

THE EFFECT OF SCHOOL SAFETY TIP LINES  
ON YOUTH SUICIDE PREVENTION

by

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DEDICATION

In memory of my mother, Tahameena Begum.

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## ABSTRACT

Suicidal deaths of high school-aged youths (14-to-18-year-olds) have almost doubled over the past decade. School safety tip lines, an anonymous reporting method that enables students to submit tips about their suicidal friends and classmates, have emerged as a potential solution to reduce youth suicide. Using data from the CDC's Multiple Causes of Death data for the period 1999-2018, this is the first study to formally investigate the effect of introducing school safety tip lines on youth suicide prevention. My primary identification strategy is a difference-in-differences (DID) method that exploits variation in the timing of the adoption of the safety tip lines across states. I also employ a synthetic control method (SCM) as an alternative identification strategy to compare suicide rates in Colorado and Michigan (early adopters of tip line mobile applications and websites) to non-adopting states before and after the adoption of tip lines. Despite the existence of anecdotal evidence of tip lines saving many high-school students from committing suicides, I find little evidence that tip lines have reduced completed suicides among 14-to-18-year-old youths.



## CHAPTER ONE

## INTRODUCTION

18,306 high school-aged youths (14-to-18-years-olds) have committed suicide in the United States from 2007-2018. Suicide rate per 100,000 among this age group has almost doubled over the past decade. Moreover, suicide overtook homicide as the number two leading cause of death for high school-aged youths in 2011. While many interventions to youth suicide prevention have been implemented over the past three decades, reviews of the literature find little evidence that these interventions had any effect in decreasing youth suicide rate (Katz et. al., 2013; Robinson et. al., 2018). As health officials look for ways to prevent youth suicide, school safety tip lines have emerged as a potential program that can help identify suicidal students and reduce suicide rate among high school students (Kingkade, 2020). In this paper, I evaluate the effect of introducing school safety tip line mobile applications and websites on suicide rate of high school-aged youths.

The primary objective of school safety tip lines is to prevent school shootings. However, safety tip lines have received more than twice the number of tips on suicidal youths than on potential shooters or threats to schools in recent years, according to the annual reports of safety

tip line programs<sup>1</sup>. This is not surprising given that a high school student (age 14-18 years) is more likely to die by committing suicide than in a mass shooting in the campus. According to NBC news count, between 2016 and 2018, thirty-eight people of all ages were killed in school shootings in the US. (Chiwaya, DeFrank and Kimelman, 2019). On the other hand, the number of suicides among high school-aged youths (14-to-18-year-olds) in 2018 alone was 2039.

School safety tip lines may represent a viable way of reducing suicide mortality because suicidal students are more likely to talk to their classmates or friends than to adults about their suicidal thoughts (Kalafat and Elias, 1994). A student can anonymously submit a report to the safety tip lines about his suicidal classmate through mobile application, website or just by calling a hotline. As soon as tip line operators receive reports, they send the information to appropriate authority who can help the suicidal student.

While researchers have explored the effects of various school suicide prevention programs, there is no existing evidence on the effect of school safety tip lines. To explore the impact of the safety tip lines on youth suicide, I use restricted-use mortality data from the CDC for the years 1999-2018. I employ a difference-in-differences method that exploits variation in the timing of the launch of the safety tip lines across states as my primary identification strategy. I also use a synthetic control method (SCM) to compare youth suicides in Colorado and

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<sup>1</sup> Total number of tips on suicidal students and planned attacks on schools was calculated using the data from annual reports of Colorado, Oregon, and Wyoming's safety tip lines of 2017-18, 2018-19 and 2019-20 school years and annual reports of Michigan's safety tip line of 2017, 2018 and 2019.

Michigan (early introducers of tip line apps/websites) to other states prior to and following the introduction of tip line apps/websites.

My result provides no evidence that the tip lines had any effect on the suicide rate of high school-aged youths. The result is consistent across all specifications of the difference-in-differences method, with and without controls, and in both linear and log transformed models. An event study analysis shows statistically insignificant effects in all the post-treatment years. My alternative strategy, Synthetic Control Method, also confirms this result. Hence, the results are robust, and not dependent on the use of a particular identification strategy.

## CHAPTER TWO

### BACKGROUND

#### History of School Safety Tip Lines

Colorado was the first state to launch a school safety tip line, safe2tell, which allows students to anonymously report suspicious activities or concerns about classmates via a mobile application, website, or hotline number. Two students at Columbine High School in Colorado killed 12 students and a teacher on April 20, 1999. The two perpetrators committed suicide at the end. At that time, it was the deadliest school shooting to occur in USA. As officials in Colorado began looking for ways to prevent school shootings, Susan Payne, a 28-year law enforcement veteran based in Colorado, came up with the idea of a local hotline where young people could anonymously call before an incident happened (McCrimmon, 2009). However, getting students to come forward with information was not easy as they were afraid of retaliatory attacks on themselves, and being called a traitor. It was critical to provide them with a safe and confidential way of reporting concerns. The Columbine Review Commission, which was established to present reports about the Columbine shooting, also identified anonymity as a vital element of any school safety program. Finally, on the recommendation of the Columbine Review Commission, Susan Payne's idea of a school safety tip line was adopted. On September 14, 2004, Safe2tell, a 24/7 hotline went live. Dispatchers of the Colorado State Patrol was the main answering point. In 2007, Colorado introduced web reporting as a medium of tip line. Mobile application was added to the program in 2015.

In the wake of another tragic event, the Sandy Hook School shooting in 2012, the state of Michigan launched a school safety tip line, OK2SAY. 26 people, including 20 school children, were killed in the school shooting. Michigan launched the program at the beginning of the 2014-2015 school year. Michigan's program, OK2SAY, was modelled after Colorado's Safe2Tell. Several other states such as Wyoming, Oregon, Utah and Nevada also implemented safety tip line programs in the following years as a result of the Sandy Hook Shooting. The Sandy Hook shooting and recent high school shooting incidents in Parkland, Florida (February 14, 2018) and Santa Fe, Texas (May 18, 2018) have resulted in more states coming forward to either build their own versions of safety tip lines, or to encourage/endorse the use of private, nationwide youth violence prevention programs and apps such as "Say Something"<sup>2</sup>. 12 states are now operating school safety tip lines (listed in table 1).

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<sup>2</sup> Say Something is a youth violence prevention program established by Sandy Hook Promise (SHP), a not-for-profit organization. Several family members of the victims of the Sandy Hook School shooting founded the SHP. Anyone in the US can report safety concerns via either website or mobile app.

Table 1: School safety tip lines

<b>State</b>	<b>Effective Year</b>
Colorado	2004
Michigan	2014
Utah	2016
Wyoming	2016
Oregon	2017
Florida	2018
Nevada	2018
Maryland	2018
Pennsylvania	2019
Missouri	2019
Ohio	2019
Kentucky	2019

Notes: Colorado introduced web reporting in 2007. Between 2004 and 2006, it was only a hotline. There is confusion regarding the effective year of Missouri's school safety tip line. Different sources show different effective years for Missouri. According to the website of Missouri's tip line, it was launched in 2019.

### How School Safety Tip Lines Work

The operating procedure of school safety tip lines in different adopting states is similar. As soon as a student or someone else submits a report to the school safety tip line either by calling a hotline number or by using mobile application and/or website, an analyst or an operator fields initial information for the report. Tip lines ensure anonymity as no caller id is displayed, and submission of a name is not required. The information is then investigated by analysts. Depending on the type and urgency of the reports, the analysts send the information to appropriate authorities including local law enforcement agency, school and state-level officials. If immediate action is necessary, typically local law enforcement agency will intervene. Tips are also generally forwarded to school officials who can notify parents or provide counsel to students or take other necessary actions. State level officials generally oversee that concerned authorities

are taking proper actions following a submitted tip. The intervening parties have to submit reports about how they addressed a tip and what the outcome was. Although initial purpose of school safety tip lines was preventing school shooting, tip lines also receive reports on bullying, drug use, sexual abuse, suicidal behavior, suspicious activities, and other categories. Almost all the safety tip lines are established and funded by state legislatures. Typically, different public offices such as Office of the Attorney General, Department of Education, Department of Public Safety, Department of Law, State Police jointly oversee the operation of safety tip lines.

An important reason why safety tip lines have been successful in encouraging students to come forward and report safety concerns is the use of the websites and mobile applications. The use of mobile applications and websites also distinguishes school safety tip lines from simple hotline numbers and 911. With the popularity of internet and mobile apps, especially among teens, it is not unreasonable to assume that high school students will be more comfortable in reporting tips via website and mobile apps than by calling to a number and talking to an operator. Annual reports from different states' support this assumption. The number of tips received via mobile applications and websites far outnumber the tips received via phone calls, making it evident that students feel comfortable in using websites and mobile apps<sup>3</sup>.

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<sup>3</sup> For example, in the 2018-19 school year, safe2tell Colorado received 31% of the tips via mobile app and 46% via web, as opposed to 23% by phone calls (Safe2tell annual report, 2018-19 school year). In the 2019-20 school year, although percentage of tips received via phone call increased to 30%, it still lagged web (45%). Mobile apps received 25% of tips (Safe2tell annual report, 2019-20 school year). The same scenario is seen in Oregon, where during the school years between 2017 and 2020, SafeOregon received a total of 3680 tips from the website and 831

### School Safety Tip Lines and Youth Suicide

States initiated tip line programs to prevent attacks on schools. However, reports about self-harm or suicidal students have far outnumbered reports about potential shooters or threats to school. For example, safe2tell received 499 reports of planned school attacks in 2018-19 school year, compared to 3668 reports of suicide threats in the same school year. The situation is similar in other states such as Wyoming, Oregon, Michigan. Figure 1 shows the comparison between reports of suicidal students and planned attacks on schools in these four states for the school years 2017-18, 2018-19 and 2019-20<sup>4</sup>.

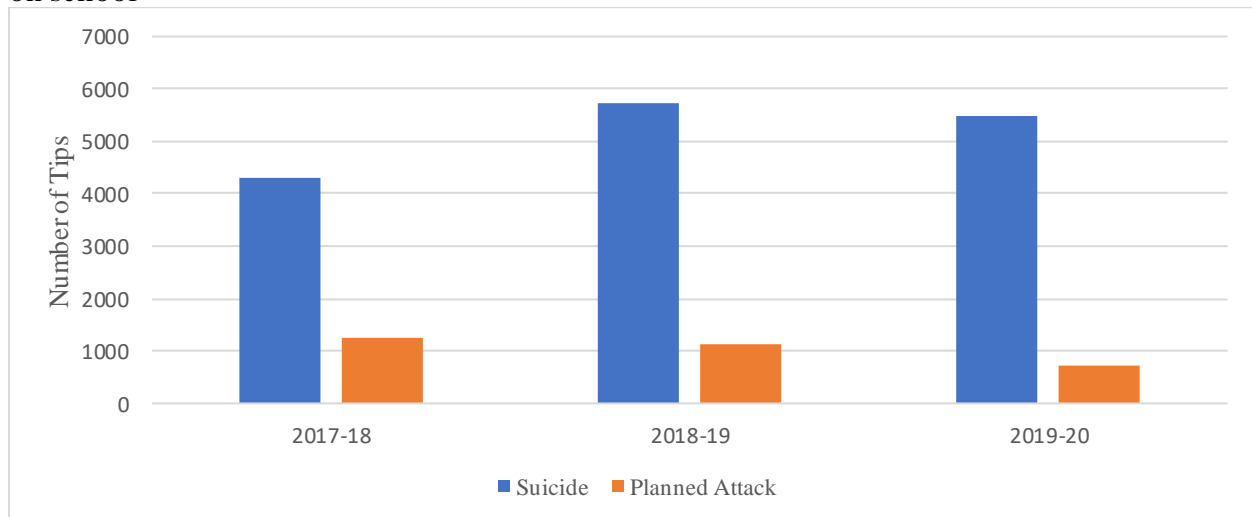
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tips from the mobile app (SafeOregon annual report, 2017, 2018, 2019). On the other hand, calls contributed to only 416 tips. In Pennsylvania, mobile app contributed to about 83% of total reports in the 2018-19 school year. In other states where apps and websites are being utilized, only a fraction of tips come from calls.

<sup>4</sup> Statistics of SafeUt, Utah's tip line, could not be collected. Other states that have launched tip lines in or after 2018 have not published statistics yet.



Figure 1: Comparison between number of tips on suicide and number of tips on planned attacks on school



The large number of reports about suicidal students is not surprising in light of the high rates of teen suicides. From 2007, the number of suicides has been continuously rising. The number nearly doubled between 2007 and 2018, from 1124 to 2039. Moreover, a large number of youths are struggling with suicide ideation, often resulting in suicide attempts. For example, about 95,000 youths of this age group visited emergency departments for self-harm injuries during 2018 (Ivey-Stephenson AZ et al., 2019). These figures and the statistics indicate that suicidal behavior by youth poses a major public health challenge. While suicide is the tenth leading cause of death overall in the US, it is the second leading cause of death for high school-aged youths (14-18 years) (Ivey-Stephenson AZ et al., 2019).

