Tackling Sexual Transmitted Disease Prevalence in the United States

Analysis on the Effectiveness of State-Level Policies to Prevent Sexual Transmitted Diseases (STDs) in Georgia, Maryland, and New York

Team Members:
Ruixin Lou
Emmanuel Ruhamyankaka
Sukhpreet Sahota
Jiaxin Ying

Team Number: 10

Executive Summary

Sexual Transmitted Diseases (STDs) have an imprint on every fabric of human life, dating all the way back to early civilization. Millions of individuals around the world have been diagnosed with at least one form of STDs: “Sexually transmitted infections (STIs) are among the most common infectious diseases reported worldwide. More than one million people are newly infected with STIs per day. In 2016, the World Health Organization (WHO) estimated there were 376 million new infections of four curable STIs” [13]. Like the rest of the globe, in the United States, these viruses and infections are having a significant impact on not only the national economy, but on the entire healthcare system. Therefore, noting that these diseases had been significantly reduced during the 1990s and have made an unfortunate comeback within US society, US medical professionals and government officials are seeking policy changes that can change this recent national trajectory. Through our analysis, we analyzed three states that passed legislation on this topic: Maryland (2015), New York (2016), and Georgia (2017). From our analysis, we found that Georgia’s policy was the most effective as overall STD within the state as well as STD rates for Chlamydia and Gonorrhea experienced declines in the years following its implementation in the state. In addition to the impact on the disease, the Georgia law also benefited communities and demographic categories in which STD cases were most prevalent (Females and Young Adults (13 - 24 year olds)). On the contrary, the policies administered within Maryland and New York were not only ineffective in lowering the STD rates, these states experienced higher rates of STDs after implementation (when compared to states that were determined as respective controls). Below is a holistic overview of this health crisis and our motivation, methods used, considerations and assumptions made, and our findings.

Based on our findings, stakeholders, such as federal and state government officials, medical professionals, or curious readers, such as yourself, designing new policies and recommendations for other states within the union, should model the new legislations on Georgia’s policy and enforcement. It is worth noting that while we believe our analysis is complete, further research into each respective set of reference states is required to ensure they are truly representative of the selected state they act as controls for. In addition, the limitations we experienced should be addressed and the analysis conducted should be further built upon. Therefore, we would highly encourage stakeholders to use our findings as a starting point on this topic.

Introduction

November 7, 1991. This is a date that not only many sports fanatics note in sports history, but the general public remembers as famed basketball icon Earvin “Magic” Johnson stood in front of a podium and stunned the world: “Because of the HIV virus I have attained, I will have to announce my retirement from the Lakers today” [17][22].

In the more than 30 years since this shocking announcement, there has been an increase in raising awareness and understanding of Sexual Transmitted Diseases (STDs, also known as Sexual Transmitted Infections (STIs)). According to the CDC and other prominent medical institutions (such as Pfizer), though there are many types and forms of STDs, the eight most common types are Human Papillomavirus

(HPV), Herpes, Syphilis, Hepatitis, Trichomoniasis, Gonorrhea, Chlamydia, and Human Immunodeficiency Virus (HIV)/Acquired Immunodeficiency Syndrome (AIDS) [9][21].

While there is an increase in awareness campaigns, there is also a harsh reality that these infections are increasing dramatically compared to 20 years ago. According to the 2019 CDC STD Surveillance, "reported cases of chlamydia, gonorrhea, and syphilis have increased for the sixth consecutive year – reaching a new, all-time high. These infections remain common, costly, and challenge the health and wellness of millions of people across the United States. In 2019, U.S. health departments reported 1.8 million cases of chlamydia, an increase of nearly 20 percent since 2015; ~620,000 cases of gonorrhea, an increase of more than 50 percent since 2015; and ~130,000 cases of syphilis (all stages), an increase of more than 70 percent since 2015. Congenital syphilis, an incredibly harmful infection, has increased by a staggering 279 percent since 2015. In 2019 alone, there were nearly 2,000 cases of congenital syphilis reported, including 128 deaths. In addition to infant morbidity and mortality, STIs can also lead to long-term health consequences, like infertility, and they can facilitate HIV transmission…Less than 20 years ago, gonorrhea rates in the U.S. were at historic lows, syphilis was close to elimination, and advances in chlamydia diagnostics made it easier to detect infections. That progress has been lost, due in part to challenges to our public health system" [6][24]. Because of this increasing trend, STDs are once again becoming a more significant threat to society: "Sexually transmitted infections are an enormous, low-priority public health problem. And they've been a low-priority problem for decades, even though they are the most commonly reported infectious disease" [25].

As quoted, in recent years, the United States has seen some of the highest rates of sexually transmitted diseases (STDs) in the developed world, leading to serious health and economic consequences. According to CDC estimates, close to 68 million individuals in the United States (or about 1 in 5 Americans) had STD incidences in 2018 (Appendix Exhibit 1)[5]. In addition, new infections accounted for nearly $16 billion in medical expenses and healthcare costs (Appendix Exhibit 1)[5]. Additional research suggests that this health concern impacts Americans disproportionately: "Social inequity often leads to health inequity and, ultimately, manifests as health disparities. Even when STI rates reached historic lows, disparities have persisted because of the social, cultural, and economic conditions that make it more difficult for sexually active people to stay healthy. And while reported STDs have once again become increasingly common, racial and ethnic minority populations, adolescent and young adults, and gay and bisexual men still bear the brunt of these deeply entrenched social determinants of health" [6]. "Rates are highest in men who have sex with men, among Black and Hispanic Americans and Native Americans. While the rate for women is lower than for men, officials noted that it has been rising more dramatically — up about 50% last year" [24]. Based on these sharp increasing trends and the fact that most STDs are preventable, U.S. health officials and medical professionals are calling for new preventive measures and treatment efforts [5].

In recognizing not only this dire health issue but the need for a domestic resolution, our team set out to better understand and provide a thorough analysis of policies created throughout the 2010s that were aimed at providing reinforcements to the public health system over this matter and slowing the rate of prevalence and transmission of Sexual Transmitted Diseases (STDs). We wanted to understand if these policies had any impact by investigating the causal relationship between the treatment policy and potential benefits for sexual health, with a focus on three notable laws enacted within three states over a three-consecutive year span: Maryland (2015), New York (2016), and Georgia (2017), hereinafter referred to as our Treatment States. While the laws passed within Georgia and Maryland were to forestall increases in both chlamydia and gonorrhea, New York was only geared towards slowing the rate of chlamydia [16][19][23].

With each of these treatment states having recently enacted these policies (within the last 5-7 years), it allowed us to investigate the causal effects of disease-specific policies on sexual health outcomes. Since the policies vary across each state, it would enable us to compare the effectiveness of each policy and identify best practices. Additionally, these three states rank in the top six states with the highest number of STD cases (per 100,000 residents) (Appendix Exhibit 1)[2]. Lastly, since Maryland, New York, and Georgia are geographically and demographically diverse, representing different regions of the United States, we could assert generalizable and relevant conclusions that can be provided as use cases or starting points for federal and other state government officials. As a result of this analysis, we hope that our project can provide valuable insights to be used by respective stakeholders, such as yourself - the reader, into creating effective sexual health policies, ultimately contributing to improving sexual health outcomes and decreases in STDs across the United States.

Data Overview

To investigate the causal relationship between the treatment policy and potential benefits for sexual health, we relied heavily on data collected from the Centers for Disease Control (CDC). Since 1984, the CDC has been at the forefront of data collection and aggregation efforts, analyzing Sexually Transmitted Disease Morbidity Data. Our analysis focused on the prevalence of four main types of STDs: HIV/AIDS, syphilis, chlamydia, and gonorrhea, during the late 2000s through the 2010s (2008 - 2019), with 2020 excluded to avoid any confounding effects of the COVID-19 Pandemic. Additionally, based on the aforementioned research on gender and race and to understand the underlying trends in STDs demographically, we were able to further segment this data by specific age groups, gender, and race/ethnicity from the CDC.

To truly understand the impact of the policies on sexual health and account for any potential influence of external factors, we identified corresponding control states for each treatment state. Specifically, we focused on the following respective states to act as controls for each of the treatment states:

Treatment State	Control States
Maryland	Arizona
	Delaware
	New Jersey
	Ohio
	Pennsylvania
	Virginia

Treatment State	Control States
New York	California
	Florida
	Illinois
	Louisiana
	Texas

Treatment State	Control States
Georgia	Arkansas
	Mississippi
	Missouri
	Nevada
	New Mexico
	North Carolina
	Tennessee

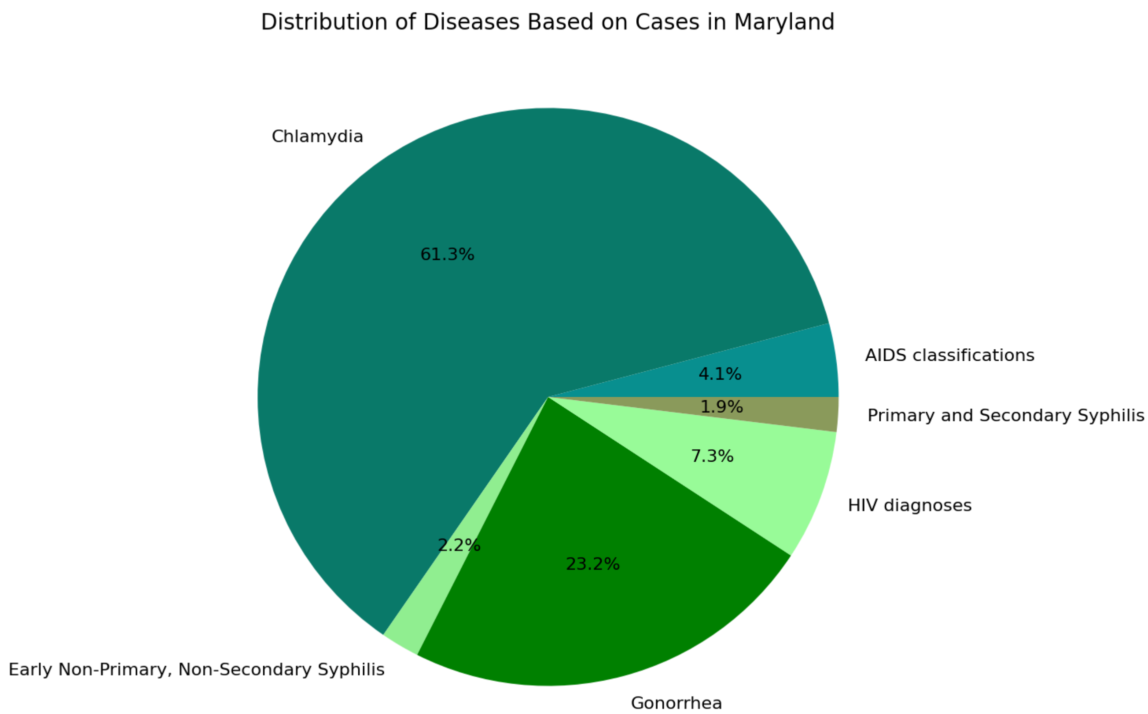
We selected these respective control states because jointly, they represented the intersection of the demographic, geographic, and health and STD attributes of the respective treatment state. Further details on the STD situation within these respective states can be found in Appendix Exhibit 1 (*Summary of STD Cases By State - with alike highlighting for your convenience)*.

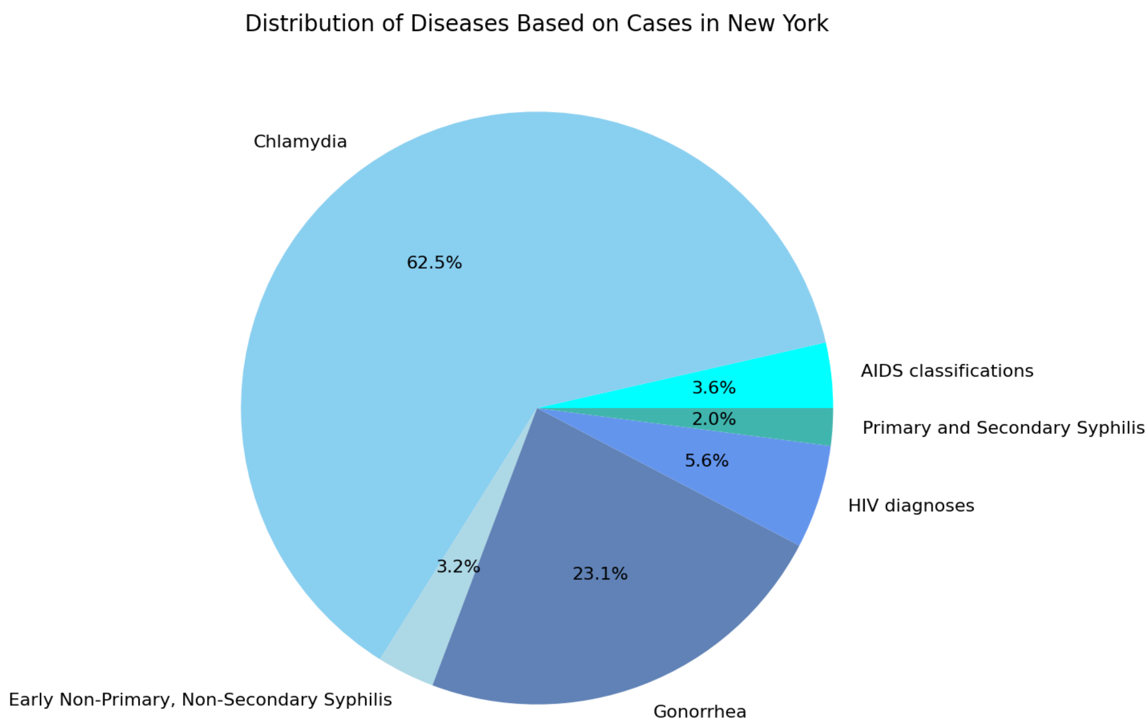
Findings from EDA

Upon cleansing the data collected from the CDC, our exploratory data analysis (EDA) was centered on better understanding and assessing the impact of STDs on different demographic groups. Our research identified the following demographic factors to consider for each of the treatment states:

- Trends and status of STDs by disease types
- Disparities among different racial groups
- Differences in gender
- Variations among different age groups

As mentioned in the introduction, the policies enacted by these respective states were to impede the increase of specific diseases. Our analysis shows that all three treatment states were most impacted by chlamydia cases, with gonorrhea being the second most common STD. This high-level analysis of disease prevalence supports the rationale behind each state's legislation bills as they targeted the most prevalent disease type(s) within each state. The charts below illustrate the prevalence of different STDs in the respective state.


