Inequalities in access to HIV and syphilis tests in prenatal care in Brazil

Desigualdades no acesso a testes para HIV e sífilis durante a assistência pré-natal no Brasil

Inequidades en el acceso a las pruebas de VIH y sífilis durante el cuidado prenatal en Brasil

Claudia Helena Soares de Morais Freitas [1]
Franklin Delano Soares Forte [1]
Maria Helena Rodrigues Galvão [2]
Ardigleusa Alves Coelho [3]
Angelo Giuseppe Roncalli [2]
Sonia Maria Ferreira Dias [4]

Abstract

This study aims to evaluate the social determinants of access to HIV and VDRL tests during pregnancy in Brazil. The dependent variables were based on prenatal care access: prenatal care appointments, no HIV and syphilis tests. The independent variables at the first level were formal education level, age, race, work and participation in the Family Income program conditional cash transfer program. The city-level variables were the human development index (HDI), Gini index, and indicators related to health services. An exploratory analysis was performed assessing the effect of each level through prevalence ratios (PR) calculation. A multilevel mixed-effect Poisson regression model was constructed for all outcomes to verify the effect of individual level and with both the individual and contextual levels. Regarding prenatal appointments, the main implicated factors were related to individual socioeconomic position (education level and participation in the Family Income Program conditional cash transfer program), however only HDI maintained significance for the city-level context. The city-level variance dropped from 0.049 to 0.042, indicating an important between-city effect. Regarding the outcomes performing tests in prenatal care, the worst conditions such as contextual (HDI > 0.694, p < 0.001; Gini index ≥ 0.521, p < 0.001) and individual (> 8 years of schooling, p < 0.001) showed a risk effect in the final model. Variables related to health services did not show significant effects. They were associated with individual socioeconomic position and a city-level contextual effect. These findings indicate the importance of strengthening HIV and syphilis infection control programs during pregnancy.

Health Services Accessibility; Prenatal Care; HIV; Syphilis; Vertical Infectious Disease Transmission

Correspondence
C. H. S. M. Freitas
Universidade Federal da Paraíba.
Rua Poeta Luis Raimundo Batista de Carvalho 357,
João Pessoa, PB 58037-530, Brasil.
chsmfreitas@hotmail.com

[1] *Universidade Federal da Paraíba, João Pessoa, Paraíba.*
[2] *Universidade Federal do Rio Grande do Norte, Natal, Brasil.*
[3] *Universidade Estadual da Paraíba, Campina Grande, Paraíba.*
[4] *Instituto de Higiene e Medicina Tropical, Universidade Nova de Lisboa, Lisboa, Portugal.*

Introduction

Vertical transmission of both HIV and congenital syphilis from mother-to-child continue to be a public health concern around the world. Among the health targets that were established by the Millennium Development Goals (MDGs), the MDG 6 defines actions to halt and begin to reverse the AIDS epidemic, in addition to eliminating vertical transmission.

Globally, 44% of pregnant women in low- and middle-income countries received HIV testing and counseling in 2013, up from 26% in 2009 [1]. In Brazil, 37% of pregnant women had HIV tests in 2008, up from 28% in 2004 [2]. The Global Plan was launched in 2011 towards eliminating new born HIV infections, but further efforts are needed to reach the Global Plan's target of reducing new infections among children in 90% by 2015 [3].

Some key actions are recommended to reduce the number of HIV infected children: providing HIV testing, counseling and antiretroviral medicines in a timely manner to HIV-infected pregnant women to prevent transmission to their children.

Therefore, program advisers are now recommending that countries decentralize services to the lowest levels and include equitable considerations, in order to target vulnerable women when developing strategies for scaling up interventions [4,5].

In Brazil, the health policy for AIDS and congenital syphilis includes the *Operational Plan for Vertical Transmission Reduction of HIV and Syphilis*, published in 2007 [6], which outlines specific actions and goals to improve control of these diseases, including increasing HIV and syphilis test coverage in prenatal care. Several government initiatives have performed tests, medications, infant formula feeding and care routines available for managing HIV during pregnancy, delivery and the postpartum period since the end of the 1990s. The government expanded access and care routines for women, newborns and children, in addition to offering the diagnosis of HIV and syphilis (rapid tests) for pregnant women [7].

Access to health care, prenatal care and tests for HIV and syphilis diagnosis are influenced by socioeconomic factors and are unequally distributed in populations. Studies show problems in carrying out simple actions to prevent vertical transmission of AIDS and syphilis, even in women who accomplish the prenatal appointments [8]. Furthermore, the need to include mother-to-child transmission prevention of hiv and syphilis testing and treatment in prenatal care services has been suggested [9,10]. Other studies have shown the influence of individual factors, such as employment status, education status, age and race to access the prevention of vertical transmission of HIV services [11,12], but these are inadequate to explain the distribution among populations. Some studies found associations between contextual variables and inequities in health care access [13,14], maternal health care service utilization [15] and effects of a conditional cash transfer program on childhood mortality [16].

