Evaluation and Impact Assessment of Virginia's REVIVE! for First Responder Training Program

Center for Urban and Regional Analysis, VCU

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Evaluation and Impact Assessment of Virginia's REVIVE! Training Program

Prepared for:
Virginia Association of Chiefs of Police and Foundation (VACP)

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Prepared by:
Center for Urban and Regional Analysis (CURA)
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Acknowledgment

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The L. Douglas Wilder School of Government and Public Affairs at Virginia Commonwealth University informs public policy through cutting-edge research and community engagement while preparing students to be tomorrow's leaders. The Wilder School's Center for Public Policy conducts research, translates VCU faculty research into policy briefs for state and local leaders, and provides leadership development, education and training for state and local governments, nonprofit organizations and businesses across Virginia and beyond.

About CURA

The Center for Urban and Regional Analysis (CURA) is the economic and policy research center of the L. Douglas Wilder School of Government & Public Affairs at Virginia Commonwealth University. The Center serves stakeholders and organizations at all levels of focus, providing information systems support, program impact analysis, public policy evaluation, targeted investment models, and strategic plans to state agencies, regional and metropolitan organizations, planning districts, cities, counties and towns, as well as businesses and non-profit organizations.

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Abbreviations

AAGR	Average Annual Growth Rate
EMS	Emergency Medical Service
HRC	Harm Reduction Coalition
ITS	Interrupted Time Series
LE	Law Enforcement
OD	Overdose
PAARI	Police Assisted Addiction and Recovery
SAMHSA	Substance Abuse and Mental Health Services Administration
VACP	Virginia Association of Chiefs of Police and Foundation
(V)DBHDS	Virginia Department of Behavioral Health and Developmental Services

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Executive Summary

Opioid Overdose and Naloxone Education for Virginia program (OONE), more commonly referred to as the REVIVE! for First Responders program was implemented in 2015. REVIVE! provides training to first responders including law enforcement officers, fire fighters, and private citizens on symptoms recognition and response to opioid overdose emergencies. All trainings cover the basics of opioids, how opioid overdoses occur, the risk factors involved with an opioid overdose, and how a person should respond to an opioid overdose with Naloxone. The trainees are expected to administer Naloxone upon arrival at the scene of incidence and help reverse physical symptoms of opioid overdose instantaneously. The REVIVE! for First Responders training program was run by DBHDS from 2015 to 2019 and provided training to 14,031 first responders. The VACP has been managing the training program since March of 2020.

In preparing this report, researchers from Virginia Commonwealth University's Center for Urban and Regional Analysis (CURA) analyzed the trend in opioid overdose death over the past ten years and examined if the REVIVE! for First Responders program had any role in changing the outcome trend. The team also interviewed first responders to collect a first-person account of their experience.

Following are some of the highlights of the study:
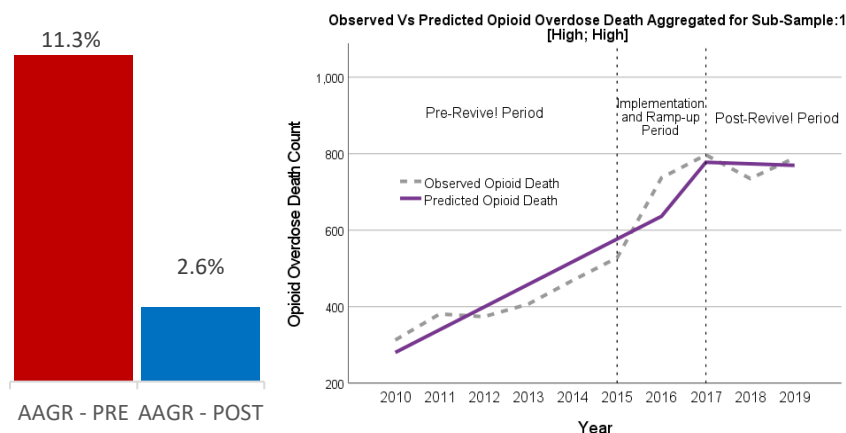
- The number of overdose deaths in Virginia has been on the rise since 2012. However, the growth rate after 2017 is considerably lower than that between 2012 and 2016.

- Localities with higher number of REVIVE! trainees have reported steeper reduction in growth rate compared to localities with fewer trainees.

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- Larger cities and counties where there are substantially more first responders trained under the REVIVE! program compared to smaller localities have reported the maximum reduction in overdose death rates.

- Localities with the lowest number of REVIVE! trainees and historically low overdose deaths show no change in death rates in pre- and post- REVIVE! timelines.

- Based on the quantitative findings, we reject the null hypothesis, and conclude that the training program has had some impact on reducing overdose related death rate in Virginia. However, the post- REVIVE! time period is only 3-years long and it is also possible that this recent trend is just a random phenomenon. Although the current trend is encouraging and substantiates the effectiveness of the REVIVE! for First Responders program, the analysis of program outcomes after a sufficiently longer (5 years or more) timeline will provide more accurate picture.

- While many participants took the training voluntarily and for some it was a mandatory part of their job, all reported that they were happy to have the opportunity and were willing to participate.

- Some participants felt that the training should be offered to a greater number of people, perhaps as part of police academy training.

- Participants suggested expanding the training to other groups such as tow truck drivers and those working at funeral homes who could help save lives.

- Continuing the existing virtual training option, even after the COVID-19 crisis has ended, in order to expand the program's reach and make it more attractive to people around the Commonwealth.

- The following are some first person accounts that summarize the importance and effectiveness of the program:

> "Absolutely [I would recommend the REVIVE! program to others].
> Every police department in the Commonwealth should have a Narcan
> program"

> "It is a source of great pride for our department. It's been a very
> successful program for our department and so again we hope that it will
> be continued because it does make a difference, absolutely."

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Introduction

More than 750,000 Americans died from a drug overdose from 1999 to 2018[1]. Drug overdoses have become the leading cause of "injury" death in America (Lott & Rhodes, 2016). The opioid epidemic has hit the entire country, with Virginia being no exception. In 2017, there were 1,230 deaths from opioid overdoses; in 2018 1,215; and in 2019, a predicted 1,280 deaths (Virginia Department of Health and Human Services, 2019). Opioid-involved death in Virginia rose from six per 100,000 people in 2010 to 14.3 in 2018[2].

At the peak of the opioid epidemic, Governor McAuliffe of Virginia signed an executive order in 2014 establishing the Governor's Task Force on opioid abuse and assigned to recommend immediate steps to address the growing epidemic of opioid abuse and overdose related deaths. The task force recommended a comprehensive harm reduction strategy by expanding access to Naloxone to lay rescuers and law enforcement officers, and increased access to Naloxone by making the prescription process easier.

In 2015, the Opioid Overdose and Naloxone Education for Virginia program (OONE), more commonly referred to as REVIVE! for First Responders program was implemented. REVIVE! provides training to first responders including law enforcement officers, firefighters, and private citizens on symptoms recognition and response to opioid overdose emergencies. REVIVE! offers two levels of training- REVIVE! Basic Training for First Responders, and REVIVE! Train the Trainer for First Responders. All trainings cover the basics of opioids, how opioid overdoses occur, the risk factors involved with an opioid overdose, and how a person should respond to an opioid overdose with Naloxone. The expectation on effectiveness of the REVIVE! for First Responders training program sits on the fact that Naloxone can reverse physical symptoms due to opioid overdose almost instantaneously , and the probability of preventing a death increases substantially if the drug is administered early.

The Center for Urban and Regional Analysis at Virginia Commonwealth University was approached by Virginia Association of Chiefs of Police and Foundation (VACP)[3] - the organization that manages the REVIVE! for First Responders training program - to evaluate the effectiveness of the training program in reducing overdose related deaths in Virginia.

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[1] Center or Disease Control and Prevention, 2020

[2] NIDA. 2020, April 3. Virginia: Opioid-Involved Deaths and Related Harms. Retrieved from https://www.drugabuse.gov/drug-topics/opioids/opioid-summaries-by-state/virginia-opioid-involved-deaths-related-harms on 2020, September 24

[3] VACP is also the sponsor of this study.

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Background and Literature

There is a two-front battle when it comes to fighting the opioid epidemic: prevention of addiction and response. The response side of the opioid crisis focuses on harm reduction, which includes needle exchange programs, addiction help services, and overdose prevention. This report focuses on harm reduction, more specifically, on the outcome of REVIVE! for First Responders program that strives to save lives through quick and effective administration of live saving drug Naloxone to the victims of opioid overdose.

Over the last 7 years there has been a large increase in the number of community organizations and programs focusing on a mixture of overdose prevention and addiction help services. Overdose prevention and reversal can be done with the administration of Naloxone. Naloxone binds to the opioid receptors and blocks the effect of the opioids allowing for the user to recover; more specifically, it reverses respiratory depression from opioid use. The growing questions among policy makers include 1) do these programs work and 2) what are the best practices going forward?

In 2014, the Harm Reduction Coalition (HRC) surveyed 140 organizations in the United States who provide Naloxone kits, with 136 managers from the organization responding (Wheeler, Jones, Gilbert, & Davidson, 2015). The organizations were asked to answer how many Naloxone kits were distributed, reversals completed by laypersons, type of drug administered, and other training program information. The survey found that between 1996 and June 2014, 152,283 kits were given out and there were 26,463 overdose reversals (Wheeler, Jones, Gilbert, & Davidson, 2015).

There has been a large push from states and local governments to combat the opioid epidemic; of the 140 HRC survey respondents, half of the organizations began operation in 2013-2014 (Wheeler, Jones, Gilbert, & Davidson, 2015). Opioid prevention programs are carried out by a myriad of organizations including community based, health care facilities, veteran affairs organizations, state or local health departments, police departments, and other EMS organizations. Many other organizations have implemented programs similar to the REVIVE! for First Responders program, and are working to educate laypersons and first responders on opioid use and the administering of Naloxone.

The group Police Assisted Addiction & Recovery (PAARI), who specialize in setting up pre-arrest addiction and recovery programs, found that these programs were highly successful. Success was measured in three parameters: number of addicted persons seeking treatment, reduction in crime in the associated program area, and doses of Naloxone administered. In 2015-2016, 160 programs were studied, and it was found that there was a 25% reduction of crime associated with addiction, thousands of people sought out treatment after officer intervention, and over 5000 doses of Naloxone were administered (Police Assisted Addiction Recovery Initiative, 2016) . In another study done in 2010, it was reported that the 200 community-based prevention programs reversed over 10,000 overdoes. A deeper look into programs in Massachusetts suggests that communities with Naloxone access programs saw a lower opioid death rate (Wheeler, Jones, Gilbert, & Davidson, 2015). In a review of 3 Massachusetts localities, researchers reviewed the effectiveness of EMS, police, and firefighter administration

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of Naloxone with all three resulting in hundreds of overdose reversals (Davis, Ruiz, Glynn, Picarello, & Walley, 2014).

The literature suggests that getting Naloxone in the hands of more people lead to increased recoveries from overdoes and a decrease in deaths. There has not been many studies comparing the effectiveness of community administered Naloxone versus EMS, first responder, or police administration of Naloxone. A meta-analysis on 5 studies showed that trained participants had better overdose recognition and overdose response (Giglio, Guohua, & Dimaggio, 2015). The idea of community involved Naloxone administration and education program is fairly recent, and there are not much literature out there focused on best practice methods of implementation of such programs.

Objective of This Study

The REVIVE! First Responder Training program managed by VACP and VDBHDS under the federal grant funding from Substance Abuse and Mental Health Services Administration (SAMHSA) has two major components:

1. Provide basic and advanced training to the first responders and enable them to effectively administer Naloxone when they respond to overdose incidences, and
2. Facilitate the distribution of Naloxone spray and support supplies for use in reviving opioid overdose victims.

The program expects that by providing essential training and material support, the first responders are able to administer Naloxone to opioid overdose victims at the location of the incidence even before any medical support arrives at the scene, potentially saving the victims' lives. This study seeks to evaluate the effectiveness of the REVIVE! for First Responder program in saving lives of opioid overdose victims as a justification to the efficient use of SAMHSA federal funds that support the program.

Research Question

The REVIVE! for First Responders program is specifically focused on saving the lives of opioid overdose victims, and its foundation rests on the premise that the first responders, specifically law enforcement officers and firefighters, are typically the first ones to receive information about an overdose incidence and arrive at the location before the emergency medical team. Early administration of Naloxone and revival of the victims very likely decreases the probability of overdose related deaths. Many first responders and corrections officers free Naloxone from various sources and it is difficult to track which ones saved lives and which ones did not. Therefore, the study looks more into the overarching outcome – i.e. aggregate lives saved, rather than evaluating individual cases. The study focuses on following primary research question:

Has there been a significant increase in lives saved (or overdose deaths reduced) after rollout of the REVIVE! Program that provides training to first responders to administer Naloxone drug to the victims of opioid overdose?