Distribution of Diseases Based on Cases in Maryland
Chlamydia
61.3%
AIDS classifications
4.1%
1.9%
Primary and Secondary Syphilis
7.3%
HIV diagnoses
2.2%
23.2%
Early Non-Primary, Non-Secondary Syphilis
Gonorrhea


Distribution of Diseases Based on Cases in New York
Chlamydia
62.5%
AIDS classifications
3.6%
2.0%
Primary and Secondary Syphilis
5.6%
HIV diagnoses
3.2%
23.1%
Early Non-Primary, Non-Secondary Syphilis
Gonorrhea

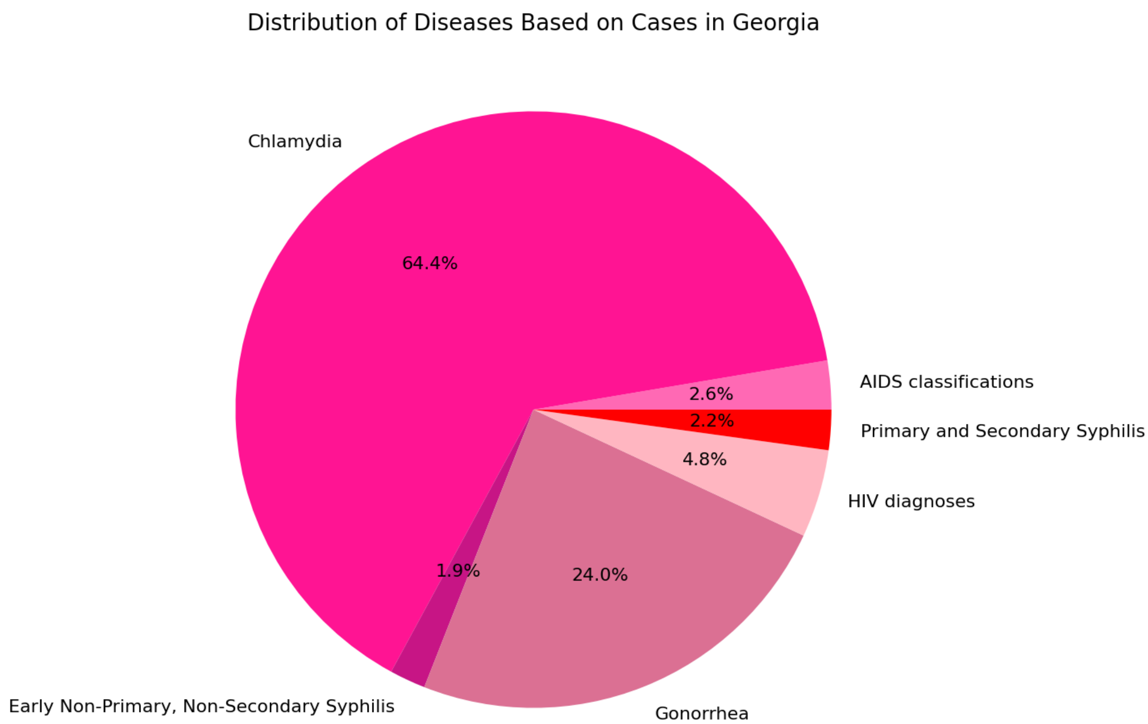


Figure 1: Analysis of Distribution of STD Cases by Disease Type for Treatment States

Through our analysis, we also validated our research as we found adolescent and young adults, blacks/African Americans, and Multiracial were the groups most impacted by STDs in their respective treatment states. The table below summarizes our exploratory data analysis findings, emphasizing the demographic areas most impacted by STDs within each respective treatment state:

	Maryland	New York	Georgia
By Disease Type	Chlamydia	Chlamydia	Chlamydia
By Race	Black/African American	Multiracial	Black/African American
By Gender	Females	Males	Females
By Age Group	13-24 year olds	13-24 year olds	13-24 year olds

Table 1: Demographic groups most impacted by STDs within each respective Treatment State

In the Appendix, we have included graphical representations of the demographic findings from our exploratory data analysis for our respective treatment and control states to provide a more comprehensive understanding of our findings (Appendix Exhibits 3 - 6). These exhibits highlight the patterns observed among various groups in each state and will provide a more holistic view of the impact of STDs on different groups.

Methods

To understand the impact of these policies on STD rates, a linear regression of STD rates (STD cases per 100,000 individuals) was calculated and plotted for each treatment state and examined using a difference-in-difference analysis against its respective control states. As a result of this method, we could compare the linear trend before and after the policy implementation. We then conducted the same linear trend analysis on the control states for each treatment state before comparing both plots. As a result, a difference-in-difference analysis enables us to have a broader, nationwide view of changes in STD trends. Throughout the 2010s, all states in the US experienced an increasing trend based on this difference-in-difference analysis. To determine the effectiveness of the policy within each respective treatment state, this trend would have to demonstrate the opposite after the policy was enacted. Additionally, if the trend and rate of change for the control were similar to the treatment state for both pre-post policy implementations, in that case, it can be inferred that other external factors contributed to the change in trend that occurred nationally rather than just at the state-level.

Based on the specific policy, our exploratory data analysis findings, as well as due to our research, it is also essential to examine the linear trends and conduct a difference-in-difference for not just the overall STD rate within the state but similar to our exploratory data analysis, also at the following levels for each treatment state:

1. The specific diseases the policy was designed to impact
2. The race/ethnicity most impacted with STDs (the one with the highest percentage of STD cases)
3. The gender most impacted with STDs (the one with the highest percentage of STD cases)
4. The age group most impacted by STDs (the one with the highest percentage of STD cases)

The analysis at these levels will contribute to understanding the policy's effectiveness.

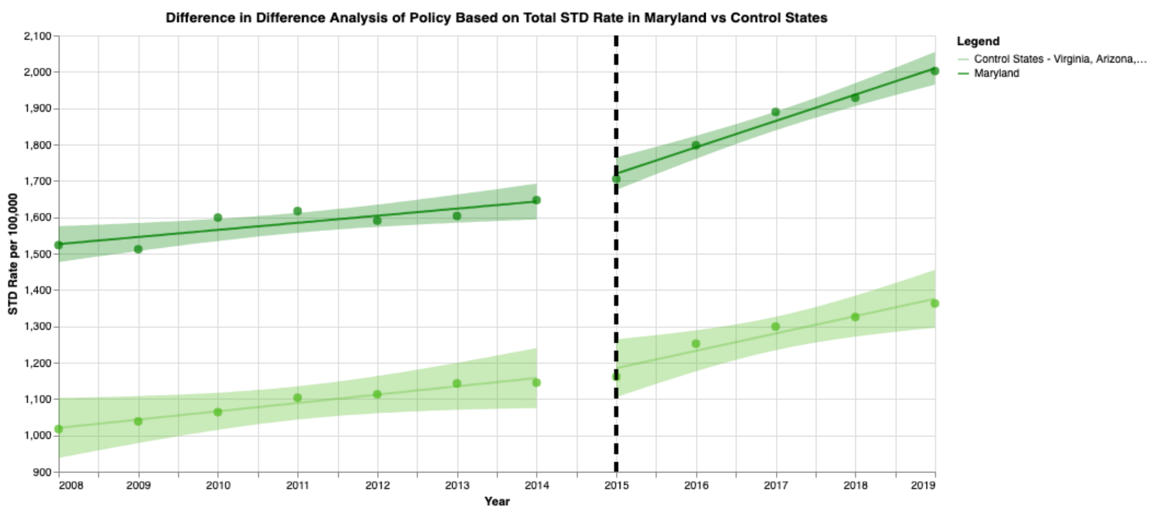
Analysis

As our methodology outlines, our analysis of each treatment state will include two difference-in-difference plots. The first plot will evaluate the overall STD cases (per 100,000 residents), while the second plot will focus on the specific disease level for the STD cases (per 100,000 residents). By assessing the trends at both levels, the plots will help us isolate the effect of the policy interventions and identify the disease types most impacted by the policies.

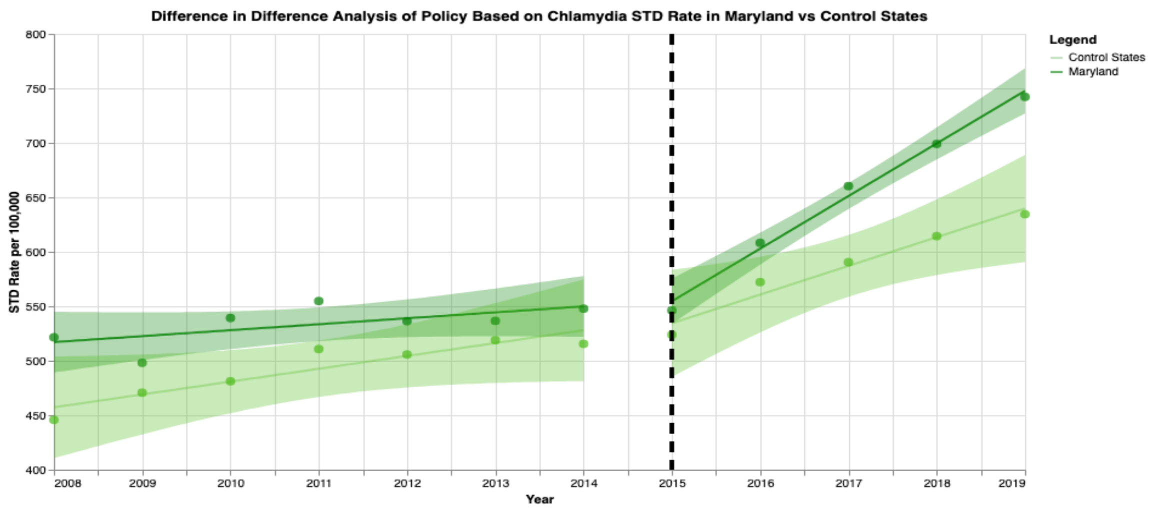
Although it is crucial to examine the impact of the policies on the specific demographics most affected by STDs within the respective treatment state (as shown in Table 1), we are more focused on the impact on the overall STD rate within the respective state, and the rate for the STD disease type most prevalent within the respective states per the legislation passed. Therefore, the difference-in-difference graphs and analysis for each demographic most impacted for the respective state have been included in the Appendix for your convenience (Appendix Exhibit 7 - 9).

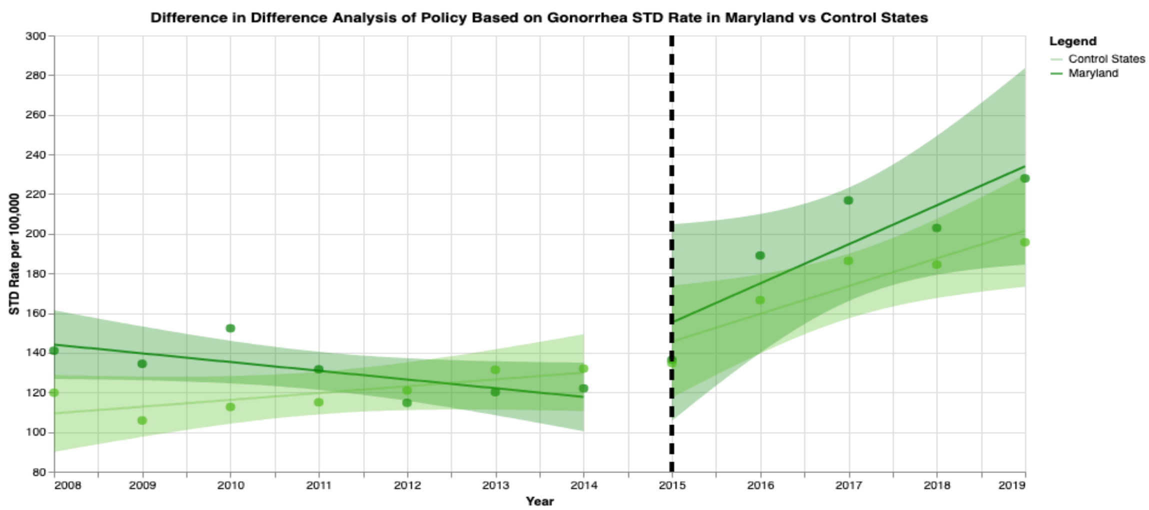
Effect of Policy within Maryland (2015)

In analyzing the overall STD rate within Maryland, as seen in the graph below, prior to the implementation of the policy in 2015, the rate of sexually transmitted diseases (STDs) per 100,000 individuals was on the rise for both Maryland and the control states, including Virginia, Ohio, Pennsylvania, Arizona, New Jersey, and Delaware. The trend was similar for both Maryland and the control states. However, following the policy implementation, Maryland experienced a faster rate of increase in the STD rate per 100,000 individuals, whereas the control states had a relatively slower increase.



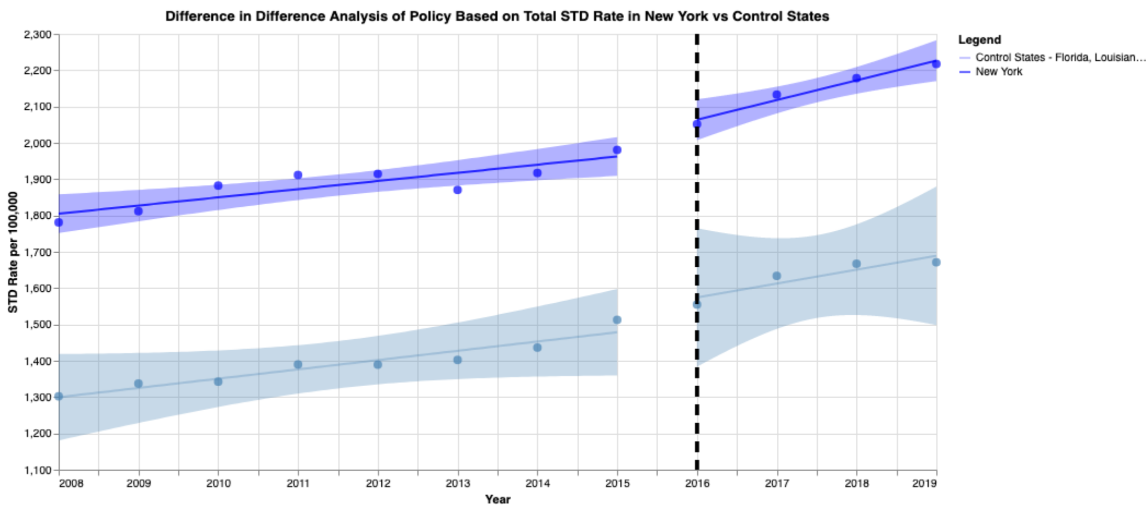
As spotlighted earlier, the law passed in Maryland aimed to decrease the rate of both gonorrhea disease and chlamydia. While analyzing the number of gonorrhea cases before and after the implementation of the policy, the yearly rate of the number of cases appears to follow a similar trend to the overall STD rate highlighted for the state of Georgia and its control states. On the other hand, when observing the trend for chlamydia cases, we discovered a surprising and alarming trend as the rate in the number of chlamydia cases initially decreased while the rate for control states was increasing steadily before the policy was implemented in 2015. However, after the policy was implemented, the state of Georgia not only noticed the opposite effect of what it was seeing before the policy implementation, but the rate of yearly change was steeper than even the control states!



