THE IMPACT OF NALOXONE ACCESS ON OPIOID OVERDOSES IN MASSACHUSETTS: A SINGLE INTERRUPTED TIME SERIES DESIGN

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ABSTRACT

In 2006, Massachusetts implemented the Overdose Education and Naloxone Distribution (OEND) prevention program in order to reduce the fatality associated with opioid overdoses. As part of this program, individuals could receive kits containing naloxone contingent on completing training to administer the drug. This program evaluation uses multivariate regression analysis in order to determine whether or not OEND had an effect on the rate and number of overdoses in Massachusetts counties after implementation. The research design is characterized as an interrupted time series evaluation with comparison groups, using data on Massachusetts counties both before and after OEND was implemented. Multivariate regression indicates that OEND reduced both the rate and number of overdoses in counties once the program had been in place for at least one year. These results are significant at an alpha level of 0.10. According to this study, the rate of overdoses in Massachusetts counties was reduced by 1.12 individuals per 100,000 in the population. This reduction reflects the life-saving properties of naloxone, and it's magnitude provides a compelling reason to enact this policy change, given the problem of rising opioid overdoses throughout the United States.

INTRODUCTION

Overdose from opioid drugs (heroin and other prescription medications) has
become a serious public health problem in the United States. According to data from the Centers for Disease Control (CDC), the rate of fatal drug overdoses increased by 130 percent from 1999-2013, and most of this increase is due to higher use and abuse of prescription drugs – particularly opioids.[1] In response, some advocacy organizations, policymakers, and other stakeholders have worked to increase access to the drug naloxone hydrochloride (naloxone). This drug acts as an "opioid antagonist" that can "reverse the potentially fatal respiratory depression caused by heroin and other opioids".[2] More precisely, if naloxone is given to an individual experiencing an opioid overdose, it has the potential to prevent the overdose from becoming fatal.

States and localities have begun implementing and testing programs that provide naloxone to individuals who are at risk or know individuals who are at risk of opioid overdose. Since these programs give naloxone to non-medical professionals, programs also require those individuals to receive training in how to recognize an opioid overdose and what to do when an individual is experiencing one – including how to administer naloxone and perform rescue breathing.[3] This training is essential to ensure that individuals actually know how to use naloxone and what other steps to take that increase the likelihood of survival for the person experiencing the overdose.

In response to rising overdose rates in the state, Massachusetts has implemented a naloxone program through its Department of Public Health in order to reduce the rate of fatal overdoses from opioids, and its program will be the focus of this evaluation. The Overdose Education and Naloxone Distribution (OEND) prevention program started in 2006 in limited locations and was expanded in 2012 to bring training and naloxone

1 Leonard J. Paulozzi et al., "Controlled Substance Prescribing Patterns – Prescription Behavior Surveillance System, Eight States, 2013," Morbidity and Mortality Weekly Report Surveillance Summaries 64, no. 9 (October 16, 2015): 1, http://www.cdc.gov/mmwr/preview/mmwrhtml/ss6409a1.htm.

2 Eliza Wheeler et al., "Opioid Overdose Prevention Programs Providing Naloxone to Laypersons — United States, 2014," Morbidity and Mortality Weekly Report 64, no. 23 (June 19, 2015): 631, http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6423a2.htm.

3 "Opioid Overdose Education and Naloxone Distribution: MDPH Naloxone pilot project Core Competencies," Massachusetts Department of Public Health, Accessed December 29, 2015, http://www.mass.gov/eohhs/docs/dph/substance-abuse/core-competencies-for-naloxone-pilot-participants.pdf.

distribution centers to every county. Text of the law from the Department of Public Health states:

- Naloxone may lawfully be prescribed and dispensed to a person at risk of experiencing an opiate-related overdose or a family member, friend or other person in a position to assist a person at risk of experiencing an opiate-related overdose.[4]

The aim of this program is relatively straightforward: expanding access to naloxone in order to reduce the number of fatal opioid overdoses. Consequently, this evaluation will examine how both the number and the rate of unintentional opioid overdose deaths has been impacted with the implementation of this program.

