# The Effect of Catholic Hospitals on Rates of Postpartum Sterilization in California and Texas

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## Abstract

We examine the role of Catholic hospitals in determining variation across local areas in rates of postpartum tubal ligation (PPTL), the second most common method of contraception in the U.S. Focusing on Texas and California, two large and diverse U.S. states with very different levels of public provision of reproductive health care, we find that in both states women who live in areas served more heavily by Catholic hospitals are less likely to receive postpartum sterilizations, even after accounting for individual characteristics, county poverty, and religious adherence. We conclude that current U.S. debates over the role of religious prohibitions on the provision of reproductive healthcare can have implications for the population-level prevalence of these services. To the extent that this variation in prevalence is due to limitations on access, Catholic hospitals' refusal to provide PPTL may contribute to low levels of women accessing their preferred method of contraception.

## Introduction

Nationally, 9% of all deliveries are followed by postpartum sterilization, but at the hospital level, rates of postpartum sterilization range from zero to almost a third (Chan and Westhoff, 2010; Potter, et. al, 2013). In particular, hospitals owned by the Catholic Church, which represent 10% of hospitals nationwide, provide no postpartum sterilization (Gold, 2010).

In the United States, female sterilization is the second most commonly utilized method of contraception and more than half of all sterilizations are accessed as part of postpartum care (Chan and Westhoff, 2010). Thus, the unavailability of this method for women who deliver in Catholic hospitals may pose a barrier to access to this popular and highly effective method of contraception. In order to assess the impact of the unavailability of this care for women who deliver in Catholic hospitals, we estimate the extent to which Catholic hospitals impact rates of postpartum sterilization in the areas they serve.

Hospitals owned by the Catholic Church do not provide the full spectrum of reproductive health care services because they follow the Ethical and Religious Directives for Catholic Health Care Services from the United States Conference of Catholic Bishops, which disallows "direct sterilization of either men or women, whether permanent or temporary" (United States

Conference of Catholic Bishops, 2009). The Ethical and Religious Directives also prohibit the provision of contraceptive counseling and put limits on miscarriage management. The American College of Obstetricians and Gynecologists Committee Opinion on Access to Postpartum Women states that women delivering in religiously affiliated hospitals should be referred to counseling and services to ensure they receive the full spectrum of care (ACOG, 2012). This recommendation may limit the impact of the Ethical and Religious Directives' prohibition on the provision of prenatal and postpartum contraceptive counseling, but PPTL is least invasively, and most easily and cheaply provided within the same hospitalization immediately following delivery. Thus, referral to a provider of interval sterilizations does not provide the same level of care to women seeking sterilization as would providing the sterilization in the same hospitalization as the delivery of her last wanted child. (Please note that we have secured data on interval sterilizations from the Outpatient Discharge data in both states and will analyze these data for the full paper as well.)

The impact of the Catholic Church's prohibitions on its hospitals' provision of this type of health care is timely in light of Pope Francis' September 19th speech on the relative importance of social issues (including birth control) in the church's mission (Times NY 1). Concern specifically regarding the availability of postpartum sterilization in the United States surfaced recently in the controversy regarding the insurance coverage mandate included in the Patient Protection and Affordable Care Act (PPACA). An editorial noted that: "Catholic hospitals have refused to … allow sterilization after cesarean sections …women seeking tubal ligations are then forced to have a second operation elsewhere, exposing them to additional risks" (Times NY, 2-4).

While postpartum sterilization is more frequent among women delivering by cesarean section, the Catholic Directives prohibit sterilizations following both a vaginal delivery and a cesarean section. No woman who delivers in a Catholic hospital has access to PPTL. Therefore, unless women who want postpartum sterilization specifically choose non-Catholic hospitals in which to deliver, access to the method may be curtailed when women live in areas served by Catholic hospitals.