School safety tip line programs in different states have emerged as potential solutions in curbing youth suicide. For example, in November, 2017, two police officers in Hermiston, Oregon saved a teenager at his home from committing suicide after they received a report from

SafeOregon, Oregon's school safety tip line (Kingkade, 2020). One of the teenager's classmates had submitted a report that the teenager was suicidal. The officers went to the teenager's home and found the teen in his bedroom with a belt wrapped firmly around his neck. The teenager was not breathing. One of the officers quickly removed the belt and performed CPR on him. The teen was then immediately taken to a hospital. He eventually recovered and received mental health service later (Kingkade, 2020). A tip from SafeOregon saved another student, who talked about wanting to shoot herself on the head. She later received mental health counsel (Kingkade, 2020). The tip lines have led to many interventions like these two examples and have prevented multiple youth suicides, according to the annual reports of safety tip line programs.

There seems to be a consensus among the implementers of safety tip line programs in different states that safety tip line is an effective tool of preventing youth suicide. Particularly, the use of websites and mobile applications seem to have encouraged high school students to report about suicidal students (and potential threats to schools) without any fear of retaliation or worry about being wrong. But has there really been a significant impact of the safety tip line on youth suicide prevention? In this paper, I aim to provide empirical evidence of the causal effects of the school safety tip lines on suicide prevention of high school students.

## CHAPTER THREE

## LITERATURE REVIEW

French sociologist, Emile Durkheim's book "Suicide: A Study in Sociology" was published in 1897. Since then, sociologists have been making significant contributions to the literature of suicide. Also, due to the close relationship between mental health and suicide, psychologists and public health professionals have published influential works on suicide. Studies in sociology, public health and other fields are largely different than studies in economics in terms of methodology, rigor, and structure. Despite these differences, I discuss influential studies from journals of sociology, psychology, public health, epidemiology, and other fields, along with economics, in the literature review section as insights from all these studies should be considered while discussing youth suicide.

I have divided the literature review section into two parts: determinants of youth suicide, and school-based suicide prevention programs. Most studies relating to youth suicide, both in economics and in other fields, are concerned with finding or explaining one or more causes of completed suicides, suicide attempts and suicide ideation. Section 1, therefore, provides a discussion of the causes of youth suicide. In section 2, I review the studies on past and ongoing school suicide prevention programs, and the evaluation studies of these programs.

#### Determinants of Youth Suicide

Marcotte's (2003) survey on suicide finds that most empirical research on suicide done by economists follow the theoretical model developed by Hamermesh and Soss (1974). The decision of committing suicide depends on an individual's discounted expected lifetime utility,

according to Hamermesh and Soss (1974). If the utility level falls below a threshold level, the individual will commit suicide. Their theoretical model identifies income and unemployment as the most important predictors of suicide (Hamermesh and Soss, 1974). To test their theoretical model, Hamermesh and Soss (1974) used the 1970 suicide rates data across states in the US. Their empirical research supported their theory, and their predictions have generally held up well in subsequent studies by other economists. For example, according to Chuang and Huang (1997), per capita income is the most important variable for predicting suicide. Similar result is found in Meel (2003), who conclude that financial hardship is the main determinant of suicide. Neumayer (2003) observes that rise in individual or household income leads to lower suicide rates in several countries. Stack (2000) argues that financial security lowers stress level, decreasing the likelihood of committing suicide. Some other studies that find similar negative association between suicide and income are Chuang and Huang (2007), Andrés (2005), Brainerd (2001), Altinanahtar and Halicioglu (2009), Andrés and Halicioglu (2010). However, there are few studies that find opposite results, with income affecting suicide rate positively (Lester, 1996; Unnithan et al., 1994, Jungeilges & Kirchgässner, 2002).

In the literature, poverty rate, as a proxy of income level, has come up many times as a main factor behind youth suicide. For example, Dupéré, Leventhal and Lacourse (2009) find that children and youth in poor localities are more likely to suffer from suicide ideation compared to their counterparts in non-poor localities of Canada. According to Hoffmann et al. (2020), higher poverty concentration at the county level causes suicide rates to rise among children and youths aged 5 to 19 years in the US. Using a sample of American students across 132 middle and high schools, Fang (2018) shows that both prevalence of suicidal thoughts and attempts of suicide

were higher among boys in low-income schools than among boys in middle-income schools. Although he did not find any significant result for girls. In a systematic review of 37 studies, Iemmi et al. (2016) finds that almost all studies reported a positive relation between suicide ideation and poverty.

Gunnell et al. (1999), using data of England and Wales that expands from 1921-1995, observes significant association between suicide and unemployment, with stronger associations at younger age. Jaen-Varas et al. (2019) find similar result in Brazil, where unemployment, along with social inequality, leads to increase in suicide rate of adolescents aged 15-19 years. According to Fergusson, Horwood and Woodward (2001), exposure to unemployment has significant positive impact on suicide ideation in New Zealand. Parental unemployment can also have negative effect on children's self-esteem, which can lead to suicidal behavior (Christoffersen, 1994). Pritchard's (1992) study also gets similar results for most of the European countries, although only for young males, and not for females.

Individuals who commit suicide might do so when faced with a serious albeit temporary crisis (Seiden, 1977). Impulsive behavior is particularly found among suicidal youths, and hence, they are more likely to use means at hand, i.e., guns (Rich et al., 1986). Moreover, research suggests that suicide attempts by guns fail only in about 15% of cases, compared to 91% failure rate for all methods (Miller, Azrael and Barber, 2012). On the other hand, most people who survive a suicide attempt die later from a cause other than suicide (Owens, Horrocks and House, 2002). All these facts imply that restricting or delaying access to guns are likely to have negative effect on youth suicides. There have been studies, particularly in the context of the US, that investigate the relationship between gun ownership and youth suicide. Knopov et al. (2019), in a

time-lagged analysis of household gun ownership in 2004 and youth suicide rates in the following decade (2005-2015), find that a 10 percentage-point increase in firearm ownership leads to a 26.9% increase in youth suicide. Firearms laws that serve to lower firearm ownership have a preventive effect on male suicide, while laws that seek to forbid high risk individuals from possessing guns have minor effect, according to Rodríguez Andrés and Hempstead (2011). For example, Gius (2015) and Webster et. al., (2004) find evidence of negative effects of Child Access Prevention (CAP) laws on youth suicide rate<sup>5</sup>.

Many studies have noted a close relationship between family cohesion and adolescent suicide attempts. Cebula and Zelenskaya (2006), in a study of youth, and Pfeffer et al. (1984), in a study of children, find suicide ideation to be positively influenced by parental separation and divorce. Kok and Goh (2011) identify family issues, along with stress from schoolwork and boy-girl relationship, as the main determinants of suicide ideation among 270 students from different schools and universities in Malaysia. Different family problems such as ideological conflicts with parents, communication gap, lack of affection and support are also determined as important factors of suicide by Hawton (1982). Rubenstein et al. (1989) observe that high school students who receive high level of emotional support from parents and who have great deal of shared interests and mutual involvement with parents have 3.5 to 5.5 times less chance of committing

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<sup>5</sup> CAP laws are safe storage gun laws that mandate minors do not have unsupervised access to firearms.

suicide than students who come from a family with less cohesion, even after controlling for depression or life stress. Lack of parental support can cause adolescent depression (Kaplan, 1977) and low self-esteem (Petersen and Kellam, 1977), which in turn can result in suicide ideation and suicide attempt. Among 1050 junior and senior high school students, Wagner, Cole and Schwartzman (1995) observe that those who attempted suicide in the past had experienced stress related to parents. They were also more likely to live apart from both parents and physically hurt by parents (Wagner, Cole and Schwartzman, 1995).

Various studies have shown bullying to have significant impact on youth suicide rate. According to Espelage and Holt (2013), among middle school students, both bully-victims and perpetrators are three to five times more likely candidates of suicidal ideation and suicide attempts than students who are not involved in bullying related activity. Gower and Borowsky (2013) find similar results for 6th, 9th and 12th graders. While only 1.2% youth who were uninvolved with any sort of bullying related activity made suicide attempts, 11.1% frequent bully-victims made suicide attempts. The rate of suicide attempt is 5% more for those who frequently bullied other students than students not involved in bullying activities (Gower and Borowsky, 2013). Even if someone is not a victim or a perpetrator, he/she can still be at increased risk of suicide just by witnessing bullying incident. For example, Rivers and Noret (2013) find that witnessing bullying can lead to feelings of being hurt and inferiority and hopelessness, which can lead to suicide attempts. Hepburn et al. (2012) find similar result for 1963 middle schoolers. Nikolaou (2017), using data from the Youth Risk Behavioral Survey, observe that cyber-bullying is associated with 14.5% increase in suicidal thoughts and 8.7%

increase in suicide attempts. Also, the impact is more serious for females compared to males (Nikolaou, 2017).

Experience of sexual abuse during childhood as a factor of youth suicide have also been discussed in the literature. According to Martin et al. (2004), professionals and clinicians should carefully treat those adolescent patients who have experienced sexual abuse, as it often leads to suicidal behavior. They come to this conclusion after surveying 2485 students from schools in Australia. Eskin, Kaynak-Demir and Demir (2005) find that sexual abuse in childhood is a contributing factor of suicide attempt and ideation among university students in Turkey. Street youth in the US who experienced sexual or physical abuse in the childhood are 1.9 to 4.3 times more likely to attempt suicide than those street youths who were not physically or sexually abused (Molnar et al., 1998). Eisenberg, Ackard and Resnick (2007), using a survey data of 83,371 students in the 6th, 9th, and 12th grades, observe that youth with history of sexual and physical abuse are at increased risk of suicide attempt.

Overall, various studies from sociology, public health and psychology identify a lack of parental support and family cohesion, sexual abuse victimization, and being bullied as the most important risk factors of youth and adolescent suicide. On the other hand, income, poverty, and unemployment generally come up as the main economic determinants of youth suicide.

### School-Based Suicide Prevention Programs

Suicide prevention programs can be broadly divided into five types: awareness, screening, gatekeeper, peer leadership, and skills training (Katz et al., 2013). The aim of awareness programs is to make pupils acquainted with early indications of suicide so that they can recognize the symptoms in other students (Katz et al., 2013). The programs also encourage



students to disclose any suicidal thoughts or ideation they might have, especially to their classmates or friends. (Kalafat and Elias, 1994).

Signs of Suicide (SOS) is an example of successful awareness program. SOS uses video and guided classroom discussions to teach students about the symptoms of suicide so that they can take those symptoms seriously, be sympathetic to suicidal students and report to proper authority (Katz et al., 2013).

Aseltine & DeMartino (2004) evaluate the effectiveness of SOS in reducing suicidal attempts by randomly assigning 2100 students of 5 high schools in intervention and control groups. According to their evaluation, SOS significantly reduce self-reported suicide attempts. In a follow-up study, Aseltine et al. (2007) again use RCT method on 4133 students in nine high schools to evaluate the SOS program. Like the previous study, they find significant reductions in suicide attempts in the intervention groups. Particularly encouraging was the fact that result did not change due to students' grade, gender, race (Aseltine et al., 2007).

Although the two evaluation studies observe encouraging results, Katz et al. (2013) have reservations about the validity of these results, stating that result may be inflated due to the self-report structure of the study. Also, according to Gould et al. (2003), while these types of programs have had success in improving attitudes and knowledge towards suicide, they have limitations too. One important limitation is the fact that suicidal students often do not have a big enough peer group, thereby restricting the extent of awareness programs. (Gould et al., 2003)

Screening is a case-finding method of suicide prevention that entails evaluating students and then identifying those who have suicidal tendencies (Katz et al., 2013). Following the identification of suicidal students, treatment is recommended to them. Students with history of or

ongoing depression, drug and alcohol abuse, and suicidal behavior are targeted in this program. One limitation of screening procedure is the possibility of false positives and false negatives (Katz et al., 2013). Another pervasive concern of the screening methods are their potential iatrogenic effects (Gaynes et al., 2004). That is, inquiring about suicidal thoughts may prompt subsequent suicidal ideation. Gould et al. (2005), however, discover no evidence of such effects in an RCT. They conclude screening in high schools to be a safe process of youth suicide prevention efforts. Rather, suicidal students seemed more distressed if they were not asked about suicide (Gould et al., 2005).

TeenScreen, also called Columbia Suicide Screen (CSS), is an example of a screening program. While TeenScreen was developed for use in different places, it is mainly used in school-based settings. Two studies, Shaffer et al. (2004) and Scott et al. (2009), evaluate Columbia Suicide Screen (CSS). The CSS has significant sensitivity and specificity in identifying suicidal students (Shaffer et al. 2004). Also, according to Scott et al. (2009), CSS is successful in identifying troubled students who are otherwise not recognized by school professionals. Screening program was successful in identifying 34% of students with significant mental health problems and suicidal tendencies. On the other hand, school professionals, without the help of screening program, could identify only 13.0% suicidal students with mental health problems (Scott et al., 2009).

Another type of school-suicide prevention program is Gatekeeper training, which involves training teachers and other staffs to recognize symptoms of suicide in students. They are also trained so that they can respond effectively to the needs of the suicidal students. Question, Persuade, Refer (QPR) is a widely used gatekeeper program. Using a group-based randomized

trial of 249 school staff in 32 schools with one-year average follow-up, Wyman et al. (2008) find positive impact of the program on suicide knowledge and attitude. The program also affected perceived preparedness and efficacy outcome of school staff positively. However, while all staff learned to recognize suicidal students, only those who usually communicated with troubled students about suicide and distress felt comfortable in helping them (Wyman et al., 2008). In another study, Tompkins, Witt and Abraibesh (2010) observe similar results. QPR resulted in significant positive impact on knowledge and attitude towards suicide, but gatekeeper behavioral outcome such as connecting with at-risk students, asking them about suicide, number of referrals were not satisfactory (Tompkins, Witt and Abraibesh, 2010).

