Title: Association of maternal age 35 years and over and prenatal care utilization, preterm birth, and low birth weight, in Mexico 2008-2019: A historical cohort study

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Running Head

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ABSTRACT

Objective: We compared prenatal care utilization, preterm birth, and low birth weight neonates among women 35 years and older compared to women 20-34 years old in Mexico, 2008-2019.

Study Design: We used birth certificate data and conducted a historical cohort study of all singleton live births in Mexico from 2008-2019. Study outcomes were inadequate prenatal care (timing of initiation of care and number of visits), preterm birth, and low birth weight. We compared outcomes among women 35-39, 40-44, and 45-49 with births to women 20-34. We used logistic regression to account for individual, health system, and contextual confounders.

**Results:** We included a total of N=19,526,922 births; 11.9% (n=2,325,725) were to women 35 and older. Compared to women aged 20 to 34, the oldest (45-49 years old) were more likely to reside in poorer communities, have less education, and be uninsured. The odds of inadequate prenatal care (aOR 1.12 95% CI 1.09-1.15 p<0.01), preterm birth (aOR 2.05 95% CI 1.97-2.13 p<0.01), and low birth weight (2.03 95% CI 1.95-2.12 p<0.01) were highest for women 45-49, compared to women 20-34. Patterns were similar among women 35-39 and 40-44 with the exception of lower odds of inadequate prenatal care (aOR 0.77 95% CI 0.76-0.77 p<0.01) for 35-39 compared to women 20-34.

**Conclusion**: Women who deliver at 35 years old and over are a heterogeneous group in Mexico. Being 35 years old and older is associated with increases in preterm birth and low birth weight neonates. Women who give birth between 45-49 may be especially vulnerable.

INTRODUCTION

There is a clear trend in higher-income countries towards delaying childbirth to later reproductive years (1–3) and this trend is also becoming more common in low-and-middle income countries (4–6). For example, births to women 35 years and older represent nearly 20% of births in the US (3). Widespread use of family planning, postponing pregnancy because of education or career goals, and advances in assisted reproductive technology contribute to ﻿pregnancy later in life (7). Prenatal care is important for a healthy pregnancy and birth outcomes, especially for older women (8). Enhanced prenatal care that includes additional monitoring during pregnancy and birth is recommended for women over the age of 35 due to associated health risks (9) including increased rates of gestational diabetes, high blood pressure, and miscarriage (10–12). Additionally, pregnancy over 35 years old is associated with adverse birth outcomes including low birth weight, small for gestational age, preterm birth, and congenital disorders (12–14).

Countries in the Latin American region have also reported increases in maternal age at birth over the last several decades (15). In Mexico, some evidence suggests that younger generations of Mexican women are delaying first births (16,17). Births to women 35 and over also represent higher-order births; thus, births to older women include both those who delay childbearing and those who have multiple births. This is important because socio-economic conditions may be different for older women with multiple children compared to older nulliparous women (18). In Mexico, while deliveries overwhelmingly occur in health facilities (19,20), disparities exist in prenatal care coverage and quality and birth outcomes by socioeconomic status, and indigenous ethnicity (21).

Much of the literature on maternal and infant outcomes for births to women over 35 years old ignores possible heterogeneity in this age group (13,22). In addition, studies do not always take into account clinical and social-structural factors that influence both health services utilization and health outcomes (23), making it difficult to isolate the effects of maternal age from other factors. The purpose of this study is to describe the characteristics of live births to women over the age of 35 in Mexico by five-year age groups, compare them to births to women 20-34, and test the association of age (over 35 years) and inadequate prenatal care, low birth weight, and preterm birth accounting for clinical and social factors.

