Abortion access and state variation in measured unintended pregnancy

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Abstract

Comparing unintended pregnancy rates across states and within states across time could allow demographers to describe the impact of increasingly divergent state reproductive health policies. For example, California has greater access to subsidized contraception than Texas and comparing the two states' unintended pregnancy rates could illuminate the impact of their divergent policies. Unexpectedly, California's unintended pregnancy rate is estimated to be slightly higher. We identify and describe possible bias in the estimation of state unintended pregnancy rates arising from between-state variation in rates of induced abortion and the possibility of imperfect retrospective reporting of unintended pregnancies. We find that with imperfect (<90%) retrospective reporting of unintended pregnancy, the current method of estimating state unintended pregnancy rates could rank states inaccurately due differences in abortion rates. Between-state differences in rates of retrospective reporting of unintended pregnancy could also bias between-state comparisons of unintended pregnancy rates.

Introduction

Unintended pregnancy rates are an influential public health indicator, and as states increasingly diverge in their reproductive health policies, meaningful comparisons of unintended pregnancy across states have become an important public health and demographic question. There has been a deluge of state legislation affecting the funding of family planning, parental consent for minors, contraceptive access for undocumented migrants, and sexual education in the schools. In the last two years, States have also responded to the ACA in different ways with 21 states rejecting the Medicaid expansion, 27 implementing it one way or another, and 2 states still debating the issue (Kaiser Family Foundation). Most recently, important rule changes within some state Medicaid systems have been implemented that will greatly increase access to highly effective contraception for postpartum women. With these changes, access to subsidized or low-cost contraception in individual states is, in many cases, shifting dramatically, and the differences in access between blue and red states is likely increasing. In this circumstance, there is a pressing need to assess the impact of state-level policies, and the first indicator that legislators, elected officials, and media are likely to call for and examine is the state rate of unintended pregnancy.

Comparing Texas and California illustrates the importance of unintended pregnancy as an indicator of policy impacts. Even before Texas cut its family planning program by 66% in 2011, Texas' subsidized family planning program was less robust than California's (Bixby Center for Reproductive Health, 2011). However the best current method for estimating state-level unintended pregnancy calculates 53% of Texas pregnancies as unintended in 2008, as opposed to California's 56% (Finer and Kost, 2011). That California would have a higher unintended pregnancy rate than Texas, given California's markedly more generous approach to supporting family planning, motivated an investigation of the data underlying the estimates of each state's rates. In this paper, we simulate the impact of one possible explanation for the observed higher rate in California.

Most analyses of unintended pregnancy in the United States have drawn on the National Survey of Family Growth (NSFG), a nationally representative survey of women aged 15-44 conducted by the National Center for Health Statistics (NCHS) since 1982. The respondents in this survey are asked a series of questions about each pregnancy that they report to determine whether the pregnancy was intended, mistimed or unwanted, as well questions related to the termination of the pregnancy, whether it ended in a live birth, an induced abortion, or a miscarriage. There are two main problems with using the information collected in NSFG to determine the proportion of pregnancies that are unintended—either mistimed or unwanted—for the population as a whole as well as for specific sub-groups. The first problem is that there is incomplete reporting of pregnancies that ended in abortions and miscarriages. The analysts who have constructed the most widely used estimates of unintended pregnancy for the US have relied on vital registration reported by most states to NCHS and the Guttmacher Institute's census of abortion providers to correct for this under-reporting.

The second large problem with using NSFG or other retrospective surveys to estimate the proportion of pregnancies that is unintended stems from the pregnancies ending in live births. While the timing of these events seems to be reliably recorded in the survey, the respondents' retrospective reports as to the intendedness of these pregnancies may have less fidelity. Women may be unwilling to report a living child as unwanted or mistimed, and their feelings about their pregnancy have likely changed between conception and the time of the interview. Various types of evidence suggest that there is substantial over-reporting of intendedness, or conversely, under-reporting of unintendedness. First, there is relationship between the age of a child and whether the child is reported as having resulted from a wanted pregnancy (White, personal communication). Second, only 60% of women interviewed in the 1995 round of NSFG reported pregnancies that resulted from a contraceptive failure as unintended (Trussell, Vaughan and Stanford 1999). And, third, in situations where it has been possible to contrast prospective reports of intentions before a pregnancy with retrospective reports obtained after the pregnancy had been detected, large discrepancies have been found (Aiken and Potter 2013). To complicate matters further, it seems that the extent of over-reporting of intendedness varies considerably by social and demographic characteristics. Latinas seem particularly likely to be happier about unintended pregnancies (Aiken and Potter 2013; Hartnett 2012), and by extension to over-report intendedness.

