NOTE FOR NICK EUBANK AS HE PROVIDES FEEDBACK ON ROUGH DRAFT

As we continue to work through our analysis, please note the following will be added to this project for the final draft:

1. *Diff-in-diff for each treatment state (NY, GA, and MD) by age, race, and gender (will be referenced in the main body of the final draft - analysis and/or conclusion; however, these diff-in-diff charts will end up in the Appendix)*
2. *Regression on STD Rate by different variables using fixed effects and findings from EDA/Diff-in-Diff*
3. *Findings from EDA*
4. *Additional Exhibits via research (at the moment, we have a substantial amount so need to decide which to include and which to exclude via stakeholder viewpoint)*

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

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Team Number: 10

Executive Summary

[To add later]

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" [16][21].

In the 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 (Pfizers), 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). While there is an increase in awareness campaigns, there is also a harsh reality that these infections are increasing dramatically in comparison to 20 years ago, and becoming a greater threat to society: "Sexually transmitted infections are an enormous, low-priority public health problem. And they've been a low-priority problem for decades, in spite of the fact that they are the most commonly reported kind of infectious disease." [24]

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 [5]. "Infections rates for some STDs, including gonorrhea and syphilis, have been rising for years. Last year [2021] the rate of syphilis cases reached its highest since 1991 and the total number of cases hit its highest since 1948. HIV cases are also on the rise, up 16% last year" [23]. According to the CDC, in 2018, new infections accounted for nearly $16 billion in medical expenses and healthcare costs. Additional research suggests that this health concern impacts Americans disproportionately: "Rates are highest in men who have sex with men, and among Black and Hispanic Americans and Native Americans. While the rate for women is lower than it is for men, officials noted that it has been rising more dramatically — up about 50% last year" [23]. 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 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 through three notable laws enacted within three states over a three 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 [15][18][22].

With each of these treatments 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 STDs 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 would be able to 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, our hope is that our project can provide valuable insights to be used by respective stakeholders, such as yourself - the reader, into effectively creating sexual health policies, ultimately contributing to the improvement of 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 Center for Disease Control (CDC). The CDC has led the forefront in the data collection and data aggregation efforts, analyzing Sexually Transmitted Disease Morbidity Data since 1984. For our analysis, we concentrated on the prevalence of cases for four main types of STDs: HIV/AIDS, syphilis, chlamydia, and gonorrhea. Additionally, based on the aforementioned research on gender and race and to understand the underlying rise in STDs demographically, we were able to further segment this data by specific age groups, gender, and race/ethnicity from the CDC.

In our analysis, to truly understand the impact of the policies, we focused on the following respective states to act as controls for each of the treatment states:

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

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

We selected these respective control states because jointly, they represented the intersection of the demographic, geographic, and the health and STDs 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)*. Additionally, each of the demographic findings from our exploratory data analysis on our respective treatment states and controls states are provided in the Appendix.

Methods

To understand the impact of these policies on STD rates, a linear regression of STD rates (per 100,000 individuals) was calculated and plotted for each treatment state and examined using a difference-in-difference analysis. As a result of this method, we would be able to compare the linear trend before policy implementation and after the policy implementation. We, then, subsequently conducted the same linear trend analysis on the control states for each respective treatment state before comparing both plots.

Throughout the 2010s, all states in the US experienced an increasing trend. Based on this difference-in-difference analysis, in order 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 was also similar to the treatment state for both pre-post policy implementation, 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 important to examine the linear trends and conduct a difference-in-difference for not just the overall STD rate within the state, but 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 with STDs (the one with the highest percentage of STD cases)

