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VDH VIRGINIA DEPARTMENT OF HEALTH
Protecting You and Your Environment

Expanding Access to Medication-Assisted Treatment in Virginia

Solutions for the opioid crisis

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Applied Policy Project: Frank Batten School of Leadership and Public Policy with the Virginia Department of Health Injury & Violence Prevention Program

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On my honor as a student, I have neither given nor received aid on this assignment.

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List of Acronyms

CDC: Centers for Disease Control and Prevention

CODs: Co-Occurring Disorders

HIV: Human Immunodeficiency Virus

MAT: Medication-Assisted Treatment

SAMHSA: Substance Abuse and Mental Health Services Administration

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Executive Summary

The opioid epidemic is a national public health crisis and its effects are felt acutely in Virginia: 1,507 Virginians died from drug overdoses in 2017, marking the fourth consecutive year of increases in opioid-related deaths in the Commonwealth (CDC National Center for Health Statistics, 2019). One way to address the opioid crisis is expanding access to medication-assisted treatment (MAT), which is a comprehensive treatment strategy for people with opioid use disorder that includes the usage of drugs such as buprenorphine, naltrexone, and methadone. In Virginia, there is an undersupply of MAT: the rate of opioid use or dependence in the past year is more than two times as large as the maximum potential MAT treatment capacity in the Commonwealth (Jones et al., 2015).

To close the MAT supply gap, the Virginia Department of Health Injury and Violence Prevention Program seeks to increase the number of physicians in the Commonwealth with MAT prescription waivers. These prescrption waivers are a federal requirement for physicians who intend to prescribe MAT to patients with opioid use disoder. In this report, I offer six alternatives for the Injury and Violence Prevention Program to increase the number of physicians prescribing MAT in Virginia:

1. Implement an MAT training program in the curricula of all Virginia medical schools based on the Rhode Island model
2. Pilot an MAT training model in the curriculum of one Virginia medical school based on the Rhode Island model
3. Introduce and promote a multipronged MAT training program that is available to medical school students and practicing physicians throughout the Commonwealth
4. Expand access to naloxone by increasing the supply of naloxone in health care facilities, introducing trainings and public awareness campaigns for citizens to administer naloxone, and advocating for laws to protect Good Samaritans
5. Launch an MAT evaluation focused on assessing the landscape and effectiveness of Rhode Island's training program, existing MAT training programs for practicing physicians, and the effects of naloxone access in Virginia
6. Let present trends continue

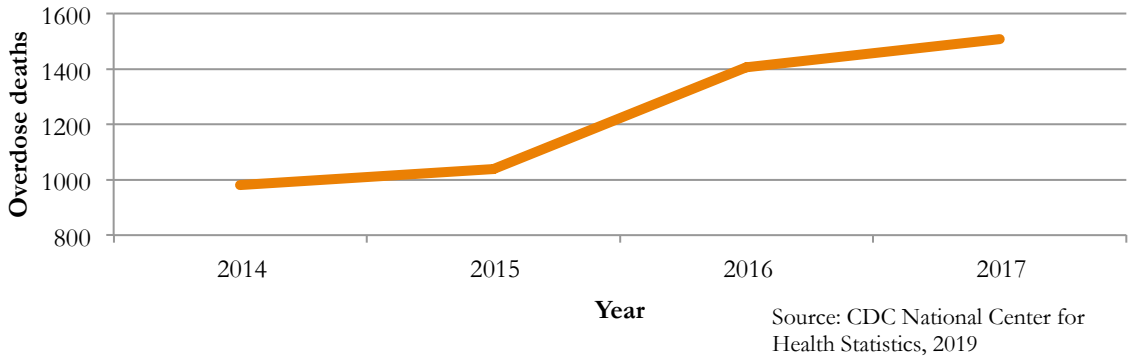
Due to bandwidth constraints, I recommend that the Injury and Violence Prevention Program implement one of the six alternatives. To select the optimal alternative, I evaluated the projected outcomes of each alternative on four criteria: cost, cost-effectiveness, geographic equity, and administrative feasibility.

After completing this analysis, I recommend that the Injury and Violence Prevention Program implement Alternative 3: introduce and promote a multipronged MAT training program that is available to medical school students and practicing physicians throughout the Commonwealth. I conclude the report with a description of how the Injury and Violence Prevention Program can implement the recommended alternative most effectively: by offering trainings online and in person, particularly in areas with medical schools and in localities with the higher drug overdose rates.

Problem Statement

There is an undersupply of physicians prescribing medication-assisted treatment (MAT) to Virginians with opioid use disorder: the rate of opioid use or dependence in Virginia in the past year is more than two times as large as the maximum potential MAT treatment capacity (Jones et al., 2015). In 2017, the most recent year of available data, 1,507 Virginians died from drug overdoses, marking the fourth consecutive year of increases in opioid-related deaths in the Commonwealth (see Figure 1) (CDC National Center for Health Statistics, 2019). One evidence-based approach to combating the opioid crisis is using MAT to help people with opioid use disorder to curb their addictions. Medications such as buprenorphine, naltrexone, and methadone are proven to be effective components of comprehensive treatment plans for opioid use disorder (Sharp et al., 2018). However, there are approximately half as many doctors as needed to prescribe MAT in Virginia.

Figure 1: Drug overdose deaths in Virginia, 2014-2017



Source: CDC National Center for Health Statistics, 2019

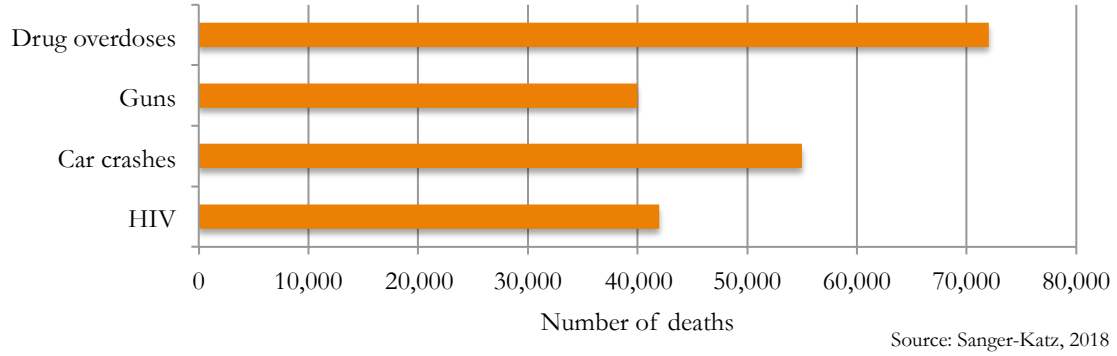
The Virginia Department of Health Injury and Violence Prevention Program intends to address opioid misuse by expanding access to MAT. Currently, there is not a standard approach across Virginia's six medical schools to ensure that all graduating medical school students have MAT prescription waivers or an understanding of when and how to prescribe MAT to patients. There is also not a specific training program being promoted for currently practicing physicians to obtain MAT waivers in Virginia. The Injury and Violence Prevention Program must determine how to most effectively increase the number of doctors prescribing MAT in the Commonwealth. If implemented successfully, the Virginia Department of Health can make significant progress against the state's most pressing health crisis.

Background

The opioid crisis

In the past year, drug overdoses (see Appendix I) killed more people in the United States (72,000) than the peak yearly death totals for HIV (42,000), car crashes (55,000), or gun deaths (40,000) (see Figure 2) (Sanger-Katz, 2018).

Figure 2: Peak annual deaths by cause



Source: Sanger-Katz, 2018

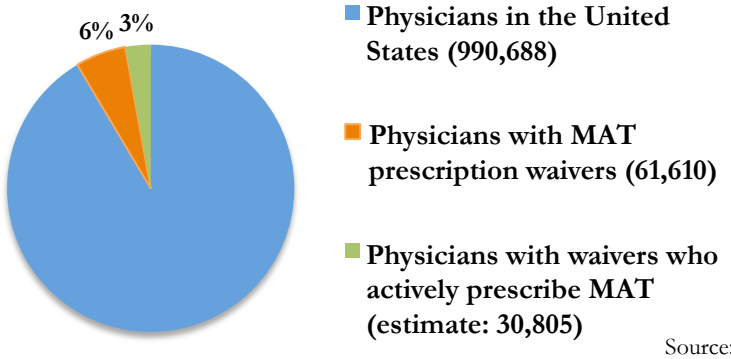
With Virginia's overdose death rate continuing to rise, the Department of Health's Injury and Violence Prevention Program is seeking to expand access to MAT in the Commonwealth because MAT is, "the most effective regimen for reducing drug use and is effective in reducing overdose rates, HIV transmission, and criminal activity, while increasing treatment retention" (see Appendix II) (Sharp et al., 2018, p. 642).

The undersupply of MAT

Despite the proven effectiveness of MAT, supply of MAT is insufficient, particularly in certain geographic areas. One of the reasons why MAT is currently underprescribed is that physicians are required to obtain a waiver to prescribe MAT drugs and there is an insufficient number of doctors with such waivers (McCance-Katz et al., 2017). To obtain a waiver, the Drug Abuse Treatment Act of 2000 requires physisicians to have at least eight hours of training endorsed by one of a few national stakeholder groups (McCance-Katz et al., 2017).

McCance-Katz and fellow authors, who are the most prominent scholars on the issue of MAT training, also found that even when physicians obtain a waiver for MAT, many still do not prescribe the drugs. Of the 61,610 waivered physicians in the United States, less than half offer MAT to patients (see Appendix III) (SAMHSA, 2019; McCance-Katz et al., 2017). Therefore, the MAT access problem is twofold: an insufficient number of doctors with MAT prescription waivers, and a large percentage of doctors who have the waivers but still do not prescribe MAT. Figure 3 shows the proportion of physicians in the United States with MAT prescription waivers.