The research will proceed as follows: Part I will present an overview of previous literature that has examined the impact of naloxone programs. Part II will describe the research design for this evaluation and defend why this is the best design available. Part III will provide an overview of the key variables of interest, including the treatment variable, the outcome variable, and control variables, along with descriptive statistics for the continuous variables. Part IV will present the results of the evaluation and, finally, Part V will present a discussion of their implications.

PART I: LITERATURE REVIEW

The majority of previous research evaluations for programs that expand access to naloxone have focused on obtaining quantitative data on the number of trainings completed by participants, the number of kits administered, and the number of overdoses that were reportedly reversed through naloxone treatment, along with some limited qualitative data. These data were collected through a variety of sources, and their analyses support the efficacy of naloxone programs in reversing potentially fatal opioid overdoses.

Banjo et al. gathered data from the British Columbia Take Home Naloxone program in Canada that was tested at 40 sites across the province.[5] After the program was implemented for 18 months, 1,318 individuals had been trained to recognize and respond to overdose, and there were 836 kits administered to the participants. From these kits, there were reports of 85 cases in which opioid overdoses were reversed through

4 "Opioid Overdose Education," 4.

5 Oluwajenyo Banjo, "A quantitative and qualitative evaluation of the British Columbia Take Home Naloxone program," CMAJ Open 2, no. 3 (2014): E153, doi:10.9778/cmajo.20140008.

naloxone.[6] In addition, qualitative data from interviews with stakeholders found general support for the program, and participants "reported a strong sense of pride for taking part" and "having learned the skills to help save someone's life."[7] The only negative responses came from police who believed that participants would fail to call medical authorities following administration of naloxone due to overconfidence that the user had fully recovered. Police were also concerned about the potential for black market sales of naloxone, although this has so far not been empirically demonstrated.[8]

Evaluations of similar programs in New York City and San Francisco corroborate these findings. Piper et al. collected questionnaires between March 2005 and December 2005 in New York City from 122 participants who requested a naloxone refill.[9] Of the 71 participants who had witnessed an overdose since their training, participants administered naloxone "82 times (i.e., some participants had used naloxone more than once)", and this resulted in the reversal of 68 overdoses with the outcome of the remaining 14 cases being unknown.[10] Rowe et al. used data reported by 2,500 registered participants in the San Francisco naloxone distribution program to find that there were 702 overdoses reversed between 2010 and 2013.[11] They also used demographic characteristics from this data to run logistic models that identified what types of participants were more likely to obtain naloxone refills and report reversals of overdoses.[12] However, the specific findings from the logistic models are outside the scope of the evaluation conducted in this research, as data was not collected in Massachusetts about characteristics of program participants.

Walley et al. conducted an evaluation that is most relevant to this one, as they analyzed rates of unintentional opioid overdoses in Massachusetts communities.[13] Their study also takes advantage of an

6 Ibid.

7 Ibid., E158.

8 Banjo et al., E158

9 Tinka Markham Piper et al., "Evaluation of a Naloxone Distribution and Administration Program in New York City," Substance Use & Misuse 43, no. 7 (2008): 858, doi: 10.1080/10826080701801261.

10 Ibid., 862.

11 Christopher Rowe et al., "Predictors of participant engagement and naloxone utilization in a community-based naloxone distribution program," Addition 110, no. 8 (August 2015): 1301, doi:10.1111/add.12961.

12 Ibid., 1301.

13 Alexander Y. Walley et al., "Opioid overdose rates and implementation of overdose education and nasal naloxone distribution in Massachusetts: interrupted time series

interrupted time series design by looking at these rates from 2002-09 with the program interruption occurring in 2006-07 when certain communities instituted OEND programs.[14] The authors bifurcated the program variable based on the number of participants enrolled in the program for each community such that high enrollment was defined as a community with more than 100 people enrolled per 100,000 in the population and low enrollment meant there were fewer than 100 participants per 100,000 residents.[15] Their results show that, compared to communities with no naloxone distribution programs, communities with low enrollment experienced about 27 percent lower rates of fatal opioid overdoses and communities with high enrollment had rates that were 46 percent lower (Walley et al., 2013).[16]