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Research Methodology, Data Sources, and Limitations

This study uses mixed – quantitative and qualitative – approach to evaluate the impact of the REVIVE! for First Responders training program. Quantitative evaluation is conducted in four stages – data preparation, identification of program timeline, comparison of Average Annual Growth Rate (AAGR), and evaluation of Interrupted Time Series (ITS) model. A brief description of the methods adopted for each of these steps is described below.

About the Data

The total number of first responders trained through the REVIVE! program is the input variable for the study. DBHDS provided us the training data from 2015 through 2020 (data after March 2020 has been provided by the VACP). The data included information on the type of the training – e.g. Rescuer, Trainer, Master Trainer, etc., training date, trainer name, trainee name, name of the organization where the trainee works, and geographic location of the trainee. DBHDS database specifies the location of the organization where the trainee belongs to, and this location has been assumed to be the primary service location of the trainee and matched with the geographic identifiers accordingly.

We also noted that DBHDS had improved upon the record keeping format by disaggregating trainees by disciplines (e.g. Law Enforcement, Fire, and Corrections) and by type of training received. The VACP made further improvements since that time by simplifying the registration data collected and collecting evaluation data in an electronic format. The CURA team merged the different datasets provided by DBHDS and VACP and removed duplicate entries to prepare a clean dataset that has unique person-event information. During the cleaning process, special consideration was given to the individuals coming for a refresher training or those registering into multiple training categories. A new field combining individual IDs and the date of training was created and multiple entries for the same combination of person, date, training type, and training location were removed.

In developing the timeline, we looked into the program output by all Virginia counties. Although the program officially started in 2015, all counties and their emergency departments could not possibly get their personnel trained at the same time. Some counties participated in the program earlier than others did. Hence, the timeline for each of them is different. In aggregate, there seems to be sharp increase in the number of trainees in the year 2017 followed by a plateau in 2018. While analyzing aggregate data, we considered 2015-2016 as ramp-up period, 2017 as the intervention year, and 2017, 2018, and 2019 as post-intervention period. For cross-sectional comparison (between counties and cities), the timeline for each locality is determined based on when they had a sizeable number of first responders trained.

Another input variable used in this study is the total number of Naloxone administered by the REVIVE! Trainees based on the information provided by the Virginia Department of Health (VDH). An important limitation of this data is its timeline. According to the data, the provision of Naloxone to first responders graduating from the REVIVE! program started on October 2019, and although the available data runs through nine months until June 2020, the timeline is too short to significantly overlap with the timeline in the training data and that in the outcome data. Hence, this information has been presented in the report for descriptive purposes and not

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included in any of the statistical models. Besides, free Naloxone provided by many other sources are not accounted for in the data available to us. Hence, we are focused on the overall impact due to the training and readiness of the first responders than from where the Naloxone was sourced.

Death due to drug overdose is our output variable. We obtained the data from the Virginia Department of Health's Office of the Chief Medical Examiner which prepares and maintains a public repository of opioid related death database for the Commonwealth [4]. The data runs from 2007 to 2019 and is disaggregated by Virginia localities.

Average Annual Growth Rate (AAGR)

This study uses average annual rate of change in death due to opioid overdose as a preliminary measure for comparing between the pre- and post- REVIVE! timelines. The pre- REVIVE! timeline runs from 2010 to 2016 and post- REVIVE! timeline runs from 2017 to 2019. We first calculated year-to-year percentage change in the number of overdose death and then calculated average of the growth rate for the entire timeline. The AAGR method used here can be summarized by the following equation:

$$AAGR = \frac{GR_{[2,1]} + GR_{[3,2]} + GR_{[4,3]} + \cdots + GR_{[t,t-1]}}{N}$$

Where, *GR* is the rate of change in the aggregate number of overdose death for each individual year compared to the previous year, and N is the total number of years in pre- or post- REVIVE! time period.

Interrupted Time Series (ITS) Analysis

For comparing between the opioid death trends before and after the REVIVE! for First Responders program (the intervention), we analyzed Interrupted Time Series (ITS) regression models, compared the coefficients (slopes) for the variables representing pre- and post- timelines, and calculated predicted values for outcome variable – total number of death due to opioid related overdose – over a 10 year time period that has been interrupted by the intervention. We compared pre-intervention trend with post-intervention trend in the outcome variable and measured statistical significance of the difference. Following is the mathematical representation of the ITS model used for the evaluation:

$$Y_t = \beta_0 + \beta_1 T_1 + \beta_i T_i + \beta_3 T_2 + e_1,$$

Where,
Y_t is the outcome variable – number of deaths due to opioid overdose
T_1 is the numerical representation (1~10) of time from 2010 to 2019 increasing one unit every year
T_i is a dummy variable coded "0" for years prior to the intervention (REVIVE! program) and "1" for years after.

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[4] https://www.vdh.virginia.gov/medical-examiner/forensic-epidemiology/

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T_2 is the time since the intervention took place increasing 1 unit every year while all years before intervention are coded as "0"

β_1 represents the slope of the trend line before the intervention and β_3 represents the slope after intervention. We evaluated the model significance using r-squared and model p-value, and the statistical significance of the β coefficients using t-statistic and corresponding p-values. We compared the predicted values of the outcome variable calculated using model coefficients with observed values and represented the differences in predicted trends in graphic format. Our null hypothesis states that the growth trend of death due to opioid overdose is lower in the post-REVIVE! timeline, and ideally the β coefficients of T_2 are numerically smaller than that of T_1.

First-Person Interviews

To learn how REVIVE! participants perceived the trainings, we included a qualitative component to our analysis featuring first-person interviews with those who had previously taken the training. Individuals were invited to participate in an interview via two emails sent by the VACP. Nine participants responded and were subsequently interviewed for this study. Of these, five were master trainers and one was looking to begin the process of becoming a master trainer. Participants represented nine localities from across the state:

- Culpepper County
- The City of Emporia
- The City of Fairfax
- Franklin County
- The City of Norfolk
- Warren County
- Westmoreland County
- The City of Williamsburg
- Wise County

Interviews were conducted in June 2020 via telephone, and all interviews were recorded with permission from the participant and later transcribed. The transcribed interviews were then analyzed using qualitative content analysis, identifying common themes that arose. This information was then used to draw conclusions regarding perceptions of and recommendations for the REVIVE! program.

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REVIVE! Training and Opioid Overdose Trends in Virginia

REVIVE! Training Statewide Trend

The REVIVE! for First Responders training program was started by VDBHDS in August of 2015 under grant support by SAMHSA. The program had a slow start in the beginning with only 47 First Responders trained from August through December of 2015. The numbers jumped by 22% in 2016 to 1,067, and by the end of 2017, there were already 1,967 trainings completed statewide, which is equivalent to 93% increase since the previous year. After the initial ramp-up period, the number of trainings picked up very rapidly in 2018 with 6,527 trainings completed by the end of the year (equivalent to an increase by 232%). There were 4,470 trainings completed in 2019 bringing the cumulative total to 14,031. The management of the training program was overseen by the VACP since March of 2020, and at the time of the preparation of this report, 335 trainings were already complete during the first quarter of 2020. Due to the pandemic caused by COVID-19, the VACP paused in-person trainings after April of 2020. Due to possible discrepancy in the trend in the data during early 2020, this study only uses data from 2015 through 2019 for the quantitative analysis. Figure- 1 presents a graphical representation of the statewide trend of REVIVE! Training during the study period.

Figure -1: Annual and Cumulative Number of First Responders Trained under REVIVE! Program
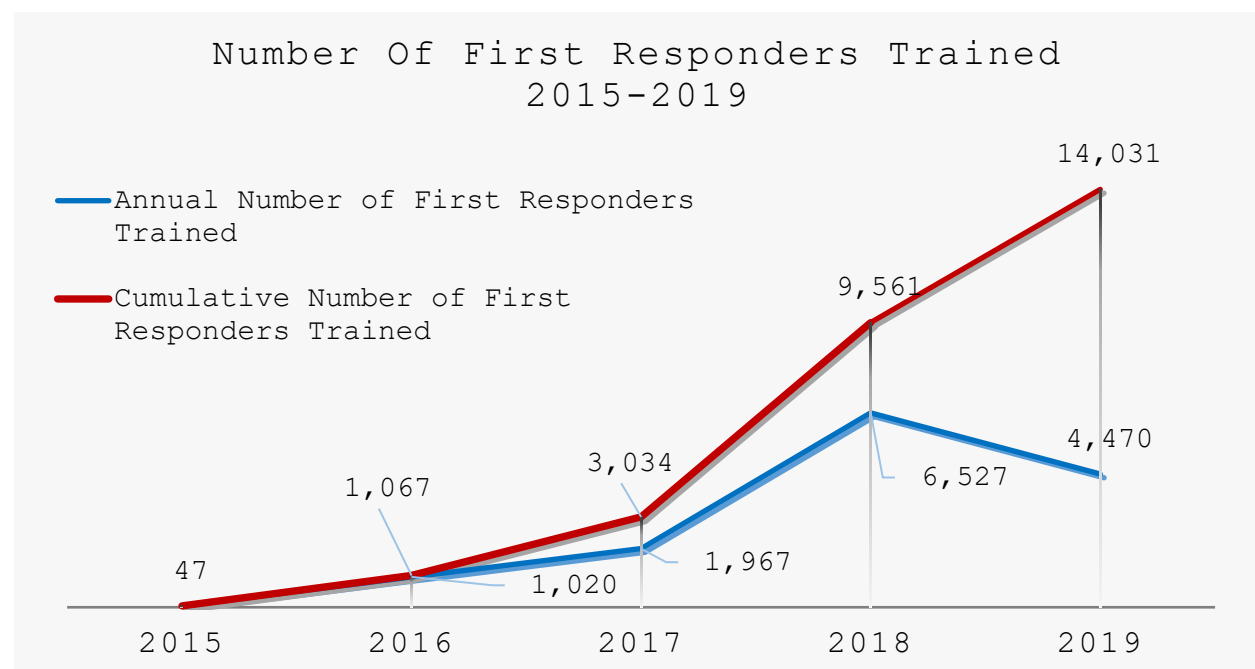
REVIVE! Trainee Demographics

Besides the information on training date, location, name and organizational affiliation of the trainee, all the other demographic characteristics such as race, gender, age, etc. were voluntarily provided by the trainees. Figure – 2.a presents a snapshot of the demographic characteristics based on the information voluntarily provided by 5,630 REVIVE! Trainees.

Figure-2.a: Demographic Characteristics of REVIVE! Trainees
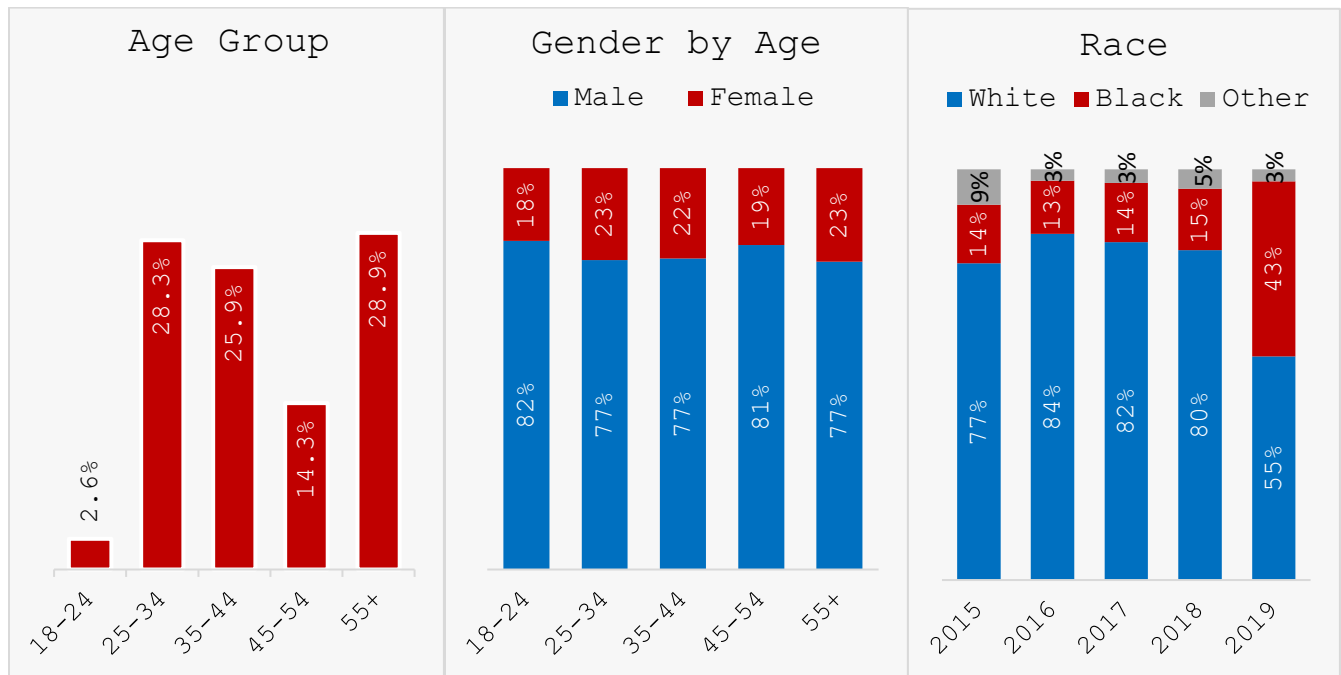
A majority of the trainee population (about 57%) was 44 years or younger, and trainees aged 55 and above made almost about 30% of the total trainee population. The gender distribution for the trainees was 78% male and 22% female and this ratio was roughly consistent throughout the different age groups. A large majority of the sample (77%) were white. Black trainees made up a little under 19% of the sample. Although females only comprised of about 22% of trainees, African American females and mixed race females respectively made up 40% and 32% of all the female trainees. The racial and gender diversity among the trainees have been improving in the recent years. In 2019, about 43% of the trainees were Black, and among them 53% were female.

