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Utilization of second-trimester spontaneous and induced abortion services in public hospitals in Mexico, 2007-2015

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ABSTRACT

Data on utilization of in-facility second-trimester abortion services are sparse. We used 2007-2015 data from Mexico's Automated Hospital Discharge System (SAEH) to provide some evidence about the utilization of second-trimester spontaneous, induced, and post-abortion services in public hospitals across Mexico. We describe utilization and identify woman and state-level factors associated with utilization using regression. We identified 145,956 second-trimester abortions from 2007 to 2015, or 13.4% of total documented hospitalizations for abortion over the time period. The annual utilization rate of second-trimester abortion remained constant, fluctuating between 0.5 to 0.6 per 1,000 women ages 15-44. Young, marginalized women were more likely to seek second (versus first) trimester abortion services and living in a state with a health or fetal anomaly exception was not associated with higher utilization. These data demonstrate that there is a need for increased access to safe second-trimester abortion services through implementation of state-based legal exceptions.

I. INTRODUCTION

Approximately 10-15% of abortions worldwide occur in the second trimester, yet they account for a disproportionate number of maternal deaths when carried out in unsafe circumstances (1-3). Late diagnosis of fetal anomalies, delays in recognition of pregnancy, newly diagnosed or worsening maternal health conditions, and delays associated with access to care, all make access to safe second-trimester abortion an essential part of efforts to reduce maternal morbidity and mortality worldwide (2-4).

Two-thirds of countries with laws regulating second-trimester abortion allow it *only* to save the woman's life (3). While many countries do have exceptions permitting second-trimester abortion, such as the woman's physical or mental health, rape, fetal anomalies, or socio-economic reasons, they are implemented unevenly (5-7). Data on the incidence of in-facility second-trimester abortions remain sparse, especially in settings where abortion is legally restricted. Mexico is among a few low- and middle-income countries with robust health information systems in maternal health. We therefore used Mexico's office hospital discharge registers to describe utilization of second-trimester abortion services.

In Mexico, abortion laws are determined at the state level. In Mexico City, one of Mexico's 32 states, women have had access to first-trimester abortion in the private and public sectors since 2007 (8). In Mexico's 31 other states, abortion at all gestational ages continues to remain restricted (7). Rape is the only circumstance for which abortion is legally permitted at the federal level, across all states (9). Other grounds for legal access vary by state. For example, 27 states permit abortion when the life of the woman is at risk, but only 14 states permit abortion when the health of a woman is at risk, and 16 for fetal anomalies (10).

Previous research on abortion in Mexico has estimated incidence using indirect methods (11-13) or focused on Mexico City's public abortion program (8,14,15). No previous studies have focused on documented in-facility second-trimester abortion. We focus on trends in utilization over time (2007-2015) and by state.

II. METHODS

2.1 Data sources

We used 2007-2015 data from Mexico's hospital discharge system, SAEH (Subsistema Automatizado de Egresos Hospitalarios) (16). All facilities included in this dataset are operated by national and state ministries of health (Secretaría de Salud, SSA). These facilities largely serve individuals without insurance or covered by Seguro Popular, a public insurance program for the unemployed, self-employed, or those without access to employment-based social security (17). These government facilities accounted for an estimated 76% of the country's total inpatient post-abortion cases in 2009 (12).

We used 2010 population estimates of women 15-44 from the Mexican government, Consejo Nacional de Población's (18), at the state and national level. We also used the 2010 municipality-level marginalization index, a measure of community level socioeconomic status (19). The index includes information about education, housing, income, and population density and is generated using principal components analysis (20). We classified municipalities into five groups: very low, low, medium, high, and very high marginalization (high marginalization indicates the lowest socio-economic status group). We merged the marginalization index into the individual-level discharge data using the residence municipality of the woman. We also categorized states into four groups based on the percentage of the population living in poverty

in 2014 as reported by The National Council for the Evaluation of Social Development Policy (Consejo Nacional de Evaluación de la Política de Desarrollo Social – CONEVAL) (20). Mexico City was treated as a region apart due to its density of services, education, and infrastructure. Region 2 included states with less than 40% of the population in poverty, Region 3 with between 40-65% of the population in poverty, and Region 4 with 65% or more of state residents living in poverty (21). Data on state-level legal exceptions were extracted from Grupo de Información en Reproducción Elegida (GIRE) and categorized as binary variables based on whether a state had the health or fetal anomaly exception in their penal code (10). Finally, we downloaded facility-level characteristics, such as size and specialization of the hospital, from the Ministry of Health’s catalog of health facilities (22). All data sources are publicly-available and downloadable (web appendix pp 1).