PART II: RESEARCH DESIGN AND METHODOLOGY

This study is characterized as an interrupted time series evaluation with comparison groups (ITSCG), and the unit of analysis is a county-year. This evaluation concentrates on the OEND prevention program in Massachusetts because their Department of Public Health has the best data available for the annual number of unintentional opioid overdoses in each county from 2000-2014.[17] These types of overdoses are the focus because data is not available on intentional overdoses and because unintentional overdoses tend to happen more often in the presence of others who could prevent fatality with naloxone. In addition, Massachusetts has a large number of naloxone training and distribution centers compared to other states since this program has been in effect for almost a decade, and opening of centers varies by county-year such that certain counties had centers open at the inception of the program in 2006 and other counties had centers opened in later years with the most recent centers opening in 2012. These features of the Massachusetts program and the quality of data available about overdose rates make Massachusetts an excellent location to examine the effect of naloxone programs. No other state had a program instituted long enough to allow enough time for it to have an impact on

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analysis," BMJ 346, no. f174 (2013): 1, doi: 10.1136/bmj.f174.

14 Walley et al., 2.

15 Ibid., 3.

16 Ibid., 10.

17 "Data Brief: Fatal Opioid-related Overdoses among Massachusetts Residents." Massachusetts Department of Public Health. Last modified April 6, 2015. http://www.mass.gov/eohhs/docs/dph/quality/drugcontrol/county-level-pmp/data-brief-apr-2015-overdose-county.pdf.

rates of fatal overdoses, or those states did not have publicly available data on the annual rates of fatal overdoses within each county.

Further, in the absence of data from a randomized experiment, an ITSCG design is desirable to evaluate a naloxone access program because this design can isolate the program's impact from other historical trends that could explain the rate of fatal opioid overdoses. For instance, opioid use has increased substantially since 2005, which is indicated by Figure 1 of the appendix where the drug use indicator traces the rate of opioid use over time in Massachusetts. Much of this increase in use can be traced to prescription opioids, including oxycodone and hydrocodone.[18] Consequently, the rate of fatal opioid overdoses in each Massachusetts county has also increased over this same time period; Figure 2 shows where each county-year is represented by a point in the scatterplot. Having these yearly data for each county both before and after the naloxone program was implemented will isolate historical trends that could detract from a possible effect of the OEND program.

Using this design with annual data from each of the 14 counties in Massachusetts, multivariate regression analysis will determine how the OEND program impacted fatal overdoses from opioids. The null and alternative hypothesis to be analyzed with this design are stated below:

> Null Hypothesis: OEND programs have no effect on fatal opioid overdoses ($\beta=0$)
> Alternative Hypothesis: OEND programs have an effect on fatal opioid overdoses ($\beta\neq0$)

For this reason, the coefficient associated with program inception found from the multivariate regressions will represent the impact of the program on fatal overdoses, and statistical significance will be evaluated at an alpha level of 0.10. Data on the number of overdoses in each county in Massachusetts was found from 2000-2014 with the exception of 2013-14 data in Nantucket and Dukes counties, so this missing data limits total observations from 210 to 206. Separate regressions will also be performed that entirely exclude Nantucket and Dukes county since data for those years are missing, and the number of overdoses in these counties is abnormally low (0-3 total) compared to other counties. The low number of fatal overdoses in these locations is most likely due to the fact that these areas are tiny islands mostly populated by vacation homes. In addition, data indicating the level of opioid use in each county over time was only

18 Wheeler et al., 631.

found from 2005-2014, so the regression analysis will be limited to 136 observations when all counties are included or to 120 observations when Nantucket and Dukes are excluded. Although limiting the regression to the data from these county-years will lower the number of available observations, it is important to include the control variable indicating the level of opioid use since it will impact the outcome variable of fatal overdoses, and, thus, its omission will bias the regression results.

In addition, since the multivariate regression analysis will be performed on multiple observations over time from the same 14 counties in Massachusetts, the statistical analysis will use clustered standard errors based on the county. This clustering will control for the fact that observations from the same county over this time period will not be independent from one other because observations within one county will be more similar to each other than observations from another county. For instance, there are certain characteristics of one county that contribute to the fatal opioid overdoses, such as the fact that Boston is a large and diverse city located within Suffolk county, and other Massachusetts counties will be more rural.