In terms of trainee professional background, the VACP had maintained information on three sub-categories - Corrections & Security, Law Enforcement, and Lay person/First Responder/ Government Employee. The third category grouped everyone else that could not be assigned

Figure-2.b: Trainee Background by Age
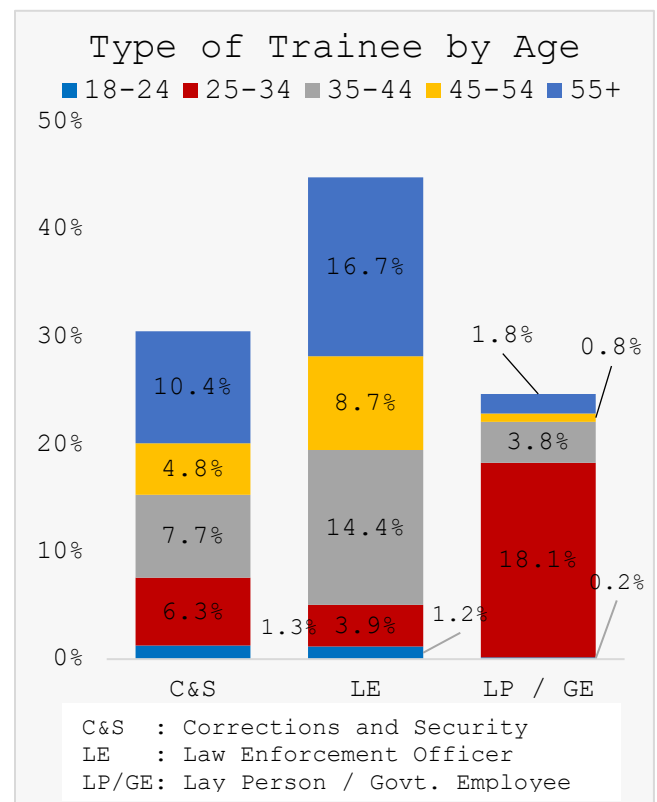
to the other two groups. As presented in Figure-2.b, about 45% of the trainees came from law enforcement professions, 30% were staff personnel from correctional institutions, and 25% were first responders from other agencies.

Opioid Overdose Death Trend in Virginia

According to a recent report published by Virginia Department of Health, opioid overdose has been the leading cause of unnatural death in Virginia since 2013.[5] Figure – 3.a presents the number of opioid overdose related death from 2007 to 2019, and Figure – 3.b presents the 3-year moving average of growth rate with reference to the year 2007. Opioid overdose deaths had been slowly rising from 2007 to 2012 with an average growth rate of 3% during that period. The number of opioid death increased rapidly from 2012 to 2015 with an average rate of 8%. The number of death spiked in 2016 with 40% increase compared to the previous year and has since been maintained at an average growth rate of 5%.

Figure-3.a: Annual Number of Recorded Death due to Opioid Overdose in Virginia (2007-2019)
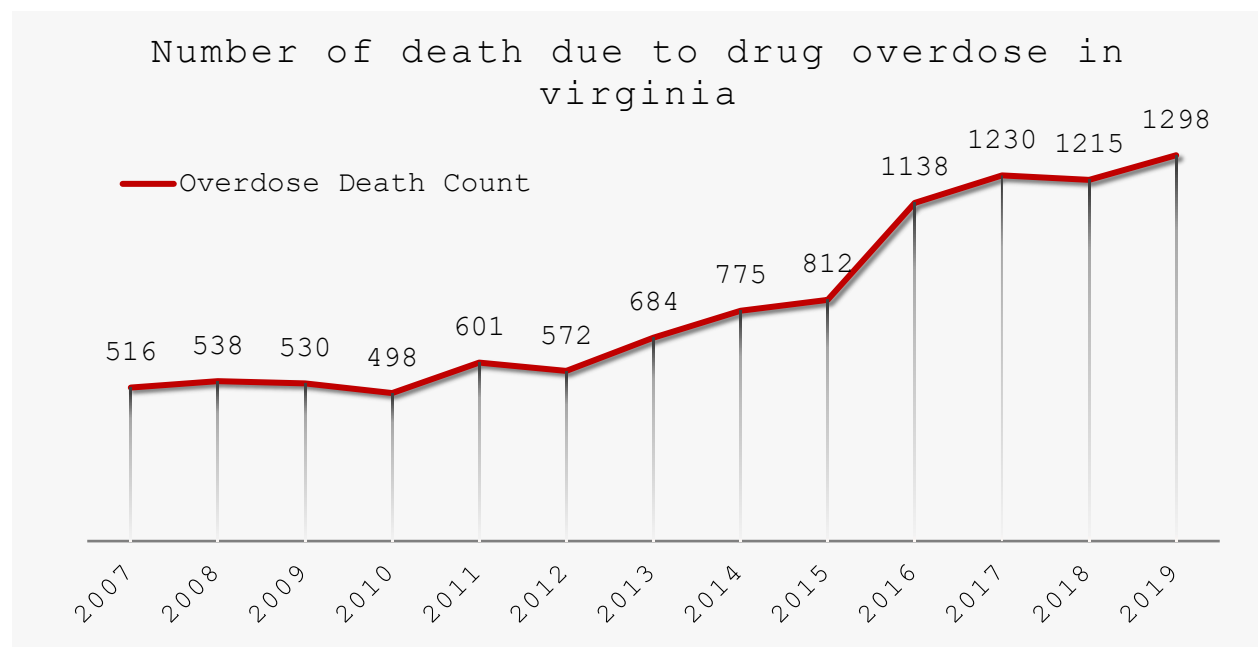
Data Source: VDH Office of Medical Examiner

Comparing year-to-year numbers can be deceptive since the numbers can vary for no apparent reason and that can reflect on the percentage change when measured in that unit. It is more useful to look at a relatively longer length of time. The trend chart above can be clearly broken into three periods- one from 2007 to 2012 when the overdose death almost followed a flat line, then from 2012 to 2016 when the death numbers picked an upward trend, and from 2016 to 2019 when the trend slumped again and followed a less aggressive growth. In an attempt to remove the impact of year-to-year variation, we calculated three-year average growth rate with the base value set at year 2007. Figure 3.b presents the three-year moving average curve which shows that the overdose death followed a mild downward trend between 2007 and 2009, and since then the

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three-year average grew consistently until 2017 after which the average death rate started to slump a little. The post-2017 growth rate (about 7% per year) is very similar to 2011-2014 average growth rate of 8.5% per year. The moving average methods tells us that the overdose death rate broke away from its long upward trend in 2017 and started following a less aggressive slope. It is certain that the growth rate slumped in 2017 after almost 10 years of consistent increase, however, due to the short time frame after the slowdown, it cannot be definitely concluded if this trend will follow in the same pattern in the coming years. This could very well be a random blip in the trend.

Figure-3.b: Annual Percentage Change in Overdose Death and 3-year Moving Average
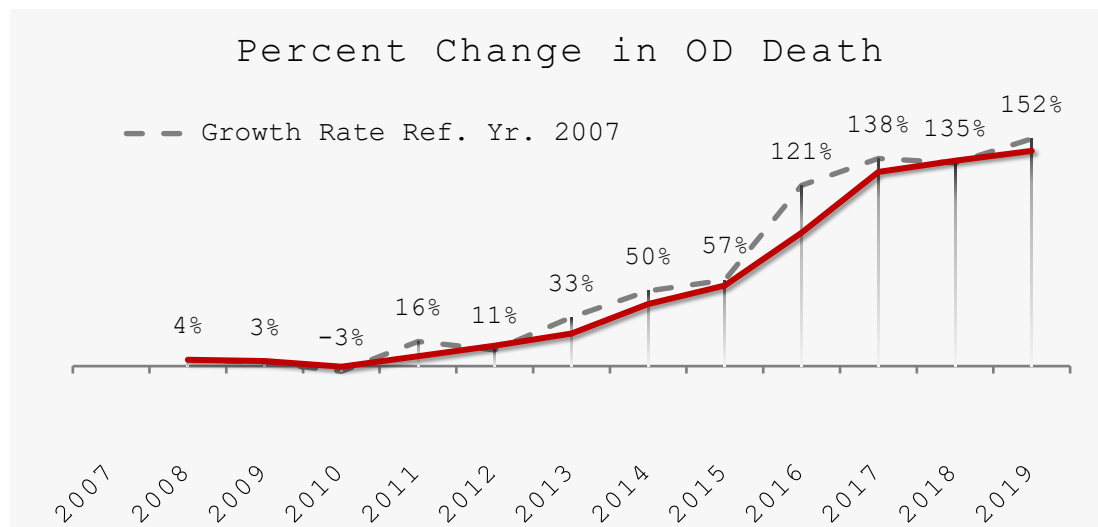
Geographic Distribution of Overdose Deaths and REVIVE! Trainees

In general, overdose death counts are higher in localities with larger population. However, this correlation is not always consistent. Urban localities such as Fairfax County, Richmond City, Chesterfield County, Virginia Beach City, Norfolk City, Prince William County, have the higher share of overdose death. These seven localities together account for 36% of all overdose death in the Commonwealth within the last decade. However, rural localities such as Lee County, Wise County, Dickenson County, Buchanan County, Tazewell County, Russell County, Wythe County, Pulaski County, Culpeper County, and Orange County have higher overdose death compared to their population. Figure-4.a presents the aggregated and standardized count of overdose death in the Commonwealth.

Figure-4.a: Overdose Death by Virginia Localities
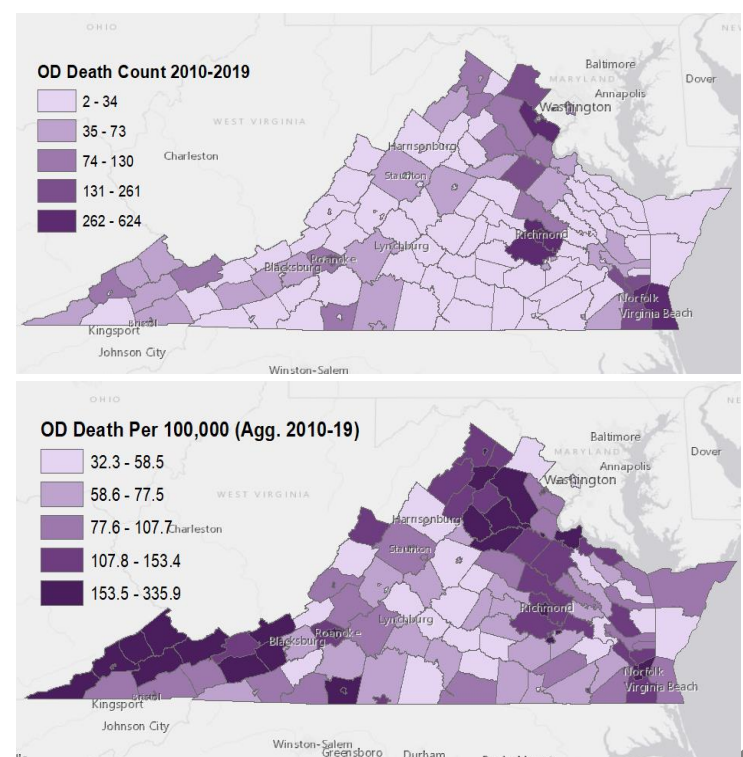
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Similarly, Figure-4.b represents geographic distribution of REVIVE! trainees in the Commonwealth. As mentioned earlier, this aggregation only includes trainees who had geolocation information such as work address or organizational affiliation on file.

In terms of raw numbers, Chesterfield County has the highest number of REVIVE! trained first responders, followed by Fairfax County, Newport News City, Richmond City, Norfolk City, and Chesapeake City. Wise County and Augusta County, although rural in nature, report very high numbers of REVIVE! trainees. More than half of these trainees report their organizational affiliation with Red Onion State Prison in Wise County, and Central Shenandoah Criminal Justice Training Academy in Augusta County. It is unclear if the trainees in the academy worked in the same county or moved somewhere else after graduating.

