

Abortion in the United States: Occurrence, trends, cross-state care-seeking and unmet need

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**Abstract**

Abortion in the United States: Occurrence, trends, cross-state care-seeking and unmet need

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*Introduction:* Nationally, the abortion rate has fallen over the last two decades. During the same period, the number restrictions and regulations on abortion have increased, especially after 2010. From 2001 to 2008 the percent of unintended pregnancies ending in abortion has fallen by 7 percentage points indicating a potential decrease in access to abortion services or decreased demand. Therefore, it is crucial to determine the drivers of these declines to tease apart the effect of access, restrictions, family planning, demographic and socioeconomic factors.

*Methods:* This study utilizes data from the Alan Guttmacher Institute (AGI) alongside the Center for Disease Control's (CDC) abortion surveillance data to estimate the trends and levels in state-level abortion by occurrence, age-standardized occurrence, and residence from 1990 to 2012. These values are then used to model resident in-state care-seeking for abortion services controlling for sociodemographic characteristics, access and restrictions. Counterfactual scenarios are constructed to measure unmet need.

*Results:* In almost every state, the abortion ratio by occurrence decreased between 1990 and 2012 with the largest decreases seen in those states with the lowest ratios. Few differences were observed between the birth-rate standardized ratio to the crude estimated occurrence ratio. Over half of the residents in Wyoming, Mississippi and Missouri sought their abortions from other states in 2012. The estimated unmet need in 2012 was 70.5 abortions per 1,000 live births to women aged 10-49. The largest single impact for reducing this unmet need was predicted for eliminating restrictions in Medicaid funding for abortions.

*Conclusion:* Despite an overall decrease in the abortion ratio over the past decade, the expected abortion ratio would be considerably higher controlling for socioeconomic, demographic and cultural factors if there were more providers, if providers were distributed so every woman had access to a provider in her county and given changes in legislation and abortion restrictions. The largest impact on reducing unmet need was observed for lifting Medicaid funding restrictions, suggesting a disproportionate level of unmet need among low income women. There is also a need for more standardized data on abortion reporting at the state level to monitor the effect of restrictions on access to abortion services and to bolster family planning services in areas with the most unmet need.

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## Section 1. Introduction

Abortion rates have fallen across the United States (US) in the last few decades mirroring a decline in unintended pregnancy. The rate of unintended pregnancies ending in abortion has also fallen from 2001 to 2008 from 47% to 40%,<sup>1</sup> a potential sign that women have less access to abortion services<sup>2</sup> or that demand has fallen. In recent years, the number of abortion regulations and restrictions increased; over 92 provisions were enacted in 2011 alone compared to 189 enacted over the previous decade.<sup>3</sup> These laws ranged from requiring minors to obtain parental consent before getting an abortion to laws requiring abortion clinics to comply with certain standards or restrict public funding for abortion services. Therefore, it is important to understand the drivers of the decline in abortion to tease apart the effect of access, restrictions, family planning, demographic and socioeconomic factors.

Quantifying the drivers of change is essential given evidence that even when abortions are not legal or accessible, women terminate their pregnancies using unsafe methods.<sup>4,5</sup> Before abortion was legal in the US, estimates of unsafe abortion range from 200,000 to 1.2 million per year.<sup>6</sup> Although this is no longer the case, there are still women who self-induce abortion because of lack of access or other barriers.<sup>4</sup> Research has shown that lack of access to abortion services falls disproportionately on minority and low SES women who tend to seek abortions at higher rates and who may be less willing or able to travel distances to obtain services.<sup>7,8</sup>

Research on abortion is challenged by the lack of data and its quality. The Center for Disease Control's (CDC) abortion surveillance system, a passive voluntary system relying on data reported by states, provides some statistics on abortion. Reporting on abortion services, though, varies by state—some states do not report on abortion services at all or do not track the residence of those seeking abortion in the state—and often times the data collected underreports the total abortions in the state. The CDC reports that their total abortion counts are consistently around 70% of the totals reported by The Alan Guttmacher Institute (AGI).<sup>9</sup> Thus, much of the research relies on provider surveys performed by AGI. Much of the literature therefore focuses on abortion occurrence, a count of the number of abortions by where the service was performed, rather than by the residence of the women. This is a limitation as a non-trivial number of women seek abortion care across state lines.<sup>8</sup> Of note, AGI does release data on abortion by residence,<sup>10</sup> but their methods to estimate these counts have not been released.

The body of work on the effect of laws and access to providers on abortion is concentrated in the 1990s and early 2000s since when an abundance of laws and restrictions have been passed.<sup>3</sup> Recent literature examining the effects of policies or access to providers focus on a single state or a single law.<sup>11-14</sup> This body of literature is mixed in its findings. Several studies on the effect of Medicaid funding restrictions and parental involvement laws have shown an overall reduction in abortion rates in states with these laws.<sup>15-22</sup> While other studies on mandatory delay and counseling laws as well as Targeted Regulation of Abortion Provider (TRAP) laws have found no effect of these laws on abortion demand.<sup>23-29</sup> Many of these studies do use abortion residence measures as their outcome of interest, but are limited in the years for which AGI releases this

data and in the conclusions they can draw. Abortion measures by residence do not represent the difficulty or ease of getting an abortion in a state, as they only show when women unable to obtain abortions at all, not whether women sought services in a different state. Jones and Jerman showed that in states with wait time or counseling requirements, women sought services further from where they lived, often times to neighboring states, suggesting legislation impacted care-seeking behavior of women to neighboring states.<sup>8</sup> Such care-seeking behavior varied among racial groups and socioeconomic lines.<sup>8</sup>

This study aims to quantify the proportion of the decline in the abortion ratio that is due to changing demand versus a change in access to services. This analysis aims to utilize all data released on abortion by AGI and the CDC—seeking to describe abortion services over time by where the abortion occurred and by the residence of the woman who sought the procedure. It also aims to describe cross-state care-seeking for such services and by doing so, measure the contribution legislation and changes in access had on abortion ratios, controlling for sociodemographic factors that might have changed over time.

## Section 2. Methods

### 2.1 Framework

This analysis has two major steps: (1) estimate abortion rates and ratios by state in the US and (2) explain the drivers of the changes in abortion ratios estimated in step 1 to understand whether these changes are driven by sociodemographic changes, the implementation of abortion regulation or a lack of access to services.

Step one seeks to describe abortion incidence by where the abortions occurred (occurrence) and by the residence of the woman who sought the abortion (residence). To estimate abortion occurrence for women aged 10-49, this study utilizes AGI data given the active follow-up techniques employed by AGI to get information from all known abortion providers.<sup>2</sup> These estimates are used as an envelope for the total occurrence by state-year. To model age-specific occurrence, residence and cross-state abortion seeking, I used data reported by the CDC on age patterns of abortion occurrence, the ratio of residence to occurrence, and the proportion of occurrence to out-of-state residents to estimate the trend and relative levels by state and then scaled my estimates to the levels predicted in the model of total occurrence.