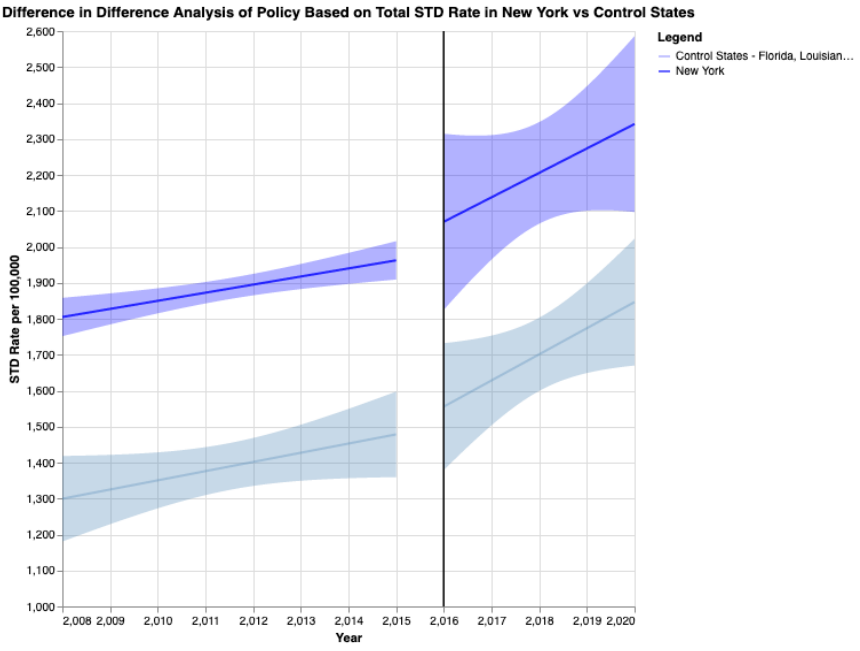
The analysis at these specific levels will contribute to the understanding of the policy's effectiveness.

Analysis

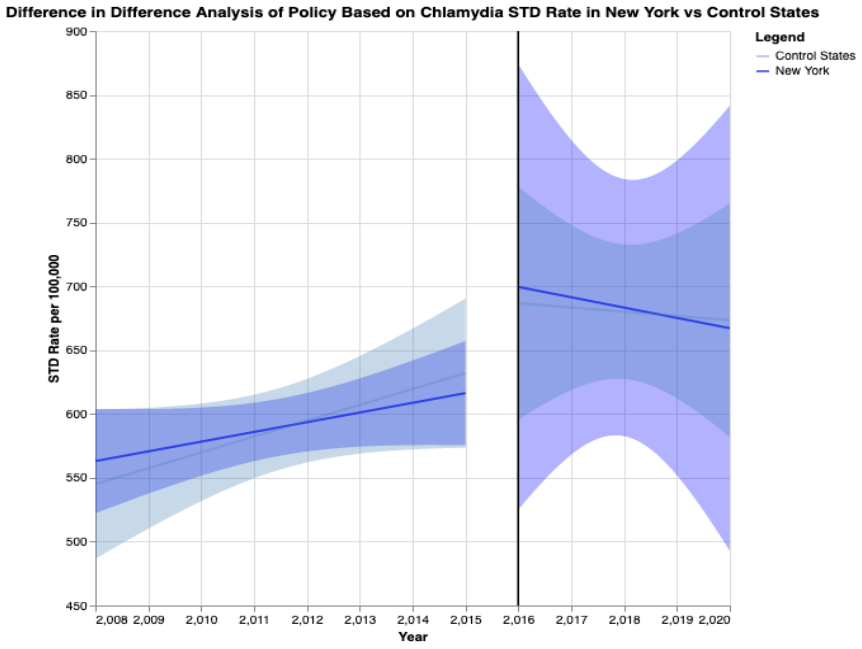
As outlined within our methodology, the below analysis of each treatment state will consist of two difference-in-difference plots: 1) At an overall STD cases (per 100,000 residents) and 2) At the specific disease level for the STD cases (per 100,000 residents).

Effect of Policies for New York

As seen through the difference-in-difference graph, the state of 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) prior to 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 faster rate, when compared to the control states.