Variation in rates of postpartum sterilization may be due to variation in demand from women or variation in access. If all women who want postpartum sterilizations are delivering in non-Catholic hospitals then there are no limits on access due to Catholic hospitals. In order to estimate the extent to which limits on access are created by Catholic hospitals, this paper describes spatial variation in determinants of demand and the population-level rates of postpartum sterilization in the U.S. states of California and Texas at the county and ZIP code

levels and investigates the role of Catholic hospitals in shaping the spatial variation in the population-level rates of postpartum sterilization. These analyses have been made possible because of newly available data on the universe of hospital discharges with spatial identifiers for both women and their hospitals of delivery. These data allow us to directly investigate the influence of the presence of a Catholic hospital on spatial variation in rates of postpartum sterilization. Additionally, we use newly released spatial data on rates of Catholic adherence to demonstrate that Catholic hospitals are not located in areas with greater Catholic populations.

**Data**

We use data from the Texas Inpatient Hospital Discharge (THID) and California Patient Discharge (CPD). Because both states mandate complete reporting of all discharges, these data include virtually all hospital deliveries. The data are structured as one record per discharge with multiple procedures and diagnoses, which allows us to identify deliveries with and without postpartum sterilizations.

The inpatient hospital discharge data for each state are extracted by hospitals from their electronic medical records billing systems. They include space for up to 75 CPT procedure codes and ICD-9-CM codes, allowing us to precisely determine the type of delivery, including number of infants born and their vital status, surgical procedures, and complications. The records also include the patient age, insurance status, and hospital name. However, the reporting on race/ethnicity is incomplete, and parity is not available in these records.
We used public records to find Hospital addresses.

We identify deliveries by type (vaginal or caesarean) and by the provision of postpartum sterilization. First, using inpatient data for each state, we applied CPT and ICD-9-CM codes for vaginal and cesarean deliveries of singleton live born infants. Second, using the inpatient data for each state, we apply CPT and ICD-9-CM codes for bilateral occlusion or destruction of the fallopian tubes to identify discharges with sterilizations.

We also make use of county-level estimates of Catholic adherence from the newly released U.S. Religion Census: Religious Congregations and Membership Study, 2010 County File from the Association of Statisticians of American Religious Bodies. (Grammich, et al, 2012)

Our estimates of poverty come from the American Communities Survey 5 Year Data API. We performed custom calculations to retrieve poverty among women of reproductive age (15-44).

We identified Catholic hospitals in the data first by searching for hospitals with no or virtually no PPTL and then by comparing our methodology and list of Catholic hospitals with

other researchers' methodologies and lists, including a comparison with a list of Catholic hospitals published online by a group holding Catholic hospitals accountable for providing PPTL (CatholicHospitals.org).

**Methods**

Our primary interest is in the relationship between concentration of Catholic hospitals and rates of PPTL. However, if Catholic hospitals are primarily serving Catholic adherents and Catholic adherents do not want PPTL endogeneity could distort our estimates. Thus we investigate the relationship between levels of Catholic adherence and concentration of delivery in Catholic hospitals and Catholic adherence and rates of PPTL, both at the county level because that is the level of aggregation for which we have Catholic adherence. Figure 2 displays the relationship between quintile of Catholic adherence and concentration of deliveries in Catholic hospitals.

In order to investigate the relationship between Catholic adherence and the use of PPTL, we plot county rates of delivery in Catholic hospitals by quintile of county rates of Catholic adherence in Figure 3.

Next we model the variation in two ways (Tables 4 and 5), first using a multilevel model incorporating county covariates, and then using a multilevel model with a more refined measure of women's local choice set of hospitals for delivery at the ZIP code level. The first logistic mixed effects models place women within counties (Table 4) and measure density of Catholic hospitals as the proportion of deliveries in a county occurring in a Catholic hospital. While this is a very rough estimate of the effect of exposure to Catholic hospital delivery, we include these county models in order to allow an evaluation of the importance of county-level demographic covariates. In these county models, we include county level rates of female reproductive age poverty and county rates of Catholic adherence. At the individual level, the models include available individual level predictors of PPTL: cesarean delivery, maternal age greater than 30, and Medicaid status, all of which increase the likelihood of PPTL (Chan and Westhoff, 2010).

