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Quantifying Disparities in the Continuum of Care for Maternal Health Attributable to Age Discrimination in Mexico, 1994–2018

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Abstract

Introduction It has been widely recognized that adolescents exhibit a low coverage rate for continuous maternal health services as a result of structural social disadvantages, often exacerbated by age-related discrimination. Notwithstanding its importance, this fact has received little attention during quantitative evaluations of health system performance. The present study quantified the magnitude and trend of the adult-adolescent gap in continuum of care (CoC) coverage for maternal health over the last quarter century. A decomposition analysis of the gap was performed to ascertain the portion of disparities attributable to age discrimination.

Methods A pooled, cross-sectional, and retrospective study was conducted utilizing data from the 1997, 2009, 2014, and 2018 waves of the population-based National Survey of Demographic Dynamics in Mexico. After describing the sociodemographic characteristics and CoC coverage levels by age group, a fixed-effects multiple-logistic model was run to assess the predictors of the gap. The nonlinear Blinder-Oaxaca (BO) decomposition method was employed to analyze age disparities in CoC coverage attributable to discrimination. Sensitivity analyses were performed by limiting estimates to the subsample of primiparous women.

Results Coverage for all maternal CoC indicators increased in both age groups throughout the periods analyzed; however, gaps persisted in favor of adult mothers (primiparous or otherwise). Timely and frequent antenatal care (ANC), as well as having received postnatal care within the first 15 days following the birth of the last live child, were the indicators reflecting the greatest inter-group inequality. BO analyses showed that discriminatory practices accounted for 89.9% of the overall gap, with this figure dropping to 60.5% among primiparous women. Both the overall gap and the portion attributable to age discrimination increased over time.

Conclusions Despite advances in CoC delivery in Mexico, age-related disparities remain to the detriment of adolescent women. The largest portion of the gap between adult and adolescent women can be interpreted as a consequence of the underlying discriminatory practices to which adolescent mothers are exposed.

Policy Implications There is a dual agenda for the government, the first aimed at preventing adolescent pregnancy and the second focused on reducing the age-related CoC coverage gap. Efforts to address structural discrimination against adolescent mothers should include social-support initiatives with a focus on first pregnancies.

Keywords Adolescents · Maternal health · Continuum of care · Inequalities · Mexico

Introduction

The provision of adequate maternal care (timely and according to specific health needs) can prevent adverse pregnancy outcomes for mothers and their offspring (Gross et al., 2012; Magadi et al., 2007). Ensuring effective pregnancy, childbirth, and postpartum care, regardless of age or social status, is fundamental to guaranteeing sexual and reproductive health rights (SRHRs) (Starrs et al., 2018) as well as

We dedicate this paper to our colleague Dr. Sandra Sosa-Rubi who passed away in March 2021. Dr. Sosa will be remembered as a remarkable health economist, friend, professor, and human being.

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to achieving the Sustainable Development Goals (SDG 3) (Owolabi et al., 2017; UN, 2016).

The World Health Organization (WHO) recommends that women begin antenatal care (ANC) in the first trimester of pregnancy (Owolabi et al., 2017) and attend at least eight antenatal visits (Tunçalp et al., 2017), such that they have the opportunity to effectively receive all required interventions (Starrs et al., 2018). The WHO also recommends that skilled personnel assess the health status of mothers and their newborns within 24 h after birth (Li et al., 2020). Although coverage for essential maternal and newborn health services has improved substantially in recent decades among low- and middle-income countries (LMICs), significant challenges persist for socially vulnerable women, including adolescents and members of indigenous communities (Amouzou et al., 2020; Anindya et al., 2021; Berrueta et al., 2021; Serván-Mori et al., 2021a, b; Sobanjo-ter Meulen et al., 2019; Starrs et al., 2018).

Adolescent women represent a high priority for virtually all sexual and reproductive health (SRH) services as part of the effective exercise of SRHRs, with these rights, in turn, being key to achieving universal health coverage (UHC) and meeting the SDGs. During adolescence, women experience the onset of puberty and begin to engage in sexual activity, in some cases even experiencing cohabitation and motherhood (Starrs et al., 2018). This typically occurs in circumstances where adolescent women exercise little autonomy in decision-making and are highly dependent financially on their families (Atuyambe et al., 2008; Reynolds et al., 2006; Shitie et al., 2020).

Globally, pregnancy and childbirth complications are the leading causes of death among female adolescents (Leftwich & Alves, 2017; Neal et al., 2012). In LMICs, pregnancies increase the risk of hypertensive diseases and eclampsia, more so among adolescents than adults. Furthermore, the children of adolescents face a higher risk of death within the first 5 years after birth (Baltag & Chandra-Mouli, 2014; Starrs et al., 2018). In these countries, births to adolescent as opposed to adult mothers are associated with poverty, low educational levels, and restricted access to health and other services (Atuyambe et al., 2008; Owolabi et al., 2017). Notwithstanding the well-documented negative consequences of adolescent motherhood, limited evidence exists regarding the gap between adult and adolescent women in the use of maternal health services (Reynolds et al., 2006).

Access to adolescent maternal health services is affected not only by social and economic vulnerability, but also by stereotypes surrounding the concept of adolescence, that worsen the conditions of inequality and reinforce discriminatory practices experienced by this age group (Owolabi et al., 2017). Studies suggest that the status of adolescents and the extent to which they are free to make decisions influence their access to health services; it has also been shown that cohabitation arrangements, customs, and age differences between spouses often place youths at a disadvantage (Reynolds et al., 2006). Late and infrequent use of ANC during adolescence is also driven by limited financial resources, insufficient information on the risks of early pregnancy and the benefits of ANC, sociocultural norms, community stigma, and disrespectful treatment by health care workers (Owolabi et al., 2017). In many instances, married female adolescents living in extended households have limited autonomy, impeding their capacity to make decisions about ANC and place of delivery (Li et al., 2020).

The complex social reality and suboptimal coverage for maternal health interventions experienced by adolescent women call for unraveling the causes of the persistent gaps identified, especially in LMICs, where the concentration of economic and political power is a factor. Violence, in all its forms, as well as rudimentary welfare conditions and inadequate social protection systems, consistently serve to exclude the least favored social groups from the political agenda (Fulu et al., 2014; UNDP, 2021).

In line with WHO recommendations, the Guttmacher-Lancet Commission has urged governments to progressively expand equitable access to an essential and comprehensive package of effective SRH interventions including antenatal, childbirth, and postnatal care (Starrs et al., 2018). Within each particular context, these interventions should identify and focus on the specific needs of marginalized groups subject to discrimination and craft remedial strategies sensitive to the SRH needs of the adolescent population (Starrs et al., 2018). The Commission has also urged routine monitoring and evaluation of SRH programs and services using comprehensive and sensitive indicators of health gaps and health system performance.

The persistence of health and social inequalities characterizing adolescent maternal health care suggests the existence of "stigma and discrimination" (Alvidrez & Tabor, 2021) as well as discriminatory social structures associated negatively with demand for maternal health care among adolescents (Conde-Agudelo et al., 2005). These structures, not always obvious, produce, legitimize, institutionalize, and reproduce disparities based on ideologies that translate into inequality in terms of prestige, power, and resources (Castro et al., 2015; Pérez-Stable & Webb Hooper, 2021). All the above-mentioned processes include forms of mistreatment in diverse areas of social and institutional life related to the health-disease-care cycle.

It has been argued that discriminatory practices discourage pregnant adolescents from using health services in a timely and continuous manner (Li et al., 2020; Reynolds

et al., 2006; Starrs et al., 2018). Despite its importance, this fact has received little attention in the field of quantitative evaluation of the performance of health systems and the challenges for UHC in LMICs. Adopting a continuum of care (CoC) approach to maternal health and taking the life cycle of patients into account make it possible to study maternal health care from a comprehensive perspective and identify the challenges faced by health systems for its effective delivery (Kerber et al., 2007; Mothupi et al., 2018; Rai, 2014; Wang & Hong, 2015). As follow-up work on our study of the CoC for maternal health in socially vulnerable groups in Mexico (Heredia-Pi et al., 2013, 2016; Serván-Mori et al., 2021a, b, 2022a), this study quantified the magnitude and trend of the CoC coverage gap in maternal health between Mexican adult and adolescent women over the past 25 years. More specifically, we decomposed the gap in order to analyze the portion related to observable characteristics in both age groups and that attributable to discrimination associated with the age of pregnant women.

Methods

Design and Study Population

We conducted a pooled, cross-sectional, and retrospective analysis of data from the population-based Mexican National Survey of Demographic Dynamics (ENADID by its initials in Spanish) carried out in 1997, 2009, 2014, and 2018. ENADID is a periodic, cross-sectional, probabilistic, and retrospective population-based survey conducted by the National Institute of Statistics and Geography of Mexico (INEGI by its initials in Spanish). It is representative at the national and state levels in all 32 Mexican states, as well as in rural and urban areas. Using a complex multistage sampling design, ENADID is the main source of high-quality statistics on the socioeconomic and demographic characteristics of the Mexican population (INEGI, 2018). This household survey is carried out in alignment with comparable demographic and health surveys (DHSs) that have been conducted in more than 85 countries worldwide since 1984 (INEGI, 2018).

The four waves of the ENADID analyzed included the sociodemographic and reproductive characteristics of 98,156 women aged 12–19 years (adolescents) and 20–54 years (adults) at the time of last delivery. After excluding the 4.5% of participants who provided incomplete information, our study population consisted of 93,745 women. A comparison of the sociodemographic and health-related characteristics of the women who were included vs. those excluded from analysis revealed no statistically significant differences. Our research required no approval from the ethics committees of our institutions as we worked solely with publicly available secondary data. All study materials are publicly available at https://www.inegi.org.mx/programas/enadid/2018/.

Measures

Our outcome variable was CoC for maternal health, defined as the quality-adjusted, conditional, and unweighted coverage indicator, that is, a comprehensive metric indicating the receipt of high-quality services and not simply contact with a health care provider (Amouzou et al., 2019). In line with our previous work (Heredia-Pi et al., 2016; Serván-Mori et al., 2021a, b; 2022a), and based on the coverage cascade principle (Amouzou et al., 2019), CoC for maternal health was defined as conditional and joint compliance with eight specific interventions pertaining to antenatal and postnatal health care processes according to international (WHO, 2016, 2017) and Mexican health care-system guidelines (SEGOB, 2016). The interventions were categorized as follows: (i) ANC was received; (ii) ANC was received from a skilled birth attendant (a doctor or nurse); (iii) the initial medical consultation occurred during the first 8 weeks of pregnancy (timely ANC); (iv) at least five antenatal consultations took place (frequent ANC); (v) ANC included at least 75% of recommended care interventions (adequate ANC) (Heredia-Pi et al., 2013, 2016), with percentages ranging from 60 to 80% in the literature (Beeckman et al., 2012; Tran et al., 2012); (vi) the delivery was attended by skilled personnel; (vii) a postnatal consultation took place; and (viii) postnatal care was received within 15 days following delivery (timely postnatal care) (SEGOB, 2016). Women who reported receiving all eight interventions were classified as having received CoC for maternal health.