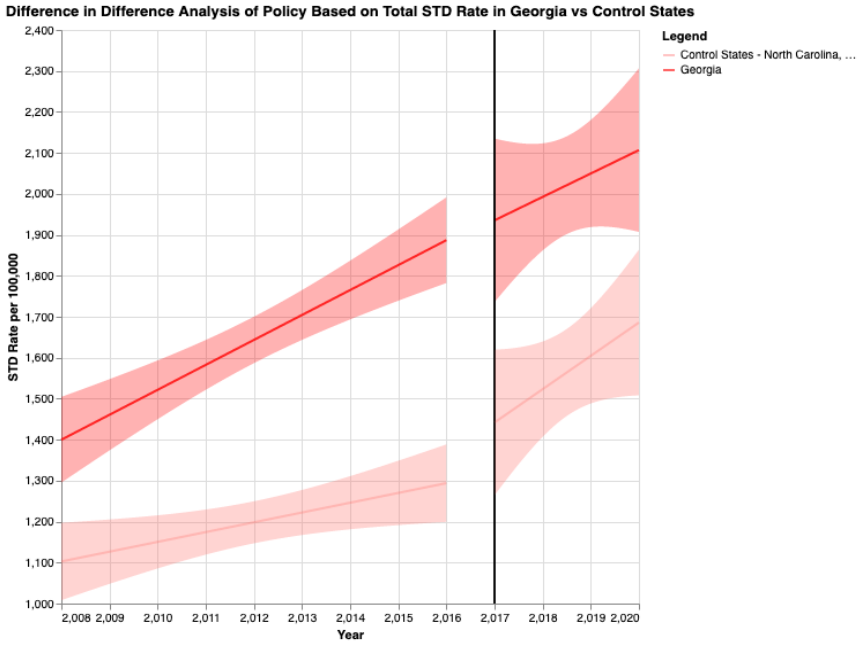


As the law passed in New York was to regulate the rate and number of Chlamydia cases, it is important to see if the policy had an impact at the specific-disease level. As shown through the difference-in-difference graph, the rate of Chlamydia cases (per 100,000 residents) was rising steadily for both the state of New York and its respective control states before the policy. However, after the policy was enacted, the rate of Chlamydia decreased for both the state of New York and the control states. While the decrease may seem consistent and thus show no real change by the policy, the rate of decrease appears to be steeper for the state of New York, when compared to the control states.