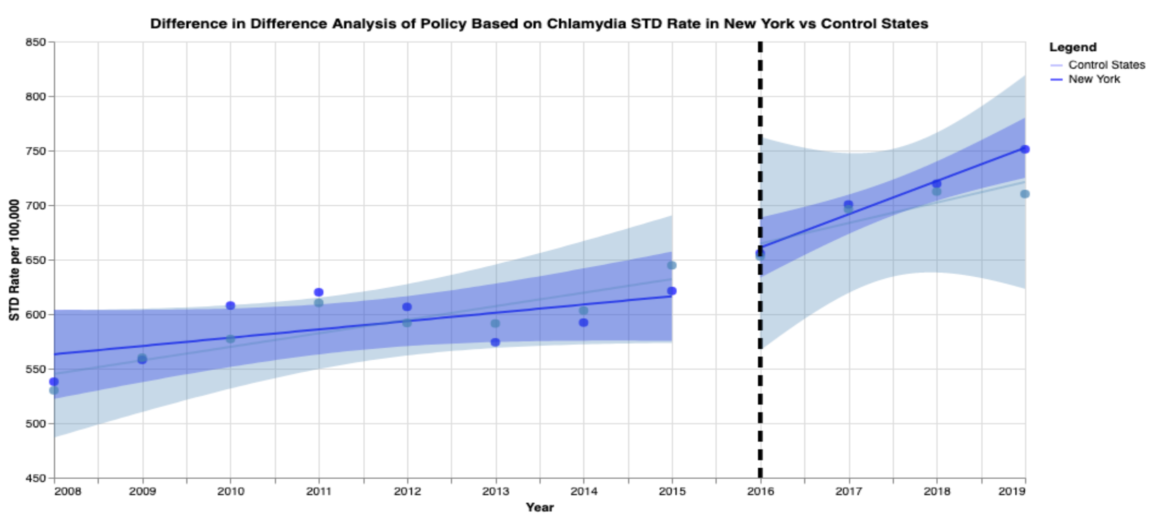


Effect of Policy within New York (2016)

As seen through the difference-in-difference graph, New York and the respective control states (Florida, Louisiana, Texas, California, and Illinois) display the same overall trend, a comparable increasing rate of STDs (per 100,000) before the policy implementation in New York in 2016. However, following the policy implementation, the STD rate per 100,000 individuals in New York continued to increase, but at a slightly faster rate when compared to the control states.

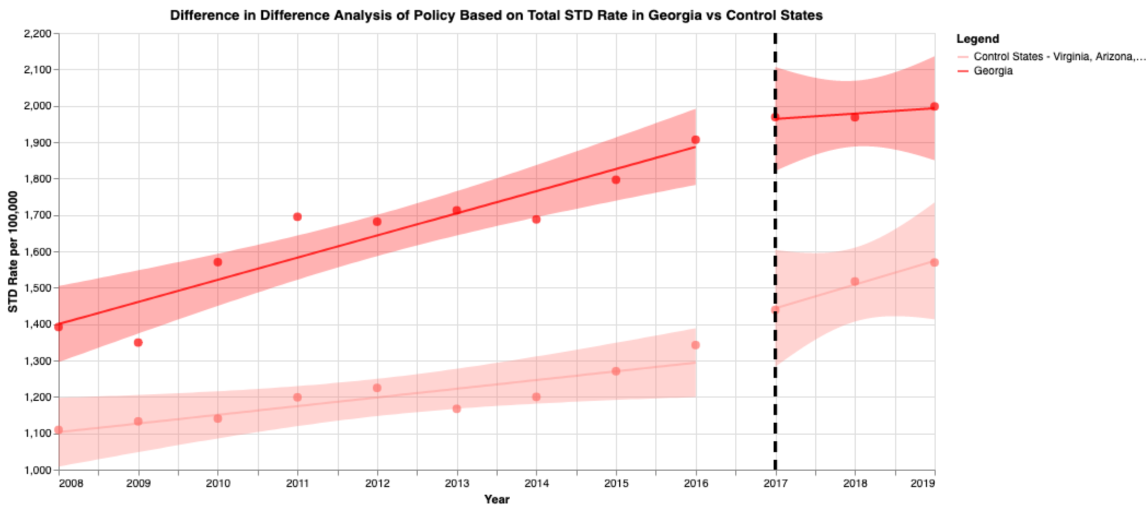


As the law passed in New York was to regulate the rate and number of chlamydia cases, it is essential to see if the policy had an impact at the specific-disease level. The difference-in-difference graph shows that the rate of chlamydia cases (per 100,000 residents) rose steadily for New York and its respective control states before the policy. However, after the policy was enacted, the rate of chlamydia increased for both the state of New York and the control states. While the increase may seem consistent and thus show no real change by the policy, the rate of increase is slightly steeper for the state of New York compared to the control states.

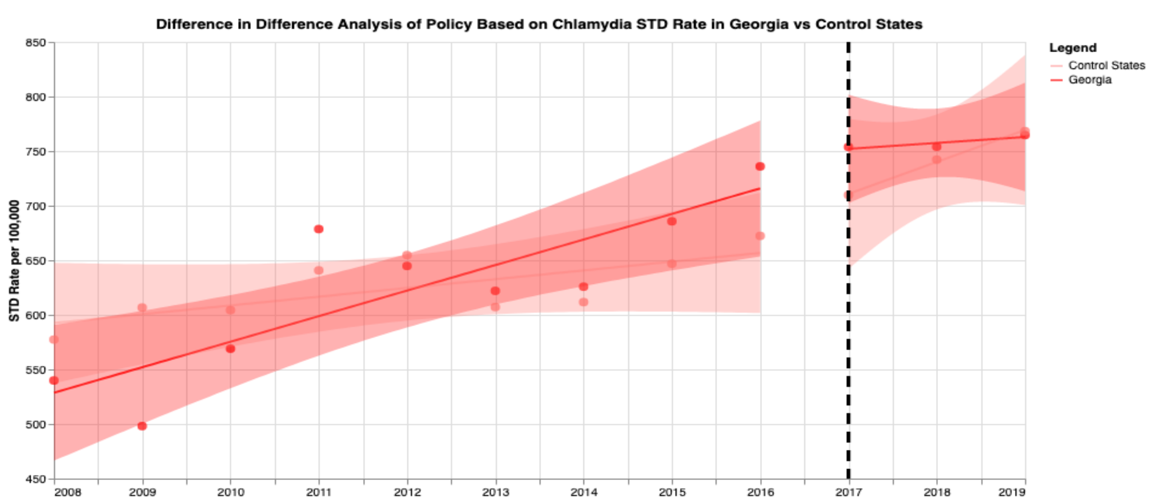


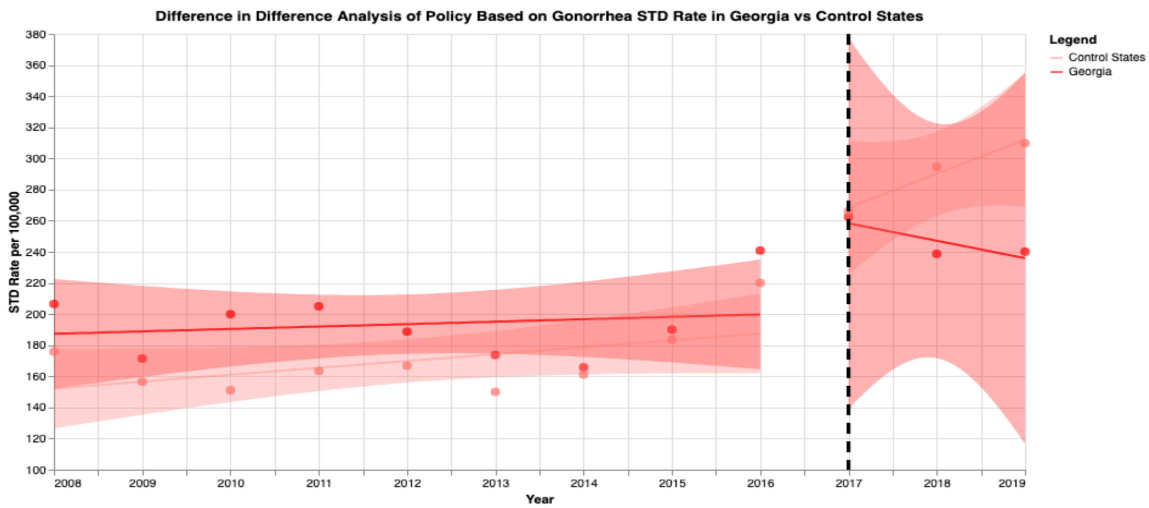
Effect of Policy within Georgia (2017)

The graph indicates that prior to the implementation of the policy in 2017, the rate of sexually transmitted diseases (STDs) per 100,000 individuals in Georgia and the control states (North Carolina, Nevada, Tennessee, Arkansas, New Mexico, Missouri, and Mississippi) had been on the rise. While the increase in Georgia was more pronounced, the other states also experienced a growing STD rate. Following the policy implementation, Georgia's STD rate stays constant. In contrast, the control states saw an escalation in the rate of increase in STD Rate per 100,000 individuals.



Like Maryland, the law passed in Georgia was tailored to decrease the rate of both chlamydia and gonorrhea disease. Therefore, one can observe that while the state of Georgia saw an uptick in the number of chlamydia cases before and after the implementation of the policy, the yearly rate of the number of cases stayed constant after implementation. In comparison, the control states noticed not only a significant growth in the number of chlamydia cases but also a significantly steeper increase in the yearly number of chlamydia cases. When observing the trend for gonorrhea cases, the rate in the number of chlamydia cases within the state of Georgia and the control states before the policy implementation was approximately level. However, after the policy was implemented, the state of Georgia realized the intended effect as there was not only a decrease, but the rate of decrease was significantly steeper. On the other hand, the control states observed the opposite, with a rate of increase just as steep as the decrease in Georgia.





Considerations and Assumptions

As we analyze the results of our difference-in-difference analyses, we believe the story depicted through the data supports the research conducted by the CDC and the potential effectiveness of STD policies in lowering STD rates. However, while our confidence in our results is high, our analysis of the policy's effectiveness has several limitations. To start, the dataset contained minimal inaccuracies as there were several missing values (~10-20 missing values per demographic category explored). This can be partly because of two reasons: First, while the CDC has been collecting and reporting on this data for more than 40 years, there are still small segments of the population that the CDC is unable to determine STD rates for accurately. And second, there may be underreporting of STD cases due to the stigma associated with STDs, particularly with certain demographics. As outlined by medical professionals, the lack of access to proper public healthcare has put a strain on the health system that can lead to an underestimation of actual STD rates and limit the accuracy of the analysis.

Additionally, we acknowledged the exclusion of data from 2020 due to COVID-19. While we had planned to include the data points in our analysis, we ultimately decided against it due to the significant drop-off in reported STD cases across all states during the period. The main reason for this decline is the prioritization of healthcare resources towards addressing the COVID-19 pandemic. Given medical professionals were overwhelmed with COVID-19 cases, it is extremely plausible that STD cases were "put on the back burner" as STDs are considered an "enormous, [yet] low-priority public health problem" [25]. We also underscore this exclusion for future work as the number of STD cases after 2020 will significantly change, which may lead to inaccurate results and conclusions.

Lastly, as we analyzed only three treatment states between 2008 and 2019, more confident inferences can be made if we widen our selection pool regarding both treatment states and years analyzed. As demonstrated through the policy implemented within Georgia, we cannot get a decisive picture of the impact post-implementation as we can only examine the three years after the policy was implemented (2017 - 2019). Furthermore, as referenced within the introduction, since the late 1990s experienced record-low rates of STDs, it would be valuable to analyze any policies enacted during that time period that led to those desired results. It can also be asserted that although control states provide a good reference point and representation for our analysis, the geographical proximity between the treatment states and some of the control states can cause “spillover” effects due to a multitude of possibilities. In validating the trend for STD cases over the last several years through our analysis, it is important to understand the driving factors behind this national observation, which cannot be fully captured from just data that is collected and analyzed.

Conclusion

To summarize our findings, after analyzing the data and difference-in-difference analysis from Maryland, New York, and Georgia, we can contend that from the implemented policies, the sole policy constituted within Georgia was the only effective law. Within the state of Georgia, we observed a slight reduction in the rate of increase for overall STDs and chlamydia, but the sought-after impact for gonorrhea rates, which observed a more pronounced decrease in STD rate. Unlike Georgia, it can be stated that the policies implemented within New York and Maryland were ineffective in reducing the overall rate of sexually transmitted diseases (STDs) per 100,000 individuals. The STD rate per 100,000 individuals continued to increase for these two treatment states at a higher rate than even their respective control states, despite the policy interventions.

The policy in Georgia, which allows medical providers to treat a patient's partner for a sexually transmitted infection without first seeing the partner, may have been partially effective in preventing the increase of the overall STD rate as the trend did not change. The control states showed a faster increase in the absence of policy intervention, while the rate of increase in Georgia did not change, indicating that the policy could have had some impact on preventing the spread of STDs. This policy may have effectively helped infected individuals and their partners receive treatment more quickly, decreasing the spread of STDs. The rate of chlamydia cases also observed a similar outcome as the overall STD rate. On the contrary, the policy seemed to have its most significant impact on the rate of gonorrhea, which recognized a drastic shift and resulted in a lower year-over-year rate than not only its respective control states but also before the policy was implemented in 2015! While understanding the impact on the disease rate was the main focus, our team also recognized that the policy observed an effective result amongst females and adolescents and young adults.

The policy implemented in New York in 2016, requiring healthcare practitioners to provide educational materials to patients who receive antibiotics or prescriptions for Expedited Partner Therapy (EPT), appears to have been ineffective in reducing the number of overall STD cases as well as chlamydia cases (per 100,000 residents) as intended. This conclusion is based on the observation that the rate of chlamydia cases increased significantly in New York than in the control states. While the underlying reason for these increases after the policy was implemented cannot be defined, exploring effective education methods to deliver the necessary knowledge to patients effectively is essential. Additionally, healthcare providers must do their part, emphasize the importance of reading and understanding the educational materials to patients, and encourage them to seek clarification if needed. With this recommendation and other tweaks to the law, the policy will hopefully significantly reduce not just chlamydia cases, but the overall rate of STDs in New York in the future.