We also recorded individual, household, and contextual characteristics. At the individual level, we included the period of the last obstetric event (1994–1997, 2004–2009, 2010–2014, and 2015–2018); being head of household (yes = 1/no = 0); whether at least one indigenous language was spoken in the household (yes = 1/no = 0); marital status (single, married or in union, and divorced, separated, or widowed); whether the respondent was recently employed; health insurance coverage at the time of the survey—none, Social Security or Seguro Popular de Salud, a public health insurance program for people without Social Security coverage (Gómez Dantés & Ortiz, 2004; Knaul & Frenk, 2005; Knaul et al., 2012); and a proxy for the stock of human capital or educational attainment (Patrinos, 2018). This last concept was measured through the level of educational lag,

which, in turn, was defined as the difference between the number of years of schooling expected according to age and the actual number of self-reported years of school attendance (Darney et al., 2016; Serván-Mori et al., 2022b). Educational lag was operationalized in years as a continuous variable. We also recorded obstetric information including whether respondents were primiparous; whether they had experienced the death of an infant, a miscarriage or abortion, or a health problem during pregnancy or childbirth; the type of delivery (cesarean or vaginal); and outcome of the pregnancy (stillbirth, child currently alive, or child deceased). At the level of the household and place of residence, we included a factorial asset and housing material index as a measure of socioeconomic status. The index served to categorize participants into five groups (lowest, low, middle, high, and highest) according to the Dalenius and Hodges method (Dalenius & Hodges, 1959), where higher categories indicated a greater number of assets and better housing conditions. Finally, we included the area of residence according to its population (rural: < 2500 inhabitants, urban: 2500–100,000 inhabitants, and metropolitan: > 100,000 inhabitants), as well as the socioeconomic region of residence according to the official Mexican definition (INEGI, 2004).

Data Analysis

First, we calculated the sociodemographic and obstetric characteristics of the women surveyed according to the period of last delivery (defined above). Second, we estimated crude coverage percentages (with Standard Errors, SE) for the eight independent CoC coverage indicators mentioned above, as well as for full compliance with the recommended interventions along the ANC–postnatal continuum. For each period of the last delivery, we analyzed the differences between adult and adolescent women as regards each of the sociodemographic, obstetric, and maternal health characteristics, using linear and logistic bivariate regression models. We also assessed the temporal evolution of each CoC component among adolescent and adult women using unadjusted logistic regression models and reported the p-for-trend.

Third, we developed a pooled fixed-effects multiple logistic model (Agresti & Kateri, 2011; Cameron & Trivedi, 2005, 2010; Knoke et al., 2002; Wooldridge, 2002) to determine which sociodemographic and obstetric characteristics affected the likelihood of receiving CoC. We adjusted our model for all covariates recorded in the surveys, including survey year, and used a binary variable for each officially designated socioeconomic region (INEGI, 2004). All estimates were performed on the basis of maximum likelihood. We reported adjusted odds ratios (aORs) and robust 95% CIs. We also assessed the goodness-of-fit of our model according to Akaike criteria (AIC), Hosmer–Lemeshow and link tests, McFadden's R^2 statistic, and the area under the ROC curve (Agresti & Kateri, 2011; Knoke et al., 2002).

Fourth, in order to analyze age disparities in CoC coverage attributable to discriminatory practices against adolescents, we used the nonlinear Blinder-Oaxaca (BO) decomposition method (Amporfu & Grépin, 2019; Charasse-Pouélé & Fournier, 2006; Sen, 2014; Sinning et al., 2008; Taber et al., 2016), a technique frequently utilized to analyze health disparities (Lê Cook et al., 2008; Lhila & Long, 2012; Sen et al., 2011). This approach allowed for dividing our outcome gap into "explained" and "unexplained" categories or portions. To obtain the nonlinear BO decomposition of CoC, we estimated separate logistic regression models for adults and adolescents as follows:

$$CoC^{Adu} = F\left(X_{Adu}\widehat{\beta}_{Adu}\right) \tag{1}$$

$$CoC^{Ado} = F\left(X_{Ado}\widehat{\beta}_{Ado}\right) \tag{2}$$

where subscript *Ado* represented adolescent women and *Adu* adult women, F stood for the cumulative distribution function, X was a vector of observable characteristics for each i women, and β referred to the estimated parameters. The difference between (1) and (2) allowed us to decompose the CoC gap into two components:

$$CoC^{Adu} - CoC^{Ado} = \underbrace{\left[\sum_{i=1}^{N^{Adu}} \frac{F\left(X_i^{Adu}\widehat{\beta}^{Adu}\right)}{N^{Adu}} - \sum_{i=1}^{N^{Ado}} \frac{F\left(X_i^{Ado}\widehat{\beta}^{Adu}\right)}{N^{Ado}}\right]}_{\text{(first component)}} + \underbrace{\left[\sum_{i=1}^{N^{Ado}} \frac{F\left(X_i^{Ado}\widehat{\beta}^{Adu}\right)}{N^{Ado}} - \sum_{i=1}^{N^{Ado}} \frac{F\left(X_i^{Ado}\widehat{\beta}^{Ado}\right)}{N^{Ado}}\right]}_{\text{(second component)}} \tag{3}$$

The first component in brackets represented the portion of the adult-adolescent gap resulting from inter-group differences in the distribution of observable characteristics, while the second represented the portion attributable to differences in group processes determining the levels of CoC coverage. It also captured the portion of the gap due to group differences in unmeasurable or unobserved characteristics (the unexplained component). This portion would have persisted even if the disadvantaged group were to have attained the same average levels of measured predictor variables as the advantaged group. In the absence of other factors such as discriminatory practices between *Adu* and *Ado*, we concluded that discrepancies in CoC resulted from differences in characteristics and that the second term could therefore be

interpreted as the portion of the CoC difference attributable to discrimination (Piatt, 2021; Sen, 2014).

Using the BO method required 1-to-1 matching of observations between adolescents and adults in order to identify the contribution of individual characteristics to the CoC coverage gap. A random subsample of observations was selected from the majority group (adults) and matched with those from the minority group (adolescents) based on the ranking of the predicted probability of the dependent variable. The matched sample was then used to calculate the contribution of each factor in explaining disparities. Five hundred random subsamples of adolescents were used to eliminate estimations biased because of subsampling; the final decomposition estimate was an average of the replication samples. We conducted a sensitivity analysis and assessed the robustness of results by limiting the estimates of the raw coverage of each CoC component, the multiple logistic regression model and the BO decomposition analysis to the subsample of primiparous women. All analyses were performed using the Stata version 17MP statistical package (StataCorp, 2021), while the BO analysis, specifically, was performed using the Stata *nldecompose* command (Sinning et al., 2008).

Results

Descriptive Results

The data analyzed in this study showed that more adult than adolescent women were heads of household and had experienced their last pregnancy being married or in union, while more adolescents reported being single, separated, divorced, or widowed (Table 1). The gap in years of educational lag between the two age groups narrowed towards the end of the last period analyzed. For the period 1994–1997, we found a lag of 5.1 and 4.7 years for adults and adolescents, respectively, vs. 2.3 and 2.1 years, respectively, from 2015 to 2018. Throughout the four periods under study, we also observed a higher and growing percentage of adult women in the labor market, a trend that increased over time. Among adolescent women, affiliation with Seguro Popular became progressively prevalent, with a concomitant reduction in the percentage of those without health insurance. The data analyzed also revealed an increase in the percentage of adolescent women with a history of abortion, as well as an increase in cesarean births for both groups. The intergroup gap in cesarean births widened during 2015–2018, with 47.0% and 37.2% of births in adults and adolescents performed via cesarean section, respectively. Throughout the four periods analyzed, adolescent women tended to live in households with lower socioeconomic status and in rural areas, although we found a downward trend for the latter. During 2015–2018, 28.8% of adult vs. 33.4% of adolescent women resided in rural areas; those percentages had been 33.2% vs. 36.8%, respectively, during 1994–1997.

We observed an increase in the coverage of all maternal CoC components for both age groups during the periods analyzed, with gaps in favor of adult women (Table 2). Timely and frequent ANC and having received postnatal care within the first 15 days following the birth of the last live child were the indicators reflecting the greatest inter-group inequality. Our study revealed that, during 2015-2018, 54.7%±0.4% of adult mothers enjoyed CoC coverage, as compared to only 43.0%±0.9% of adolescents. Although primiparous women also demonstrated these patterns, they benefited from higher coverage rates for all indicators among both adults and adolescents, while age inequality in CoC coverage continued to widen over time. During 2015–2018, 58.4%±0.8% and 43.9%±1.0% of primiparous adults and adolescents received all CoC interventions, respectively. Both age groups, including primiparous women, saw an increase in coverage levels over time; however, inequality in coverage persisted between adult and adolescent women, with this gap showing a tendency to increase.

Regression Results

Table 3 shows the results of the multiple logistic regression models for the entire sample analyzed as well as for primiparous women. In both models, the likelihood of receiving CoC for maternal health increased over the years analyzed. However, adolescent primiparous mothers were less likely to receive continuous maternal care compared to their adult counterparts (aOR = 0.69; 95% CI: 0.65, 0.72). Similar results were observed for indigenous primiparous mothers (aOR = 0.73; 95% CI: 0.65, 0.83), for indigenous women in both age groups with no health insurance (aOR = 0.80; 95% CI: 0.75, 0.86), and for indigenous women affiliated with Seguro Popular (aOR = 0.87; 95% CI: 0.82, 0.93), compared to non-indigenous primiparous mothers and non-indigenous women in both age groups affiliated with Social Security, respectively. A lower probability of receiving CoC was associated with living in a metropolitan area (aOR: 0.92; 95% CI: 0.85, 0.99) and with experiencing a health problem during pregnancy or childbirth (aOR = 0.95; 95% CI: 0.92, 0.98 and aOR = 0.89; 95% CI: 0.84, 0.94). In both models, the likelihood of receiving CoC was higher among the following groups: women who were married/in union, divorced, separated, or widowed (aOR = 1.33; 95% CI: 1.24, 1.42 and aOR = 1.16; 95% CI: 1.05, 1.28, respectively, for primiparous women); women who reported being recently employed (aOR = 1.10; 95% CI: 1.06, 1.13 and aOR = 1.17; 95% CI: 1.11, 1.24, respectively); those residing in households with higher socioeconomic status; and those living in geographic regions with higher levels of well-being.