Figure-4.b: Map showing REVIVE! Trainees by VA Localities

Counties that have relatively smaller population and more or less rural in characteristics such as Sussex County, Bland County, Grayson County, Goochland County, Northampton County, Wythe County report relatively higher number of REVIVE! trainee per 100,000 people. Co-location of State Prisons and correctional centers have also played important role in increase the count per capita in these Counties.

Comparing between Figures 4.a and 4.b, many localities that have reported higher overdose death rates have trained more first responders to administer Naloxone. However, there is also mismatch in some localities where there are more REVIVE! trainees compared to the number of overdose death and vice versa.

Trend in Naloxone Dispensing and Administration

Starting in October of 2019, the Virginia Department of Health started dispensing Naloxone to the first responders who graduated from REVIVE! program. Figure-5 presents the monthly and cumulative numbers of Naloxone distributed to first responders or their affiliate agencies. On average, about 560 Naloxone were dispensed every month, and over the last nine months a total of 5,069 doses have already been distributed to the first responders.

The second chart displays the cumulative and monthly number of times Naloxone that have been administered to a person experiencing an overdose. Over the same nine month period a total of 97 Naloxone were administered. Out of 97 administered, 10 victims were reported to have shown no response to the drug. This amounts to a failure rate of 10%. However, the sample is too small to make any judgment yet.

Figure-5: Number of Naloxone Dispensed and Administered
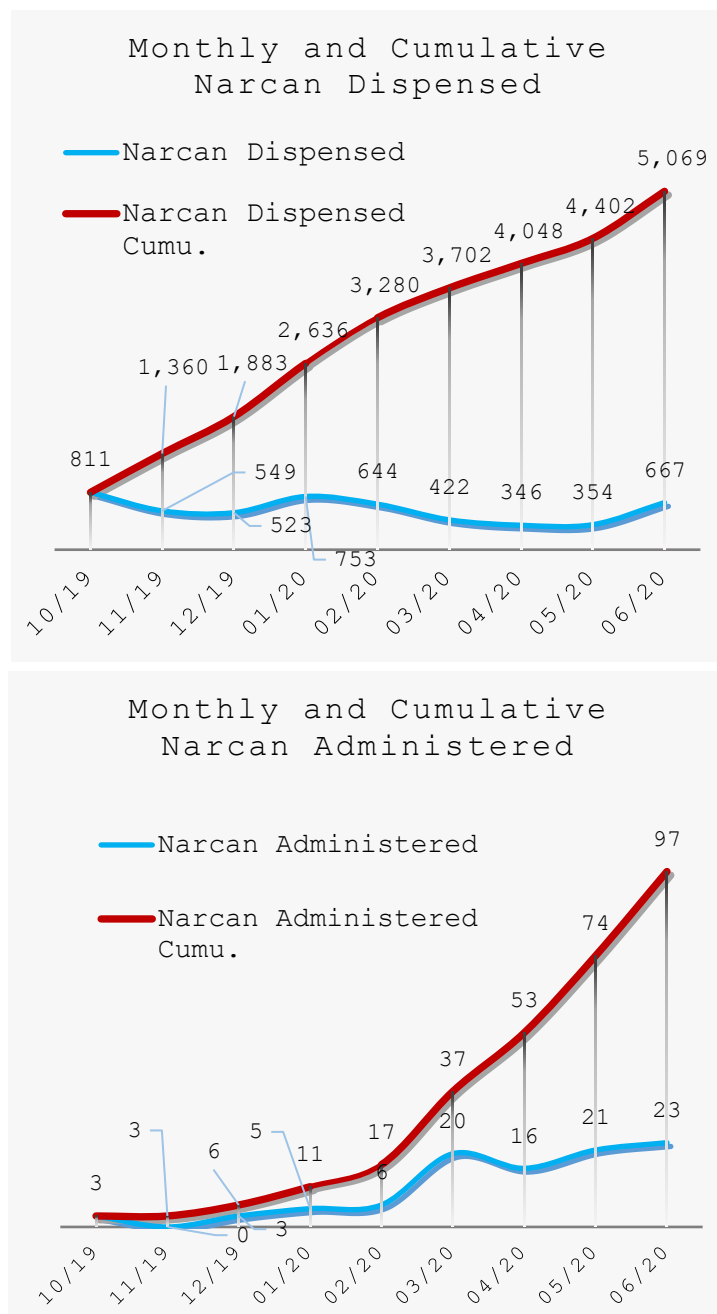
Data Sampling and Methods

We compared all 132 localities[6] in Virginia to better understand trends in REVIVE! Training and overdose related deaths. Localities with higher populations generally have higher aggregate number of overdose deaths, and also higher number of professionals trained to administer Naloxone, but this generalization is not always true. For example, Fairfax County ranks top in total population and the number of total overdose related deaths (624), but it ranks third in total number of first responders trained (474) under the REVIVE! program. Similarly, Chesterfield County ranks the highest in total number of REVIVE! trainees (655) whereas it ranks 5th in total number of overdose deaths (372). When normalized by population, Dickenson County has the highest number of overdose death per 10,000 population (34), whereas it ranks 26th in terms of number of REVIVE! trainee per 10,000 people (38). In similar comparison, Sussex County has the highest number of REVIVE! trainees per 10,000 people (245), yet one of the lowest overdose death per 10,000 people (10). As the statewide sample is too heterogeneous in terms of population size, training metrics, and number of overdose related deaths, even the standardized comparison using normalization by population results into biased results. We decided to run the analysis for the entire state and then compare the results with five sub-samples grouping localities based on population, number of trainees, and overdose related deaths.

Figure-6 presents an x-y plot showing the number of REVIVE! Trainees and the number of overdose related deaths for each county transformed into a common logarithmic scale for comparison. The plot is divided by a horizontal line representing the median value of number of deaths (log transformed), and a vertical line representing the median value of the number of REVIVE! trainees (log transformed), resulting into four quadrants. The four quadrants represent grouping of localities based on number of trainees and number of overdose related deaths.

Localities such as Surry County, bath County, Emporia City, Dinwiddie County, Rockingham County, Westmoreland County, etc. are categorized as having low number of overdose deaths and low number of REVIVE! trainees (also called as low-low category). On the opposite spectrum, localities such as Fairfax County, Richmond City, Chesterfield County, Norfolk City, Henrico County, Virginia Beach City, Prince William County, Newport News City, Loudoun County, Hampton City, etc. are categorized as having high number of REVIVE! trainees and high number of overdose related deaths (or high-high category). Similarly, localities with high number of overdose deaths, yet having small number of REVIVE! trainees such as Portsmouth City, Frederick County, Culpeper City, Arlington City, Fauquier County, etc. are grouped under low-high category. Similarly, localities with low overdose deaths yet high number of REVIVE! trainees such as Powhatan County, Northampton County, Bland County, Grayson County, Sussex County, Goochland County, etc. are classified under high-low category.

Out of the 14,031 total cases in the original REVIVE! dataset, only 12,599 had valid location information and hence this is the sample used for the remainder of the quantitative analysis. Further, we created sub-samples based on these four categories and based on population of the localities. Breaking up the statewide sample into five different sub-samples helped us understand the nuances in the data that would otherwise be dwarfed by the noise in the statewide aggregated master sample.

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[6] Virginia has 133 localities (Counties and Independent city) in total. We aggregated Fairfax City's data with Fairfax County's due to the Fairfax County's significantly numbers.

Figure-6: X-Y plot showing the grouping of Virginia localities by number of REVIVE! Trainees and number of overdose deaths (Log)

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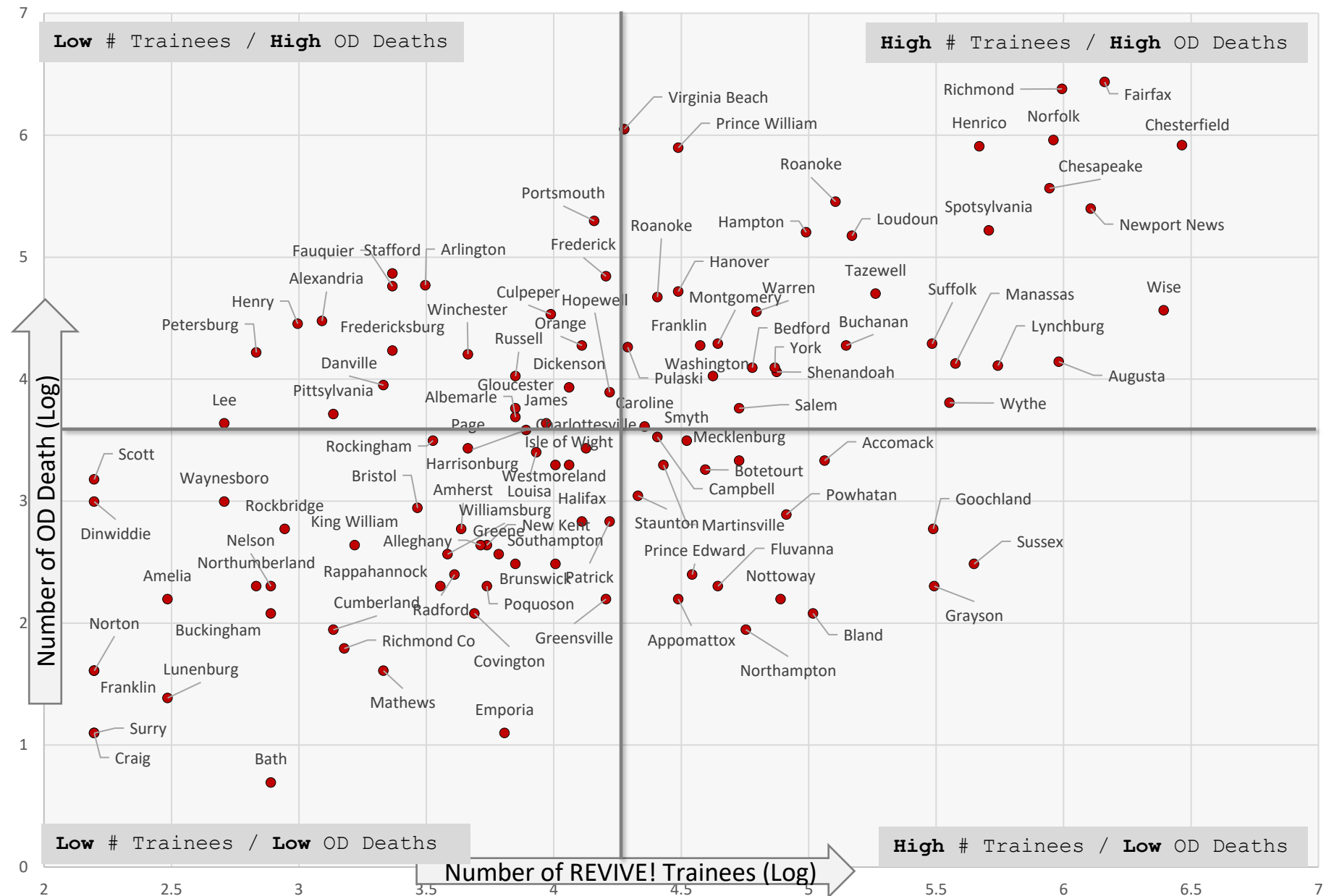
Time Series Analysis of Aggregated Locality Data
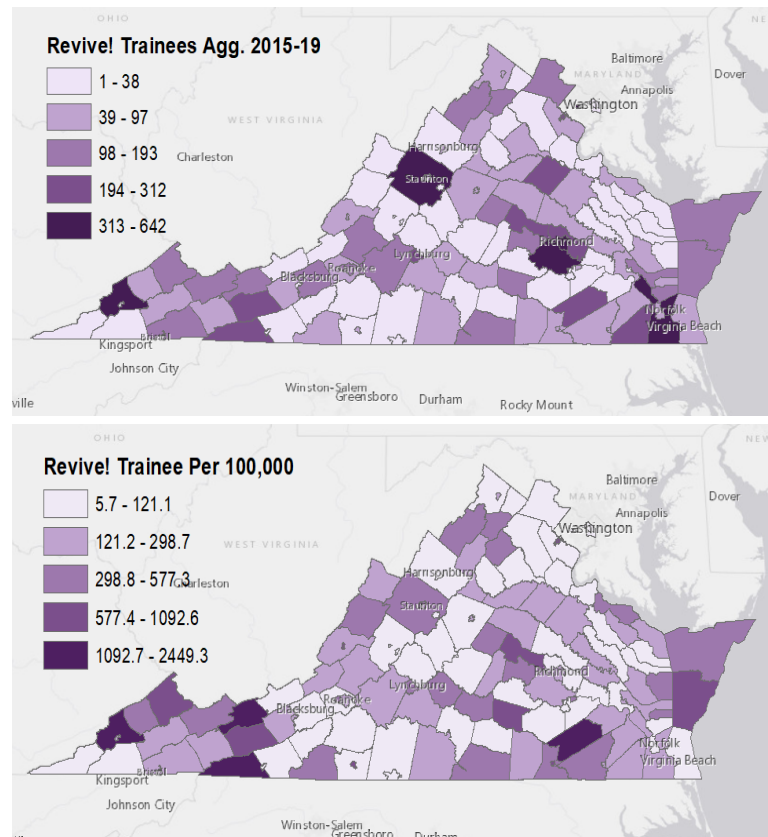
This section focuses on studying the statistically significant differences in overdose death and in the time periods pre- and post- REVIVE! The timeline selected for analyzing the overdose deaths runs from 2010 to 2019. Although the REVIVE! intervention started in 2015, we noticed that the program had not gained traction until the end of 2016. By 2017, the program had trained first responders in almost all localities in the Commonwealth. Hence, for comparing between the pre- and post- timelines, we have considered 2017 as the effective intervention year and hence the expected point of inflection on the overdose death trend.