2.2 Sample Selection

Hospital discharges are defined as the exit of a patient from inpatient services (at least one night in the hospital, thus excluding outpatient clinics). We built a dataset of only obstetric events (births and abortions). Each discharge record includes up to six international Classification of Diagnosis Codes Version 10 (ICD-10) codes for reason for admission. We identified spontaneous and induced abortions using ICD-10 codes O02-O08 (**Table 1**); we excluded ectopic and molar pregnancies with an abortive outcome, ICD O00 and O01. We identified all types of abortion care through these hospital records: induced, spontaneous, and post-abortion care. Thus, when we say “abortion” in this paper, we are referring to *both* induced and spontaneous abortions.

In order to comprehensively capture second-trimester abortions, we also included women who had abortion codes in any of the maximum six discharge diagnosis codes (N=894; 0.6% of total sample). For these cases, we reviewed the principal diagnosis codes to ensure that were related to second-trimester abortion procedures (webappendix pp 2). Additional abortions that may not have been identified using ICD-10 diagnostic codes were identified using a “type of treatment” checkbox in the SAEH records, which indicates whether an abortion or a delivery was performed (N=3,974; 2.7% of total sample).

Gestational age (GA), which measures in weeks and days the age of a pregnancy, usually dated from the first day of the last menstrual period and corroborated with ultrasound imaging when possible (23), was not routinely recorded prior to the legalization of first trimester abortion in Mexico City in 2007 (24). Of total records, 22% (238,972) were missing gestational age. Although there were few abortions identified after 20 weeks, under international and national definitions, spontaneous or induced abortions after 20 weeks are classified as “stillbirths” (25).

The SAEH records also include the following variables: woman’s age, municipality and state of residence, parity, hospital of admission, and length of hospital stay. We defined reproductive age as women ages 15-44 to make our results comparable with other studies, even though we acknowledge that pregnancy can occur outside this range.

2.3 Analysis

We calculated second-trimester abortion hospitalization rates per year per 1,000 women of reproductive age, ages 15-44, at the national and state levels. We then mapped

these second-trimester abortion hospitalization rates across Mexico by state (32 states), socioeconomic region (4 regions), and by the presence of a state-level health or fetal anomaly exception laws.

We next examined changes in mean and median GA of second-trimester abortions over time. In addition to looking at these trends nationally, we examined GA trends in Mexico City versus the rest of the country. Given that Mexico City has legal first-trimester abortion services, we hypothesized that trends in second-trimester GA would be different from the rest of the country due to availability of first trimester abortion.

Finally, we identified factors associated with utilization of hospital-based second-trimester abortion using a logistic regression model. Through iterative testing of different covariates to ensure model robustness, we developed a final model:

$$\begin{aligned} \text{logit}(\text{SecondTri}) &= \beta + \beta_1(\text{AgeGroup}) + \beta_2(\text{Parity}) + \beta_3(\text{Marginalization}) \\ &+ \beta_4(\text{Health Exception}) + \beta_5(\text{Fetal Anomaly Exception}) \\ &+ \beta_6(\text{Hospital Type}) + \varepsilon \end{aligned}$$

Here, we compared first versus second-trimester abortion patients. Independent variables included age group, parity, municipality-level marginalization, state-level health and fetal anomaly exceptions, and specialization of hospital where the woman sought care. We estimated robust standard errors to account for non-independence of observations within hospitals using the “cluster” option in STATA (26).

III. RESULTS

Of the 1,083,803 induced and spontaneous abortions documented in the SAEH hospitalization records from 2007 to 2015, we identified 145,956 (13.4%) second-trimester

abortions. The majority of second trimester abortions (70%) were classified as ICD-10 code O06 (“unspecified”) (**Table 1**).

Nearly 60% of second-trimester abortions were among women under 25 years old, 45.4% between 18-25, and only 2.4% were among women over 40 (**Table 2**). Most (70%) women who had a second-trimester abortion were hospitalized for one day. Over 50% of reported second-trimester abortions occurred in the least marginalized, or wealthiest, municipalities (**Table 2**). Overall, 24% of second-trimester abortions were performed in specialized hospitals, while 68% took place in general hospitals. However, in Mexico City, 56.4% of second-trimester abortions were performed in specialized hospitals, while in Guerrero, Oaxaca and Chiapas, only 1.6% of second-trimester abortions were performed in specialized hospitals (webappendix pp 2).