To estimate the unintended pregnancy rate at the state level, one must rely on surveys carried out in the state since the NSFG is not representative at this level. Finer and Kost (Finer and Kost 2011) are the first to have done this, and their estimates are based on a combination of vital registration data together with data from states' Pregnancy Risk Assessment Monitoring Systems (PRAMS) surveys (and PRAMS-like surveys for states without PRAMS data). In most states, the survey is of a representative sample of 1,300 – 3,400 women who gave birth in each reporting area surveyed two to four months following delivery. The survey includes a core set of questions that include the standard items regarding the timing of the pregnancy and whether it was wanted, and because of the sample design, it does not cover abortion. Thus, as at the national level, it is necessary to combine a survey based estimate of the proportion of live births that were intended with an external source of data on pregnancies that end in abortion.

The problem we investigate in this paper is what happens when one of the two sources of data is more affected by under-reporting than the other, and the proportion of data that comes from each source varies widely across states. It is based on the proposition that there may be over-reporting of the intendedness of pregnancies that end in live births in the survey data, but there is complete reporting of pregnancies that end in abortions in the vital registration. We carry out a sensitivity analysis to investigate the degree to which the observed differences between states in the proportion of pregnancies ending in abortion can affect comparisons of their measured rates of unintended pregnancy.

We begin by specifying algebraically how Finer and Kost (2011) combine data from vital registration and surveys to estimate state unintended pregnancy. Part of this specification is the illustration of the model of pregnancy partitioning underlying Finer and Kost's estimates. We then extend Finer and Kost's model to allow for variation in the fidelity of retrospective reporting of pregnancy intentions. Using this extended model, we simulate the impact of variability in the number of births and abortions and the fidelity of retrospective reporting for a sample of states.

Background

The ideal measure of the proportion of pregnancies that are unintended, a parameter we refer to as μ, is the number of unintended pregnancies by resolution divided by the total number of pregnancies as specified in Equation 1.

(1)

$$\mu = \frac{A + B_U + M_U}{P}$$

Where A is the number of abortions (assumed for the purposes of this analysis to all be unintended); B_U is the number of births that were unintended; M_U is the number of miscarriages that were unintended; and P is total pregnancies, the sum of all abortions, births (B), and miscarriages (M), stated explicitly in Equation 2.

(2)

$$P = A + B + M$$

Intention status is not known for all births, and thus demographers must approximate B_U using survey data and vital statistics. Furthermore, measuring miscarriages, particularly by intention status, is not possible with vital statistics or survey data. Finer and Kost approximate M_U and its counterpart – miscarriages of intended pregnancies, M_I - in three parts by inflating A, B_U, and B_I to include the pregnancies that ended in miscarriage but would have ended in abortion, unintended, or intended births respectively. This estimation is based on a model where each unintended pregnancy either would or would not end in abortion, were miscarriage not present.

Figure 1 displays the model underlying Finer and Kost's partition of all pregnancies, P, into unintended pregnancies (P_U) and intended pregnancies (P_I). As in our discussion, the quantity μ represents the proportion of P that are unintended (explicitly, $P \cdot \mu = P_U$), and correspondingly 1- μ is the proportion of P that are intended, P_I. Following down Figure 1, unintended pregnancies (P_U) are further partitioned into those the woman would end with abortion (P_A) and those the woman would carry to term (P_T) – were miscarriage not present. The pregnancies P_A resolve either through abortion (A) or through random miscarriage (M_A). Analogously, the pregnancies P_T resolve either through birth as unintended pregnancies (B_U) or through random miscarriage (M_T).

Quantities in this model can be classified as observed or unobserved. The only quantities in the model observed in administrative data are A, all abortions from vital statistics, and B, all births from vital statistics. B is present in the model as the sum of

$B_U + B_I$. Importantly, this means that the only component of the numerator of μ that is measured without error is the number of abortions, A.

