Accessing medical care for infertility: a study of women in Mexico

Leslie V. Farland, Sc.D.,[a] Sana M. Khan, M.P.H.,[a] Stacey A. Missmer, Sc.D.,[b,c] Dalia Stern, Ph.D.,[d] Ruy Lopez-Ridaura, M.D., Sc.D.,[d] Jorge E. Chavarro, M.D., Sc.D.,[c,e] Andres Catzin-Kuhlmann, M.D.,[f] Ana Paola Sanchez-Serrano, M.D.,[g] Megan S. Rice, Sc.D.,[h] and Martín Lajous, M.D., Sc.D.[d,i]

[a] Department of Epidemiology and Biostatistics, Mel and Enid Zuckerman College of Public Health, University of Arizona, Tucson, Arizona; [b] Department of Obstetrics, Gynecology and Reproductive Biology, College of Human Medicine, Michigan State University, East Lansing, Michigan; [c] Department of Epidemiology, Harvard T.H. Chan School of Public Health, Boston, Massachusetts; [d] Center for Population Health Research, National Institute of Public Health, Cuernavaca, Morelos, Mexico; [e] Department of Nutrition, Harvard T.H. Chan School of Public Health, Boston, Massachusetts; [f] Department of Medicine, National Institute of Medical Sciences and Nutrition, Mexico City, Mexico; [g] Procrea, Centro de Reproducción Asistida, Mexico City, Mexico; [h] Clinical and Translational Epidemiology Unit, Department of Medicine, Massachusetts General Hospital and Harvard Medical School, Boston, Massachusetts; and [i] Department of Global Health and Population, Harvard T.H. Chan School of Public Health, Boston, Massachusetts

Objective: To investigate barriers in accessing care for infertility in Mexico, because little is known about this issue for low and middle-income countries, which comprise 80% of the world's population.
Design: Cross-sectional analysis.
Setting: Mexcian Teachers' Cohort.
Patient(s): A total of 115,315 female public school teachers from 12 states in Mexico.
Intervention(s): None.
Main Outcome Measure(s): The participants were asked detailed questions about their demographics, lifestyle characteristics, access to the health care system, and infertility history via a self-reported questionnaire. Log-binomial models, adjusted a priori for potential confounding factors, were used to estimate the prevalence ratios (PRs) and 95% confidence intervals (CIs) of accessing medical care for infertility among women reporting a history of infertility.
Result(s): A total of 19,580 (17%) participants reported a history of infertility. Of those who experienced infertility, 12,470 (63.7%) reported seeking medical care for infertility, among whom 8,467 (67.9%) reported undergoing fertility treatments. Among women who reported a history of infertility, women who taught in a rural school (PR, 0.95; 95% CI, 0.92–0.97), spoke an indigenous language (PR, 0.88; 95% CI, 0.84–0.92), or had less than a university degree (PR, 0.93; 95% CI, 0.90–0.97) were less likely to access medical care for fertility. Women who had ever had a mammogram (PR, 1.07; 95% CI, 1.05–1.10), had a pap smear in the past year (PR, 1.08; 95% CI, 1.06–1.10), or who had used private health care regularly or in times of illness were more likely to access medical care for fertility.

Received March 23, 2022; revised November 18, 2022; accepted November 21, 2022.
L.V.F. reports funding from the National Institutes of Health, Centers for Disease Control, and Federal Emergency Management Agency outside the submitted work. J.E.Ch. reports funding from the National Institutes of Health and on Food and Drug Administration; royalties from Harvard Health Publications; honoraria from Johns Hopkins University School of Medicine, National Institutes of Health, Northwestern University Feinberg School of Medicine, Carolinas Medical Center, American Society for Reproductive Medicine, British Dietetic Association, and Pacific Coast Reproductive Society; travel support from Johns Hopkins University School of Medicine, Pacific Coast Reproductive Society, European Society of Human Reproduction and Embryology, Health Sciences University School of Medicine (Colombia), Institut Hospital del Mar d'Investigacions Mediques (Spain), Japanese Society for Reproductive Medicine (Japan), Zhejiang University School of Medicine (China), Lund University Faculty of Medicine (Sweden), Medical University of Vienna (Austria) outside the submitted work. S.A.M. reports funding from AbbVie, NIH, and Marriot Family Foundation; honoraria from University British Columbia, WERF, and Huilun Shanghai; travel support ESHRE 2019 (and 2020 virtual), International Association for the Study of Pain (IASP) 4th World Congress on Abdominal and Pelvic Pain (WCAPP) 2019, National Endometriosis Network UK Meeting 2019, Society for Reproductive Investigation–69th Annual Scientific Meeting (2022), ESHRE 2022, FWGBD 2022, University of Michigan, Massachusetts Institute of Technology; advisory board AbbVie and Roche, field chief editor Frontiers in Reproductive Health, Roundtable participation–Abbott; unpaid leadership roles SWHR, WERF, WES, ASRM, and ESHRE outside the submitted work. S.M.K. has nothing to disclose. D.S. has nothing to disclose. R.L-R. has nothing to disclose. A.C-K. has nothing to disclose. A.P.S-S. has nothing to disclose. M.S.R. is currently an employee of Sanofi and may hold stock/stock options in the company. M.L. reports funding from the National Institutes of Health, the American Institute for Cancer Research, and hte Mexican Council for Science and Technology
Correspondence: Martín Lajous, M.D., Sc.D. Center for Population Health Research, National Institute of Public Health, Tlaplan, Ciudad de Mexico, CDMX, Mexico (E-mail: mlajous@insp.mx).