The second mixed effects logistic models (Table 5) place women within ZIP code-based local contexts. In these models, exposure to Catholic hospitals is more precisely measured through the construction of a local density of Catholic hospitals at the ZIP Code level. The local context is constructed stepwise. The first step is to include all the hospitals in the ZIP code. If there are fewer than 5 hospitals in the zip code, more hospitals are added to the ZIP code context by finding hospitals within a radius from the centroid of the ZIP code. The radius is initialized at 0.1 miles and successively increased by 0.1 miles until 5 hospitals are included or

the mean distance women traveled to a hospital in the data from the centroid of the ZIP code is reached (8 miles in California and 11 miles in Texas). Thus, some local contexts have fewer than 5 hospitals (if a radius of the mean distanced travelled does not include 5 hospitals) or more than 5 hospitals (if one of the increments of the radius yielded a total of more than 5 hospitals.) If no hospital is within the mean distance of the centroid of the ZIP code, then that ZIP code's hospital context is assigned to be the hospital where the majority of women in the ZIP code delivered. The range of the number of hospitals in ZIP code contexts is 1 to 17. Models were fit using HLM7 software (SSI).

As a diagnostic, we display ZIP code PPTL rates by rates of local concentration of Catholic hospital deliveries in Figure 4.

Geocoding of hospitals addresses was performed in ArcMAP 10 using street-level geocoding (ESRI, 2010). ZIP code centroids were found using the ZIP code centroids files in SAS 9.3 (SAS Institute Inc.).

**Results**

Figure 2 displays the relationship between quintile of Catholic adherence and concentration of deliveries in Catholic hospitals. It illustrates a weak negative relationship between the two values, demonstrating that Catholic hospitals are not more concentrated in places where Catholic adherence is higher.

In order to investigate the relationship between Catholic adherence and the use of PPTL, we plot county rates of delivery in Catholic hospitals by quintile of county rates of Catholic adherence in Figure 3. We find a weak negative association, indicating that counties with lower rates of Catholic adherence have weakly higher rates of delivery in Catholic hospitals.

Table 1 quantifies the variation in rates of postpartum sterilization and associated covariates (Medicaid payment of delivery, Cesarean section, and maternal age) between groups. Overall, rates of PPTL are higher among deliveries in Texas, deliveries with Cesarean section, and deliveries to women 30 years of age or older. The difference between California and Texas in overall rates of PPTL is large. In California the proportion of deliveries with PPTL is 6.7%, while in Texas it is 10.2%.

Examining county-level variation in the same measures, Table 2 illustrates the wide county-level variation in all the individual-level covariates. County rates of PPTL vary between and within states, ranging from 2.5% to 14.3% in California and from 0% to 31.5% in Texas. Similarly, the predictors of PPTL rate at the population level vary substantially. Female reproductive age poverty ranges from 6% to 25.5% in California and from 6% to 35% in Texas.

The variation in Catholic adherence at the County level is striking, ranging from less than 5% of the population to almost all of the population in California and from 12% of the population to about two thirds of the population in Texas. Table 3 analogously illustrates the variation at the ZIP code level.

The structure of this substantial variation in outcome and predictors is formalized in the mixed effects logistic models in Tables 4 and 5. The county models in Table 4 are designed to evaluate the importance of county-level demographic characteristics, including female reproductive age poverty and rates of Catholic adherence. We find no evidence at the 0.05 level of these covariates' predictive capacity with regard to PPTL. Thus, we proceed to the ZIP code models, where we have a higher quality measure of exposure to Catholic hospital delivery but in which we cannot include poverty and Catholic adherence because these statistics are not reliably available at the ZIP code level of aggregation.