In contrast to New York and Georgia policies, the Maryland policy, requiring sex education to include information on affirmative consent as part of interpersonal relationships, had unexpected outcomes. The policy not only failed to prevent an increase in the STD rate per 100,000 individuals but may have also contributed to a faster increase in Maryland compared to the control states. Unlike the policies within Georgia and New York that affected one of the demographic areas most impacted by STDs, the policy in Maryland was ineffective across all demographic categories in addition to overall STD and both disease types hampering the state. Additionally, the rate of gonorrhea cases was decreasing yearly before the policy was implemented; however, after the policy was enacted, the state not only realized the opposite effect but at a significantly higher rate! While the cause for this shift in trend may not be due to the policy, this unexpected outcome of the policy in Maryland underscores the need for careful consideration and evaluation of policy interventions. Policymakers must carefully evaluate the potential outcomes of policies and their effects on specific populations to ensure that they effectively achieve their intended goals.

As seen through the difference-in-difference graphs (including the graphs illustrated within the Appendix), below is a summary table of whether the policy in the respective treatment state was effective or ineffective for the scope and each demographic dimension we analyzed:

	Maryland	New York	Georgia
Overall STD Rate	Ineffective	Ineffective	Effective
Chlamydia STD Rate	Ineffective	Ineffective	Effective
Gonorrhea STD Rate	Ineffective	-	Effective
By Race	Ineffective	Effective	Ineffective
By Gender	Ineffective	Ineffective	Effective
By Age Group	Ineffective	Ineffective	Effective

Ineffective
Effective

Table 2: Summary Table on Policy Effectiveness by Demographic Dimensions

It is important to recognize that the results are subject to the above mentioned limitations. As we continue to address these limitations and refine our analysis, our work will contribute to a more comprehensive understanding of the effectiveness of different policy interventions in addressing the issue of STDs. Therefore, we encourage stakeholders to consider our findings as a starting point for further research and policy development rather than definitive conclusions.

To address the limitations we presented above, as well as make more definitive conclusions in the long-term, it is crucial to build on the current work by executing the following:

Future Work

- Incorporate information on policy implementation and enforcement quality, possibly through resource allocation data, staff training evaluations, public awareness campaigns, or surveys with healthcare providers and patients. This would provide a more accurate assessment of policy effectiveness.
- Expand the scope to include a broader range of states and time periods to better understand policy impacts across different contexts, regional disparities, and over time. This would allow for a more comprehensive understanding of the effectiveness of different policy interventions and help identify which policies are most successful in reducing STD rates.

- Include additional confounding factors, such as education, income, and access to healthcare, by linking datasets like the American Community Survey or the Behavioral Risk Factor Surveillance System. This would provide a more accurate assessment of the impact of policies on STD rates by controlling for potential biases and lend to greater external validity.
- Improve dataset accuracy and completeness by addressing underreporting and stigma, developing new data collection methods, such as using electronic health records or leveraging social media, and exploring strategies to reduce stigma and encourage accurate reporting.

These policy recommendations should be considered alongside the limitations of our analysis, and further research is needed to confirm the effectiveness of these interventions. By continuing to investigate the impact of sexual health policies and incorporating additional data sources, future research can help policymakers develop more effective strategies to address the complex issue of STDs across diverse demographic groups.

References

[1] African American Health Program. (2020, August 20). *STI/HIV & AIDS*. African American Health Program. Retrieved April 23, 2023, from https://aahpmontgomerycounty.org/sti-hiv-and-sti/#:~:text=African%20Americans%20have%20a%20higher,Blacks%20than%20Whites%20in%202014

[2] Background Checks.org. (n.d.). *Which States Have the Most STDs? (2023)*. Background Checks.org. Retrieved April 20, 2023, from https://backgroundchecks.org/which-states-have-the-most-stds.html

[3] Burg, G. (2012, August). *History of sexually transmitted infections (STI)*. U.S. National Library of Medicine. Retrieved April 21, 2023, from https://pubmed.ncbi.nlm.nih.gov/23007208/

[4] Centers for Disease Control and Prevention. (2018, August 28). *New CDC analysis shows steep and sustained increases in STDs in recent years*. Centers for Disease Control and Prevention. Retrieved April 22, 2023, from https://www.cdc.gov/media/releases/2018/p0828-increases-in-stds.html

[5] Centers for Disease Control and Prevention. (2022, March 16). *Incidence, Prevalence, and Cost of Sexually Transmitted Infections in the United States*. Centers for Disease Control and Prevention. Retrieved April 22, 2023, from https://www.cdc.gov/nchhstp/newsroom/fact-sheets/std/STI-Incidence-Prevalence-Cost-Factsheet.html

[6] Centers for Disease Control and Prevention. (2023, April 11). *Sexually Transmitted Disease Surveillance 2019*. Centers for Disease Control and Prevention. Retrieved April 21, 2023, from https://www.cdc.gov/std/statistics/2021/default.html

[7] Centers for Disease Control and Prevention. (2023, April 11). *Sexually Transmitted Disease Surveillance 2021 - Tables*. Centers for Disease Control and Prevention. Retrieved April 22, 2023, from https://www.cdc.gov/std/statistics/2021/tables.htm

[8] Centers for Disease Control and Prevention. (2023, April 11). *Sexually Transmitted Disease Surveillance 2021*. Centers for Disease Control and Prevention. Retrieved April 22, 2023, from https://www.cdc.gov/std/statistics/2021/default.html

[9] Centers for Disease Control and Prevention. (2023, March 2). *CDC - STD Diseases & Related Conditions*. Centers for Disease Control and Prevention. Retrieved April 21, 2023, from https://www.cdc.gov/std/general/default.html

[10] Centers for Disease Control and Prevention. (n.d.). *AtlasPlus - Maps*. Centers for Disease Control and Prevention. Retrieved April 22, 2023, from https://gis.cdc.gov/grasp/nchhstpatlas/maps.html

[11] Centers for Disease Control and Prevention. (n.d.). *AtlasPlus - Tables*. Centers for Disease Control and Prevention. Retrieved April 18, 2023, from https://gis.cdc.gov/grasp/nchhstpatlas/tables.html

[12] Centers for Disease Control and Prevention. (n.d.). *Sexually transmitted disease morbidity on CDC Wonder*. Centers for Disease Control and Prevention. Retrieved April 21, 2023, from https://wonder.cdc.gov/std.html

[13] Fu, L., Sun, Y., Han, M., Wang, B., Xiao, F., Zhou, Y., Gao, Y., Fitzpatrick, T., Yuan, T., Li, P., Zhan, Y., Lu, Y., Luo, G., Duan, J., Hong, Z., Fairley, C. K., Zhang, T., Zhao, J., & Zou, H. (2022, March 2). *Incidence Trends of Five Common Sexually Transmitted Infections Excluding HIV From 1990 to 2019 at the Global, Regional, and National Levels: Results From the Global Burden of Disease Study 2019*. Frontiers in medicine. Retrieved April 30, 2023, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8924524/

[14] Ghosh, I. (2020, December 28). *Visualizing the U.S. Population by Race*. Visual Capitalist. Retrieved April 22, 2023, from https://www.visualcapitalist.com/visualizing-u-s-population-by-race/

[15] Gruber, F., Lipozenčić, J., & Kehler, T. (2015). *History of venereal diseases from antiquity to the renaissance*. U.S. National Library of Medicine. Retrieved April 21, 2023, from https://pubmed.ncbi.nlm.nih.gov/25969906/

[16] Guttmacher Institute. (2023, April 17). *STATE LEGISLATION TRACKER - Major Developments in Sexual & Reproductive Health*. Guttmacher Institute. Retrieved April 22, 2023, from https://www.guttmacher.org/state-legislation-tracker

[17] History.com Editors. (2009, November 24). *Magic Johnson announces he is HIV-positive*. HISTORY. Retrieved April 22, 2023, from https://www.history.com/this-day-in-history/magic-johnson-announces-he-is-hiv-positive

[18] Jaklevic, M. C. (n.d.). *It's hard to tell stories of real people dealing with STDs, but here's why it matters*. Center for Health Journalism. Retrieved April 20, 2023, from https://centerforhealthjournalism.org/resources/lessons/it-s-hard-tell-stories-real-people-dealing-stds-here-s-why-it-s-crucial

[19] LegiScan. (2015, May 12). *Maryland SB337: 2015: Regular session*. LegiScan. Retrieved April 24, 2023, from https://legiscan.com/MD/supplement/SB337/id/27105

[20] Levine, B., Masters, M., Bennington-Castro, J., Dawson, M., Editors, E. H., Upham, B., Listfield, E., Tigar, L., & Iliades, C. (2019, October 17). *STDs Rise Sharply Among Older Americans*. EverydayHealth.com. Retrieved April 21, 2023, from https://www.everydayhealth.com/stds/rise-sharply-among-older-americans/

[21] Murtha, J. (n.d.). *8 Common STDs: What You Need to Know*. Pfizer. Retrieved April 20, 2023, from https://www.pfizer.com/news/articles/8_common_stds

[22] Nadel, J. (2022, February 23). *AP was there: Magic announces he has HIV, retires from NBA*. AP News. Retrieved April 22, 2023, from https://apnews.com/article/los-angeles-lakers-nba-entertainment-sports-health-d51716031d2641c7e58957e9ef9da718

[23] NYC Department of Health and Mental Hygiene. (2016, September 30). *Expedited Partner Therapy: NYS Law and Regulations State of New York Public Health Law*. NYC Department of Health and Mental Hygiene. Retrieved April 21, 2023, from https://www.nyc.gov/assets/doh/downloads/pdf/std/nys-ept-law.pdf

[24] Stobbe, M. (2022, September 19). *'Out of control' STD situation prompts call for changes*. AP News. Retrieved April 21, 2023, from https://apnews.com/article/monkeypox-science-health-covid-epidemics-aaac64591251293f45c225d3fe963d0c?utm_source=apnews&utm_medium=relatedcontentmodule

[25] Stobbe, M. (2023, April 11). *STDs are on the rise. This morning-after-style pill may help*. AP News. Retrieved April 22, 2023, from https://apnews.com/article/stds-doxycycline-pills-635aa358871bd67088573f0ecdc01ec9

[26] U.S. Department of Health and Human Services. (n.d.). *Sexually Transmitted Infections*. Healthy People 2030. Retrieved April 22, 2023, from https://health.gov/healthypeople/objectives-and-data/browse-objectives/sexually-transmitted-infections#cit1

Appendix

Exhibit 1 - Summary of STD Cases By State

Rank	State	STD Cases Per 100K	Total STD Cases	Gonorrhea Cases	Chlamydia Cases	Syphilis Cases	HIV Prevalence	HIV Diagnoses
1	Mississippi	1,958	48,548	13,773	23,919	741	9,713	402
2	Louisiana	1,846	71,286	15,483	32,997	704	21,380	722
3	Georgia	1,657	147,340	23,463	62,582	1,757	57,561	1,977
4	New York	1,639	270,607	42,517	97,722	3,022	125,383	1,963
5	South Carolina	1,599	70,044	16,705	34,118	652	17,914	655
6	Maryland	1,560	79,454	12,052	32,398	873	33,425	706
7	North Carolina	1,447	128,861	28,258	64,640	1,322	33,562	1,079
8	Florida	1,411	262,287	40,788	100,030	3,520	114,541	3,408
9	Alabama	1,373	56,773	14,426	27,075	529	14,158	585
10	Alaska	1,334	8,007	1,982	5,090	176	730	29
11	Tennessee	1,314	75,986	18,458	37,907	767	18,207	647
12	Illinois	1,295	138,127	31,055	68,716	1,467	35,793	1,096
13	Nevada	1,280	33,304	6,364	14,739	767	11,042	392
14	Texas	1,246	297,042	58,246	135,124	2,708	97,416	3,548
15	Oklahoma	1,228	40,289	11,204	21,208	941	6,603	333
16	Arkansas	1,218	30,712	7,857	16,053	502	6,058	242
17	California	1,218	403,116	78,444	178,679	7,688	134,381	3,924
18	Missouri	1,214	62,722	16,855	31,815	829	12,864	359
19	New Mexico	1,203	21,224	4,608	12,084	467	3,934	131
20	Delaware	1,199	9,987	1,503	4,855	97	3,439	93
21	Arizona	1,191	73,442	16,342	37,289	1,454	17,695	662
22	Ohio	1,178	116,154	30,977	59,520	1,084	23,685	888
23	Virginia	1,130	81,557	15,217	40,965	701	24,046	628
24	Indiana	1,073	60,316	14,111	33,372	527	11,873	433
25	New Jersey	1,044	78,414	10,060	31,649	764	35,136	805
26	Colorado	1,025	50,036	9,686	26,137	640	13,249	324
27	Michigan	1,019	86,368	23,412	44,769	787	16,881	519
28	Pennsylvania	998	108,986	18,280	52,272	1,046	36,613	775
29	South Dakota	995	7,261	2,424	4,044	66	693	34
30	Kansas	989	23,888	5,626	14,620	150	3,354	138
31	Rhode Island	975	8,927	1,399	4,714	89	2,672	53
32	Iowa	959	25,250	6,919	15,097	194	2,940	100
33	Kentucky	954	35,799	8,393	18,750	445	7,911	300
34	Hawaii	931	11,102	1,484	7,005	182	2,380	51
35	Nebraska	928	14,779	3,434	8,844	104	2,324	73
36	Connecticut	925	28,340	4,604	12,716	280	10,569	171
37	North Dakota	925	5,816	1,660	3,562	32	526	36
38	Massachusetts	918	54,491	7,494	24,901	615	21,047	434
39	Washington	907	58,408	11,667	31,181	836	14,303	421
40	Wisconsin	894	44,134	10,346	26,564	366	6,645	213
41	Minnesota	890	42,081	10,320	22,114	417	9,001	229
42	Oregon	844	30,425	6,412	15,858	628	7,347	180
43	Montana	722	6,577	1,698	4,133	45	687	14
44	Utah	671	17,105	3,112	10,466	131	3,265	131
45	West Virginia	624	9,566	1,780	5,431	127	2,089	139
46	Idaho	613	9,116	1,480	6,273	66	1,265	32
47	Wyoming	566	2,734	392	1,961	11	356	14
48	Maine	487	5,701	520	3,466	38	1,661	16
49	New Hampshire	406	4,804	461	2,931	51	1,328	33
50	Vermont	372	1,993	139	1,117	3	722	12