The annual nation-wide hospitalization rate of second-trimester abortion services remained stable, between 0.5 to 0.6 per 1,000 women of reproductive age (15-44) over the study period (webappendix pp 3). When we examine the spatial pattern of second-trimester induced and spontaneous abortion hospitalizations, there appears to be clustering of higher rates of hospitalization in the central and southern parts of the country (**Figure 1**). The states of Zacatecas and Durango have the highest rates of utilization of hospital-based, second-trimester abortion services in the country, with 1.1 and 0.89 per 1,000 women respectively. These are followed by predominantly southern states, including Tlaxcala, Guerrero, and San Luis de Potosí. The northeastern states, including Coahuila, Nuevo León and Tamaulipas, have some of the lowest rates of utilization of second-trimester abortion services.

There does not appear to be a clear relationship between having legal exceptions that permit abortion and documented utilization of public, hospital-based abortion services. In states with a health exception (**Figure 2**), utilization rates of hospital-based second-trimester abortion vary between 0.30 and 1.10 per 1,000 women, with no clear relationship between existence of this exception and utilization. Among states with fetal anomaly exceptions, the hospitalization rate varies between 0.21 and 0.77 per 1,000 women, with a similar lack of spatial pattern (**Figure 3**).

The majority (62%) of second-trimester abortions were between 13-16 weeks, 38% occurred between 17-20 weeks, and < 1% from 21-24 weeks. Mean gestational age of second-trimester abortion patients in Mexico City was significantly higher than the rest of Mexico in 2007, dropped from 2007-2009, and then plateaued (**Figure 4**). However, mean gestational age remained slightly higher in Mexico City than in the rest of Mexico over the entire study period.

In multivariate analyses, adolescents were more likely than older women to present for abortion services in their second-trimester compared to first-trimester services (OR 1.07; 95% CI 1.04-1.11) (**Figure 5**). Women living in municipalities with high levels of marginalization (lower SES) also had higher odds of utilizing abortion services in their second trimester compared to women living in municipalities with lower marginalization (OR 1.43; 95% CI 1.18-1.73). Women utilizing hospital-based second-trimester abortion services were more likely to receive services in a specialized hospital (OR 1.19; 95% 1.02-1.39) than a general or community hospital. Living in a state with a health or fetal anomaly exception was not associated with utilization of second-trimester services compared to first trimester abortion care.

IV. DISCUSSION

There are a few key takeaways from our study on hospital-based, second-trimester abortion care in Mexico and its implications for other low- and middle-income countries. First, we found that women are having second-trimester abortions even where they are highly restricted. Second, despite the stated purpose to expand access, the health and fetal anomaly exceptions in the state laws do not appear to be associated with higher utilization of second-trimester abortion services in state-level hospital settings. And, third, there are differences in use of second-trimester abortion services that disproportionately affect poor, adolescent women.

Although second-trimester induced abortion is largely illegal throughout Mexico and punishable by imprisonment, it is probable that some women are able to access abortion services under the available exceptions; many others present for and receive post-abortion care. As stated previously, this study did not intend to distinguish between the two categories. We found that the average hospitalization rate for second-trimester abortions over the period was 0.57 per 1,000 women, and that 13.4% of total abortions over the period occurred in the second-trimester. These rates vary across the country, ranging from 0.21 per 1,000 of reproductive age in the Yucatán, to 1.1 per 1,000 in Zacatecas. Using the most recent indirect estimates of abortion incidence in Mexico -- an annual abortion rate of 38 per 1,000 women (12) -- and the assumption that second-trimester induced and spontaneous abortions account for about 15% of total abortions (2, 27), we would expect the utilization of second-trimester abortion to be more like 5.7 per 1,000 women. Despite lower than expected rates, we found consistent utilization of second-trimester abortion services, including in Mexico City, despite

liberalization of first-trimester abortion in the capital in 2007. This demonstrates that the need for these services is not going to disappear, even with expansion of first-trimester abortion services.

The potential under-utilization of second-trimester abortion services may be due to poor implementation of all legal exceptions (7). For example, while Jalisco passed a law in 2009 that mandated institutions to provide abortion in cases of rape, the first case was not documented until 2016 (28). Since then, there have been only 16 cases of abortions performed under this exception in Jalisco (28). This was reflected in our study; women living in states with legal exceptions for health or fetal anomaly were no more likely to utilize second-trimester services than women living in states without these exceptions. There remains widespread under-utilization of these legal exceptions, likely due to lack of information and training among providers, poor dissemination of information about the legal exceptions to women, and a continued environment of stigma and criminalization of women seeking abortion (7,29,30).