Figure 3: Proportion of American physicians who prescribe MAT



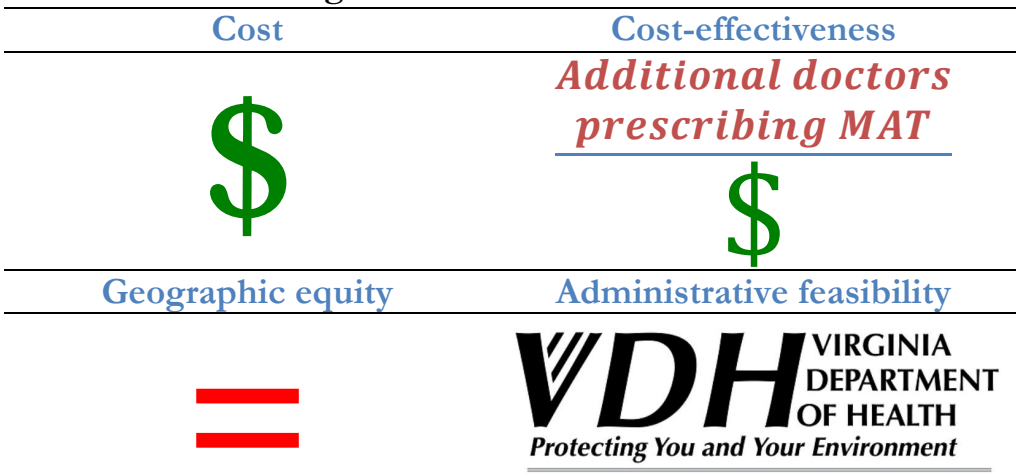
Source: SAMHSA, 2019; McCance-Katz et al., 2017

As a result of the under-prescription of opioid use disorder medications, nearly nine in ten people with addictions lack consistent access to MAT (Sharp et al., 2018). Another study found that more than 40 percent of counties in the United States have no physicians waivered to prescribe buprenorphine (Huhn & Dunn, 2017). In Virginia specifically, the rate of opioid use or dependence in the past year is more than two times as large as the maximum potential buprenorphine treatment capacity (Jones et al., 2015). In other words, demand for MAT in Virginia is outpacing supply.

Evaluative Criteria

I will be using four different criteria to evaluate the projected outcomes of the alternatives I describe in the following section. The four criteria are: (1) cost, (2) cost-effectiveness, (3) geographic equity, and (4) administrative feasibility. Although the overarching goal of the Injury and Violence Prevention Program is to increase the number of doctors prescribing MAT in Virginia, there are cost and administrative feasibility constraints for the Virginia Department of Health that must be considered. Additionally, the Department is "committed to ensuring all Virginians have fair and quality health care in every corner of the state," making geographic equity an important criterion as well (Virginia Department of Health, 2019).

Figure 4: Evaluative criteria



Source: Author

Criterion 1: Cost

Description: I will evaluate each alternative based on the projected cost of its implementation and sustained execution.

Measurement: I will measure the projected cost of each alternative in 2018 U.S. dollars over the course of ten years, with adjustments for discounting at 3 percent and 7 percent levels. I will not adjust for deflation due to the current historically low inflation rates in the United States. Because significant parts of the alternatives that I am proposing are new programs without existing cost data, I will include information in Appendix VI about my cost projection methods and estimates.

Criterion 2: Cost-effectiveness

Description: The second criterion that I will use to evaluate the projected outcomes of the alternatives is cost-effectiveness: specifically, I will calculate how many additional physicians will be prescribing MAT in Virginia per dollar spent on the alternative.

Measurement: I will measure effectiveness by calculating projected quantities of the additional number of Virginia physicians prescribing MAT to Virginians with opioid use disorder per dollar spent over the course of ten years. I will then divide the total cost projection of the

alternative by the number of MAT-prescribing physicians to develop a cost-effectiveness estimate. Like cost estimates, there are limited existing data about the projected outcomes of the alternatives I will be proposing. In Appendix VII, I will provide information about my effectiveness projection methods and estimates.

Criterion 3: Geographic equity

Description: There is a significant amount of geographic variance in access to health care throughout Virginia (Kaiser Family Foundation, 2014). Additionally, opioid use disorder rates tend to be the highest in concentrated pockets of the Commonwealth that have some of the most limited access to health care resources (see Figure 5) (Virginia Department of Health, 2019). Therefore, I will evaluate each alternative on its projected impact on the geographic disparities in MAT access throughout the Commonwealth.

Figure 5: Prescription opioid overdose death rate per 100,000 by county, 2017

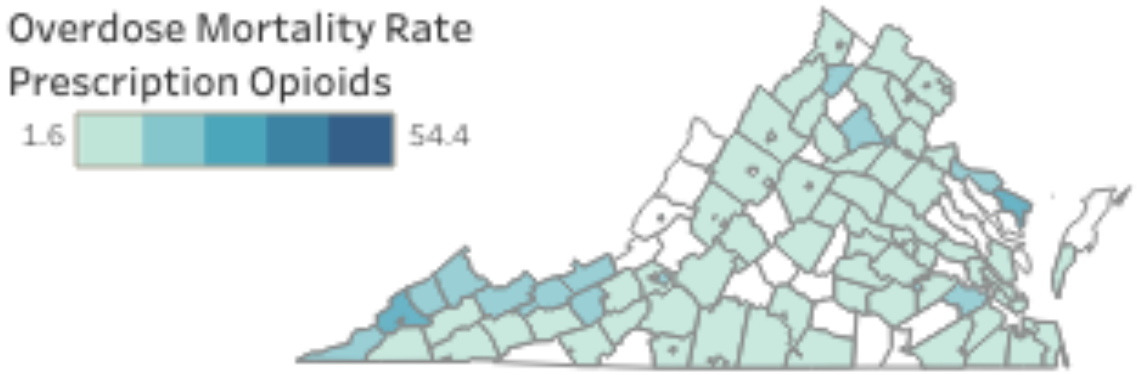


Image reproduced from: Virginia Department of Health, 2019

Measurement: I will measure geographic equity by using a Gini coefficient indicator to compare disparities in the projected increases in physicians prescribing MAT per county in Virginia. I will provide more information about this process in Appendix VIII.

Criterion 4: Administrative feasibility

Description: The final criterion I will use to evaluate each alternative is administrative feasibility. I will use this criterion to evaluate the extent to which each alternative could be reasonably implemented by the Virginia Department of Health Injury and Violence Prevention Program given their staffing constraints, jurisdiction, and relationships with relevant stakeholders.

Measurement: I will assign each alternative an administrative feasibility classification of *low*, *medium*, or *high*.

Constraints

In the next section, I will offer six alternatives to increase the number of doctors with MAT prescription waivers in Virginia. When evaluating these alternatives on the criteria described in the previous section, the Virginia Department of Health Injury and Violence Prevention Program might find that multiple alternatives have merit and could be worthy of implementation.

However, I advise the Injury and Violence Prevention Program to concentrate on the implementation of one alternative due to bandwidth constraints. Sendhil Mullainathan and Eldar Shafir describe the psychology behind bandwidth constraints in their book *Scarcity*. Bandwidth is an outgrowth of the scarcity of resources – most notably time – that we face in our daily lives. Bandwidth refers to our mental capacity, which gets taxed as more items seek our attention. In a world of limited bandwidth, we engage in "tunneling," focusing on nothing but the seemingly urgent task at hand, at the expense of all other worthy objects of our attention. The result of this phenomenon is a significant limitation in our ability to "solve problems, retain information, (and) engage in logical reasoning" (Mullainathan & Shafir, 2013, p. 47). The same consequences that individuals face from limited bandwidth can also apply to organizations (Mullainathan & Shafir, 2013).

Mullainathan and Shafir's research reflects the importance of imposing a bandwidth constraint on the consideration of different alternatives. The Injury and Violence Prevention Program has several priorities, including child passenger safety, traumatic brain injury prevention, and suicide prevention, among others (VDHLiveWell, 2019). If the Program were to try to introduce multiple new opioid misuse initiatives on top of existing projects, the bandwidth of the agency might be so significantly taxed that their ability to solve any of the problems they confront will be impaired.

Therefore, in light of the bandwidth constraint, I recommend that the Injury and Violence Prevention Program consider the alternatives with the intention of selecting only one of the alternatives to implement. In the following section, I will describe the alternatives that the Program can consider.

Alternatives

Although the Virginia Department of Health is pursuing a variety of different approaches to addressing the opioid crisis, the Injury and Violence Prevention Program is focused specifically on expanding access to MAT. There are three potential areas to focus on: (1) medical school training for future doctors, (2) training for currently practicing physicians, and (3) access to a specific type of medication used in the immediate aftermath of an overdose: naloxone. There is a limited body of evidence on the role of medical schools in MAT training, but Rhode Island implemented a program that can serve as a model for Virginia. For currently practicing physicians, the United States Department of Health and Human Services Substance Abuse and Mental Health Services Administration (SAMHSA) created a national standard for MAT trainings that can be implemented in Virginia. Finally, there is conflicting evidence on the net impact of naloxone, though the U.S. Surgeon General has called for expanded access to the medication. Below, I will describe six different alternatives that the Virginia Department of Health Injury and Violence Prevention Program can consider to expand MAT access in the Commonwealth. I will also evaluate the projected outcomes of each alternative based on the criteria described in the previous section.

Figure 6: Alternatives

1	Implement an MAT training program in the curricula of all Virginia medical schools based on the Rhode Island model
2	Pilot an MAT training model in the curriculum of one Virginia medical school based on the Rhode Island model
3	Introduce and promote a multipronged MAT training program that is available to medical school students and practicing physicians throughout the Commonwealth
4	Expand access to naloxone by increasing the supply of naloxone in health care facilities, introducing trainings and public awareness campaigns for citizens to administer naloxone, and advocating for laws to protect Good Samaritans
5	Launch an MAT evaluation focused on assessing the landscape and effectiveness of Rhode Island's training program, existing MAT training programs for practicing physicians, and the effects of naloxone access in Virginia
6	Let present trends continue

Source: Author

Alternative 1: Implement an MAT training program in the curricula of all Virginia medical schools based on the Rhode Island model

One potential way to increase the number of physicians prescribing MAT in Virginia is by focusing on MAT training in the Commonwealth's medical schools (see Figure 7). I reached out to all six Virginia medical schools to see if they have any existing trainings. Only two responded, the University of Virginia School of Medicine and Eastern Virginia Medical School, and neither have any MAT training built into their standard curriculum. A growing body of research sheds light on how Virginia's medical schools can prepare their students to prescribe MAT.

