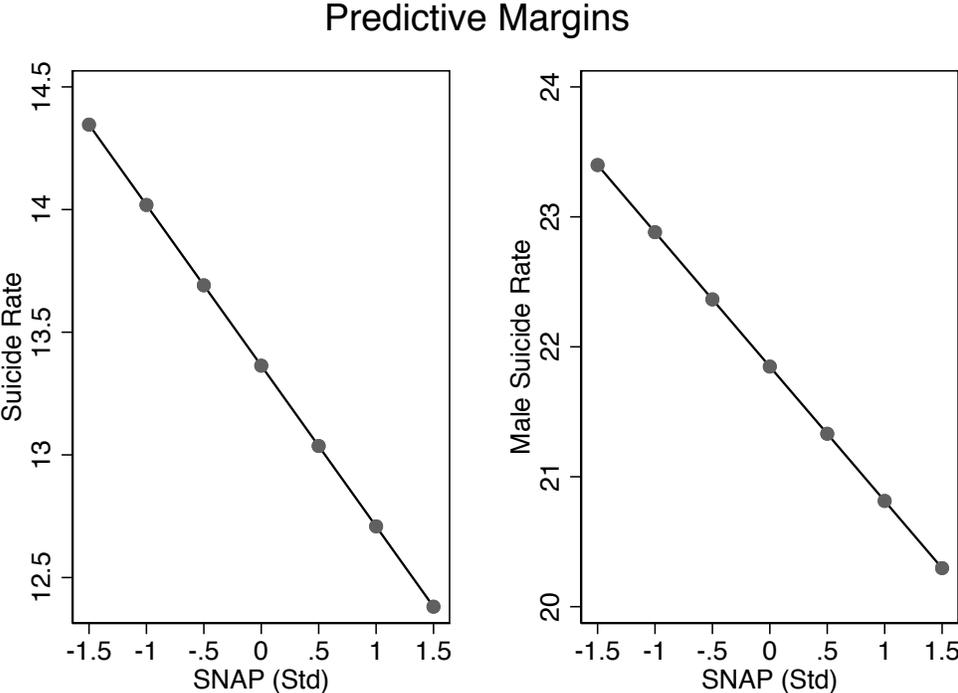
Notes: *** p<.001, ** p<.01, * p<.05; Standardized Coefficients; Robust SE clustered by State in parentheses.

Figure 1: State & Year Fixed-Effects Models Predicting Overall and Gender-Specific Suicide Death Rate 2000-15



Notes: Standardized Coefficients; Robust SE clustered by State; Multiple Model Adjusted for Population (ln), % Black, and % Hispanic.

Figure 2: Predictive Margins of Overall Suicide and Male Suicide Rate



Notes: Margins computed using model 4 in tables 2 and 3; One standard deviation of SNAP Recipients is 4.5% of the state population.

Figure A1: Correlation Matrix