Table 1 Adolescent vs. adult women: sociodemographic and obstetric characteristics analyzed to assess the continuum of maternal-health care, Mexico, 1994–2018

Time of last obstetric event	from 1994 to 1997		from 2004 to 2009		from 2010 to 2014		from 2015 to 2018	
	Adults	Adolescents	Adults	Adolescents	Adults	Adolescents	Adults	Adolescents
sample n	*19,198*	*3,234*	*21,488*	*3,907*	*23,740*	*4,661*	*14,478*	*3,039*
	Estimation ± SE							
Individual *(sociodemographics and obstetrics)*								
Household head[a,e]	5.57±0.17	2.41±0.27[i]	9.01±0.20	4.20±0.32[i]	10.65±0.20	5.28±0.33[i]	9.52±0.24	3.95±0.35[i]
Speak at least one indigenous language[a,f]	9.55±0.21	9.55±0.52	6.47±0.17	5.43±0.36[k]	7.61±0.17	6.31±0.36[j]	7.79±0.22	7.17±0.47
Marital status								
Single[a,f]	4.44±0.15	11.35±0.56[i]	7.51±0.18	15.69±0.58[i]	6.65±0.16	14.65±0.52[i]	6.44±0.20	14.38±0.64[i]
Married/free union[a,e]	90.63±0.21	82.28±0.67[i]	84.07±0.25	74.87±0.69[i]	83.89±0.24	73.48±0.65[i]	84.65±0.30	75.45±0.78[i]
Divorced/Separated/Widowed[a,e]	4.93±0.16	6.37±0.43[j]	8.43±0.19	9.44±0.47[k]	9.46±0.19	11.86±0.47[i]	8.91±0.24	10.17±0.55[k]
Educational backwardness, years[a,e]	5.15±0.03	4.68±0.05[i]	3.20±0.02	2.52±0.04[i]	2.79±0.02	2.25±0.03[i]	2.29±0.02	2.11±0.04b
Employed[a]	36.49±0.35	27.27±0.78[i]	38.04±0.33	26.80±0.71[i]	39.35±0.32	28.41±0.66[i]	38.87±0.41	25.73±0.79[i]
Health insurance[a,e]								
Social Security[a,e]	40.69±0.35	29.87±0.80[i]	39.98±0.33	26.72±0.71[i]	35.20±0.31	21.09±0.60[i]	36.14±0.40	20.37±0.73[i]
Seguro Popular de Salud (SP)[a,e]	NA	NA	32.27±0.32	36.91±0.77[i]	52.27±0.32	61.62±0.71[i]	53.04±0.41	63.18±0.88[i]
None[a,e]	59.31±0.35	70.13±0.80[i]	27.75±0.31	36.37±0.77[i]	12.53±0.21	17.29±0.55[i]	10.82±0.26	16.45±0.67[i]
Primiparous woman[a,e]	22.20±0.30	74.40±0.77[i]	23.92±0.29	79.04±0.65[i]	25.40±0.28	79.40±0.59[i]	27.44±0.37	81.67±0.70[i]
Stillbirth or death within the first year of life[a]	3.85±0.14	0.96±0.17[i]	2.43±0.11	0.90±0.15[i]	2.07±0.09	0.77±0.13[i]	1.74±0.11	0.69±0.15[i]
At least one miscarriage or abortion[b]	14.62±0.25	3.77±0.34[i]	13.80±0.24	4.61±0.34[i]	14.99±0.23	4.25±0.30[i]	15.44±0.30	4.57±0.38[i]
Health problem diagnosed during pregnancy[f]	68.80±0.33	67.35±0.82[l]	62.75±0.33	63.68±0.77	64.75±0.31	67.45±0.69[i]	68.20±0.39	69.27±0.84
Health problem diagnosed during childbirth[a,e]	48.72±0.36	45.05±0.88[i]	44.37±0.34	44.59±0.80	37.75±0.31	38.19±0.71	40.32±0.41	43.44±0.90[j]
Type of delivery								
Cesarean section[a,e]	28.40±0.33	20.50±0.71[i]	45.03±0.34	35.65±0.77[i]	47.27±0.32	38.30±0.71[i]	46.97±0.41	37.18±0.88[i]
Vaginal delivery[a,e]	71.60±0.33	79.50±0.71[i]	54.97±0.34	64.35±0.77[i]	52.73±0.32	61.70±0.71[i]	53.03±0.41	62.82±0.88[i]
Pregnancy outcome								
Stillbirth[c]	0.69±0.06	0.12±0.06[i]	0.65±0.05	0.61±0.13	0.55±0.05	0.41±0.09	0.50±0.06	0.43±0.12
Currently alive[a]	97.52±0.11	98.39±0.22[j]	98.18±0.09	98.31±0.21	98.24±0.09	98.48±0.18	98.24±0.11	98.59±0.21
Currently death[a,h]	1.79±0.10	1.48±0.21	1.17±0.07	1.07±0.17	1.22±0.07	1.12±0.15	1.26±0.09	0.99±0.18
Household and area of residence								
SES level								
Lowest[a,e]	16.01±0.26	21.71±0.73[i]	1.89±0.09	2.51±0.25[k]	1.55±0.08	2.23±0.22[j]	1.36±0.10	1.84±0.24[k]
Low[a,e]	17.25±0.27	19.79±0.70[i]	6.05±0.16	6.37±0.39	6.28±0.16	7.53±0.39j	4.69±0.18	6.65±0.45[i]
Middle[a,e]	18.78±0.28	22.14±0.73[i]	16.75±0.25	20.55±0.65[i]	20.57±0.26	24.59±0.63[i]	19.22±0.33	24.88±0.78[i]
High[a,e]	10.58±0.22	11.41±0.56	18.82±0.27	22.06±0.66[i]	18.35±0.25	19.95±0.59[k]	18.78±0.32	21.68±0.75[i]
Highest[a,e]	37.37±0.35	24.95±0.76[i]	56.49±0.34	48.50±0.80[i]	53.26±0.32	45.70±0.73[i]	55.95±0.41	44.95±0.90[i]

Table 1 (continued)

Time of last obstetric event	from 1994 to 1997		from 2004 to 2009		from 2010 to 2014		from 2015 to 2018	
	Adults	**Adolescents**	**Adults**	**Adolescents**	**Adults**	**Adolescents**	**Adults**	**Adolescents**
sample n	*19,198*	*3,234*	*21,488*	*3,907*	*23,740*	*4,661*	*14,478*	*3,039*
	Estimation ± SE							
Area of residence								
Rural[a]	33.20±0.34	36.77±0.85[i]	23.25±0.29	22.93±0.67	28.81±0.29	31.56±0.68[i]	28.77±0.38	33.43±0.86[i]
Urban[a,e]	28.08±0.32	28.94±0.80	30.97±0.32	32.02±0.75	33.53±0.31	34.61±0.70	32.99±0.39	35.24±0.87[k]
Metropolitan[a,e]	38.73±0.35	34.29±0.83[i]	45.78±0.34	45.05±0.80	37.66±0.31	33.83±0.69[i]	38.24±0.40	31.33±0.84[i]
Socioeconomic Region								
Lowest[c]	10.19±0.22	11.04±0.55	10.31±0.21	9.91±0.48	10.90±0.20	11.89±0.47[l]	10.78±0.26	11.48±0.58
2	19.99±0.29	21.09±0.72	18.70±0.27	17.79±0.61	19.72±0.26	19.01±0.57	20.27±0.33	20.34±0.73
3[e]	17.11±0.27	15.99±0.64	17.59±0.26	16.20±0.59[k]	17.86±0.25	18.79±0.57	17.41±0.32	18.95±0.71[k]
4[f]	24.62±0.31	24.46±0.76	23.67±0.29	24.49±0.69	23.95±0.28	22.81±0.61[l]	23.75±0.35	21.65±0.75[k]
5[f]	13.17±0.24	15.18±0.63[j]	13.27±0.23	15.10±0.57[j]	13.18±0.22	13.30±0.50	13.51±0.28	13.49±0.62
6[b,h]	12.71±0.24	10.51±0.54[i]	13.12±0.23	13.16±0.54	11.93±0.21	12.25±0.48	12.15±0.27	12.31±0.60
Highest[d]	2.20±0.11	1.73±0.23[l]	3.33±0.12	3.35±0.29	2.46±0.10	1.95±0.20[k]	2.13±0.12	1.78±0.24

SE Standard Error, *NA* not applicable

P-for-trend in adults: [a]$p<0.001$; [b]$p<0.01$; [c]$p<0.05$; [d]$p<0.10$

P-for-trend in adolescents: [e]$p<0.001$; [f]$p<0.01$; [g]$p<0.05$; [h]$p<0.10$

Significance levels refer to the differences between adolescent and adult as regards the time of their last obstetric event in each period analyzed: [i]$p<0.001$; [j] $p<0.01$; [k]$p<0.05$; [l]$p<0.10$