Any estimate of unintended pregnancies must (1) estimate a partition of B by intention status and (2) estimate miscarriages by intention status. Note that miscarriages are located at three places in this model (Equation 3a) and unintended miscarriages are located at two places in this model (Equation 3b).

(3a) $$M = M_A + M_T + M_I$$

(3b) $$M_U = M_A + M_T$$

Finer and Kost perform two intermediate estimations for each state in order to generate their state-by-state estimate of unintended pregnancy ($\hat{\mu}$). First, they use state survey data from each state to partition B and thereby estimate the number of unintended births (B_U), and second they inflate births and abortions by intention status to estimate miscarriages by intention status.

The first intermediate step uses data from states' Pregnancy Risk Assessment Monitoring Systems (PRAMS) surveys (and PRAMS-like surveys for states without PRAMS data). This step generates an estimate of number of unintended births which we refer to as $\widehat{B_U}$. It is the product of the number of births from vital statistics (B), and the proportion of live births that are reported as unintended in the state PRAMS or PRAMS-like survey (p), calculated as a product:

(4)

$$\widehat{B_U} = B \cdot p$$

The quantity p is based on a question in each state's respective PRAMS or PRAMS-like survey, which asks "At the time of your last pregnancy, did you want the child then, later or not at all?" Because PRAMS is a survey of a sample of birth certificates, the proportion of PRAMS respondents answering that they would have liked to have their child later or not at all is a retrospective measure of intention status among pregnancies carried to term. These surveys are carried out by each state separately.

The second intermediate step Finer and Kost use is inflation of measured outcomes (births and abortions) to account for random spontaneous abortion. Thus, Finer and Kost estimate M as:

(5)

$$\widehat{M} = 0.1 \cdot A + 0.2 \cdot B$$

Because only unintended miscarriages are included in the numerator of μ, the number of unintended pregnancies ending in miscarriage (M_U) is estimated. The theoretical value is calculated as the sum of miscarriages among pregnancies that would have ended in births (M_T) and miscarriages that would have ended in abortion (M_A).

(6)

$$M_U = M_A + M_T$$

Because the true values of both terms on the right hand side of Equation 6 are unknown, each type of unintended miscarriage (M_T and M_A) is estimated as a fraction of each of the measured unintended pregnancy outcomes, abortions (A) and unintended births (B_U).

(7)

$$\widehat{M_U} = 0.1 \cdot A + 0.2 \cdot B_U$$

Finally, spontaneous miscarriage among intended pregnancies that would have been carried to term is estimated as a fraction of intended births.

(8)

$$\widehat{M_I} = 0.2 \cdot B_I$$

Using their estimate of B_U, together with the number of births and abortion from vital registration, and their estimates of miscarriages by intention status, Finer and Kost construct their estimate of unintended pregnancy at the state level, $\hat{\mu}$, based on equation 1 and the estimates generated in equations 2 through 8.

(9)

$$\hat{\mu} = \frac{1.1 \cdot A + 1.2 \cdot B \cdot p}{1.1 \cdot A + 1.2 \cdot B}$$

One important result we can derive from specifying Finer and Kost's calculation algebraically in Equation 9 is the quantification of the proportionate contribution to $\hat{\mu}$ from the second term ($1.2 \cdot B \cdot p$). In this way, we can determine how states differ in their observed unintended pregnancy rates' ($\hat{\mu}$) reliance on retrospective reporting. A histogram of this variation at the US state level for 2008 is displayed in Figure 2.

Method

While this important contribution allows Finer and Kost to estimate each state's unintended pregnancy rate, our concern is that rates constructed in this way may not be comparable to one another when rates of abortion or rates of retrospective recall vary. If retrospective recall is imperfect, each unintended pregnancy that it carried to term is only partially counted. Because different proportions of unintended pregnancies are carried to term in each state (because of variations in abortion access and acceptability), the effect of retrospective recall will vary by state. In order to address this concern, we extend Finer and Kosts' model to include the proportion of unintended pregnancies that are carried to term that are reported via retrospective recall as unintended.

Thus, we include the rate at which unintended pregnancies are reported retrospectively as unintended in our estimate of B_U. Equation specifies our estimate ($B_U{}'$).