Students are more likely to talk to their classmates or friends than to adults about suicidal thoughts (Kalafat, and Elias, 1994). This is the main idea of peer leadership training program (e.g., Sources of Strength) which involves training students so that they can respond appropriately to the needs of suicidal peers and can associate the suicidal students with a trusted adult (Gould et al., 2003). The aim of Sources of Strength is to strengthen protective factors and reduce risk factors associated with decreasing suicide rate. Wyman et al. (2010) use RCT in 18 high schools to evaluate SOS. 453 peer leaders and 2675 students were selected for the RCT. The result was encouraging. Training resulted in enhanced adaptive norms of peer leaders regarding suicide. Suicidal students were four times more likely to be referred to an adult by a trained peer leader than by an untrained peer leader (Wyman et al. 2010).

The final type of suicide prevention program is skills training program, which aims to reduce risk factors of suicide. While skills training program does not directly target suicide prevention, it does contribute to suicide prevention by teaching students important life skills,

which causes enhancement of protective factors against suicide (Katz et al., 2013). The American Indian Life Skills Development (AILS D) is such a skills training program, which has been used in schools of 20 different aboriginal tribes (Kirmayer et al., 2009). Students learn important life skills, such as coping with emotions and anxiety, decision-making, problem-solving, eliminating self-destructive behavior, et cetera (Katz et al., 2013). Reducing hopelessness and increasing suicide intervention skills is the anticipated result of this program. LaFromboise and Howard-Pitney (1995) appraised this program in a Native American reservation. 69 students were selected in the treatment group and 59 students were in the control group. The life skills development curriculum was taught to the intervention group. Students in the intervention group performed better than the students in the control group on measure of hopelessness and suicide probability. Furthermore, students who were introduced to the curriculum showed better problem solving and suicide intervention skills.

Some other suicide prevention programs that have been implemented in different schools are CARE (Care, Assess, Respond, Empower), Reconnecting Youth (RY), The Good Behavior Game (GBG). There is not any consensus in the literature as to which one or two programs might be the most effective in preventing suicide.

The main idea behind school safety tip lines is that classmates and friends are more likely to identify suicidal students (Kalafat and Elias, 1994). Some school suicide prevention programs such as peer leadership training (e.g., Sources of Strength), awareness programs (e.g., Signs of Suicide) are also based on the same idea. These programs have generally shown encouraging results in terms of improvement in attitude of students and school staffs towards suicidal students (Nelson, 1987; Wyman et al., 2010; Schilling, 2014). Evaluation studies of Signs of Suicide

show that the program has reduced suicide attempts (Aseltine and DeMartino, 2004; Aseltine et al., 2007). However, there have been concerns about the validity of these results due to the self-report structure of the study (Katz et. al., 2013). Also, signs of suicide did not have any effect on suicide ideation. One explanation behind this result is that the program may not be effective in addressing the underlying causes of suicide attempts (Katz et. al., 2013). Another explanation is that treatment of suicide ideation takes a long time (Katz et. al., 2013). On the other hand, no study has evaluated Sources of Strength's impact on suicidal behavior so far. Hence, there is currently little evidence to support the notion that programs which give a lot of weight on the roles of classmates and friends have shown any significant effect in the reduction of youth suicide rate. This lack of evidence, however, does not mean that these programs do not have merits and cannot affect completed suicides. Previous research suggests that the majority of individuals with a history of suicide attempts die later from a cause other than suicide (Owens, Horrocks and House, 2002). Hence, any program that reduces suicide attempts or even helps to delay suicide attempts either by identifying suicidal individuals or by improving knowledge and attitude towards suicide may increase the chance of survival of suicidal individuals. While some programs may not indeed be effective in decreasing completed suicides, the lack of evidence of the impact of some other programs on completed suicides may exist because suicide remains a rare incident (9.7 per 100000 youths aged 14-to-18-year-olds in 2018), despite the increase in suicidal deaths in recent years. Hence, reducing the suicide mortality of a specific demographic group and estimating the impact of a program is a difficult task. Therefore, most interventions are and will continue to be evaluated on their success in either identifying suicidal students or reducing suicide attempts/non-fatal self-harm instead of impact on completed suicides.

## CHAPTER FOUR

## DATA

County-level suicide data of high school-aged youths (14–18 years) comes from Centers for Disease Control and Prevention’s (CDC) restricted-use Multiple Causes of Death data for the period 1999-2018. I measure suicide mortality based on International Classification of Diseases, Tenth Revision codes (ICD-10), with specific reference to intentional self-harm. To calculate suicide rate per 100000 population, I collect population data from National Cancer Institute’s SEER data. Although presence of tip lines varies at the state level, I analyze the outcome variable at the county level to account for variation in factors such as underlying county’s age distribution, community characteristics, school quality, income level, and other county characteristics—either through county fixed effects or control variables.

Data for control variables used in the main regression, such as percent male, percent white, percent under 19-year-old, are also obtained from the SEER data. Data for county unemployment rates and per capita income are collected from Bureau of Labor Statistics’ Local Area Unemployment Statistics and Bureau of Economic Analysis’ Local Area Personal Income

data, respectively. I also collect data on Child Access Prevention (CAP) laws from the Giffords Law Center that varies at the state level.<sup>6</sup>

In table 2, I present descriptive statistics for the data used in my analysis.<sup>7</sup> Table 2 indicates an average of 10.22 annual suicide deaths per 100,000 youths aged 14-18 years. It also indicates relatively high youth suicide rates for males and whites.

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<sup>6</sup> CAP laws mandate that minors do not have unsupervised access to guns by enforcing liability on adults (Giffords Law Center to Prevent Gun Violence, 2018). Studies show that risk of suicide is higher among youths whose guardians keep their guns loaded and/or unlocked (Grossman et al., 2005; Miller and Hemenway, 1999)

<sup>7</sup> The sample contains data of U.S. counties within 49 states and District of Columbia. Missouri is excluded from the sample as a potential treated state due to confusion about the effective year of Missouri's school safety tip line.

Table 2: Summary statistics

	(Mean)	(std. dev.)
Youth Suicide (Per 100000)	10.22	42.38
White	10.24	45.74
Black	5.407	196.9
Other Races	10.26	358.7
Male	15.85	71.48
Female	4.194	36.06
Percent White	86.49	15.85
Percent Male	49.83	2.019
Percent Under 19	25.14	3.514
CAP law	0.503	0.500
Log Per Capita Income	10.37	0.297
Unemployment Rate	6.181	2.700
County-year observations	50,874	

Notes: The sample contains data of U.S. counties within 49 states (excluding Missouri) and District of Columbia.

In Table 3, I show the means before (Column A) and after (Column B) the implementation of school safety tip lines.<sup>8</sup> These averages indicate increases in suicide outcomes of males, females, and whites from column A to Column B. This is not surprising as youth suicide rate had been consistently rising in almost all the states in the US from 2007-2018. And almost all school safety tip line programs were launched during that period.

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<sup>8</sup> If a tip line is not in effect for any portion of the year,  $y$ , in a specific county,  $c$ , the mortality observation is included in column A of table 2 for  $c$  and  $y$ . Column B includes mortality observations of treatment years and post-treatment years of a county.



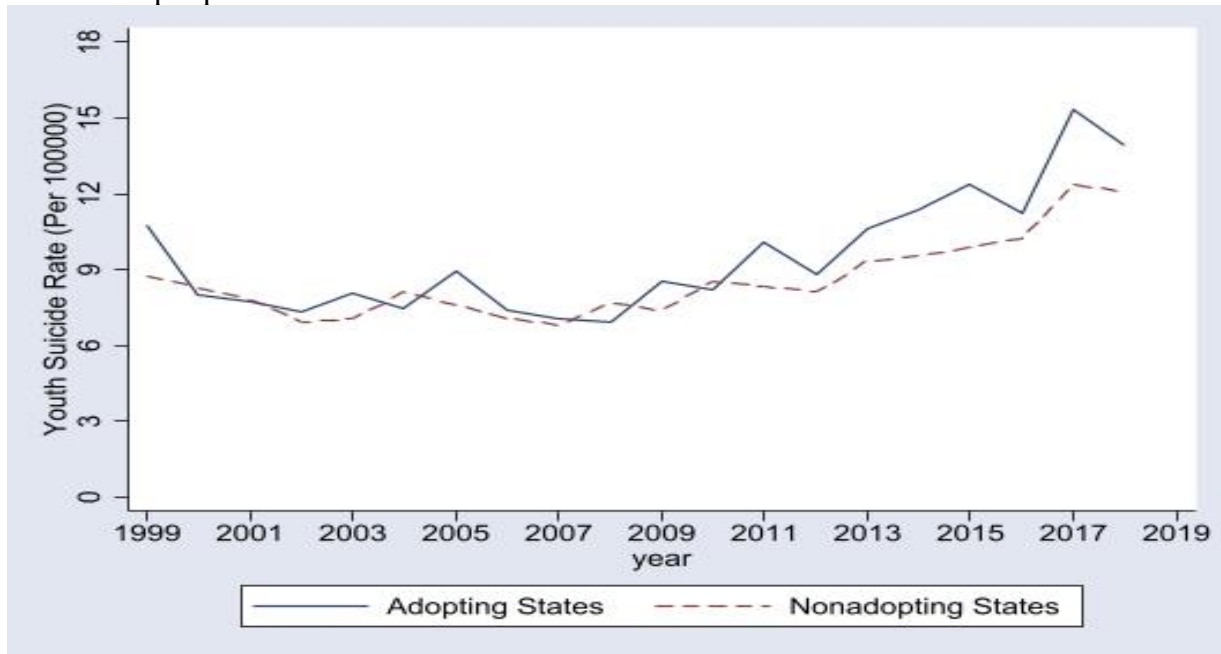
Table 3: Comparison of mortality rates between pre-treatment and post-treatment periods

	(1) Tip Line = 0	(2) Tip Line = 1
Youth Suicide (Per 100000)	10.089 (42.420)	14.895 (40.626)
White	10.094 (45.794)	15.606 (43.379)
Black	5.434 (199.347)	4.439 (57.617)
Other Races	10.362 (363.435)	6.718 (64.863)
Male	15.674 (71.518)	22.054 (69.704)
Female	4.103 (35.822)	7.493 (43.820)

Notes: The sample contains data of U.S. counties within 49 states (excluding Missouri) and District of Columbia.

Figure 2 shows a time series of the average youth suicide rates for the tip line adopting states, compared to states that did not adopt tip lines during 1999-2018 period. From the figure, it seems that average suicide rate has a slightly decreasing trend for both groups from 1999 to 2007. Also, two groups have similar average rates of youth suicide during this period. However, from 2008 to 2018, both groups have increasing trend in the suicide rates, and the rate of increase is higher in tip line adopting states relative to the non-adopting states. As a result, the average rate of suicide is higher in treated states than in control states during this period.

Figure 2: Time series of average youth suicide rate for the treated states, compared to states that did not adopt tip lines between 1999 and 2018.



## CHAPTER FIVE

## EMPIRICAL STRATEGY

I employ a difference-in-differences method as my preferred approach to estimate the causal impact of school safety tip lines on youth suicide rate. As an alternative identification strategy, I use Synthetic Control Method formulated by Abadie and Gardeazabal (2003).

Difference-in-differences Model

As my primary identification strategy, I exploit the variation in the timing of launching safety tip line mobile applications and websites across states. To explore the effect of school safety tip line programs on youth suicide, I estimate a difference-in-differences regression that takes the following form:

$$Y_{cst} = \beta_0 + \beta_1 \text{tip line}_{st} + \beta_2 X_{ct} + \beta_3 Z_{st} + v_c + w_t + u_{st} + \varepsilon_{cst},$$

where  $Y_{cst}$  represents suicide rate of 14-to-18-year-olds per 100000 residents of the same age group in county  $c$  of state  $s$  and year  $t$ . The independent variable of interest,  $\text{tip line}_{st}$ , is

equal to 1 if tip line mobile application and/or website was in effect in state  $s$  and year  $t$ , and equal to 0 otherwise.<sup>9,10</sup>

Although I use a linear model with suicide rate as the outcome in my main specification, I also show results of alternative specifications including Poisson and log models that adjust for zero outcomes. In the Poisson model, the count of youth suicides is the outcome variable. I show that the results are similar across all specifications.

The vectors  $v_c$  and  $w_t$  represent county and year fixed effects, respectively. County fixed effects control for time invariant attributes of a county that may be related to youth suicide. Year fixed effects control for shocks that are common to all counties during a year.  $\varepsilon_{cst}$  represent unobserved factors. I also include state specific linear time trends ( $u_{s,t}$ ), permitting each state to follow a separate trend. Linear time trends account for state specific factors that evolve steadily over time, such as attitude towards mental health, LGBT community, gun control.