In the ZIP code based local context model in Table 5, the coefficients on the level-1 variables are roughly the same, but the odds of PPTL with delivery decrease by roughly half (95% CI (0.479, 0.673)) when all deliveries are in very low sterilization hospitals. In most contexts, this effect means that for each additional 10% of deliveries occurring in Catholic hospitals, the odds of PPTL are decreased by about 5%.

As a diagnostic of our model of PPTL using local concentration of Catholic hospitals, we display ZIP code PPTL rates by rates of local concentration of Catholic hospital deliveries in Figure 4. This figure illustrates the negative relationship between the two variables, indicating the finding that local concentration of Catholic hospitals is negatively related to population PPTL rates at the ZIP code level. This illustration validates the assumption of linear effect in our model and is consistent with our interpretation of local concentration of Catholic hospital deliveries as an important predictor of ZIP code population rates of PPTL.

In summary, the mixed effects models demonstrate that, accounting for individual characteristics of deliveries and demographic characteristics of places, women are less likely to receive PPTL when they reside in counties in which very low sterilization hospitals serve large numbers of women.

**Discussion**

Catholic hospitals structurally deny their patients access to female sterilization at a critical point in their reproductive life course – when they deliver the baby that they intend to be their last. Unless women who want to end childbearing by accessing PPTL consistently and successfully plan to deliver in non-Catholic institutions, this denial of services may present a

barrier to access to this popular and highly effective method of contraception. We find that the proportion of deliveries occurring in Catholic hospitals has a strong association with population-level rates of PPTL. This could either be because women who live in places where Catholic hospitals are highly concentrated do not want PPTL or because women cannot access PPTL when they deliver in Catholic institutions.

While the discharge data do not include parity, which could potentially have explained some of the variation in PPTL and most importantly, we have no individual measure of patient demand beyond the covariates included, we do find that the concentration of Catholic hospitals in a woman's local context is an important predictor of getting a PPTL even net of age, cesarean section, Medicaid enrollment, and county rates of Catholic adherence and female reproductive age poverty.

The non-importance of rates of Catholic adherence in determining rates of PPTL and concentrations of Catholic hospital delivery demonstrate that Catholic hospitals serve non-Catholics. Similarly, the non-importance of county rates of Catholic adherence in predicting population and individual PPTL points to the non-importance of Catholic patients – who may hypothetically have lower demand for sterilization – in constructing Catholic hospitals' extremely low rates of PPTL. This strengthens the conclusion that Catholic hospitals' influence on spatial variation in rates of postpartum sterilization is due to their institutional policies regarding not providing this type of care, not because these hospitals serve populations with lower demand for postpartum sterilization. These findings are consistent with national work demonstrating that Catholic adherence does not substantially alter contraceptive use (Jones, 2011).

Taken together, these findings point to the possibility that Catholic hospitals may limit access to PPTL for women who live near them. If Catholic hospitals did not limit access, the measure of concentration of deliveries in Catholic hospitals would not be an important predictor of rates of PPTL. Instead, we find that it is. The degree to which Catholic hospitals limit access to PPTL may be mitigated to extent that women who want PPTL are choosing to deliver in non-Catholic hospitals in order to access the method. However, if all women who wanted PPTL successfully delivered in non-Catholic hospitals we would no influence of concentration of Catholic hospitals on rates of PPTL. Instead PPTL rates are lower in places where Catholic hospitals serve more women.

If women living in areas with high concentrations of Catholic hospital deliveries who wanted PPTL were choosing non-Catholic hospitals in which to deliver in order to access PPTL, we would find higher than expected rates of PPTL in these non-Catholic hospitals. Preliminary

analysis of the rates of PPTL in non-Catholic hospitals in places with high concentrations of Catholic hospital deliveries, we do not find evidence of higher than expected rates of PPTL. Thus, we do not find evidence that women are successfully selecting non-Catholic hospitals in which to deliver. This is consistent with our finding that the concentration of Catholic hospital deliveries is highly predictive of population rates of PPTL.