Table 2 Adolescent vs. adult women: coverage indicators ± SE in the assessment of continuum of maternal-health care, Mexico, 1994–2018

	from 1994 to 1997		from 2004 to 2009		from 2010 to 2014		from 2015 to 2018	
	Adults	**Adolescents**	**Adults**	**Adolescents**	**Adults**	**Adolescents**	**Adults**	**Adolescents**
Overall, sample n	*19,198*	*3,234*	*21,488*	*3,907*	*23,740*	*4,661*	*14,478*	*3,039*
Received ANC[a,b]	93.22±0.18	94.06±0.42[f]	98.94±0.07	98.57±0.19[e]	99.12±0.06	99.06±0.14	99.10±0.08	98.78±0.20
Received skilled ANC[a,b]	87.80±0.24	86.73±0.60[f]	97.72±0.10	97.01±0.27[d]	98.32±0.08	97.75±0.22[d]	98.52±0.10	97.73±0.27[d]
Timely ANC[a,b]	49.90±0.36	41.77±0.87[c]	70.12±0.31	57.95±0.79[c]	75.80±0.28	65.05±0.70[c]	88.96±0.26	82.43±0.69[c]
Frequent ANC[a,b]	71.81±0.32	66.82±0.83[c]	90.09±0.20	84.34±0.58[c]	93.48±0.16	90.20±0.44[c]	94.09±0.20	91.08±0.52[c]
Adequate content of ANC[a,b]	79.44±0.29	78.17±0.73	83.27±0.25	83.34±0.60	87.40±0.22	87.19±0.49	88.85±0.26	86.87±0.61[d]
Skilled delivery[a,b]	85.97±0.25	83.98±0.65[d]	96.42±0.13	95.96±0.32	96.69±0.12	96.59±0.27	97.33±0.13	97.07±0.31
Received postnatal care[a,b]	60.26±0.35	58.50±0.87[f]	84.60±0.25	79.17±0.65[c]	83.16±0.24	78.48±0.60[c]	82.45±0.32	75.16±0.78[c]
Timely postnatal care[a,b]	39.79±0.35	34.85±0.84[c]	65.86±0.32	58.77±0.79[c]	67.39±0.30	59.71±0.72[c]	69.33±0.38	60.48±0.89[c]
Continuum of maternal health care[a,b]	18.87±0.28	12.83±0.59[c]	40.86±0.34	29.97±0.73[c]	45.48±0.32	35.25±0.70[c]	54.72±0.41	43.01±0.90[c]
Among primiparous woman	*4,262*	*2,406*	*5,139*	*3,088*	*6,031*	*3,701*	*3,973*	*2,482*
Received ANC[a,b]	98.24±0.20	95.76±0.41[c]	99.51±0.10	99.03±0.18[d]	99.47±0.09	99.35±0.13	99.45±0.12	99.11±0.19
Received skilled ANC[a,b]	95.96±0.30	89.78±0.62[c]	99.14±0.13	97.77±0.27[c]	99.02±0.13	98.27±0.21[d]	99.32±0.13	98.15±0.27[c]
Timely ANC[a,b]	60.72±0.75	43.27±1.01[c]	74.02±0.61	59.16±0.88[c]	78.28±0.53	65.85±0.78[c]	92.22±0.42	83.56±0.74[c]
Frequent ANC[a,b]	83.76±0.56	70.78±0.93[c]	93.50±0.34	86.50±0.62[c]	95.57±0.26	91.43±0.46[c]	96.43±0.29	91.98±0.55[c]
Adequate content of ANC[a,b]	85.95±0.53	80.55±0.81[c]	86.73±0.47	85.30±0.64[f]	88.29±0.41	87.84±0.54	88.70±0.50	87.15±0.67[f]
Skilled delivery[a,b]	95.07±0.33	87.70±0.67[c]	98.79±0.15	96.92±0.31[c]	98.71±0.15	97.54±0.25[c]	98.94±0.16	97.50±0.31[c]
Received postnatal care[a,b]	73.23±0.68	61.26±0.99[c]	88.25±0.45	80.18±0.72[c]	85.56±0.45	78.79±0.67[c]	84.77±0.57	76.15±0.86[c]
Timely postnatal care[a,b]	47.25±0.76	36.28±0.98[c]	68.57±0.65	59.72±0.88[c]	68.50±0.60	60.01±0.81[c]	71.13±0.72	60.96±0.98[c]
Continuum of maternal health care[a,b]	26.16±0.67	14.26±0.71[c]	46.06±0.70	31.28±0.83[c]	48.22±0.64	36.13±0.79[c]	58.42±0.78	43.92±1.00[c]

SE Standard Error

P-for-trend in adults: [a]$p<0.001$

P-for-trend in adolescents: [b]$p<0.001$

Significance levels refer to the differences between adolescent and adult as regards the time of their last obstetric event in each period analyzed: [c]$p<0.001$; [d]$p<0.01$; [e]$p<0.05$; [f]$p<0.10$

Table 3 Adolescent vs. adult women: pooled and multiple logistic model results for receiving continuum of maternal health care, Mexico, 1994–2018

	Overall	**Primiparous women**
	Adjusted odds ratio (robust 95% CI)	
Individual (sociodemographic and obstetric characteristics)		
Age at last delivery		
Adult (20–54 years)	Ref	Ref
Adolescent (12–19 years)	0.67 (0.65, 0.71)***	0.69 (0.65, 0.72)***
Time of last delivery		
1994–1997	Ref	Ref
2004–2009	2.14 (2.04, 2.24)***	1.98 (1.83, 2.14)***
2010–2014	2.47 (2.35, 2.59)***	2.18 (2.01,2 .37)***
2015–2018	3.49 (3.31, 3.68)***	3.20 (2.93, 3.50)***
Head of household		
No	Ref	Ref
Yes	1.05 (0.99, 1.11)	1.02 (0.91,1 .14)
Speaks at least one indigenous language		
No	Ref	Ref
Yes	0.78 (0.74, 0.83)***	0.73 (0.65, 0.83)***
Marital status		
Single	Ref	Ref
Married/in union	1.32 (1.25, 1.39)**	1.33 (1.24, 1.42)***
Divorced/separated/widowed	1.10 (1.03, 1.19)**	1.16 (1.05, 1.28)**
Educational lag (years)	0.93 (0.92, 0.93)***	0.94 (0.93, 0.95)***
Employed		
No	Ref	Ref
Yes	1.10 (1.06, 1.13)***	1.17 (1.11, 1.24)***
Health insurance		
Social security	Ref	Ref
Seguro Popular de Salud (SP)	0.87 (0.84, 0.91)***	0.87 (0.82, 0.93)***
None	0.76 (0.73, 0.79)***	0.80 (0.75, 0.86)***
Primiparous		
No	Ref	
Yes	1.07 (1.03, 1.11)**	
Experienced a stillbirth or death of a child within his/her first year of life		
No	Ref	Ref
Yes	0.98 (0.87, 1.10)**	1.22 (0.92, 1.63)
Experienced at least one miscarriage or abortion		
No	Ref	Ref
Yes	1.06 (1.02, 1.11)**	1.10 (1.00, 1.21)*
Had health problem diagnosed during pregnancy		
No	Ref	Ref
Yes	0.95 (0.92, 0.98)**	0.89 (0.84, 0.94)***
Had health problem diagnosed during childbirth		
No	Ref	Ref
Yes	0.95 (0.92, 0.98)**	0.97 (0.92, 1.02)
Type of delivery		
Cesarean	Ref	Ref
Vaginal	0.54 (0.53, 0.56)***	0.55 (0.53, 0.58)***
Pregnancy outcome		
Stillbirth	Ref	Ref
Child currently alive	1.46 (1.15, 1.85)**	1.91 (1.28, 2.87)**

Table 3 (continued)

	Overall	**Primiparous women**
	Adjusted odds ratio (robust 95% CI)	
Child deceased	0.99 (0.76, 1.30)	1.21 (0.75, 1.96)
Household and place of residence		
SES		
Lowest	Ref	Ref
Low	1.43 (1.29, 1.59)***	1.29 (1.07, 1.56)**
Middle	1.64 (1.49, 1.80)***	1.39 (1.17, 1.66)***
High	1.83 (1.66, 2.03)***	1.55 (1.30, 1.85)***
Highest	2.02 (1.83, 2.24)***	1.70 (1.42, 2.03)***
Place of residence		
Rural	Ref	Ref
Urban	0.96 (0.93, 1.00)+	0.99 (0.93, 1.06)
Metropolitan	0.89 (0.85, 0.93)***	0.92 (0.85, 0.99)**
Socioeconomic region		
Lowest	Ref	Ref
2	1.19 (1.13, 1.26)***	1.18 (1.08, 1.30)**
3	1.10 (1.04, 1.17)**	1.10 (0.99, 1.21)+
4	1.19 (1.12, 1.25)***	1.16 (1.05, 1.27)**
5	1.24 (1.16, 1.31)***	1.16 (1.04, 1.29)**
6	0.99 (0.93, 1.05)	1.01 (0.90, 1.13)
Highest	1.22 (1.11, 1.35)***	1.26 (1.08, 1.48)**
Observations	93,745	31,082
Akaike information criterion (AIC)	112,315.20	38,535.78
Hosmer–Lemeshow $\chi 2$ ($P > \chi 2$)	64,355.40 (0.929)	23,633.61 (0.873)
McFadden's R2	0.10	0.08
Area under the ROC curve	0.70	0.69

CI confidence interval, *Ref* reference group

Significance levels: ***$p < 0.001$; **$p < 0.01$; *$p < 0.05$; +$p < 0.10$

During the 24 years analyzed, the adjusted CoC coverage for adult and adolescent women averaged 39.31% (95% CI: 38.98%, 39.63%) and 31.35% (95% CI: 30.57%, 32.13%) respectively (Fig. 1A), with significant growth ranging from 24.07 (95% CI: 23.38%, 24.76%) in 1994–1997 to 50.45% (95% CI: 49.67%, 51.22%) in 2015–2018, for adult women,

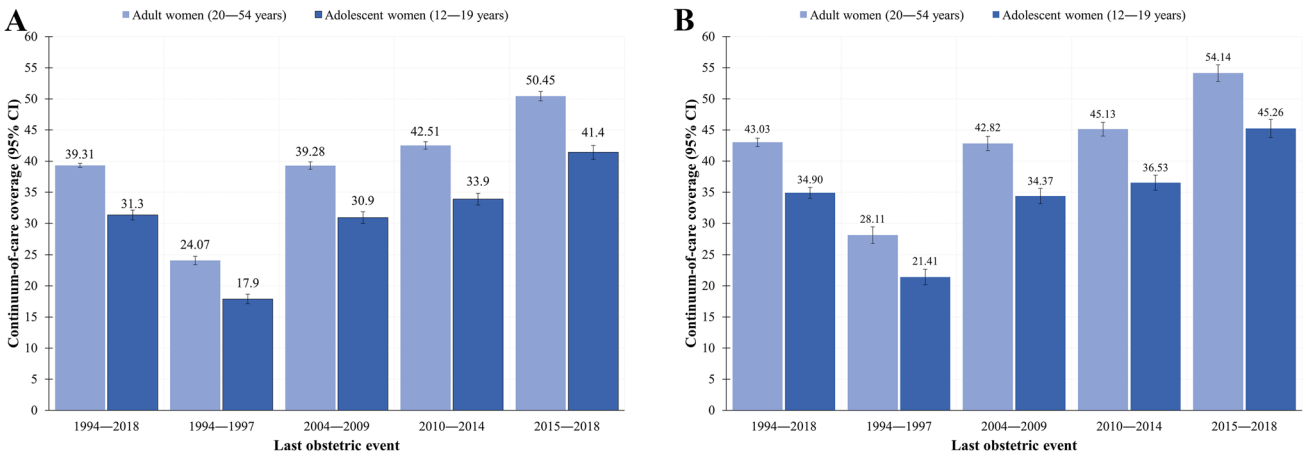

Fig. 1 Adult vs. adolescent women: adjusted coverage of continuum of maternal health care, Mexico, 1994–2018. **A** Overall. **B** Primiparous women

and from 17.89 (95% CI: 17.10%, 18.68%) in 1994–1997 to 41.42% (95% CI: 40.30%, 42.53%) in 2015–2018 for adolescents. For primiparous women, the estimated CoC coverage was higher in adults and adolescents, with coverage adjusted for adults (43.03%, 95% CI: 42.35%, 43.70) and adolescents (34.90%, 95% CI: 34.03%, 35.77%) (Fig. 1B). Significant growth was also recorded in CoC coverage for this group of women, going from 28.11 (95% CI: 26.80%, 29.43%) in 1994–1997 to 54.14% (95% CI: 52.80%, 55.47%) in 2015–2018 among adults and from 21.41 (95% CI: 20.16%, 22.66%) in 1994–1997 to 45.26% (95% CI: 43.80%, 46.71%) in 2015–2018 among adolescents.