(10)

$$B_U{}' = B \cdot \frac{p}{r}$$

Where B is all births, p is the proportion of births reported as unintended in each state's PRAMS or PRAMS-like survey, and r is the rate at which unintended pregnancies are reported as unintended after birth. Note that when $r=1$ – or when reporting is perfect – our $B_U{}'$ is identical to $\widehat{B_U}$.

Using this definition of $B_U{}'$, and substituting in to Equation 2, we define our estimate of the proportion of pregnancies that are unintended *(μ')* as an estimate of μ accounting for the factor r.

(11)

$$\mu' = \frac{1.1 \cdot A + 1.2 \cdot B_U{}'}{1.1 \cdot A + 1.2 \cdot B} = \frac{1.1 \cdot A + 1.2 \cdot B \cdot \frac{p}{r}}{1.1 \cdot A + 1.2 \cdot B}$$

As above, note that Equation 11 is equivalent to Equation 1 when $r=1$, or when retrospective recall is perfect. Thus, our model for state-level unintended pregnancy extends Finer and Kost's by modeling the effect of underreporting on observed unintended pregnancy proportions.

Visualizing our Model

Based on Equations 1 and 11, we can write an expression describing the responsiveness of the observed estimate of unintended pregnancy to the level of retrospective reporting *(r)*. In addition to r, this expression relies on the underlying unintended pregnancy rate *(μ)*, the number of abortions, A, and the number of pregnancies, P. Note from Equation

2 that P is calculated as an inflation of A and B from vital statistics and thus does not rely on survey data. Equation 12 describes how the true unintended pregnancy proportion, μ, is measured when retrospective reporting fidelity is incorporated into the model.

(12)

$$\hat{\mu} = \mu - \left(1 - \frac{A}{\mu \cdot P}\right) \cdot \frac{1}{1.1} \cdot (1 - r) \cdot \mu$$

The second term of Equation 12 describes the unintended pregnancies that are not counted as unintended when retrospective reporting is less than 1. The first factor in the second term, $\left(1 - \frac{A}{\mu \cdot P}\right)$ is the proportion of all unintended pregnancies that do not end in abortion. The second factor inflates this number to address the absence of miscarriages in the data sources. The third factor, $(1 - r)$, reflects the proportion of unintended pregnancies that are reported as unintended retrospectively. And the final factor, μ, is the proportion of all pregnancies that are unintended. Subtracting the first term from the underlying unintended pregnancy rate yields the observed unintended pregnancy rate, $\hat{\mu}$. Note that the second term of this expression is zero and $\hat{\mu} = \mu$ when retrospective reporting is perfect or $r=1$.

In Figure 3 panels A and B, we illustrate the responsiveness of observed unintended pregnancy estimates to underreporting by plotting the trajectories of $\hat{\mu}$ by level of r using actual A and P values for states and Equation 12. For any given state with vital statistics available for births and abortions, Equation 12 has three unknowns ($\hat{\mu}$, r, and μ). Therefore, we must fix the true underlying unintended pregnancy rate (μ) in order to display the relationships between $\hat{\mu}$ and r. We picked two pairs of states with similar levels of unintended pregnancy but different levels of abortion in order to illustrate the way different states are impacted by retrospective reporting in different ways. In panel A, we plot $\hat{\mu}$ by r for California and Texas, assuming both states have true underlying unintended pregnancy rates of 0.6. In panel B, we do the same for New Hampshire and Utah, assuming that both states have unintended pregnancy rates of 0.5. In both panels, the lines represent the positive relationship between retrospective reporting and estimated unintended pregnancy rates. Thus, as retrospective reporting changes, observed unintended pregnancy changes even when the true underlying unintended pregnancy rate remains fixed, as it does in each panel. In both panels, the right hand side, the vertical line where r=1, reflects the point where observed unintended pregnancy is equal to the true underlying unintended pregnancy rate. Note that the shape of these graphs would look very similar for any assumed underlying rate, since the equation is a first order polynomial.