We then calculated year-to-year rate of change for all years prior and after the intervention year. We then proceed to compare the average annual growth rate (AAGR) aggregated for three years before and three years after the REVIVE! intervention. Next, we aggregated the overdose death data by localities for each year and the resulting time-series data frame was used to develop the interrupted time series (ITS) models as described in the methodology section above. The objective of the modeling exercise is to make sure that the data trend shows measurable correlation with time (years) and that the rate of change (or slope of the regression line) is significantly different in the pre- and post- REVIVE! timelines. We ran the ITS model for the entire statewide aggregated sample of data and also for the five sub-sample discussed in the previous section. We expect that if REVIVE! Program has had no impact on the rate of change in opioid overdose deaths, then we would see no difference in the pre- and post- AAGR and the slope or regression coefficient between the pre- and post- REVIVE! timelines. In other words, the death rate in the post- REVIVE! Period should be consistent with that in the pre- REVIVE! period. So, for the entire dataset, our null and alternative hypotheses are as follows:

Null hypothesis (H_0): The rate of change in death due to opioid overdose is consistent in pre- and post- REVIVE! Timelines.

Alternative hypothesis (H_1): The rate of change in death due to opioid overdose is lower in post- REVIVE! Timeline.

In other words, if the REVIVE! program had no impact on the number of deaths due to opioid overdose, then the average annual growth rate (AAGR) before 2017 should be comparable to the AAGR after 2017. Likewise, the beta coefficient (slope of the regression line) for the variable representing the pre- REVIVE! timeline should be equal to the coefficient representing post- REVIVE! timeline. However, if a statistically significant reduction in overdose related death rate was observed between pre- and post- REVIVE! time periods, then the null hypothesis is rejected which would suggest that the change is death rate is consistent with the implementation of the REVIVE! program. However, this does not suggest a causal relationship between the two phenomena as there could be other confounding parameters that could have impact on the outcome variable that is not included in the modeling process. The effect of other parameters has been explored through qualitative methods and is discussed later in the report. Figure-6.a presents the output from interrupted time series (ITS) models, and Figure-6.b presents the curves representing observed and predicted trends in pre- and post- REVIVE! time periods.

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Figure-7.a: Summary of AAGR Comparison and Interrupted Time Series (ITS) Models

Sample	Sample-1	Sample-2	Sample-3	Sample-4	Sample-5	Sample-6
Sample membership	All Counties	High-High	High-Low	Low-High	Low-Low	Population more than 100,000
Average Annual Growth Rate (AAGR) comparison between Pre-REVIVE! and Post- REVIVE! Overdose Deaths						
AAGR of opioid related death: Pre- and Post-REVIVE! ■ Pre-REVIVE! ■ Post-REVIVE!	Pre 10.8%, Post 3.3%	Pre 11.3%, Post 2.6%	Pre 8.8%, Post 3.6%	Pre 21%, Post 6%	Pre 10%, Post 12%	Pre 20%, Post 2%
Results of Interrupted Time Series (ITS) Analysis						
Intercept	362.14***	221.14**	18.28*	57.85*	46.85***	95.57
Timeline	90.89*** (.89)	59.32*** (.93)	2.78 (.73)	21.46** (1.11)	5.39* (.67)	68*** (1.04)
Intervention (Dummy)	579.52 (.91)	588.52 (.1.48)	-26.28 (-1.1)	109.97* (.91)	-30.35 (-.60)	505.26 (1.23)
Post- Timeline	-56.89 (-.81)	-63.32 (-1.44)	3.21 (1.22)	-14.96 (-1.12)	5.17 (.91)	-59.5 (-1.31)
R-Squared	.949	.930	.729	.894	.906	.938
Adjusted R-Squared	.924	.895	.593	.841	.859	.907
Standard error	84.56	62.15	7.33	23.22	9.13	60.25
N (Localities Aggregated)	132	32	18	22	60	17

Dependent Variable: Aggregated number of death due to opioid overdose
Statistical significance notation: *p < .05, **p <.01, ***p < .001.

Figure-7.b: Observed and Predicted values of overdose death pre- and post- REVIVE!
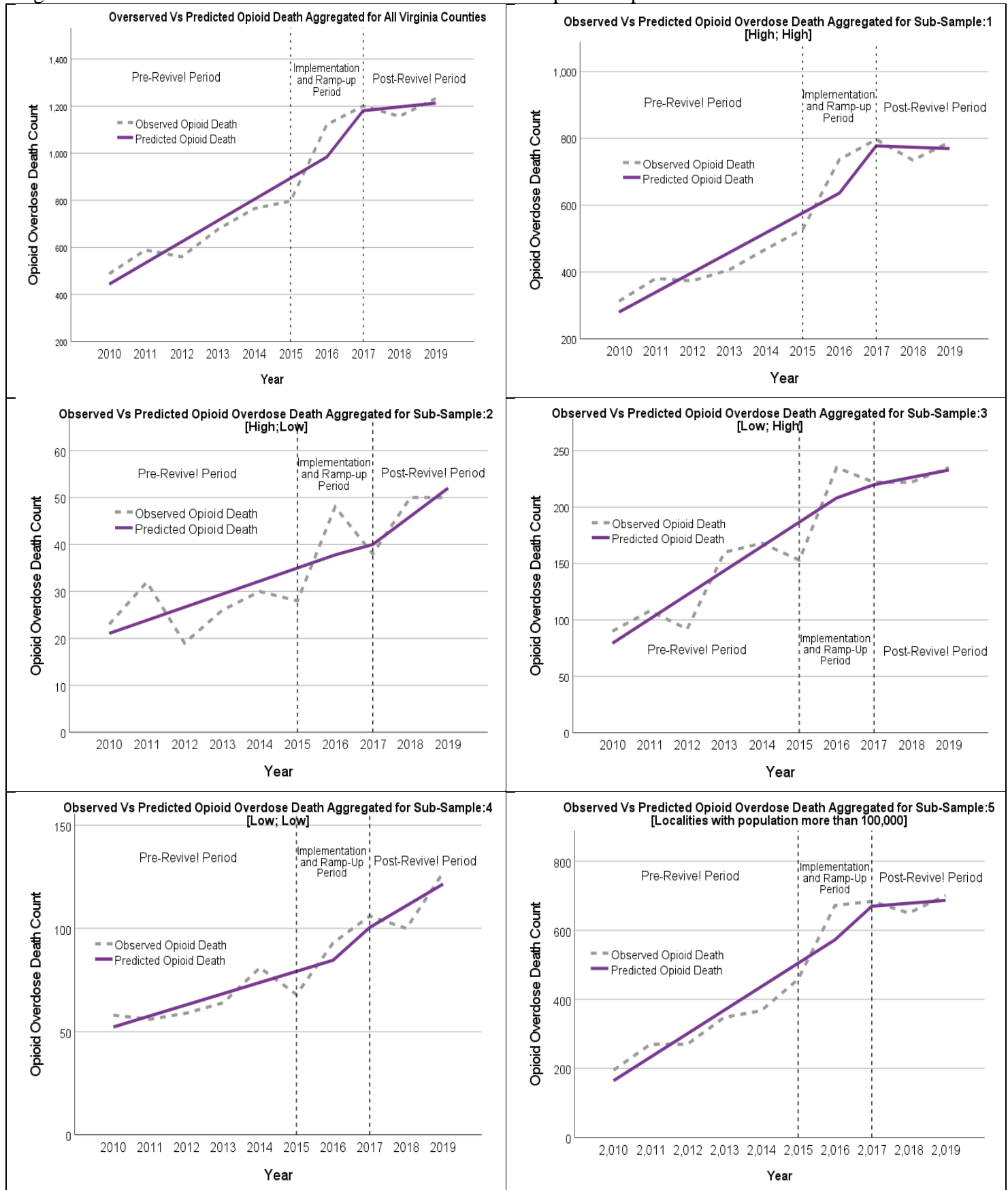
At first, we conducted comparison between average annual growth rates (AAGR) in aggregated data for all 132 locality over the ten-year period from 2010 to 2019 with the intervention effective on 2017. The included localities varied in size – from Highland County having population of 2,213 to Fairfax County with a population of 1,142,004[7]. Similarly, the total number of REVIVE! trainee during the study period ranged from 1 trainee in Charles City County to 642 in Chesterfield County. The number of death due to opioid overdose aggregated over the study period ranged from 2 deaths in Bath County to 624 in Fairfax County. The data showed an average annual growth rate of 10.8% before 2017 that dropped to an average of 3.3% afterwards. This is a significant drop, which coincides with the implementation and ramp-up period of the REVIVE! Program.

Next, we tested a time series regression model with the number of opioid deaths as the dependent variable and two variables representing timelines – one from the beginning of the study period to the end increasing by one year, and another beginning after the implementation of REVIVE!, i.e. beginning at 2017 and running through 2019. We also added a dummy variable coded '0' for pre- REVIVE! Period and '1' for post- REVIVE! period to account for the point in time when the intervention happened. As presented in Figure – 6.a, the data perfectly fit the time series with the model adjusted r-squared of 0.92. The beta coefficient for the variable "Timeline" is 90.89 and is statistically significant at 99 percent confidence interval. In plain words, the model shows that the overdose death rate has been consistently increasing as the number of years increased, and also that for every passing year, the number of overdose death had been increasing by 90 deaths per year during the pre- REVIVE! period. The beta coefficient for the `Intervention (Dummy)` variable indicates that at there were estimated 579 more deaths during the post- REVIVE! period compared to the pre- REVIVE! period. The beta coefficient of `Post-Timeline` variable has a negative value, which suggests a negative growth rate during the post- REVIVE! period. The numerical value suggests an estimate of about 57 fewer deaths on average for every subsequent year in the post- REVIVE! period i.e. from 2017 to 2019. However, this coefficient does not achieve statistical significance at 95% confidence interval. In plain words, the models suggests that the post- REVIVE! growth rate should average around -56.8 but the margins of error are too large to predict with confidence. This happens when there are fewer data points or when sample timeline is too short. More discussion on sample confidence interval is presented in the quantitative summary section later in this report. Figure-6.b shows the predicted value for sample-1 plotted alongside the observed value. The predicted curve shows a consistent growth rate from 2010 to 2016 which abruptly flattens after the intervention year 2017 and follows a less aggressive, yet positive, growth trend.

Sample-2 represents 32 localities that had experienced higher aggregate overdose deaths that also reported higher counts of REVIVE! trainees over the study period. Pulaski County reported the least number of REVIVE! Trainees (73) in this category and Chesterfield County reported the highest number of trainees (655). Similarly, Caroline County reported the least aggregate number of overdose deaths (37) and Fairfax County reported the highest aggregate number of deaths (624). Although, the localities in this category reported higher overdose deaths over the study period, the fact that they have more number of trained first responders also suggests that this sub-sample should be able to show more impact of the REVIVE! intervention than any other sub-sample studied. The results show exactly what we expected. First, we found the AAGR dropped

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[7] 2017 American Community Survey 1 year estimate.

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from 11.3% to 2.6% when comparing between pre- and post- REVIVE! periods. Then the interrupted time series model fitted very nicely with an adjusted r-squared of 0.89 and produced statistically significant coefficient for the variable representing the overall timeline. The coefficient (slope) for `Timeline` was 59.3 whereas the one for `Post-Timeline` was -63.2. Putting in overly simplified non-statistical language, the overdose death increased by an average of 59 deaths every year before 2017, while for every single year since 2017, the number of overdose death is estimated to have reduced by 63 counts every subsequent year until 2019. The curve representing predicted values for the number of overdose deaths graphically shows a consistent upward trend until 2016 and an abrupt negative trend after 2017. These findings are encouraging and highlight the potential role of the REVIVE! program, however, it should be noted that these models do not suggest that the total count of death have reduced, but only that the growth rate has flattened. In terms of overall numbers, the model predicts that there were 588 more count of deaths on average during the post- REVIVE! timeline compared to the average in the pre- REVIVE! period.