Decomposition Results

Finally, our BO nonlinear decomposition analyses showed an overall CoC coverage gap between adults and adolescents of 0.089 (95% CI: 0.080, 0.097). We found that 10.1% of the gap was linked to observable characteristics and 89.9% to age-related discriminatory practices (Table 4). Analyses focused on primiparous women found an even larger overall coverage gap between adults and adolescents, estimated at 0.129 (95% CI: 0.118, 0.140). However, in this case, the contribution of observable characteristics to the gap increased to 39.5%, while that attributable to age-related discriminatory practices fell to 60.5%. We observed an increase of the global gap over time, as well as an increase in the contribution attributable to age discrimination.

Discussion

To the best of our knowledge, this is the first study conducted in the last quarter century with a view to disaggregating and describing disparities associated with age discrimination in coverage of the continuum of care (CoC) for maternal health among adult and adolescent women in Mexico. First, we found a significant increase in coverage throughout the four periods analyzed. However, we noted that, on average, adult women enjoyed higher coverage levels (54.7%) than their adolescent counterparts (43.0%). Specifically, among primiparous women, CoC coverage was estimated at 58.4% for adults vs. 43.9% for adolescents. Second, we found that the maternal CoC components showing the greatest disparities between the two age groups were timely and frequent antenatal care (ANC) interventions as well as postnatal care within the first 15 days following the birth of the last living child. Third, the estimated gap in CoC coverage between adolescent and adult mothers (8.9% in the general sample and 12.9% for primiparous) trended slightly upward throughout the four periods analyzed. The smallest portion of the gap (10.1% in the general sample and 39.5% in primiparous women) related to inter-group differences in observable characteristics, while the largest portion (89.9% in the general sample and 60.5% in primiparous women) can be interpreted as a consequence of the discriminatory practices to which adolescent mothers were exposed.

Our results are in line with those of other studies where adult mothers have been found to make greater use of ANC and delivery services for pregnancies in general and for first births in particular (Atuyambe et al., 2008; Gross et al., 2012; Li et al., 2020; Owolabi et al., 2017; Sanhueza et al., 2021). These studies have also reported lower coverage levels for adolescents as regards timeliness (opportune care), intensity (number of ANC visits), and adequate provision of antenatal and delivery care components (Magadi et al., 2007; Reynolds et al., 2006; Sanhueza et al., 2021). Our study found that, in addition to encountering more challenges during pregnancy and early motherhood, adolescents faced considerably greater impediments in seeking and obtaining maternal health services than did their adult counterparts. The adolescent mothers in our study were less likely to participate in the labor market. They were more likely to belong to households with lower socioeconomic status and to reside in rural areas with lower levels of economic development (Atuyambe et al., 2008; Gross et al., 2012; Li et al., 2020; Owolabi et al., 2017). However, contrary to expectations, and in contrast with the results of previous studies (Reynolds et al., 2006), we found that adolescent mothers exhibited less of an educational lag than did their adult counterparts. This may reflect the fact that, in Mexico, the medium- and long-term effects of adolescent pregnancy on social capital are more significant than in other countries, considering the high prevalence of pregnancies in Mexican youths and the fact that under 30% of adult mothers in this study reported being primiparous.

Our analyses revealed only a slight increase in the percentage of adolescent women reporting a history of abortion across the four periods analyzed. This may indicate that policies adopted in recent years and efforts to ensure access to safe and legal interruption of pregnancy (LIP) services have been insufficient and unequally implemented across the country (CONAPO, 2022; GIRE, 2021). Of the 32 states in Mexico, only nine have decriminalized abortion: Mexico City in 2007; Oaxaca in 2019; Baja California, Coahuila, Colima, Hidalgo, and Veracruz in 2021; and Guerrero and Sinaloa in 2022 (CONAPO, 2022; GIRE, 2021; SSa, 2021). Albeit a major step towards offering legal and safe LIP services that are free and voluntary during the first 12 weeks of gestation, challenges persist that transcend the legal aspects. In Mexico, as in other LMICs, the poor, and especially the rural, communities suffer from a shortage of health personnel and facilities as well as from low-quality care (Jacobson et al., 2022). It is vital to reinforce training programs as a means of enhancing the availability of human resources with clinical skills in providing abortion services. It is also of primary importance to learn from international experiences that can serve as a

Table 4 Decomposition of adolescent-adult gap in continuum of maternal health care, Mexico, 1994–2018

Difference	Estimate (95% CI)	Contribution percent
Overall		
Last obstetric event during period 1994–2018		
Raw difference	0.089 (0.080, 0.097)	100.00
Explained: differences in characteristics	0.009 (0.004, 0.014)	10.11
Unexplained: differences in coefficients (*age discrimination*)	0.079 (0.070, 0.089)	89.89
Last obstetric event during period 1994–1997		
Raw difference	0.060 (0.048, 0.073)	100.00
Explained: differences in characteristics	0.022 (0.014, 0.030)	36.67
Unexplained: differences in coefficients (*age discrimination*)	0.038 (0.024, 0.052)	63.33
Last obstetric event during period 2004–2009		
Raw difference	0.109 (0.093, 0.125)	100.00
Explained: differences in characteristics	0.013 (0.002, 0.023)	11.93
Unexplained: differences in coefficients (*age discrimination*)	0.096 (0.079, 0.113)	88.07
Last obstetric event during period 2010–2014		
Raw differences	0.102 (0.088, 0.117)	100.00
Explained: differences in characteristics	0.028 (0.018, 0.037)	27.45
Unexplained: differences in coefficients (*age discrimination*)	0.075 (0.058, 0.092)	72.55
Last obstetric period: 2015–2018		
Raw difference	0.117 (0.098, 0.136)	100.00
Explained: differences in characteristics	0.011 (−0.001, 0.024)	9.40
Unexplained: differences in coefficients (*age discrimination*)	0.106 (0.084, 0.128)	90.60
Primiparous women		
Last obstetric event during period 1994–2018		
Raw difference	0.129 (0.118, 0.140)	100.00
Explained: differences in characteristics	0.051 (0.045, 0.056)	39.53
Unexplained: differences in coefficients (*age discrimination*)	0.078 (0.067, 0.089)	60.47
Last obstetric event during period 1994–1997		
Raw difference	0.119 (0.099, 0.139)	100.00
Explained: differences in characteristics	0.076 (0.067, 0.086)	63.87
Unexplained: differences in coefficients (*age discrimination*)	0.043 (0.024, 0.061)	36.13
Last obstetric event during period 2004–2009		
Raw difference	0.147 (0.126, 0.169)	100.00
Explained: differences in characteristics	0.049 (0.040, 0.059)	33.33
Unexplained: differences in coefficients (*age discrimination*)	0.098 (0.077, 0.120)	66.67
Last obstetric event during period 2010–2014		
Raw difference	0.120 (0.102, 0.139)	100.00
Explained: differences in characteristics	0.049 (0.040, 0.057)	40.83
Unexplained: differences in coefficients (*age discrimination*)	0.071 (0.051, 0.091)	59.17
Last obstetric event during period 2015–2018		
Raw difference	0.145 (0.121, 0.169)	100.00
Explained: differences in characteristics	0.042 (0.029, 0.054)	28.97
Unexplained: differences in coefficients (*age discrimination*)	0.103 (0.076, 0.131)	71.03

guide for achieving the highest standards in the accreditation and certification processes of medical and non-medical professionals for this purpose. Values need to be reexamined and attitudes transformed if existing stigma and social prejudices against LIP are to be eradicated (Schiavon & Troncoso, 2020). Mexico faces an unmet demand for access to abortion; as a consequence, the lack of access to local LIP services worsens disparities in access to health care, violating SRHRs (Jacobson et al., 2022).

Performing a decomposition analysis of the CoC gap by age allowed us to quantify its sources and identify the extent to which disparities could theoretically be reduced if the

differences between adolescents and adults were eliminated. The decomposition method employed served to assess the potential relative weight of the discrimination mechanisms encountered by adolescents in their pursuit, access to, and use of maternal health services (Sen, 2014; Taber et al., 2016). Our findings indicate that the largest portion of the inequality gap associated with age in CoC coverage relates not to the observable characteristics of women but rather to structural conditions that foster discrimination in the family, community, and health services. In their homes and communities, adolescent women are often stigmatized and socially isolated. They face political barriers and community norms that exclude them from receiving information and services, restricting their access to health care as well as to sexual and reproductive health education (Magadi et al., 2007). Adolescent pregnancies are generally unplanned and unwanted, especially in the case of unmarried adolescents. Premarital maternity has been associated with limited use of health services because the young mothers often fail to recognize their pregnancy early on (Alem et al., 2022; Magadi et al., 2007). Additionally, most adolescent mothers are unable to negotiate egalitarian and secure relationships with their partners, who tend to be much older than they (Magadi et al., 2007; Starrs et al., 2018).