Fertil Steril Rep® Vol. 4, No. 1, March 2023 2666-3341

https://doi.org/10.1016/j.xfre.2022.11.013

Conclusion(s): The usage of infertility care varied by demographic, lifestyle, and access characteristics, including speaking an indigenous language, teaching in a rural school, and having a private health care provider. (Fertil Steril Rep® 2023;4:112–20. ©2022 by American Society for Reproductive Medicine.)
Key Words: Infertility, access to care, fertility treatment

Infertility affects approximately 50–80 million people worldwide; however, the true global burden is difficult to estimate, given different definitions of infertility and a lack of available surveillance data in many settings (1–3). Among couples who experience infertility, there are many barriers that prevent them from accessing appropriate fertility care. Differences in access have been documented by race, age, socioeconomic status, and health-related factors (4–13). Prior research on barriers to accessing fertility care has focused predominantly on the influence of markers of financial access (e.g., household income, insurance, and education) and racial disparities in accessing care, with little information on how other cultural or lifestyle factors (eg, physical activity and health history) may influence accessing fertility care (4, 14). Moreover, most of the research on barriers to accessing fertility care has been conducted within the United States and has focused on non-Hispanic white women (15).

Low- and middle-income countries make up >80% of the world's population, but very little is known regarding the burden of infertility and access to fertility care in these settings. Extrapolating information from the United States to inform health care interventions in other regions is inappropriate because of differences in cultural and regional barriers to access. Prior research has suggested regional and geographic variations of infertility prevalence among couples in Mexico, possibly influenced by differences in economic factors, environmental exposures, literacy, and nutrition (16). Therefore, the objective of this study was to investigate predictors of access to fertility care among a large cohort of reproductive-aged women across 12 states in Mexico enrolled in the Mexican Teachers' Cohort (MTC) (n = 115,307) (17).

MATERIALS AND METHODS

Study Design

The MTC is a large, prospective cohort study that was established in 2006 when teachers from two states (Veracruz and Jalisco) responded to a baseline questionnaire about their health and lifestyle (17). The cohort was expanded to ten additional states from 2008 to 2010 and included 115,307 female teachers from across 12 diverse states in Mexico. The cohort study was a result of a partnership with Mexico's public education system and included a range of culturally and economically diverse women. The MTC collected comprehensive baseline data on medical and lifestyle factors and assessed several exposures and risk factors associated with chronic disease. All participants have health care coverage, which includes fertility services, by a small number of social security institutions with integrated or separate health care providers. The study was approved by the institutional review board at the National Institute of Public Health in Mexico, and informed consent was obtained from all women. Our sample was restricted to participants who indicated that they had ever experienced infertility (n = 19,580), and therefore, participants in the MTC who had not experienced infertility were excluded.

Infertility History

Women were asked if they had ever undergone 12 months of trying to conceive without success (infertility). If they answered "yes," they were asked if they ever sought medical care for help to get pregnant and at what age they experienced infertility. They were then asked about what was the medical reason(s) why they experienced difficulty getting pregnant and were given the following possible responses: blocked tubes, polycystic ovary syndrome (PCOS), other ovulation disorders, endometriosis, abnormalities of the uterus, problems with the male partner, no known reason, and other. Participants could mark multiple reasons for their infertility. Participants with a history of infertility were then asked whether they received medical treatment or procedures for help getting pregnant. Participants could select multiple treatment options, including none, intrauterine insemination (IUI), in vitro fertilization (IVF), and medications to induce ovulation (clomiphene, metformin, injections of gonadotropin, and other treatment or procedure). For this analysis, participants were categorized as having "accessed medical care for infertility" if they reported that they sought medical attention for themselves or their partner to achieve pregnancy or if they reported having used fertility treatment or had a diagnosis for their infertility.

Demographic predictors of accessing infertility care. Information on demographic characteristics was assessed on the baseline questionnaire in 2008. Specifically, we collected information on teaching in a rural school (no or yes), speaking an indigenous language (no or yes), the highest level of education completed (less than university, university degree, or graduate degree), and state of residence, which we categorized into four regions (Mexico City, northern states [Baja California, Durango, Nuevo León, and Sonora], central states [Guanajuato, Hidalgo, Jalisco, México], and southern states [Chiapas, Yucatán, Veracruz]).

Health care systems predictors of accessing infertility care. We also collected information on markers of health care usage. In Mexico, federal and state-level employees and individuals in the formal private sector have health care coverage through several social security systems. Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado (ISSSTE) covers federal government employees (79.5% of MTC participants), Instituto Mexicano del Seguro Social (IMSS) is responsible for the care of most state-level employees in the cohort (11.4%), whereas four more public

health care providers do the same for the remaining state-level employees (9.1%). These insurance options provide infertility care at their public hospitals; the out-of-pocket cost of treatment is limited to the medication cost, which can range from $500–2,100 USD and is based on socioeconomic status. However, a participant covered by one social security institution may choose to seek care with a private provider or with a different social security institution that provides care to a family member. Thus, independently of women's employer and social security coverage, we categorized women according to their self-reported health care services used for regular care (private, IMSS, ISSSTE, other public, or other) and health care service used for major illness or intervention (private, IMSS, ISSSTE, other public, or other). We also collected information on the history of mammograms (never or ever) and pap smears in the past year (no or yes), which we considered proxy variables for access to health care and screening services.