Figure 7: Medical schools in Virginia

From top-left, clockwise: University of Virginia School of Medicine, Virginia Commonwealth University School of Medicine, Edward Via College of Osteopathic Medicine, Virginia Tech/Carilion School of Medicine, Eastern Virginia Medical School, Liberty College of Osteopathic Medicine
Source: Virginia Academy of Family Physicians, 2018

Specifically, medical students should receive the necessary training to "be eligible for the waiver to prescribe opioid medications to treat (opioid use disorders) by the time of medical school graduation" (McCance-Katz et al., 2017, p. 1). By including such training in medical school curricula, students could gain experience in treating opioid use disorders during residency and simultaneously expand access to clinical care for people with opioid use disorders (McCance-Katz et al., 2017). Although the opioid crisis has gained widespread public attention only recently, there is a larger body of evidence on treating substance use disorders more broadly. One of the key findings of this research is that medical students who go through a standalone course dedicated specifically to teaching about screening, interventions, and referrals to treatments for substance abuse are better equipped to treat patients with addictions than students who lack such a training (Neufeld et al., 2012). The Neufeld et al. study did not apply to MAT specifically, but its results could provide the Injury and Violence Prevention Program with a basis for applying the lessons to MAT.

One particular curriculum on opioid use disorder was developed by Brown University's Warren Alpert Medical School in conjunction with the Rhode Island Department of Health. It spans the entire four years of medical school and includes training on identifying when MAT prescription is appropriate, how to prescribe it, and how to monitor its effectiveness (McCance-Katz et al., 2017). It includes three times as many hours (24, compared to the eight required by SAMHSA) of training as the necessary amount for a waiver and also places students into patient simulations to prepare them for future experiences they will encounter (McCance-Katz et al., 2017).

Because Rhode Island's program was implemented in 2017, there are not yet data on its effectiveness. Students who started medical school in 2017 are still enrolled, so it will not be possible

to gauge the impact of this training curriculum for multiple years. Additionally, although I attempted to reach out to other medical schools and state health departments for information about similar programs in other states, I did not find any. Therefore, there is not a clear body of evidence to confidently project how this program would influence patient outcomes.

However, given the urgency of the large and growing opioid crisis (Sanger-Katz, 2018), the Commonwealth needs to take comprehensive, immediate action. If the Injury and Violence Prevention Program ensures that every medical school student in Virginia will graduate with an MAT waiver and a robust understanding of how, when, and why to prescribe MAT (McCance-Katz et al., 2017), the gap between the need for MAT and the supply of it can be closed in the coming years.

Analysis

Cost:

The annual cost of a Rhode Island-styled curriculum adaptation across every medical school in Virginia would be an estimated $950,000 per year. Over a ten-year horizon, this policy alternative is projected to cost $9.5 million. Compared to the other alternatives, this alternative is the fourth-most expensive, meaning that only two other alternatives are more expensive. I will provide a full explanation of this cost estimate in Appendix VI.

Cost-effectiveness:

With the updated curriculum in all six Virginia medical schools, the cost per additional doctor prescribing MAT would be approximately $1500. Compared to the other alternatives, this alternative is tied for having the second-highest cost per additional doctor prescribing MAT. I will provide a full explanation of this cost-effectiveness estimate in Appendix VII.

Geographic equity:

The Gini coefficient associated with the projected outcome of this policy alternative is 0.558. Compared to the other alternatives, this alternative has the third-highest Gini coefficient, which means it is the third-least geographically equitable. The most direct implication of this finding is that this alternative will do less to specifically increase the number of doctors prescribing MAT in underserved localities than most other alternatives will. I will provide a full explanation of this measure of geographic equity in Appendix VIII.

Administrative feasibility:

I assess the administrative feasibility of this policy alternative to be medium. The main reason why it would be difficult for the Injury and Violence Prevention Program to effect curriculum change in every Virginia medical school is that two medical schools, the Edward Via College of Osteopathic Medicine and Liberty College of Osteopathic Medicine, are private. The Injury and Violence Prevention Program would need to convince private medical schools to make changes to their curriculum without having any financial influence over the schools. Although an effective partnership is possible, this policy alternative would be less administratively feasible than others that only involve public institutions and stakeholders.

Alternative 1: Adapting the curricula in all Virginia medical schools to include MAT training			
Cost	**Cost-Effectiveness**	**Geographic Equity**	**Administrative Feasibility**
$9.5 million	$1500 per doctor	Gini coefficient: 0.558	Medium

Source: Author

Alternative 2: Pilot an MAT training model in the curriculum of one Virginia medical school based on the Rhode Island model

The Rhode Island model shows promise and meets MAT waiver requirements (McCance-Katz et al., 2017), but because it was implemented in 2017, there are not yet data on its effectiveness across indicators that matter most. In particular, we do not know whether students who go through the Rhode Island program go on to prescibe MAT at higher rates or if their patients have better outcomes. Therefore, the Injury and Violence Prevention Program should pilot the program at one medical school and evaluate its impact before expanding the training to all medical schools in the Commonwealth.

Unlike Alternative 1, which would call for a universal introduction of the MAT training across all of Virginia's medical schools, this alternative would be data dependent. The Injury and Violence Prevention Program would select one medical school at which they would implement the pilot into the curriculum for medical school students in their final year of classes. By implementing the program for students in their final year, data can be collected more quickly. If the program has the intended effect of increasing the number of doctors prescribing MAT, then it can be expanded to the other five medical schools in the Commonwealth.

The Injury and Violence Prevention Program should implement and evaluate the pilot program at the University of Virginia given the pre-existing ties between the Commonwealth and the University. The pilot should be run over a period of five years and, if effective, it can be expanded to the other schools for the next five years and beyond.

Analysis

Cost:

The annual cost of a Rhode Island-styled curriculum adaptation at the University of Virginia would be approximately $230,000 per year over the course of the five years that the pilot would be run. If the pilot is successful and the program is expanded to include all six Virginia medical schools for the final five years, then the cost per year would be approximately $950,000 over the final five years. Over a ten-year horizon, assuming that the pilot will be expanded, this policy alternative is projected to cost $5.9 million. Compared to the other alternatives, this alternative is the third-most expensive, meaning that three other alternatives are cheaper. I will provide a full explanation of this cost estimate in Appendix VI.

Cost-effectiveness:

With the updated curriculum at the University of Virginia and then all six Virginia medical schools, the cost per additional doctor prescribing MAT would be approximately $1500. Compared to the other alternatives, this alternative is tied for having the second-highest cost per additional doctor prescribing MAT. I will provide a full explanation of this cost-effectiveness estimate in Appendix VII.

Geographic equity:

The Gini coefficient associated with the projected outcome of this policy alternative is 0.653. Compared to the other alternatives, this alternative has the second-highest Gini coefficient, which means it is the second-least geographically equitable. The most direct implication of this finding is

that this alternative will do less to specifically increase the number of doctors prescribing MAT in underserved localities than most other alternatives will. I will provide a full explanation of this measure of geographic equity in Appendix VIII.

Administrative feasibility:

I assess the administrative feasibility of this policy alternative to be medium. Although pushing all medical schools in Virginia to change their curricula would be difficult, the Commonwealth already has a close relationship with the University of Virginia in Charlottesville. In the 2017-18 fiscal year, 5.0 percent of the University of Virginia's revenue and operational funding sources came from appropriations from the Commonwealth (Hogan, 2018). The Injury and Violence Prevention Program could leverage this close relationship to encourage the University of Virginia School of Medicine to implement a Rhode Island-styled curriculum adaptation for MAT training. If the pilot proves successful over the course of five years, it would strengthen the Injury and Violence Prevention Program's case for the other five medical schools to adapt their curriculum as well.

Alternative 2: Adapting the curriculum at the University of Virginia to include MAT training			
Cost	**Cost-Effectiveness**	**Geographic Equity**	**Administrative Feasibility**
$5.9 million	$1500 per doctor	Gini coefficient: 0.653	Medium

Source: Author

Alternative 3: Introduce and promote a multipronged MAT training program that is available to medical school students and practicing physicians throughout the Commonwealth

Although programs targeted at Virginia's medical school students will effectively prepare future physicians to prescribe MAT, the urgency of the crisis demands more immediate and wide-reaching solutions. To reach a larger population of physicians who could prescribe MAT, the Injury and Violence Prevention Program should develop standalone training programs that can be completed by medical school students and currently practicing physicians in Virginia.

In May 2018, Lin and fellow authors found that physician attitudes towards buprenorphine significantly influence their willingness to prescribe the medication to patients with opioid use disorders (Lin et al., 2018). Therefore, a training program for physicians that provides MAT waivers and also explains how MAT helps patients could be an effective way to address the insufficient supply of MAT prescriptions in Virginia.

SAMHSA currently issues MAT prescription waivers to practicing physicians who complete one of three training programs: one is offered by the American Academy of Addiction Psychiatry, another is offered by the American Society of Addiction Medicine, and the final is offered by the Providers' Clinical Support System for Medication Assisted Treatment. These training modules are offered online, in person, or as a combination of the two (e.g. four hours online and four hours in person) (SAMHSA, 2019). These trainings are already available to Virginia physicians, yet they have not been completed at high rates: Virginia has the 12th largest population of any state in the country (U.S. Census Bureau, 2018) but had the 23rd highest number of MAT prescription waivers issued in 2018 (SAMHSA, 2019).

The Injury and Violence Prevention Program can increase the number of practicing physicans obtaining MAT waivers by offering highly accessible MAT prescription trainings to doctors and medical school students in every part of the Commonwealth. The in-person trainings should be held at each medical school so that they are easily accessible for current medical school students. However, those trainings should also be open to practicing physicians. In-person trainings should also be offered in the ten counties with the highest opioid overdose rates in the Commonwealth (see Figure 8).

Year-round, always-avilable online training programs recognized by SAMHSA already exist, meaning that the Injury and Violence Prevention Program does not need to develop new ones. However, the Commonwealth can promote these programs to raise

Figure 8: Localities with the highest opioid fatal overdose rates in Virginia, 2007-2018

Locality Name	Fatal opioid overdoses per 100,000 people
Dickenson County	36.7
Buchanan County	32.5
Wise County	26.8
Tazewell County	23.9
Russell County	23.4
Pulaski County	22.3
Winchester City	21.0
Richmond City	20.1
Warren County	19.6
Fredericksburg City	19.6

Source: Virginia Department of Health, 2019

awareness about them with Virginia physicians. Because the Virginia Department of Health Professions sends out regular information to all physicians in the Commonwealth about license renewal, they can include information about MAT training programs in those notices (Virginia Board of Medicine, 2019).