Our results support other evidence that Mexico's most vulnerable women are often disproportionately affected by obstacles to care. This finding has been reflected in other contexts as well, such as the U.S. and Colombia, where younger, poorer, and more disenfranchised women were more likely to seek second trimester abortions (4,14,31,32,33). These same women also face disparities in access to obstetric and prenatal care (14). In our study, despite the fact that women in richer municipalities made up half of our sample of second-trimester abortions, women living in highly marginalized municipalities and adolescents were more likely to present for second-trimester abortion services (vs. first). Our results showed that many women in poorer, more rural areas were seeking care in general or

community hospitals, where physicians may not have the training or experience to safely manage second trimester abortion.

This study has some key limitations, mostly driven by common limitations in abortion data. First, we included all abortions – spontaneous and induced, and were not able to differentiate between them. Second, this is not a study of abortion incidence, but of documented utilization in the public sector. It is important to understand what is happening in the public health sector as these facilities serve the most vulnerable women. The Ministry of Health is the largest hospital system in Mexico and covers more than 75% of the country's inpatient post-abortion care (12). However, we are unable to comment on private sector or out-of-facility abortion. In this study, we are interested in care received for the obstetric event and are not attempting to estimate incidence of induced abortion. Third, the SAEH data contains limited individual-level socio-demographic information; we leveraged other data sources with facility, municipality, and state-level characteristics to partially address this limitation of the data. Fourth, in our comparison of women seeking first versus second-trimester abortions, our sample of first-trimester abortions is limited by the fact that it does not include any outpatient services that occur in Mexico City through their legal, first-trimester abortion program. However, we found similar results when running our model with and without Mexico City data. Fifth, gestational age was often poorly recorded, making it difficult to know when the abortion occurred in the woman's pregnancy. Although we restricted our analysis to data collected on or after 2007, gestational age continued to be missing in some areas after this date.

Pregnancy duration is often not recorded in the clinical charts, and even when it is, it is often not recorded consistently. For example, some physicians measure gestational age as the number of weeks from the last menstrual period, while other physicians count from the estimated day of conception (32). This can lead second-trimester abortions to be inaccurately categorized as either first-trimester abortions or stillbirths. Accurate estimates of utilization of second-trimester abortion are not possible without comprehensively-recorded gestational age data.

This is one of the first studies to leverage robust health information systems and use clinical data to report on in-facility second-trimester abortion across the public sector in a low- and middle-income country where abortion is restricted. These data demonstrate that there is a need for safe, second-trimester abortion services throughout Mexico that is not going to go away. Access to safe, second-trimester services must be improved through the implementation of state-based legal exceptions, availability of trained health professionals, comprehensive recording of gestational age, and particular attention to Mexico's most vulnerable women.

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Table 1. ICD-10 codes for second trimester hospital-based abortions, 2007-2015

ABORTION DIAGNOSIS CODES	FREQUENCY	PERCENT
	N = 145,956	
O02 Other abnormal products of conception	19,932	13.66%
O03 Spontaneous abortion	16,972	11.63%
O04 Medical abortion	353	0.24%
O05 Other abortion	2,642	1.81%
O06 Unspecified abortion	101,696	69.68%
O07 Failed attempted abortion	19	0.01%
O08 Complications following abortion and ectopic and molar pregnancy	368	0.25%
“Type of Attention” checkbox	3,974	2.72%

Table 2. Characteristics of women receiving in-hospital second-trimester abortions, Mexico 2007-2015

Characteristic	Frequency N = 145,956	Percent
Age Group		
< 18 yr	18,397	12.60%
18-25 yr	66,924	45.42%
26-30 yr	27,626	18.93%
31-40 yr	30,208	20.70%
> 40 yr	3,421	2.35%
Length of hospital stay		
0 days	2,576	1.76%
1 day	102,609	70.30%
2 days	27,124	18.58%
3 or more days	13,647	9.35%
Municipality-Level Marginalization		
Very low ¹	73,660	50.55%
Low	23,719	16.28%
Medium	33,250	22.82%
High	8,139	5.59%
Very High	6,947	4.77%

¹ Marginalization index is based on 9 different indicators that cover four main domains: education, housing, income, and population distribution. Index is calculated for years 1990, 1995, 2000, 2005, 2010, and 2015. We used the 2010 ranking for modelling.