Reproductive and lifestyle predictors of accessing fertility care. Finally, we collected information on health and lifestyle history at baseline, including age at menarche (<12, 12, 13, or ≥ 14), hormonal contraceptive (HC) usage (never or ever), parity (nulliparous, 1, 2, or 3+), history of smoking (never or ever), alcoholic drinks/day (0, <0.1, or ≥ 0.1), participated in vigorous physical activity at the age of 18 years (≤ 3 hours per week or >3 hours per week), and history of type 2 diabetes (no or yes), given its association with PCOS. Hormonal contraceptive use was investigated as a covariate in our analysis because it reflects having a connection with the medical system and is suggestive of pregnancy planning. Information on the height and weight at baseline and at age of 18 years was used to calculate body mass index (BMI; kg/m^2) (BMI in 2008: <25, 25 to <30, and ≥ 30) (BMI at age 18: <18.5, 18.5 to <21, 21 to <25, and ≥ 25). Body size was estimated based on figure drawings (somatotypes) (18). Women were asked to report the figure drawing (range, 1–9) that best reflected their body shape in young adolescence (2 years after their first menstrual period) and when they were aged 25–30 years. For our analysis, we created categories of somatotype in young adolescence (1, 2, 3, and ≥ 4) and somatotype at 25–30 years (1–3, 4, 5, and ≥ 6).

Statistical Analysis

For the analysis, we used data collected at the study baseline in 2008. Among women with a history of infertility, we modeled the probability of accessing medical care for infertility. Generalized linear models with a log link and a binomial distribution were used to estimate the prevalence ratio (PR) and 95% confidence intervals (CIs) of seeking medical care for infertility. Multivariable models were adjusted for age, HCs use, teaching in a rural school, and speaking an indigenous language. These covariates were chosen for adjustment in multivariable models given their strong observed relationship with accessing fertility care in crude models. For covariates with missing values, missing indicators variables were created. SAS version 9.4 (Carry, NC) was used to conduct these analyses.

RESULTS

Among the 115,307 participants, 19,580 (17%) reported infertility. Participants who reported having accessed medical care for infertility were, on average, 43.2 years old (standard deviation [SD] = 7.0) at baseline and 28.0 (5.3) at the first experience of infertility, whereas participants who did not access care for infertility were 44.2 (7.3) years old at baseline and 26.1 (5.6) at reported infertility. Among women who experienced infertility, 63.7% (n = 12,470) reported accessing medical care for infertility (Table 1). Among women who did access care, the most common infertility diagnoses were ovulatory disorders (other than PCOS) (18.7%), tubal-factor infertility (16.2%), and PCOS (13.0%); 21.5% reported an unknown or idiopathic cause of their infertility and 11% reported cause attributed to their male partner. Most participants with infertility reported having used fertility treatment (67.9%). The most common type of treatment used was ovulation induction (62.3%), with fewer women reporting IUI (4.3%) and IVF (1.3%). When asked about specific fertility drugs used, most women reported using "other" (47.5%), followed by clomiphene (34.5%), and gonadotropin injections (14.6%).

When investigating the relationship between demographic characteristics and the probability of fertility care, several associations emerged (Table 2). Women who taught in a rural school (PR, 0.95; 95% CI, 0.92–0.97) or who spoke an indigenous language (PR, 0.88; 95% CI, 0.84–0.92) were less likely to access fertility care. Compared with women with a university degree, women with a graduate degree were more likely to access medical care for infertility (PR, 1.06; 95% CI, 1.03–1.09), whereas women with less than a university degree were less likely to access care (PR, 0.93; 95% CI, 0.90–0.97). Compared with women who lived in Mexico City, women who lived in central states (Guanajuato, Hidalgo, Jalisco, and México) were also less likely to access fertility care (PR: 0.96; 95% CI, 0.93–0.99).

When investigating the role of health care systems access (Table 3), we found that women who had ever had a mammogram (PR, 1.07; 95% CI, 1.05–1.10) or who had undergone a pap smear in the past year (PR, 1.08; 95% CI, 1.06–1.10) were more likely to access fertility care than women who had not (Table 3). Compared with women who used private health care providers as their primary provider, women who used IMSS (PR, 0.88; 95% CI, 0.86 -0.91) or ISSSTE (PR, 0.88; 95% CI, 0.84–0.92) as their primary health care provider were less likely to seek medical care for fertility, as were women with other public insurance (PR, 0.83; 95% CI, 0.72–0.95) and other insurance (PR, 0.94; 95% CI, 0.91–0.97). Specifically, during a time of illness, women who used IMSS (PR, 0.94; 95% CI, 0.92–0.97) or ISSSTE (PR, 0.95; 95% CI, 0.95–0.99) were less likely to seek out fertility care compared with women who used private health care providers during times of illness.

When investigating the role of reproductive and lifestyle characteristics, women who had a history of using HCs were less likely to access care (PR, 0.91; 95% CI, 0.89–0.93) (Table 4). Compared with nulliparous women, women who were parous were also less likely to access fertility care,

TABLE 1

Accessing medical care for infertility among participants with self-reported infertility in the Mexican Teacher's Cohort at baseline in 2008.