PART III: DATA DESCRIPTION

As detailed in Part II, the outcome variable will represent fatal overdoses in Massachusetts since the OEND program was implemented to address this problem. The Massachusetts Dept. of Public Health compiles and publishes yearly data on "the number of unintentional opioid overdose deaths by county", so this data only counts cases where there is a reasonable basis to determine that the subject did not intend to commit suicide.[19] Since this data only reports the raw number of overdoses, United States Census Bureau (2015) counts of the population in each county from 2000-2014 was used to calculate the rate of unintentional opioid overdoses in each county per 100,000 residents.[20] Table 1 in the appendix summarizes key descriptive statistics of these two outcome variables. For instance, the number of overdoses ranges from a minimum of zero to a high of 257 in Middlesex County in 2014. In addition, the mean number of overdoses is about 44, yet the standard deviation is 41, indicating high variance. For this reason, using the rate of overdose deaths per 100,000 residents in a county may provide a better indicator of fatal overdoses since there is less

19 "Data Brief," 3.

20 U.S. Census Bureau, "State and County QuickFacts," U.S. Department of Commerce, Last modified December 1, 2015, Accessed December 29, 2015, http://quickfacts.census.gov/qfd/states/25000.html.

variation in the rate with a minimum of zero and a maximum of 24.9, and this spread of rates is shown in Figure 2. The average rate of fatal overdoses in a county-year is 8.31 with a standard deviation of about 5.

The OEND program is the treatment being evaluated by this design, so it is represented as a dummy variable equal to one if the county has a naloxone training and distribution center open in that year. The program was started in 2006 with the first centers opening that year in Suffolk, where Boston is located. Centers were opened in Middlesex in 2007. The program expanded further in 2008 to Barnstable, Bristol, Essex, and Hampden counties. Centers opened in the rest of the Massachusetts counties in either 2010 or 2012. Data indicating when centers were opened come from a program overview presented by Dr. Alexander Walley[21] and the Massachusetts Dept. of Public Health.[22] In order to better estimate the impact of the OEND program, a second lagged program variable was coded to indicate whether a county had a naloxone training and distribution center opened in the previous year. This lagged variation will track whether it takes additional time for enough individuals to receive training and naloxone kits in order to have a meaningful impact.

Other important variables that could impact the overall number of fatal opioid overdoses were included in the multivariate regressions if data measuring the variable was publicly available. As previously stated, data were found to indicate the level of opioid abuse in the overall Massachusetts population. When individuals enter rehab in the state, they are asked what drugs they had used in the previous year, and the percentage of people admitting to the use of these drugs is compiled by the Massachusetts Department of Public Health.[23] Figure 1 in the Appendix shows that more clients in rehab programs have been reporting opioid use from a low of about 61 percent in 2005-07 to a high of about 77 percent in 2014, as is also reflected in Table 1.

Another key dummy variable controls for whether or not a county

21 Alexander Y. Walley, "Overdose education and naloxone rescue kits in Massachusetts," Red Project, Last modified May 12, 2014, Accessed December 29, 2015, http://redproject.org/wp-content/uploads/2014/01/Overdose-Education-and-Naloxone-Distribution-Massachusetts-Part-1.pdf.

22 "Opioid Overdose Prevention & Reversal: Information Sheet," Massachusetts Department of Public Health, Last modified July 2015, http://www.mass.gov/eohhs/docs/dph/substance-abuse/naloxone-info.pdf.

23 "Description of Admissions to BSAS Contracted/Licensed Programs: FY 2014," Massachusetts Department of Public Health, Last modified March 5, 2015, http://www.mass.gov/eohhs/docs/dph/substance-abuse/care-principles/state-and-city-town-admissions-fy14.pdf.

is designated as a High Intensity Drug Trafficking Area (HIDTA) by the federal government where a county is coded one if it has such status. Six counties in Massachusetts have this status, and law enforcement agencies located in these counties receive additional funds and resources from the federal government to help target and limit drug trafficking, along with its consequences.[24] Thus, HIDTA status likely has an association with opioid overdoses. However, the direction of this effect is undetermined since higher drug trafficking in these counties could lead to more fatal opioid overdoses from the presence of more illegal drugs, or larger resources to target drug trafficking could reduce drug use and consequently fatal overdoses in HIDTA counties.