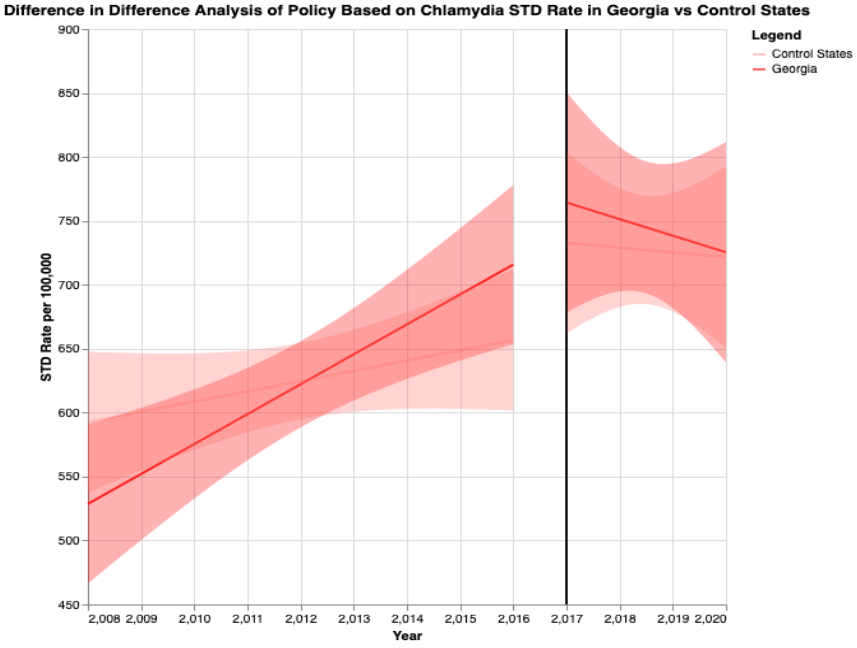


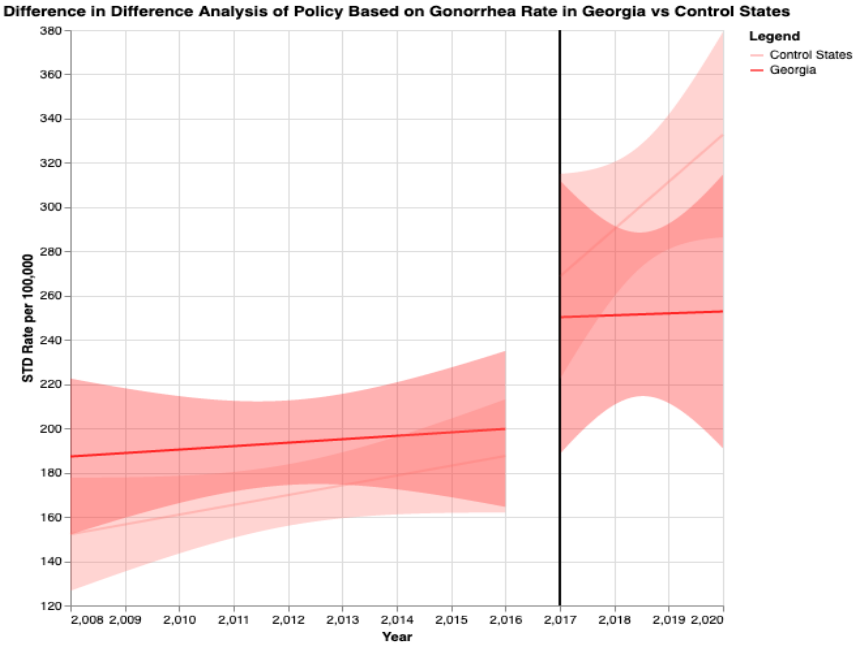
Effect of Policies for Georgia

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 increased at the same rate. In contrast, the control states saw an escalation in the rate of increasing in STD Rate per 100,000 individuals.



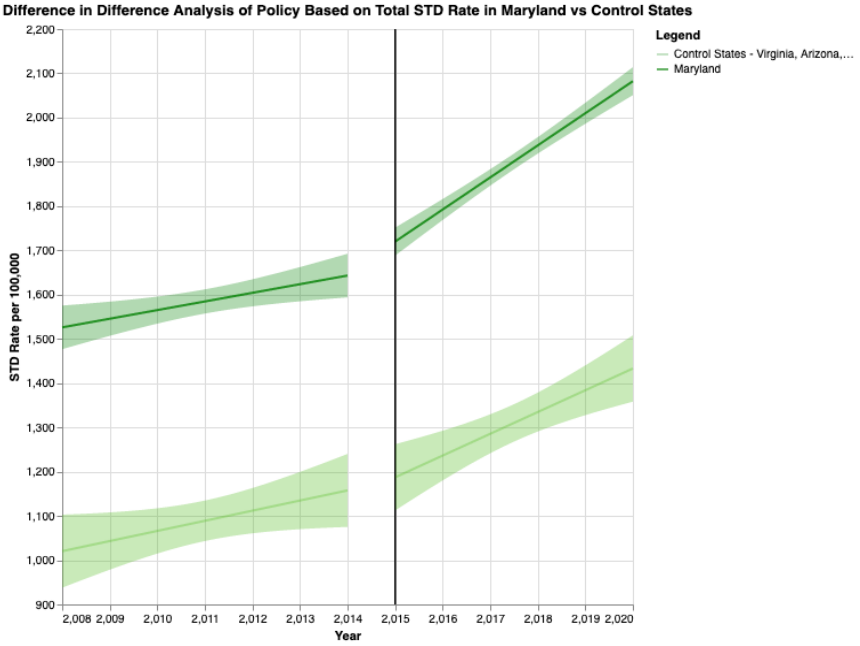
The law passed in Georgia was tailored to decrease the rate of both the Gonorrhea disease as well as the Chlamydia. Therefore, one can observe that while the state of Georgia saw an uptick in the number of Gonorrhea cases before and after the implementation of the policy, the yearly rate of the number of cases stays constant. In comparison, the control states noticed not only a significant growth in the number of Gonorrhea cases, but also a significantly steeper increase in the yearly number of Gonorrhea cases. When observing the trend for Chlamydia cases, the rate in the number of Chlamydia cases is far steeper than the control states before the policy implementation. After the policy is implemented, similar to the state of New York, while both the state of Georgia and the control states show a decrease, the rate of decrease appears to be steeper for the state of Georgia.