Characteristics	Accessed medical care for infertility: No (n = 7,110)	Accessed medical care for infertility: Yes (n = 12,470)
Infertility experience		
Age at reported infertility[a]	26.1(5.6)	28.0(5.3)
Type of infertility diagnosis		
Fallopian tube, %		16.2
Polycystic ovarian syndrome, %		13.0
Ovulatory infertility, %		18.7
Endometriosis, %		7.9
Uterine factor infertility, %		7.2
Male factor infertility, %		11.0
Unknown infertility, %		21.5
Another reason, %		13.4
Type of infertility treatment used		
-None, %		32.1
-IUI, %		4.3
-IVF, %		1.3
-Ovulation induction, %		62.3
Among those who used treatment, type of infertility drugs used		
-Clomiphene, %		34.5
-Metformin, %		3.4
-Gonadotropin injections, %		14.6
-Other, %		47.5
Demographic characteristics		
Age (y)[a]	44.2(7.3)	43.2(7.0)
BMI (kg/m^2)	27.8(4.5)	27.9(4.6)
Nulliparous, %	8.6	19.3
Smoking history		
-No, %	76.7	76.5
-Current/former, %	23.3	23.5
History of hormonal contraceptive use, %	46.2	39.1
Age at first birth*	25.4(4.5)	26.8(4.7)
Vigorous activity >3 h at age of 18 y, %	74.0	76.0
Somatotype Adolescent (2 y after your first menstrual period)		
-1, %	14.1	14.7
-2, %	27.2	29.6
-3, %	28.3	27.7
-4, %	23.0	23.6
-5, %	7.5	4.4
BMI at the age of 18 y		
-<18.5, %	18.7	18.7
-8.5 to <21, %	34.5	34.3
-21 to >25, %	37.1	37.0
-≥25, %	9.7	10.1
Age at menarche		
-≤12, %	24.4	26.2
-12, %	27.9	29.0
-13, %	19.7	19.9
-≥14, %	28.0	25.0
Health care service used (Regular care)		
-Private, %	17.4	23.5
-ISSSTE, %	62.4	56.4
-IMSS, %	9.3	8.5
-Other public, %	1.0	0.7
-Other, %	9.8	10.9
Health care service used (Illness)		
-Private, %	16.6	18.9
-ISSSTE, %	63.1	60.1
-IMSS, %	10.8	10.8
-Other public, %	1.0	1.0
-Other, %	8.4	9.2
Speaks and indigenous language, %	10.7	7.6
Teaches in a rural school, %	26.0	22.6

Note: Values are mean ± standard deviation or percentages and are standardized to the age distribution of the study population
Values of polytomous variables may not sum to 100% because of rounding
BMI = body mass index; IMSS = Instituto Mexicano del Seguro Social; ISSSTE = Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado; IUI = intrauterine insemination; IVF = in vitro fertilization.
[a] Value is not age-adjusted

Farland. Medical care for infertility in Mexico. Fertil Steril Rep 2023.

with women who had three or more children the least likely to access care (PR, 0.74; 95% CI, 0.72–0.76). We observed a statistically significant inverse linear relationship between increasing age at menarche and the likelihood of accessing medical care for infertility ($P<.001$ for linear trend). Women who reported >3 hours of vigorous physical activity per week at the age of 18 years were more likely to access fertility care (PR, 1.04; 95% CI, 1.01–1.06). There was no difference between women seeking care for infertility by the history of smoking, alcohol consumption, type 2 diabetes diagnosis, BMI at the age of 18 years or baseline, or body size in adolescence or adulthood.

DISCUSSION

Among our sample of female teachers across 12 regions in Mexico, 17% of women reported infertility. Of these women, the majority (63.7%) reported seeking access to fertility care. The most common diagnoses of infertility were an ovulatory, tubal factor, and unknown. The fertility care use in Mexico varied by demographic, lifestyle, and access characteristics. Women were less likely to seek access to infertility care if they were single, used HCs, taught in a rural area, spoke an indigenous language, or had less than a university degree. Women were also less likely to access medical care for infertility if they had previously had a child. Conversely, women were more likely to seek medical care for infertility if they had ever had a mammogram or pap smear in the past year or if they had used private health care providers.

Our study found that approximately 17% of women in our sample reported a history of infertility. This finding is slightly higher than estimates in the United States that have ranged from 6.0% (19)–15.5% (20). Estimates of infertility prevalence across 25 population surveys from low, middle, and high-income countries observed that infertility ranged from 3.5%–16.7%, with an overall median prevalence among less developed countries of 9% (21). Most women who experienced infertility in our sample accessed medical care for their infertility (63.7%). Our estimate of fertility care access is similar to previous findings from 25 international studies, which found that 56% of couples reported access to medical care for infertility globally (range, 42%–76%), with slightly fewer couples seeking care in less developed countries (mean = 51.2%; range, 27–74%) (21). This is similar to findings from the Nurses' Health Study II in the United States (65%) (4, 22) but greater than estimates from the National Survey for Family Growth in the United States (36%) (19). This may reflect the fact that Mexican citizens who are government employees or in the formal private sector have access to universal health care coverage and, therefore, are more likely to access medical care than couples in the United States. Among women who accessed medical care for infertility, the most common diagnoses were ovarian infertility, PCOS, blockage of the fallopian tube, and unknown. Our findings are consistent with prior research on infertility in Mexico that suggested that the most common causes for infertility were asymptomatic infection and anovulation, possibly indicative of PCOS (16). Only 11% of women indicated that their infertility is because of the male partner, which is lower than previous estimates among infertile couples in Mexico (23). Consistent with findings in the United States (4), the cause of infertility for many women is unknown.

Of those women who accessed medical care for fertility, the majority underwent ovulation induction (62.3%); the most common drug used was clomiphene (34.5%). A large percentage of women (47.5%) reported using "other" types

TABLE 2

The association between demographic characteristics and accessing medical care for infertility in the Mexican teacher's cohort among women reporting a history of infertility.