In Figure 4 we graph μ' by level of r based on Equation 11 for selected states' empirical 2008 values of number of abortions *(A)*, number of births *(B)*, and observed proportion of births that are reported as unintended *(p)*. We selected six states with a wide range of observed rates of unintended pregnancy and a wide range of rates of abortion utilization. Each line represents all possible values of the true underlying unintended pregnancy rate for all possible levels of retrospective reporting for a single state. The right hand side of the graph, the vertical line $r = 1$, reflects the observed estimated unintended pregnancy rates, since the current method of estimating these rates assumes that retrospective reporting is perfect, or $r = 1$.

Results

Figure 2 illustrates substantial between-state variation in the proportion of unintended pregnancies measured via retrospective reporting. The proportion ranges from 98% in Wyoming to 34% in New York State. The proportion of unintended pregnancies measured via retrospective reporting is concentrated in a relatively flat distribution ranging from 55% to 85%. Forty two of the fifty states fall into this range.

In Figure 3, the effect of retrospective reporting *(r)* on observed unintended pregnancy $(\hat{\mu})$ is displayed for two pairs of states with similar levels of observed unintended pregnancy (μ). In each panel, the two states are assumed to have the same underlying rate of unintended pregnancy, and given each state's number of abortions *(A)*, births *(B)*, proportion of births reported as unintended *(p)*, the relationship between r and $\hat{\mu}$ is plotted. States with greater levels of abortion are less responsive to decreases in retrospective reporting. Stated another way, states with greater abortion (California in Panel A and New Hampshire in Panel B) have flatter slopes in $\hat{\mu}$ as r changes. In states with more abortion fewer unintended pregnancies are measured via retrospective reporting and thus the rate of retrospective reporting has less influence on the observed rate.

Turning away from the observed rates of unintended pregnancy to the theoretical underlying rate of unintended pregnancy (μ), we fix values in Equation 11 to reflect empirical statistics from vital registration in selected states and use the resulting equations to describe the relationship between retrospective reporting *(r)* and unintended pregnancy rate (μ) in Figure 5. The curves take the form of hyperbolas with asymptotes at $r=0$. Where they intersect with the vertical line $r=1$ they reflect the observed unintended pregnancy rate $(\hat{\mu})$. The curves increase as r decreases, reflecting the intuition that lower levels of retrospective reporting *(r)* are associated with increased underestimation of unintended pregnancy (μ).

Where the plotted lines in Figure 4 intersect, states' orderings by true unintended pregnancy reverse. Tracing the lines' intersections to the x-axis, we can find the levels of retrospective reporting *(r)* at which states' ordering with respect to unintended pregnancy proportion switch. For example, for values of r greater than about 0.9, New York has a higher unintended pregnancy rate than California, whose own rate is higher than the rate Texas. At levels of *r* less than about 0.9, however, Texas has a higher rate of unintended pregnancy than does either New York or California. Similarly, New Hampshire has a higher unintended pregnancy rate than Utah under Finer and Kost's estimation (at *r=1*), but at about *r=.65* the two lines cross and their ordering flips.

While Figure 6 can be read via inspecting vertical line intersections in order to interpret the influence of retrospective reporting on between-state comparisons when the fidelity of retrospective reporting is uniform across states, the figure also allows us to examine the levels of unintended pregnancy (μ) when states' levels of *r* vary. For example, if *r* is low in Texas but high in New York, then the true unintended pregnancy proportion in Texas may be much higher than it is in New York. Specifically, if Texas' level of reporting is 80% (*r=0.8*) and if New York's level of underreporting is 95% (*r=0.95*), then Texas' true unintended pregnancy proportion is 61% and New York's is 55%. In this case, not only is their ordering switched, but Texas' proportion of unintended pregnancy is substantially higher than New York's.

Discussion

By constructing estimates of unintended pregnancy at the state level, Finer and Kost (Finer and Kost 2011) have substantially advanced our capacity to discuss unintended pregnancy in the United States. However, our results indicate that comparisons of US states' unintended pregnancy proportions may be biased by variations in the contribution of different sources of demographic data.