The Virginia Deparment of Health Professions can also include information about in-person trainings. The Commonwealth should work with the three existing SAMHSA-recognized programs to design and administer in-person MAT trainings. These sessions are led by medical doctors and provide not only a waiver that will allow physicians to prescribe MAT, but also an understanding of how, when, and why to prescribe MAT (Providers Clinical Support System, 2019).

Analysis

Cost:

The annual cost of a multipronged MAT training program for all Virginia physicians and medical school students would be an estimated $370,000 per year. Over a ten-year horizon, this policy alternative is projected to cost $3.7 million. Compared to the other alternatives, this alternative is the fifth-most expensive, meaning that just one other alternative is cheaper. I will provide a full explanation of this cost estimate in Appendix VI, including sensitivity analyses based on assumptions regarding participation rates in these training programs.

Cost-effectiveness:

With the training program available throughout Virginia, the cost per additional doctor prescribing MAT would be approximately $720. Compared to the other alternatives, this alternative is tied for having the lowest cost per additional doctor prescribing MAT. I will provide a full explanation of this cost-effectiveness estimate in Appendix VII.

Geographic equity:

The Gini coefficient associated with the projected outcomes of this policy alternative is 0.155. Compared to the other alternatives, this alternative has the lowest Gini coefficient, which means it is the most geographically equitable. The most direct implication of this finding is that this alternative will do more to specifically increase the number of doctors prescribing MAT in underserved localities than any of the other alternatives will. I will provide a full explanation of this measure of geographic equity in Appendix VIII.

Administrative feasibility:

I assess the administrative feasibility of this policy alternative to be high. First, online MAT trainings that are available nationwide already exist. Therefore, the Injury and Violence Prevention Program would not need to develop a new online training. Additionally, there are already models for in-person and hybrid trainings that the Injury and Violence Prevention Program could use to easily introduce in-person training options across the Commonwealth. Finally, because none of the trainings are mandated, there would be no issues of conflicting jurisdictions.

Alternative 3: Multipronged MAT training for all Virginia physicians and medical students			
Cost	**Cost-Effectiveness**	**Geographic Equity**	**Administrative Feasibility**
$3.7 million	$720 per doctor	Gini coefficient: 0.155	High

Source: Author

Alternative 4: Expand access to naloxone by increasing the supply of naloxone in health care facilities, introducing trainings and public awareness campaigns for citizens to administer naloxone, and advocating for laws to protect Good Samaritans

Given the evidence of the effectiveness of naloxone (Coffin et al., 2016; Walley et al., 2013), the Injury and Violence Prevention Program could enact a number of steps to expand access to the medication. First, the Virginia Department of Health could increase the supply of naloxone in hospitals, medical offices, other health care facilities, and on the persons of first responders (Schiavon et al., 2018). The Injury and Violence Prevention Program could also develop training programs for citizens to learn how to administer naloxone and call for more citizens to possess the medication (Adams, 2018). Finally, the Injury and Violence Prevention Program could advocate for laws to protect untrained "good Samaritans" who use naloxone on individuals experiencing an opioid overdose to address the barrier of fears of potential legal ramifications for naloxone use gone wrong (Schiavon et al., 2018).

Unlike other forms of MAT, naloxone is not intended to be a component of a long-term treatment strategy. Instead, it is an agent that is used immediately after an overdose to prevent the victim from dying. Naloxone works as an antagonist on the receptors in the brain that are activated by opioid use (Robinson & Wermeling, 2014). Naloxone is the preferred response of medical providers to overdoses because it is both effective and safe, with relatively few side effects (Prabhu et al., 2018).

However, the most contentious point surrounding naloxone is the issue of risk compensation: the notion that the availability of naloxone will cause opioid users to engage in riskier behaviors without a fear of fatal repercussions (Prabhu et al., 2018). Doleac and Mukherjee's research advanced the notion that the moral hazard associated with naloxone access is worrisome: they found that expanded access to naloxone led to more opioid-related emergency room visits with no reduction in opioid-related mortality (Doleac & Mukherjee, 2018).

Doleac and Mukherjee's findings are disputed by other researchers who have found that hospitalization rates for opioid overdoses are lower in communities that have readily available naloxone than communities that do not (Coffin et al., 2016). Another group of researchers found that communities with readily available naloxone have lower opioid overdose death rates, which is the purpose of using the drug (Walley et al., 2013). Additionally, Doleac and Mukherjee found that most of the negative effects of naloxone are concentrated in the Midwest, potentially offering reason to believe that their results may not be transferrable to Virginia (Doleac & Mukherjee, 2018).

After evaluating the full body of evidence on naloxone's effectiveness, I believe that naloxone has a net positive impact on the communities that make it readily available for potential opioid overdoses. The preponderance of the evidence, including the opinion of the Surgeon General of the United States, confirms that naloxone access is worth expanding (Adams, 2018).

Recently, hospitals, first responders, and medical offices have increased their supply of naloxone, a trend that could continue (Schiavon et al., 2018). The United States Surgeon General has also called for more citizens to possess naloxone, particularly for anyone associated with a heightened risk of opioid overdoses (Adams, 2018). More health care facilities could also offer trainings for citizens to learn how to administer naloxone in the event of an overdose (Schiavon et al., 2018). The Commonwealth of Pennsylvania, under an initiative launched by Governor Tom

Wolf, implemented a naloxone expansion in 2017 that serves a model for this alternative (Hutcheson, 2017).

Analysis

Cost:

The annual cost of a naloxone expansion throughout Virginia would be an estimated $6 million per year. Over a ten-year horizon, this policy alternative is projected to cost $60 million. Compared to the other alternatives, this alternative is the second-most expensive, meaning that four other alternatives are cheaper. I will provide a full explanation of this cost estimate in Appendix VI.

Cost-effectiveness:

The metric by which I am measuring cost-effectiveness, per the Injury and Violence Prevention Program's targeted impact, is the additional number of doctors prescribing MAT per dollar spent on a given policy alternative. Therefore, the cost-effectiveness of a naloxone expansion is indeterminate with respect to doctors prescribing MAT and cannot be compared to other alternatives. However, there is broader evidence on the cost-effectiveness of naloxone distribution generally. Coffin and Sullivan, in the most-cited study on naloxone's cost-effectiveness, found that cost-effectiveness estimates for naloxone rely on many assumptions and wide sensitivity analyses, resulting in a range of estimates that show that the net benefits of naloxone could exceed the costs, or costs could exceed benefits (Coffin & Sullivan, 2013).

Geographic equity:

Similarly, I am measuring geographic equity using projected levels of additional doctors prescribing MAT per locality throughout Virginia, which would make the geographic equity measurement indeterminate for this policy alternative and impossible to compare to other alternatives. More broadly, naloxone expansion could be fully equitable depending on where the kits are distributed.

Administrative feasibility:

I assess the administrative feasibility of this policy alternative to be low. Although distributing naloxone kits across the Commonwealth would not be logistically challenging, the projected outcomes of this policy alternative are outside of the bounds of the Injury and Violence Prevention Program's emphasis on increasing the number of physicians prescribing MAT.

Alternative 4: Naloxone expansion			
Cost	**Cost-Effectiveness**	**Geographic Equity**	**Administrative Feasibility**
$60 million	Indeterminate	Indeterminate	Low

Source: Author

Alternative 5: Launch an MAT evaluation focused on assessing the landscape and effectiveness of Rhode Island's training program, existing MAT training programs for practicing physicians, and the effects of naloxone access in Virginia

Although there is clear evidence that MAT is generally effective (Sharp et al., 2018), we still do not know how effective training programs are in leading to desired outcomes in efforts to treat opioid use disorder (McCance-Katz et al., 2017). We also have conflicting evidence on the net impact of naloxone (Coffin et al., 2016; Walley et al., 2013; Doleac & Mukherjee, 2018). Therefore, before introducing MAT training programs within or outside of medical schools, or expanding access to naloxone, we should study the effects of these programs and initiatives more carefully. If they prove to have the intended effect, then the Injury and Violence Prevention Program can implement them.

The Virginia Department of Health Injury and Violence Prevention Program should task one full-time staffer with this evaluation task specifically. The study should be conducted over the course of two years to expedite the process of implementing effective programs as much as possible while still ensuring that there is clear evidence justifying the program's expansion. The staffer should analyze the effects of Rhode Island's medical school curriculum adaptation, existing MAT training programs offered nationally, and the distribution of naloxone in communities with elevated levels of opioid use disorder.

Analysis

Cost:

In the two years of program evaluation, the cost of this policy alternative would be $40,000 per year, for a total of $80,000. After the two-year window, if the medical school curricula changes were adopted, the cost would be $950,000 per year for a total of $7.6 million. If the training programs for all physicians were implemented, the cost would be $370,000 per year for a total of $3 million. If the naloxone expansion were implemented, the cost would be $6 million per year for a total of $48 million. If all of the programs were implemented, the cumulative cost over ten years would be $60.6 million. Compared to the other alternatives, this alternative is the most expensive, meaning that all five other alternatives are cheaper. I will provide a full explanation of this cost estimate in Appendix VI.

Cost-effectiveness:

The metric by which I am measuring cost-effectiveness, per the Injury and Violence Prevention Program's targeted impact, is the additional number of doctors prescribing MAT per dollar spent on a given policy alternative. Therefore, the two-year evaluation phase cannot be evaluated on cost-effectiveness. However, if all of the initiatives being evaluated were implemented over the course of the final eight years of the ten-year window, it would cost approximately $6300 per doctor prescribing MAT. Compared to the other alternatives, this alternative has the highest cost per additional doctor prescribing MAT. I will provide a full explanation of this cost-effectiveness estimate in Appendix VII.

Geographic equity:

Similarly, I am measuring geographic equity using projected levels of additional doctors prescribing MAT per county throughout Virginia, which would make the geographic equity measurement

indeterminate for two-year evaluation phase. However, if all of the initiatives being evaluated were implemented over the course of the final eight years of the ten-year window, the Gini coefficient would be 0.374. Compared to the other alternatives, this alternative has the fourth-highest Gini coefficient, which means it is the second-most geographically equitable. The most direct implication of this finding is that this alternative will do more to specifically increase the number of doctors prescribing MAT in underserved localities than all but one of the other alternatives will. I will provide a full explanation of this measure of geographic equity in Appendix VIII.

Administrative feasibility:

I assess the administrative feasibility of this policy alternative to be medium. The most problematic aspect of starting with policy evaluation is the lack of immediate action. Given the urgency of the opioid crisis, there is political pressure on the Commonwealth to take meaningful action. However, if the evaluation proves that the initiatives are effective, strongly justified policies that could have a significant impact would be implemented.