I include several county-level control variables for demographic measures such as race, age, gender (% white, % under 19, % male) and economic conditions including the unemployment rate and per capita income in the vector  $X$  to test the robustness of my result.  $Z_{st}$

<sup>9</sup> Colorado launched safety tip line in 2004 with phone call as the only method of reporting tips. Colorado introduced website in 2007. Because this study is mainly concerned with the effect of tip line mobile applications and websites, I treat 2007 as the first year of treatment for Colorado. Data from Safe2Tell Colorado's annual reports also indicate that the tip line was not immediately fully utilized as it received just over 100 tips during each of 2004-05 and 2005-06 school years. In 2006-07, number of tips increased to 453. However, the main result remains similar even if I select 2004 as the treatment year.

<sup>10</sup> Tip line<sub>st</sub> is equal to fractional values during the year the tip line was implemented. For example, Florida launched tip line in October, 2018. Hence, in 2018, tip line<sub>st</sub> is equal to 8/12 or 0.25 in Florida.

represents a gun control law (Child Access Prevention Law) that varies at the state level. I weight the regressions by county populations to improve efficiency and use standard errors clustered at the state level, allowing yearly observations to be correlated within states.

### Synthetic Control Method

As an alternative strategy, I use the synthetic control method (SCM) to estimate the impact of tip lines on youth suicide rate. SCM is a data-driven process that generates a synthetic control group in comparative case studies for estimating treatment effects. To construct the synthetic control group for the treated unit, SCM uses a weighted average of the control groups that closely matches the treatment group during the pre-treatment period. SCM has similarity to the difference-in-differences method, as both methods exploit differences in treatment group and control group across the event of interest. However, SCM assigns different weights (including zero) to different untreated units, as opposed to the difference-in-differences method that assigns equal weight for all untreated units.

Following Abadie, Diamond, and Hainmueller (2010), and Cavallo et al. (2013), let  $S_{it}^N$  be the suicide rate of 14-to-18-year-olds per 100000 in state  $i$  at time  $t$  if there is no safety tip line, for state  $i = 1, \dots, j + 1$ , and time periods  $t = 1, \dots, T$ . Let,  $S_{it}^I$  be the youth suicide rate per 100000 in state  $i$  at time  $t$  if state  $i$  introduces safety tip line. If  $T_0$  is the number of years before the launch of safety tip line, with  $1 \leq T_0 < T$ , then for  $t \in \{1, \dots, T_0\}$  and all  $i \in \{1, \dots, N\}$ , we have that  $S_{it}^I = S_{it}^N$ .

Let  $\alpha_{it} = S_{it}^N - S_{it}^I$  be the impact of the tip line for state  $i$  at time  $t$  if tip line is in effect in state  $i$  in periods  $T_0 + 1, T_0 + 2, \dots, T$ . Rearranging,

$$S_{it}^I = S_{it}^N + \alpha_{it}$$

Next, let  $D_{it}$  be a dummy variable that is equal to 1 if safety tip line is in effect in state  $i$  at time  $t$  and is equal to 0 otherwise. The observed youth suicide rate for state  $i$  at time  $t$  is

$$S_{it}^I = S_{it}^N + \alpha_{it} D_{it}$$

If the tip line is in effect only in the first state (say, Colorado) and only after period  $T_0$ , we have that  $D_{it} = 1$  if  $i = 1$  and  $t > T_0$ .

Let the first state (say, Colorado) be the treated state. Hence, parameters of interest are  $(\alpha_{1,T_0+1}, \dots, \alpha_{1,T})$ , the lead specific causal effect of the school safety tip line on youth suicide. For  $t > T_0$ ,

$$\alpha_{1t} = S_{1t}^I - S_{1t}^N = S_{1t} - S_{1t}^N$$

Because  $S_{1t}$  is observed, we only need an estimate of  $S_{1t}^N$  to estimate the effect of the tip line. The unknown  $S_{1t}^N$  is approximated with a weighted average of untreated states. Hence, the effect of the tip line is:

$$\hat{\alpha}_{1t} = S_{1t} - \sum_{j=2}^{j+1} W_j^* S_{jt}$$

The weighting vector  $W^*$  in SCM is chosen such that it minimizes some distance,  $|X_1 - X_0 W|$ , as follows:

$$||X_1 - X_0 W|| = \sqrt{(X_1 - X_0 W)' V (X_1 - X_0 W)}$$

where  $X_1$  is the vector of pre-treatment linear combinations of suicide rate and predictors of suicide rate not affected by the safety tip line for the treated state and  $X_0$  is a vector with the same variables for the control states.  $V$  is a positive definite and diagonal matrix.  $V$  minimizes

the root mean squared prediction error (RMSPE) of the dependent variable for the pre-treatment period. The predictors of suicide that are not affected by the safety tip lines are the percentage of the population that are less than age 19, male, white, and county unemployment rate and per capita income.

I evaluate the effect of school safety tip line using SCM for two states, Colorado and Michigan, separately. Therefore, I construct two separate synthetic control groups for the two treated states to show the outcome of intervention in each of the two states. I exclude other treated states as these states introduced safety tip lines in or after 2016. Because my sample period ends in 2018, there is either too few or zero post-intervention periods for these excluded states. I also discard Missouri as a potential treated state due to confusion regarding the effective year of Missouri's school safety tip line.

Because eight states launched statewide safety tip line programs during the 1999–2018 period, those states and Missouri are excluded from the donor pool of control states. My donor pool includes the remaining 41 states and District of Columbia.

## CHAPTER SIX

## RESULTS

Following Cheng and Hoekstra (2013), I begin my analysis by presenting the raw data of the tip line adopting and non-adopting states in a set of figures to check if the parallel trends assumption holds for the two groups. Figure 3 shows youth suicide rates over time for treated states and control states, by year of treatment. For example, Figure 3A shows the youth suicide rate for Colorado, which launched safety tip line website in 2007, compared to states that did not launch tip line websites and mobile applications between 1999 and 2018. We can make few observations from figure 3. The first is that suicide rate has a rising trend in both control and adopting states after 2007. The trend is flat or slightly decreasing between years 1999 and 2006.

Second, except for the three states introducing tip lines in 2018 (Nevada, Maryland, and Florida), suicide rate in tip line adopting states increased more or decreased less than in nontreated states before the treatment takes place. While the trend is not clear for Colorado in the pre-treatment period, if we look at the line of best fit for both Colorado (treated state) and the control states in pre-treatment periods (1999-2006) in figure 4, we see that suicide rate had a slightly decreasing trend for both groups. But the rate of decrease was larger for non-adopting states relative to Colorado. On the other hand, the rate of increase was larger in Michigan, Utah, Wyoming, and Oregon compared to control states in the pre-adoption periods. Hence, the two groups of states have diverging trends, that is, the slope of the trend lines differ for the two groups. This violates the parallel trends assumption of the difference in difference model. I relax this parallel trend assumption by including the state specific linear time trends, which moves the



Figure 3: Suicide rates before and after the introduction of tip lines, by year of introduction

Figure 3A: Colorado (adoption of tip line in 2007) vs control states

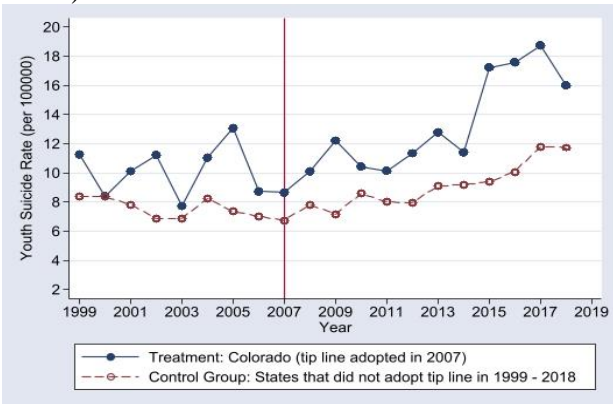


Figure 3B: Michigan (adoption of tip line in 2014) vs control states

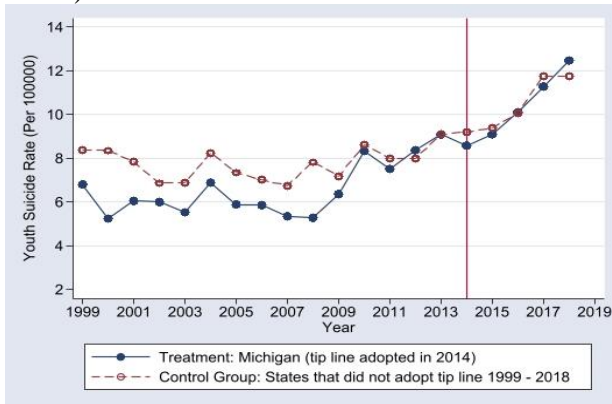


Figure 3C: Utah and Wyoming (adoption of tip line in 2016) vs control states

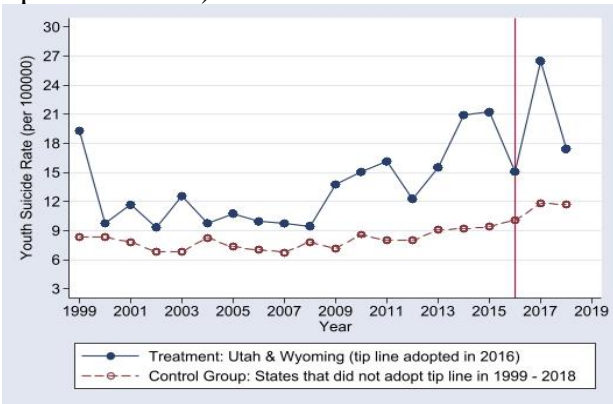


Figure 3D: Oregon (adoption of tip line in 2017) vs control states

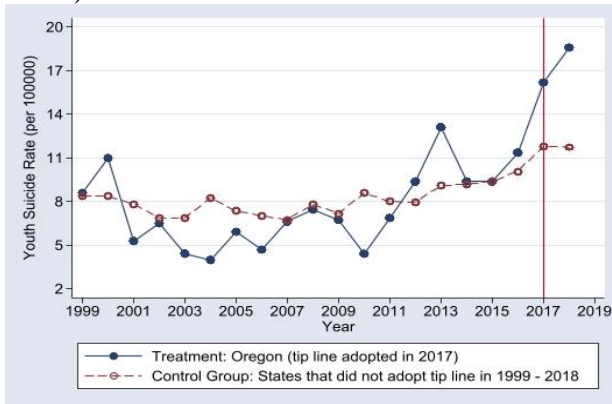


Figure 3E: Nevada, Florida and Maryland (adoption of tip line in 2018) vs control states

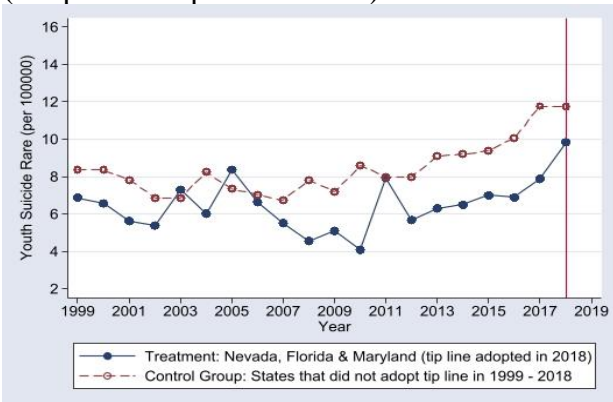
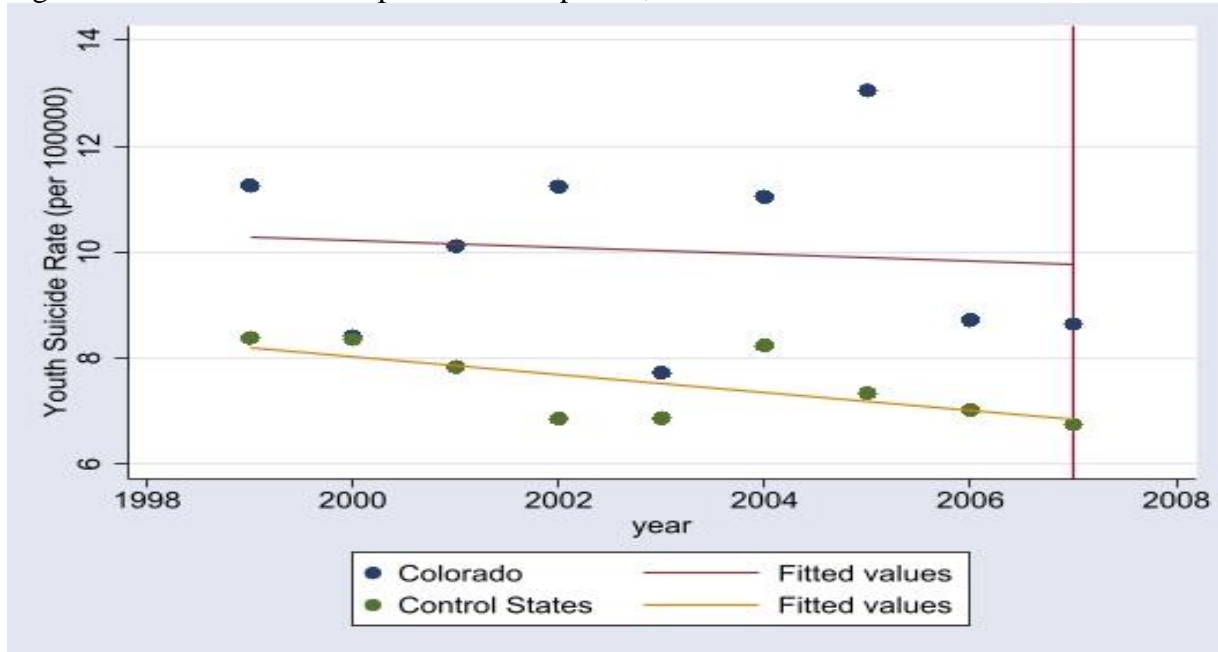


Figure 4: Line of best fit for pre-treatment period, Colorado vs control States



underlying assumption from parallel trends to parallel growth (More and Reggio, 2012). Now the trend lines do not need to have the same slope. The two groups just need to have linearly increasing or similar non-linear trends, which is a less stringent assumption than the parallel trend assumption (More and Reggio, 2012).