In step 2, I used these inputs to construct a model that describes abortion care-seeking behavior by residents within their own state, controlling for a number of sociodemographic and cultural characteristics listed below alongside measures of access to abortion services and restrictions. I then constructed counterfactual scenarios to predict abortion care-seeking with the enactment of different laws and increased access to providers.

### 2.2 Data

AGI performs a survey of abortion providers by mailing a survey to all known abortion providers. This survey asks providers to report on the number of induced abortions performed in their facility. When facilities fail to respond after multiple follow-up calls, AGI estimates this quantity for providers using past responses or other available data.<sup>2</sup>

The CDC releases an annual surveillance report on abortions which relies on data reported voluntarily by state central health agencies. These reports include total abortions by occurrence, residence and the proportion occurrence sought by out-of-state residents. The report also breaks down occurrence by age, race, marital status, previous births and previous induced legal abortions. I extract data from 1990 on, but only in 1997 did the CDC begin reporting on the number of abortions by residence. States differ in their own reporting of induced abortions and this is reflected in the CDC data. Several states, including California, do not report any data to the CDC and several states do not record information on residence or other breakdowns of abortion services.

I also use a variety of data sources to construct a set of covariates at the state-year level to use in both the modeling of abortion counts and in the modeling of abortion care-seeking behavior. See Table 1 for a list of covariates and data sources used. Where data is unavailable for certain years, I interpolate and extrapolate available data to construct a full time-series. All data is at the state-year level.

*Table 1: Description and source of covariates*

<i>Variable</i>	<i>Data source</i>	<i>Definition</i>
<b>Demographic variables</b>		
Total population	US Census & Human Mortality Database	Women aged 10-49 living residing in each state. Measured in July 2016.
Births	National Vital Statistics System & US Census	Number of births to women aged 10 to 49 by state
Proportion of African American population as proportion of total state population	NCHS Bridged Race populations	Proportion of African American population as proportion of total female population aged 10-49
Proportion of Hispanic population as proportion of total state population	NCHS Bridged Race populations	Proportion of Hispanic population as proportion of total female population aged 10-49
Unintended pregnancy rate	AGI	Unintended births, abortions and fetal losses per 1,000 women aged 15-44
<b>Socioeconomic variables</b>		
Unemployment rate	Bureau of Labor Statistics	Percent of labor force unemployed
Marriage rate*	National Vital Statistics System, NCHS	Marriage counts by state of occurrence per 1,000 population residing in area
Average years of education among women	Global Educational Attainment, IHME, 1970-2015	Average years of education among women aged 15-44
Per capita income	Bureau of Economic Analysis	Average personal income over total population (Thousands of dollars)
Total religious adherents rate	ASARB Religious Census Congregation Membership study	Members, their children and the estimated number of other participants who participate or belong to a religious group over the total state population.

Health care indicators		
Percent of population under 65 uninsured*	US Census	Percent of state population under 65 years of age without any form of health insurance.
Reproductive/maternal health variables		
Proportion of women with four antenatal care visits (ANC4)	GBD 2015	Proportion of women aged 15-44 with all four recommended ANC visits during pregnancy.
Number of abortion providers	AGI	Number of providers performing abortions. Includes hospitals, clinic or physician's office where abortions are performed.
Percent of women living in counties without an abortion provider	AGI	Percentage of women aged 15-44 living in counties without an abortion provider
Number of counties without abortion provider	AGI	Percentage of counties without a known abortion provider.
Laws (Descriptions adapted from AGI)		All measured as binary indicator of whether or not law was in effect as of January 1 <sup>st</sup> . Laws that are permanently or temporarily enjoined are treated as zeros.
Licensed physician requirement*	AGI	Law requiring abortions be performed by licensed physicians.
Hospital requirements	AGI	Law requiring an abortion to be performed in a hospital after a specified gestational age.
Second physician requirement*	AGI	Law requiring a second physician be involved in the abortion after a specified point in the pregnancy.
Gestational limits*	AGI	Law prohibiting abortions, "except when necessary to protect the women's life or health, after a certain point in pregnancy, most often fetal viability."
Partial birth abortion ban	AGI	Law prohibiting "partial-birth" abortion.
Public funding	AGI	Law where states use their own funds to pay for "all or most medically necessary abortion for Medicaid enrollees in the state". Where not in effect, Medicaid funds only the cases where the women's life is in danger or the pregnancy is result of rape or incest.
Private Insurance coverage restrictions	AGI	Laws restricting coverage of abortion in private insurance plans to coverage for scenarios when the women's life would be endangered.
Waiting periods	AGI	Laws requiring a woman to wait a specified time when seeking an abortion.
Refusals	AGI	Law allowing facilities and providers to refuse to perform abortion—such laws vary from all providers to private or religious providers.
Parental notification and consent	AGI	Laws requiring minors to notify or notify and consent their parents to the procedure.

\*Not included in final model

## 2.3 Analysis

### 2.3.1 Step 1: Abortion rates and ratios by occurrence and residence

Methods to estimate different abortion rates and quantities of interest are explained in detail below. All models are mixed-effects models with random intercepts and slopes included for each state to model state-level differences. The random slope takes the form of a natural cubic spline with two to three knots. In estimating the quantities described in this section, I select only one to three covariates in each model to ensure I am not predicting abortion rates/ratios with variables I then use to explain changes in these quantities. All models include the proportion of women receiving four antenatal care visits (ANC4), a potential indicator of access to and utilization of reproductive health services.

#### Occurrence

To model occurrence, counts of induced abortion were extracted where surveys were available using the AGI data center—spanning years 1991 to 2011. The abortion ratio, abortions per live birth, was modeled using a log-linear model implemented as a generalized linear model with a Poisson response and link log using the log of the total births from women aged 10-49 (see Table 1 for more information) as an offset. Covariates included in the model included ANC4 and a linear time trend. Results from this model were used as a total envelope of abortion occurrence in each state-year.

#### Age-standardized occurrence

Age-standardized occurrence was estimated by modeling the age-specific occurrence ratio in 5-year age groups with data from the CDC abortion surveillance reports. The log ratio was modeled using a mixed-effects model including a linear trend on time, an indicator for each age group, the logged proportion of births in each age group, logged ANC4, and a random intercept and slope for each age group. The modeled estimates were scaled to the total occurrence predicted in the state and then used to age-standardize both the rate and ratio of occurrence to the age pattern in the US in 2012 for the occurrence rate, or to the birth-rate age pattern for the occurrence ratio.