Interval sterilizations may make up some of the shortfall in areas heavily served by Catholic hospitals. However, even if women to access interval sterilizations, they do so undertaking a new set of medical risks and costs associated with additional surgery, risks and costs which would have been avoided if they could have accessed PPTL when they delivered. (And we have analogous data on interval sterilizations from the Outpatient Discharge data in both states, which we will analyze for the full paper). Interval sterilization as a solution to Catholic hospitals non-provision of PPTL may have the most dramatic effect on women whose deliveries were paid by Medicaid (over half of deliveries in these two states), since many women lose Medicaid eligibility shortly after delivery. Thus, the least advantaged women may be the most impacted by Catholic hospitals' non-provision of PPTL.

Unfulfilled demand for PPTL may result in substantial rates of unintended pregnancy (Thurman and Janecek, 2010; Thurman et. al., 2010). And hospital policies, including Catholic hospitals' refusal to provide PPTL, have been identified as one element shaping hospital variation in rates of PPTL (Thurman and Janecek, 2010; Seibel-Seamon et al, 2009; Zite et al, 2006; Potter et al, 2013). The present work demonstrates that the institutional policies of Catholic hospitals impact women living in the areas they serve by impacting population-level rates of PPTL. This provides evidence that women who would have gotten a PPTL if they delivered where they could access it are not getting PPTL because they happen to live in an area with concentrated Catholic hospitals and happen to deliver in one. The fact that unfulfilled demand for PPTL puts women at elevated risk for unintended pregnancy is particularly important if it is indeed the case that there are women who deliver in Catholic hospitals and want PPTL but cannot get it.

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Figure 1. Counties with 1 or more Catholic hospital

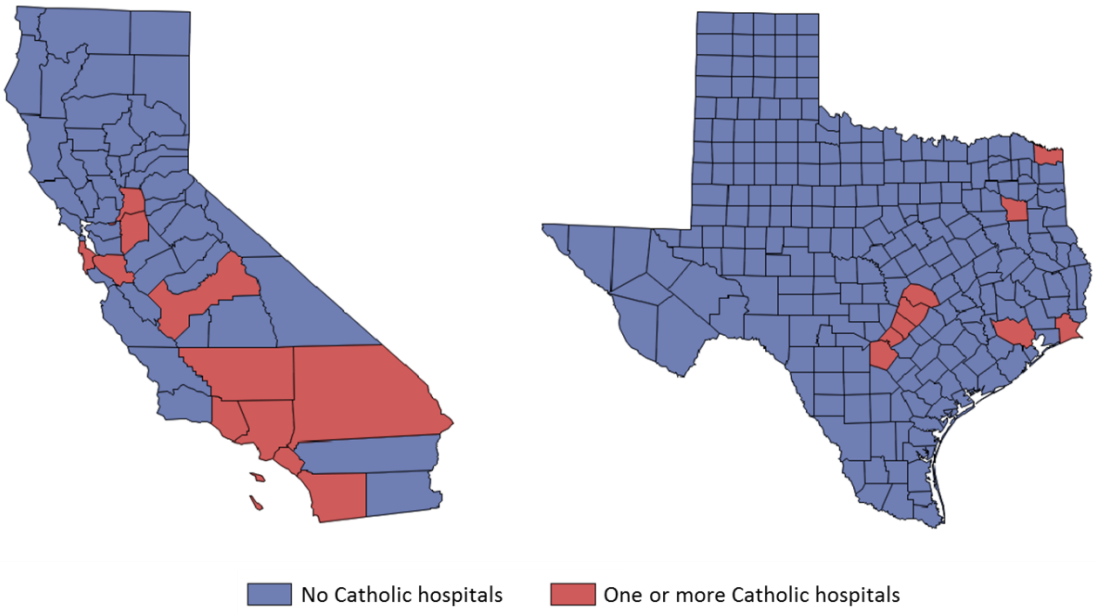

Figure 2. Counties Percent Deliveries in Catholic Hospitals by County Catholic Adherence Rate, 2009 California and Texas