Alternative 5: Evaluation of existing programs			
Cost	**Cost-Effectiveness**	**Geographic Equity**	**Administrative Feasibility**
$60.6 million	$6300 per doctor	Gini coefficient: 0.374	Medium

Source: Author

Alternative 6: Let present trends continue

The Injury and Violence Prevention Program should not take further action at this time on the issue of MAT supply in Virginia. The Injury and Violence Prevention Program has a significant number of priorities ranging from vehicle passenger safety to traumatic brain injuries in children (VDHLiveWell, 2019). Resources and attention devoted to opioid misuse will not be available for other initiatives. At the same time, the federal government and other state agencies are already working on the opioid crisis across several dimensions of the epidemic, including access to MAT.

Therefore, even if the Injury and Violence Prevention Program does not divert attention from other priorities to focus on opioid misuse, the efforts of other public agencies could result in meaningful progress against the opioid crisis nonetheless. For example, 2018 was the fifth consecutive year of increases in the number of newly certified MAT prescribers in Virginia (see Appendix V) (SAMHSA, 2019). Even without further intervention, this trend suggests that the universe of MAT access will continue to expand in the Commonwealth.

Analysis

Cost:

The annual cost of letting present trends continue would be equal to the cost of maintaining existing MAT prescription training programs. Assuming these training programs continue to issue waivers at a constant rate of increase from the most recent year of available data, this policy alternative is projected to cost an estimated $220,000 per year. Over a ten-year horizon, this policy alternative is projected to cost $2.2 million. Compared to the other alternatives, this alternative is the cheapest. I will provide a full explanation of this cost estimate in Appendix VI.

Cost-effectiveness:

If the Injury and Violence Prevention Program allows present trends to continue, the cost per additional doctor prescribing MAT would be approximately $720. Compared to the other alternatives, this is alternative is tied for having the lowest cost per additional doctor prescribing MAT. I will provide a full explanation of this cost-effectiveness estimate in Appendix VII.

Geographic equity:

The Gini coefficient associated with the projected outcomes of this policy alternative is 0.727. Compared to the other alternatives, this alternative has the highest Gini coefficient, which means it is the least geographically equitable. The most direct implication of this finding is that this alternative will do less to specifically increase the number of doctors prescribing MAT in underserved localities than all of the other alternatives. I will provide a full explanation of this measure of geographic equity in Appendix VIII.

Administrative feasibility:

I assess the administrative feasibility of this policy alternative to be low. The Injury and Violence Prevention Program was tasked with addressing the undersupply of MAT in the Commonwealth. Taking no action would not satisfy the priorities of the Virginia Department of Health, the Governor of Virginia, or the President of the United States.

Alternative 6: Let present trends continue			
Cost	**Cost-Effectiveness**	**Geographic Equity**	**Administrative Feasibility**
$2.2 million	$720 per doctor	Gini coefficient: 0.727	Low

Source: Author

Outcomes Matrix

The following matrix compares the projected outcomes of each alternative across each of the evaluative criteria I am using. The row highlighted in orange, a multipronged MAT training for all Virginia physicians, is the alternative that I recommend.

Alternatives	Evaluative Criteria			
	Cost	**Cost-effectiveness**	**Geographic equity (Gini coefficient)**	**Administrative feasibility**
MAT curriculum change in all medical schools	$9.5 million	$1500 per doctor	0.558	Medium
MAT curriculum piloted at UVA then expanded	$5.9 million	$1500 per doctor	0.653	Medium
Multipronged MAT training for all Virginia physicians	**$3.7 million**	**$720 per doctor**	**0.155**	**High**
Naloxone expansion	$60 million	Indeterminate	Indeterminate	Low
Evaluation of existing programs then implementations	$60.6 million	$6300 per doctor	0.374	Medium
Let present trends continue	$2.2 million	$720 per doctor	0.727	Low

Source: Author

Recommendation

I recommend that the Virginia Department of Health Injury and Violence Prevention Program implement Alternative 3:

Introduce and promote a multipronged MAT training program that is available to medical school students and practicing physicians throughout the Commonwealth.

On the criterion of cost, only one alternative costs less than the multipronged MAT training program. The multipronged training program costs $3.7 million over ten years. By comparison, the average cost of the other alternatives over ten years is $23.65 million. When calculating the cost of the recommended alternative, I conducted a sensitivity analysis in case the participation rate in the program differs from my estimate. Even at the upper bound, the cost of the multipronged MAT training over the course of ten years would be $5.5 million, still significantly less than the average of the other alternatives.

There are also no alternatives that are more cost-effective than the multipronged MAT training. For every additional doctor prescribing MAT under the recommended alternative, the cost will be $720. By comparison, the average cost-effectiveness of the other alternatives is $2,150 per doctor prescribing MAT. My sensitivity analysis calculations showed that the recommended alternative could result in as many as 724 doctors obtaining MAT prescription waivers per year, which would be one of the highest rates of any state in the country. Even a more conservative estimate shows that an additional 367 physicians would obtain MAT waivers per year, a significant increase over Virginia's current level of physicians obtaining waivers.

The recommended alternative is the most geographically equitable as well: the Gini coefficient associated with the multipronged MAT training program's effect on the distribution of doctors prescribing MAT is 0.155. By comparison, the average Gini coefficient of the other alternatives is 0.493, reflecting a much higher degree of concentration of physicians in particular areas, leaving other parts of the Commonwealth underserved and undersupplied with MAT. The recommended alternative will do the most to equip physicians in the localities most severely affected by the opioid crisis with the waivers they need to prescribe MAT and reduce opioid use and overdose death rates.

Finally, the recommended alternative is the only alternative with an administrative feasibility score of "high." In the next section, I will discuss the implementation of the multipronged MAT training program in greater depth. Because the core features of the recommended alternative are expansions of existing programs, the alternative is the most administratively feasible.

I believe that other alternatives have merit. However, acknowledging the bandwidth constraint facing the Virginia Department of Health Injury and Violence Prevention Program, the Program should select one alternative only. Based on the criteria that I used to evaluate the alternatives, the alternative that the Program should select is introducing and promoting a multipronged MAT training program. In the next section, I will describe how the Program can implement the recommended alternative most effectively.

Implementation Considerations

If the Virginia Department of Health Injury and Violence Prevention Program chooses to implement the alternative recommended above, there are several implementation components to consider: the online training, the in-person trainings, and the promotion of the trainings so that doctors and medical students participate.

First, to introduce the online trainings, the Injury and Violence Prevention Program can use the trainings that already exist and are certified by SAMHSA as sufficient for obtaining an MAT waiver. These online trainings come from the American Academy of Addiciton Psychiatry, the American Society of Addiction Medicine, and the Providers' Clinical Support System for Medication Assisted Treatment. The Injury and Violence Prevention Program therefore does not need to develop any online trainings to implement the recommended alternative.

The Program also does not need to develop the curriculum or structure of in-person MAT trainings: all three of the SAMHSA-recognized online training providers also offer in-person trainings. The Program can collaborate with these organizations to use their curriculum and structure for in-person trainings. The in-person trainings are taught by currently practicing physicians who already have MAT prescription waivers. In calculating the cost and cost-effectiveness of the recommended alternative, I accounted for the participation of Virginia physicians who already have MAT prescription waivers in leading the trainings. Because in-person trainings have been offered in Virginia in the past, the Injury and Violence Prevention Program can reach out to the physicians who have led past trainings to lead new ones and recommend colleagues who can lead trainings as well.

The Program should be strategic in where it locates in-person trainings. First, because the Program emphasizes geographic equity and addressing MAT supply gaps in areas hit the hardest by the opioid crisis, in-person trainings should be held in the ten localities with the highest opioid fatal overdose rates in the Commonwealth: Dickenson County, Buchanan County, Wise County, Tazewell County, Russell County, Pulaski County, Winchester City, Richmond City, Warren County, and Fredericksburg City (Virginia Department of Health, 2019). Additionally, because the Injury and Violence Prevention Program wanted to assess the possibility of incorporating MAT prescription training into medical school curricula, the Program should host trainings at each of Virginia's six accredited medical schools: the University of Virginia School of Medicine, Virginia Commonwealth University School of Medicine, Edward Via College of Osteopathic Medicine, Virginia Tech/Carilion School of Medicine, Eastern Virginia Medical School, and Liberty College of Osteopathic Medicine (Virginia Academy of Family Physicians, 2018). The ease of completing a training on campus should attract medical school students, but the openness of the trainings to currently practicing physicians as well will result in the broadest possible participation.

The final component of the effective implementation of the recommended alternative is promoting the trainings to maximize participation. One way that the Program can promote online and in-person trainings is to collaborate with the Virginia Department of Health Professions to include MAT prescription training information in the regular outreach that the Department of Health Professions does with doctors regarding license renewal and other relevant updates (Virginia Board of Medicine, 2019). The Injury and Violence Prevention Program can also provide information about trainings at conferences for physicians. Finally, the Program could ask each of the

Commonwealth's medical schools to disseminate information about trainings to their students via email lists, social media, and other forms of university communications. The effectiveness of the recommended alternative depends on physicians and medical students choosing to participate. Therefore, the Injury and Violence Prevention Program should focus significant attention on promoting the trainings being conducted online and in person.

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Appendix

Appendix I: Background information on the opioid crisis

In the past year, drug overdoses killed more people in the United States (72,000) than the peak yearly death totals for HIV, car crashes, or gun deaths (Sanger-Katz, 2018). As the crisis has intensified, policymakers have struggled to respond effectively. Part of the challenge comes from the multidimensional and interconnected drivers of the epidemic. The most prevalent driver of drug overdoses generally is opioids specifically: around two-thirds of overdose deaths in 2016 involved an opioid (Centers for Disease Control and Prevention, 2018).

The opioid crisis has proliferated across the United States and parts of Virginia have been hit especially hard. In 2017, more than 500 Virginians died from accidental overdoses on prescription opioids (Virginia Department of Health, 2018). To answer questions about how Virginia can prevent accidental overdoses on prescription opioids, the causes of these overdoses must first be understood. A growing body of literature has attempted to answer that question, shedding light on the complex set of factors contributing to the crisis.