A central motivation for this paper is the observation that variation in abortion rates between states yields different sets of women carrying pregnancies to term in different states. For example, if a woman lives in a state where abortion is relatively difficult to access, she may be less successful in terminating an unwanted or ill-timed pregnancy than her hypothetical counterpart in a state with greater abortion access. Thus, in states with less access to abortion, more unwanted or ill-timed pregnancies are measured by asking women with infants if their infant was intended. This thought experiment is documented empirically in our description of the wide between-state variation in the proportion of unintended pregnancies that are measured via retrospective reporting. By specifying an equation for the relationship between retrospective reporting and the underlying unintended pregnancy rate given a state's number of abortions, number of births, and reported proportion of unintended pregnancies, we demonstrate that this could lead to bias in between-state comparisons if retrospective reporting is below about 90%-95%.

Our paper is limited by the fact that there are no reliable empirical estimates of the rate at which unintended pregnancies are reported retrospectively. While demographers have hypothesized that reporting of this type is likely imperfect and thus *r* is likely less than 1, we cannot point to a place on each states' line and say, "The true unintended pregnancy rate is here." Furthermore, the problems we delineate only exist if retrospective reporting is not uniformly high. If it is only low in some places, our findings of bias hold, but if it is uniformly high everywhere current methods for estimating unintended pregnancy are adequate. However, if retrospective reporting is not uniformly very high, our findings point to the need for novel approaches to estimating state-level unintended pregnancy, particularly if between-state comparisons are to be made.

We do not focus on between-state variation in retrospective reporting, but other authors have hypothesized that pronatalism may contribute to differences between prospective and retrospective reports of pregnancy intendedness (Aiken and Potter, 2013, Hartnet, 2011). To the extent that US states where access to and acceptability of abortion is low (particularly conservative states) may also be more pronatalist, biases may compound and unintended pregnancy in these states could be substantially higher than current estimates reflect, since they may have lower levels of retrospective reporting and more unintended pregnancies measured via retrospective reporting. Thus, there may be cause for particular caution when using unintended pregnancy rates to compare the effects of reproductive health policies across places with variation in culture.

We also do not discuss comparisons of unintended pregnancy proportions within states across time, but such comparisons would be subject to similar biases when rates of abortion in a state change dramatically, such as when a supply-side restriction is imposed. For example, in Texas, recent abortion restriction legislation has decreased abortions by 13% (Grossman et al., 2014). If the fidelity of retrospective reports of unintended pregnancy is imperfect in Texas, this decrease in abortions may bias attempts to compare unintended pregnancy proportions before and after the law took effect.

It has not escaped our attention that an implication of our model is that state unintended pregnancy may be underestimated, sometimes by substantial margins. Additionally, a similar method has also been used to estimate unintended pregnancy rates by age, union type, educational attainment, religious affiliation, race/ethnicity, and parity (Finer and Zolna 2014). To the extent that these population subgroups utilize abortion at varying rates or have varying rates of fidelity in retrospective reporting of intendedness, these comparisons may be biased in the same way between-state comparisons have been demonstrated to be here.

The present analysis leaves unanswered the question of the extent to which fidelity in retrospective reports of pregnancy intendedness varies across place and across population subroups. Further work should address this question. Should such fidelity be a problem, researchers should also construct estimates of the extent to which women in US states experience unintended pregnancy in such a way that between state comparisons are unbiased.

Figure 1. Partition of pregnancies by intention and resolution

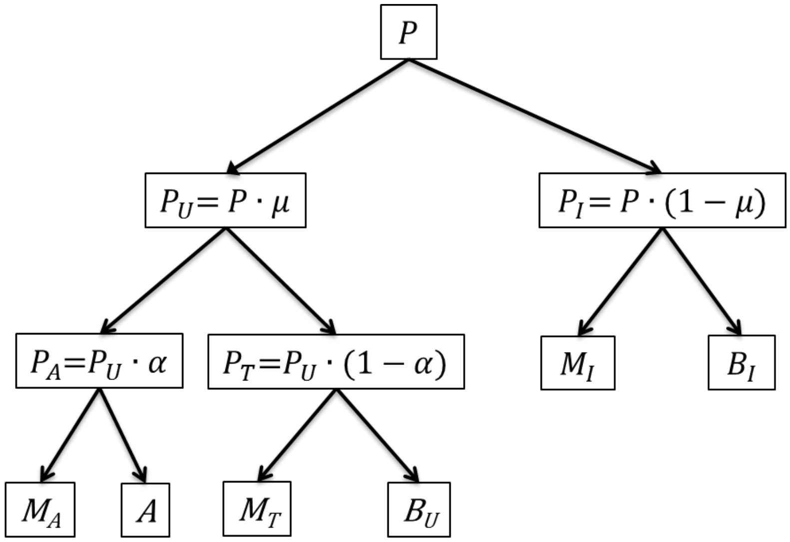


Figure 2: States by categories of proportion unintended pregnancy measured via retrospective reporting