#### Residence

To model residence, estimates of abortion residence and occurrence were extracted from the CDC abortion surveillance reports. The ratio of residence to occurrence was modeled with a mixed effects linear model in order to apply this ratio to the total occurrence estimated from the AGI data. Covariates included a linear trend on time, ANC4, the number of neighboring states, the percent of counties without a provider in the state, and an indicator for state-years with large changes in their residence to occurrence ratios. This modeled ratio was multiplied by the modeled occurrence to estimate abortion by residence.

### Resident in-state occurrence

To estimate the number of abortions obtained by residents in their home state, the proportion of occurrence by out-of-state residents was extracted from the CDC abortion surveillance. This proportion was modeled using a linear mixed effects model after logit transforming the proportion of occurrence by out-of-state residents. Covariates included a linear time trend, ANC4, and the number of bordering states, and the percent of counties with no provider in the state. The estimated proportion was multiplied by the modeled occurrence, assuming abortion to women of unknown residence had the same distribution of in-state to out-of-state as the abortions with known residence.

### Resident out-of-state occurrence

Resident out-of-state occurrence could only be estimated for 2012 given that a proportion of abortions are from unknown residence. The CDC releases a cross-tabulation of occurrence by state of residence. The proportion of occurrence to women of unknown residence was extracted from this table. Where this information was not reported or censored given small numbers, I searched the state's department of health website. If the information could not be found, and the CDC reported numbers smaller than 50, I assumed a zero percent unknown residence. This proportion, alongside the modeled proportion non-resident occurrence and estimated abortion by residence was used to calculate the proportion of residents that sought abortions in another state. In one state, Maine, this took a small less than zero value and was replaced with 0.

### 2.3.2 Step 2: Modeling effect of laws and providers

To estimate the effect of laws and the availability of abortion providers on care-seeking behavior for abortions with a woman's home state, I constructed a model to describe the factors that affect abortion demand and care-seeking. These factors were chosen after a systematic review of published literature for factors that affect abortion-seeking behavior among women of reproductive age. These factors include information on demographics—including fertility patterns among 5-year age groups and racial composition of the population given the higher rates of abortion observed in African American populations<sup>30</sup>—as well as factors to describe the social, economic and cultural factors that affect reproductive decisions. I also include the unintended pregnancy rate estimated by AGI to isolate the effect of the above factors on decisions related to abortions and remove the impact of family planning coverage differences. Information on abortion laws from the *Overview of State Abortion Law* series from AGI were included alongside information on abortion provider availability and distribution. This model was only fit from 2006-2012 given comparable information on laws could only be found starting in 2006. To determine which of the covariates to include in the final model, I performed a binary regression analysis of each covariate on the in-state resident abortion occurrence ratio and include only those with a significant effect.

I modeled the residents in-state abortion ratio ( $AR$ ) using a mixed-effects linear model.

$$\ln(AR_{s,y}) = \ln(Female\ Pop) + \mathbf{CX}_{s,y} + \mathbf{BProviders}_{s,y} + \mathbf{FLaws}_{s,y} + \gamma_s + \delta_t + \varepsilon_{s,y}$$

where  $X$  is a vector of covariates including the proportion of births to mother aged 15-19, 20-24, 25-29, 30-34 and 35-39; average years of education for women aged 15-44; per capita income; the unemployment rate; total religious adherents rate; and the unintended pregnancy rate.

*Providers* is a vector that includes the log number of providers per pregnancy (births + unintended pregnancies) in each state and the percent of women in the state living in a county with no provider. *Laws* is a vector of indicators for each law in Table 1 measured on January 1<sup>st</sup> of the given year. For a list of laws by state, see Appendix Table 1.  $\gamma_s$  is random intercept on state and  $\delta_t$  a random intercept on year. The District of Columbia is removed from this analysis given the unavailability of complete information on policies.

To estimate the level of unmet need and the effect of changing certain restrictions and increasing access on this level, I constructed counterfactual scenarios. Unmet need is defined as abortions that took place in a non-home state or that did not occur at all. In these scenarios I modified four variables-- implementation of public funding for all or most medically necessary abortions for Medicaid enrollees, removal of restrictions on private insurance coverage of abortion, the log-transformed abortion providers per pregnancy and the percent of women living in a county with no provider—the access and restrictions factors for which my model predicted a significant effect. To estimate the total level of unmet need, I modified all four factors to be the least restrictive; changing the providers per pregnancy to match the highest value observed in the data (Hawaii with 7.9 providers per 10,000 pregnancies in 2006), the percent of women living in counties without providers to 0% as also observed in Hawaii, and abolishing the restrictions on private insurance coverage as well as public funding restrictions. Total unmet need was calculated subtracting the predicted abortion incidence using observed values from the counterfactual predictions after varying these factors. I then modified each factor separately to understand its impact on unmet need. The final two scenarios involved changing the four variables listed above to match California and Washington State in 2012—the two highest ranked states for reproductive health rights by NARAL.<sup>31</sup>

