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## State earned income tax credits and suicidal behavior: A repeated cross-sectional study

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### Abstract

Suicide is an increasingly common cause of death in the United States and recent increases in suicide rates disproportionately impact low income individuals. We sought to assess the impact of income support in the form of state earned income tax credit policies on suicide-related behaviors. This state-level study used repeated cross-sectional data from vital records and the National Survey of Drug Use and Health data representative at the state-level. The population included adults who either died by suicide or were selected for in-person NSDUH interviews between 2008 and 2018. Exposure was measured as the generosity of a refundable state earned income tax credit policy measured as a percentage of the federal policy. Outcomes assessed were suicidal ideation, suicidal planning, non-fatal suicide attempt, suicide deaths, and combined fatal and non-fatal suicide attempts. Analyses were performed between April and June 2020. A 10 percentage-point increase in the generosity of state earned income tax credit was associated with lower frequency

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Declaration of Competing Interest

The authors report no conflicts of interest and have no financial interests to disclose.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ypmed.2020.106403>.

of non-fatal suicide attempts (prevalence ratio [PR] = 0.96; 95% CI: 0.93–0.99), combined fatal and non-fatal suicide attempts (PR = 0.96; 95% CI: 0.93–0.99), and suicide deaths (PR = 0.99; 95% CI: 0.99–1.00). This translates to 4 fewer suicide attempts per 10,000 population each year. Generous state earned income tax credit policies are associated with reductions in the frequency of most severe suicidal behavior. Income support policies may be one way to reduce suicide attempts and death, especially among low-income adults.

## Keywords

Suicide; Earned income tax credit; Poverty; Income support

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## 1. Introduction

In the United States, 48,344 people died by suicide in 2018 and the rate of suicide increased 36% from 1999 to 2018.(United States Department of Health and Human Services, 2019; Hedegaard et al., 2018) More broadly, suicide attempts, including those that do not result in loss of life, have also increased in recent years.(Olfson et al., 2017; Owens et al., 2020) The burden of suicide and non-fatal suicide attempt is not only considerable but also unequally distributed. For example, non-fatal suicide attempts are more common and have disproportionately grown among young adults with less formal education.(Olfson et al., 2017) This is perhaps due to the known role of poverty and unemployment as predictors of poor mental health and suicide.(de Ruffi and Zdanowicz, 2018; Burns, 2015; Platt, 1984; Kerr et al., 2017) Analyses of deaths preceding, during, and following the Great Recession found that suicide was strongly associated with poverty at the individual and neighborhood levels.(Kerr et al., 2017) Similarly, other investigations have found strong relationships between unemployment or unstable employment and suicidal behavior—ideation, planning, nonfatal attempts, and death.(Platt, 1984; Kerr et al., 2017; Norström and Grönqvist, 2015)

Due to the strong association of financial precarity with suicide attempts and deaths, policies that target poverty and promote employment may be one way to address the rising rates of self-inflicted injury. Moreover, because exposure to peer or community suicidal behavior—including non-fatal behaviors—is associated with heightened risk for engaging in both suicidal and non-suicidal self-injurious behavior, (Chan et al., 2018; Hill et al., 2020) policies that reduce the incidence of all suicidal behaviors may improve population health even if they do not reduce the incidence of suicide death.

The federal Earned Income Tax Credit (EITC) is currently the largest anti-poverty program for working adults with children in the U.S.(Meyer, 2010) Introduced in 1975, the EITC is a credit to low-earning working families.(Internal Revenue Service, 2020) The credit received by EITC beneficiaries as a tax refund is based on pretax earnings, marital status, and the number of children in the household.(Center on Budget and Policy Priorities, 2020) It is “refundable,” meaning that tax filers can receive the credit even if they do not have tax liability.(Internal Revenue Service, 2019) In 2018, approximately \$63 billion from the federal program was sent to an estimated 25 million recipients.(Internal Revenue Service, 2019) Since the federal policy was enacted, many states have created supplemental

EITC policies and, as of 2017, 29 states and the District of Columbia had their own EITC. (Center on Budget and Policy Priorities, 2020) The implementation of state EITCs occurred incrementally since 1986, and state EITC generosity (i.e. the value of the credit in dollars) varies between states and over time. This variation creates the opportunity to examine impacts of state-level EITC policies on suicidal behavior at the population level.