Third observation from figure 3 is that suicide rate increased in the post treatment periods for both the groups, with slightly greater increase in adopting states. Post treatment trend seems to have followed from the pre-treatment trend. It does not look like there is any significant effect of the tip line.

Consistent with the post-treatment trends in figure 3, the baseline results of my difference-in-differences regressions presented in table 4 suggest no clear effect on youth suicide rate following the adoption of school safety tip lines. Column 1 represents a model that accounts

for county and year fixed effects but does not include any control variable. In columns (2) through (4), I add county-level time-varying demographic and economic covariates, and state-level CAP law. The estimates remain similar and insignificant for all the specifications. As my estimates are not precisely estimated zeroes, I cannot definitively rule out effects of any meaningful magnitude. My 95% confidence interval is between -1.22 and 2.80 in the main specification (Column 4). Hence, the true effects may be negative, zero or positive. However, since my point estimates are positive and moderately large (0.786 percentage point or 7.69%), it is likely that tip lines did not have a large negative effect on youth suicide.

Table 4: Difference-in-differences results: youth suicide rate

	(1)	(2)	(3)	(4)
	Youth Suicide Rate	Youth Suicide Rate	Youth Suicide Rate	Youth Suicide Rate
Safety tip line	0.724 (0.809)	0.724 (0.810)	0.785 (0.806)	0.786 (0.806)
County-year Observations	50,874	50,874	50,874	50,874
Number of counties	2,968	2,968	2,968	2,968
Demographic Controls	No	YES	YES	YES
Economic Controls	No	No	YES	YES
CAP Law	No	No	No	YES
County FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
State Specific Time Trend	YES	YES	YES	YES

\*Statistically significant at 10% level; \*\* at 5% level; \*\*\* at 1% level.

Notes: The outcome variable is annual county suicide rates of 14-to-18-year-olds per 100000 obtained from the CDC's Multiple Causes of Death data (1999-2018). Controls include county level unemployment rate, log of per capita income, the share of county population that is male, white, under the age of 19 and an indicator for the presence of CAP laws. Standard errors in the parentheses are corrected for clustering at the state level.

I also present my results using an event study analysis. I replace school safety tip line program with a dummy variable that is equal to 1 the year in which a tip line was launched, 5 leads of this indicator (lead2, lead3, lead4, lead5 and lead5+), and 5 lags (lag1, lag2, lag3, lag4, lag5 and lag5+). The omitted category is one year prior to the adoption of the program. That is, each estimate of coefficient represents the change in youth suicide rate in tip line adopting states relative to non-adopting states during year  $y$ , as estimated from the year immediately before adoption. The outcome is youth suicide rate and controls include county fixed effects, year fixed effects, state specific linear time trends, demographic and economic controls, and presence of

Child Access Prevention (CAP) laws. The results are presented in table 5 and figure 5. We can see from the figure and the table that the pre-adoption coefficients are statistically indistinguishable from zero, thereby satisfying the parallel growth assumptions. The post-treatment coefficients, while positive, are insignificant with large standard errors. There is no evidence of any effect of the school safety tip lines on youth suicide rate.

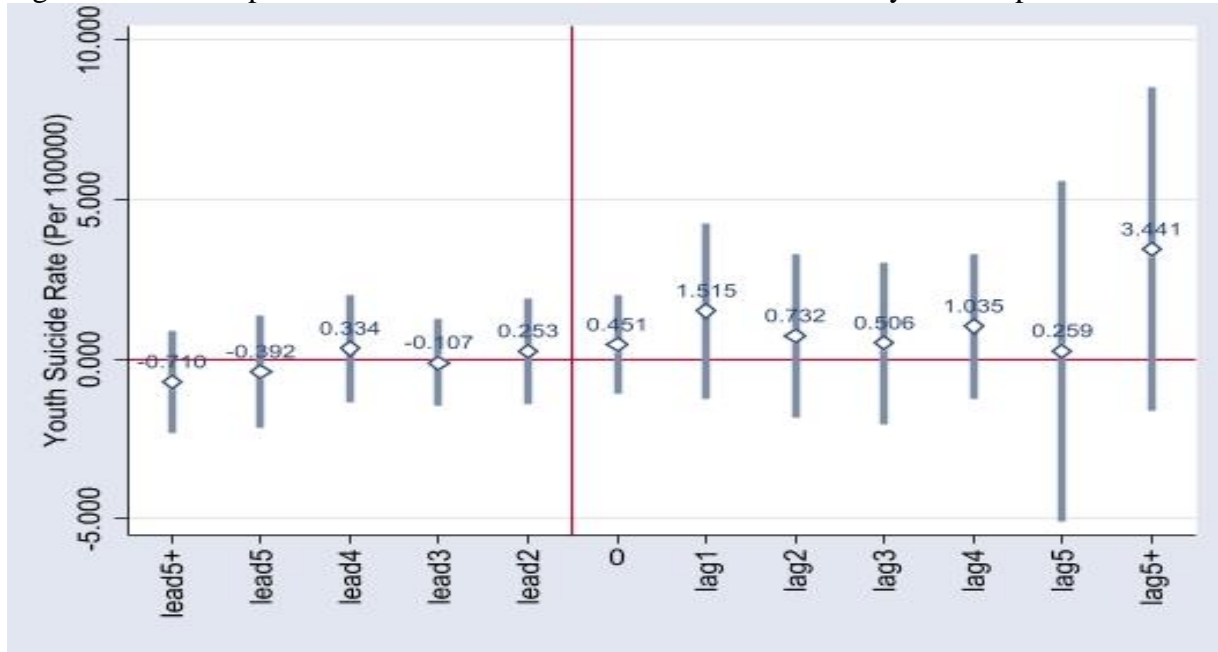
Table 5: Leads and lags of school safety tip lines

	(1) Youth Suicide Rate
5+ years prior to Tip line	-0.710 (0.821)
5 years prior to Tip line	-0.392 (0.896)
4 years prior to Tip line	0.334 (0.847)
3 years prior to Tip line	-0.107 (0.695)
2 years prior to Tip line	0.253 (0.844)
Year of Tip line	0.451 (0.788)
1 year after Tip line	1.515 (1.397)
2 year after Tip line	0.732 (1.316)
3 year after Tip line	0.506 (1.298)
4 year after Tip line	1.035 (1.155)
5 year after Tip line	0.259 (2.717)
5+ year after Tip line	3.441 (2.589)
County-year observations	50,874
Number of counties	2,968
Demographic Controls	YES
Economic Controls	YES
CAP Law	YES
County FE	YES
Year FE	YES
State Specific Time Trend	YES

\*Statistically significant at 10% level; \*\* at 5% level; \*\*\* at 1% level.

Notes: The outcome variable is annual county suicide rates of 14-to-18-year-olds per 100000 obtained from the CDC's Multiple Causes of Death data (1999-2018). Controls include county level unemployment rate, log of per capita income, the share of county population that is male, white, under the age of 19 and an indicator for the presence of CAP laws. Standard errors in the parentheses are corrected for clustering at the state level. The omitted category is one year prior to the adoption of the program.

Figure 5: Pre- and post-treatment trends in suicide rates of 14-to-18-year-olds per 100000



Notes: The outcome variable is annual county suicide rates of 14-to-18-year-olds per 100000 obtained from the CDC's Multiple Causes of Death data (1999-2018). Controls include county level unemployment rate, log of per capita income, the share of county population that is male, white, under the age of 19 and indicator for the presence of CAP laws. Standard errors in the parentheses are corrected for clustering at the state level. The omitted category is one year prior to the adoption of the program.

As robustness checks for my difference-in-difference results, I apply natural log and inverse hyperbolic sine (IHS) transformation to the dependent variable, youth suicide rate<sup>11</sup>. An

<sup>11</sup> Youth suicide rate's histogram shows skewness to the right, indicating that natural log and IHS transformation may improve efficiency in the estimation.

advantage of the natural log and inverse hyperbolic sine (IHS) transformation is that both diminish the influence of outliers. Also,  $\ln(y+1)$  and IHS transformed dependent variables are defined when the original variable is zero, thus allowing for zero values<sup>12</sup>. I also estimate a Poisson regression, with the dependent variable as the count of suicides of 14-to-18-year-olds in county  $c$  and year  $t$ . The natural logarithm of the county population of 14-to-18-year-olds is used as an offset variable in the Poisson regression. Accounting for the full set of control variables, fixed effects and state specific linear time trend, columns 1, 2, and 3 of table 6 report the results. All three specifications show no significant effect for youth suicide rate.

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<sup>12</sup> Since  $\ln(y)$  is undefined when  $y=0$ , dependent variable is transformed as  $\ln(y+1)$



Table 6: Difference-in-differences results: robustness checks with transformed dependent variables and Poisson regression

	(1) Natural Log Rate	(2) Inverse Hyperbolic Sine	(3) Poisson
Safety Tip Line	0.0197 (0.0792)	0.0143 (0.0936)	0.00823 (0.0742)
County-year observations	50,874	50,874	44,647
Number of counties	2,968	2,968	2,444
Demographic Controls	YES	YES	YES
Economic Controls	YES	YES	YES
CAP Law	YES	YES	YES
County FE	YES	YES	YES
Year FE	YES	YES	YES
State Specific Time Trend	YES	YES	YES

\*Statistically significant at 10% level; \*\* at 5% level; \*\*\* at 1% level.

Notes: In columns (1) and (2), the outcome variable is annual county suicide rates of 14-to-18-year-olds per 100000 obtained from the CDC's Multiple Causes of Death data (1999-2018). In column (3), the outcome variable is annual counts of suicide of 14-to-18-year-olds in a county. Controls include county level unemployment rate, log of per capita income, the share of county population that is male, white, under the age of 19 and an indicator for the presence of CAP laws. Standard errors in the parentheses are corrected for clustering at the state level.

Although tip line programs may have some spillover effects on other age groups, such effects should be very low. Therefore, finding effects on suicide rate of other age groups might invalidate my research specification. To that end, I replace youth suicide rates with adult suicide rates in columns (1) and (2) of Table 7. Specifically, I consider the suicides rate of 18+ year-olds in column (2). I restrict the age range between 19- and 23-year-olds in column (1). I find estimated coefficients to be statistically insignificant across both specifications. Additionally, an event study analysis (Figure 6) shows zero difference in adult suicide rate between adopting and non-adopting states in both pre-treatment and post-treatment periods.

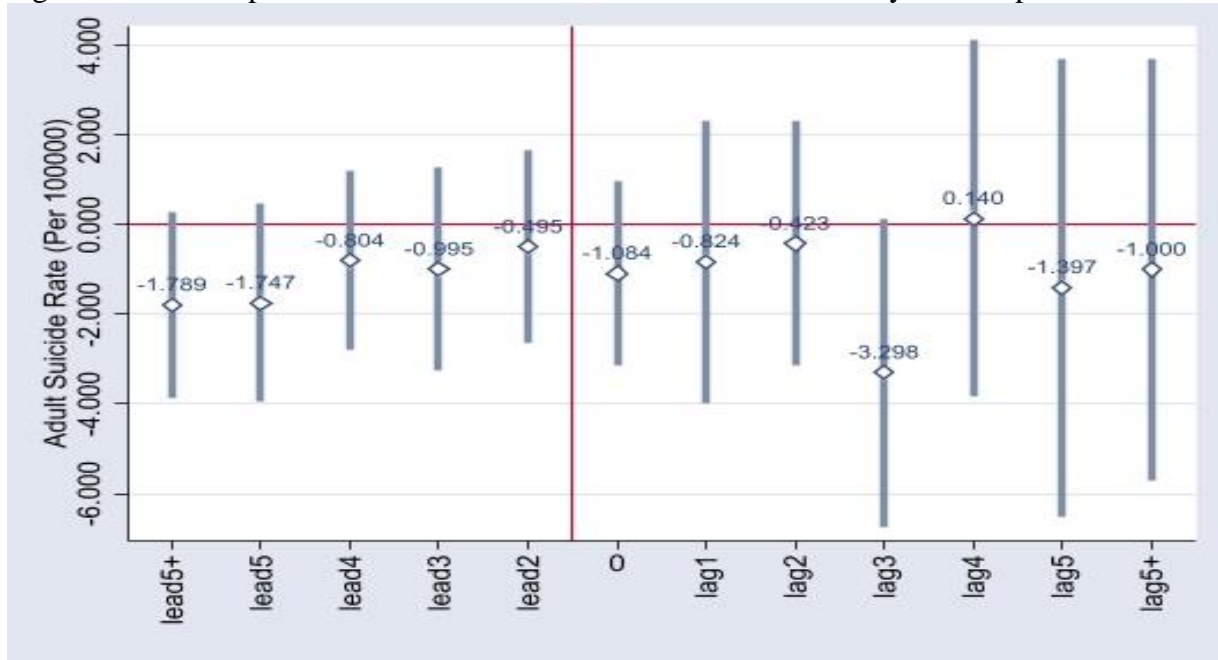
Table 7: Difference-in-differences results: adult suicide rate

	(1) Adult Suicide Rate (19- to 23-year-olds)	(2) Adult Suicide Rate (19+ year-olds)
Tip Line	-0.649 (0.932)	0.205 (0.333)
County-year observations	50,874	50,874
Number of counties	2,968	2,968
Demographic Controls	YES	YES
Economic Controls	YES	YES
CAP Law	YES	YES
County FE	YES	YES
Year FE	YES	YES
State Specific Time Trend	YES	YES

\*Statistically significant at 10% level; \*\* at 5% level; \*\*\* at 1% level.