METHODS

Data and variables

We conducted a historical cohort study of all singleton live births in Mexico from 2008-2019. We identified births through the Birth Information Subsystem (Subsistema de Información sobre Nacimientos, SINAC), an initiative of the Mexican government that provides data on live births obtained from registered birth certificates beginning in 2008 (24). These birth certificate data include self-reported maternal characteristics and birth outcomes identified by the birth attendant. We excluded birth records missing maternal age (n= 71,571/0.36%; Figure 1). This analysis focuses on women 20-49 years old at the time of birth. We included all births in order to calculate the proportion of births to all age groups; we then restricted all analyses to women 20-49 years old at time of birth (**Figure 1**). Our primary outcomes were maternal utilization of prenatal care, preterm birth, and neonate low birth weight. We measured prenatal care utilization by constructing a binary measure of inadequate prenatal care defined as care that is less than five prenatal visits and care that is not initiated in the first trimester (<13 weeks), following the Mexican practice guidelines for number of visits (25) modeled on the Kotelchuk index (26). We identified weeks of gestation at birth as late prematurity (34 to 37 weeks), moderate prematurity (between 32 and 34 weeks), very premature (between 28 and 32 weeks), and extreme prematurity (less than 28 weeks). For multivariable modeling we compared preterm births to term births (<37 weeks or not). We evaluated birth weight, subcategorized as low birth weight (1500-2500 g), very low birth weight (1000-1499 g), and extremely low birth weight (<1000 g). For multivariable modeling, we used a binary indicator of low birth weight (<2500 g or not).

Maternal age was categorized in four categories: 20-34 years old, 35-39, 40-44, and 45-49. The age group 20 to 34 served as a reference group for all comparisons because this represents the ages when most births occur and with less risk of adverse birth outcomes. Other maternal characteristics included education; marital status; health insurance status; region of maternal residence; municipality population size; *grado de marginacion* (a municipality-level measure of structural vulnerability built by the Consejo Nacional de Población and includes measures of education, income, household materials, and the proportion of the population that is rural (27)); parity; place of delivery; birth attendant (physician vs other provider); and mode of delivery (vaginal or cesarean). We described maternal education as none, completion of primary school, secondary school (reference), high school, or completion of professional-level or higher schooling, and marital status as married or cohabiting, single, or separated/divorced/widowed. We classified health insurance following previous literature as via social security institutions, which cover those working in the formal sector[[1]](#footnote-1) (reference), Seguro Popular or IMSS Oportunidades, which cover those in the informal sector, unemployed, none, or other, which includes the small population with private-sector insurance (28). We described parity as 1 (first live birth) (reference), 2, 3, 4, and 5 or more. We defined the population size of maternal residence following Mexican government standard classifications: less than 2,500 inhabitants, 2,500 to 14,999 inhabitants, 15,000 to 99,999 inhabitants, or 100,000 or more (29). We classified maternal state of residence into regions: central, north, south, Zona Metropolitana del Valle de México (ZMVZ) (the area that constitutes the greater Mexico City metropolitan area) or other country. We classified municipality-level (a jurisdiction similar to a county in the US) marginalization as very high, high, medium, low, or very low (reference) using *grado de Marginacion* where higher values indicate higher marginalization (more social-structural vulnerability) (27). We analyzed mode of delivery (vaginal or cesarean section) and noted the health professional who attended the delivery (physician or other provider which includes nurses and midwives). Finally, we included maternal state of residence (Mexico has 32 states) and year of birth. We also described missing data for all variables and present a heat map of missing variables by year in **Figure S1**. Missing variables are slightly higher among the oldest groups, and low birth weight represents the most missingness of all variables; however, completeness of the data has improved over time.

***Analysis***

We first included all births and calculated the proportion of births to all age groups; we then restricted all further analyses to women 20-49 years old at time of birth. We described the woman’s individual, geographic, and clinical characteristics by age categories (20-34, 35-39, 40-44, 45-49). Next, we described clinical and birth outcomes and prenatal care utilization by age groups. Then, we built three logistic regression models with dichotomous outcomes: inadequate prenatal care, preterm birth, and low birth weight. We adjusted for education, parity, insurance status, state, year, and municipality-level marginalization. Due to the computational challenges of modeling the full sample of the reference group (births to women 20-34), we selected a 10% simple random sample of that group for modeling. Descriptive characteristics of this 10% simple random sample are shown in **Table S1** and did not differ from the full sample (**Table 1**).

Finally, we calculated adjusted predicted probabilities (average marginal effects at the mean) for each outcome (inadequate prenatal care, preterm birth, and low birth weight) and plotted the predicted probabilities by age categories. All analyses were conducted in R (R Core Team, 2022). This analysis was deemed non-human subjects by the Oregon Health and Science University Institutional Review Board.