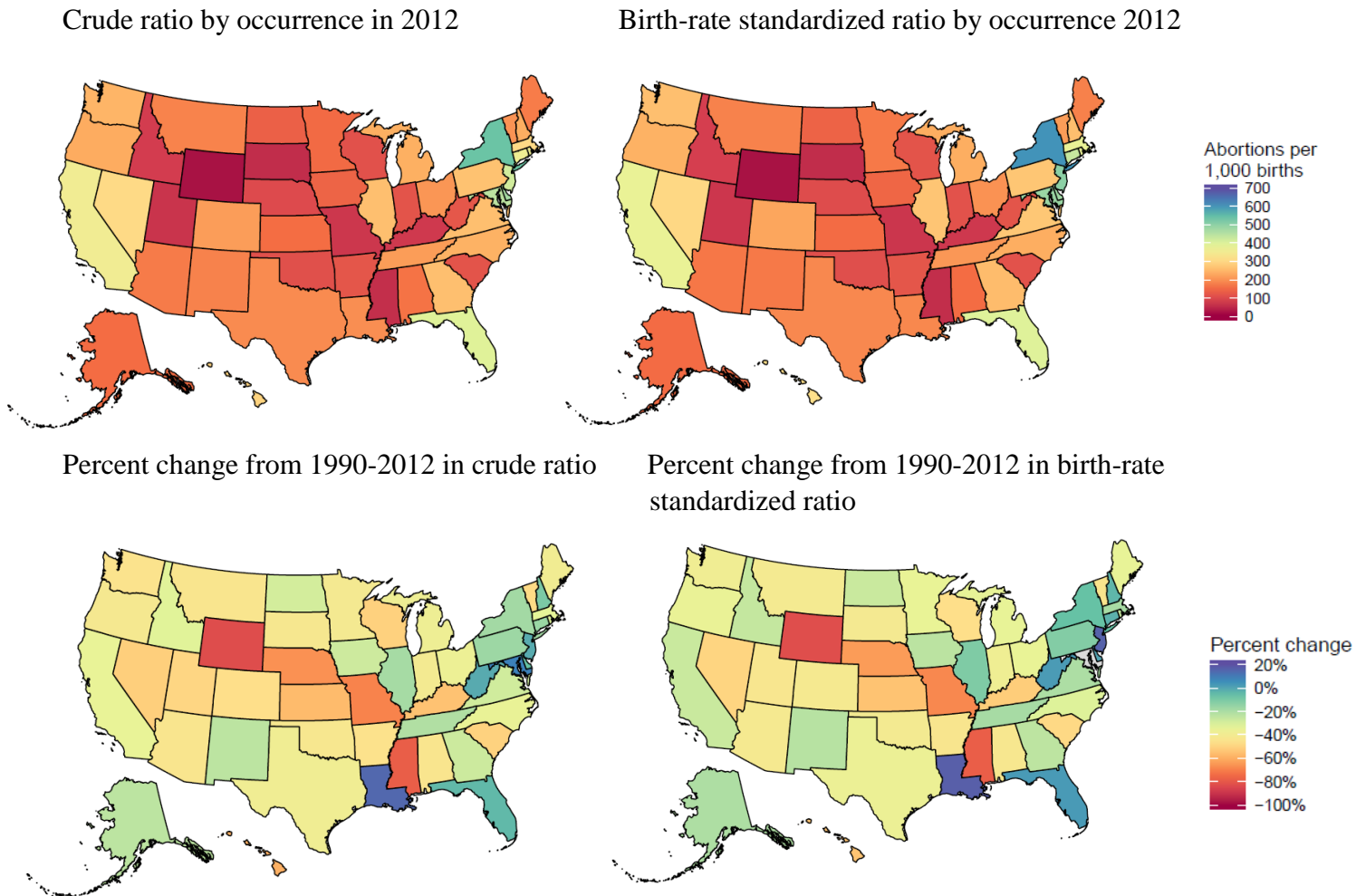
### Section 3 Results

In this section I discuss the results from the analyses described above, starting with trends and levels of occurrence. I then present abortion incidence by residence and describe cross-state care-seeking. I then present the model results for abortion care-seeking and unmet need. I focus on the abortion ratio (abortions per birth) over the abortion rate (abortions per women) given the former takes out the effect of fertility. For more information on results by state, see Appendix Table 2.

Abortion ratios dropped in every state from 1990 to 2012 with the exception of two states—Louisiana and Maryland—where the ratio increased (Figure 1). Abortion ratios by occurrence ranged from 539.8 (95% CI: 440.3, 652.34) to 14.3 (95% CI: 11.1, 18.47) abortions per 1,000 births to women aged 10-49 in New York and Wyoming respectively in 2012. Those states with the lowest abortion ratios in 2012 had the largest rates of decline in their abortion occurrence ratio between 1990 and 2012. Wyoming, Mississippi, Missouri and Nebraska, which had occurrence ratios under 100 abortions per 1,000 births in 2012 recorded over 60% declines over this time period. When controlling for age-patterns in birth-rates, the relative ordering of states by ratios of occurrence holds, with a few exceptions and the ratios are almost identical,

suggesting the age pattern of birth in states does not vary greatly between states or over time. Rates of decline between 1990 and 2012 were slightly smaller for age-standardized ratios of occurrence and more states recorded an overall increase (West Virginia, Louisiana, Florida, New Jersey, Maryland and Delaware). Within all states, the largest abortion ratio was observed for women aged 20 to 24.

Figure 1: Occurrence ratio in 2012 and rate of change from 1990-2012, crude and age-standardized\* (a) Crude ratio birth-rate standardized ratio (b) Percent change in crude and birth-rate standardized ratio

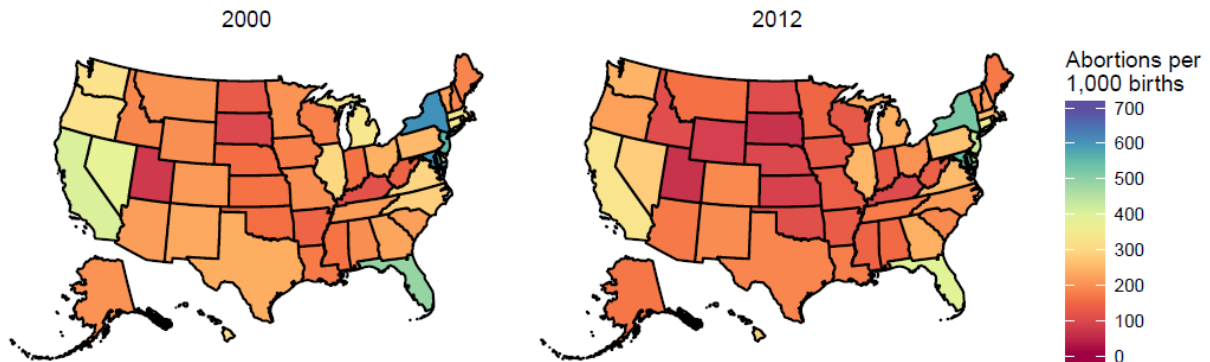


\*Washington DC is removed from this figure.

In terms of abortion ratio by residence, similar patterns were observed geographically to abortion occurrence with the highest ratios estimated in New York, Maryland, Delaware, and New Jersey with ratios over 400 per 1,000 live births (Figure 2). In 2012, the residence ratio exceeded the occurrence ratio by 101.3 abortions per 1,000 women in Maryland (95% CI: -8.5, 249.5) and was 195.7 abortions per 1,000 births less than the occurrence rate in the District of Columbia (95% CI 136.3, 252.8). Changes in abortion ratio by residence from 2000 to 2012 reflects the changes in occurrence in the same time period with a few exceptions; Idaho, Wyoming and Iowa saw

larger decreases in abortion ratios by residence, while in Mississippi and Delaware, the rates of change in residence ratios were almost half that of occurrence. In contrast to occurrence, the state with the lowest abortion ratio by residence was Utah with an estimated ratio of 58.1 abortions per 1,000 births to women aged 10-49 in 2012 (95% CI 47.13, 71.56).

Figure 2: Residence ratio in 2000 and 2012\*



\*Washington DC is removed from this figure.