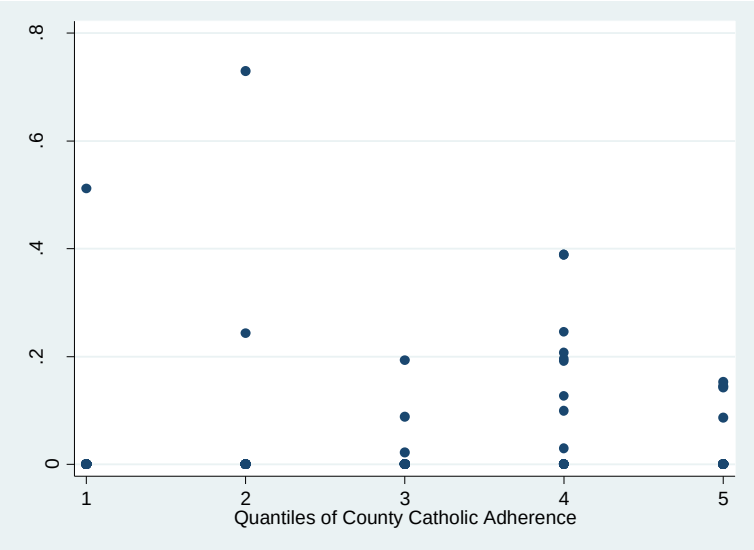

Figure 3. Counties PPTL Rate by County Catholic Adherence Rate, 2009

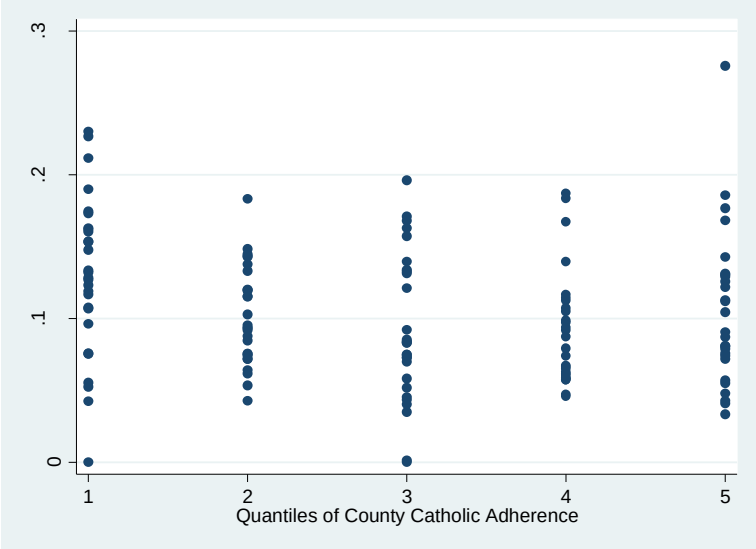


Figure 4. ZIP Code PPTL Rate by Local Concentration of Catholic Hospitals, 2009

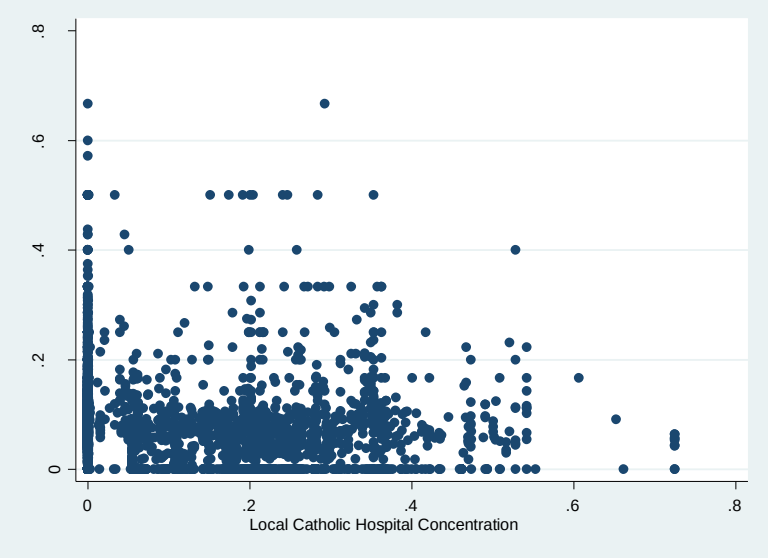

Table 1. Characteristics of Deliveries

| | California | | | Texas | | |
|---|---|---|---|---|---|---|
| | Medicaid | Private | Total | Medicaid | Private | Total |
| All Births | | | | | | |
| Births | 247,831 | 244,709 | 492,540 | 193,617 | 143,050 | 336,667 |
| with PPTL | 19,377 | 13,683 | 33,060 | 21,733 | 12,688 | 34,421 |
| PPTL Rate | 7.8% | 5.6% | 6.7% | 11.2% | 8.9% | 10.2% |
| Cesarean | | | | | | |
| Births | 79,647 | 82,879 | 162,526 | 66,501 | 56,843 | 123,344 |
| with PPTL | 12,971 | 10,907 | 23,878 | 14,003 | 10,056 | 24,059 |
| PPTL Rate | 16.3% | 13.2% | 14.7% | 21.1% | 17.7% | 19.5% |
| Vaginal | | | | | | |