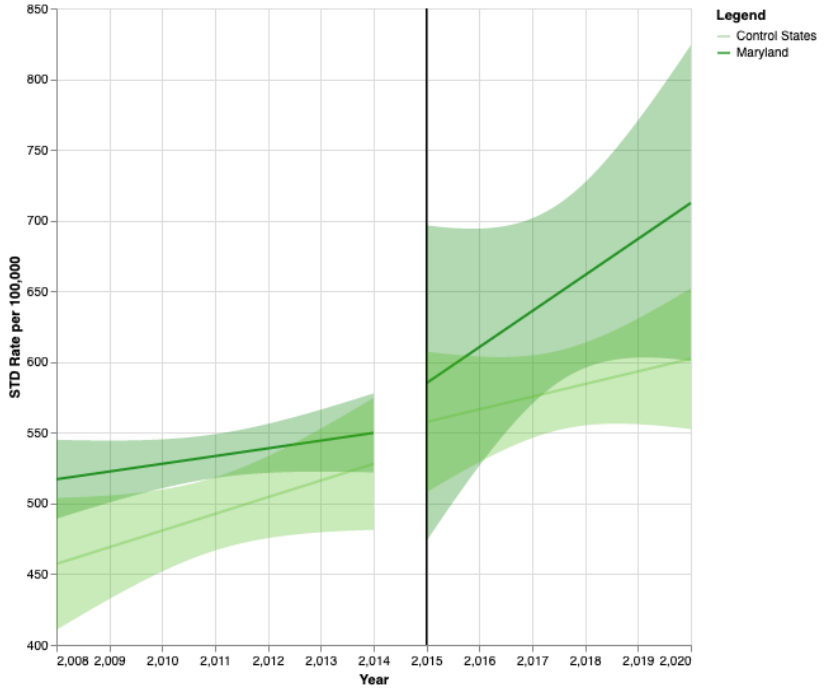
Effect of Policies for Maryland

According to the graph, 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.

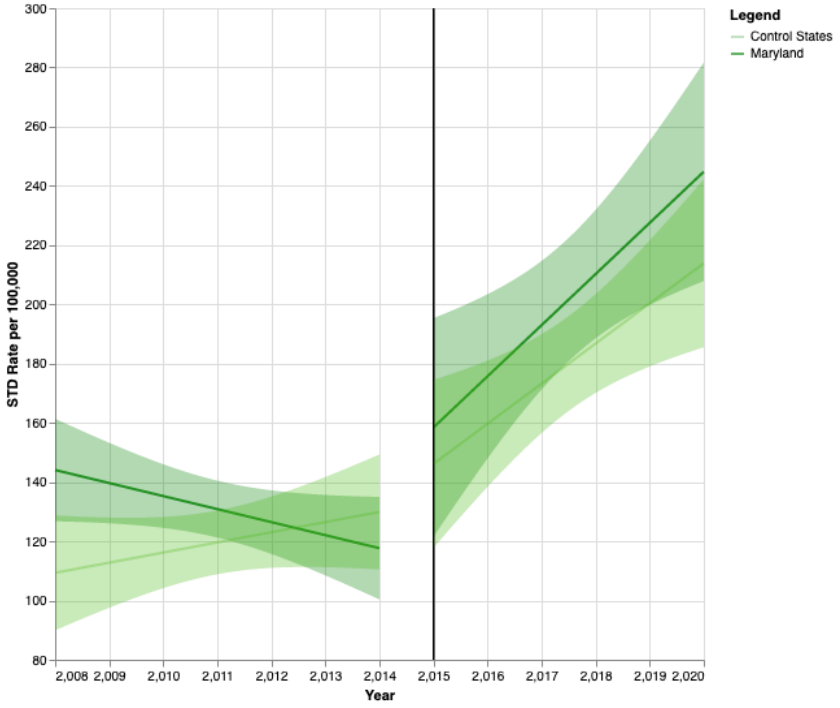


Like Georgia, the law passed in Maryland aimed to decrease the rate of both the Gonorrhea disease as well as the Chlamydia. While analyzing the number of Gonorrhea cases before and after the implementation of the policy, the yearly rate of the number of cases appears to follow a similar trend to the overall STD rate highlighted above for both the state of Georgia and its control states. When observing the trend for Chlamydia cases, we discovered a surprising and alarming trend as the rate in the number of Chlamydia cases was initially decreasing while the rate for control states was increasing substantially 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 far steeper than even the control states!