To date, there have been at least three studies of the relationship between state EITC and suicide death, with varied findings.(Rambotti, 2020; Lenhart, 2019; Dow et al., 2019) Two studies showed a reduction in suicide with the addition or increase generosity of state EITCs,(Lenhart, 2019; Dow et al., 2019) findings that were robust to differing parameterizations of EITC, whereas the third found no effect.(Rambotti, 2020) Some of these studies additionally focused on the populations most likely to be impacted by EITC policies—women,(Rambotti, 2020) and women with no more than a high school education. (Dow et al., 2019) We sought to assess the relationship between the generosity of refundable state-level EITC policies and the prevalence of suicidal ideation, suicidal planning, and non-fatal suicide attempt, as well as the incidence of suicide death in the United States between 2007 and 2018. This study furthers our understanding of the relationship between EITC and mental health by providing information on the impact of this policy on non-fatal outcomes of population health importance add to the existing literature which indicates an effect of EITC on suicide deaths.

## 2. Methods

### 2.1. Study design and population

We used state variation in the presence, refundability, and generosity of state EITC and repeated measures from the National Survey of Drug Use and Health (NSDUH) and National Vital Statistics System (NVSS) to assess suicidal behavior biannually from 2007 to 2018. NSDUH uses in-person computer-assisted interviews to survey noninstitutionalized individuals 12 years of age or older about substance use, mental health, and other factors associated with social health. We used the NSDUH modules on suicidal behavior in adults as these individuals are most likely to benefit from the EITC. Additional details about the NSDUH methodology have been documented elsewhere.(Center for Behavioral Health Statistics, S, 2018) NVSS maintains all records and causes of death in the United States; for deaths attributable to an external cause or injury, this includes the manner or intent of the death (i.e., intentionally self-inflicted).

### 2.2. Policy exposure

The primary exposure was the existence and generosity of a state EITC; data were obtained from the National Bureau of Economic Research.(National Bureau of Economic Research, 2020) In most states, the benefits are set as a percentage of the federal benefit and included as a continuous exposure in our analyses. In our analysis, states with nonrefundable EITCs—where the value of the credit cannot exceed the recipient's tax liability—were considered to not have an EITC because individuals who qualify for the EITC benefits tend to have limited tax liability and thus would not receive any substantial rebate.(Hoffman, 2007) Prior work has shown that non-refundable credits do not have a discernible impact on

health-related outcomes.(Lenhart, 2019; Klevens et al., 2017; Rostad et al., 2020; Markowitz et al., 2017) Wisconsin, Minnesota, and California are exceptions to the usual structure of state EITCs; exposure measurement for these states is detailed in the Appendix.

### 2.3. Outcomes

Data regarding suicidal ideation, having planned a suicide attempt, and having enacted a non-fatal suicide attempt in the past 12 months were collected through the adult depression module in NSDUH. Participants were asked: “At any time in the past 12 months, up to and including today, did you seriously think about trying to kill yourself?” If a respondent answered yes, they were subsequently asked: “During the past 12 months, did you make any plans to kill yourself?” Respondents who endorsed this question were then asked: “During the past 12 months, did you try to kill yourself?” Due to the retrospective nature of this question, we created a one-year lag between EITC exposure and the first year of the survey cycle outcome. For instance, participants interviewed during the 2008–2009 cycle would be considered exposed to the EITC received in 2007. This ensured that the participants would be referring to events that occurred after they had received the EITC credit. The mapping of outcome measurement period to the EITC exposure for each analytic state year is depicted in Fig. 1.

The aforementioned data on non-fatal suicidal behavior were ascertained from the NSDUH Restricted-use Data Analysis System aggregated by state.(SAMHDA, 2020) To maintain statistical fidelity and ensure participant confidentiality, these data are combined into overlapping two-year averages for each state-cycle; data for suicide attempt from the combined 2015–2016 survey period are suppressed due to low response rates. Because NSDUH questionnaires vary from year-to-year, modules on all of the suicidal behaviors of interest are not available for the 2009–2010, 2011–2012, 2012–2013, or 2013–2014 survey cycles; this leaves all other overlapping two-year periods from 2008 to 2009 through 2017–2018 for analysis.