| Births | 168,184 | 161,830 | 330,014 | 127,116 | 86,207 | 213,323 |
| with PPTL | 6,406 | 2,776 | 9,182 | 7,730 | 2,632 | 10,362 |
| PPTL Rate | 3.8% | 1.7% | 2.8% | 6.1% | 3.1% | 4.9% |
| Age <30* | | | | | | |
| Births | 166,655 | 91,823 | 258,478 | 152,048 | 76,008 | 228,056 |
| with PPTL | 6,548 | 2,304 | 8,852 | 11,494 | 3,725 | 15,219 |
| PPTL Rate | 3.9% | 2.5% | 3.4% | 7.6% | 4.9% | 6.7% |
| Age >= 30* | | | | | | |
| Births | 64,430 | 130,842 | 195,272 | 39,431 | 66,646 | 106,077 |
| with PPTL | 11,820 | 10,451 | 22,271 | 9,939 | 8,922 | 18,861 |
| PPTL Rate | 18.3% | 8.0% | 11.4% | 25.2% | 13.4% | 17.8% |
| State Rates of Individual-Level Variables | | | | | | |
| Cesarean Rate | 32.1% | 33.9% | 33.0% | 34.3% | 39.7% | 36.6% |
| Proportion >= 30 | 27.9% | 58.8% | 43.0% | 20.6% | 46.7% | 31.7% |

*Because of redaction, age is missing for 7.8% of California deliveries and <1% of Texas deliv