Figure 3 shows the percent of total abortion by occurrence obtained by out-of-state residents. The distribution and geographic pattern of out of state-abortion seeking changed little over time, although Delaware and Vermont saw close to a 10 percentage point drop in the percent of occurrence obtained by out-of-state residents. The largest proportion of occurrence by out-of-state residents occurred in the District of Columbia, Kansas and North Dakota with 51.7% (95% CI: 31%, 71%), 49.4% (95% CI: 37%, 62%) and 31.0% (95% CI: 20%, 43%) of abortions performed for out-of-state residents respectively. In Tennessee, 23.8% (95% CI: 13%, 39%) of abortions were obtained by out-of-state-residents in 2012. In Wyoming, Hawaii, Alaska and Arizona less than 1% of abortions performed in 2012 were sought by out-of-state residents. Contrasting this to the proportion of residents who went out-of-state to obtain an abortion, the majority of women in Wyoming, Mississippi, and Missouri went out of state for the procedure (Figure 4). In South Carolina, Kentucky, Idaho, South Dakota, West Virginia and Arkansas over 20% of women received their abortion in a state other than their own.

Figure 3: Percent of abortions obtained by out-of-state residents as proportion of occurrence

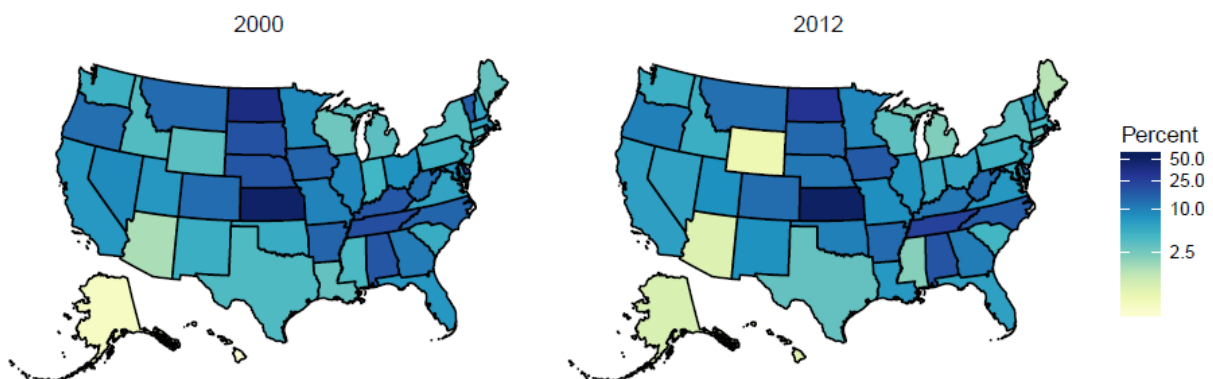
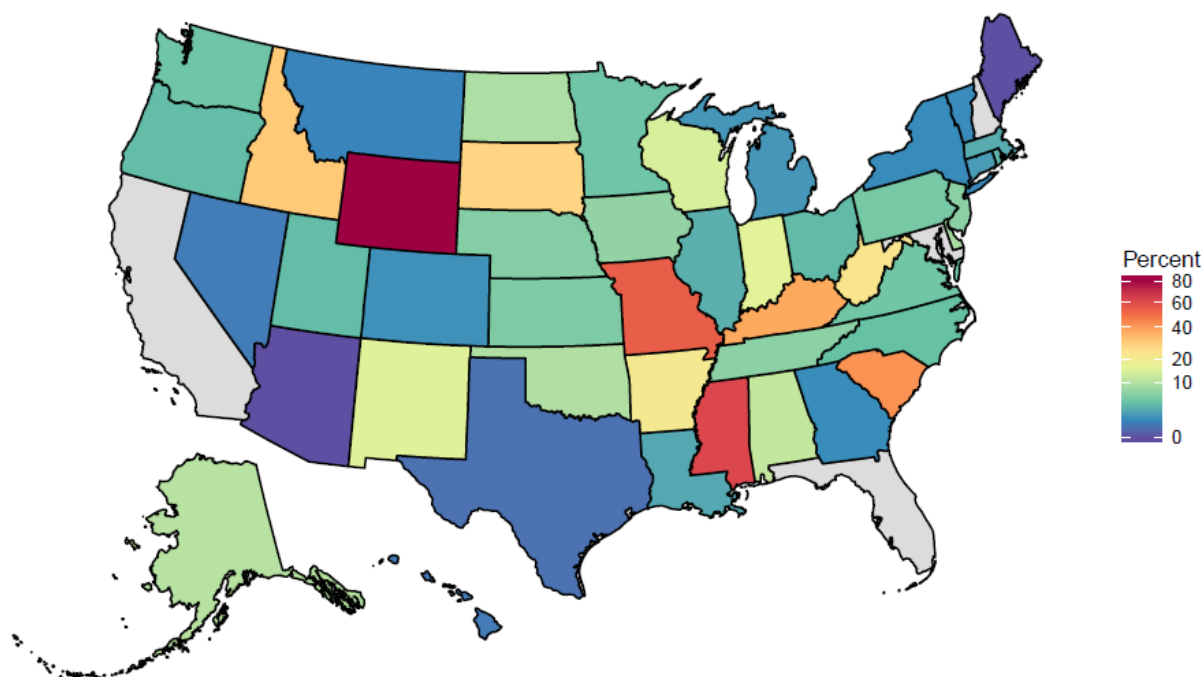


Figure 4: Percent of residents who went out-of-state to obtain an abortion in 2012



In analyzing the effect of providers and laws on resident in-state abortion occurrence, several laws and the number and distribution of providers were found to be significant (Table 2). A number of demographic and socioeconomic factors were also found to be significant, including the proportion of African Americans of the total state population, average years of education among women, the unintended pregnancy rate, the unemployment rate, and per-capita income. With the exception of education, an increase in each of these factors was associated with increases in the resident in-state abortion occurrence ratio. Both measures of provider access had a positive effect on the resident in-state occurrence abortion ratio. A 1% increase in the number of providers per pregnancy was associated with a 0.073% (95% CI: 0.0062%, 0.139%) increase in the resident in-state abortion occurrence ratio and a decrease of 10 percentage points in the percent of women living in a county without a provider was associated with a 0.027% (95% CI: 0.0050%, 0.0485%) increase in the resident in-state abortion occurrence ratio. Restrictions on public funding for abortion services and limits on private insurance coverage for abortion had significant negative effects on the in-state abortion occurrence ratio.