We complemented analysis of non-fatal suicide behavior from NSDUH with analysis of suicide deaths from NVSS among adults aged 18 or older in two ways. First, we assessed the relationship between EITC and suicide death. Second, we combined measures of suicide death with suicide attempts to generate a composite measure of fatal and non-fatal suicide attempts. All suicide deaths necessarily involve a suicide attempt; however, these individuals would not have survived to be included in the NSDUH. The deaths included in NVSS are reported by the year in which they occurred. Because these do not include the same retrospective components, we used deaths occurring in the same year as the EITC and deaths occurring in the subsequent year. This means the measurement of deaths most closely reflected the two years immediately following changes in EITC policy and matched the period covered by the retrospective questions in NSDUH.

### 2.4. Covariates

We controlled for a set of time-varying state-level covariates that could have changed over the study period differentially by state and that are plausibly related to suicidal behavior. Specifically, we adjusted for state minimum wage in 2016 inflation-adjusted dollars, state

gross domestic product (GDP) in 2016-inflation-adjusted dollars, and maximum Temporary Assistance for Needy Families (TANF) benefits for a family of three. These financial covariates were obtained from the University of Kentucky Center for Poverty Research (UKCPR) database. (University of Kentucky Center for Poverty Research, 2020) Covariates were available for all state-years of the study period.

We did not include measures of employment and insurance in our models, though each is a potentially important determinant of suicide. (Platt, 1984; Kerr et al., 2017; Norström and Grönqvist, 2015) We were concerned that the EITC may directly affect employment, (Meyer, 2010) which would in turn impact insurance. To avoid adjusting for a potential mediator, we did not include these factors in the models. (Westreich and Greenland, 2013) Empirical measures of the relationship between EITC and contemporaneous measures of insurance and unemployment are presented in the appendix (eTable 1). We additionally considered including measures of the Supplemental Nutrition Assistance Program (SNAP). However, because SNAP is a federal program and there is little variation in benefit levels by state, we decided that it was unnecessary to include in our models.

## 2.5. Statistical analysis

This analysis used a difference-in-differences approach, comparing the change in prevalence of each suicide-related outcome across states with more and less generous EITC benefits as the benefits changed. In adjusted models, we included state and year fixed-effects in addition to time varying state-level covariates described above. We used Poisson regressions to calculate prevalence ratios (PRs) and 95% confidence intervals (CIs). These models took the following form:

$$\log(Y_{it}) = \alpha + \beta_1 EITC_{it} + \beta_2 \sum X_{it} + \gamma_i + \delta_t + \varepsilon_{it} + \log(\pi_{it}),$$

where  $t$  indexed years and  $i$  states.  $Y_{it}$  was the estimated number of persons experiencing that outcome in a specific state-year and  $\pi_{it}$  was the offset representing the total adult population for the same state-year.  $EITC_{it}$  denoted a continuous variable, for which each one-unit increase represented a 10 percentage-point increase in the state refundable EITC (as a percentage of the federal EITC).  $X_{it}$  was a vector of time-varying state-year covariates and  $\gamma_i$  and  $\delta_t$  were state and year fixed-effects, respectively. (Wing et al., 2018) Error terms in analyses were clustered by state. Poisson models were selected because they incorporate the variation in size of the underlying population in the offset term. Assumptions of parallel trends in the primary analysis were assessed via lead-term (i.e. event study) analyses. (Wing et al., 2018) We additionally performed sensitivity analyses that included nonrefundable credits in Poisson models as well as analyses using rates as an outcome in linear regression models. All analyses were completed between April and June 2020 with Stata release 14.2 (StataCorp LP, College Station, TX). This project was approved by the University of Washington Institutional Review Board.