Characteristics	Did not access care for infertility 7,110 (36.3%)	Accessed medical care for infertility 12,470 (63.7%)	Prevalence ratio (95% CI) accessing care for infertility	Multivariable adjusted prevalence ratio[a] (95% CI)
Teacher in a rural school				
No	5,222 (35.5)	9,468 (64.5)	1.00 (Ref)	1.00 (Ref)
Yes	1,783 (38.6)	2,837 (61.4)	0.95 (0.93–0.98)	0.95 (0.92–0.97)
Speaks an indigenous language				
No	6,263 (35.5)	11,393 (64.5)	1.00 (Ref)	1.00 (Ref)
Yes	793 (45.7)	954 (56.4)	0.87 (0.84–0.91)	0.88 (0.84–0.92)
Highest level of education completed				
<University	896 (40.8)	1,300 (59.2)	0.91 (0.88–0.94)	0.93 (0.90–0.97)
University degree	4,111 (35.0)	7,648 (65.0)	1.00 (Ref)	1.00 (Ref)
Graduate degree	709 (29.9)	1,664 (70.1)	1.08 (1.05–1.11)	1.06 (1.03–1.09)
Region[b]				
Mexico City	1,023 (33.3)	2,048 (66.7)	1.00 (Ref)	1.00 (Ref)
North	1,309 (36.2)	2,312 (63.9)	0.96 (0.92–0.99)	0.97 (0.94–1.01)
Central	2,323 (37.9)	3,805 (62.1)	0.93 (0.90–0.96)	0.96 (0.93–0.99)
South	2,455 (36.3)	4,305 (63.7)	0.95 (0.93–0.98)	0.98 (0.95–1.01)

Central: Guanajuato, Hidalgo, Jalisco, México;
South: Chiapas, Yucatán, Veracruz
[a] Multivariable models adjusted for age (continuous), history of hormonal contraceptive use, teaching in a rural school, speaking an indigenous language
[b] North: Baja California, Durango, Nuevo León, Sonora;

Farland. Medical care for infertility in Mexico. Fertil Steril Rep 2023.

TABLE 3

The association between health care systems access and accessing medical diagnosis of infertility in the Mexican teacher's cohort among women reporting a history of infertility.

Healthcare system access	Did not access care for infertility 7,110 (36.3%)	Accessed medical care for infertility 12,470 (63.7%)	Prevalence ratio (95% CI) accessing care for infertility	Multivariable adjusted prevalence ratio [a] (95% CI)
Health care service used (regular care)				
Private	1,177 (29.5)	2,811 (70.5)	1.00 (Ref)	1.00 (Ref)
IMSS	4,262 (38.9)	6,701 (61.1)	0.87 (0.85–0.89)	0.88 (0.86–0.91)
ISSSTE	627 (38.3)	1,011 (61.7)	0.88 (0.84–0.91)	0.88 (0.84–0.92)
Other Public	69 (44.0)	88 (56.1)	0.80 (0.69–0.91)	0.83 (0.72–0.95)
Other	657 (33.5)	1307 (66.6)	0.94 (0.91–0.98)	0.94 (0.91–0.97)
Health care service used (illness)				
Private	1,123 (32.8)	2,304 (67.2)	1.00 (Ref)	1.00 (Ref)
IMSS	4,363 (37.6)	7,228 (62.4)	0.93 (0.90– 0.95)	0.94 (0.92–0.97)
ISSSTE	742 (36.1)	1,311 (63.9)	0.95 (0.91–0.99)	0.95 (0.92–0.99)
Other Public	67 (36.2)	118 (63.8)	0.95 (0.85–1.06)	0.97 (0.87–1.09)
Other	577 (34.3)	1105 (65.7)	0.98 (0.94–1.02)	0.98 (0.94–1.02)
Mammogram				
Never	3,584 (37.0)	6,096 (63.0)	1.00 (Ref)	1.00 (Ref)
Ever	3,204 (34.8)	6,015 (65.3)	1.04 (1.01–1.06)	1.07 (1.05–1.10)
Pap smear in the past y				
No	3,438 (38.9)	5,391 (61.1)	1.00 (Ref)	1.00 (Ref)
Yes	3,672 (34.2)	7,079 (65.9)	1.08 (1.06–1.10)	1.8 (1.06–1.10)

[a] Multivariable models adjusted for age (continuous), history of hormonal contraceptive use, teaching in a rural school, and speaking an indigenous language

Farland. Medical care for infertility in Mexico. Fertil Steril Rep 2023.

of infertility drugs. This may reflect differences in drug name provided on the survey (eg, "Clomifeno") and the more commonly known brand names for clomiphene which was not included on the questionnaire (eg, Omifin). Of all the women who received treatment, only 1.3% underwent IVF, and 4.3% underwent IUI. We hypothesize that this low use is partially influenced by economic, geographic, and time barriers in accessing treatment. In the country of México, there are few public hospitals with IVF programs. These public hospitals perform IVF services according to the government budget, so the number of cycles and patients can fluctuate. The public hospital with the largest IVF program is the Instituto Nacional de Perinatología, which offers approximately 200 IVF cycles per year and has an approximately 1-year waiting list to enroll in their IVF program. The cost of an IVF cycle at a public hospital is limited to the medication cost, which can range from $500–2,100 USD, based on socioeconomic status. As of 2019, there were approximately 40 private fertility clinics in Mexico that reported their outcomes to the Latin American Registry of Assisted Reproduction. The cost of IVF at private clinics can range from $1,500–10,500 USD per cycle, and many are located in major metropolitan centers. Therefore, women may need to wait to access fertility care at a public hospital or pay higher costs with private clinics, which may explain the low use of IUI and IVF.