The population of each Massachusetts county in these years is also included as a control, but there are other features of each county that cannot be measured by the population or controlled through the clustered standard errors by county. As a result, regression analyses include fixed effects in the form of many dummy variables for each county and another set of dummy variables for each year. Certain features of each county and each year may influence overdoses, but not all of these features can be controlled through the inclusion of specific variables. For this reason, fixed effects at the county level or within each year that could have an effect on fatal opioid overdoses can be controlled through this statistical technique.

Part IV: Evaluation Results

Given this available data, regression results will take the following form to estimate program impact where controls include coefficients for other confounding variables and fixed effects:

$$Overdoses_{it} = a + \beta_1(program_{it}) + \beta_2(laggedprogram_{it}) + controls(z_{it}) + (FEit) + e_{it}$$

Results from two separate regressions indicate that the OEND program has a negative effect on fatal opioid overdoses in Massachusetts. The first regression includes observations from all Massachusetts counties and the other excludes observations from Nantucket and Dukes County. This negative effect of OEND programs was only observed through the lagged program coefficient, and the non-lagged program coefficient did not achieve statistical significance at an alpha level of 0.10. The program tends to be introduced in areas where overdoses are known to be high, so it is unsurprising that there is no effect seen in the first year. Nevertheless, from these findings, the null hypothesis can be rejected in favor of the

24 "Massachusetts Drug Control Update," Executive Office of the President of the United States, Accessed December 29, 2015, https://www.whitehouse.gov/sites/default/files/docs/state_profile_-_massachusetts.pdf.

alternative hypothesis since the OEND program has clearly reduced fatal opioid overdoses. Following is a more detailed description of the results from the two separate regressions.

Table 2 includes the coefficients and their associated p-values from a regression conducted on the limited selection of Massachusetts counties where Nantucket and Dukes county are excluded. In this case, the outcome variable is the rate of fatal opioid overdoses per 100,000 residents in a county. The following regression equation was found:

$$Rate_{it} = 303.98 + 1.2(program_{it}) - 1.12\ (laggedprogram_{it}) + controls(z_{it}) + e_{it}$$

From this analysis, the OEND program is estimated to reduce the rate of fatal overdoses by 1.12 per 100,000 county residents once naloxone training and distribution centers have been opened for a year based on the lagged program variable. This coefficient achieved statistical significance at the alpha level of 0.10, so the estimated reduction in the rate of fatal overdoses is precise with at least 90 percent confidence. However, the magnitude of the coefficient only indicates slight practical significance because the programs are only expected to decrease the rate of fatal overdoses by about 22 percent of a standard deviation, which is large in magnitude, given the high monetary value of one statistical life saved in cost-benefit analysis. Without including a lagged program variable for treatment, the OEND program is estimated to actually increase the rate of fatal overdoses in Massachusetts, even though this coefficient does not achieve statistical significance.

Table 3 summarizes the results from the regression using data in all Massachusetts counties where the outcome variable is the number of fatal opioid overdoses, not the rate. The following regression was found from this model:

$$Count_{it} = -201.07 + 2.49(program_{it}) - 7.09\ (laggedprogram_{it}) + controls(z_{it}) + e_{it}$$

In this analysis, the OEND program is estimated to reduce the number of fatal overdoses by about seven in each county once the naloxone centers have been opened for one year as indicated by the lagged treatment variable. Like the preceding model, this lagged program coefficient reached statistical significance at an alpha level of 0.10. Similarly, the magnitude of this estimated coefficient has practical significance since the program is estimated to decrease the number of fatal overdoses by roughly 17 percent of a standard deviation. On average then, counties that have had the naloxone program in place for at least a year will experience roughly seven fewer opioid overdoses amongst all of their residents.