### 3. Results

During the study period, there were a total of 255 state-cycles of survey data available for analysis, including Washington DC as a “state.” Throughout this time, seven states introduced a new refundable EITC or made an existing EITC refundable (Fig. 2A). Including new EITC and EITC that changed generosity during the study period, there were 11 states in which a refundable EITC changed by five or more percentage points of the federal credit (Fig. 2B).

Baseline prevalence of suicidal ideation and planning did not differ notably by EITC status (Table 1). The baseline prevalence of combined fatal and non-fatal suicide attempt was somewhat lower in states that did not have an EITC at any point during the study, while the baseline incidence of suicide death was highest in these states. Between 2007 and 2018, the frequency of all outcomes increased in most states (Fig. 3 reflects all suicide attempts including deaths; other outcomes available in Appendix).

In difference-in-differences models, changes in EITC generosity were not significantly associated with changes in reported suicidal ideation or planning (Table 2). This was true in both unadjusted and adjusted models. However, a 10 percentage-point increase in the EITC was associated with a significant 5% reduction in prevalence of non-fatal suicide attempts in minimally adjusted models (PR: 0.95; 95% CI: 0.93–0.97). These estimates remained significant when additional terms for state minimum wage, state GDP, and maximum TANF benefits were included (PR: 0.96; 95% CI: 0.93–0.99).

Increases in EITC generosity were also associated with reductions in the composite of fatal and non-fatal suicide attempts, and in suicide deaths alone. The association with combined attempts was marginally smaller than non-fatal attempts alone in the minimally adjusted models (PR: 0.95; 95% CI: 0.93–0.97) as well as in fully adjusted models (PR: 0.96; 95% CI: 0.93–0.99). The relative reduction in suicide deaths somewhat attenuated when only adjusting for state and year (PR: 0.99; 95% CI: 0.99–1.00) and when additionally adjusting for economic variables (PR: 0.99; 95% CI: 0.99–1.00).

In assessing parallel trends through inspection of coefficients in event models, we found no relationship between reduced frequency of suicidal behavior and future EITC generosity; however, the impact of the contemporaneous EITC was somewhat attenuated in models with lead terms (eTables 2 and 3). When we additionally included nonrefundable credits, the estimated effects of EITC did not change notably (eTable 4). In a sensitivity test using linear regression, our results indicating a negative relationship between EITC and suicide death were robust to model selection in unadjusted (PD =  $-0.024$  deaths per 10,000 population; 95% CI:  $-0.036, -0.011$ ) and adjusted models (PD =  $-0.023$  deaths per 10,000 population; 95% CI:  $-0.037, -0.010$ ). Though findings for suicide attempt—non-fatal and the combined measure—were no longer statistically significant, they did indicate a relationship of similar magnitude (eTable 5).



## 4. Discussion

This investigation provides new information on the relationship between state EITC and multiple suicide-related outcomes. To our knowledge, it is the first study to assess the association between EITC and non-fatal suicidal behavior. We found that a 10 percentage-point increase in state EITC, relative to the federal credit, was associated with a 4% reduction in suicide attempts and a 1% reduction in suicide deaths. This is consistent with the prior literature that generous economic programs—including state EITC specifically—were associated with reductions in incidence of suicide death,(Rambotti, 2020; Lenhart, 2019; Dow et al., 2019) and provides evidence that this policy may be additionally associated with reductions in the prevalence of non-fatal suicide attempt.

Prior studies of state EITCs and suicidal behavior have focused solely on suicide death. (Rambotti, 2020; Lenhart, 2019; Dow et al., 2019) These studies did not investigate how such reductions in incidence of suicide death might be explained, such as being partially attributable to substitution for less lethal means or if there is an overall reduction in the number of suicide attempts, including those that are non-fatal. Our findings on the association between EITC and suicide attempts contributes to addressing this gap in knowledge. Two of the prior studies examining the relationship between economic policy and suicide deaths did not solely focus on state EITC as an exposure.(Rambotti, 2020; Dow et al., 2019) While they provide important insight to the policy’s relationship with suicide, the covariates were not selected with EITC in mind and may have resulted in over-adjustment. By using the prior investigations as guidelines for potential covariates and removing variables that may lie on the causal pathway, such as per-capita alcohol consumption and unemployment rates, we can bolster the evidence supporting the *total* effect of economic policy on preventing suicide-related outcomes.