Some of the strongest predictors of opioid overdoses are unsurprising: low-income status, unstable housing, interactions with the criminal justice system, recent releases from substance abuse treatment, chronic pain, and various psychological disorders (Schiavon et al., 2018). Still, these factors alone cannot explain the entirety of the increase in overdoses and overdose deaths. There is a need for more links to be established between opioid overdoses and their predictors. New research has found other, less predictable causes, including being Caucasian and using a combination of prescription opioids and heroin, witnessing a friend overdose, having chronic hepatitis virus infection, reporting a higher frequency of buprenorphine treatment episodes, and having a higher frequency of witnessing others overdose (Schiavon et al., 2018).

Appendix II: Medication-assisted treatment information

Medication-assisted treatment (MAT) is a substance use disorder treatment program that combines traditional behavioral therapy with a medication like naltrexone, buprenorphine, or methadone (SAMHSA, 2018). Naltrexone is an opioid antagonist that blocks the "subjective, reinforcing and physiological effects of opioids" and "has no abuse liability" (Jarvis et al., 2016, p. 830). Buprenorphine is an opioid partial agonist that produces similar sensations to opioids, but with weaker effects, to curb dependency while reducing the risk of withdrawal (SAMHSA, 2018). Methadone is currently a clinic-based opioid agonist that changes how the brain and nervous system respond to pain, lessens opiate withdrawal pains, and blocks the euphoric effects of opiates (SAMHSA, 2018).

The effectiveness of MAT has been proven across a variety of studies (Saloner & Barry, 2018). The World Health Organization has concluded that MAT is, "the most effective regimen for reducing drug use and is effective in reducing overdose rates, HIV transmission, and criminal activity, while increasing treatment retention" (Sharp et al., 2018, p. 642). Studies have confirmed that MAT is effective even for individuals with substance use disorders and co-occurring mental health challenges like PTSD (Saunders et al., 2015).

Appendix III: MAT prescription rates

McCance-Katz and fellow authors, who are the most prominent scholars on the issue of MAT training, found that even when physicians obtain a waiver for MAT, many still do not prescribe the drugs. Of the 61,610 waivered physicians in the United States, less than half offer MAT to patients because of concerns about potential unintended consequences of MAT for patients with co-occuring mental illnesses or other substance use disorders, liability concerns, and lingering stigma surrounding the use of drugs to treat opioid use disorders (SAMHSA, 2019; McCance-Katz et al., 2017). It should be noted that these findings were based on surveys with doctors conducted in 2016. In subsequent years, the opioid crisis has become an increasingly visible public health crisis and it is possible that doctors with MAT waivers are now prescribing the medications at a higher rate as a result. However, no additional surveys have been conducted, so we currently must rely on the 2016 figure.

Appendix IV: Medicaid expansion and other ways to increase access to MAT in Virginia

The question of how to expand access to MAT is the central issue that the Injury and Violence Prevention Program at the Virginia Department of Health is addressing. One way to increase access to MAT would be to promote broader access to Medicaid. Virginia's recent vote to expand Medicaid in the Commonwealth will increase MAT access. Up to one-third of Virginians who currently lack reliable MAT access cite lack of insurance as the primary barrier (Sharp et al., 2018). Medicaid is an effective antidote: it currently covers nearly one-fifth of all MAT expenses in the United States, a proportion that is rapidly rising (Sharp et al., 2018).

One concern with Medicaid expansion is the fear that it would also lead to an increase in opioid prescriptions. However, a difference-in-differences analysis found that states that did and did not expand Medicaid had similar growth in opioid prescription rates per Medicaid enrollee after the Affordable Care Act Medicaid expansions were implemented (Sharp et al., 2018). At the same time, Medicaid-reimbursed MAT increased significantly more in states that expanded Medicaid than in states that rejected expansion (Sharp et al., 2018). These results suggest that if expanding access to MAT is a policy goal – and the evidence on MAT's effectiveness would suggest that it should be – then Virginia's Medicaid expansion will be a positive step in addressing the opioid crisis in the Commonwealth.

In addition to Medicaid expansion, a valuable step in reducing opioid overdose rates is to improve in-patient treatment centers. One shortcoming of most existing treatment centers is that they have inadequate responses for patients with co-occurring disorders (CODs). For example, as many as 74 percent of patients in substance abuse treatment centers for drug or alcohol abuse are also experiencing at least one psychiatric disorder (Chan, Dennis, & Funk, 2008). However, as few as 15 percent of patients admitted for a substance use disorder also receive the treatment they need for their psychiatric condition (Chan, Godley, Godley, & Dennis, 2009). When treatment centers neglect to address co-occurring psychiatric conditions when treating patients with substance use disorders, those patients have worse outcomes after discharge, including a "higher likelihood of relapse, earlier return to substance use, and a more persistent course of substance involvement" (Godley, Smith, Passetti, & Subramaniam, 2014).

There are multiple reasons why in-patient substance use disorder treatment centers are failing to provide adequate care for the psychiatric conditions seen in their patients. First, there is a general lack of formal assessment practices for CODs that would guarantee that treatment centers are aware of psychiatric conditions in their patients (Lichtenstein, Spirito, & Zimmermann, 2010). Other potential factors include a lack of treatment protocols to address CODs and the fragmentations that exist between substance use and mental health treatment systems (Lichtenstein, Spirito, & Zimmermann, 2010; Godley, Smith, Passetti, & Subramaniam, 2014). Substance use and mental health treatment systems are disjointed because they often have "separate funding mechanisms and different expectations for staff educational backgrounds, training experiences, and licensing requirements" (Godley, Smith, Passetti, & Subramaniam, 2014).

To address this issue and improve the quality of in-patient treatment centers, the most important step is to increase collaboration and coordination between substance use and mental health treatment systems (Godley, Smith, Passetti, & Subramaniam, 2014). Integrated care programs have been proven to lead to greater decreases in substance use rates for patients with CODs (Godley, Smith, Passetti, & Subramaniam, 2014). To reduce the number of opioid overdoses overall, an important group to focus on is people who have already been diagnosed with opioid addictions

and are therefore at a higher risk of future overdoses. To improve the quality of the treatment they receive, in-patient care should promote deeper integration with mental health systems for patients with CODs.

Appendix V: Number of Virginia physicians obtaining MAT waivers per year, 2002-2018

Year	Ceritified physicians obtaining MAT waivers
2002	29
2003	22
2004	20
2005	56
2006	40
2007	106
2008	59
2009	49
2010	58
2011	51
2012	74
2013	95
2014	87
2015	110
2016	127
2017	260
2018	276

Source: SAMHSA, 2019

Appendix VI: Cost projection methods and estimates

Alternative 1: Implement an MAT training program in the curricula of all Virginia medical schools based on the Rhode Island model

To estimate the cost of the first policy alternative, I started by finding the the average number of contact hours (hours during which students receive active instruction) per year for a student in medical school: 777.6 (Association of American Medical Colleges, 2019). Next, I found the cost of one year of medical school in the Commonwealth, which is $48,416 at the University of Virginia (University of Virginia School of Medicine, 2019). Then, I used the number of hours of contact for the Rhode Island training program (24) to find the proportion of the overall year of medical school instruction that would need to be devoted to implementing an MAT training in Virginia's medical schools: 24 hours out of 777.6 is 3.09 percent of the overall hours. Assuming that all hours contribute equally to the overall cost of medical school education, I then calculated 3.09 percent of the overall $48,416 cost for one year of medical school: $1,494.32. Therefore, the cost of the MAT training per student per year is $1,492.32. Then, I calculated the total number of students per class across the six medical schools using each medical school's admissions data, which added up to 634 students. I then multiplied the $1,492.32 cost per student per year by 634 students to come up with a total cost of $947,398.88 per year.

Over the course of ten years, this policy alternative would then cost $9,473,988.80, which is the number rounded to $9.5 million listed in the section on Alternative 1. I also discounted this total at 3 percent and 7 percent rates. At a discounting rate of 3 percent, Alternative 1 will cost $8,081,504.61 over ten years and at a rate of 7 percent, the alternative will cost $6,654,133.29 over ten years.

Alternative 2: Pilot an MAT training model in the curriculum of one Virginia medical school based on the Rhode Island model

To estimate the total cost of the second policy alternative, I relied on similar data to Alternative 1. The estimated cost of MAT training per student is the same. However, because the pilot is being introduced at the University of Virginia School of Medicine for the first five years of implementation, there will only be 156 students matriculating through the program. Therefore, the cost of Alternative 2 over the first five years is $1,492.32 per student per year for 156 students, which is $233,113.92 per year. If the pilot is successful and the program is expanded to every Virginia medical school for the next five years, then there will be 634 students completing the program per year. The cost of Alternative 2 over the second five years is $1,492.32 per student per year for 634 students, for a total of $947,398.99 per year.

The cumulative cost over the first five years is $1,165,669.50 and the cumulative cost over the second five years is $4,736,994.95 for a ten-year total of $5,902,664.55. This total is presented as a rounded estimate of $5.9 million in the section on Alternative 2. I also discounted this total at 3 percent and 7 percent rates. At a discounting rate of 3 percent, Alternative 2 will cost $4,810,288.65 over ten years and at a rate of 7 percent, the alternative will cost $3,725,423.92 over ten years.

Alternative 3: Introduce and promote a multipronged MAT training program that is available to medical school students and practicing physicians throughout the Commonwealth

Alternative 3 includes three components: the online training, the in-person training, and the promotion of the trainings to Virginia physicians. I estimate that two of those components, the

online training and promotional efforts, will have negligible costs. The online trainings already exist and the Virginia Department of Health Professions already sends out regular information to Virginia physicians, to which the MAT promotion can be easily added.

Therefore, the cost of Alternative 3 comes from the administration of in-person trainings and the cost of doctors completing MAT trainings. To calculate these costs, I started by finding that as of 2016, the most recent year of available data, there are 25,060 practicing physicians in Virginia (Brown & Hahn, 2017). Because Alternative 3 also includes trainings at each of Virginia's six medical schools, I added the number of medical students per class (634) to the number of currently practicing physicians to determine that there are 25,694 physicians who are eligible to complete MAT training programs each year in Virginia.

However, I then needed to subtract the number of Virginia doctors who already have the waiver and therefore would not complete another waiver training. There are not data on the specific number of Virginia physicians with MAT waivers. However, there are currently 990,688 active physicians in the United States and 61,610 physicians with a waiver to prescribe MAT (Kaiser Family Foundation, 2018; SAMHSA, 2019). At this rate of 6.22 percent of physicians with waivers, Virginia would have 1,559 physicians with waivers. Subtracting these 1,559 physicians from the 25,694 eligible physicians, I found that 24,135 physicians could complete the MAT waiver training every year in the Commonwealth.