Among women who experience infertility, not all are able to access medical care for treatment. Issues related to accessing medical care for fertility are complex. In the United States, there are established differences in accessing fertility care by race, age, causes of infertility, and socioeconomic factors that influence who receives medical care (4, 8). Indeed, research from the National Survey of Fertility Barriers found that Black and Hispanic women were less likely to receive infertility services than white women and that this relationship was driven, but not fully accounted for, by income, insurance status, and level of education (9). Research from the National Survey of Family Growth found that among women who reported infertility, whether a woman sought out fertility treatment varied by income, insurance coverage, age, and parity (6). In addition to socioeconomic factors, other demographic, lifestyle, and environmental factors may also explain potential differences between women who accessed care and those who did not; however, this relationship has not been adequately studied. Prior research in the Nurses' Health Study II found that in addition to the traditional relationships, a pattern of "healthy lifestyle behavior" was associated with accessing infertility care. Women were less likely to seek medical care related to infertility if they were older, parous, current smokers, or had a higher BMI than their counterparts who did seek medical care (4). Those who did seek fertility care were also more likely to take multivitamins, exercise, and have had a recent physical examination.

We observed that women who reported speaking an indigenous language were less likely to access medical care for infertility. Prior research has suggested that indigenous people in Mexico have a higher prevalence of health problems and lower rates of using primary health care (24). Additionally, we found that women with graduate-level education were more likely to access care, whereas women with less than a university degree were less likely to access fertility care. Our findings support other studies that have found

TABLE 4

The association between reproductive and lifestyle characteristics and accessing medical care for infertility in the Mexican teacher's cohort among women reporting a history of infertility.

Characersitics	Did not access care for infertility 7,110 (36.3%)	Accessed medical care for infertility 12,470 (63.7%)	Prevalence ratio (95% CI) Accessing care for infertility	Multivariable adjusted prevalence ratio[a] (95% CI)
Hormonal contraceptive use				
Never	3,820 (33.5)	7,597 (66.5)	1.00 (Ref)	1.00 (Ref)
Ever	2,764 (39.6)	4,210 (60.4)	0.91 (0.89–0.93)	0.91 (0.89–0.93)
Parity in 2008				
Nulliparous	587 (19.9)	2,358 (80.1)	1.00 (Ref)	1.00 (Ref)
1	1,171 (32.7)	2,413 (67.3)	0.84 (0.82–0.87)	0.85 (0.82–0.87)
2	2,139 (38.6)	3,396 (61.4)	0.77 (0.75–0.79)	0.78 (0.76–0.80)
3+	3,062 (42.9)	4,076 (57.1)	0.71 (0.69–0.73)	0.74 (0.72–0.76)
History of smoking				
Never	5,085 (35.6)	9,185 (64.4)	1.00 (Ref)	1.00 (Ref)
Ever	1,566 (36.0)	2,779 (64.0)	0.99 (0.97–1.02)	1.00 (0.98–1.03)
Alcoholic drinks/d				
0	2,362 (36.1)	4174 (63.9)	1.00 (Ref)	1.00 (Ref)
<0.1	2,780 (34.4)	5,291 (65.6)	1.03 (1.00–1.05)	1.02 (1.00–1.05)
≥0.1	1,111 (35.2)	2,047 (64.8)	1.01 (0.98–1.05)	1.02 (0.99–1.05)
Type 2 diabetes				
No	6,577 (36.2)	11,593 (63.8)	1.00 (Ref)	1.00 (Ref)
Yes	533 (37.8)	877 (62.2)	0.97 (0.93–1.02)	1.00 (0.96–1.04)
Vigorous Physical Activity at the age of 18 y				
≤3 h/wk	1,422 (36.0)	2,525 (64.0)	1.00 (Ref)	1.00 (Ref)
>3 h/wk	3,997 (33.2)	8,026 (66.8)	1.04 (1.02–1.07)	1.04 (1.01–1.06)
Age at menarche				
<12	1,690 (34.3)	3,233 (65.7)	1.00 (Ref)	1.00 (Ref)
12	1,931 (35.0)	3,584 (65.0)	0.99 (0.96–1.02)	1.00 (0.97–1.03)
13	1,391 (36.4)	2,436 (63.7)	0.97 (0.94–1.00)	0.98 (0.95–1.01)
≥14	1,993 (39.5)	3,053 (60.5)	0.92 (0.89–0.95)	0.95 (0.92–0.98)
Linear trend			<0.0001	0.0002
BMI (kg/m^2) in 2008				
<25	1,852 (35.1)	3,429 (64.9)	1.00 (Ref)	1.00 (Ref)
25 to <30	2,781 (37.0)	4,738 (63.0)	0.97 (0.95–1.00)	0.99 (0.96–1.01)
≥30	1,753 (35.4)	3,189 (64.5)	0.99 (0.97–1.02)	1.01 (0.98–1.04)
Linear trend			0.88	0.34
Somatotype in young adolescence[b]				
1	1,002 (35.3)	1,838 (64.7)	1.00 (Ref)	1.00 (Ref)
2	1,936 (34.4)	3,686 (65.6)	1.01 (0.98–1.05)	1.01 (0.98–1.05)
3	2,006 (36.8)	3,451 (63.2)	0.98 (0.94–1.01)	0.98 (0.95–1.01)
≥4	1,626 (35.5)	2,955 (64.5)	1.00 (0.96–1.03)	1.00 (0.96–1.03)
Linear trend			0.28	0.24
BMI at the age of 18 y				
<18.5	1,099 (35.8)	1,967 (64.2)	1.00 (Ref)	1.00 (Ref)
18.5 to <21	2,018 (35.8)	3,615 (64.2)	1.00 (0.97–1.03)	1.00 (0.97–1.03)
21 to <25	2,164 (35.6)	3,915 (64.4)	1.00 (0.97–1.04)	1.00 (0.97–1.04)
≥25	556 (34.1)	1,074 (65.9)	1.03 (0.98–1.07)	1.02 (0.97–1.06)
Linear trend			0.25	0.45
Somatotype (25–30 y)				
1–3	1,659 (35.2)	3,055 (64.8)	1.00 (Ref)	1.00 (Ref)
4	1,714 (35.9)	3,064 (64.1)	0.99 (0.96–1.02)	0.98 (0.96–1.01)
5	1,132 (35.6)	2,047 (64.4)	0.99 (0.96–1.03)	0.99 (0.95–1.02)
≥6	2,060 (35.8)	3,699 (64.2)	0.99 (0.96–1.02)	0.98 (0.95–1.01)
Linear trend			0.74	0.23