The third time-series model included localities that reported high number of REVIVE! trainees while had fewer aggregated number of overdose deaths compared to the rest. This sample had a total of 18 localities such as Sussex County, Grayson County, and Goochland County which respectively reported 284, 243, and 242 REVIVE! trainees and 12, 10, and 16 total overdose deaths in the 10-year study period. Although, this sample also reports a reduction in AAGR from 8.8% in pre- REVIVE! timeline to 3.6% in post- REVIVE! timeline, the low value of adjusted r-squared (0.59) shows an imperfect fit between the time series and the annual number of overdose deaths. The pre- and post-timeline coefficient values are comparable and none of the coefficients achieve statistical significance. This suggests that there is no identified trend in the outcome variable (death) and the pre- and post- REVIVE! variation could have been completely random.

Our fourth sub-sample represents localities that have trained fewer first responders under the REVIVE! program while having higher number of aggregated overdose deaths during the study period.   The sample had 22 localities which mostly included medium sized cities and counties such as Portsmouth City, Arlington County, Frederick County, Town of Culpeper, Petersburg City, etc. This sample reported a substantial reduction in the AAGR from 21% in pre- REVIVE! period to 6% in post- REVIVE! period. The time series model also had relatively higher coefficient of determination (r-squared) of 0.84 and the beta coefficient for the Timeline variable was significant at 99% confidence interval. The model predicted that the average overdose death in this sample was increasing by about 21 counts every year in the timeline before REVIVE! while the number of overdose death was estimated to decrease by about 15 counts every year in the post- REVIVE! period. Even by training fewer first responders, these localities were able to experience reduction in overdose related death rate. However, it should be noted that the `Post-Timeline` coefficient is not statistically significant even at 95% confidence interval and the model has standard error that is higher than the coefficient estimate. Again, this is the sign that the trend is probably becoming less aggressive but there is not enough data points to assert the argument. The difference in predicted overdose death trend, as visualized in Figure- 6.b, shows a less aggressive slope after the REVIVE! intervention.

The fourth sample analyzed here represents 60 localities that have reported low number of trainees and low number of aggregated overdose death. This is a perfect sample to compare

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outcomes with the High-High and High-Low samples above. Since the localities reported lower number of trainees, and already have comparably fewer overdose death than the other samples, we would expect smaller impact of the REVIVE! intervention on the overdose death rate. The model outcomes are consistent with our expectations. The sample count is relatively high, hence the model has good fit with adjusted r-squared of 0.9, and the coefficient for the `Timeline` variable is statistically significant. However, there is not significant difference between the estimates of pre- and post- REVIVE! slopes, suggesting that the annual rate of overdose death did not change before and after intervention.

The final analysis sample is composed of 17 most populous localities in Virginia that had a population more than 100,000 as per 2017 American Community Survey 1-year estimates. This sample reports the largest difference in pre- and post- AAGR from 20% to 2%. The time series model also shows good fit with adjusted r-squared of 0.93 and statistically significant beta coefficient for the `Timeline` variable. Although the average number of overdose death has increased by 505 between pre- and post- REVIVE! period, the growth rate, represented by the value and sign of the beta coefficients for time variables, has significantly reduced since 2017. The graphical representation of the predicted value shows less aggressive slope after the REVIVE! intervention.

Summary of Quantitative Findings

Following are some of the highlights from the quantitative exercise:

- 14,031 First Responders were trained under Virginia's REVIVE! program between 2015 and 2019. The annual number of trained professionals ramped-up slowly from 2015 to 2016 and increased rapidly after 2017.

- The number of overdose deaths in Virginia has been on the rise since 2012. However, the growth rate after 2017 is considerably lower than that between 2012 and 2016.

- Generally, localities with larger population also have higher count of REVIVE! trainees. However, there is also some mismatch between overdose death rate and number of REVIVE! trainees across the Commonwealth.

- Localities with higher number of REVIVE! trainees have reported steeper reduction in growth rate compared to localities with fewer REVIVE! trainees.

- Larger cities and counties where there are substantially more first responders trained under the REVIVE! program compared to smaller localities have reported the maximum reduction in overdose death rates.

- Localities with the lowest number of REVIVE! trainees and historically low overdose deaths show no change in death rates in pre- and post- REVIVE! timelines.

- Irrespective of the various different ways of slicing and dicing the dataset, reduction in overdose death rate coincides with the time when the REVIVE! program reached its peak.

- Based on these quantitative findings, we reject the null hypothesis, and conclude that the training program has had some impact on reducing overdose related death rate in Virginia. However, the post- REVIVE! time period is only 3-years long and it is also possible that this

recent trend is just a random phenomenon. Although the current trend is encouraging and substantiates the effectiveness of the REVIVE! program, the analysis of program outcomes after a sufficiently longer (5 years or more) timeline will provide more accurate picture.

Participant Perceptions of REVIVE! Trainings

This component of the report aims to share perspectives on the REVIVE! trainings that cannot be captured by numbers alone. Key findings from first-person interviews with REVIVE! participants are described below. To maintain confidentiality, identifying information such as a participant's location has been removed.

Participants take the training for various reasons

During the initial stage of each interview, participants were asked their reasons for attending the training, as well as if their participation was voluntary or mandatory. Of the nine participants, five reported that they took the training voluntarily, while four reported that they took the training as a mandatory requirement for their job.

Those who took the training voluntarily did so primarily because they saw it as something that would be beneficial for their agency and for their community as a whole. As the participant below describes, they signed up to take the training after seeing a large increase in overdoses in their community:

> *"[I took the training because] we were hit so hard with the amount of overdoses, and we had not done anything to get ready for what we were seeing...I got us 100 doses of Narcan from them but we didn't have the training to start using them yet so I needed to get out to get some training so we could implement that with our office. We ended up being like number one in the region for overdoses for a couple years so we had to train everybody in the office."*

Another participant who took the training voluntarily did so because of their newly implemented Narcan program. This participant then went on to become a REVIVE! trainer as a continuation of their existing job as a training coordinator:

> *"It was voluntary. I was the training coordinator at the time and we were in the process of developing a process for Narcan implementation in our program so it was kind of logical that I would go become a trainer because that was kind of my job."*

Even those who were mandated to take the training reported that they found it useful. As the participant below described, they were excited to be trained and would have gladly participated even if it was not a mandatory part of their job:

> *"It was mandatory, but I was very excited to do it. I know I was asked to do it, and I was thrilled I was asked to do it. I would've volunteered for the opportunity."*

Another participant who volunteered for the training recognized the value of the program and said would have volunteered if no one else had been available to participate. In the case of this participant and several others, having a medical background made them a good fit to participate:

> *"I [volunteered] because of my medical background…If no one else would've volunteered to do it. I mean, you know, our department needed someone to do the training. If nobody else would've stepped up to the plate, of course, I'd have done it."*

Using information learned while on the job

Participants were also asked of the extent to which they used new information learned during the REVIVE! training while on the job, and if the training changed anything about how they carried out their role. Six participants said that they did learn new information. Two participants discussed how becoming a master trainer allowed them to expand upon their existing role as a trainer in their department, which they appreciated.

Two others discussed how they felt better prepared to administer Naloxone, with one noting that they've seen an increase in overdoses due to the COVID-19 pandemic. Another discussed how their staff has had to administer Naloxone, and how they were pleased that the staff seemed to prepared to do so thanks to the training:

> *"We've had to use [Naloxone]. What's been great is three of our staff have had to use it and we've been very happy with the response of our staff and the enthusiasm of our staff to do it. And just giving you an FYI, we had to administer three of them here in one weekend here at the jail…so having that opportunity for our staff to have it on them it makes it faster. Of course, we've got medical but they gotta come down three or four floors to get somewhere. Having our staff having it on their belt has been an asset for us here at the [location] sheriff's office."*

Two participants stated that, although they did not necessarily learn anything new, completing the training was still worthwhile as it allowed them to administer Naloxone. One for example, stated:

> *"No [I didn't learn anything new]. It just gave us the ability to use it because, before, we didn't have the ability."*

Improved communication between program participants and organizers

When asked about improvements that have been made or could be made to the program, four participants discussed communication. In two cases, these participants noted that communication between REVIVE! program organizations and program participants/master trainers has been excellent. For example:

> *"[The communication I've received has been] as high as you can go. [The VACP Program Director] is a very quality person. I've known her for years. She*

> *did an awesome job. I don't know how you could go with it or go ten times higher than her."*

Another participant felt similarly:

> *"[Communication has] been great. [The VACP Program Manager] is fantastic."*

Another participant stated that they were satisfied with the level and quality of communication they had received, and had a suggestion for additional information they would like to receive in the future:

> *"If I was to make one recommendation, it's just to send out periodic updates about just how is the program doing overall in the Commonwealth of Virginia, what are the results, if you will, that are being seen, and were there any novel situations that have been reported that everyone else might benefit from knowing about before they encounter it? You know, maybe three times a year, four times at most just send out an email update."*

Conversely, one participant felt that some communication issues were ongoing. In this case, the majority of communication challenges seemed to be between the participant and the local health department:

> *"There's been a lack of communication from the point of where we turn in paperwork so where it makes it to the [health department] in [our city] and getting it back because there is no communication on that part and that needs to change because that is awful. I'm very OCD and if things are not done systematically it turns my nerves to pieces. I've been on the verge of just stopping teaching it period just because there's a lack of communication, and I'm fed up with the lack of communication with getting everything done when everything changed and every time the PowerPoint was updated we were notified, but if it's the case that the agency has to now buy the Narcan nobody ever notified us if we were supposed to submit the paperwork to somebody differently. Nobody ever notified us, so I've followed the same process that I've followed since day one and it has been a mockery...I spoke with someone at the health department at [my city] last fall when we were planning a medical health clinic...and she said to reach out to her and I've tried numerous times - voicemails, emails - nothing. And then she told me "the version you're teaching, there's a different version out". Well I never got the new version, so she's asked me to do several trainings in several police departments and I'm willing to do it. I have no problem and my sheriff is willing to let me go do it on our time but the lack of training updates coming to us, that's one issue and you know getting the paperwork submitted. I don't want to train these people and then show them how they need to submit their paperwork and then have it be a failed process for people and then they're going to say essentially why did I do this when it's just a mess? And then they're going to stop doing it and eventually if we don't get the process down and say this is how it's going to work and this is how it's going to go and keep the communication lines open*

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with everybody, agencies are going to stop doing it. This whole process that we put in place over time which I think is a very good benefit not only for the officer who could be exposed but for the citizens of our community, they're going to suffer because the agencies are going to stop doing it because it's a hassle."

Participants would recommend the training to others

All nine participants said that they would recommend the training to others. As one participant stated:

> *"Yes, absolutely [I would recommend the program]. Every police department in the Commonwealth should have a Narcan program"*

Another noted that others in their department were also enthusiastic about the training:

> *"Oh yes [I would recommend it]. It's been an asset for our department; everyone bought into it. They wanted to do it."*

One participant stated that not only would they recommend the training, but that they were also interested in becoming a master trainer:

> *"Yes [I would recommend the training]. Actually, I reached out to [the VACP Program Manager] this morning to become a master instructor…I think it's a good program and it definitely has its value."*

Another participant stated that they would especially recommend the training if it was conducted by a law enforcement trainer, as they may be better able to work with law enforcement participants:

> *"Yeah definitely [I would recommend the program] depending on who you have as a trainer…If you have a law enforcement trainer, so a law enforcement trainer training law enforcement, it's much easier than if you have an outside trainer coming in to do law enforcement training. It's always going to be tougher because the crowd's tougher."*

One participant was slightly less enthusiastic in their recommendation due to the communication concerns discussed in the previous section. While this participant would still recommend the training, they also had some suggestions for improvement that, if implemented, could make their recommendation more enthusiastic:

> *"I think yes, that [I would recommend the REVIVE! training to others] if improvements can be made…if they can do some type of webinar and give a couple of dates for all the trainers to attend at least one of them and explain to them 'this is the process', have a flipchart in place that this is where it's going to go and that it sticks to that and if anything changes let [the trainers] know. I'm willing to train or go teach in any department, I love to teach…but at the*

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end of the day I need the process… this is how we report it, this is the form that needs to be completed, this is where it needs to go and to know that it's going to get to that place and back to you. There needs to be a smooth transition, it shouldn't be something that I have to call 20 people for."

Considerations for when trainings should be held

During the interview, one participant mentioned that they thought the REVIVE! training should be mandatory for law enforcement across the Commonwealth, and that it should take place when new officers first begin their job:

> *"One thing that I had proposed was make it part of academy training in police academy. I think it should be a block even though it doesn't take long. I think it should be a small block in every police academy. "*

This participant then went on to suggest that, if this were to occur, it would likely need to be included in the training standards created by the Department of Criminal Justice Services.