The next calculation I needed to make was the percentage of the 24,135 eligible physicians that I could expect to complete the training. This calculation is critical to the overall cost projection because slight variations in the number of physicians expected to complete the training would have significant implications for overall cost projections. Therefore, I completed a sensitivity analysis to account for different possible participation rates.

The first rate that I calculated for the sensitivity analysis was the most conservative estimate, which assumes that physicians will participate in the MAT trainings at the same rate that a constant trajectory of participation would imply. In other words, this rate would represent a scenario in which Alternative 3 is entirely unsuccessful and does not alter the number of physicians who would have otherwise obtained trainings. In 2018, the most recent year of available data, 276 Virginia physicians obtained MAT waivers. Of the 24,135 eligible physicians, the percentage of doctors obtaining waivers annually is 1.14 percent. The 276 Virginia physicians who obtained MAT waivers in 2018 represented a 6.2 percent rate of increase in the number of waivers obtained from 2017 (SAMHSA, 2019). Therefore, if there is another 6.2 percent rate of increase on 1.14 percent participation rate, then 1.21 percent of Virginia physicians would be participating in MAT training programs. 1.21 percent of the 24,135 physicians would mean that 292 physicians are completing the MAT training per year.

For the other participation rates in my sensitivity analysis, I used case studies of other states that emphasized expanding access to MAT training: Washington State and Arizona. Washington State implemented a hybrid online and in-person training program that contributed to a 33.5 percent increase in new MAT prescription waivers from 2017 to 2018 (Corbridge, 2018; SAMHSA, 2019). Arizona implemented a similar program on an even greater scale that achieved an 85.6 percent increase in new MAT prescription waivers from 2017 to 2018 (ASU Center for Applied Behavioral Health Policy, 2018; SAHMHSA, 2019).

If Alternative 3 has the same effect on MAT training participation rates as Washingon State's program, then the 1.14 participation rate would increase by 33.5 percent to 1.52 percent of Virginia doctors completing the training. 1.52 percent of the 24,135 eligible physicians represents 367 physicians completing the training.

If Alternative 3 has the same effect on MAT training participation rates as Arizona's program, then the 1.14 percent participation rate would increase by 85.6 percent to 2.12 percent of Virginia doctors completing the training. 2.12 percent of the 24,135 eligible physicians represents 512 physicians completing the training. Based on the amont of emphasis that the Virginia Department of Health is placing on the issue of opioid misuse, and given the focus that the Injury and Violence Prevention Program is directing to expanding MAT access, I believe that using Arizona as a model for Virginia's program is most appropriate. Therefore, I used the estimate of 512 physicians completing the training as the basis for the overall cost estimate that I listed in the section for Alternative 3 and in other evaluations of the alternatives.

However, the Injury and Violence Prevention Program should be aware of the upper bound of potential costs as well. To develop an upper bound estimate, I calculated the costs associated with 3 percent of physicians completing the MAT training. The 3 percent participation rate would constitute a 263 percent increase in participation. If 3 percent of the 24,135 elibible physicians complete the training, 724 Virginia doctors would be participating. To summarize:

Participation Rate	**Reasoning**	**Number of physicians completing MAT training per year**
1.21 percent	Constant rate of increase from 2017-2018	292
1.52 percent	Washington State rate of increase	367
2.12 percent	Arizona rate of increase	512
3 percent	Upper bound estimate	724

The estimated numbers of physicians completing the trainings do not include the number of physicians needed to administer in-person trainings. Assuming that trainings require one physician leading the training for every 25 participants, I divided the total number of people completing MAT trainings under each of the four participation rates by 25 to determine the number of physicians required to administer the trainings. I then added the number of training leaders to the number of participants for each participation rate to determine the total number of physicians involved in the trainings at each of the four rates:

Participation Rate	Number of physicians completing MAT training	Number of physicians needed to lead trainings	Total number of physicians involved in training per year
1.21 percent	292	12	304
1.52 percent	367	15	382
2.12 percent	512	20	532
3 percent	724	29	753

Next, I found the median hourly wage rate for general practitioners in Virginia, which is $90.26 (Bureau of Labor Statistics, 2018). To obtain an MAT waiver, SAMHSA requires eight hours of training. Therefore, at a wage rate of $90.26 per hour over eight hours, the cost of Alternative 3 is $722.08 per doctor per training. I then multiplied $722.08 by the number of physicians involved in MAT trainings at each of the four participation rate levels to determine the annual cost of Alternative 3. At the 2.12 participation rate level, the annual cost of Alternative 3 is $369,704.96. Over ten years, Alternative 3 will cost $3,697,049.60, which is the source of the $3.7 million cost estimate listed in the section for Alternative 3. I then discounted the ten-year costs at 3 percent and 7 percent rates:

Participation Rate	Annual Cost	10-Year Total Cost	10-Year Total Cost, 3% Discount Rate	10-Year Total Cost, 7% Discount Rate
1.21 percent	$219,512.32	$2,195,123.20	$1,872,484.61	$1,541,762.68
1.52 percent	$275,834.56	$2,758,345.60	$2,352,924.75	$1,937,346.52
2.12 percent	$369,704.96	$3,697,049.60	$3,153,658.30	$2,596,652.93
3 percent	$543,726.24	$5,437,262.40	$4,638,095.11	$3,818,905.58

Alternative 4: Expand access to naloxone by increasing the supply of naloxone in health care facilities, introducing trainings and public awareness campaigns for citizens to administer naloxone, and advocating for laws to protect Good Samaritans

To estimate the projected cost of Alternative 4, I relied on information from Pennsylvania's naloxone expansion, which serves as the model for Alternative 4. Pennsylvania's naloxone expansion made 60,000 kits available, distributed through first responders in every county of their state (Hutcheson, 2017). The Pennsylvania program was implemented in 2017 and cost $5 million at the time (Hutcheson, 2017). In the year since, the opioid overdose death rate increased 16.9 percent

in Pennsylvania (CDC National Center for Health Statistics, 2019). Therefore, I assumed that if Pennsylvania implemented their naloxone expansion now and increased the program proportionally to the growth of the opioid crisis in their state, the overall price would be $5,845,000 (a 16.9 percent increase from the $5 million they spent in the previous year). I then converted the $5,845,000 cost to 2018 U.S. dollars, which is $5,987,758.82, to find the annual cost of the naloxone expansion.

Over the course of ten years, this policy alternative would cost $59,877,582.82, which is the number rounded to $60 million listed in the section on Alternative 4. I also discounted this total at 3 percent and 7 percent rates. At a discounting rate of 3 percent, Alternative 4 will cost $51,076,797.27 over ten years and at a rate of 7 percent, the alternative will cost $42,055,512.32 over ten years.

Alternative 5: Launch an MAT evaluation focused on assessing the landscape and effectiveness of Rhode Island's training program, existing MAT training programs for practicing physicians, and the effects of naloxone access in Virginia

Alternative 5 begins with a two-year evaluation window in which no new programs will be introduced. Therefore, the only cost will be the salary of the full-time staffer tasked with completing the research. The salary of a Virginia Department of Health policy specialist is approximately $40,000 per year (Richmond Times-Dispatch, 2018). Therefore, the cost of Alternative 5 over the course of the two years of evaluation will be $80,000. The ten-year cost of the alternative will depend on which of the measured programs are ultimately implemented in Virginia. If the medical school curriculum adjustment is implemented in all six Virginia medical schools for eight years at a cost of $947,398.88 per year, the total cost will be $7,579,191.04. If the MAT training program for all doctors is implemented for eight years at a cost of $369,704.96 per year, the total cost will be $2,957,639.68. If the naloxone expansion is implemented for eight years at a cost of $5,987,758.82 per year, the total cost will be $47,902,070.60.

If all three programs are implemented for eight years, in addition to the two-year evaluation cost, the total ten-year cost will be $58,518,901.30. I also discounted this total at 3 percent and 7 percent rates. At a discounting rate of 3 percent, Alternative 5 will cost $48,487,404.43 over ten years and at a rate of 7 percent, the alternative will cost $38,243,615.59 over ten years.

Alternative 6: Let present trends continue

To project the costs of Alternative 6, I used the numbers of Virginia physicians obtaining waivers over the course of the past two years. In 2018, 276 Virginia doctors obtained MAT waivers, 1.14 percent of the overall number of physicians who could have obtained the waivers. The percentage increase in the number of MAT waivers issued in Virginia from 2017 to 2018 was 6.2 percent. Therefore, assuming that if the Injury and Violence Prevention Program allows present trends to continue and there is another 6.2 percent increase in the proportion of Virginia physicians obtaining waivers, then 1.21 percent of eligible physicians would obtain MAT waivers in the coming year, representing 292 physicians total. With 25 physicians per training, 12 additional physicians would be required to lead the trainings. Therefore, the total number of physicians involved in MAT trainings per year for Alternative 6 is 304. With eight hours of training and a general practioner median wage rate of $90.26 per hour, the cost per doctor per training is $722.08. The annual cost of 304 physicians participating in MAT training per year at a cost of $722.08 per physician per training will be $219,512.32.

Over the course of ten years, this policy alternative would cost $2,195,123.20, rounded to $2.2 million in the section on Alternative 6. I also discounted this total at 3 percent and 7 percent rates. At a discounting rate of 3 percent, Alternative 6 will cost $1,872,484.61 over ten years and at a rate of 7 percent, the alternative will cost $1,541,762.68 over ten years.