Under asymmetric power relationships, adolescent women are unable to either make autonomous sexual and reproductive decisions or effectively exercise this dimension of their lives; this exerts a negative impact on their life trajectories (Coast et al., 2019; Harper et al., 2018; Patton et al., 2016). The double vulnerability faced by adolescent mothers as a result of their age, social barriers, stereotypes, and discriminatory practices is exacerbated by their precarious financial status, low educational level, and inadequate health literacy (Atuyambe et al., 2008). This situation is compounded by the absence of adequate response and attention channels in the institutions where they interact (e.g., schools and health facilities) (Coast et al., 2019; Pankhurst et al., 2016; UNICEF, 2014; Yount et al., 2017). Further constraints caused by customs, marriage patterns, and age differences between the spouses hinder their power to make decisions on health care for their pregnancies (Magadi et al., 2007; Starrs et al., 2018) and limit their ability to negotiate on the use of contraceptive methods (Chandra-Mouli et al., 2014; Harper et al., 2018; Patton et al., 2016).

In the context of health institutions, the social stigma often associated with adolescent pregnancy can be exacerbated by the low levels of sensitivity and awareness with which personnel treat adolescent mothers (Li et al., 2020; Owolabi et al., 2017). Health facilities do not always maintain quality standards of care, for instance, in terms of patient confidentiality, because staff members frequently refuse to offer care to adolescent or single women in the absence of a parent or guardian. Such practices take place without any legal or administrative justification. For this reason, many adolescent mothers refrain from seeking pregnancy care in a timely fashion (Atuyambe et al., 2008; Gross et al., 2012; Owolabi et al., 2017; Starrs et al., 2018). There is evidence that Mexican adolescents are discriminated against in health facilities, even during the provision of services designed especially for them, such as the so-called youth-friendly services. We have previously documented that adolescents confront inadequate treatment and negative attitudes on the part of health personnel. In this context, negative attitudes have been defined as unfriendly behavior, rude gestures, disparaging looks, and expressions of judgment regarding the sexual practices of those seeking care. As a result, users feel misunderstood, reprehended, and ultimately decide not to return (Pastrana-Sámano et al., 2020). This calls for serious reflection on the scope of the strategies undertaken thus far to expand maternal health coverage in LMICs. It underlines the urgency of strengthening/redirecting current initiatives as well as of implementing more effective interventions that are both sensitive to the social reality of adolescents and capable of contributing to the universalization of maternal health care for this population group.

Studies on factors associated with increased use of maternal health services by adult women have indicated that acquiring knowledge and experience with regard to health services leads to greater use (Alem et al., 2022; Boamah et al., 2016; He et al., 2021). This could stem from the fact that experienced users tend to develop autonomy, confidence, and the ability to make decisions regarding their own health. Autonomous health care decisions have been positively associated with completion of the maternity care continuum (Shitie et al., 2020).

Our study highlights the need for comprehensive strategies that improve CoC indicators for adolescent mothers through social-support interventions focused on reducing the stigmatization and structural discrimination they experience. Proposals for innovative comprehensive adolescent SRH programs are required to reduce the serious consequences of early and unprotected sexual activity. More effective adolescent-friendly initiatives must be developed; these could include, for instance, pregnancy groups designed to empower pregnant adolescents with information on pregnancy, childbirth, and early-childhood care. In addition to improving the health of mothers and newborns, such initiatives would foster a greater use of maternity care services. It should be mandatory to approach adolescent women from a CoC and life-cycle perspective while recognizing the multiple social vulnerabilities they face. The growing phenomenon of adolescent motherhood in Mexico is a cause for concern and calls for broader access to reproductive health services, particularly among women who have never married. Special importance must be attached to the effects of age-related stigmatization and discrimination perpetrated by communities and health personnel. Comprehensive sexual

education must be offered to girls before the onset of puberty in order to help them make informed decisions regarding their sexual activities (Atuyambe et al., 2008). There clearly is a need for policies and interventions that are sensitive to the necessities of adolescent mothers, which may differ in many respects from those of adult mothers. The design and contents of such interventions should be appropriate for the age and educational level of these young mothers and should recognize their increased vulnerability to pregnancy-related complications (Boamah et al., 2016). In parallel, it is essential to strengthen the capacities of health personnel, ensuring clinical competencies in the provision of services that are sensitive to the cultural and age-related requirements of each context. In all instances, special efforts should be devoted to clarifying values and transforming attitudes entrenched in stigma and prejudices against early pregnancy (Schiavon & Troncoso, 2020).

Notwithstanding the challenges inherent in operationalizing a concept as complex and multifactorial as social discrimination, it must be incorporated into the indicator scoreboard for monitoring and evaluating the performance of CoC-coverage initiatives. Our study contributes to this endeavor by assessing the magnitude of the discrimination-related proportion of the CoC coverage gap. However, a consensus has yet to be reached on the promotion and adoption of comprehensive indicators for equity in health. This would allow for measuring the levels of discrimination experienced by the disadvantaged groups. To this end, censuses and household surveys should incorporate questions that facilitate such measurement and collect data that are consistent. Qualitative information must also be gathered in order to better understand the mechanisms underlying the complexities of discrimination in its various expressions (UNICEF, 2019).

Our work must be interpreted bearing in mind several limitations. First, although we analyzed high-quality population data, the cross-sectional design adopted allowed for estimating only degrees of association and not causal inferences. Second, our work shared the limitations of all studies based on self-reported data; nonetheless, we considered only births in the 5 years prior to the survey in order to reduce the probability of recall bias. Third, the Blinder-Oaxaca decomposition technique made it difficult to draw inferences concerning the primary cause of the unexplained portion of the gap found in effective coverage: although it allowed for making a number of conjectures concerning the unexplained portion of the gap, we were unable to derive additional information as to which of these conjectures was the most plausible (Sen, 2014); other confounding factors—observed and unobserved—could conceivably have explained the differentials we did not control. Nonetheless, we used a comprehensive set of factors that allowed for providing an overview of the magnitude of the unobserved portion of the gap possibly related to ethnic-based structural discrimination. Finally, while we selected indicators that generally adhered to WHO recommendations (WHO, 2016, 2017) in order to allow for drawing comparisons at the international level, some exceptions are worth noting. For example, the WHO suggests a minimum of eight ANC visits (WHO, 2016, 2017), whereas national guidelines recommend five or more (SEGOB, 2016). In addition, Mexican guidelines recommend that the initial ANC visit take place between the sixth and eighth weeks of gestation, whereas the WHO recommendations reference the first trimester (WHO, 2016, 2017). Similarly, national guidelines recommend a minimum of two clinic visits—one within 15 days following birth and the second at the end of puerperium—(SEGOB, 2016) while the WHO recommends three visits over the same period, including home visits (WHO, 2016, 2017).

In sum, Mexico has made significant headway in CoC coverage over the last 25 years. Nonetheless, glaring disparities in maternal health services persist, possibly reflecting the presence of stigmatization and discriminatory practices associated with age. Adolescent mothers are burdened with significant social disadvantages in their quest for comprehensive care during pregnancy, childbirth, and the postpartum period. Adopting an age-sensitive approach that addresses social norms and power imbalances in the design and implementation of maternal health policies would help achieve the Sustainable Development Goals (SDGs) concerning the reduction of social disparities and inequities in health. The evidence provided by this study can serve as a guide for policymakers seeking to combat these deterrents to achieving an effective continuum of maternal health care.

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Author Contribution IHP and ESM conceived the idea for the paper, contributed equally to this work, and share first authorship. ESM led the formal analysis and performed the data curation. ESM and IHP wrote the first draft of the manuscript. GN, NA, HRM, and RL provided critical input on multiple iterations. ESM is the guarantor of the work and, as such, had full access to all study data and is responsible for the integrity of the data and the accuracy of the data analysis. The final version of the manuscript was revised and approved by all authors.

Availability of Data and Materials The dataset analyzed during this study is available from the corresponding author upon request.

Declarations

Ethics Statement This study constitutes a secondary analysis of data from the National Surveys of Demographic Dynamics (ENADID by its initials in Spanish) 1997, 2009, 2014, and 2018. The data was obtained from the public repository of survey data hosted at the National Institute of Statistics and Geography of Mexico (INEGI by its initials in Spanish) and is available through their webpage: https://www.inegi.org.mx/. The data at the repository has been de-identified and therefore cannot be traced to specific individuals.

Conflict of Interest The authors declare no competing interests.

References

Agresti, A., & Kateri, M. (2011). Logistic regression. In M. Lovric (Ed.), *Categorical Data Analysis* (3rd ed., pp. 163–196). Springer Berlin Heidelberg.

Alem, A. Z., Shitu, K., & Alamneh, T. S. (2022). Coverage and factors associated with completion of continuum of care for maternal health in sub-Saharan Africa: A multicountry analysis. *BMC Pregnancy and Childbirth, 22*(1), 422. https://doi.org/10.1186/s12884-022-04757-1

Alvidrez, J., & Tabor, D. C. (2021). Now is the time to incorporate the construct of structural racism and discrimination into health research. *Ethnicity & Disease*, *31*(Suppl 1), 283–284. https://doi.org/10.18865/ed.31.S1.283

Amouzou, A., Jiwani, S. S., da Silva, I. C. M., Carvajal-Aguirre, L., Maïga, A., & Vaz, L. M. E. (2020). Closing the inequality gaps in reproductive, maternal, newborn and child health coverage: Slow and fast progressors. *BMJ Global Health, 5*(e002230), 1–11. https://doi.org/10.1136/bmjgh-2019-002230

Amouzou, A., Leslie, H. H., Ram, M., Fox, M., Jiwani, S. S., Requejo, J., Marchant, T., Munos, M. K., Vaz, L. M. E., Weiss, W., Hayashi, C., & Boerma, T. (2019). Advances in the measurement of coverage for RMNCH and nutrition: From contact to effective coverage. *BMJ Global Health, 4*(Suppl 4), e001297. https://doi.org/10.1136/bmjgh-2018-001297

Amporfu, E., & Grépin, K. A. (2019). Measuring and explaining changing patterns of inequality in institutional deliveries between urban and rural women in Ghana: A decomposition analysis. *International Journal for Equity in Health, 18*(1), 123. https://doi.org/10.1186/s12939-019-1025-z

Anindya, K., Marthias, T., Vellakkal, S., Carvalho, N., Atun, R., Morgan, A., Zhao, Y., Hulse, E. S. G., McPake, B., & Lee, J. T. (2021). Socioeconomic inequalities in effective service coverage for reproductive, maternal, newborn, and child health: A comparative analysis of 39 low-income and middle-income countries. *E Clinical Medicine, 40*(101103), 1–10. https://doi.org/10.1016/j.eclinm.2021.101103