RESULTS

There were 24,391,493 singleton live births in Mexico between 2008-2019 (Figure 1). Births to women 35 years and older represented 9.6% of all births. Our analytic sample included 19,526,922 live births to women 20-49 years old at time of birth: 17,201,197 (88.1%) aged 20-34; 1,872,563 (9.6%) aged 35-39; 425,354 (2.2%) aged 40-44; and 27,808 (0.14%) aged 45-49 (Figure 1). Overall, women 45-49 years old were more structurally vulnerable as measured by education, insurance, and municipality-level marginalization. Older women tended to have lower levels of education, and the proportion of women with no education increased with increasing age: 6.9% among women 20-34, 12% among women 35-39, 17% among women 40-44, and 25% in women 45-49 years old reported no education (p<0.001; Table 1). A larger proportion of older women were uninsured (45-49 years old, 27%) compared to younger women (20-34 years old, 21%; p<0.001). Older women also tended to come from less densely populated and more highly marginalized municipalities (p<0.001). All three age groups of women over 35 years old had higher parity compared to women 20-34 (p<0.001) with nearly half of women 45-49 (48%) already having four or more children at time of birth. The proportion of out-of-facility births as well as the proportion of deliveries attended by non-medical providers increased with age (p<0.001) (Table 1). Overall, nearly half of all births were by cesarean delivery (47%); women aged 40-44 had the highest proportion of cesarean births (58%). The full descriptive table including state and year of birth are shown in Table S2.

In bivariate analyses, the oldest women (45-49) had the highest crude proportions of inadequate prenatal care (38%) compared with women 20-34 (30%) as well as with other age groups 35-39 (26%) and 40-44 (30%) (p<0.001) (Table 2). The 45-49 age group also had the highest proportion of preterm births (11%) compared to 20-34 (6%), 35-39 (8%), and 40-44 (10%) (p<0.001) as well as the highest proportion of low birth weight neonates (10%) compared to 20-34 (5%), 35-39 (7%), and 40-44 (8%) (p<0.001) (Table 2).

In multivariable analyses, the adjusted predicted probability of receiving inadequate prenatal care was highest for the oldest women (45-49) 29.3% (95% CI 28.7-29.9%) but lowest for women aged 35-39 years old (22.1%; 95% CI 21.9-22.4%) and 40-44 years old (24.4%; 95% CI 24.1-24.7%) compared to 20-34 years old (26.9%; 95% CI 26.7-27.2%) (Figure 2). Other factors associated with inadequate prenatal care included municipality-level vulnerability (marginalization) and education. Women living in municipalities with very high marginalization (versus very low) had greater odds of receiving inadequate prenatal care (aOR 1.28 95% CI 1.26-1.29) (Table 3). Having a high school (aOR 0.78, 95% CI 0.77-0.79) or professional education (aOR 0.47 95% CI 0.47-0.48) (vs secondary school education) was associated with lower odds of receiving inadequate prenatal care (Table 3).

In multivariable analyses, the patterns of preterm birth and low birth weight increased with age in a dose-dependent pattern. The adjusted probability of preterm birth was 7.9% (95% CI 7.8-8.1%) for the 20-34 age category, compared to 11.2% (95% CI 11.0-11.4%) for 35-39 years old, 13.3% (95% CI 13.0-13.5%) for 40-44 years old, and 15.0% (95% CI 14.4-15.5%) in the 45-49 year old age categories, holding all other covariates at the mean. The adjusted probability of a low birth weight neonate similarly increased with age: it was 7.4% (95% CI 7.2-7.6%) for the 20-34 age category, compared to 9.9% (95% CI 9.7-10.1%) for 35-39 years old, 11.9% (95% CI 11.7-12.2) for 40-44 years old, and 13.9% (95% CI 13.4-14.5) for the 45-49 year age category, holding all other covariates at the mean (Figure 2). Additional factors associated with preterm birth and low birth weight were insurance status, parity, inadequate prenatal care, and municipality-level marginalization. Coming from a more marginalized (higher vulnerability) municipality was associated with lower odds of preterm birth or low birth weight (aOR 0.59 CI 0.57-0.60 and aOR 0.73 CI 0.71-0.75, respectively). The full models and adjusted odds ratios are in Table 3.