Our findings suggest that state EITC may reduce fatal and non-fatal suicidal behavior, though we did not find a significant association between EITC and suicidal ideation or planning. EITC benefits may relieve acute stressors while not disrupting persistent patterns of thought and behavior that often underlie suicidal thoughts. For example, a refund received during tax season may provide enough extra income to help individuals pay off some debts, catch up on late rent, or otherwise prevent what could be a precipitating or triggering event. (Kerr et al., 2017) In contrast, because suicidal ideation and planning are not single discrete events, and can persist over longer periods of time, EITC may not be a sufficient resource to overcome long-term factors for these more common and less severe outcomes, which often do not lead to suicidal attempts.(de Ruffi and Zdanowicz, 2018) Additional research should assess the impact of programs designed to disperse funds over a longer period and their association with suicidality.

EITC has been successful as an anti-poverty policy not only through income support, but also by increasing employment through incentivizing earned income.(Evans and Kantrowitz, 2002) Unemployment can lead to worsening mental health, suggesting a policy that increases employment could decrease suicidal behavior.(Burns, 2015; Platt, 1984) Household income is also likely to increase by virtue of increased employment and earned-wages in addition to funds received through the tax return. These broad gains in financial

security can contribute to improved mental wellbeing throughout the year thereby decreasing risk for suicide attempt and death.

#### 4.1. Limitations

Some limitations to our findings stem from NSDUH constraints: Public Use NSDUH data were only available for 255 state-cycles out of a potential 510 state-cycles, limiting the number of changes in state EITC that we could assess to seven new EITC policies and 11 changes in EITC generosity greater than five percentage-points of the federal. Nonetheless, we observed reductions in suicidal behavior following these increases in EITC generosity, and these observations were robust to sensitivity analyses with alternative regression models.

Our findings are also subject to reporting limitations typical of survey data. Mental health, suicide, and related behaviors are sensitive and stigmatized topics, which may lead to some intentional underreporting. To mitigate this risk, NSDUH uses computer assisted interviews that ensure anonymity to participants.(Epstein et al., 2001) There are also potential concerns about misclassification. Prior work in other surveys has found that if respondents are probed for further information about a past suicide attempt or an act of self-harm without suicidal intentions, the additional details reveal that the behavior was originally misreported.(Millner et al., 2015; Plöderl et al., 2011) Subtle differences in what does or does not constitute a suicide attempt can lead to this misclassification; however, we have no reason to believe that this error in reporting would vary by state or be associated with the presence of a state EITC. Related to this limitation, suicidal ideation is assessed via a single item on the NSDUH, and thus it was not possible to examine nuanced effects of EITC relative to different levels of severity of suicidal thoughts (e.g., active v. passive, wish to live/die, control over suicidal urges, etc.).

Also, our analysis included all adult participants—including many who likely did not qualify for or did not have receive the EITC. We were unable to focus on likely EITC recipients owing to limitations in the public use NSDUH data.(SAMHDA, 2020) However, we would expect that incorporating likely unaffected individuals attenuates observed associations; despite this attenuation, we found an association between state refundable EITC generosity and reductions in suicide attempt and death. Similar findings in previous studies investigating suicide deaths among single mothers and persons with no post-secondary education also suggest that the inclusion of a broader study population likely had limited effects on our results.(Lenhart, 2019; Dow et al., 2019) Finally, the quasi-experimental technique used in this study controlled for many, but not all, possible sources of bias. In particular, unobserved time variant state characteristics correlated with state EITC policy and suicidal behavior could confound our estimates.