[a] Multivariable models adjusted for age (continuous), history of hormonal contraceptive use, teaching in a rural school, and speaking an indigenous language
[b] Young adolescence defined as 2 years after the first menstrual period

Farland. Medical care for infertility in Mexico. Fertil Steril Rep 2023.

higher levels of education were associated with increased access to fertility care (12). This gradient demonstrates the role education plays in gaining financial resources that may help access care but may also be reflective of self-advocacy skills learned from gaining a higher education.

We observed that reproductive history and some lifestyle factors were associated with access to infertility care. Women who reported ever using HCs, were parous, and started menarche at an older age were less likely to access fertility care. We found no association between type 2 diabetes

history, BMI at the age of 18 years, BMI at questionnaire baseline, or body size in adolescence and adulthood and accessing fertility care. Women who participated in ≥3 hours of vigorous physical activity at the age of 18 years were more likely to access fertility care. This finding is consistent with other research from the Nurses' Health Study II that found an association between "healthy lifestyle behaviors" and accessing fertility care. Specifically, they found that women who exercised regularly were more likely to access fertility care (4).

Most women in our research reported using ISSSTE, which covers health care for federal government employees, for regular health care needs, and for major illness or intervention; our findings demonstrated that those who were able to supplement their public or government insurance (ISSSTE, IMSS, or other public) with private health care coverage were more likely to access fertility care. We also found that women who taught in rural areas were less likely to access fertility care, indicating that women who live and teach in rural areas may be presented with additional geographic barriers to seeking care. Geographic barriers to accessing fertility care have been documented in the United States as well (25); because quality fertility services tend to be clustered in urban regions, women who live further away from these centers need to travel a greater distance to access this care. We found that women who had a mammogram or pap smear in the past year were more likely to access infertility care, suggesting that women who are more connected with the medical system (i.e., undergoing screening services) may be more likely to access fertility care. When stratified by region, women in the north, central, and south regions were less likely to report seeking access to infertility care than women in Mexico City.

Our study, among a sample of Mexican women, confirmed similar patterns of access as have been found in other populations; women who are single, had lower income, had lower education levels, or who taught in rural areas were less likely to access medical care for infertility, whereas women who were well connected to the health care system as estimated by having private health care insurance, having undergone mammography, or having a pap smear in the past year were more likely to receive medical care. We found some unique patterns related to accessing fertility care among women in Mexico; women who spoke an indigenous language and who lived in regions outside of Mexico City were less likely to access care. Our findings add to the existing body of literature, which can inform future policy recommendations by examining how lifestyle and demographic factors influence who receives care and provide insight into how these factors are related to accessing care. Future research should continue to investigate policies focused on improving access to fertility care for women who speak an indigenous language or who live in rural areas.

A strength of our study was the use of the MTC, a well-established, large cohort study with detailed information from across 12 states in Mexico (17). However, there also are important limitations of our findings. Our analysis uses self-reported measures that may be prone to misclassification. However, we would expect that any misclassification would be nondifferential and, thus, attenuate our reported relationships. Additionally, given the cross-sectional nature of the baseline survey collection, there is the possibility of recall bias; however, we would expect this bias to be minimal. Additionally, the findings of the study may not be generalizable to other populations inside and outside of Mexico, because this sample was comprised of women employed as teachers. Thus, these findings may be most appropriately generalized to women with similar occupational and educational backgrounds within Mexico with access to health care. However, our population has geographic variability as we were able to study women from 12 states and several geographic regions across Mexico. Lastly, our data source lacked detailed information on the use of gynecologic surgery to treat infertility, and therefore, we are not able to comment on the prevalence of these procedures.

CONCLUSION

In sum, we found that using of fertility care varied by demographic, lifestyle, and access characteristics, including speaking an indigenous language, teaching in a rural school, and having a private health care provider. These findings could inform public health care policy on alleviating barriers to access care among women who experience infertility in Mexico.