Other participants had mixed feelings about this, with two more supporting the idea. Conversely, another participant felt that including this in an initial police academy could be too overwhelming:

> *"We have always given [the training] to the officers that have been in the department and on the streets for a while, and that is because we cram so much into our recruit training program already that the curriculum just might easily not absorb it at all. It wasn't that the new guy or gal in school couldn't master it, it's more not having the time to give them one more thing to master."*

Additional information to include in the trainings

Of the five participants who are master trainers, four noted that they individually decided to include additional information in their own trainings beyond what they learned in the official program (a fifth stated that they did not choose to include any additional information). Two of these participants said that they have been stressing the importance of taking the training for personal reasons, in addition to saving the lives of others. This helped them to reach some people who had not wanted to initially take the training, but then went on to understand its importance. As one stated:

> *"Some of the [people who had initially not wanted to attend the training] are the biggest cheerleaders for it now, and I think once they see that it will benefit us personally. I always used an analogy for some of the young daddies in this classroom - what if you go home and you have fentanyl on your clothes from a search warrant, and they say "daddy daddy" and you pick them up and they get a secondary exposure? What are you going to do if you don't have Narcan; it's going to be 10 to 15 minutes for an ambulance to get there? Now what are you going to do? So we just try to bring it home for them."*

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Another participant discussed how they made the trainings they taught more hands-on in order to ensure that participants were better prepared to administer Naloxone in three different ways, rather than only showing the auto-injector method that was initially featured in the training:

> *"One thing that they didn't do that I incorporated into my course whether it was wrong, right, or indifferent is you have to show them the different types of device, whether it's the auto-injector or the nasal spray or the actual the one that comes in a pre-filled syringe. We showed them all three...If it is in my ambulance we carry the pre-filled syringes so, therefore, they can see they can always hook up an atomizer to it and still administer it in the same method that you would with the nasal spray, and I would pass it around the room...I would take an empty one and pre-fill it with saline and let them see how the atomizer works, how to hook it up, and different things like that. The stuff I did wasn't covered in the class and in the training materials that I added extra just so they could get the extra hands-on to see well what are guys carrying on the ambulance I wasn't trained with. I just want them to be able to see everything."*

In addition, one participant discussed how they began to offer the training to different groups of people who may need to know how to administer Naloxone. As an example, this trainer had also worked to train those who worked at funeral homes and tow truck drivers, who may experience secondary exposure. In this type of training, the material may need to be tailored to the audience:

> *"This is something that you could probably add to your training...if a police officer stops a car, the police officer has a potential of exposure. If they arrest the person, there is a second part to the exposure which is the tow truck drivers, so the tow truck drivers have to take the car if the person is arrested...so they have a potential of exposure. So, we trained our tow truck drivers. Then, the third part of the exposure is the funeral home operators and directors, so if for some reason we didn't revive the person and they died we have to get the funeral home involved and they may be taking a person out of a car or taking a person out of a bathroom stall...but they have the potential for exposure so we had to train all of our funeral folks. We did 36 funeral homes; we did about 40 tow truck drivers all around the region so that they were prepared, and now they have Narcan on hand as well."*

Online options could provide additional opportunities

One participant participated in the REVIVE! training virtually due to the COVID-19 pandemic, and was pleased with the results. This participant also felt that there was nothing about the virtual training that needed to be improved:

> *"I actually thought the training was spectacular, truth be told, for a virtual platform. I was totally amazed...I personally thought it was a great platform put out virtually...I mean I just can't say it enough it was just a great opportunity to take it to another platform and for us it worked out fantastic. I mean I sat in my office and three other guys sat in our training room and watched it together, so*

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> *my hats off to VACP, [the VACP Program Manager], the whole nine yards for getting it up and running."*

During the interview, the participant was also asked if they felt that online options for this training should continue to be offered even after the pandemic is over. The participant believed that consistently having an online option would make the training more accessible and easier to attend. They also felt that an online training could allow some individuals who live far from the training location to participate when they may not be able to otherwise:

> *"Yeah I think [they should keep an online option.]…For me, they were going to have the class at VACP office, it would've been an hour and a half ride, one hour class, and another hour and a half ride. I hate to say it, but when you do a cost-benefit analysis of driving three hours for one hour, it doesn't make any sense. I do think keep a virtual option."*

Summary of interviews

In sum, key findings from the interviews include:

- While some participants took the training voluntarily and for others it was a mandatory part of their job, all reported that they were happy to have the opportunity and were willing to participate.

- Overall, participants were pleased with the communication they received about the training from the Virginia Association of Chiefs of Police.

- One participant felt that communication from the local health department needed improvement.

- Periodic emails with updates about the program and its impact could be of interest to participants.

- Participants were likely to recommend the program to others.

- Some participants felt that the training should be offered to a greater number of people, perhaps as part of police academy training. However, this could be challenging to enforce.

- Showing potential participants ways that the training can help them personally, in addition to helping others, may increase participation.

- Adding a greater hands-on component to the training could help increase understanding.

- Expanding the training to other groups such as tow truck drivers and those working at funeral homes could help save even more lives.

- Continuing the virtual training option, even after the COVID-19 crisis has ended, in order to expand the program's reach and make it more attractive to people around the Commonwealth.

Findings from the interviews identified both areas of success as well as areas for improvement for the REVIVE! program. However, even those participants who had recommendations for

improvement still recognized the importance of the program and would recommend it to others. Overall, REVIVE! appears to be a valuable, needed resource for program participants. In the words of one participant:

> *"It is a source of great pride for our department. It's been a very successful program for our department and so again we hope that it will be continued because it does make a difference, absolutely."*

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Discussion and Closing Remarks

The national and statewide trends clearly show that opioid epidemic is a public health emergency. The rise in the number of overdose deaths over the last decade is staggering. Both administrative leadership and local communities in Virginia have felt the severity of opioid addiction and overdose deaths. REVIVE! for First Responders is one of the initiatives towards addressing the issue and it focuses on educating first responders – professionals or civilian – on early detection and intervention to reduce harm to the victim. REVIVE! program is founded on the assumption that with the correct training and right tools first responders can help reverse the effects of opioid overdose and save lives even before medical assistance reaches the incidence site. Launched in mid-2015, the training program quickly caught traction and within two years, it already had enough graduates to start making measurable difference in the affected communities.

From the policy perspective, the overarching question is "*Has the program been successful in moving the needle in the overall objective of saving lives of overdose victims?"* The initial results based on our analysis of REVIVE! training data are very promising. We see remarkable correlation in reduction in growth rate of opioid related deaths and the implementation timeline of the program. The correlation is more pronounced in Virginia localities that have more REVIVE! trained first responders than those with fewer of them. However, the slowdown in the opioid death trend could have been a perfectly random phenomenon and its association with REVIVE! timeline could have happened by chance. The revival rate of the Naloxone administered under the program in the past year also substantiates the role of the training in improving accuracy in Naloxone administration.

In addition, first-person interviews conducted during this research show that the participants value the skills learned during the training and believe that it has improved their confidence in effectively administering Naloxone to a victim when needed. They also show that the program has been successful in reducing overdose deaths. As one participant stated:

"We actually had a save the other day…. Trained officers responded from our agency and another agency and the fire department used Narcan for this man and saved his life, and so I feel like the more agencies we can train the better"

The initial results are encouraging and the post- REVIVE! timeline is not long enough to merely reject the positive outcome as happenstance.

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References

Center for Disease Control and Prevention . (2020, March 24). *Drug Overdose Epidemic* . Retrieved from A Center for Disease Control and Prevention Website: https://www.cdc.gov/injury/features/prescription-drug-overdose/index.html

Davis, C. S., Ruiz, D., Glynn, P., Picarello, G., & Walley, A. Y. (2014). Expanded Access to Naloxone Among Firefighters, Police Officers, and Emergency Medical Technicians in Massachusetts. *American Journal of Public Health*, e7-e9.

Giglio, R. E., Guohua, L., & Dimaggio, C. J. (2015). Effectiveness of bystander naloxone administration and overdose education programs: a meta-analysis. *Injury Epidemiology, 2*. Retrieved from https://doi.org/10.1186/s40621-015-0041-8

Lott, D. C., & Rhodes, J. (2016). Opioid overdose and naloxone education in a substance use disorder treatment program. *The American Journal on Addictions* , 221-226.

Police Assisted Addiction Recovery Initiative. (2016). *Annual Report* . Gloucester : Police Assisted Addiction Recovery Initiative.

Virginia Department of Health and Human Services . (2019). *REVIVE! Opioid Overdose and Naloxone Education (OONE) program for the Commonwealth of Virginia*. Retrieved from A Virginia Department of Health and Human Services Website: http://www.dbhds.virginia.gov/behavioral-health/substance-abuse-services/revive

Wheeler, E., Jones, S. T., Gilbert, M. K., & Davidson, P. J. (2015). Opioid Overdose Prevention Programs Providing Naloxone to Laypersons — United States, 2014. *Morbidity and Mortality Weekly Report* , 631-635.

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Appendix I: Output Tables for Interrupted Time Series Models

All Counties ITS Analysis results

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.974[a]	.949	.924	84.565

a. Predictors: (Constant), Post, Pre, Intervention

b. Dependent Variable: OD_Death_Count

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	805746.326	3	268582.109	37.557	.000[b]
	Residual	42907.774	6	7151.296		
	Total	848654.100	9			

a. Dependent Variable: OD_Death_Count

b. Predictors: (Constant), Post, Timeline, Intervention

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	362.143	71.471		5.067	.002
	Timeline	90.893	15.981	.896	5.687	.001
	Intervention	579.524	545.087	.912	1.063	.329
	Post	-56.893	61.895	-.810	-.919	.393

a. Dependent Variable: OD_Death_Count

Observed Vs Predicted Opioid Death Aggregated for All Virginia Counties

Subsample-1: High FR Training, High OD Death ITS results

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.964[a]	.930	.895	62.158

a. Predictors: (Constant), Post, Timeline, Intervention

b. Dependent Variable: Opioid_Death

ANOVA[a]

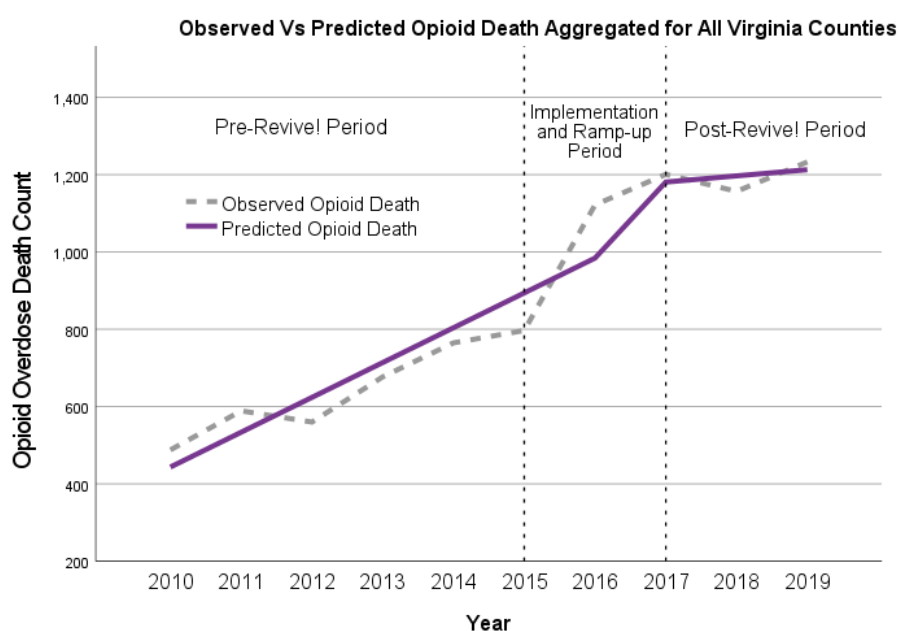| Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	307252.512	3	102417.504	26.508	.001[b]
	Residual	23181.488	6	3863.581		
	Total	330434.000	9			

a. Dependent Variable: Opioid_Death

b. Predictors: (Constant), Post, Timeline, Intervention

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	221.143	52.533		4.210	.006
	Timeline	59.321	11.747	.937	5.050	.002
	Intervention	588.524	400.653	1.484	1.469	.192
	Post	-63.321	45.495	-1.445	-1.392	.213

a. Dependent Variable: Opioid_Death

Observed Vs Predicted Opioid Overdose Death Aggregated for Sub-Sample:1 [High; High]

Subsample-2: High FR Training, Low OD Death ITS results

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.854[a]	.729	.593	7.331

a. Predictors: (Constant), Post, Timeline, Intervention

b. Dependent Variable: Opioid_Death

ANOVA[a]