Figure 1. Second-Trimester Utilization Rate per 1,000 women 15-44 in 2015

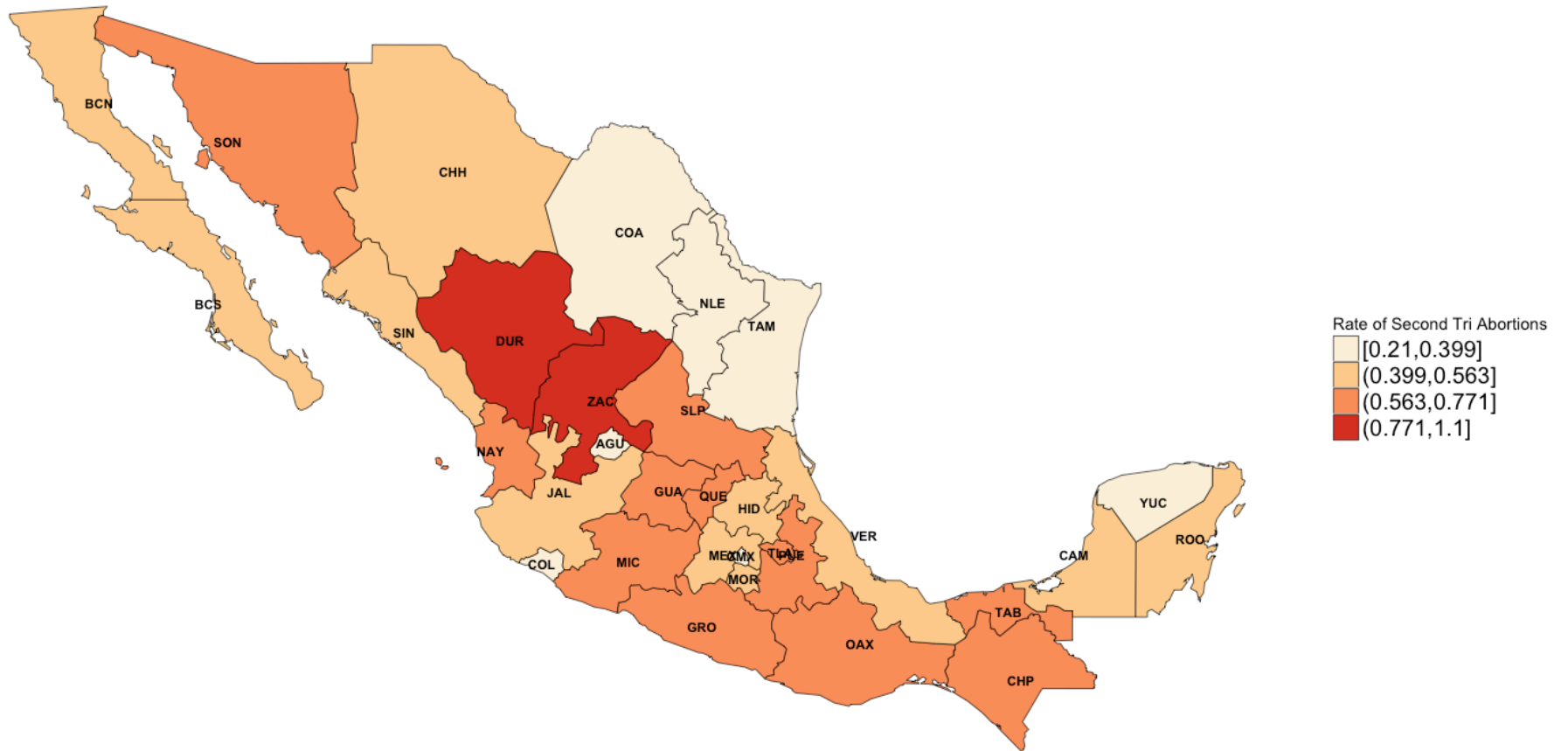


Figure 2. Second-Trimester Utilization Rate