Difference in Difference Analysis of Policy Based on Chlamydia STD Rate in Maryland vs Control States



Difference in Difference Analysis of Policy Based on Gonorrhea Rate in Maryland vs Control States



Limitations

Our analysis of the effectiveness of policies to address sexual health challenges in Maryland, New York, and Georgia has several limitations. To start, the dataset does not provide information on the quality of policy implementation and enforcement, which is crucial for understanding the true impact of these policies. Effectiveness may vary depending on factors such as resource allocation, staff training, and public awareness. Second, the analysis covers a limited number of states and years (2008 to 2020), which may not generalize to other states with different demographic distributions, cultures, and healthcare systems or capture long-term policy effects. Third, while factors such as age, sex, race, and population size were controlled for, other confounding factors, such as education, income, and access to healthcare, were not included, potentially leading to biased conclusions. Lastly, the dataset may contain inaccuracies or underreporting due to stigma associated with STDs or lack of access to healthcare, leading to an underestimation of true STD rates and limiting the accuracy of the analysis.

To address these limitation, 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.
- 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.

Additionally, future research should utilize longitudinal data to track the impact of policies on individuals as they age and experience different life stages. Qualitative methods, such as focus groups and interviews, can be used to gather in-depth data on individuals' perspectives on policies, their experiences with healthcare providers, and their knowledge and attitudes towards sexual health. This would provide valuable insights into the cultural and social factors that may impact the effectiveness of policies. Furthermore, future research should investigate the potential impact of emerging technologies, such as mobile health applications and telemedicine, on sexual health outcomes, as these technologies may provide new avenues for delivering sexual health education and interventions to individuals, particularly those who may not have access to traditional healthcare services. By exploring innovative approaches, future research can better address the complex issue of STDs across diverse demographic groups.

Conclusion

After analyzing the data from New York, Georgia, and Maryland, it can be concluded that the implemented policies were not effective in reducing the overall rate of sexually transmitted diseases (STDs) per 100,000 individuals in each of the treatment states. In fact, the STD rate per 100,000 individuals continued to increase for all three states, despite the policy interventions.

The policy implemented in New York, requiring healthcare practitioners to provide educational materials to patients who receive antibiotics or prescriptions for Expedited Partner Therapy (EPT), appears to have been effective in reducing the number of Chlamydia cases (per 100,000 residents) as intended. This conclusion is based on the observation that the rate of Chlamydia cases decreased in New York and the control states, but at a more significant rate within the state of New York. Consequently, it is essential to still explore more effective education methods to deliver the necessary knowledge to patients effectively. Additionally, healthcare providers must emphasize the importance of reading and understanding the educational materials to patients and encourage them to seek clarification if needed. By improving the delivery of educational materials, the policy may have a more significant impact on reducing not just Chlamydia cases, but the overall rate of STDs in New York.

Similar to the impact caused by the policy implemented in New York, the policy in Georgia, allowing 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 treated infected individuals and their partners more quickly, which could have led to a decrease in the spread of STDs. Additionally, the rate of Chlamydia cases also decreased substantially, as compared to the control. The policy can be partially effective as there was no change in the rate of Gonorrhea cases. However, it is important to note that other factors may have contributed to the result, and more research is needed to confirm its effectiveness. Therefore, further studies should be conducted to investigate the impact of the policy on preventing the spread of STDs in Georgia, as well as to explore any potential barriers to its implementation and effectiveness. The findings of such studies could inform future policies and initiatives aimed at addressing the issue of STDs in the state.

In contrast to the policies in New York and Georgia, the policy in Maryland 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. One possible explanation for this unexpected result is that the law invoked psychological inversion among individuals, leading to a higher reporting rate of STDs. Psychological inversion refers to the phenomenon in which individuals are more likely to engage in a behavior that they are instructed not to do. Individuals may have become unwilling to ask for affirmative consent in their relationships and even enforce others to do so, which could have led to an increase in the STD rate per 100,000. Moreover, the demographic distribution of age groups in Maryland indicates that the majority of individuals and patients affected by the increase in STD rate are under 34 years old, a group that is more susceptible to experiencing

psychological inversion. It is crucial to note that the 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 are effective in achieving their intended goals.

Overall, the results of the analysis indicate that policy interventions aimed at reducing the spread of STDs may have varying levels of effectiveness, and more research is needed to understand the underlying factors that contribute to the outcomes.

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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 -