DISCUSSION

Our study reveals that women who gave birth at 35 or older are a heterogeneous group. Our results start to explain the differences among age groups and further describe relationships between age, access to services, education, and other social-structural factors. The oldest women in our study (aged 45-49 at delivery) had the highest adjusted probabilities of receiving inadequate prenatal care, experiencing a preterm birth, and delivering a low birth weight neonate compared to women 20-34 years old. Women aged 45-49 years also had the lowest levels of education, were more likely to be uninsured, and came from highly marginalized municipalities. Women 35-39 years old also had higher adjusted probabilities of preterm birth and low birth weight compared to 20-34 year old women, despite having more advantaged socio-demographic conditions compared with women 45-49 years old. This is consistent with previous work in Mexico that showed a combination of factors including maternal age, maternal education parity, and socio-economic status play a significant role in adverse birth outcomes (30). Our results show that collapsing all births to women 35 and older together obscures important differences in the risk of adverse outcomes by age as well as other differences in life circumstance or structural vulnerability. Overall, these results suggest that people with higher levels of education from wealthier communities may be delaying births, a relatively novel phenomenon in Mexico. Clinicians should understand that pregnant people over 35 include a combination of people with and without resources, people delaying births and people with several children already, and that the evidence we have about pregnancy over 35 (which is mainly biological) (31) should be considered in the context of social factors as well.

Our findings confirm the impact of maternal age on preterm birth and low birth weight neonates. This is consistent with existing literature that have shown older age to be associated with adverse perinatal outcomes, including preterm delivery, low birth weight, higher rates of Neonatal Intensive Care Unit (NICU) admission, and worse Apgar scores (4,13,14,22,32). However, by evaluating several age categories above 35 years, we add that as maternal age increases, so does the prevalence of these outcomes with a dose-dependent effect, even when controlling for individual, health system, and contextual confounders.

Inadequate prenatal care utilization does not follow the same dose-dependent pattern with age. Prenatal care is an important part of a healthy pregnancy and birth; however, strong evidence on the link between prenatal care utilization and pregnancy outcomes is difficult to generate because patients who receive more prenatal care tend to be different from those who do not (33). Mexican woman over 40—who are also at higher risk of adverse birth outcomes—are more vulnerable to receiving inadequate prenatal care. The oldest women in our study (aged 45-49) had the highest probability receiving inadequate prenatal care; however, women aged 35-40 and the most educated group had the lowest probability, even lower than the youngest (aged 20-34) comparison group. This is consistent with previous studies that have shown an association between inadequate prenatal care utilization with low levels of education, poor social support, unplanned pregnancy and poverty (34), and that higher education is protective (35). Additionally, a study in the US showed that perinatal outcomes were better for pregnant women just over the 35-year cutoff when compared to those just under this age, suggesting that the additional age-related pregnancy monitoring may play a role in improving outcomes (8). Together these studies highlight that many factors influence utilization of prenatal services.

Strengths of our study include a standardized data source, national birth certificates (SINAC) and a census of all births in Mexico, resulting in a large analytical sample. However, our study has limitations. First, one of our outcomes (prenatal care utilization) is from self-reported data; however, they are registered within close proximity to data collection at delivery. Our dataset only includes data on live births, so we are unable to report on other pregnancy outcomes such as miscarriage, abortion, or still birth. Since in less resourced settings, preterm and low birth weight infants may not survive, this may help explain why coming from a more marginalized municipality was associated with lower odds of low birth weight and preterm birth. Moreover, we can only analyze the limited variables (clinical and socio-demographic) included in the register form and are unable to evaluate other factors that could impact outcomes such as quality of care, intendedness of pregnancy (36), and previous contraceptive use. Finally, while the quality of SINAC data has improved over time, (**Figure S1**), we excluded >75K births (0.3%) due to missing or questionable data.

**CONCLUSION**

In Mexico, women giving birth over 35 years old are a heterogenous group. Birth at 35 years and older is associated with preterm birth and low birth weight neonates and the probability increases with age, up to 49 years old. Inadequate utilization of prenatal care is greatest for the oldest women, 45-49 years, but lowest for those 35-39 years old.

**Disclosure of Interests**

BD receives research support from Merck. All other authors have no conflicts of interest to disclose.

Contributions

LJ Conducted analyses & drafted the article; EF Conducted analyses and reviewed the article; BD conceived of study design, supervised analyses, and reviewed manuscript; RS conceived of study design and reviewed manuscript.

**Details of patient's consent**

This is a de-identified secondary data only study, therefore patient’s consent is not applicable.

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**Details of ethics approval**

This analysis was deemed non-human subjects by the Oregon Health and Science University Institutional Review Board and no ethics board approval was required.