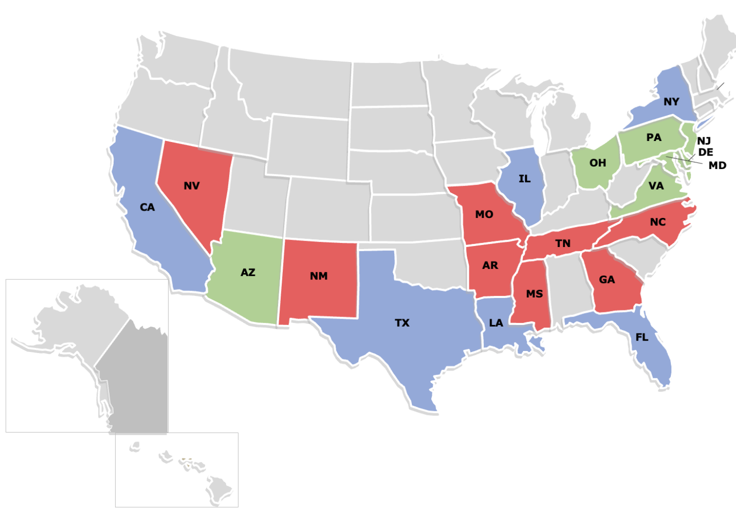


Exhibit 2 - STD Prevalence and Economic Impact

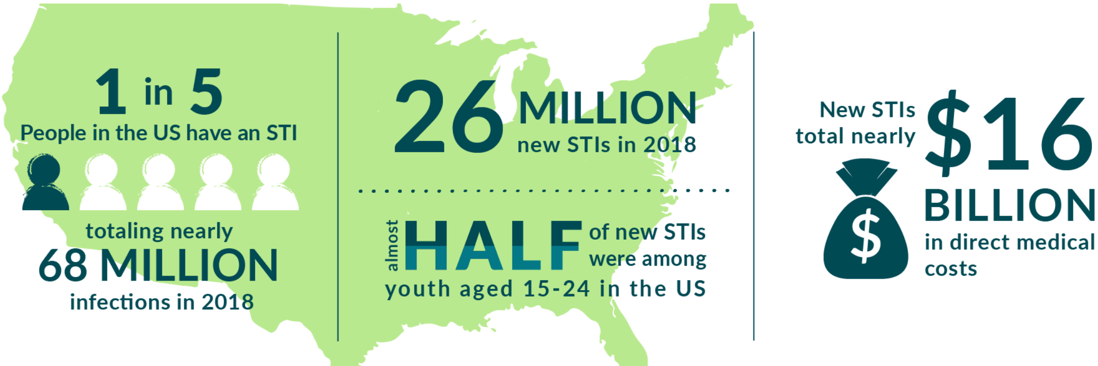
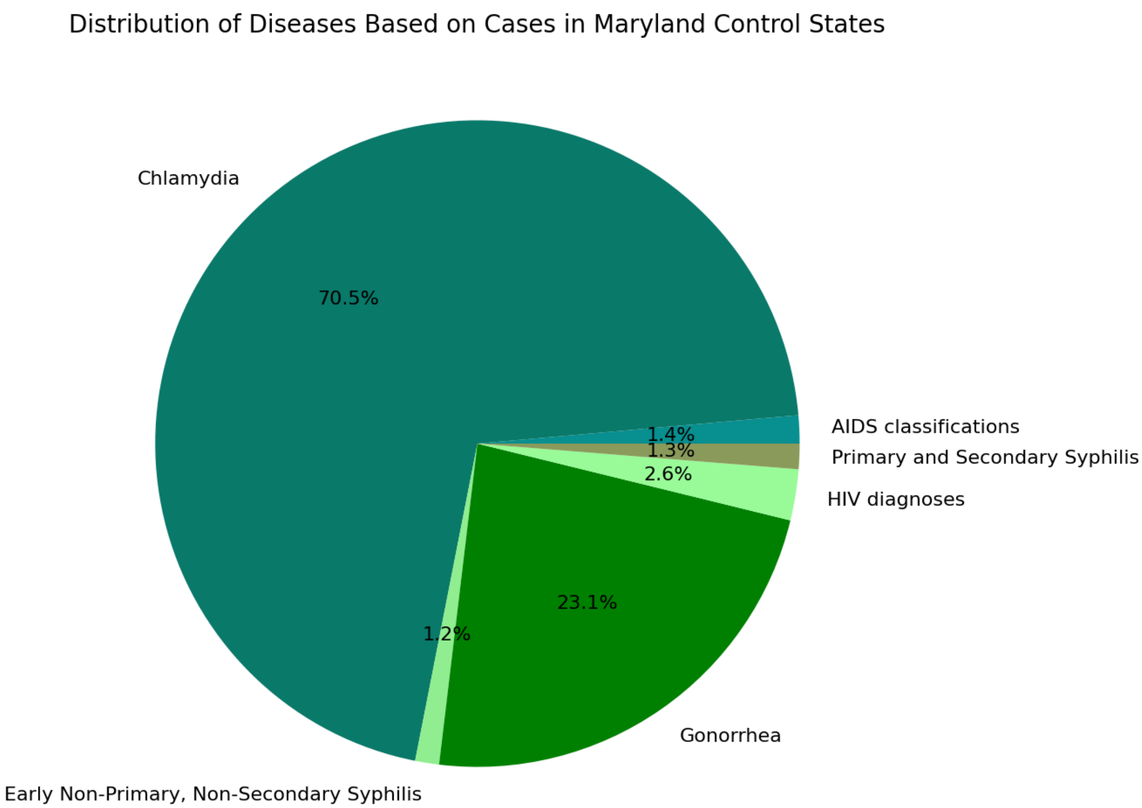
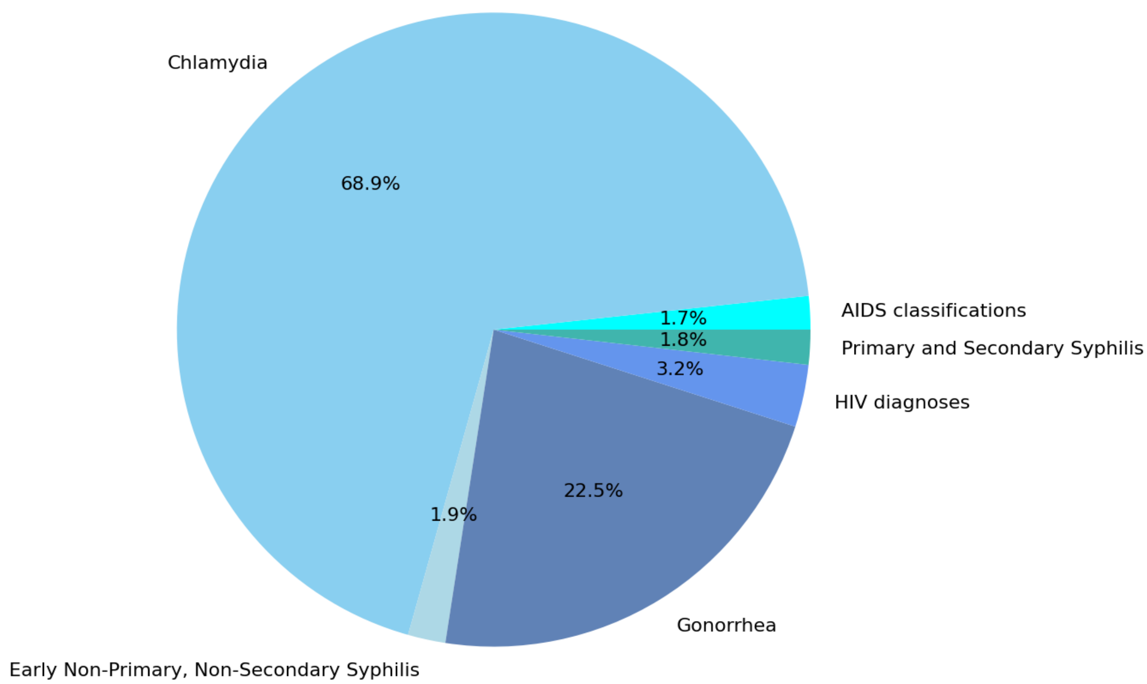


Exhibit 3 - Analysis of Distribution of STD Cases by Disease Type for Control States



Distribution of Diseases Based on Cases in New York Control States



Distribution of Diseases Based on Cases in Georgia Control States

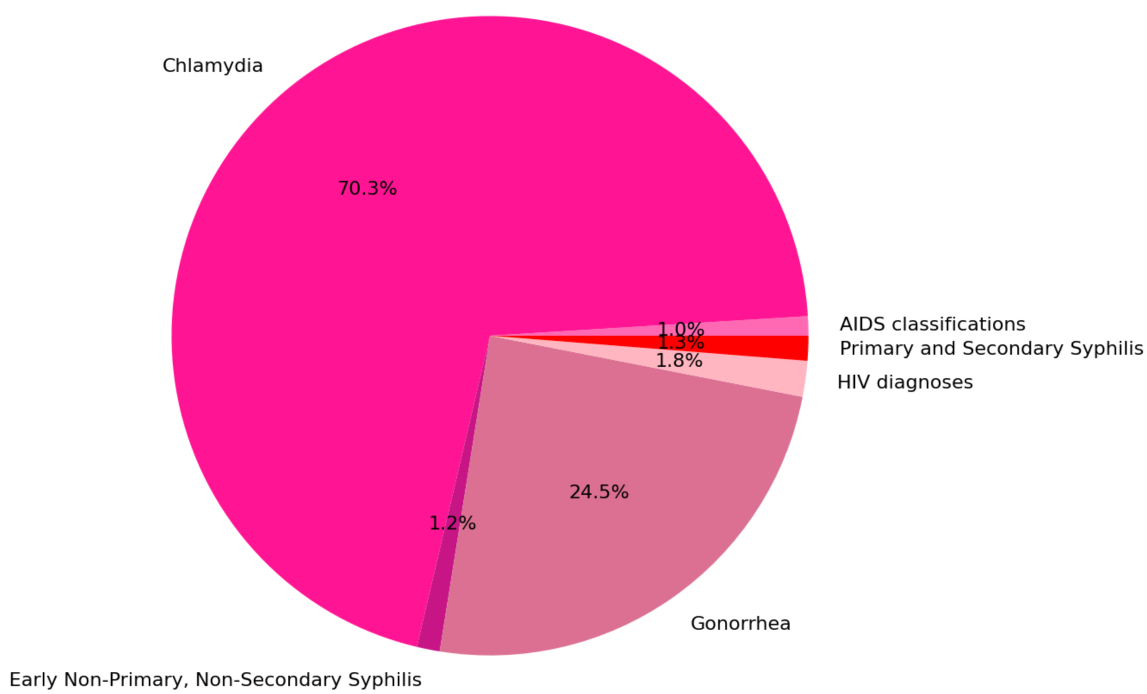
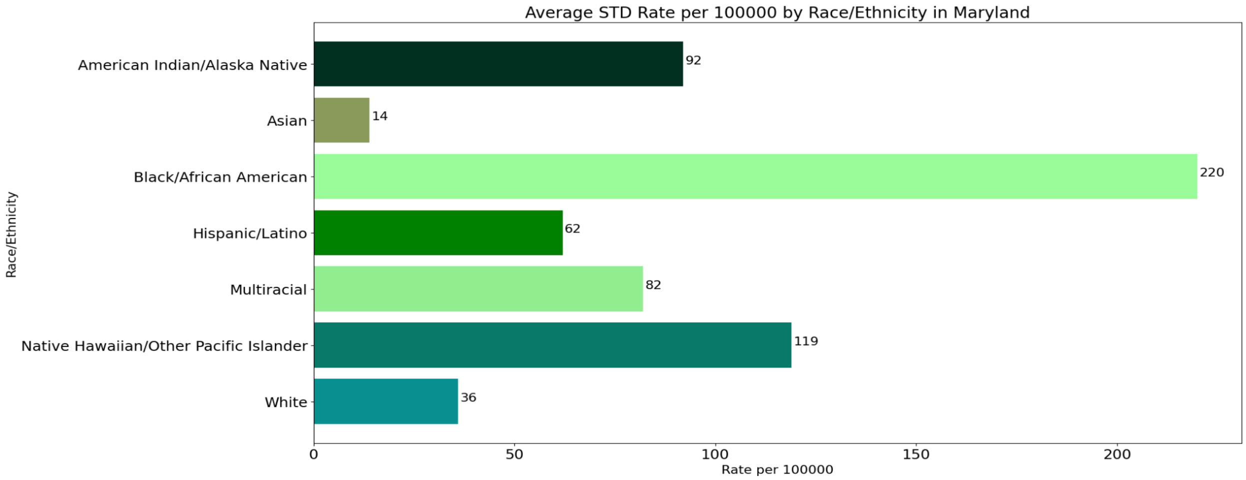
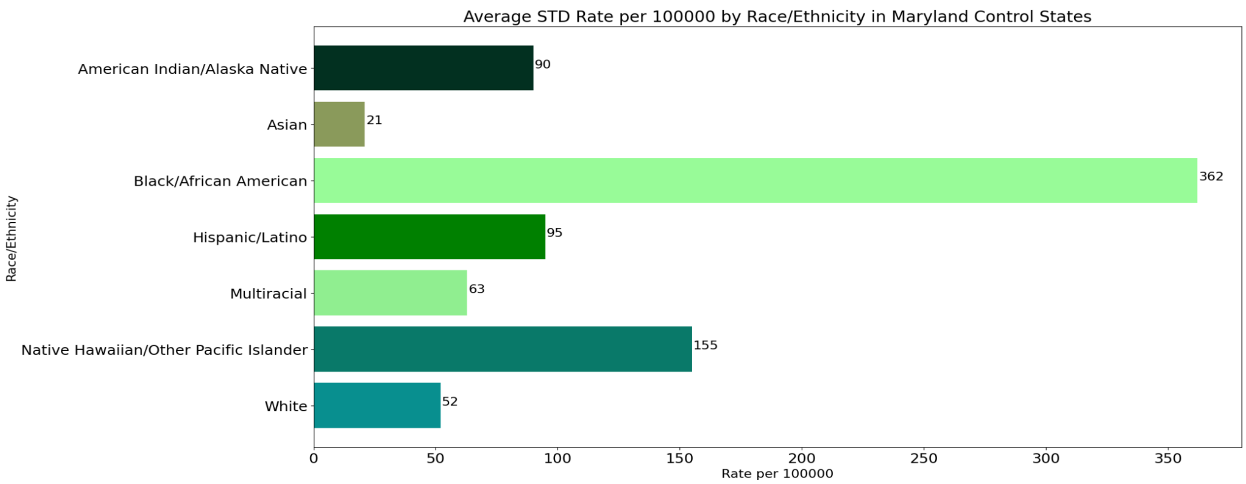
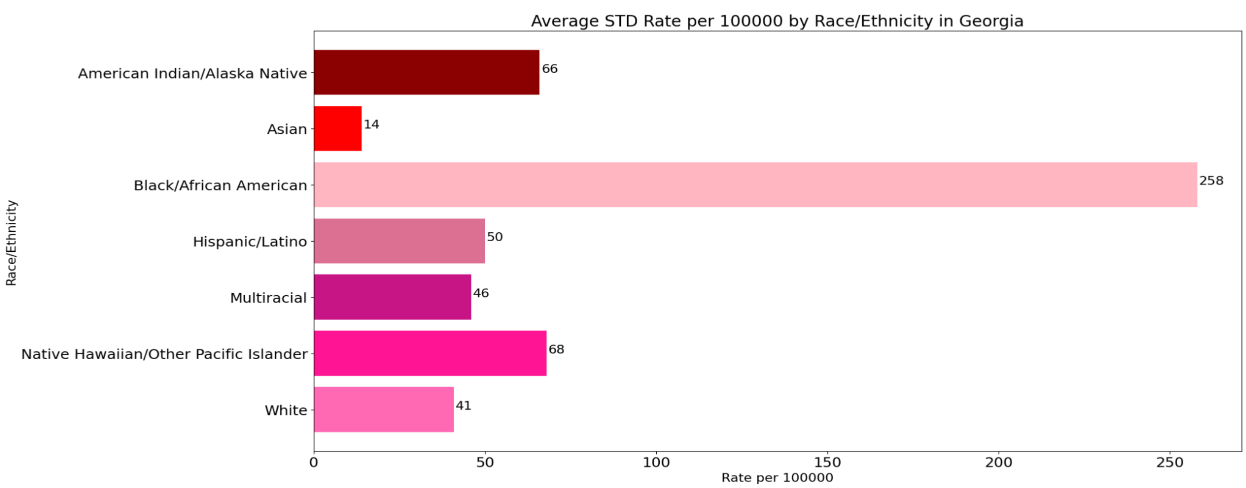
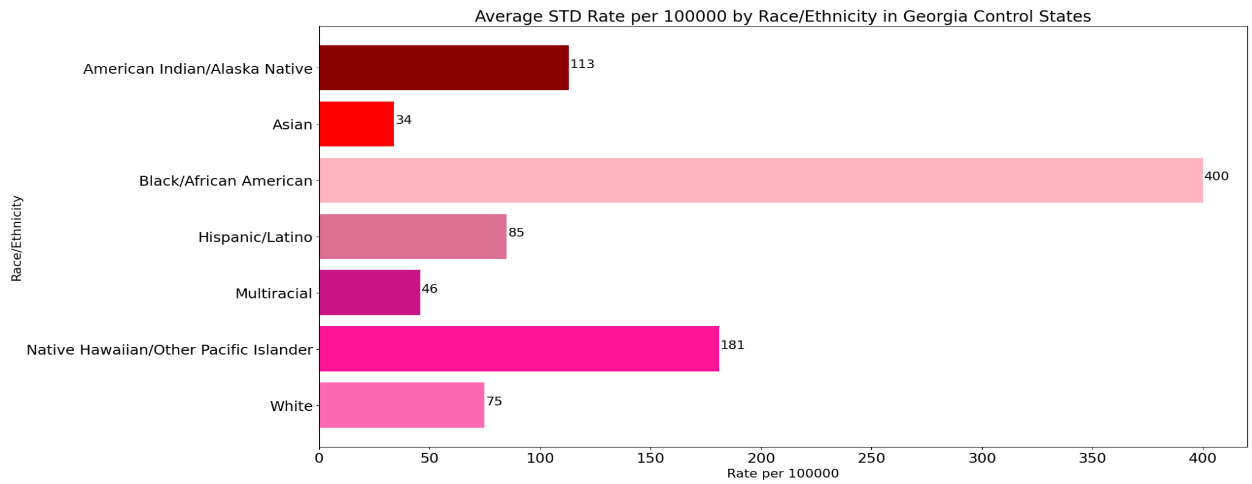