Like Alternative 3, the cost estimates of Alternative 6 depend heavily on assumptions about the participation rates in MAT training programs. I assumed that participation rates would increase at a constant rate if the Injury and Violence Prevention Program were to let present trends continue. However, it is also possible that participation rates could fall, or rise more quickly. Therefore, I conducted sensitivity analyses for participation rates of 1.11 percent (0.1 percentage points less than the 2018 participation rate) and 1.31 percent (0.1 percentage points more than the 2018 participation rate). The cost estimates of the sensitivity analysis are:

Participation Rate	Number of physicians participating	Annual Cost	10-Year Total Cost	10-Year Total Cost, 3% Discount Rate	10-Year Total Cost, 7% Discount Rate
1.11 percent	279	$201,460.32	$2,014,603.20	$1,718,497.39	$1,414,972.98
1.21 percent	304	$219,512.32	$2,195,123.20	$1,872,484.61	$1,541,762.68
1.31 percent	329	$237,564.32	$2,375,643.20	$2,026,471.84	$1,668,552.37

Appendix VII: Effectiveness projection methods and estimates

Alternative 1: Implement an MAT training program in the curricula of all Virginia medical schools based on the Rhode Island model

To calculate cost-effectiveness, I took the total projected cost of the alternative over ten years and divided it by the number of Virginia physicians projected to obtain MAT waivers under that alternative in the ten-year window. The total cost of Alternative 1 (as shown in Appendix VI) is $9,473,988.80 over ten years. There are 6,340 physicians expected to obtain MAT waivers over the course of the ten years (634 per year, as shown in Appendix VI). Therefore, the cost-effectiveness of Alternative 1 is $1,494.32 per doctor obtaining an MAT prescription waiver.

Alternative 2: Pilot an MAT training model in the curriculum of one Virginia medical school based on the Rhode Island model

The total cost of Alternative 2 (as shown in Appendix VI) is $5,902,664.55. There are 780 physicians expected to obtain MAT waivers over the course of the first five years (156 per year, as shown in Appendix VI) and 3,170 over the course of the final five years (634 per year, as shown in Appendix VI). In total, there will be 3,950 physicians projected to obtain MAT waivers over the course of ten years. Therefore, the cost-effectiveness of Alternative 2 is $1,494.32 per doctor obtaining an MAT prescription waiver.

Alternative 3: Introduce and promote a multipronged MAT training program that is available to medical school students and practicing physicians throughout the Commonwealth

The total cost of Alternative 3 (as shown in Appendix VI) is $3,697,049.60. There are 5,120 physicians expected to obtain MAT waivers over the course of the ten years (512 per year, as shown in Appendix VI). Therefore, the cost-effectiveness of Alternative 3 is $722.08 per doctor obtaining an MAT prescription waiver.

Alternative 4: Expand access to naloxone by increasing the supply of naloxone in health care facilities, introducing trainings and public awareness campaigns for citizens to administer naloxone, and advocating for laws to protect Good Samaritans

The measurement of effectiveness that I am using to evaluate the different policy alternatives is the additional number of physicians obtaining MAT waivers. Because Alternative 4 promotes naloxone access, the cost-effectiveness of the policy is indeterminate on the metric that I am using since expanding access to naloxone will have a cost, but will not explicitly add to the number of physicians obtaining MAT waivers. However, I discuss the overall cost-effectiveness of naloxone in the section on Alternative 4.

Alternative 5: Launch an MAT evaluation focused on assessing the landscape and effectiveness of Rhode Island's training program, existing MAT training programs for practicing physicians, and the effects of naloxone access in Virginia

Alternative 5 calls for a two-year evaluation period of several different programs. During those two years, no new MAT waivers will be issued as a result of the alternative, so there is no cost-effectiveness metric to measure. However, if all three programs being evaluated are implemented over the course of the final eight years of the policy, then the total ten-year cost will be $58,518,901.30 (as shown in Appendix VI). With eights years of medical school curricula changes,

there will be 5,072 additional physicians with MAT prescription waivers. With eight years of MAT training for all Virginia doctors, there will be 4,256 additional physicians with MAT prescription waivers. There will be no additional physicians prescribing MAT as a result of the naloxone expansion. In total, there will be 9,328 additional physicians prescribing MAT (as shown in Appendix VI). Therefore, the cost-effectiveness of Alternative 5 is $6,273.47 per doctor obtaining an MAT prescription waiver.

Alternative 6: Let present trends continue

The total cost of Alternative 6 (as shown in Appendix VI) is $9,473,988.80 over ten years. There are 2,920 physicians expected to obtain MAT waivers over the course of the ten years (292 per year, as shown in Appendix VI). Therefore, the cost-effectiveness of Alternative 6 is $722.08 per doctor obtaining an MAT prescription waiver.

Figure 9: Summary of each alternative's cost-effectiveness

Alternative	Cost per additional doctor obtaining an MAT prescription waiver
MAT curriculum change in all medical schools	$1,494.32
MAT curriculum piloted at UVA then expanded	$1,494.32
Multipronged MAT training for all Virginia physicians	$722.08
Naloxone expansion	Indeterminate
Evaluation of existing programs then implementations	$6,273.47
Let present trends continue	$722.08

Source: Author

Appendix VIII: Geographic equity measurements

To measure geographic equity, I used a Gini coefficient, which is a common distribution measurement statistic that ranges from zero to one. The higher the coefficient, the more uneven the distribution. The Gini coefficient is most commonly used to measure income distribution across society. In that context, a Gini coefficient of one would represent a society in which one person has all of the income. The closer the coefficient is to zero, the closer the distribution is to everyone having the same income.

I decided to apply the same concept to measure how each policy alternative would be projected to affect the geographic distribution of physicians with newly obtained MAT prescription waivers. For each alternative, I projected the number of physicians with newly obtained MAT waivers in each of Virginia's 134 localities included in Department of Health data. Then, I ranked the localities by their drug overdose mortality rates. From the 134 ranked localities, I grouped them into ten deciles of appoximately 13 localities per decile. Then, I added up the number of physicians with newly obtained MAT waivers in each locality for a given decile. Finally, I calculated the Gini coefficient for each policy alternative using the number of physicians with newly obtained MAT waivers per decile.

Alternative 1: Implement an MAT training program in the curricula of all Virginia medical schools based on the Rhode Island model

To project the number of physicians with newly obtained MAT waivers in each locality for Alternative 1, I used information from Virginia's medical schools about residency placement. I used residency placement as a proxy for where the medical students would ultimately practice, which would allow me to calculate the number of physicians with MAT waivers per locality. Approximately half of Virginia medical students stay in Virginia to complete their residencies, which can be in every part of the Commonwealth. Ultimately, after totaling the number per decile, I calculated the Gini coefficient for Alternative 1 to be 0.558.

Alternative 2: Pilot an MAT training model in the curriculum of one Virginia medical school based on the Rhode Island model

My method to calculate the Gini coefficient for Alternative 2 was similar to Alternative 1. However, since the first five years of the policy only involve students at the University of Virginia School of Medicine, I exclusively used residency placements from the University of Virginia for the first five-year period. I calculated a Gini coefficient for those five years, which was 0.748, then used the 0.558 coefficient for the second five-year period, which includes all Virginia medical schools. Then, I averaged the Gini coefficients between the two five-year periods. The final Gini coefficient for Alternative 2 is 0.653.

Alternative 3: Introduce and promote a multipronged MAT training program that is available to medical school students and practicing physicians throughout the Commonwealth

To calculate the Gini coefficient for Alternative 3, I started with an assumption that because the online MAT trainings are available to all Virginia physicians, the participation rate would be proportional to the percentage of Virginia physicians in each locality. For example, if 100 physicians are projected to complete the online training, and 4 percent of current Virginia physicians practice in Albemarle County, then I would project that there will be 4 physicians obtaining MAT prescription waivers in Albemarle County. I calculated the number of physicians in each locality using data from

County Health Rankings, a Robert Wood Johnson Foundation Project (County Health Rankings, 2019). I then adjusted for the locations of the in-person trainings. Because the in-person trainings are being held at Virginia's medical schools and in the localities with the highest drug overdose morality rates, I doubled the projected number of participants in those localities. I used these numbers to calculate the projected number of physicians with newly obtained MAT prescription waivers in each decile. From there, I found the Gini coefficient for Alternative 3 to be 0.155.

Alternative 4: Expand access to naloxone by increasing the supply of naloxone in health care facilities, introducing trainings and public awareness campaigns for citizens to administer naloxone, and advocating for laws to protect Good Samaritans

I cannot calculate a Gini coefficient for Alternative 4 because the alternative will not lead to any additional physicians prescribing MAT.

Alternative 5: Launch an MAT evaluation focused on assessing the landscape and effectiveness of Rhode Island's training program, existing MAT training programs for practicing physicians, and the effects of naloxone access in Virginia

If the two-year evaluation period in Alternative 5 leads to the implementation of both the medical school curricula changes and the more broadly available MAT trainings, then I will be able to assess the geographic equity of this alternative. The Gini coefficient associated with the medical school curricula change in all six medical schools is 0.558. The Gini coefficient associated with the MAT training programs for all Virginia physicians is 0.155. Under Alternative 5, of the 9,328 new waivers that are projected to be issued, 5,072 are projected to come from the medical school curricula changes and 4,256 are projected to come from the MAT training programs for all Virginia physicians (see Appendix VI). Therefore, of the 9,328 new waivers, 54.37 percent will come from the medical school curricula changes and 45.63 percent will come the MAT training programs for all Virginia physicians. To calculate the overall Gini coefficient for Alternative 5, I multiplied the 0.558 Gini coefficient from the medical school curricula changes by 0.5437 (the percentage of new waivers coming from this component of the alternative) and added it to the product of the 0.155 Gini coefficient from the MAT training programs for all Virginia physicians and the percentage of new waivers coming from this component of the alternative (0.4563). The final Gini coefficient for Alternative 5 is 0.374.

Alternative 6: Let present trends continue

To calculate the Gini coefficient for Alternative 6, I used the same method as I used to calculate the Gini coefficient for Alternative 3. However, because no new in-person trainings will be held in particular locations under Alternative 6, I did not make any adjustments to the number of physicians per locality. The final Gini coefficient for Alternative 6 is 0.727.

Appendix IX: Glossary

Buprenorphine: An opioid partial agonist that produces similar sensations to opioids, but with weaker effects, to curb dependency while reducing the risk of withdrawal (SAMHSA, 2018).

Medication-assisted treatment (MAT): A substance use disorder treatment program that combines traditional behavioral therapy with medications like naltrexone, buprenorphine, and methadone (SAMHSA, 2018).

Methadone: A clinic-based opioid agonist that changes how the brain and nervous system respond to pain, lessens opiate withdrawal pains, and blocks the euphoric effects of opiates (SAMHSA, 2018).

Naloxone: An agent that is used immediately after an overdose to prevent the victim from dying, working as an antagonist on the receptors in the brain that are activated by opioid use (Robinson & Wermeling, 2014).

Naltrexone: An opioid antagonist that blocks the "subjective, reinforcing and physiological effects of opioids" and "has no abuse liability" (Jarvis et al., 2016, p. 830).