**REFERENCES**

1. Wang Y, Tanbo T, Åbyholm T, Henriksen T. The impact of advanced maternal age and parity on obstetric and perinatal outcomes in singleton gestations. Arch Gynecol Obstet. 2011 Jul;284(1):31–7.

2. Dumauli MT. The timing of childbirth and the child wage-penalty in Japan. Int J Soc Econ [Internet]. 2019 Jan 1;46(12):1369–86. Available from: https://doi.org/10.1108/IJSE-12-2018-0629

3. Osterman MJK, Hamilton BE, Martin JA, Driscoll AK, Valenzuela CP. Births: Final Data for 2020 [Internet]. Vol. 70, National Vital Statistics Reports. 2022. Available from: https://www.cdc.gov/nchs/products/index.htm.

4. Laopaiboon M, Lumbiganon P, Intarut N, Mori R, Ganchimeg T, Vogel JP, et al. Advanced maternal age and pregnancy outcomes: a multicountry assessment. BJOG. 2014;121 Suppl:49–56.

5. Diamond-Smith N, Plaza N, Puri M, Dahal M, Weiser SD, Harper CC. Perceived conflicting desires to delay the first birth: A household-level exploration in Nepal. Int Perspect Sex Reprod Health. 2020;46:125–33.

6. Ibarra-Nava I, Choudhry V, Agardh A. Desire to delay the first childbirth among young, married women in India: A cross-sectional study based on national survey data. BMC Public Health. 2020 Mar 18;20(1).

7. Wennberg AL, Opdahl S, Bergh C, Aaris Henningsen AK, Gissler M, Romundstad LB, et al. Effect of maternal age on maternal and neonatal outcomes after assisted reproductive technology. Fertil Steril. 2016 Oct;106(5):1142-1149.e14.

8. Geiger CK, Clapp MA, Cohen JL. Association of Prenatal Care Services, Maternal Morbidity, and Perinatal Mortality With the Advanced Maternal Age Cutoff of 35 Years. JAMA Health Forum. 2021;2(12):e214044.

9. ACOG. Pregnancy at Age 35 Years or Older. Obstetrics & Gynecology. 2022;140(2).

10. Kahveci B, Melekoglu R, Evruke IC, Cetin C. The effect of advanced maternal age on perinatal outcomes in nulliparous singleton pregnancies. BMC Pregnancy Childbirth. 2018;18(1):1–7.

11. Fitzpatrick KE, Tuffnell D, Kurinczuk JJ, Knight M. Pregnancy at very advanced maternal age: a UK population-based cohort study. BJOG. 2017;124(7):1097–106.

12. Lean SC, Derricott H, Jones RL, Heazell AEP. Advanced maternal age and adverse pregnancy outcomes: A systematic review and meta-analysis. PLoS One. 2017;12(10):1–15.

13. Pinheiro RL, Areia AL, Pinto AM, Donato H. Advanced maternal age: Adverse outcomes of pregnancy, a meta-analysis. Acta Med Port. 2019;32(3):219–26.

14. Leader J, Bajwa A, Lanes A, Hua X, Rennicks White R, Rybak N, et al. The Effect of Very Advanced Maternal Age on Maternal and Neonatal Outcomes: A Systematic Review. Journal of Obstetrics and Gynaecology Canada [Internet]. 2018;40(9):1208–18. Available from: https://doi.org/10.1016/j.jogc.2017.10.027

15. United Nations. United Nations Demographic Yearbook  2020. UNITED NATIONS; 2021.

16. Miranda A. Are young cohorts of women delaying first birth in Mexico? J Popul Econ [Internet]. 2006;19(1):55–70. Available from: https://doi.org/10.1007/s00148-005-0046-7

17. Darney BG, Fuentes-Rivera E, Saavedra-Avendano B, Sanhueza-Smith P, Schiavon R. Preventing first births among adolescents in Mexico City’s public abortion programme. BMJ Sex Reprod Health. 2021;1–6.

18. van Roode T, Sharples K, Dickson N, Paul C. Life-Course relationship between socioeconomic circumstances and timing of first birth in a birth cohort. PLoS One. 2017 Jan 1;12(1).

19. Serván-Mori E, Contreras-Loya D, Gomez-Dantés O, Nigenda G, Sosa-Rubí SG, Lozano R. Use of performance metrics for the measurement of universal coverage for maternal care in Mexico. Health Policy Plan. 2017 Jun 1;32(5):625–33.