## 5. Conclusion

Our findings support the growing body of literature highlighting the potential impact of anti-poverty policies, such as federal and state EITCs, on reducing suicide rates and provides the first evidence that these policies may also reduce non-fatal suicidal behaviors. As policy makers consider potential solutions to increasing rates of suicidal behavior in the United States and certain other countries, it is important to consider that EITC and similar financial



policies could play an important role by reducing financial stress, increasing employment rates, and otherwise improving mental health in vulnerable populations. Advocacy for such policies that reduce suicidal behavior at the population level is needed.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

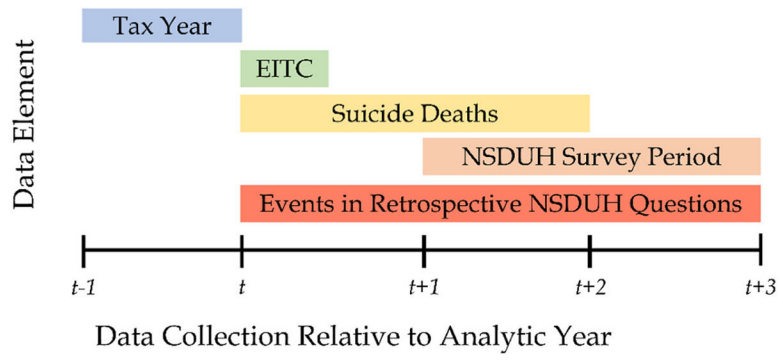
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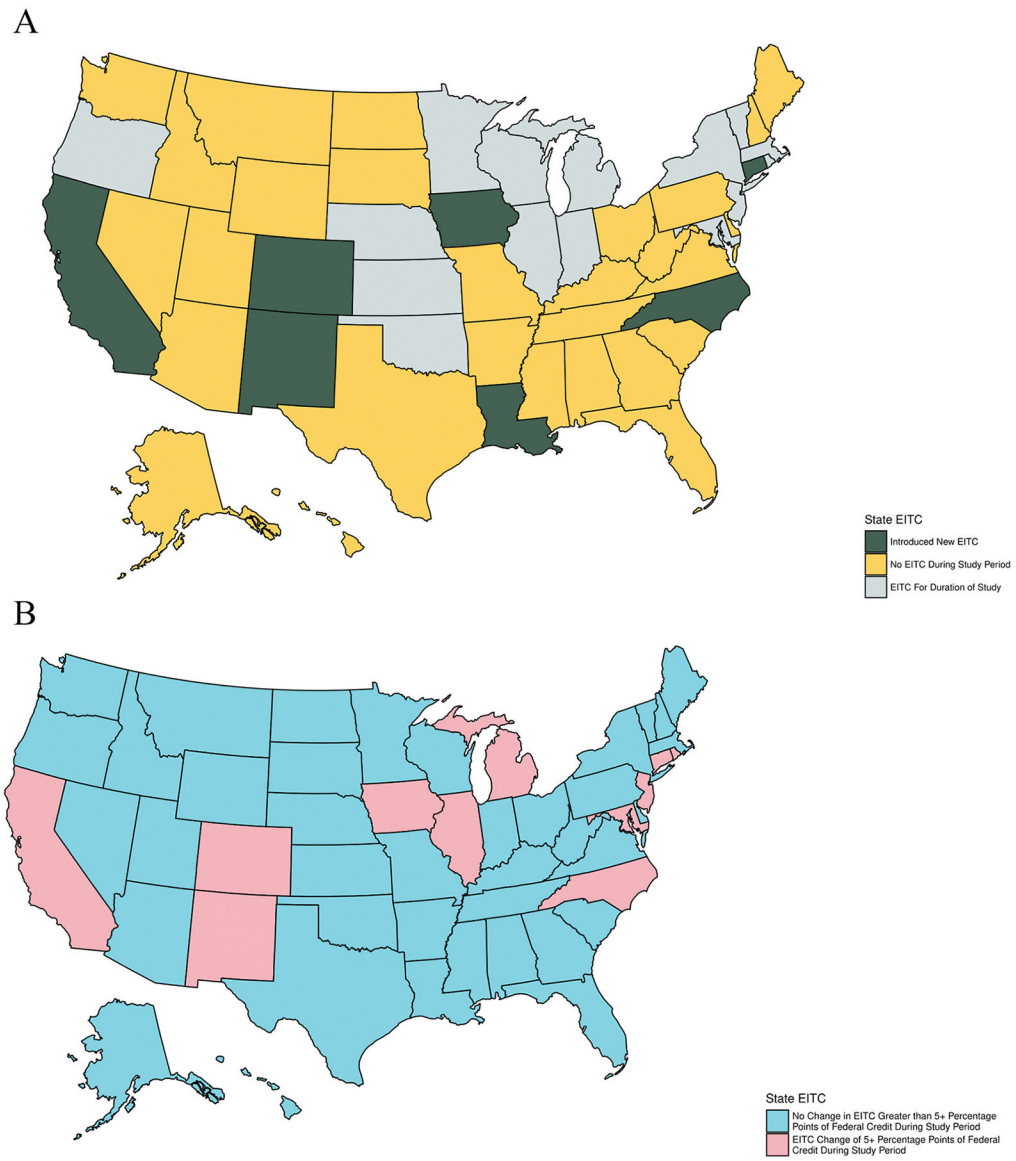
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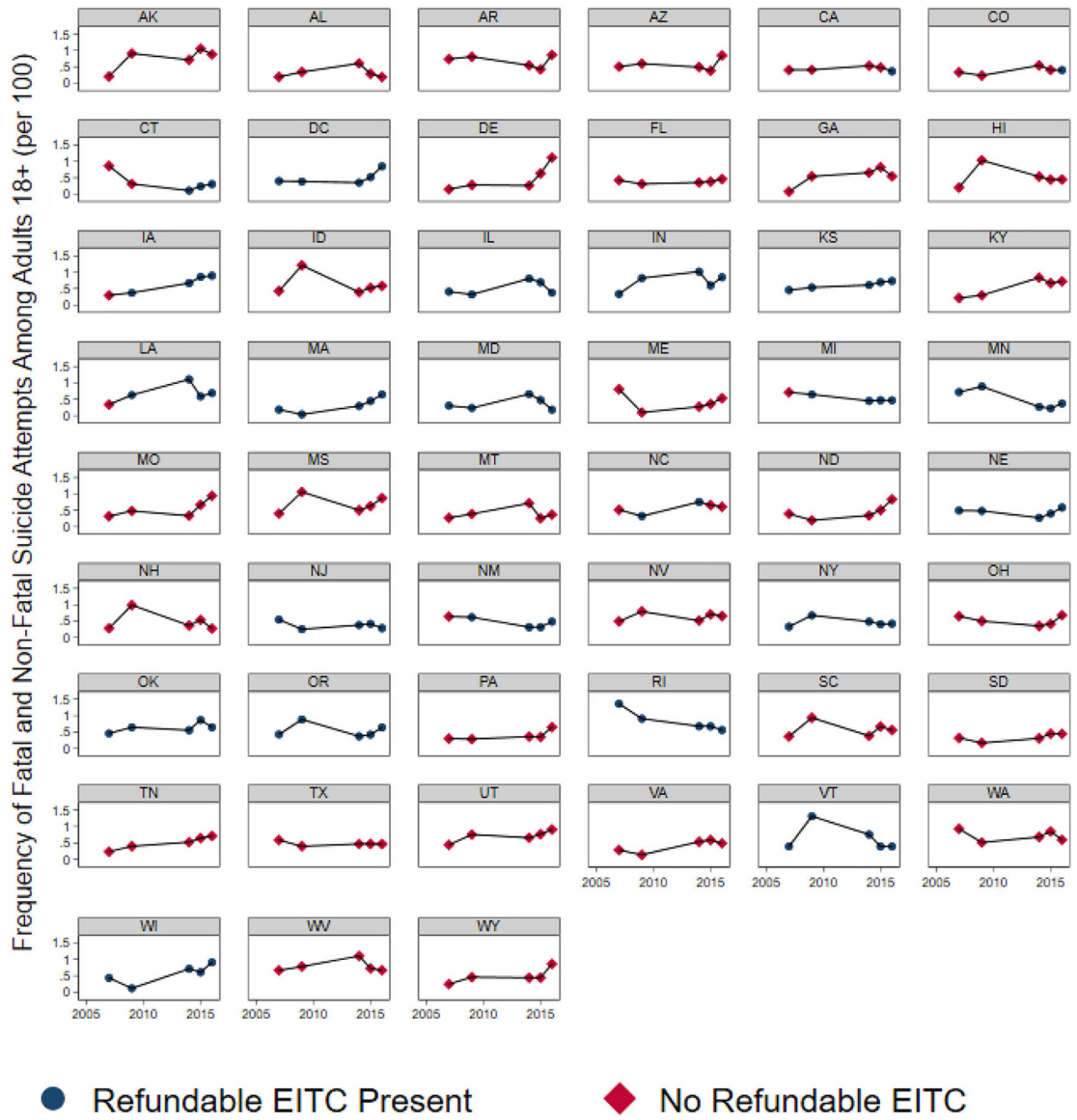
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**Fig. 1.**  
Temporal relationship between exposure and outcome measurements.