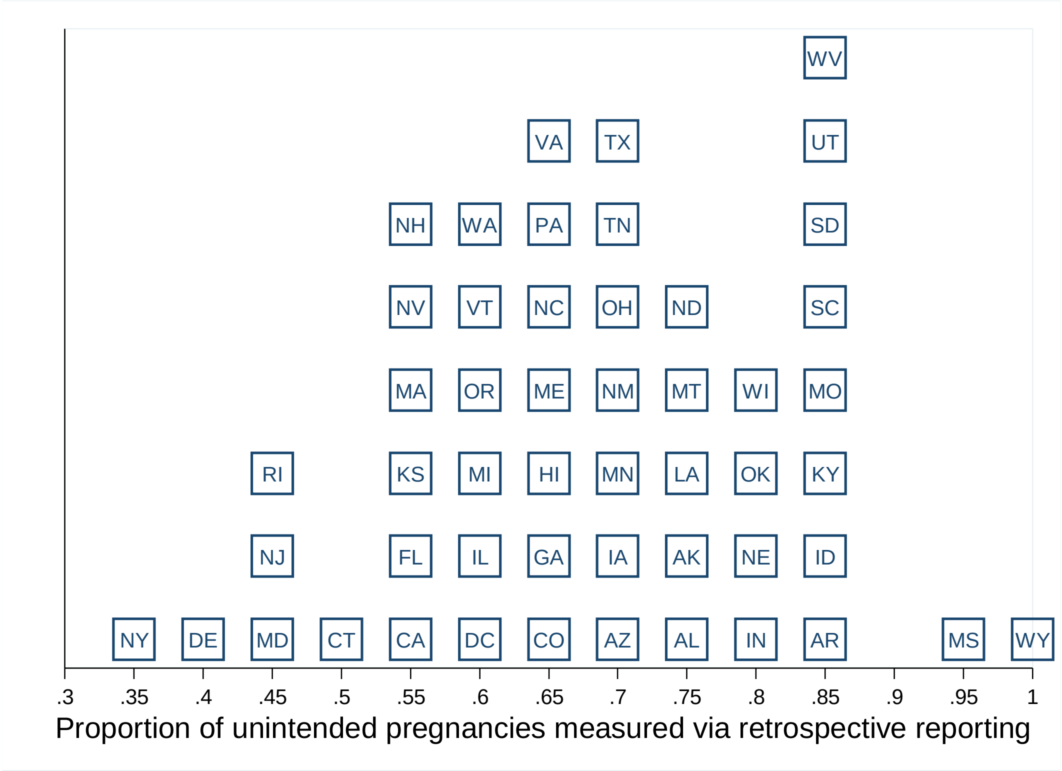
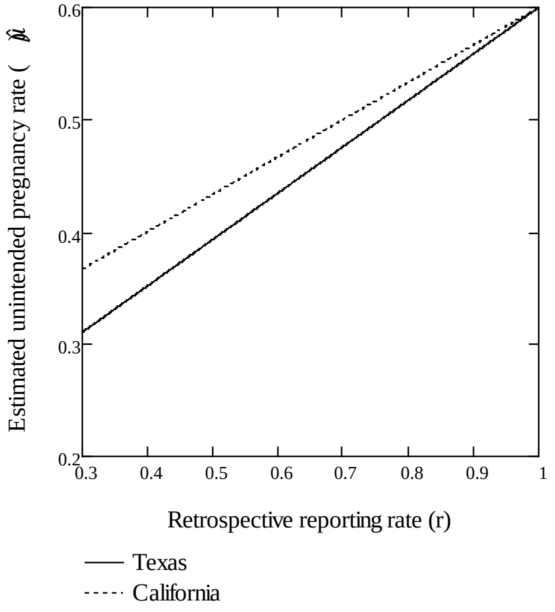


Figure 3. Responsiveness of estimated unintended pregnancy rate to variation in reporting