*Table 2: Regression results for effect of sociodemographic factors, access and restrictions on residents in-state abortion occurrence ratio. (N=350)*

	Coefficient (SE)
Intercept	12.28 (1.81)***
Proportion African American	1.53 (0.60)*
Proportion Hispanic	0.048 (0.52)
Proportion of births 15-19	-1.93 (1.51)
Proportion of births 20-24	-1.57 (1.54)
Proportion of births 25-29	-2.40 (1.45)
Proportion of births 30-34	-0.22 (1.66)
Proportion of births 35-39	-0.78 (1.90)
Average education among women	-0.44 (0.076)***
Unintended pregnancy rate	0.0050 (0.0015)**
Unemployment rate	0.0087 (0.0030)**
Per capita income	0.000013 (0.0000030)***
Total religious adherents rate	0.19 (0.30)
Log providers per pregnancy	0.073 (0.034)
Percent women in counties with no provider	-0.0027 (0.0011)*
Hospital requirement	0.021 (0.036)
Partial birth abortions	-0.0062 (0.013)
Public funding available	0.36 (0.16)*
Private insurance restrictions	-0.10 (0.031)***
Mandatory waiting period after counseling	-0.0018 (0.030)
Minor parental notification law	0.027 (0.023)
Minor parental consent law	-0.031 (0.032)
Providers able to refuse	-0.17 (0.20)

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

Coefficients represent the percent change in the abortion ratio given a unit increase in the variable.

Figure 5 shows the predicted level of unmet need and the effect of changing laws and increasing availability of providers on unmet need. In 2012, the estimated total level of unmet need at the national level was 70.5 abortions per 1,000 live births. The largest impact for a single modifiable factor was observed for removing restrictions on Medicaid funding for abortions. Removing this restriction on public funding translated into a decrease of 47.2 abortions per 1,000 births in the estimated unmet need. Increasing the number and availability of providers was predicted to decrease unmet need as well, with a larger effect predicted with an increase in the number of providers per pregnancy. Increasing the providers per pregnancy to the level observed in Hawaii in 2006, the state with the largest number providers per pregnancy, resulted in a 39% decrease in the national level of unmet need in 2012. With 0% of women living in counties without an abortion provider, I predicted a decrease in the unmet need of 16.7 abortions per live 1,000 live births. Removing limits on private insurance, had a significant but small effect on the level of

unmet need. At the state level, the largest levels of unmet need were observed in Delaware, Florida and Rhode Island with estimated unmet need over 170 abortions per 1,000 live births in 2012 (Figure 6a). When looking at the percent deficit in abortions (the percent difference between abortion ratios when meeting predicted unmet need and observed ratios), Wyoming, Idaho, North Dakota, Kentucky, Missouri and Kansas had over a 95% deficit in meeting the predicted unmet need (Figure 6b).