Atuyambe, L., Mirembe, F., Tumwesigye, N. M., Annika, J., Kirumira, E. K., & Faxelid, E. (2008). Adolescent and adult first time mothers' health seeking practices during pregnancy and early motherhood in Wakiso district, central Uganda. *Reproductive Health, 5*(1), 13. https://doi.org/10.1186/1742-4755-5-13

Baltag, V., & Chandra-Mouli, V. (2014). Adolescent pregnancy: Sexual and reproductive health. In A. L. Cherry & M. E. Dillon (Eds.), *International handbook of adolescent pregnancy* (pp. 55–78). Springer US. https://doi.org/10.1007/978-1-4899-8026-7_3

Beeckman, K., Louckx, F., & Putman, K. (2012). Content and timing of antenatal care: Predisposing, enabling and pregnancy-related determinants of antenatal care trajectories. *European Journal of Public Health, 23*(1), 67–73. https://doi.org/10.1093/eurpub/cks020

Berrueta, M., Bardach, A., Ciaponni, A., Xiong, X., Stergachis, A., Zaraa, S., Buekens, P., Group, S. R. C. (2021). Maternal and neonatal data collection systems in low- and middle-income countries: Scoping review protocol. *BMC Pregnancy and Childbirth, 21*(217), 1–19. https://doi.org/10.1186/s12884-021-03686-9

Boamah, S. A., Amoyaw, J., & Luginaah, I. (2016). Explaining the gap in antenatal care service utilization between younger and older mothers in Ghana. *Journal of Biosocial Science, 48*(3), 342–357. https://doi.org/10.1017/S0021932015000218

Cameron, A. C., & Trivedi, P. K. (2005). Binary outcome models. In C. Cameron & P. Trivedi (Eds.), *Microeconometrics: Methods and Applications Microeconometrics* (1st ed., pp. 463–487). Cambridge University Press.

Cameron, A. C., & Trivedi, P. K. (2010). Binary outcome models. In C. Cameron & P. Trivedi (Eds.), *Microeconometrics using Stata* (2nd ed., pp. 445–459). Stata press College Station, TX.

Castro, A., Savage, V., & Kaufman, H. (2015). Assessing equitable care for indigenous and afrodescendant women in Latin America. *Pan American Journal of Public Health, 38*(2), 96–109.

Chandra-Mouli, V., McCarraher, D. R., Phillips, S. J., Williamson, N. E., & Hainsworth, G. (2014). Contraception for adolescents in low and middle income countries: Needs, barriers, and access. *Reproductive Health, 11*(1), 1–8. https://doi.org/10.1186/1742-4755-11-1

Charasse-Pouélé, C., & Fournier, M. (2006). Health disparities between racial groups in South Africa: A decomposition analysis. *Social Science & Medicine, 62*(11), 2897–2914. https://doi.org/10.1016/j.socscimed.2005.11.020

Coast, E., Jones, N., Francoise, U. M., Yadete, W., Isimbi, R., Gezahegne, K., & Lunin, L. (2019). Adolescent sexual and reproductive health in Ethiopia and Rwanda: A qualitative exploration of the role of social norms. *SAGE Open*, *9*(January-March), 1–6. https://doi.org/10.1177/2158244019833587

Conde-Agudelo, A., Belizán, J. M., & Lammers, C. (2005). Maternal-perinatal morbidity and mortality associated with adolescent pregnancy in Latin America: Cross-sectional study. *American Journal of Obstetrics and Gynecology, 192*(2), 342–349. https://doi.org/10.1016/j.ajog.2004.10.593

Consejo Nacional de Poblacón (CONAPO). (2022). *El reconocimiento de la interrupción legal del embarazo en México* (pp. 1–4). Secretaría de Gobernación (SEGOB). https://www.gob.mx/cms/uploads/attachment/file/715175/El_reconocimiento_de_la_ILE_en_Mexico.pdf

Dalenius, T., & Hodges, J., Jr. (1959). Minimum variance stratification. *Journal of the American Statistical Association, 54*(285), 88–101. https://doi.org/10.2307/2282141

Darney, B., Sosa-Rubi, S., Servián-Mori, E., Rodriguez, M., Walker, D., & Lozano, R. (2016). The relationship of age and place of delivery with postpartum contraception prior to discharge in Mexico: A retrospective cohort study. *Contraception, 93*(6), 478–484. https://doi.org/10.1016/j.contraception.2016.01.015

Fulu, E., Kerr-Wilson, A., Lang, J., Gibbs, A., Jacobson, J., & Jewkes, R. (2014). What works to prevent violence against women and girls. *Evidence Review of Interventions to Prevent Violence against Women and Girls Pretoria: Medical Research Council*, 1580–1589.

Gómez Dantés, O., & Ortiz, M. (2004). Seguro Popular de Salud: Siete perspectivas. *Salud Pública De México, 46*(6), 585–588.

Gross, K., Alba, S., Glass, T. R., Schellenberg, J. A., & Obrist, B. (2012). Timing of antenatal care for adolescent and adult pregnant women in south-eastern Tanzania. *BMC Pregnancy and Childbirth, 12*(1), 16. https://doi.org/10.1186/1471-2393-12-16

Grupo de Información en Reproducción Elegida, A. C. (GIRE). (2021). Aborto legal y seguro. In *Omisión e indiferencia: Derechos reproductivos en México* (1st ed., pp. 16–66). GIRE. https://informe.gire.org.mx/

Harper, C., Jones, N., Marcus, R., Bantebya, G., & Ghimire, A. (2018). *Empowering adolescent girls in developing countries: Gender justice and norm change* (Caroline Harper, N. Jones, R. Marcus, G. Kyomuhendo Bantebya, & A. Ghimire (eds.); 1st ed.). London, England: Routledge. https://doi.org/10.4324/9781315180250

He, Z., Zhang, C., Wang, S., Bishwajit, G., & Yang, X. (2021). Socio-economic determinants of maternal healthcare utilisation in Zambia: 1997–2014. *Inquiry, 58*(January), 1–14. https://doi.org/10.1177/00469580211067480

Heredia-Pi, I., Servan-Mori, E., Darney, B., Reyes-Morales, H., & Lozano, R. (2016). Measuring the adequacy of antenatal health care: A national cross-sectional study in Mexico. *Bulletin of the World Health Organization, 94*(6), 452–461. https://doi.org/10.2471/BLT.15.168302

Heredia-Pi, I., Serván-Mori, E., Reyes-Morales, H., & Lozano, R. (2013). Gaps in the continuum of care during pregnancy and delivery in Mexico. *Salud Publica de México*, *55*(Supl 2), S282–S288.

Instituto Nacional de Estadística, Geografia e Informática (INEGI). (2004). *Regiones socioeconómicas de México*. Clasificación de Entidades Federativas. https://sc.inegi.org.mx/niveles/

Instituto Nacional de Estadística, Geografia e Informática (INEGI). (2018). *Encuesta Nacional de la Dinámica Demográfica 2018 (ENADID): Diseño conceptual*.

Jacobson, L. E., Saavedra-Avendano, B., Fuentes-Rivera, E., Schiavon, R., & Darney, B. G. (2022). Travelling for abortion services in Mexico 2016–2019: Community-level contexts of Mexico City public abortion clients. *BMJ Sexual & Reproductive Health, 48*, e81–e87. https://doi.org/10.1136/bmjsrh-2021-201079

Kerber, K., de Graft-Johnson, J., Bhutta, Z., Okong, P., Starrs, A., & Lawn, J. (2007). Continuum of care for maternal, newborn, and child health: From slogan to service delivery. *The Lancet, 370*(9595), 1358–1369. https://doi.org/10.1016/S0140-6736(07)61578-5

Knaul, F., & Frenk, J. (2005). Health insurance in Mexico: Achieving universal coverage through structural reform. *Health Affairs, 24*(6), 1467–1476. https://doi.org/10.1377/hlthaff.24.6.1467

Knaul, F., González-Pier, E., Gómez-Dantés, O., García-Junco, D., Arreola-Ornelas, H., Barraza-Lloréns, M., Sandoval, R., Caballero, F., Hernández-Avila, M., Juan, M., Kershenobich, D., Nigenda, G., Ruelas, E., Sepúlveda, J., Tapia, R., Soberón, G., Chertorivski, S., & Frenk, J. (2012). The quest for universal health coverage: Achieving social protection for all in Mexico. *The Lancet, 380*(9849), 1259–1279. https://doi.org/10.1016/S0140-6736(12)61068-X

Knoke, D., Bohrnstedt, G., & Potter-Mee, A. (2002). *Statistics for social data analysis* (J. Tilden (ed.); 4th ed.). FE Peacock Publishers Itasca, IL.

Lê Cook, B., McGuire, T. G., & Zuvekas, S. H. (2008). Measuring trends in racial/ethnic health care disparities. *Medical Care Research and Review, 66*(1), 23–48. https://doi.org/10.1177/1077558708323607

Leftwich, H. K., & Alves, M. V. O. (2017). Adolescent pregnancy. *Pediatric Clinics of North America, 64*(2), 381–388. https://doi.org/10.1016/j.pcl.2016.11.007

Lhila, A., & Long, S. (2012). What is driving the black–white difference in low birthweight in the US? *Health Economics, 21*(3), 301–315. https://doi.org/10.1002/hec.1715

Li, Z., Patton, G., Sabet, F., Subramanian, S. V., & Lu, C. (2020). Maternal healthcare coverage for first pregnancies in adolescent girls: A systematic comparison with adult mothers in household surveys across 105 countries, 2000–2019. *BMJ Global Health, 5*(10), e002373. https://doi.org/10.1136/bmjgh-2020-002372

Magadi, M. A., Agwanda, A. O., & Obare, F. O. (2007). A comparative analysis of the use of maternal health services between teenagers and older mothers in sub-Saharan Africa: Evidence from Demographic and Health Surveys (DHS). *Social Science & Medicine, 64*(6), 1311–1325. https://doi.org/10.1016/j.socscimed.2006.11.004

Mothupi, M. C., Knight, L., & Tabana, H. (2018). Measurement approaches in continuum of care for maternal health: A critical interpretive synthesis of evidence from LMICs and its implications for the South African context. *BMC Health Services Research, 18*(1), 539. https://doi.org/10.1186/s12913-018-3278-4

Neal, S., Matthews, Z., Frost, M., Fogstad, H., Camacho, A., & Laski, L. (2012). Childbearing in adolescents aged 12–15 years in low resource countries: A neglected issue. New estimates from demographic and household surveys in 42 countries. *Acta Obstetricia et Gynecologica Scandinavica*, *91*(9), 1114–1118. https://doi.org/10.1111/j.1600-0412.2012.01467.x

Owolabi, O. O., Wong, K. L. M., Dennis, M. L., Radovich, E., Cavallaro, F. L., Lynch, C. A., Fatusi, A., Sombie, I., & Benova, L. (2017). Comparing the use and content of antenatal care in adolescent and older first-time mothers in 13 countries of west Africa: A cross-sectional analysis of Demographic and Health Surveys. *The Lancet Child & Adolescent Health, 1*(3), 203–212. https://doi.org/10.1016/S2352-4642(17)30025-1

Pankhurst, A., Negussie, N., & Mulugeta, E. (2016). *Understanding children's experiences of violence in Ethiopia: Evidence from young lives* (WP-2016–25; Innocenti Working Papers). United Nations. https://www.unicef-irc.org/publications/pdf/IWP_2016_25.pdf

Pastrana-Sámano, R., Heredia-Pi, I. B., Olvera-García, M., Ibáñez-Cuevas, M., Castro, F. De, Hernández, A. V., & Torres-Pereda, M. D. P. (2020). Adolescent friendly services: Quality assessment with simulated users. *Revista de Saúde Publicapublica*, *54*(36), 1–11. https://doi.org/10.11606/s1518-8787.2020054001812

Patrinos, H. (2018). *Returns to investment in education : A decennial review of the global literature* (No. 8402; World Bank Policy Research).