Table 2. Characteristics of Counties

| | Mean | Std Dev | Minimum | Maximum |
|---|---|---|---|---|
| California | | | | |
| PPTL Rate | 0.078 | 0.023 | 0.025 | 0.143 |
| % Medicaid | 0.534 | 0.177 | 0.000 | 0.872 |
| % Cesarean | 0.320 | 0.115 | 0.000 | 1.000 |
| % >= 30 | 0.359 | 0.125 | 0.000 | 0.711 |
| Poverty Rate | 14.29 | 4.30 | 6.10 | 25.50 |
| Rate Catholic Adherence per 1,000 pop | 240.38 | 147.61 | 48.69 | 904.94 |
| Rate of Delivery in Catholic Hospital (unweighted) | 0.031 | 0.066 | 0.000 | 0.245 |
| Texas | | | | |
| PPTL Rate | 0.125 | 0.057 | 0.000 | 0.315 |
| % Medicaid | 0.623 | 0.211 | 0.041 | 1.000 |
| % Cesarean | 0.389 | 0.170 | 0.000 | 1.725 |
| % >= 30 | 0.080 | 0.034 | 0.000 | 0.213 |
| Poverty Rate | 15.77 | 5.96 | 5.00 | 35.30 |
| Rate Catholic Adherence per 1,000 pop | 166.11 | 134.96 | 12.44 | 664.38 |
| Rate of Delivery in Catholic Hospital (unweighted) | 0.041 | 0.154 | 0.000 | 1.000 |

Table 3. Characteristics of Local Contexts

| ZIP Code Local Context | Mean | Std Dev | Minimum | Maximum |
|---|---|---|---|---|
| California | | | | |
| Rate of Delivery in Catholic Hospital (unweighted) | 0.100 | 0.138 | 0.000 | 0.720 |
| Texas | | | | |
| Rate of Delivery in Catholic Hospital (unweighted) | 0.064 | 0.126 | 0.000 | 0.529 |

Table 4. Mixed Effects Models of Probability of PPTL with County-level covariates

| | Model A | Model B | Model C |
|---|---|---|---|
| **Fixed Effects** | | | |
| ***Level-1 variables*** | | | |
| Intercept | 2.2550 *** | -4.3516 *** | -4.1826 *** |
| | (0.045) | (0.087) | (0.136) |
| C-section | | 1.6392 *** | 1.6392 *** |
| | | (0.074) | (0.074) |
| GT30 | | 1.3324 *** | 1.3324 *** |
| | | (0.040) | (0.040) |
| Medicaid | | 0.6192 *** | 0.6188 *** |
| | | (0.059) | (0.059) |
| ***Level-2 variables*** | | | |
| County Catholic adherence | | | -0.0004 |
| | | | (0.000) |
| County percent deliveries in very | | | -2.0636 *** |
| low sterilization hospital | | | (0.512) |
| County female reproductive age | | | 0.0001 |
| poverty rate | | | (0.007) |
| **Random-effects** | | | |
| Level-1 Variance | | 1/[φij(1-φij)] | |
| Level-2 Variance | 0.2635 *** | 0.2361 *** | 0.1833 *** |

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

Note: Standard errors in parentheses

Note: Level-1 residual variance is fixed because the response is binary

Table 5. Mixed Effects Model of Probability of PPTL using ZIP Code measure for Local Density of Catholic Hospitals

| | Model D | |
|---|---|---|
| | **Coefficent (SE)** | **Odds Ratio (Confidence Interval)** |
| **Fixed Effects** | | |
| ***Level-1 variables*** | | |
| Intercept | -4.4433 *** | 0.0118 |
| | (0.020) | (0.011, 0.012) |
| C-section | 1.6238 *** | 5.0725 |
| | (0.017) | (4.904, 5.247) |
| GT30 | 1.3454 *** | 3.8398 |
| | (0.012) | (3.749, 3.932) |
| Medicaid | 0.5239 *** | 1.6886 |
| | (0.015) | (1.639, 1.739) |
| ***Level-2 variables*** | | |
| ZIP Code percent deliveries in Catholic | -0.5664 *** | 0.5676 |
| hospitals | (0.087) | (0.479, 0.673) |
| Texas | 0.9448 *** | 2.5722 |
| | (0.022) | (2.465, 2.684) |
| **Random-effects** | | |
| Level-1 Variance | 1/[φij(1-φij)] | |
| Level-2 Variance | 0.19539*** | |
| Variance Partition Coefficent | 0.05606 | |

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

Note: Standard errors in parentheses

Note: Level-1 residual variance is fixed because the response is binary