Notes: The outcome variable is annual county suicide rates of 19-to-23-year-olds per 100000 (column 1) and 19+ year-olds per 100000 (column 2) obtained from the CDC's Multiple Causes of Death data (1999-2018). Controls include county level unemployment rate, log of per capita income, the share of county population that is male, white, age between 19 and 23 (column 1) and over the age of 19 (column 2) and an indicator for the presence of CAP laws. Standard errors in the parentheses are corrected for clustering at the state level.

Figure 6: Pre- and post-treatment trends in suicide rates of 19-to-23-year-olds per 100000



Notes: The outcome variable is annual county suicide rates of 19-to-23-year-olds per 100000 obtained from the CDC's Multiple Causes of Death data (1999-2018). Controls include county level unemployment rate, log of per capita income, the share of county population that is male, white, age between 19 and 23 years and indicator for the presence of CAP laws. Standard errors in the parentheses are corrected for clustering at the state level. The omitted category is one year prior to the adoption of the program.

We saw in table 2 that suicide rate varies across race and gender, with white and male youths having higher rates of suicides. To that end, I explore potential heterogeneous effects of the tip lines across race and gender in table 8. Columns (1) and (2) present the impact of tip lines for white and black youths, respectively. I consider suicide rates of male and female youths in columns (3) and (4), respectively. The results suggest that tip lines did not have any impact on the suicide rates across any of the demographic groups.

Table 8: Heterogeneity

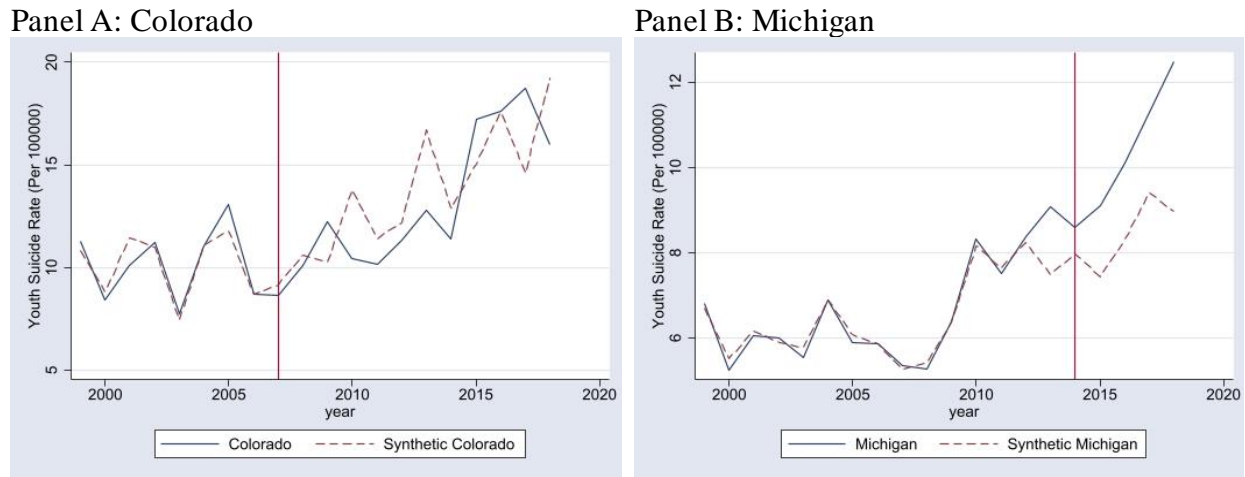
VARIABLES	(1) White Youth Suicide Rate	(2) Black Youth Suicide Rate	(3) Male Youth Suicide Rate	(4) Female Youth Suicide Rate
Tip Line	1.380 (0.887)	-1.602 (2.048)	1.930 (1.249)	-0.398 (0.880)
County-year observations	50,874	49,974	50,874	50,874
Number of counties	2,968	2,949	2,968	2,968
Demographic Controls	YES	YES	YES	YES
Economic Controls	YES	YES	YES	YES
CAP Law	YES	YES	YES	YES
County FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
State Specific Time Trend	YES	YES	YES	YES

\*Statistically significant at 10% level; \*\* at 5% level; \*\*\* at 1% level.

Notes: The outcome variable is annual county suicide rates of 14-to-18-year-old white, black, male and female youths per 100000 obtained from the CDC's Multiple Causes of Death data (1999-2018). Controls include county level unemployment rate, log of per capita income, the share of county population that is male, white, under the age of 19 and an indicator for the presence of CAP laws. Standard errors in the parentheses are corrected for clustering at the state level.

Figure 7 show results from my Synthetic Control Method analysis for Colorado (Panel A) and Michigan (Panel B). The solid line shows youth suicide rate for Colorado in Panel A and the same outcome for Michigan in Panel B. In both graphs, the dashed line represents the counterfactual of the respective states, i.e., synthetic Colorado in Panel A and synthetic Michigan

Figure 7: Synthetic control results: youth suicide rate



in Panel B<sup>13</sup>. We can see that both synthetic Colorado and synthetic Michigan closely matches actual Colorado and actual Michigan prior to the adoption of school safety tip lines. Panel A shows that there is no distinct difference between the suicide rates of actual Colorado and synthetic Colorado in the post-adoption period. Although we see no distinct difference between the two lines, and no immediate impact of the tip line, SCM suggests an average decrease in youth suicide rate of 0.56 or 4.1% each year in Colorado. However, the effect is statistically

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<sup>13</sup> Synthetic Colorado consists of Delaware (0.182), Hawaii (0.001), Idaho (0.345), Montana (0.373), North Dakota (0.023). Synthetic Michigan consists of Alabama (0.042), Delaware (0.101), District of Columbia (0.012), Illinois (0.108), Kansas (0.017), Massachusetts (0.099), Montana (0.033), New Jersey (0.203), New York (0.05), North Carolina (0.079), North Dakota (0.074), Oklahoma (0.182)

insignificant, which I will discuss shortly. This finding is consistent with the results from the difference-in-differences method.

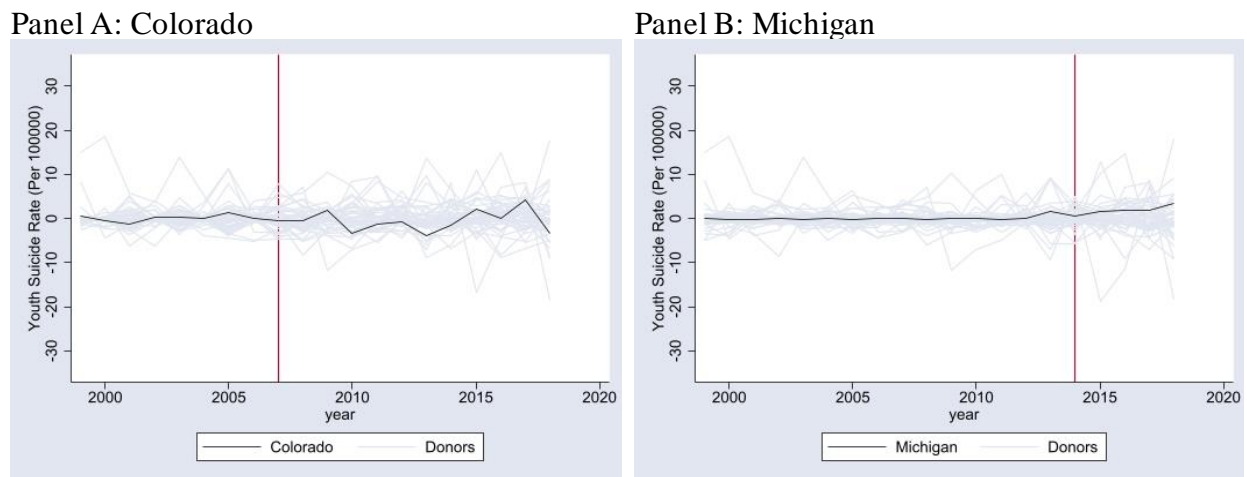
Panel B shows a surprising result for Michigan. It seems that suicide rate has increased in Michigan after the adoption of school safety tip line, compared to the counterfactual. If we look closely at the figure, however, it shows that the solid line seems to diverge from the dashed line even before the treatment takes place, as the suicide rate in Michigan rapidly increases from 2013. There was already a difference in the suicide rate between Michigan and synthetic Michigan in 2013 and 2014, and that difference seems to persist in the post-treatment years. In any case, result from the SCM suggests an average increase in suicide rates of 1.89 or 20.11% each year. However, the effect is not significant at 5% level, and is barely significant at 10% level (p value 0.093). This suggests that tip line did not have any effect on the prevention of youth suicide rate in Michigan.

To determine the significance of the result from SCM, and to calculate the p value, I follow the inferential technique proposed by Abadie, Diamond, and Hainmueller (2010). First, I iteratively apply the SCM for the same treatment period to each of the 41 control states and District of Columbia. This results in a graph that shows a distribution of placebo effects. I then compute the Root Mean Squared Prediction Error (RMSPE) for each placebo for both pre-adoption and post-adoption periods. After computing the ratio of post-treatment RMSPE to pre-treatment RMSPE for each state, I sort the ratios from highest to lowest. Finally, p value is calculated as rank/total. Intuitively, since the pre-treatment Colorado (Michigan) closely matches the synthetic Colorado (synthetic Michigan), the pre-treatment RMSPE should be a small value. On the other hand, a large deviation in the post-treatment period would have resulted in a large

post-treatment RMSPE. A high post to pre ratio therefore means low probability of SCM result being a matter of chance. However, because we do not see large post-adoption difference between the two lines in graph 7, I do not expect a large post-treatment RMSPE, and a large ratio for both Colorado and Michigan, compared to other control states on which SCM is applied.

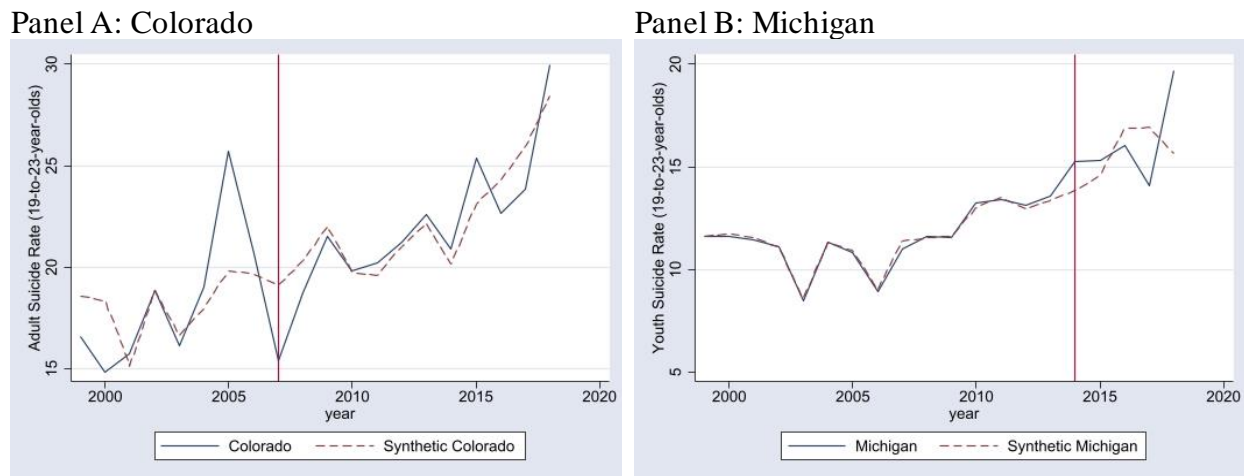
The results of these placebo exercises are shown in figure 8. Clearly, suicide rates in both Colorado and Michigan do not belong to the tails of the distribution of placebo states, that is, the two states are not outliers in the distribution. P-values for Colorado and Michigan are 0.139 and 0.093, respectively, which confirm that the effects of the tip lines are insignificant at the 5% level.

Figure 8: Synthetic control placebo results: youth suicide rate



As a falsification test, I apply the SCM to the suicide rate of 19-to-23-year-olds. The results are shown in figure 9. It is clear from Panel B of figure 9 that tip line does not cause any distinct difference in the suicide rate in Michigan, compared to its counterfactual. On the other hand, panel A shows that the pre-treatment match between Colorado and its counterfactual is not credible. A good match is not found by the algorithm as the suicide rate in Colorado sharply rises from 2004 to 2005. None of the combination of the donor states can replicate this sharp increase. As such, synthetic control method may not be well suited to identify the effect of the tip line on suicide. In any case, we do not see any significant post-treatment difference between Colorado and synthetic Colorado.