Patton, G. C., Sawyer, S. M., Santelli, J. S., Ross, D. A., Afifi, R., Allen, N. B., Arora, M., Azzopardi, P., Baldwin, W., Bonell, C., Kakuma, R., Kennedy, E., Mahon, J., McGovern, T., Mokdad, A. H., Patel, V., Petroni, S., Reavley, N., Taiwo, K., & Viner, R. M. (2016). Our future: A Lancet commission on adolescent health and wellbeing. *The Lancet, 387*(10036), 2423–2478. https://doi.org/10.1016/S0140-6736(16)00579-1

Pérez-Stable, E. J., & Webb Hooper, M. (2021). Acknowledgment of the legacy of racism and discrimination. *Ethnicity & Disease*, *31*(Suppl 1), 289–292. https://doi.org/10.18865/ed.31.S1.289

Piatt, J. (2021). Racial disparities in mortality after severe traumatic brain injury in childhood: Mediators identified by Oaxaca-Blinder decomposition of trauma registry data. *Injury Epidemiology, 8*(1), 1. https://doi.org/10.1186/s40621-020-00295-6

Rai, R. K. (2014). Tracking women and children in a continuum of reproductive, maternal, newborn, and child healthcare (RMNCH) in India. *Journal of Epidemiology and Global Health, 4*(3), 239–243. https://doi.org/10.1016/j.jegh.2013.12.006

Reynolds, H. W., Wong, E. L., & Tucker, H. (2006). Adolescents' use of maternal and child health services in developing countries. *International Family Planning Perspectives, 32*(1), 6–16. https://doi.org/10.1363/3200606

Sanhueza, A., Carvajal-Vélez, L., Mújica, O. J., Vidaletti, L. P., Victora, C. G., & Barros, A. J. D. (2021). SDG3-related inequalities in women's, children's and adolescents' health: An SDG monitoring baseline for Latin America and the Caribbean using national cross-sectional surveys. *British Medical Journal Open, 11*(8), e047779. https://doi.org/10.1136/bmjopen-2020-047779

Schiavon, R., & Troncoso, E. (2020). Inequalities in access to and quality of abortion services in Mexico: Can task-sharing be an opportunity to increase legal and safe abortion care? *International Journal of Gynecology & Obstetrics, 150*(S1), 25–33. https://doi.org/10.1002/ijgo.13002

Secretaría de Gobernación de México (SEGOB). (2016). 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, Pub. L. No. 007-SSA2–2016, 1.

Secretaría de Gobernación de México (SEGOB). (2016). 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, 24 2016.

Secretaría de Salud de México (SSa). (2021). *Lineamiento técnico para la atención del aborto seguro en México* (pp. 1–111). Gobierno de Mexico. https://www.gob.mx/cms/uploads/attachment/file/646958/LINEAMIENTO_AB_CNEGSR_OPS.pdf

Sen, B. (2014). Using the oaxaca–blinder decomposition as an empirical tool to analyze racial disparities in obesity. *Obesity, 22*(7), 1750–1755. https://doi.org/10.1002/oby.20755

Sen, B., Mennemeyer, S., & Gary, L. (2011). The relationship between perceptions of neighborhood characteristics and obesity among children. In M. Grossman & N. Mocan (Eds.), *Economic aspects of obesity* (1st ed., pp. 145–180). *National Bureau of Economic Research*.

Serván-Mori, E., Heredia-Pi, I., García-Cerecero, D., Nigenda, G., Sosa-Rubí, S. G., Seiglie, J., & Lozano, R. (2021a). Assessing the continuum of care for maternal health in Mexico, 1994–2018. *Bulletin of the World Health Organization, 99*(3), 190–200. https://doi.org/10.2471/BLT.20.252544

Serván-Mori, E., Juárez-Ramírez, C., Meneses-Navarro, S., Heredia-Pi, I., Armenta-Paulino, N., Orozco-Núñez, E., & Nigenda, G. (2022a). Ethnic disparities in effective coverage of maternal health care in Mexico, 2006–2018: A decomposition analysis. *Sexuality Research and Social Policy, in Press*. https://doi.org/10.1007/s13178-021-00685-5

Serván-Mori, E., Orozco-Núñez, E., Heredia-Pi, I., Armenta-Paulino, N., Wirtz, V., Meneses-Navarro, S., & Nigenda, G. (2021b). Public health insurance and ethnic disparities in maternal health-care: The case of vulnerable Mexican women over the last 25 years. *Health Policy and Planning, 36*(10), 1671–1680. https://doi.org/10.1093/heapol/czab119

Serván-Mori, E., Quezada-Sánchez, A. D., Sosa-Rubí, S. G., Heredia-Pi, I. B., & Lozano, R. (2022b). Intergenerational replication of teenage pregnancy and educational attainment in Mexico. *Archives of Sexual Behavior, 51*(5), 1–12. https://doi.org/10.1007/s10508-022-02309-4

Shitie, A., Assefa, N., Dhressa, M., & Dilnessa, T. (2020). Completion and factors associated with maternity continuum of care among mothers who gave birth in the last one year in Enemay district, Northwest Ethiopia. *Journal of Pregnancy, 2020*, 1–9. https://doi.org/10.1155/2020/7019676

Sinning, M., Hahn, M., & Bauer, T. K. (2008). The Blinder-Oaxaca decomposition for nonlinear regression models. *The Stata Journal, 8*(4), 480–492. https://doi.org/10.1177/1536867X0800800402

Sobanjo-ter Meulen, A., Munoz, F. M., Kaslow, D. C., Klugman, K. P., Omer, S. B., Vora, P., & Stergachis, A. (2019). Maternal interventions vigilance harmonization in low- and middle-income countries: Stakeholder meeting report. *Vaccine, 37*(20), 2643–2650. https://doi.org/10.1016/j.vaccine.2019.03.060

Starrs, A. M., Ezeh, A. C., Barker, G., Basu, A., Bertrand, J. T., Blum, R., Coll-Seck, A. M., Grover, A., Laski, L., Roa, M., Sathar, Z. A., Say, L., Serour, G. I., Singh, S., Stenberg, K., Temmerman, M., Biddlecom, A., Popinchalk, A., Summers, C., & Ashford, L. S. (2018). Accelerate progress—sexual and reproductive health and rights for all: Report of the Guttmacher-Lancet Commission. *The Lancet, 391*(10140), 2642–2692. https://doi.org/10.1016/S0140-6736(18)30293-9

StataCorp. (2021). *Stata Statistical Software: Release 17*. StataCorp LLC.

Taber, D. R., Robinson, W. R., Bleich, S. N., & Wang, Y. C. (2016). Deconstructing race and gender differences in adolescent obesity: Oaxaca-blinder decomposition. *Obesity, 24*(3), 719–726. https://doi.org/10.1002/oby.21369

Tran, T. K., Gottvall, K., Nguyen, H. D., Ascher, H., & Petzold, M. (2012). Factors associated with antenatal care adequacy in rural and urban contexts-results from two health and demographic surveillance sites in Vietnam. *BMC Health Services Research, 12*(1), 40. https://doi.org/10.1186/1472-6963-12-40

Tunçalp, Ö, Pena-Rosas, J. P., Lawrie, T., Bucagu, M., Oladapo, O. T., Portela, A., & Metin Gülmezoglu, A. (2017). WHO recommendations on antenatal care for a positive pregnancy experience—going beyond survival. *BJOG, 124*(6), 860–862. https://doi.org/10.1111/1471-0528.14599

United Nations (UN). (2016). *Annex IV: Final list of proposed Sustainable Development Goal indicators*.

United Nations Children's Fund (UNICEF). (2014). *A statistical snapshot of violence against adolescent girls*. https://data.unicef.org/resources/statistical-snapshot-violence-adolescent-girls/

United Nations Children's Fund (UNICEF). (2019). *Health equity report 2016: Analysis of reproductive, maternal, newborn, child and adolescent health inequities in Latin America and the Caribbean to inform policymaking*.

United Nations Development Programme (UNDP). (2021). *Regional human development report 2021 | Trapped: High inequality and low growth in Latin America and the Caribbean*.

Wang, W., & Hong, R. (2015). Levels and determinants of continuum of care for maternal and newborn health in Cambodia-evidence from a population-based survey. *BMC Pregnancy & Childbirth, 15*(62), 1–9. https://doi.org/10.1186/s12884-015-0497-0

Wooldridge, J. M. (2002). *Econometric analysis of cross section and panel data* (J. M. Wooldridge (ed.); 2nd ed., Vol. 58, Issue 2). The MIT Press.

World Health Organization (WHO). (2016). *WHO recommendations on antenatal care for a positive pregnancy experience* (1st ed.). World Health Organization.

World Health Organization (WHO). (2017). *WHO recommendations on maternal health: Guidelines approved by the WHO Guidelines Review Committee* (1st ed.). World Health Organization.

Yount, K. M., Krause, K. H., & Miedema, S. S. (2017). Preventing gender-based violence victimization in adolescent girls in lower-income countries: Systematic review of reviews. *Social Science & Medicine, 192*(November), 1–13. https://doi.org/10.1016/j.socscimed.2017.08.038

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