**Fig. 2.** (A) State-level refundable earned income tax credit availability 2007–2016. (B) Changes in state-level refundable earned income tax credit generosity greater than five percentage-points 2007–2016.



**Fig. 3.** Frequency of suicide attempt (fatal and non-fatal) per 100 population by state and state EITC, 2007–2018.

**Table 1**

Social and economic characteristics of surveyed states by presence of state EITC, 2007–2018.

	No EITC during study period ( <i>n</i> = 28)	EITC for full study period ( <i>n</i> = 16)	Introduction of EITC during study period ( <i>n</i> = 7)
Median Adult Population (2008) <sup>a</sup>	2,354,000	4,511,500	3,611,000
Median Adult Population (2017) <sup>a</sup>	2,505,000	4,786,000	3,829,000
Mean minimum wage during study period, 2016 inflation adjusted USD (sd)	\$7.59 (\$0.83)	\$8.15 (\$1.17)	\$7.98 (\$0.83)
Mean maximum TANF benefit for two dependent household, 2016 inflation adjusted USD (sd)	\$351.31 (\$161.46)	\$429.56 (\$122.15)	\$379.80 (\$139.05)
Mean state GDP during study period in billions, 2016 inflation adjusted USD (sd)	\$273.4 (\$323.8)	\$360.5 (\$328.6)	\$558.2 (\$751.2)
Mean prevalence of suicidal ideation at baseline (sd)	3.55% (1.06%)	3.63% (0.74%)	3.39% (0.66%)
Mean prevalence of suicidal planning at baseline (sd)	0.95% (0.42%)	1.08% (0.47%)	0.98% (0.13%)
Mean prevalence of nonfatal suicide attempt at baseline (sd)	0.38% (0.21%)	0.49% (0.27%)	0.47% (0.21%)
Mean prevalence of all suicide attempts at baseline (sd)	0.40% (0.21%)	0.50% (0.27%)	0.49% (0.20%)
Mean rate of suicide deaths at baseline, per 10,000 (sd)	1.69 (0.37)	1.26 (0.34)	1.53 (0.46)

Abbreviations: EITC: Earned income tax credit; USD: United States dollars; sd: Standard deviation; TANF: Temporary assistance for needy families; NSDUH: National Survey of Drug use and health.

Notes: <sup>a</sup> Indicates first year of two-year NSDUH survey cycle; populations come from estimates provided by NSDUH.

Unless otherwise indicated means for the entire study period are displayed—These variables were time-varying in analytic models.



**Table 2**

Impact of 10 percentage point increase in state EITC on suicidal behavior, 2006–2018.

	<b>Model I: Prevalence ratio</b>	<b>Model II: Prevalence ratio</b>
Ideation	1.00 (1.00–1.01)	1.00 (0.99–1.01)
Planning	1.01 (1.00–1.02)	1.01 (1.00–1.03)
Non-fatal attempt	0.95 (0.93–0.97)	0.96 (0.93–0.99)
All attempts	0.95 (0.93–0.97)	0.96 (0.93–0.99)
Suicide deaths	0.99 (0.99–1.00)	0.99 (0.99–1.00)

Model I: Fixed effects for state and year.

Model II: Additional terms for state minimum wage, state GDP, and maximum TANF benefits.

## Abbreviations

EITC—Earned Income Tax Credit.

GDP—Gross Domestic Product.

TANF—Temporary Assistance for Needy Families.