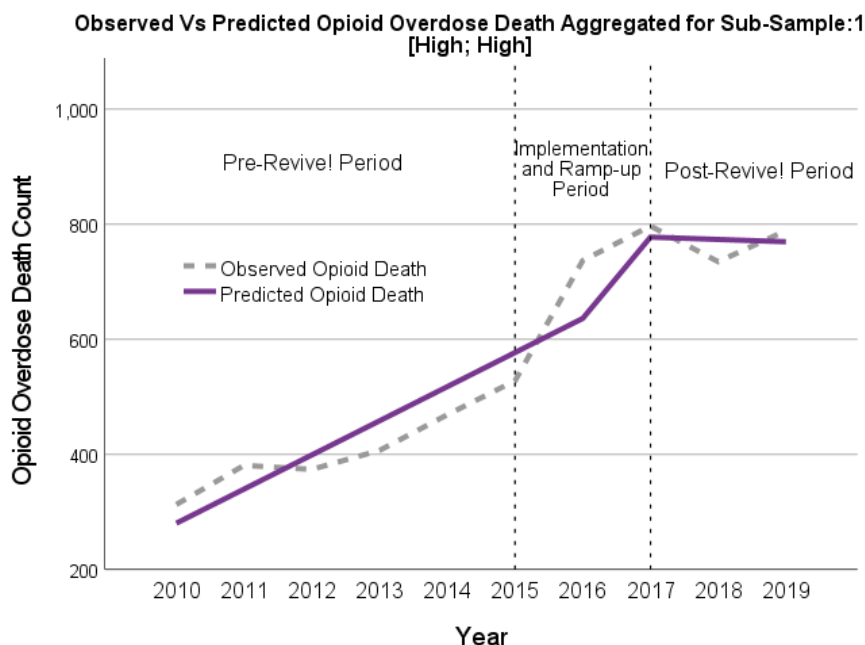| Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	865.971	3	288.657	5.372	.039[b]
	Residual	322.429	6	53.738		
	Total	1188.400	9			

a. Dependent Variable: Opioid_Death

b. Predictors: (Constant), Post, Timeline, Intervention

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	18.286	6.196		2.951	.026
	Timeline	2.786	1.385	.734	2.011	.091
	Intervention	-26.286	47.251	-1.105	-.556	.598
	Post	3.214	5.365	1.223	.599	.571

a. Dependent Variable: Opioid_Death

Subsample-3: Low FR Training, High OD Death ITS results

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.946[a]	.894	.841	23.229

a. Predictors: (Constant), Post, Timeline, Intervention

b. Dependent Variable: Opioid_Death

ANOVA[a]

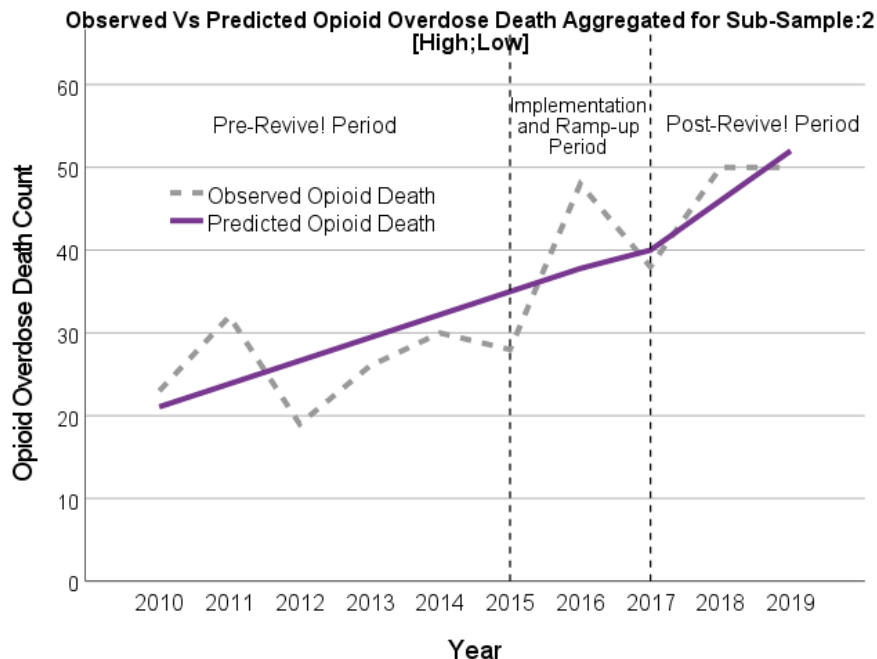| Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	27318.940	3	9106.313	16.876	.002[b]
	Residual	3237.560	6	539.593		
	Total	30556.500	9			

a. Dependent Variable: Opioid_Death

b. Predictors: (Constant), Post, Timeline, Intervention

Coefficients[a]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	57.857	19.632		2.947	.026
	Timeline	21.464	4.390	1.115	4.889	.003
	Intervention	109.976	149.729	.912	.735	.490
	Post	-14.964	17.002	-1.123	-.880	.413

a. Dependent Variable: Opioid_Death

Subsample-4: Low FR Training, Low OD Death ITS results

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.952[a]	.906	.859	9.137

a. Predictors: (Constant), Post, Timeline, Intervention

b. Dependent Variable: Opioid_Death

ANOVA[a]

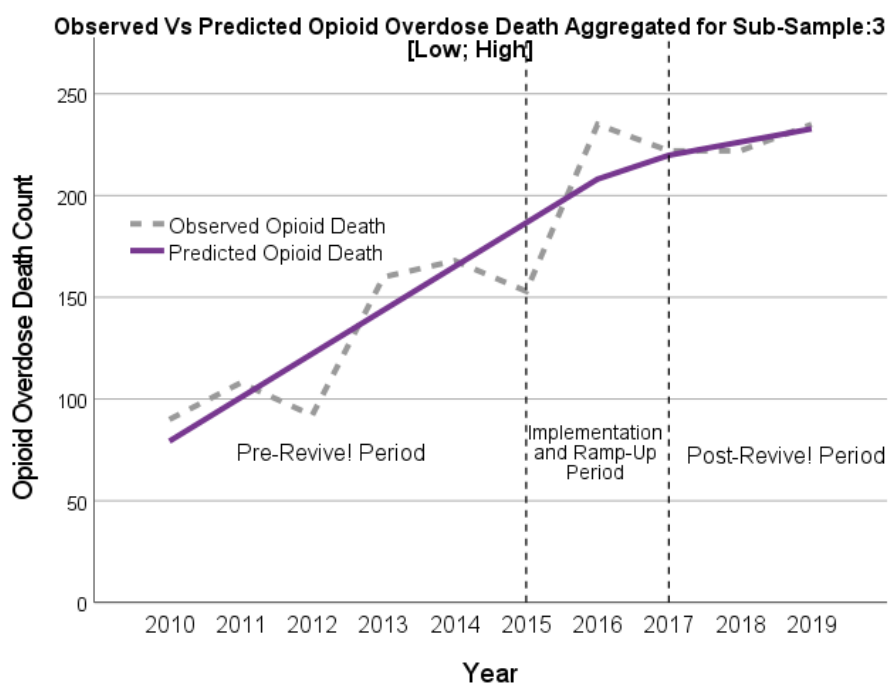| Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4840.707	3	1613.569	19.328	.002[b]
	Residual	500.893	6	83.482		
	Total	5341.600	9			

a. Dependent Variable: Opioid_Death

b. Predictors: (Constant), Post, Timeline, Intervention

Coefficients[a]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	46.857	7.722		6.068	.001
	Timeline	5.393	1.727	.670	3.123	.021
	Intervention	-30.357	58.894	-.602	-.515	.625
	Post	5.107	6.687	.917	.764	.474

a. Dependent Variable: Opioid_Death

Observed Vs Predicted Opioid Overdose Death Aggregated for Sub-Sample:4 [Low; Low]
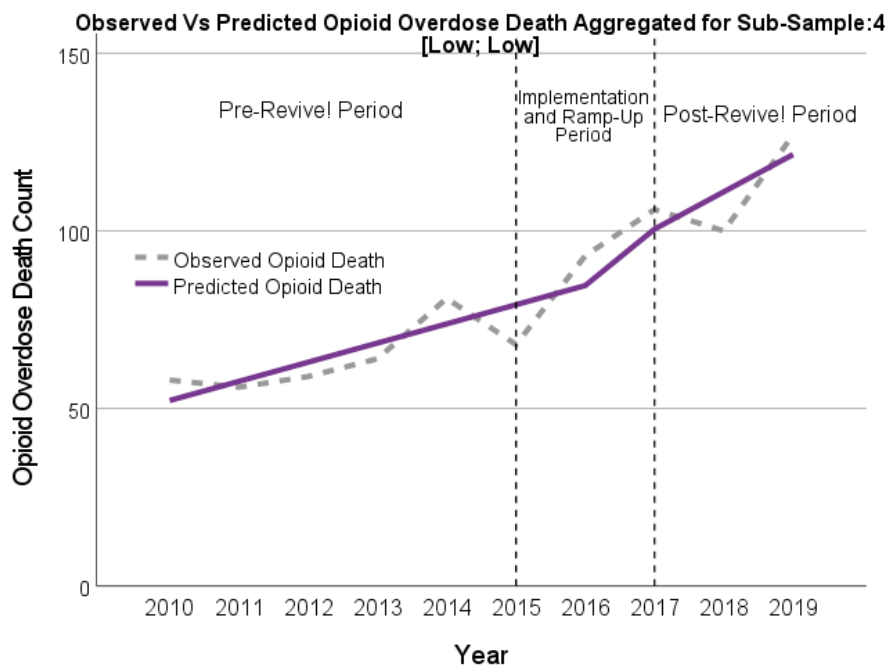
Subsample-5: Localities with population above 100,000: ITS results

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.969[a]	.938	.907	60.255

a. Predictors: (Constant), Post, Timeline, Intervention

b. Dependent Variable: Opioid_Death

ANOVA[a]

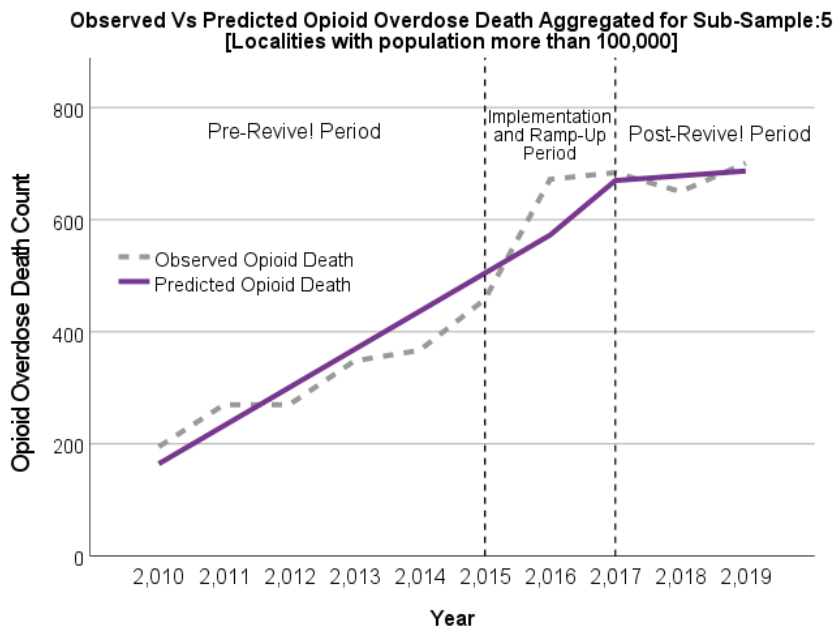| Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	331116.619	3	110372.206	30.400	.001[b]
	Residual	21783.881	6	3630.647		
	Total	352900.500	9			

a. Dependent Variable: Opioid_Death

b. Predictors: (Constant), Post, Timeline, Intervention

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	96.571	50.925		1.896	.107
	Timeline	68.000	11.387	1.040	5.972	.001
	Intervention	505.262	388.387	1.233	1.301	.241
	Post	-59.500	44.102	-1.314	-1.349	.226

a.   Dependent Variable: Opioid_Death

Observed Vs Predicted Opioid Overdose Death Aggregated for Sub-Sample:5
[Localities with population more than 100,000]

Appendix II: Participant Interview Questionnaire

1. Could you please tell me when and where you attended the training?

2. What made you choose to attend?

   a. Was your attendance voluntary or mandatory?

3. What are some things that you hoped to learn in the training?

4. Could you please talk a little bit about your experience during the training? What did you like? What did you not like?

5. Did you learn everything that you had hoped to learn?

   a. If no – what information was missing?

6. After completing the training, did you feel better prepared to administer Naloxone?

7. Have you used the information you learned in the training while on the job?

   a. If yes – how?

   b. If no – why do you think that is? Did you not learn new information during the training, or was the new information not helpful?

8. Could you please identify three areas of improvement for the program?

   a. How do you think these could be addressed or improved?

9. Would you recommend the training to others?

10. Is there anything else you'd like to share about your experience with the training that we haven't already discussed?

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