Panel A. If both Texas and California had underlying unintended pregnancy rates of 0.6



Panel B. If both New Hampshire and Utah both had underlying unintended pregnancy rates of 0.5

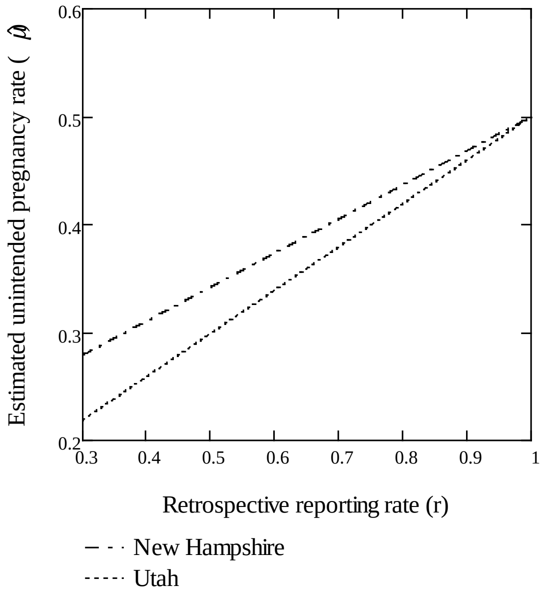
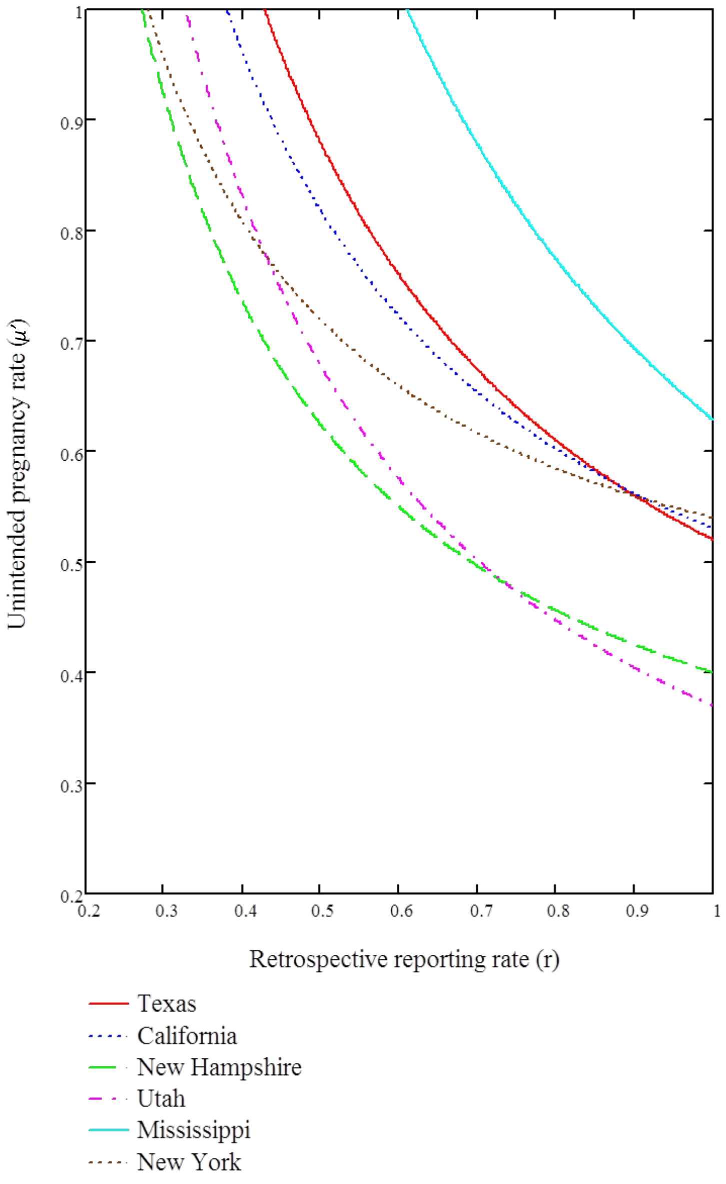


Figure 4. Underlying unintended pregnancy rate (*μ'*) by level of reporting, selected states



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