Figure 5: Resident in-state occurrence ratios under counterfactual scenarios

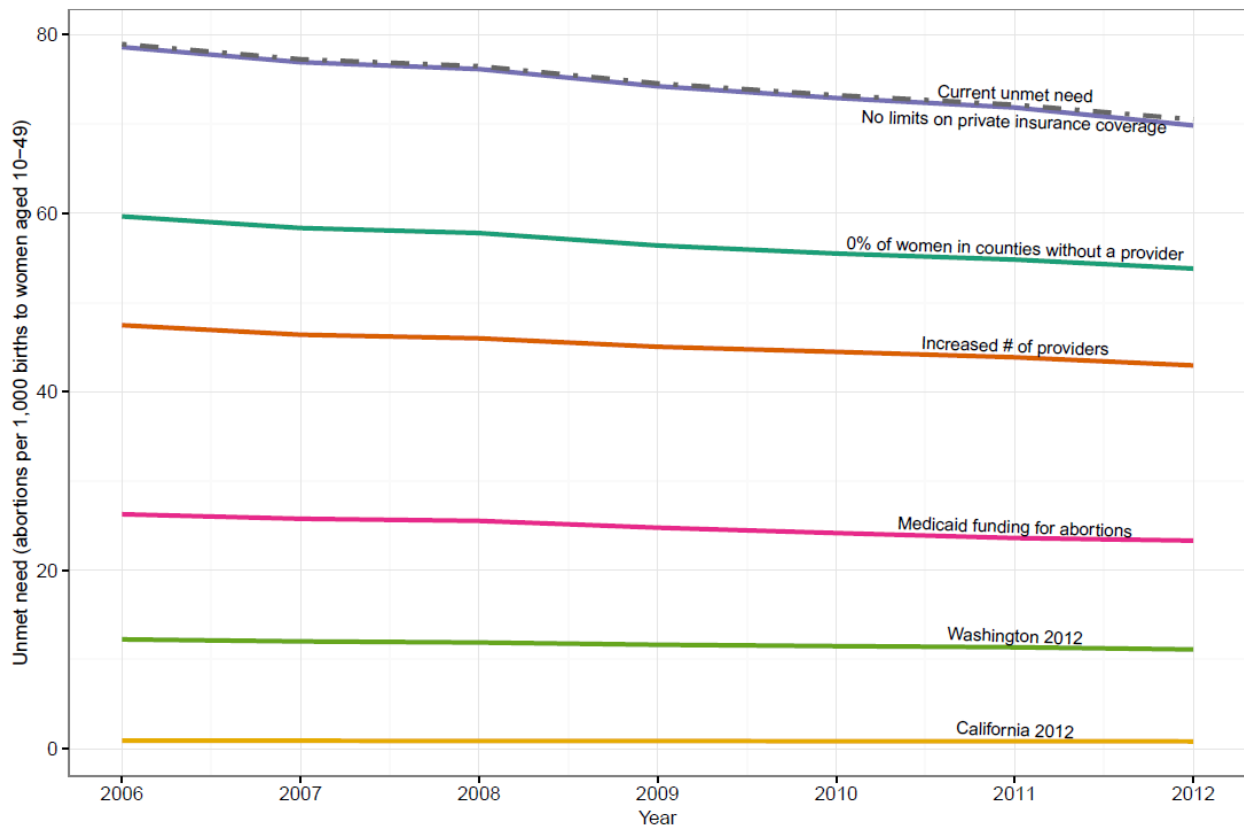
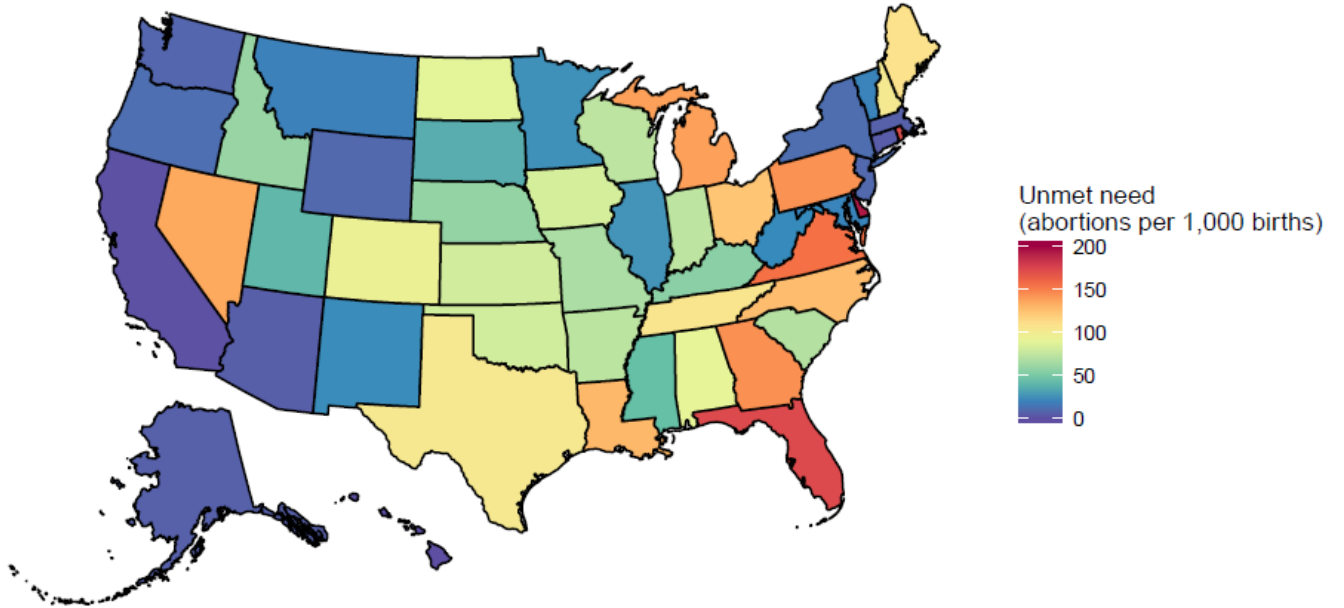
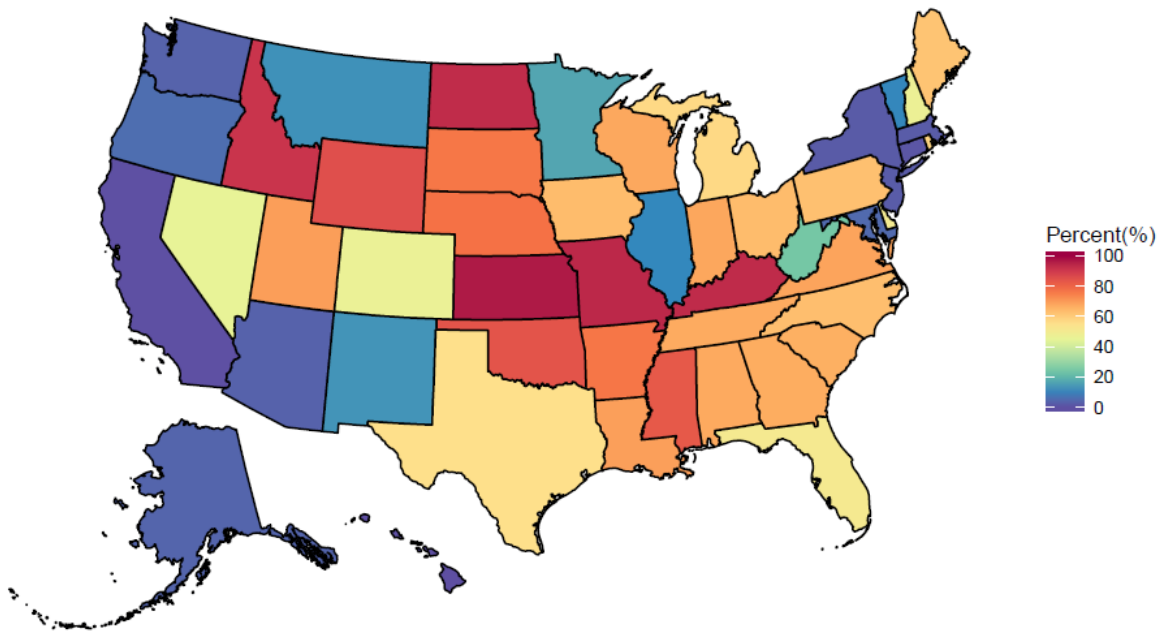


Figure 6: Unmet need by state (a) Estimated level of total unmet need in 2012 (b) Percent deficit in meeting unmet need for abortions in 2012

(a) Estimated level of total unmet need in 2012



(b) Percent deficit in in-state resident occurrence ratio observed in 2012



## Section 4. Discussion

This study aimed to describe trends in abortion rates and ratios by occurrence and residence and to describe cross-state care-seeking. To my knowledge, it is the first attempt outside of AGI's unpublished estimates to generate a full time series of abortion by residence. It is also the first study to estimate an age-standardized rate and birth-rate standardized ratio at the state level. This study is novel in its use of in-state resident occurrence to analyze the impact of laws and access on abortion demand and care-seeking. Using this measure allows this study to comment on the effect of laws on the behavior of residents seeking care within their own state—implying that significant decreases could be related to seeking care in another state or inability to obtain an abortion at all. These findings are of great importance as they speak to the high levels of unmet need for abortion services across this country and particularly within certain states and provide increasing evidence on the levels and trends of abortion care-seeking behavior across the US.

Despite an overall decrease in the abortion ratio over the past decade, the expected abortion ratio would be considerably higher controlling for socio-economic, demographic and cultural factors if there were more providers, if providers were distributed so every woman had access to a provider in her county and given changes in legislation and abortion restrictions. Increasing the number of providers to what is observed in Hawaii could decrease unmet need by almost 40% and lifting restriction on public funding for abortion could decrease the unmet need at the national level by over 65%. Changing these laws and increasing the number of providers together to levels observed in Washington and California could have even larger impacts on addressing this unmet need. This study highlights the states where access to services are the most limited. In Wyoming, Mississippi and Missouri, where there were five or fewer providers in each state in 2011<sup>2</sup>, almost all women who did seek abortions received these abortions in states other than their own. Almost all states in the mid-West and South had deficits of 40% or higher in the observed in-state resident abortion occurrence ratios in 2012 in meeting predicted levels of unmet need.