20. Lazcano-Ponce E, Schiavon R, Uribe-Zúñiga P. Cobertura de atención del parto en México.Su interpretación en el contextode la mortalidad materna. Salud Publica Mex. 2013;55.

21. Serván-Mori E, Heredia-Pi I, García DC, Nigenda G, Sosa-Rubí SG, Seiglie JA, et al. Assessing the continuum of care for maternal health in Mexico, 1994–2018. Bull World Health Organ. 2021 Mar 1;99(3):190–200.

22. Wang Y, Tanbo T, Åbyholm T, Henriksen T. The impact of advanced maternal age and parity on obstetric and perinatal outcomes in singleton gestations. Arch Gynecol Obstet. 2011 Jul;284(1):31–7.

23. Crear-Perry J, Correa-De-Araujo R, Lewis Johnson T, Mclemore MR, Neilson E, Wallace M. Social and Structural Determinants of Health Inequities in Maternal Health. J Womens Health. 2021;30(2):230–5.

24. Dirección General de Información en Salud. Subsistema de Información sobre Nacimientos (SINAC) [Internet]. 2022 [cited 2022 Jun 17]. Available from: http://www.dgis.salud.gob.mx/contenidos/sinais/s\_sinac.html. Published 2022

25. Secretaría de Salud. NORMA Oficial Mexicana NOM-007-SSA2-2016, para la atención de la mujer durante el embarazo, parto y puerperio, y de la persona recién nacida. [Internet]. 2016 [cited 2022 Sep 18]. Available from: http://www.dof.gob.mx/nota\_detalle.php?codigo=5432289&fecha=07/04/2016

26. Kotelchuck M. The Adequacy of Prenatal Care Utilization Index: Its US Distribution and Association with Low Birthweight. Am J Public Health. 1994;84(9):1486–9.

27. National Population Council. Marginalization index by state and municipality 2015 [Internet]. 2015 [cited 2021 Jan 11]. Available from: https://www.gob.mx/conapo/documentos/indice-de-marginacion-por-entidad-federativa-y-municipio-2015

28. Gómez Dantés O, Sesma S, Becerril VM, Knaul FM, Arreola H, Frenk J. Sistema de salud de México. Salud Publica Mex. 2011;53(1):95–112.

29. INEGI. Instituto Nacional de Estadística y Geografía (INEGI) [Internet]. 2020 [cited 2020 Jun 4]. Available from: https://www.inegi.org.mx/

30. Suárez-Idueta L, Bedford H, EO O, Cortina-Borja M. Maternal Risk Factors for Small-for-Gestational-Age Newborns in Mexico: Analysis of a Nationwide Representative Cohort. Front Public Health. 2021;9(December):1–8.

31. The American College of Obstetrician and Gynecologists. Pregnancy at Age 35 Years or Older. Obstetrics & Gynecology. 2022;140(2):348–66.

32. Balayla J, Azoulay L, Assayag J, Benjamin A, Abenhaim HA. Effect of maternal age on the risk of stillbirth: a population-based cohort study on 37 million births in the United States. Am J Perinatol. 2011 Sep;28(8):643–50.

33. Frick KD, Lantz PM. Selection Bias in Prenatal Care Utilization: An Interdisciplinary Framework and Review of the Literature. Medical Care Research and Review [Internet]. 1996 Dec 1;53(4):371–96. Available from: https://doi.org/10.1177/107755879605300401

34. Maldonado-Cisneros M, Medina-Gómez O. Social support and marginalization as determinants of prenatal care in women with social security in Mexico. Gaceta de Mexico. 2019 Jan 30;154(2).

35. Inés Gayet C, Juárez F. New Pattern of Low Fertility in Mexico Using Census Data. 2021.

36. Nelson HD, Darney BG, Ahrens K, Burgess A, Jungbauer RM, Cantor A, et al. Associations of Unintended Pregnancy With Maternal and Infant Health Outcomes. JAMA [Internet]. 2022 Nov 1;328(17):1714. Available from: https://jamanetwork.com/journals/jama/fullarticle/2797874

1. This comprises of the Mexican Institute of Social Security (IMSS)/Institute of Security and Social Services for State Workers (ISSSTE)/Mexican Petroleum (PEMEX)/Secretary of National Defense (SEDENA)/Secretary of the Navy (SEMAR). [↑](#footnote-ref-1)