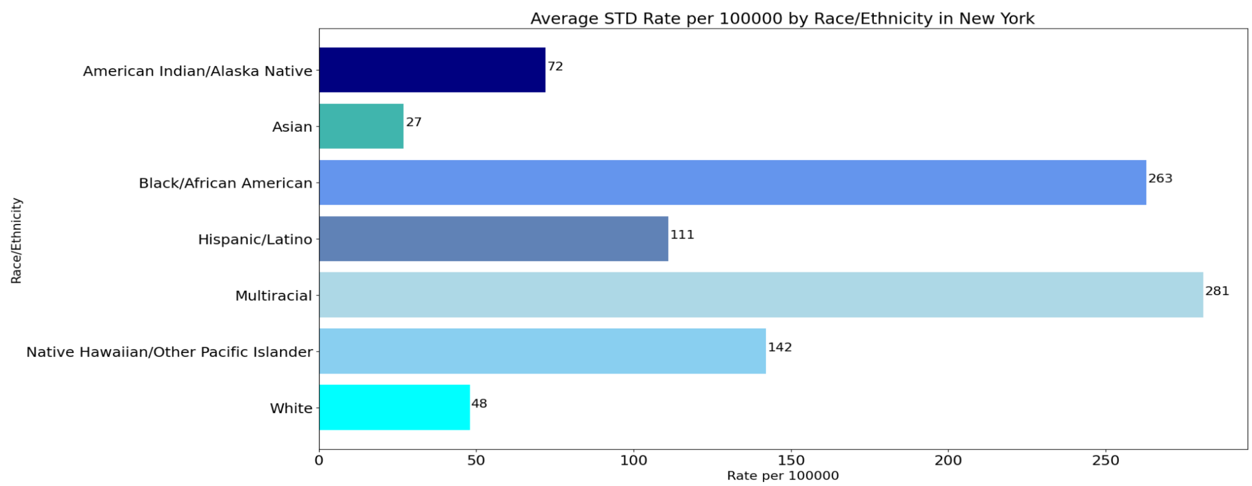
Exhibit 4 - Analysis of STD Rates by Race/Ethnicity for Treatment and Control States








Average STD Rate per 100000 by Race/Ethnicity in Georgia Control States
American Indian/Alaska Native
Asian
Black/African American
Hispanic/Latino
Multiracial
Native Hawaiian/Other Pacific Islander
White
113
34
400
85
46
181
75
Race/Ethnicity
Rate per 100000
0
50
100
150
200
250
300
350
400


Average STD Rate per 100000 by Race/Ethnicity in New York
American Indian/Alaska Native
Asian
Black/African American
Hispanic/Latino
Multiracial
Native Hawaiian/Other Pacific Islander
White
72
27
263
111
281
142
48
Race/Ethnicity
Rate per 100000
0
50
100
150
200
250

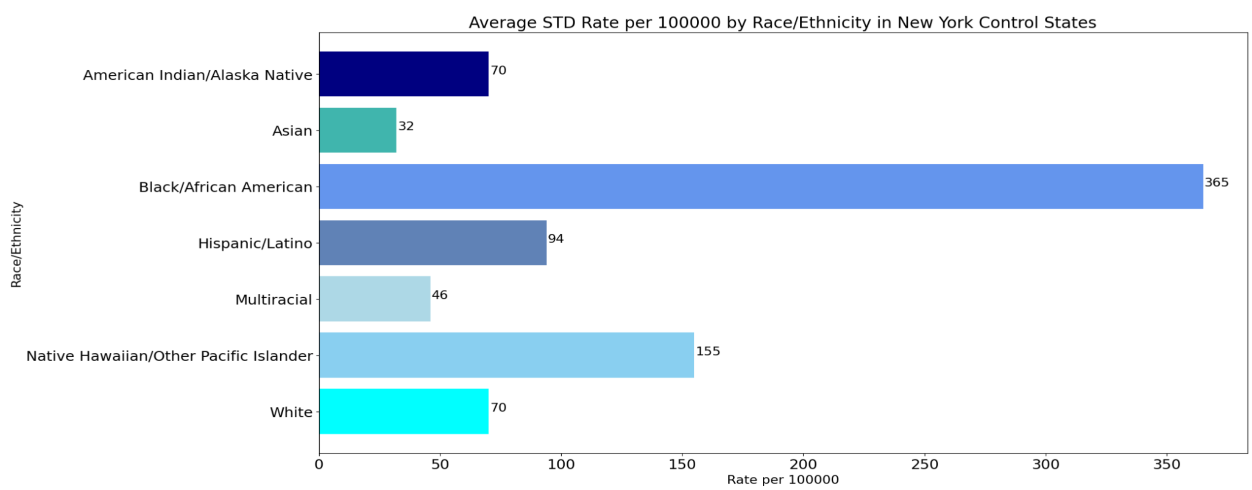
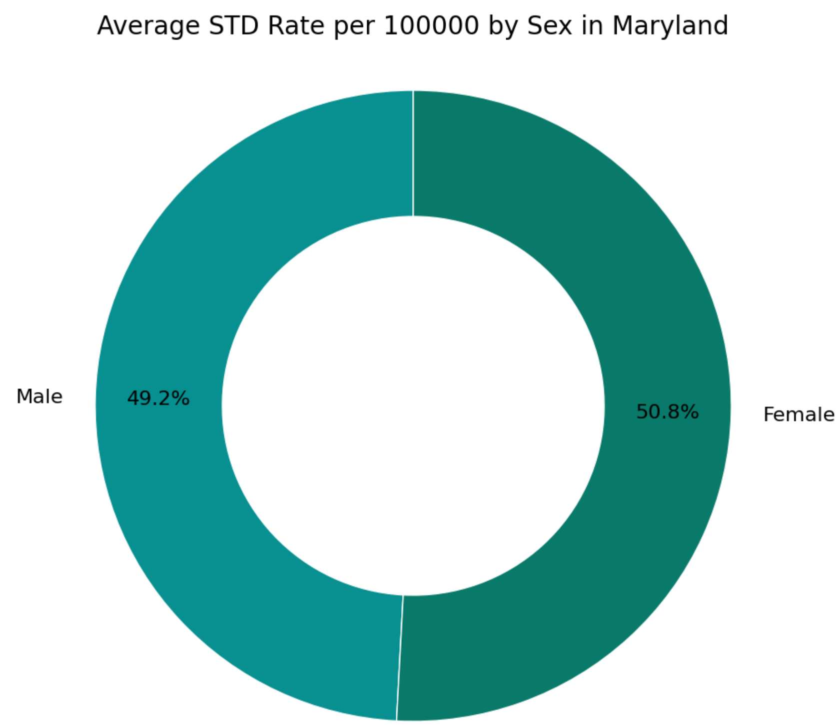
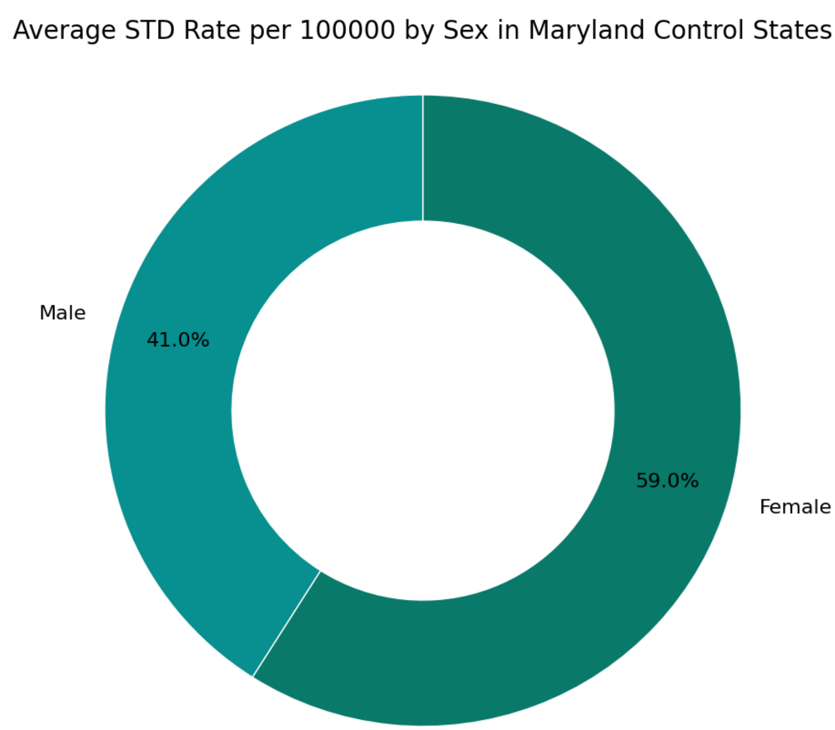
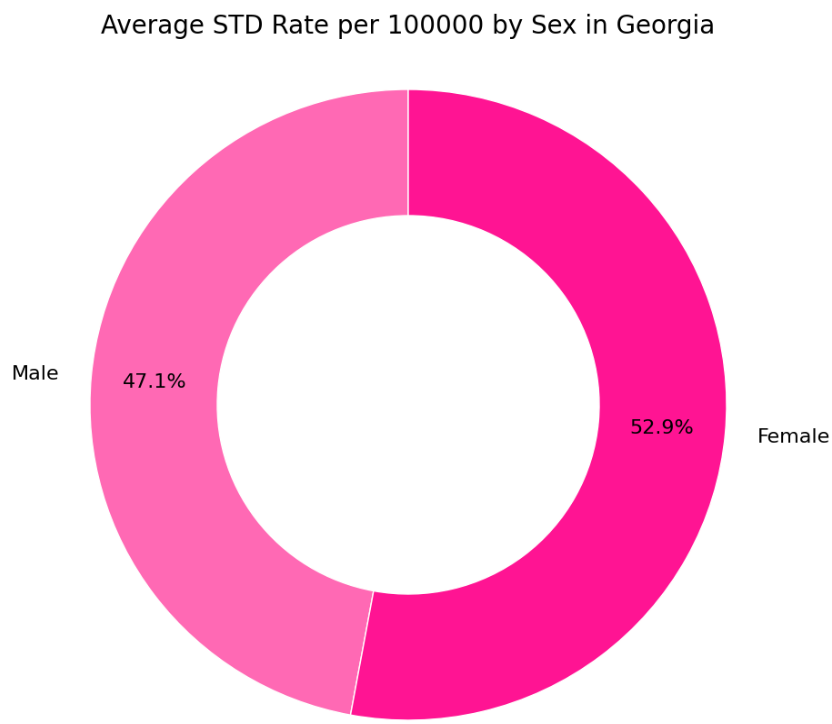
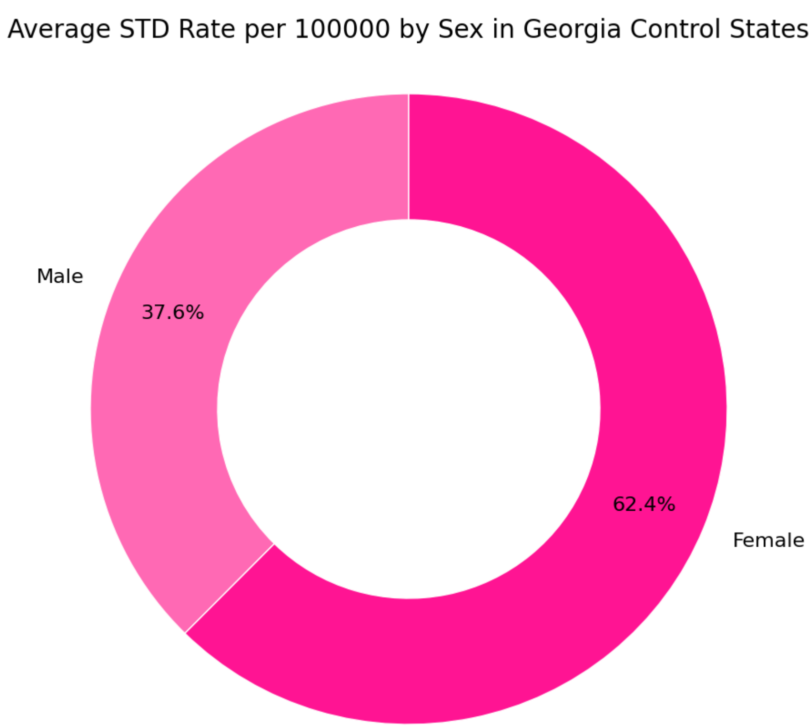