My results suggest that within a state, restrictions on public funding for abortions, have the largest impact of a single policy. Multiple studies have found similar results<sup>23–25,32,33</sup> reporting a decline in abortion rates in states with Medicaid funding restrictions concentrated in low-income populations. These results suggest a concentration of unmet need among women of lower socioeconomic status who may not be able to travel long distances for an abortion in the face of clinic closures; pay the necessary fees for the procedure especially later on in a pregnancy, a more common occurrence with restrictions; or take time off to accommodate the waiting periods that certain states require.<sup>13,24</sup> A study published in 2008 looking at distance traveled for abortion services showed that women who had to pay out-of-pocket for the procedure were less likely to travel long distance to get an abortion<sup>8</sup> and a 2009 literature review by AGI concluded that 25% of women with Medicaid in states with funding restrictions were unable to obtain the abortion they sought.<sup>34</sup> As it currently stands, states must choose to use their own funds for women covered under Medicaid as the Hyde Amendment forbids the use of federal funds for abortions except in the case of life endangerment, rape or incest making these restrictions the default. A study by Foster et al. found that being denied an abortion increased the probability that a woman would fall into poverty.<sup>35</sup> This information highlights the need to address disparities in access to

care for low income populations,<sup>8,36</sup> especially as abortions become increasingly concentrated in among this group; in 2014 three out of four abortions in this country were among low-income patients.<sup>37</sup> This issue is also one that has racial implications—Hispanic and African American women are more likely to fall into this group than white women.<sup>36</sup> There is emerging evidence that alongside the economic costs of carrying an unwanted pregnancy to term, existing children may experience delays in developmental outcomes<sup>38</sup> and women denied an abortion may be significantly more likely to experience domestic violence than those women who obtained an abortion.<sup>39</sup>

Although this study required significant effort to standardize all inputs to maximize its potential insights, the data has a number of limitations. The datasets used have some issues with consistency and completeness. A unified standard for reporting this information to the CDC would allow resources and effort to be placed in addressing the unmet need for contraception and thereby decreasing unintended pregnancy, and reducing overall need for abortion. Furthermore, given their close relationship, simultaneous data on abortion and contraception utilization, across states would be very instructive. Generating the support for such an effort will be challenging in the existing political climate, but it essential for furthering the reproductive rights and access to services for women of all socioeconomic and racial groups. Second, the information used to derive age patterns of abortion relied only on age-specific occurrence data; this limits the ability to comment on age patterns for those who seek abortions out of their own state. Improving the detail and standardization of data collected on abortion across states could greatly improve the conclusions that could be drawn from this data.

This information could also be used to track the impact of the increasing number of laws that have been passed even since 2012. In 2013, 70 restrictions alone were introduced in 22 states.<sup>3</sup> Many of these were TRAP laws—laws requiring abortion clinics to comply with certain standards, targeting the supply of providers. States have increasingly implemented these laws alongside other restrictions, spurred on by the Kermit Gosnell Case in 2013.<sup>40</sup> In 2013, after the Texas Senate Bill 5 law was passed implementing four restrictions on abortions, 22 of the 41 abortion clinics in Texas closed.<sup>41</sup> Two of these restrictions were TRAP laws requiring physicians performing abortion to have admitting privileges at a hospital within 30 miles of the facility and requiring all abortion facilities to meet the standards of an ambulatory surgical center.<sup>41</sup> Recent literature on the impact of this law showed that women were significantly delayed in their seeking of abortion and a number of women had to forgo the service completely given the increase in cost and travel time to obtain the services.<sup>13,41</sup> The recent *Whole Woman's Health v. Hellerstedt* Supreme Court ruling<sup>42</sup> on this law that these restrictions placed an undue burden for women seeking an abortion, has reinvigorated debate surrounding the ethics of implementing TRAP laws and other restrictions in the name of “protecting women’s rights”. Thus, the availability of reliable and easy to access data on this topic is important to strengthening the evidence base for the impact of these laws.

This study has several limitations. Although I have data for all states on abortion measured by occurrence, several states do not report any data to the CDC. In these instances, I rely on the relationship between covariates and the quantity of interest. Such a limitation would be

ameliorated with a standardized approach to abortion reporting across states. In using the CDC data, I make the assumption that there is non-differential reporting between years and rely on the trends to predict in-state resident occurrence as well as abortion rates and ratios by residence. There is evidence that the CDC data has high correlation to other data sources, making this a reasonable assumption.<sup>43</sup> Secondly, I make the assumption in estimating the number of in-state resident occurrence that the proportion of occurrence to out-of-state residents and in-state residents is the same among those whose residence is unknown. Given the unavailability of data, there is no way to check this assumption—but if the abortions obtained by women with unknown residence were skewed toward out-of-state residents, the most probable scenario, my results would be biased toward the null, making the findings even more compelling. Third, the model to predict in-state resident occurrence is not able to distinguish the propensity for women to stay in-state and the propensity to get an abortion at all. Additionally, although the covariates in this analysis sought to capture the best evidence on societal and sociodemographic factors that influence the need for abortion, other factors may also influence it. Fourth, the data available on abortion laws over time is limited in its scope and availability. AGI makes certain data available on laws over time, but reporting on some laws such as counseling before receiving abortion services is not consistently reported. Thus, this model may leave out important laws that influence abortion access such as bans on medication abortion and mandatory counseling, although the included law on required wait time would likely get at this effect. Finally, the model relies on state-level data to make inference about the impact of laws and access to providers. While laws and policies may be state-specific, the barriers to receiving abortions may actually be quite heterogeneous within states and even within those states with low aggregate levels of unmet need there may be geographical areas where unmet need is higher. If possible, implementing these results at the county and individual-level would be beneficial to corroborating the findings. Individual level data with state-level representation is difficult to find and there is a known bias in underreporting abortions in surveys. Such a limitation limits the causal effects that can be drawn from this analysis, although the fact that this analysis corroborates other findings, strengthens the conclusions that can be drawn.

## Section 5 Conclusion

Despite the declines in abortion over the past decade, this study shows that these declines are due to several factors above and beyond socioeconomic and demographic changes. Access to abortion is limited by the availability and distribution of providers as well as by the increasing legislation restricting and regulating abortion. Such legislation, especially limits on public funding for abortion services, may have disproportionate impact on those of low socioeconomic status and on women of color leading them to continue unintended pregnancies to term. Given the crucial role of reproductive health care in the lives and welfare of the nation's women, data and standardization of data on abortion should be a priority for the CDC and state departments, and be expanded to include contraceptive availability and utilization, financial and non-economic cost associated with receiving an abortion for each woman, and regular dissemination of this information. With such information, efforts can be focused to areas with particularly high unmet need to bolster family planning services, provide education, and support women's health in general.

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## List of Acronyms

AGI: Alan Guttmacher Institute

ANC4: Proportion of women with four antenatal care visits

ASARB: Association of Statistics of American Religious Bodies

CDC: Center for Disease Control

GBD: Global Burden of Disease Study

IHME: Institute for Health Metrics and Evaluation

NCHS: National Center for Health Statistics