Figure 9: Synthetic control results: adult (19-to-23-year-olds) suicide rate





## CHAPTER SEVEN

## CONCLUSION

The rapid rise in suicidal behavior and suicide deaths among high school students in recent years poses one of the biggest challenges that the American public health sector is currently facing. School safety tip lines, which enable students to anonymously report suspicious activities and suicidal behaviors of their classmates and friends, have emerged as a potential medium to prevent students from committing suicide. The tip lines in different implementing states have led to multiple interventions that saved the lives of suicidal high school students. Using data from the Center for Disease Control's (CDC) Multiple Causes of Death data for the period 1999-2018, I examine whether the tip lines have made any significant difference in the rate of youth suicide in the tip line adopting states, compared to non-adopting states.

My results suggest that school safety tip lines had no effect on the suicide rate of high-school aged youths (14-to-18-year-olds). My results are robust across both the difference-in-differences and synthetic control methods. Additionally, the zero effects are apparent in graphical analysis of raw data. Although there is anecdotal evidence of tip lines being used to save several suicidal students, it seems tip lines did not make enough difference to produce statistically significant results. Also, except for Colorado, there are either very few or zero post-treatment periods for other treated states during my sample period (1999-2018). This may have also contributed to insignificant results. As more states start implementing tip lines, and as data of more post-treatment years becomes available, the effect of tip lines may become evident in the prevention of youth suicide.

Because safety tip lines tend to be adopted in the wake of school shootings, the assignment of interventions may not be random. Even though youth suicide was not a primary focus for the initial adoption of the tip lines, it is likely that models in this paper suffer from slight endogeneity issues. There is possibility that tip line implementing states have passed other gun-related legislations immediately before or after the adoption of tip lines<sup>14</sup>. These laws, in turn, may change the way tip lines affect youth suicide, and may have biased the results in this paper. The direction of this bias is ambiguous. A body of research shows a positive association between firearm availability and suicides (Knopov et al., 2019; Rodríguez Andrés and Hempstead, 2011; Briggs and Tabarrok, 2014; Phillips, 2013). Restrictive gun laws may, therefore, reduce youth suicides by making guns less accessible to youths. On the other hand, possibility or discussion of the passage of restrictive gun laws leads to large spike in firearms sales in the US (Levine and McKnight, 2020). This may result in higher rates of youth suicide.

Finally, there is little evidence in the literature that previous and ongoing school-based suicide prevention programs have been successful in reducing suicide morality, although most programs have shown generally positive results in terms of increasing knowledge and improving attitudes towards suicide. Katz et. al., (2013), after conducting a systematic review of the literature of school-based suicide prevention programs in USA, hypothesize that a single

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<sup>14</sup> For example, after the Columbine School shooting, state of Colorado passed gun laws related to the sale of firearms at gun shows, concealed carry, and “straw purchases” (Schwartz, 2012).

program may not be enough to effectively prevent suicide among school students. They suggest using a combination of programs. Indeed, future research can evaluate two or more programs in combination to see whether these programs complement each other. For example, peer leadership training program such as Sources of Strength, and a school safety tip line program share the same idea about preventing suicide- classmates and friends are more likely to identify suicidal students. They differ in methods of reporting. As a result, peer leadership training program may complement school safety tip line, and potentially increase the effectiveness of tip lines. Students will be more successful in identifying suicidal students if they are properly trained to recognize symptoms of suicide, as found in peer leadership training program. This may result in more actionable tips being reported by trained students. Ideally, the synergy between two programs will lead to more suicides being prevented.

## REFERENCES CITED

- Abadie, A., Diamond, A., & Hainmueller, J. (2010). Synthetic control methods for comparative case studies: Estimating the effect of California's tobacco control program. *Journal of the American Statistical Association*, *105*(490), 493–505.  
<https://doi.org/10.1198/jasa.2009.ap08746>
- Abadie, A., & Gardeazabal, J. (2003). The economic costs of conflict: A case study of the Basque country. *American Economic Review*, *93*(1), 113–132.  
<https://doi.org/10.1257/000282803321455188>
- Altinanahtar, A., & Halicioglu, F. (2009). A dynamic econometric model of suicides in Turkey. *The Journal of Socio-Economics*, *38*(6), 903–907.  
<https://doi.org/10.1016/j.socec.2009.05.008>
- Andrés, A. R., & Halicioglu, F. (2010). Determinants of suicides in Denmark: Evidence from time series data. *Health Policy*, *98*(2–3), 263–269.  
<https://doi.org/10.1016/j.healthpol.2010.06.023>
- Andrés, A. R. (2005). Income inequality, unemployment, and suicide: A panel data analysis of 15 European countries. *Applied Economics*, *37*(4), 439–451.  
<https://doi.org/10.1080/0003684042000295304>
- Aseltine, R. H., & DeMartino, R. (2004). An outcome evaluation of the SOS suicide prevention program. *American Journal of Public Health*, *94*(3), 446–451.  
<https://doi.org/10.2105/AJPH.94.3.446>
- Aseltine, R. H., James, A., Schilling, E. A., & Glanovsky, J. (2007). Evaluating the SOS suicide prevention program: A replication and extension. *BMC Public Health*, *7*(1), 161.  
<https://doi.org/10.1186/1471-2458-7-161>
- Borum, R., Cornell, D., Modzeleski, W., & Jimerson, S. (2009). What can be done about school shootings? A review of the evidence. *Educational Researcher*, *39*(1), 27–37.  
<https://doi.org/https://doi.org/10.3102/0013189X09357620>
- Brainerd, E. (2001). Economic reform and mortality in the former Soviet Union: A study of the suicide epidemic in the 1990s. *European Economic Review*, *45*(4), 1007–1019.  
[https://doi.org/10.1016/S0014-2921\(01\)00108-8](https://doi.org/10.1016/S0014-2921(01)00108-8)
- Briggs, J. T., & Tabarrok, A. (2014). Firearms and suicides in US states. *International Review of Law & Economics, Complete*(37), 180–188. <https://doi.org/10.1016/j.irl.2013.10.004>
- Cavallo, E., Galiani, S., Noy, I., & Pantano, J. (2013). Catastrophic natural disasters and economic growth. *The Review of Economics and Statistics*, *95*(5), 1549–1561.  
[https://doi.org/10.1162/REST\\_a\\_00413](https://doi.org/10.1162/REST_a_00413)

- Cheng, C., & Hoekstra, M. (2013). Does strengthening self-defense law deter crime or escalate violence? Evidence from expansions to Castle Doctrine. *Journal of Human Resources*, 48(3), 821–854. <https://doi.org/10.3368/jhr.48.3.821>
- Cebula, R. J., & Zelenskaya, T. V. (2006). Determinants of youth suicide. *American Journal of Economics and Sociology*, 65(4), 991–996. <https://doi.org/10.1111/j.1536-7150.2006.00486.x>
- Chiwaya, N., DeFrank, P., & Kimelman, J. (2019). School Shooting Tracker: Counting school shootings since 2013. *NBC News*. Retrieved April 18, 2021, from <https://www.nbcnews.com/news/us-news/school-shooting-tracker-n969951>
- Christoffersen, M. N. (1994). A follow-up study of longterm effects of unemployment on children: Loss of self-esteem and self-destructive behavior among adolescents. *Childhood*, 2(4), 212–220. <https://doi.org/10.1177/090756829400200405>
- Chuang, H.-L., & Huang, W.-C. (1997). Economic and social correlates of regional suicide rates: A pooled cross-section and time-series analysis. *The Journal of Socio-Economics*, 26(3), 277–289. [https://doi.org/10.1016/S1053-5357\(97\)90021-4](https://doi.org/10.1016/S1053-5357(97)90021-4)
- Chuang, H.-L., & Huang, W.-C. (2007). A re-examination of the suicide rates in Taiwan. *Social Indicators Research*, 83(3), 465–485.
- Dupéré, V., Leventhal, T., & Lacourse, E. (2009). Neighborhood poverty and suicidal thoughts and attempts in late adolescence. *Psychological Medicine*, 39(8), 1295–1306. <https://doi.org/10.1017/S003329170800456X>
- Durkheim, E. (1951). *Suicide: A Study in Sociology*, Edited by: Spaulding, J. A. and Simpson, G. Gencoe, IL: Free Press.
- Eisenberg, M. E., Ackard, D. M., & Resnick, M. D. (2007). Protective factors and suicide risk in adolescents with a history of sexual abuse. *The Journal of Pediatrics*, 151(5), 482–487. <https://doi.org/10.1016/j.jpeds.2007.04.033>
- Eskin, M., Kaynak-Demir, H., & Demir, S. (2005). Same-sex sexual orientation, childhood sexual abuse, and suicidal behavior in university students in turkey. *Archives of Sexual Behavior*, 34(2), 185–195. <https://doi.org/10.1007/s10508-005-1796-8>
- Espelage, D. L., & Holt, M. K. (2013). Suicidal ideation and school bullying experiences after controlling for depression and delinquency. *Suicidal Ideation and School Bullying Experiences After Controlling for Depression and Delinquency*, 53(1S), S27–S31.
- Fang, M. (2018). School poverty and the risk of attempted suicide among adolescents. *Social Psychiatry and Psychiatric Epidemiology*, 53(9), 955–967. <https://doi.org/10.1007/s00127-018-1544-8>

- Fergusson, D. M., Horwood, L. J., & Woodward, L. J. (2001). Unemployment and psychosocial adjustment in young adults: Causation or selection? *Social Science & Medicine* (1982), 53(3), 305–320. [https://doi.org/10.1016/s0277-9536\(00\)00344-0](https://doi.org/10.1016/s0277-9536(00)00344-0)
- Gaynes, B. N., West, S. L., Ford, C. A., Frame, P., Klein, J., & Lohr, K. N. (2004). Screening for suicide risk in adults: A summary of the evidence for the US. Preventive services task force. *Annals of Internal Medicine*, 140(10), 822–835. <https://doi.org/10.7326/0003-4819-140-10-200405180-00015>
- Giffords Law Center to Prevent Gun Violence. 2018. “Child Access Prevention.” Available at: <http://lawcenter.giffords.org/gun-laws/policy-areas/child-consumer-safety/child-accessprevention>.
- Gius, M. (2015). The impact of minimum age and child access prevention laws on firearm-related youth suicides and unintentional deaths. *The Social Science Journal*, 52(2), 168–175. <https://doi.org/10.1016/j.soscij.2015.01.003>
- Gould, M. S., Greenberg, T., Velting, D. M., & Shaffer, D. (2003). Youth suicide risk and preventive interventions: A review of the past 10 years. *Journal of the American Academy of Child & Adolescent Psychiatry*, 42(4), 386–405. <https://doi.org/10.1097/01.CHI.0000046821.95464.CF>
- Gould, M. S., Marrocco, F. A., Kleinman, M., Thomas, J. G., Mostkoff, K., Cote, J., & Davies, M. (2005). Evaluating iatrogenic risk of youth suicide screening programs: A randomized controlled trial. *JAMA*, 293(13), 1635–1643. <https://doi.org/10.1001/jama.293.13.1635>
- Gower, A. L., & Borowsky, I. W. (2013). Associations between frequency of bullying involvement and adjustment in adolescence. *Academic Pediatrics*, 13(3), 214–221. <https://doi.org/10.1016/j.acap.2013.02.004>
- Grossman, D. C., Mueller, B. A., Riedy, C., Dowd, M. D., Villaveces, A., Prodzinski, J., Nakagawara, J., Howard, J., Thiersch, N., & Harruff, R. (2005). Gun storage practices and risk of youth suicide and unintentional firearm injuries. *JAMA*, 293(6), 707–714. <https://doi.org/10.1001/jama.293.6.707>
- Gunnell, D., Wehner, H., & Frankel, S. (1999). Sex differences in suicide trends in England and Wales. *Lancet (London, England)*, 353(9152), 556–557. [https://doi.org/10.1016/S0140-6736\(99\)00408-0](https://doi.org/10.1016/S0140-6736(99)00408-0)
- Hamermesh, D. S., & Soss, N. M. (1974). An economic theory of suicide. *Journal of Political Economy*, 82(1), 83–98. JSTOR.
- Hawton, K. (1982). Attempted suicide in children and adolescents. *Child Psychology & Psychiatry & Allied Disciplines*, 23(4), 497–503. <https://doi.org/10.1111/j.1469-7610.1982.tb00093.x>