in States with Health Exceptions

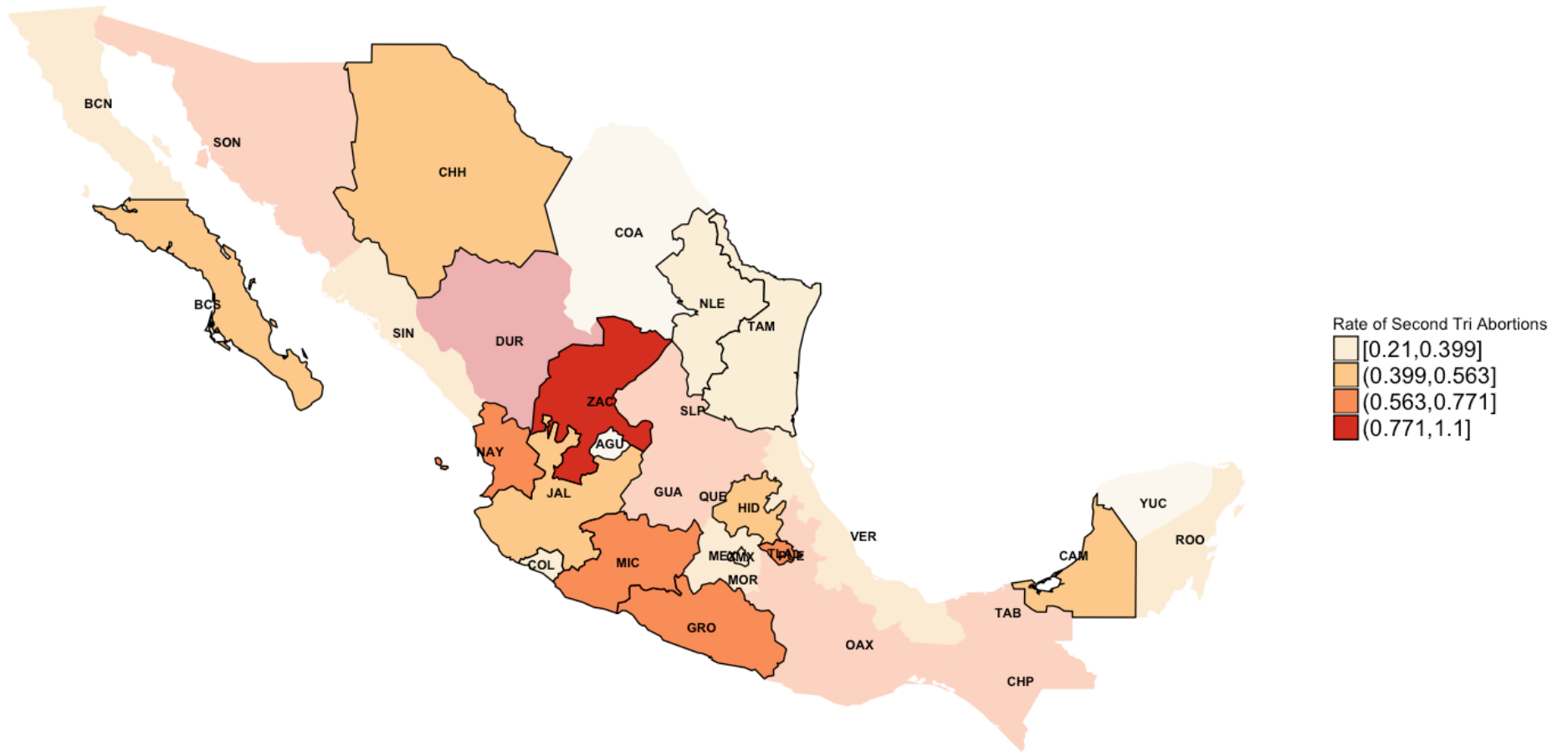


Figure 3. Second-Trimester Utilization Rate in States with Fetal Anomaly Exceptions