Average STD Rate per 100000 by Race/Ethnicity in New York Control States
American Indian/Alaska Native
Asian
Black/African American
Hispanic/Latino
Multiracial
Native Hawaiian/Other Pacific Islander
White
70
32
365
94
46
155
70
Race/Ethnicity
Rate per 100000
0
50
100
150
200
250
300
350

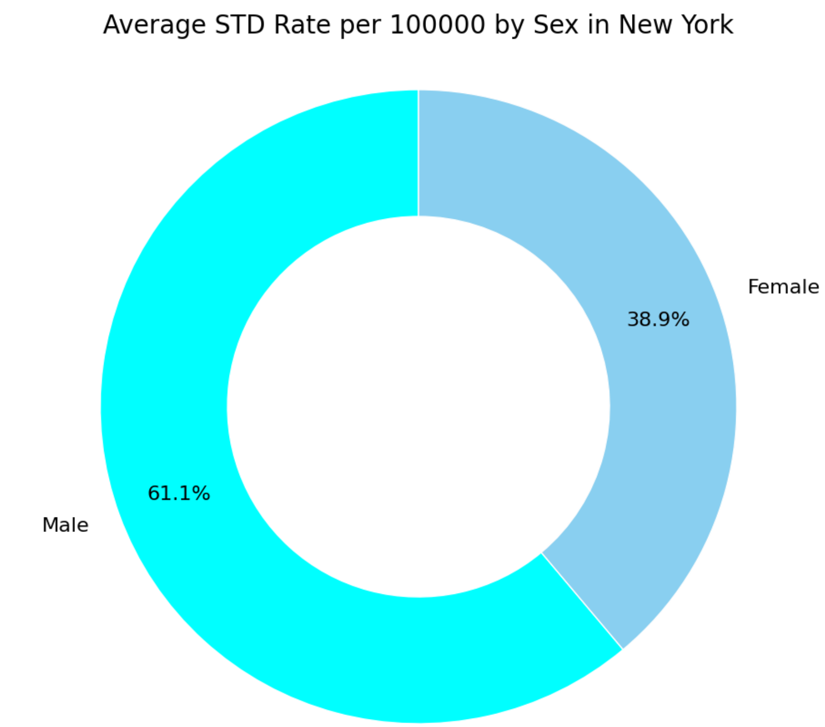
Exhibit 5 - Analysis of STD Rates by Gender for Treatment and Control States






Average STD Rate per 100000 by Sex in Georgia
Male
47.1%
52.9%
Female


Average STD Rate per 100000 by Sex in Georgia Control States
Male
37.6%
62.4%
Female


Average STD Rate per 100000 by Sex in New York
Female
38.9%
61.1%
Male

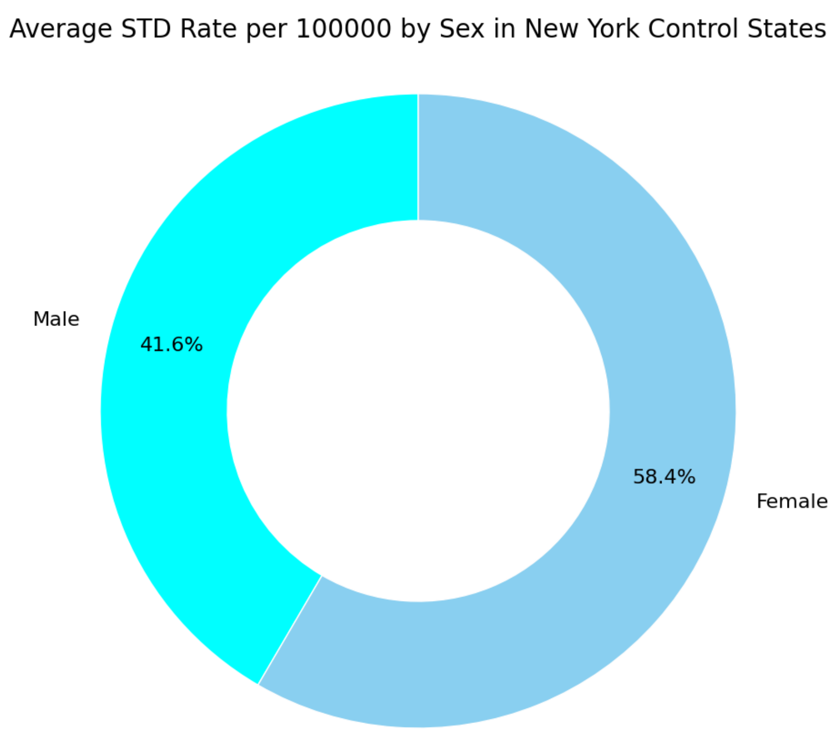
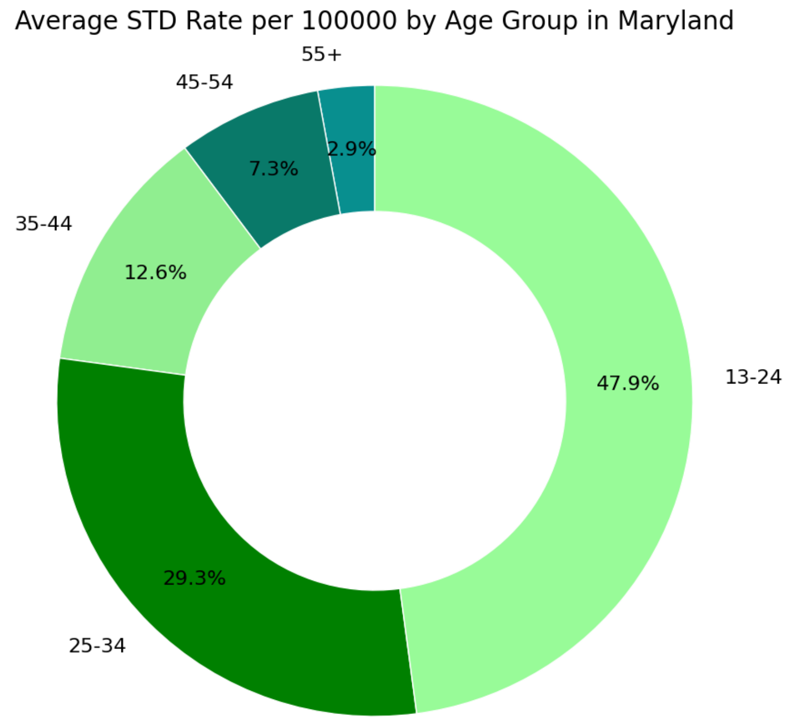
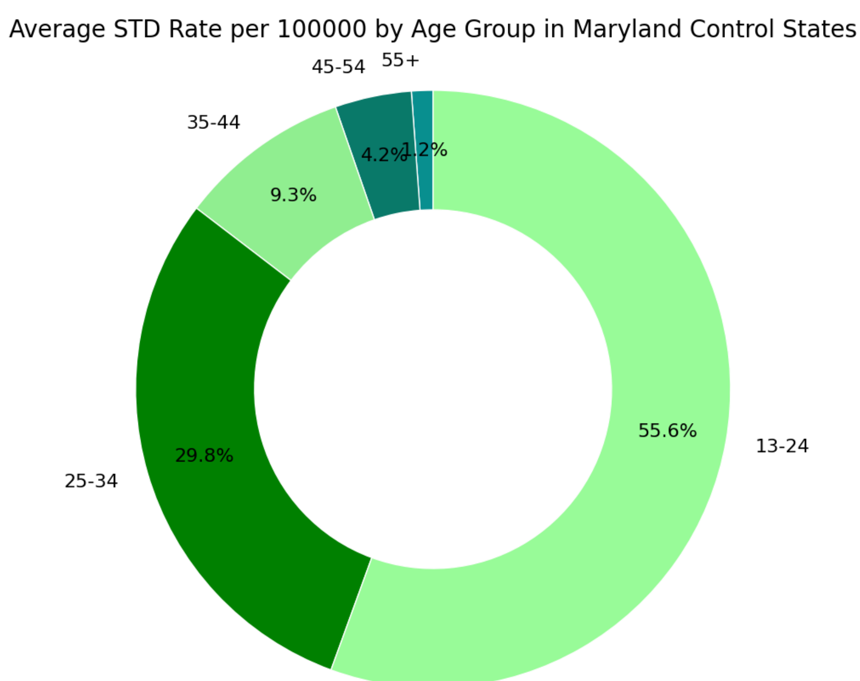
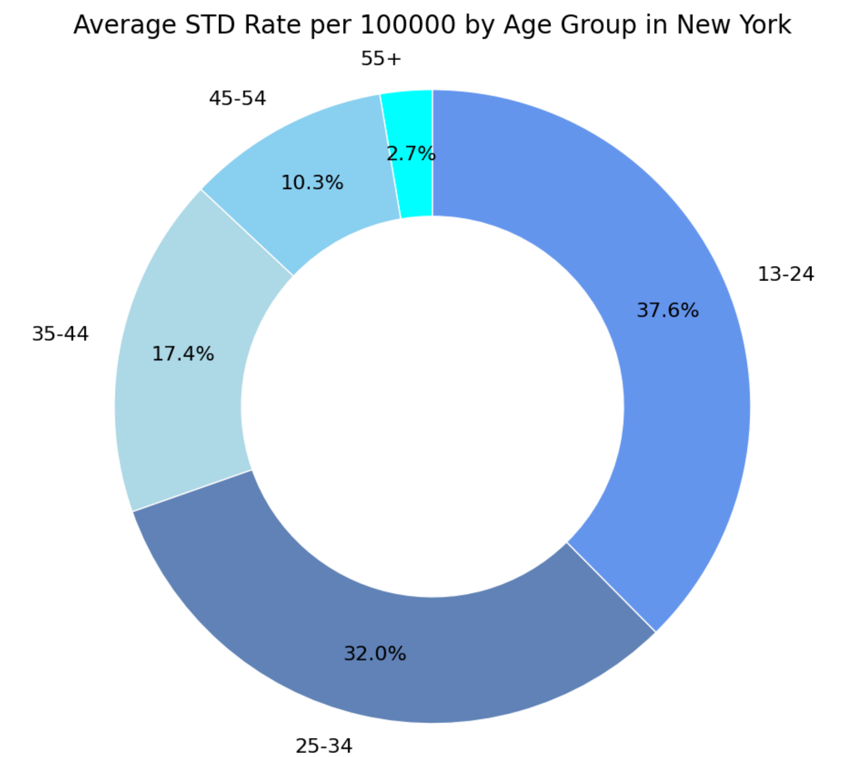
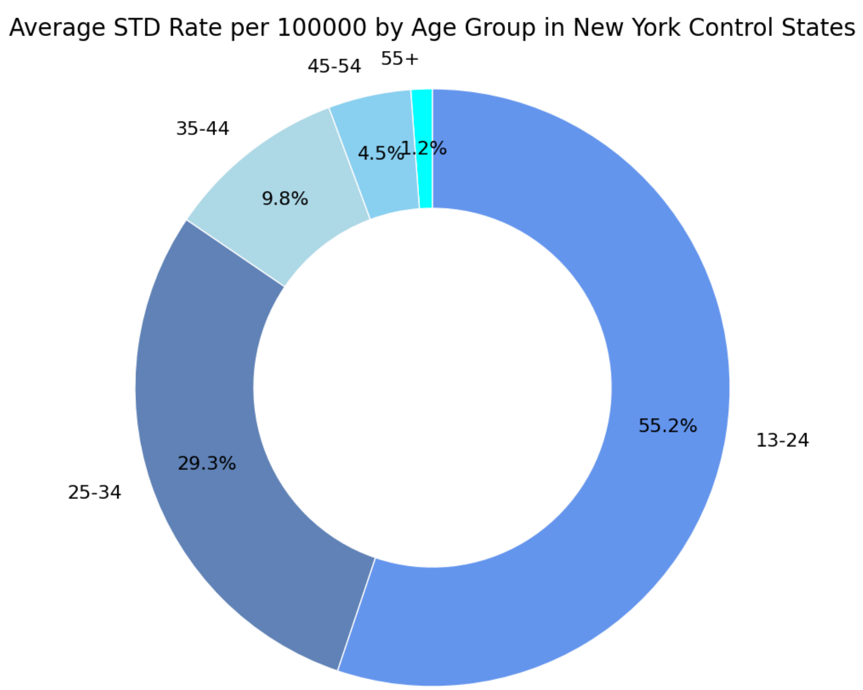

Average STD Rate per 100000 by Sex in New York Control States
Male
41.6%
58.4%
Female

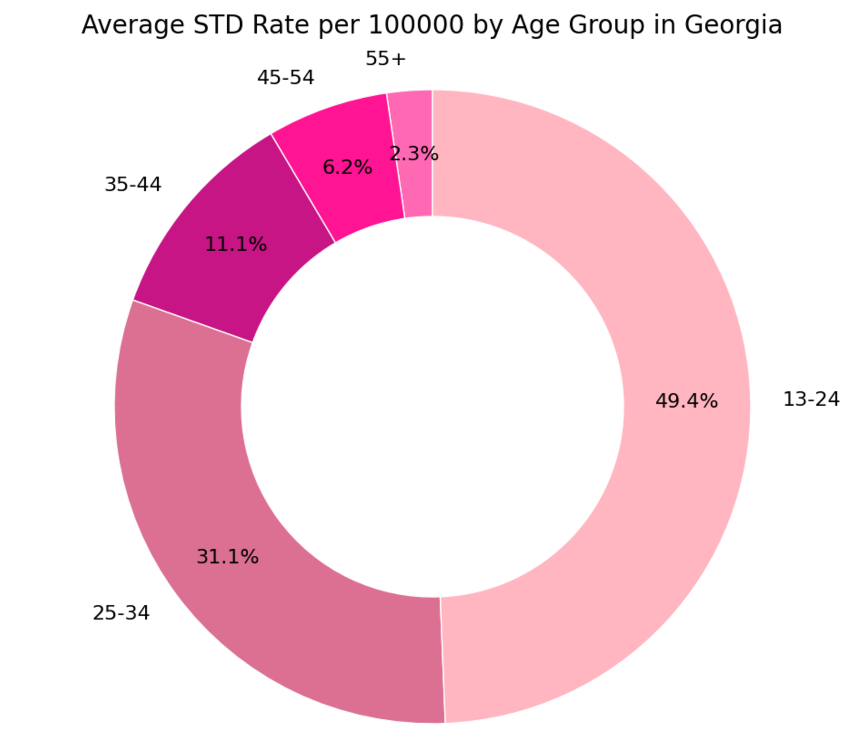
Exhibit 6 - Analysis of STD Rates by Age Group for Treatment and Control States