- Hepburn, L., Azrael, D., Molnar, B., & Miller, M. (2012). Bullying and suicidal behaviors among urban high school youth. *Journal of Adolescent Health, 51*(1), 93–95. <https://doi.org/10.1016/j.jadohealth.2011.12.014>
- Hoffmann, J. A., Farrell, C. A., Monuteaux, M. C., Fleegler, E. W., & Lee, L. K. (2020). Association of pediatric suicide with county-level poverty in the United States, 2007–2016. *JAMA Pediatrics, 174*(3), 287. <https://doi.org/10.1001/jamapediatrics.2019.5678>
- Iemmi, V., Bantjes, J., Coast, E., Channer, K., Leone, T., McDaid, D., Palfreyman, A., Stephens, B., & Lund, C. (2016). Suicide and poverty in low-income and middle-income countries: A systematic review. *The Lancet. Psychiatry, 3*(8), 774–783. [https://doi.org/10.1016/S2215-0366\(16\)30066-9](https://doi.org/10.1016/S2215-0366(16)30066-9)
- Ivey-Stephenson, A. Z. (2020). Suicidal ideation and behaviors among high school students—Youth risk behavior survey, United States, 2019. *MMWR Supplements, 69*. <https://doi.org/10.15585/mmwr.su6901a6>
- Jaen-Varas, D., Mari, J. J., Asevedo, E., Borschmann, R., Diniz, E., Ziebold, C., & Gadelha, A. (2019). The association between adolescent suicide rates and socioeconomic indicators in Brazil: A 10-year retrospective ecological study. *Revista Brasileira de Psiquiatria, 41*(5), 389–395. <https://doi.org/10.1590/1516-4446-2018-0223>
- Jungeilges, J., & Kirchgässner, G. (2002). Economic welfare, civil liberty, and suicide: An empirical investigation. *The Journal of Socio-Economics, 31*(3), 215–231. [https://doi.org/10.1016/S1053-5357\(02\)00116-6](https://doi.org/10.1016/S1053-5357(02)00116-6)
- Kalafat, J., & Elias, M. (1994). An evaluation of a school-based suicide awareness intervention. *Suicide and Life-Threatening Behavior, 24*(3), 224–233. <https://doi.org/10.1111/j.1943-278X.1994.tb00747.x>
- Kaplan, R. (1977). Patterns of environmental preference. *Environment and Behavior, 9*(2), 195–216. <https://doi.org/10.1177/001391657792003>
- Katz, C., Bolton, S.-L., Katz, L. Y., Isaak, C., Tilston-Jones, T., & Sareen, J. (2013). A systematic review of school-based suicide prevention programs. *Depression and Anxiety, 30*(10), 1030–1045. <https://doi.org/10.1002/da.22114>
- Kingkade, T. (2020). Trying to stop shootings, school tip lines uncover a teen suicide crisis. *NBC News*. Retrieved April 18, 2021, from <https://www.nbcnews.com/news/us-news/school-tip-lines-were-meant-stop-shootings-uncovered-teen-suicide-n1127876>
- Kirmayer, L.J., Fraser, S.L., Fauras, V., & Whitley, R. (2009). Current Approaches to Aboriginal Youth Suicide Prevention. Quebec: Institute of Community & Family Psychiatry. Jewish General Hospital.
- Knopov, A., Sherman, R., Raifman, J., Larson, E., & Siegel, M. (2019). Household gun

- ownership and youth suicide rates at the state level, 2005–2015. *American Journal of Preventive Medicine*, 56(3), 335–342. <https://doi.org/10.1016/j.amepre.2018.10.027>
- Kok, J. K., & Goh, L. Y. (2011). Young People and Suicide Issue. *International Conference on Humanities, Society and Culture*, 20, 32–36. IACSIT Press, Singapore.
- LaFromboise, T., & Howard-Pitney, B. (1995). The Zuni life skills development curriculum: Description and evaluation of a suicide prevention program. *Journal of Counseling Psychology*, 42(4), 479–486. <https://doi.org/10.1037/0022-0167.42.4.479>
- Langman, P., & Straub, F. (2019) A comparison of averted and completed school attacks from the police foundation averted school violence database. *National Police Foundation*. Retrieved April 18, 2021, from <https://www.policefoundation.org/publication/a-comparison-of-averted-and-completed-school-attacks-from-the-police-foundation-averted-school-violence-database/>
- Lester, D. (1996). Patterns of suicide and homicide in the world. Nova Science Publishers.
- Levine, B. P., & McKnight, R. (2020). Three million more guns: The Spring 2020 spike in firearm sales. *Brookings*. <https://www.brookings.edu/blog/up-front/2020/07/13/three-million-more-guns-the-spring-2020-spike-in-firearm-sales/>
- McCrimmon, K. K. (2009) The Story of Safe2tell. The Colorado Trust. Retrieved April 18, 2021, from [www.coloradotrust.org/sites/default/files/COT\\_Safe2TellReport08\\_web.pdf](http://www.coloradotrust.org/sites/default/files/COT_Safe2TellReport08_web.pdf).
- Marcotte, D. E. (2003). The economics of suicide, revisited. *Southern Economic Journal*, 69(3), 628–643. JSTOR. <https://doi.org/10.2307/1061698>
- Martin, G., Bergen, H. A., Richardson, A. S., Roeger, L., & Allison, S. (2004). Sexual abuse and suicidality: Gender differences in a large community sample of adolescents. *Child Abuse & Neglect*, 28(5), 491–503. <https://doi.org/10.1016/j.chiabu.2003.08.006>
- Meel, B. L. (2003). Determinants of suicide in the Transkei sub-region of South Africa. *Journal of Clinical Forensic Medicine*, 10(2), 71–76. [https://doi.org/10.1016/S1353-1131\(03\)00038-5](https://doi.org/10.1016/S1353-1131(03)00038-5)
- Miller, M., Azrael, D., & Barber, C. (2012). Suicide mortality in the united states: The importance of attending to method in understanding population-level disparities in the burden of suicide. *Annual Review of Public Health*, 33(1), 393–408. <https://doi.org/10.1146/annurev-publhealth-031811-124636>
- Miller, M., & Hemenway, D. (1999). The relationship between firearms and suicide: A review of the literature. *Aggression and Violent Behavior*, 4(1), 59–75. [https://doi.org/10.1016/S1359-1789\(97\)00057-8](https://doi.org/10.1016/S1359-1789(97)00057-8)
- Molnar, B. E., Shade, S. B., Kral, A. H., Booth, R. E., & Watters, J. K. (1998). Suicidal behavior



- and sexual/physical abuse among street youth. *Child Abuse & Neglect*, 22(3), 213–222. [https://doi.org/10.1016/S0145-2134\(97\)00137-3](https://doi.org/10.1016/S0145-2134(97)00137-3)
- Mora, R., & Reggio, I. (2012). Treatment effect identification using alternative parallel assumptions (No. we1233; UC3M Working Papers. Economics). Universidad Carlos III de Madrid. Departamento de Economía. <https://ideas.repec.org/p/cte/werepe/we1233.html>
- Nelson, F. L. (1987). Evaluation of a youth suicide prevention school program. *Adolescence*, 22(88), 813–825.
- Nikolaou, D. (2017). Does cyberbullying impact youth suicidal behaviors? *Journal of Health Economics*, 56, 30–46. <https://doi.org/10.1016/j.jhealeco.2017.09.009>
- Neumayer, E. (2003). Are socioeconomic factors valid determinants of suicide? Controlling for national cultures of suicide with fixed-effects estimation. *Cross-Cultural Research*, 37(3), 307–329. <https://doi.org/10.1177/1069397103253708>
- Owens, D., Horrocks, J., & House, A. (2002). Fatal and non-fatal repetition of self-harm. Systematic review. *The British Journal of Psychiatry: The Journal of Mental Science*, 181, 193–199. <https://doi.org/10.1192/bjp.181.3.193>
- Petersen, A. C., & Kellam, S. G. (1977). Measurement of the psychological well-being of adolescents: The psychometric properties and assessment procedures of the how I feel. *Journal of Youth and Adolescence*, 6(3), 229–247. <https://doi.org/10.1007/BF02138937>
- Pfeffer, C. R., Zuckerman, S., Plutchik, R., & Mizruchi, M. S. (1984). Suicidal behavior in normal school children: A comparison with child psychiatric inpatients. *Journal of the American Academy of Child Psychiatry*, 23(4), 416–423. [https://doi.org/10.1016/S0002-7138\(09\)60319-8](https://doi.org/10.1016/S0002-7138(09)60319-8)
- Phillips, J. A. (2013). Factors associated with temporal and spatial patterns in suicide rates across u. S. States, 1976–2000. *Demography*, 2(50), 591–614. <https://doi.org/10.1007/s13524-012-0176-y>
- Pritchard, C. (1992). Is there a link between suicide in young men and unemployment? : A comparison of the UK with other European community countries. *The British Journal of Psychiatry*, 160(6), 750–756. <https://doi.org/10.1192/bjp.160.6.750>
- Rich, C. L., Young, D., & Fowler, R. C. (1986). San Diego suicide study. I. Young vs old subjects. *Archives of General Psychiatry*, 43(6), 577–582. <https://doi.org/10.1001/archpsyc.1986.01800060071009>
- Rivers, I., & Noret, N. (2013). Potential suicide ideation and its association with observing bullying at school. *Journal of Adolescent Health*, 53(1 Suppl), S32–S36. <https://doi.org/10.1016/j.jadohealth.2012.10.279>

- Robinson, J., Bailey, E., Witt, K., Stefanac, N., Milner, A., Currier, D., Pirkis, J., Condrón, P., & Hetrick, S. (2018). What works in youth suicide prevention? A systematic review and meta-analysis. *E Clinical Medicine*, 4–5, 52–91. <https://doi.org/10.1016/j.eclinm.2018.10.004>
- Rodríguez Andrés, A., & Hempstead, K. (2011). Gun control and suicide: The impact of state firearm regulations in the United States, 1995–2004. *Health Policy (Amsterdam, Netherlands)*, 101(1), 95–103. <https://doi.org/10.1016/j.healthpol.2010.10.005>
- Rubenstein, J. L., Heeren, T., Housman, D., Rubin, C., & Stechler, G. (1989). Suicidal behavior in “normal” adolescents: Risk and protective factors. *American Journal of Orthopsychiatry*, 59(1), 59–71. <https://doi.org/10.1111/j.1939-0025.1989.tb01635.x>
- Schwartz, J. (2012). Colorado gun laws remain lax, despite some changes. *The New York Times*. <https://www.nytimes.com/2012/07/21/us/colorado-gun-laws-remain-lax-despite-changes-after-columbine.html>
- Schilling, E. A., Lawless, M., Buchanan, L., & Aseltine, R. H. (2014). “Signs of Suicide” shows promise as a middle school suicide prevention program. *Suicide & Life-Threatening Behavior*, 44(6), 653–667. <https://doi.org/10.1111/sltb.12097>
- Scott, M. A., Wilcox, H. C., Schonfeld, I. S., Davies, M., Hicks, R. C., Turner, J. B., & Shaffer, D. (2009). School-based screening to identify at-risk students not already known to school professionals: The Columbia Suicide Screen. *American Journal of Public Health*, 99(2), 334–339. <https://doi.org/10.2105/AJPH.2007.127928>
- Seiden, R. H. (1977). Suicide prevention: A public health/public policy approach. *Journal of Death and Dying*, 8(3), 267–276. <https://doi.org/10.2190/KXY8-J7QB-7BR7-J8YW>
- Shaffer, D., Scott, M., Wilcox, H., Maslow, C., Hicks, R., Lucas, C. P., Garfinkel, R., & Greenwald, S. (2004). The Columbia SuicideScreen: Validity and reliability of a screen for youth suicide and depression. *Journal of the American Academy of Child & Adolescent Psychiatry*, 43(1), 71–79. <https://doi.org/10.1097/00004583-200401000-00016>
- Stack, S. (2000). Suicide: A 15-year review of the sociological literature part ii: modernization and social integration perspectives. *Suicide and Life-Threatening Behavior*, 30(2), 163–176. <https://doi.org/10.1111/j.1943-278X.2000.tb01074.x>
- Tompkins, T. L., Witt, J., & Abraibesh, N. (2010). Does a gatekeeper suicide prevention program work in a school setting? Evaluating training outcome and moderators of effectiveness. *Suicide and Life-Threatening Behavior*, 40(5), 506–515. <https://doi.org/10.1521/suli.2010.40.5.506>
- Unnithan, N. P., Huff-Corzine, L., Corzine, J., & Whitt, H. P. (1994). The currents of lethal violence: An integrated model of suicide and homicide. SUNY Press.

- Wagner, B. M., Cole, R. E., & Schwartzman, P. (1995). Psychosocial correlates of suicide attempts among junior and senior high school youth. *Suicide and Life-Threatening Behavior*, 25(3), 358–372. <https://doi.org/10.1111/j.1943-278X.1995.tb00958.x>
- Webster, D. W., Vernick, J. S., Zeoli, A. M., & Manganello, J. A. (2004). Association between youth-focused firearm laws and youth suicides. *JAMA*, 292(5), 594–601. <https://doi.org/10.1001/jama.292.5.594>
- Wyman, P. A., Brown, C. H., Inman, J., Cross, W., Schmeelk-Cone, K., Guo, J., & Pena, J. B. (2008). Randomized trial of a gatekeeper program for suicide prevention: 1-year impact on secondary school staff. *Journal of Consulting and Clinical Psychology*, 76(1), 104–115. <https://doi.org/10.1037/0022-006X.76.1.104>
- Wyman, P. A., Brown, C. H., LoMurray, M., Schmeelk-Cone, K., Petrova, M., Yu, Q., Walsh, E., Tu, X., & Wang, W. (2010). An outcome evaluation of the sources of strength suicide prevention program delivered by adolescent peer leaders in high schools. *American Journal of Public Health*, 100(9), 1653–1661. <https://doi.org/10.2105/AJPH.2009.190025>