Acknowledgments: The authors acknowledge the participants in the Mexican Teachers Cohort study and the National Institute of Public Health of Mexico's research support staff for their time and commitment to advancing the health care of women in Mexico. They thank the Servicio Profesional Docente at the Mexican Ministry of Education, with special thanks to Victor Sastré, Director of Promotion in Service. They also thank all the staff that has participated in questionnaire distribution from the State Ministries of Education of Baja California, Chiapas, Ciudad de México, Durango, Guanajuato, Hidalgo, Jalisco, Estado de México, Nuevo Léon, Sonora, Veracruz, and Yucatan. Finally, they would like to acknowledge ISSSTE, IMSS, ISSSTECali, ISSTELeon, ISSSTESon, ISSTECH, ISSEG, and ISSTEY for their continued support of the project.

REFERENCES

1. Mascarenhas MN, Flaxman SR, Boerma T, Vanderpoel S, Stevens GA. National, regional, and global trends in infertility prevalence since 1990: a systematic analysis of 277 health surveys. PLoS Med 2012;9:e1001356.
2. World Health Organization. Programme of M, Child H. Family Planning U. Infertility: a tabulation of available data on prevalence of primary and secondary infertility. Geneva: World Health Organization; 1991.
3. Inhorn MC, Patrizio P. Infertility around the globe: new thinking on gender, reproductive technologies and global movements in the 21st century. Hum Reprod Update 2015;21:411–26.
4. Farland LV, Collier AY, Correia KF, Grodstein F, Chavarro JE, Rich-Edwards J, et al. Who receives a medical evaluation for infertility in the United States? Fertil Steril 2016;105:1274–80.
5. Chandra A, Copen CE, Stephen EH. Infertility service use in the United States: data from the National Survey of Family Growth, 1982-2010. Natl Health Stat Report 2014;1–21.
6. Ordovensky Staniec JF, Webb NJ. Utilization of infertility services: how much does money matter? Health Serv Res 2007;42:971–89.
7. Wilcox LS, Mosher WD. Use of infertility services in the United States. Obstet Gynecol 1993;82:122–7.

8. Bitler M, Schmidt L. Health disparities and infertility: impacts of state-level insurance mandates. Fertil Steril 2006;85:858–65.
9. Greil AL, McQuillan J, Shreffler KM, Johnson KM, Slauson-Blevins KS. Race-ethnicity and medical services for infertility: stratified reproduction in a population-based sample of U.S. women. J Health Soc Behav 2011;52:493–509.
10. White L, McQuillan J, Greil AL. Explaining disparities in treatment seeking: the case of infertility. Fertil Steril 2006;85:853–7.
11. Jain T. Socioeconomic and racial disparities among infertility patients seeking care. Fertil Steril 2006;85:876–81.
12. Jain T, Hornstein MD. Disparities in access to infertility services in a state with mandated insurance coverage. Fertil Steril 2005;84:221–3.
13. Davis OK, Sokol RZ. Introduction: access to fertility care. Fertil Steril 2016;105:1111–2.
14. Missmer SA, Seifer DB, Jain T. Cultural factors contributing to health care disparities among patients with infertility in Midwestern United States. Fertil Steril 2011;95:1943–9.
15. Komorowski AS, Jain T. A review of disparities in access to infertility care and treatment outcomes among Hispanic women. Reprod Biol Endocrinol 2022;20:1.
16. Leke RJ, Oduma JA, Bassol-Mayagoitia S, Bacha AM, Grigor KM. Regional and geographical variations in infertility: effects of environmental, cultural, and socioeconomic factors. Environ Health Perspect 1993;101(Suppl 2):73–80.
17. Lajous M, Ortiz-Panozo E, Monge A, Santoyo-Vistrain R, Garcia-Anaya A, Yunes-Diaz E, et al. Cohort profile: the Mexican Teachers' Cohort (MTC). Int J Epidemiol 2017;46:e10.
18. Sorensen TI, Stunkard AJ, Teasdale TW, Higgins MW. The accuracy of reports of weight: children's recall of their parents' weights 15 years earlier. Int J Obes 1983;7:115–22.
19. Chandra A, Copen CE, Stephen EH. Infertility and impaired fecundity in the United States, 1982–2010: data from the National Survey of Family Growth. Natl Health Stat Report 2013;1–18.
20. Thoma ME, McLain AC, Louis JF, King RB, Trumble AC, Sundaram R, et al. Prevalence of infertility in the United States as estimated by the current duration approach and a traditional constructed approach. Fertil Steril 2013;99:1324–13231.e1.
21. Boivin J, Bunting L, Collins JA, Nygren KG. International estimates of infertility prevalence and AU: potential need and demand for infertility medical care. Hum Reprod 2007;22:1506–12.
22. Farland LV, Missmer SA, Rich-Edwards J, Chavarro JE, Barbieri RL, Grodstein F. Use of fertility treatment modalities in a large United States cohort of professional women. Fertil Steril 2014;101:1705–10.
23. Salgado Jacobo MI, Tovar Rodríguez JM, Hernández Marín I, Ayala Ruiz AR. Frequency of altered male factor in an infertility clinic. Article in Spanish. Ginecol Obstet Mex 2003;71:233–7.
24. Leyva-Flores R, Servan-Mori E, Infante-Xibille C, Pelcastre-Villafuerte BE, Gonzalez T. Primary health care utilization by the Mexican indigenous population: the role of the Seguro popular in socially inequitable contexts. PloS One 2014;9:e102781.
25. Abusief ME, Missmer SA, Barbieri RL, Jain T, Hornstein MD. Geographic distribution of reproductive endocrinology and infertility (REI) fellowships in the United States. Fertil Steril 2009;91:1636–41.