Average STD Rate per 100000 by Age Group in New York
55+
45-54
2.7%
10.3%
13-24
37.6%
35-44
17.4%
32.0%
25-34


Average STD Rate per 100000 by Age Group in New York Control States
45-54
55+
35-44
4.5%
1.2%
9.8%
55.2%
13-24
29.3%
25-34


Average STD Rate per 100000 by Age Group in Georgia
55+
45-54
2.3%
6.2%
35-44
11.1%
49.4%
13-24
31.1%
25-34

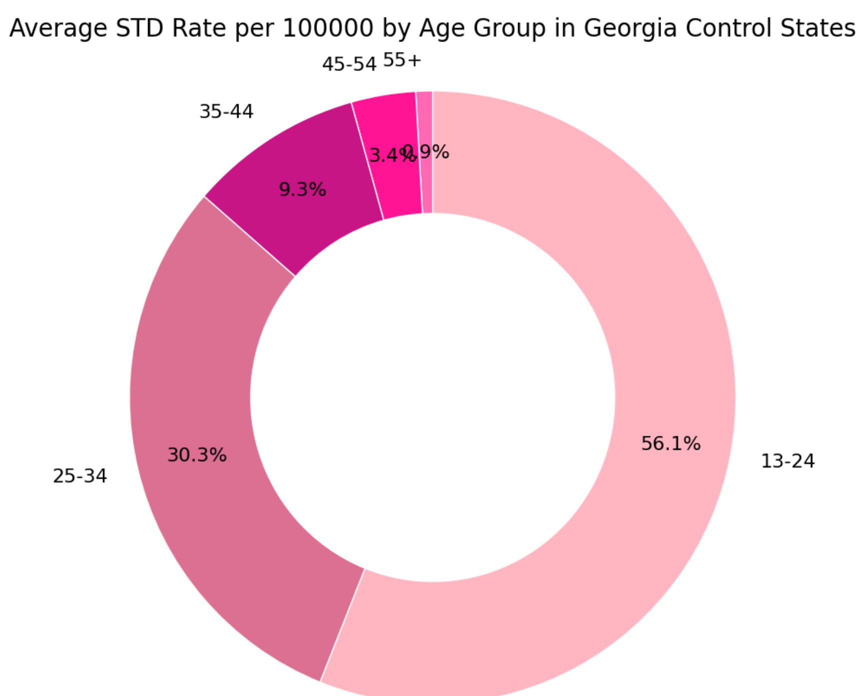
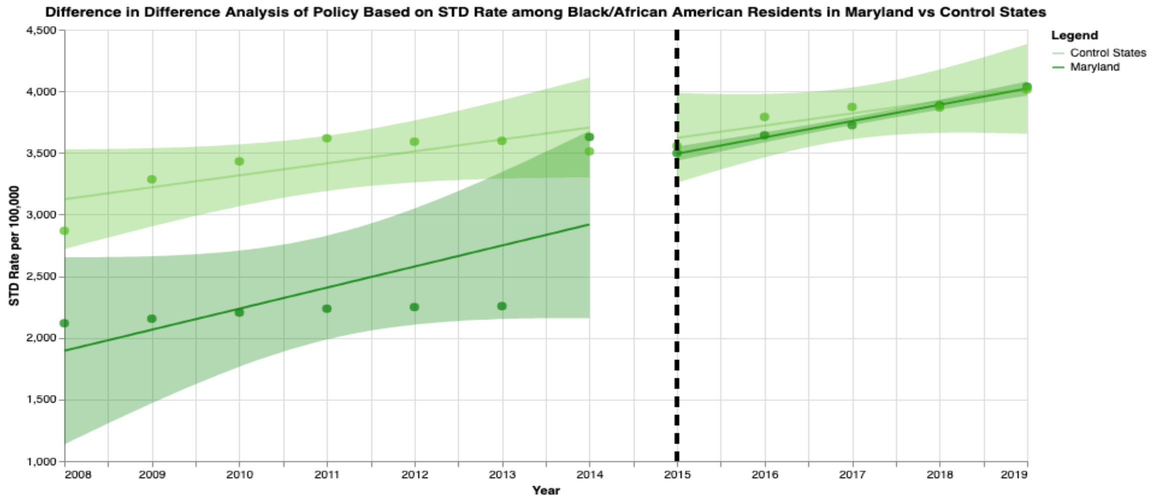
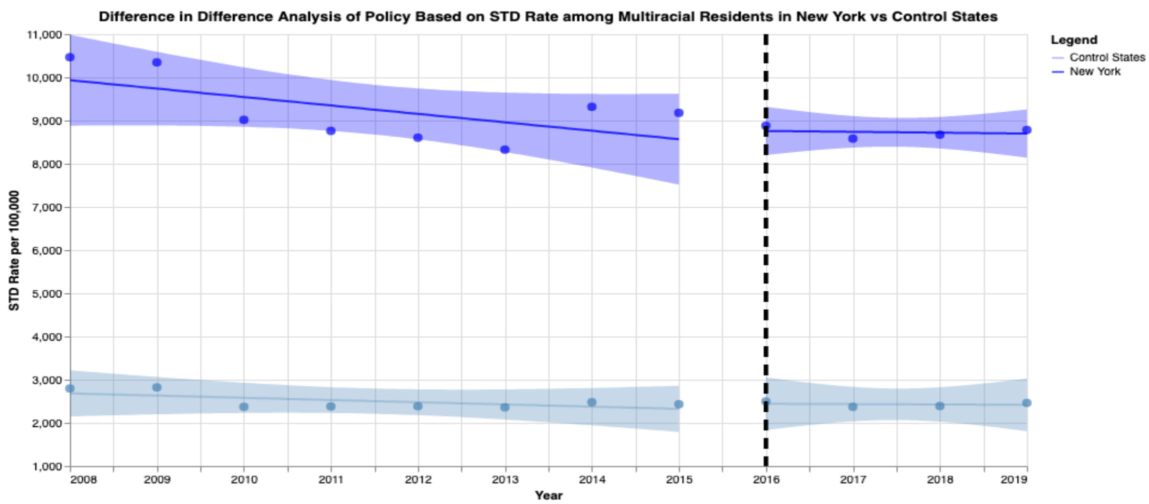

Average STD Rate per 100000 by Age Group in Georgia Control States
45-54
55+
35-44
3.4%
0.9%
9.3%
56.1%
13-24
30.3%
25-34

Exhibit 7 - Difference-in-Difference Analysis of STD Rates by Most Impacted Race/Ethnicity in Treatment State





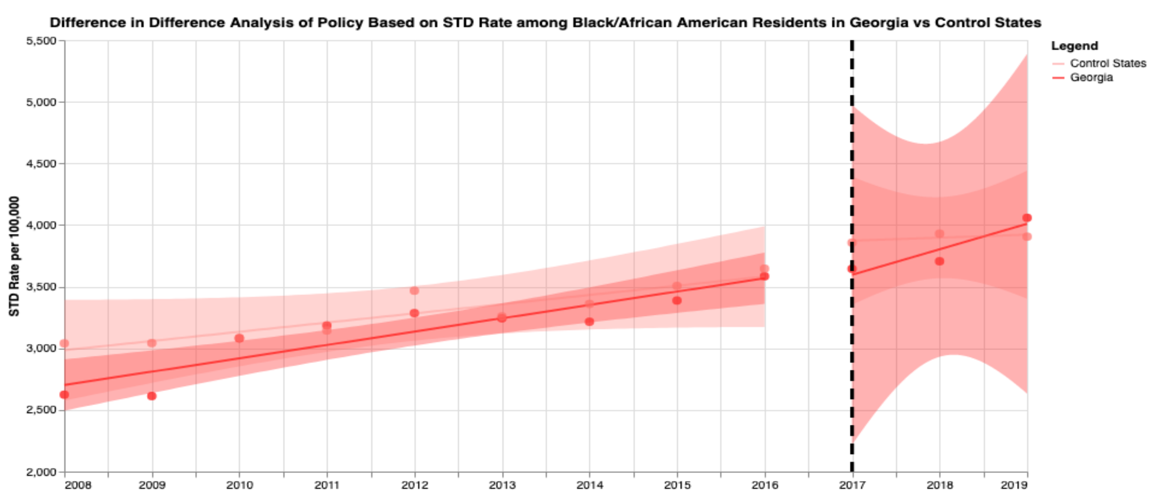
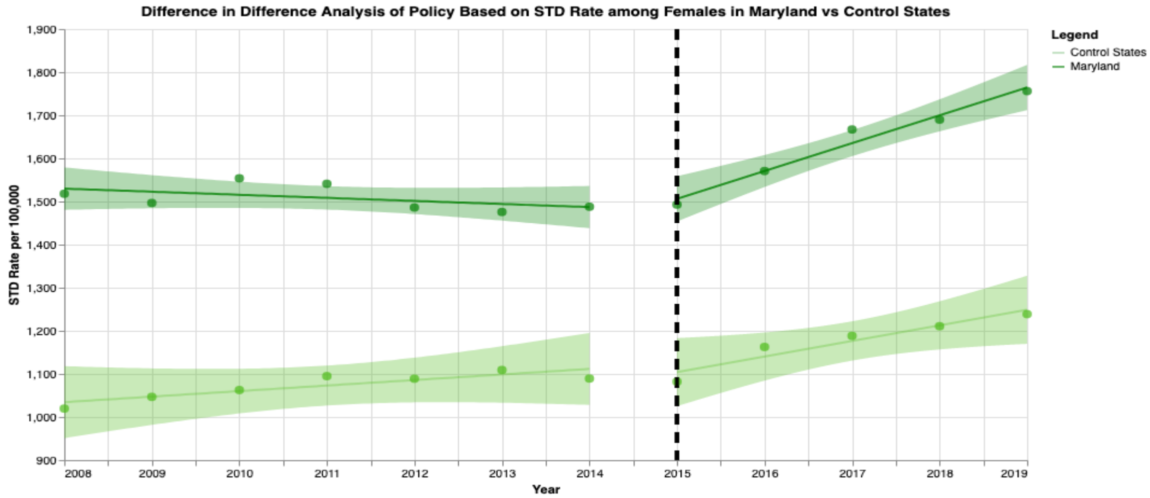
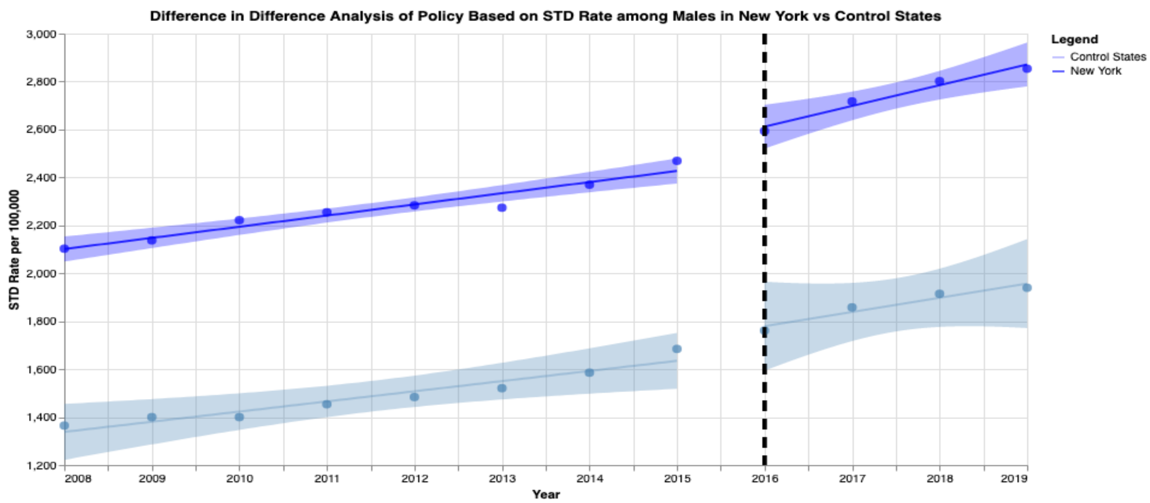


Exhibit 8 - Difference-in-Difference Analysis of STD Rates by Most Impacted Gender in Treatment State





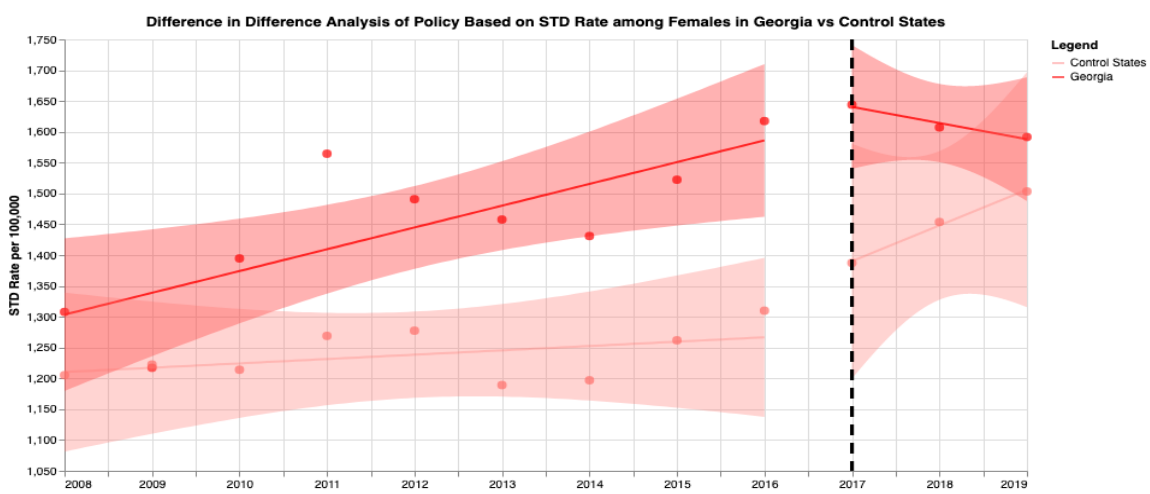


Exhibit 9 - Difference-in-Difference Analysis of STD Rates by Most Impacted Age Group in Treatment State