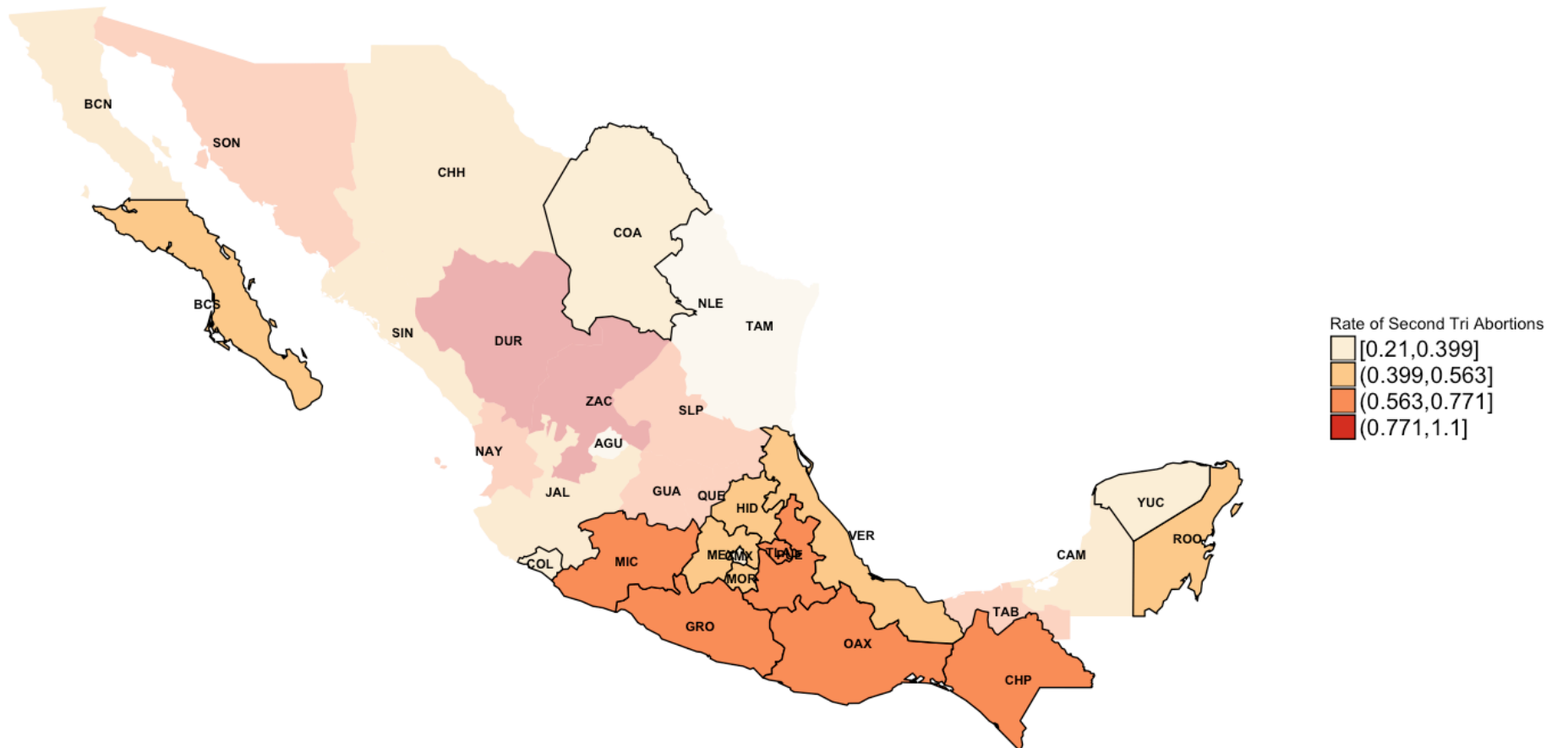


Figure 4. Trends in gestational age of second-trimester abortions over time

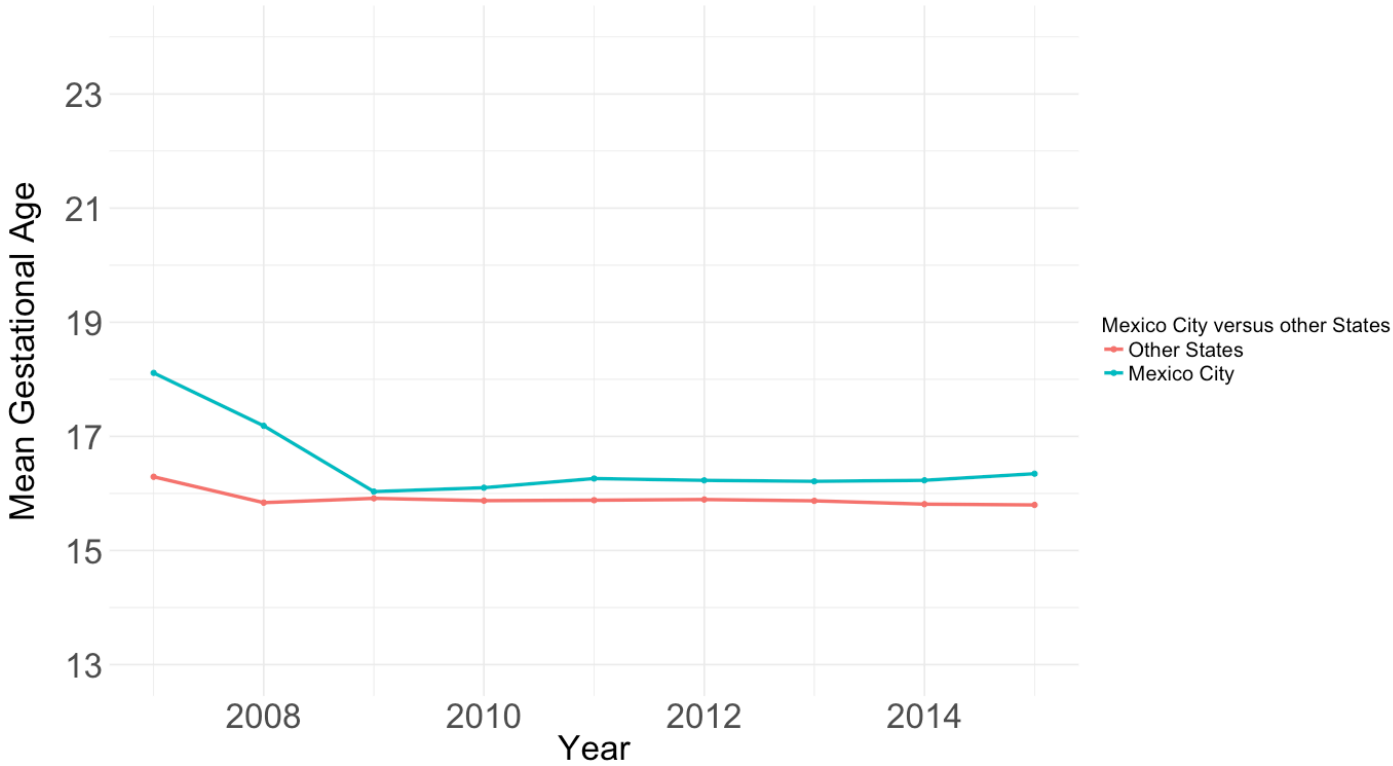
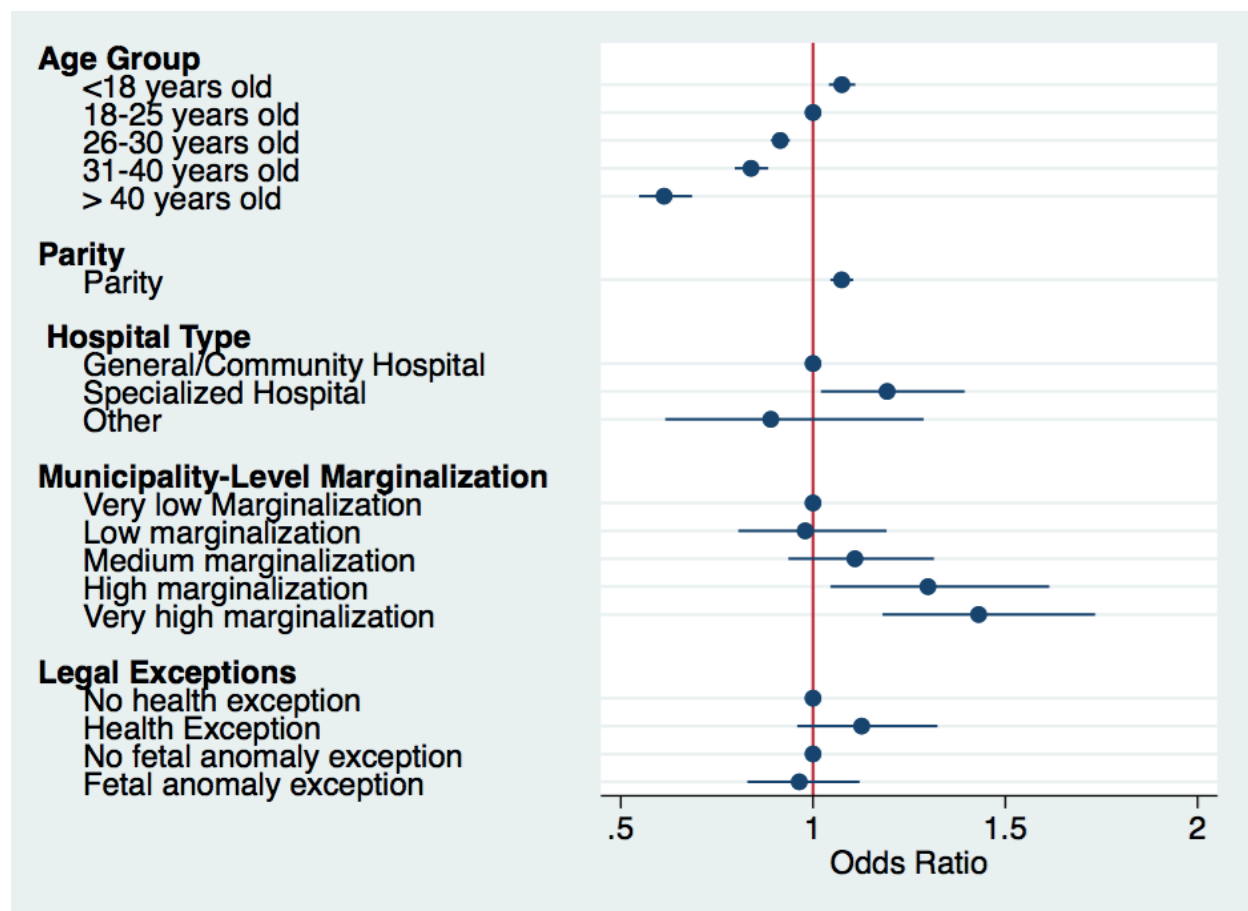


Figure 5. Factors associated with second-trimester versus first trimester abortion care



¹The reference category for each variable is represented by the dot on the line where OR = 1.