Comparing resulting coefficients from both of these regressions shows important similarities. The key treatment variable looking at the lagged effect of the OEND program is similar in its direction and magnitude in both models. Though the standardized magnitude is slightly smaller in Table 3 when the outcome variable is measured as the number of overdoses, the comparable results from both models certainly indicates that the OEND program is succeeding in its goal of reducing the rate of unintentional opioid overdoses. The high magnitude of the effect observed in both models results from the medical properties of naloxone and the life-saving effects it has when more people have access to it through programs like the one in Massachusetts. As previous research from Walley et al. has found, higher enrollment in the OEND program has a larger effect on fatal overdoses.

PART V: IMPLICATIONS OF THE FINDINGS

This evaluation has further corroborated previous research by finding a slight decrease in fatal opioid overdoses after Massachusetts' counties had opened naloxone training and distribution centers for at least one year. Given the medical benefits of naloxone to individuals experiencing an overdose, this finding was expected, so more areas should follow Massachusetts in implementing similar programs to reduce the mortality associated with opioid use. In this study, the treatment effect represents how human lives were saved, so this effect from the naloxone program provides a compelling reason to enact this policy change. However, this study was limited due to lack of data in a number of areas. For instance, future research could focus on the characteristics of individuals who receive naloxone training and medical kits, along with those who have administered naloxone in a medical emergency. Furthermore, other research could examine difference between counties that could lead to differences in the rate of individuals who have received naloxone training. These trends can lead to further insights on how to address the rising level of opioid overdoses through naloxone access programs.

Future policies should use this type of research to experiment with ways to encourage more individuals to pursue naloxone training if these individuals have a high degree of interaction with people who use and/or abuse opioid drugs. As this program evaluation indicated, increased naloxone access does lower the rate of opioid overdoses throughout a county's population, so any programs that further encourage access could possibly save even more lives. Such incentives could include education campaigns that emphasize the benefits of receiving naloxone training and administration kits. Reducing and reversing the trend of increasing opioid mortality should receive greater attention from public health experts and policymakers, and expanded naloxone access is one possible solution with proven efficacy.

APPENDIX: FIGURES AND TABLES

FIGURE 1. ANNUAL RATE OF OPIOID USE IN MASSACHUSETTS

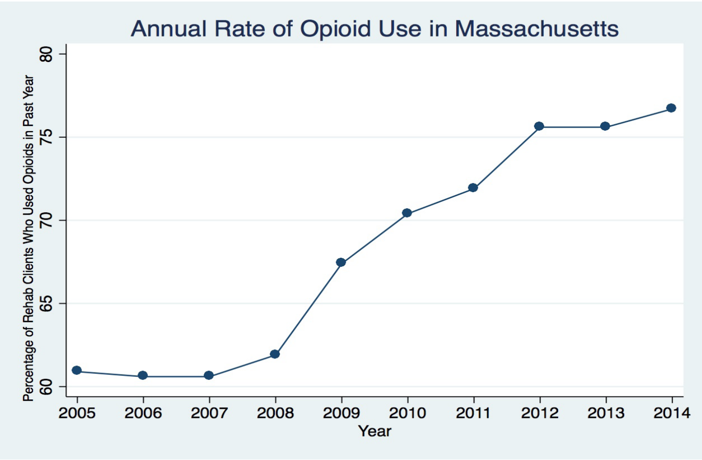

FIGURE 2. ANNUAL RATE OF FATAL OPIOID OVERDOSES FOR EACH MASSACHUSETTS COUNTY

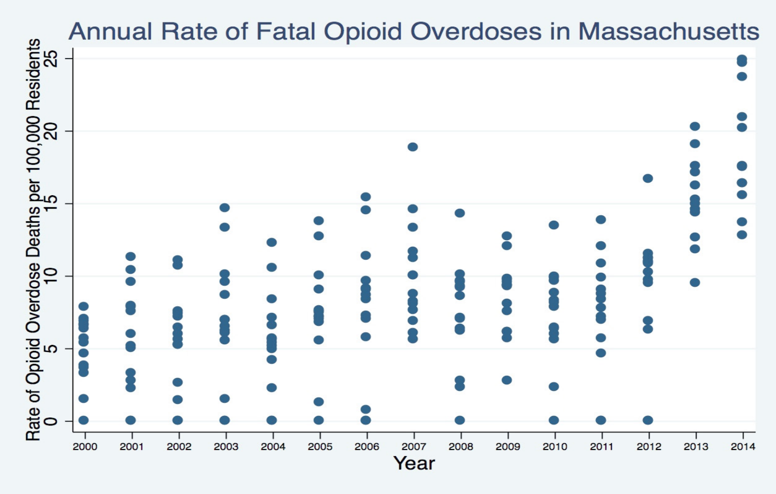

TABLE 1. DESCRIPTIVE STATISTICS FOR KEY CONTINUOUS VARIABLES FROM ALL COUNTIES

Variable	Mean	Std. Dev.	Min.	Max.
Number of Opioid Overdose Deaths	44.36	41	0	257
Rate of Opioid Overdose Deaths	8.31	4.99	0	24.9
Drug Use Indicator*	68.16	6.42	60.6	76.6
Population	464,146	394,837	9,415	1,570,315

*Drug use indicator calcuated from the percentage of clients admitted to a rehab program in Massachusetts who reported opioid use in the past year

TABLE 2. REGRESSION RESULTS PERFORMED ON LIMITED COUNTIES IN MASSACHUSETTS WITH THE RATE OF UNINTENTIONAL OPIOID OVERDOSES AS THE OUTCOME VARIABLE

Variable	Coefficient	P-Value
Program	1.2	0.359
Lagged Program *	-1.12	0.091
Population **	-0.00005	0.017
Drug Use Indicator	-4.33	0.194
HIDTA **	6.78	0.013
Barnstable **	-21.052	0.026
Berkshire **	-29.44	0.012
Bristol	-0.486	0.829
Essex	-1.41	0.213
Franklin **	-32.29	0.012
Hampden **	16.94	0.017
Hampshire **	-28.15	0.011
Plymouth **	-14.07	0.026
Suffolk	-1.69	0.299
Year 2007	0.5	0.567
Year 2008	4.56	0.27
Year 2009	29.43	0.185
Year 2010	41.8	0.198
Year 2011	49.53	0.186
Year 2012	67.24	0.175
Year 2013	72.48	0.147
Year 2014	80.88	0.131

Constant	303.98	0.136

Number of Observations = 120
Note: Counties and years not included as variables were omitted due to colinearity
* denotes significance at alpha-level of 0.10
** denotes significance at alpha-level of 0.05

TABLE 3. REGRESSION RESULTS PERFORMED ON ALL COUNTIES IN MASSACHUSETTS WITH THE NUMBER OF UNINTENTIONAL OPIOID OVERDOSES AS THE OUTCOME VARIABLE

Variable	Coefficient	P-Value
Program	2.49	0.709
Lagged Program *	-7.09	0.082
Population ***	0.0005	0.007
Use ***	3.19	0.001
HIDTA **	-325.16	0.02
Barnstable **	-84.7	0.012
Berkshire **	-58.27	0.006
Bristol **	-193.14	0.034
Dukes **	-2.65	0.018
Essex ***	33.03	0.009
Franklin ***	-32.51	0.002
Hampden **	136.87	0.027
Hampshire ***	-68.08	0.005
Middlesex ***	-311.81	0.013
Norfolk ***	-274.8	0.018
Plymouth **	130.52	0.02
Suffolk ***	49.67	0.007
Year 2006 *	6.96	0.054
Year 2007 *	6.44	0.095
Year 2008	-3.23	0.286
Year 2009 ***	-17.46	0.003
Year 2010 ***	-33.35	0.003
Year 2011 ***	-33.22	0.002
Year 2012 ***	-43	0.002
Year 2013 *	-20.38	0.051
Constant ***	-201.07	0.001

Number of Observations = 136
Note: Counties and years not included as variables were omitted due to colinearity
* denotes significance at alpha-level of 0.10
** denotes significance at alpha-level of 0.05
*** denotes significance at alpha-level of 0.01

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