Local studies in hospitals and in primay health care [17,18,19,20,21] have indicated that HIV testing coverage has increased in all Brazilian regions. However, these results were from studies implemented only in a municipal or state scope. Only one study has been found in Brazil with national coverage in hospitals [11], while no studies with national coverage in primary health care were found.

Despite the contributions on the subject, few nationwide studies have examined the relationship between access to HIV and syphilis tests in prenatal care and social context. Thus, considering the importance of context in explaining inequalities of access to health services, there are few studies using multilevel analyses focusing on prenatal care. This study aims to evaluate the social determinants of access to HIV and VDRL tests during pregnancy in Brazil, assessing whether inequalities in using health services are expressed at individual and contextual levels through a nationwide survey that was conducted in primary health care in 2013-2014.

Methods

Study area

This study used the database from the Brazilian National Program to Improve Access and Quality in Primary Care (PMAQ-AB) in Brazil, 2013. This survey was conducted by the Brazilian Ministry of Health in 5,211 cities throughout the country, including the 27 state capitals, representing 93.5% of Brazilian cities in 2013-2014. Further details about the PMAQ-AB in Brazil have been reported in other studies [20,21,22,23].

Study population and sample

This study population consisted of 13,020 users who met the following criteria: not being assisted for the first time, as well as not spending more than twelve months without attendance, and women with children up to two years old. From these, 9,945 (76.4%) had prenatal appointments in health primary services units, while 3,075 (23.6%) did not have prenatal appointments in primary service health units and were, therefore, excluded from this study, as they did not fit the scope of this analysis.

Study variables and data sources

• **Dependent variables**

The dependent variables were prenatal care access: prenatal care appointments, HIV and syphilis tests for detection in prenatal care. Data on prenatal care were obtained from the 2nd cycle of the Brazilian National Program to Improve Access and Quality in Primary Care (2nd PMAQ-AB cycle) in Brazil, external evaluation cycle, that was held between 2013 and the first half of 2014 (http://dab.saude.gov.br/portaldab/ape_pmaq.php). The criteria for assessing the prenatal care were based on the Brazilian Ministry of Health protocols, which recommend that prenatal care should begin by the 12th gestational week [7] with a minimum of six appointments during follow-up, performing both HIV serological test and venereal disease research laboratory (VDRL) test.
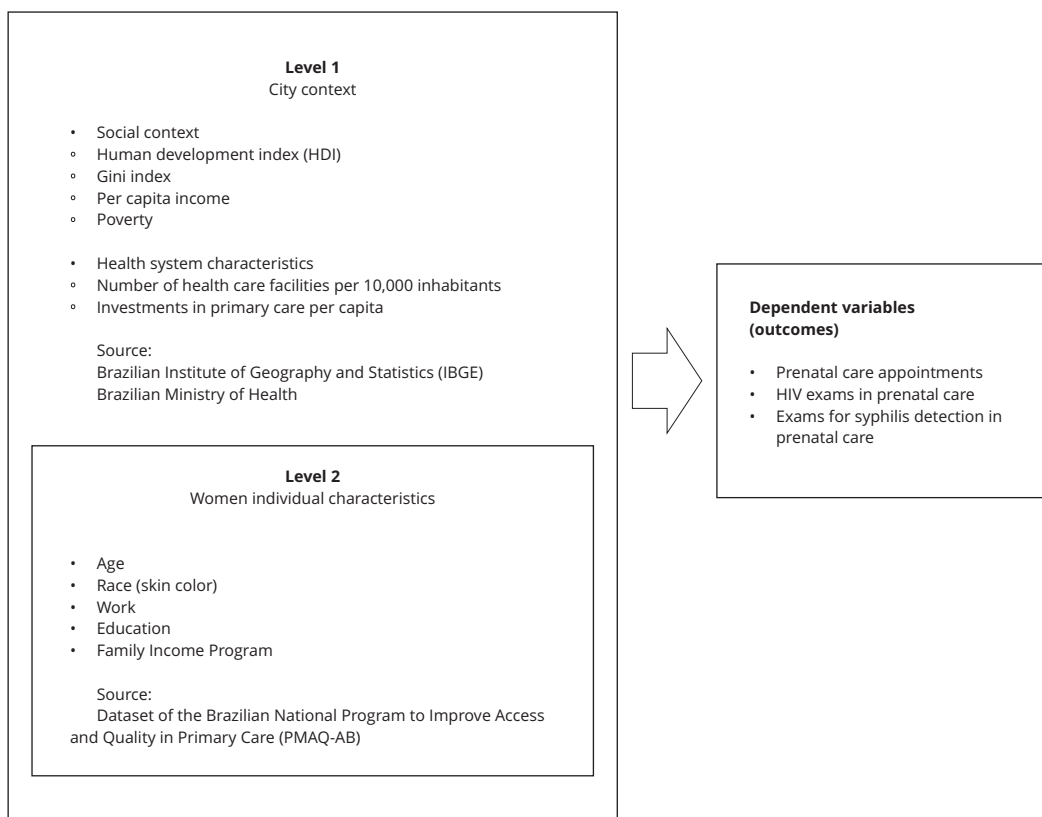
• **Independent variables**

The individual variables are related to women social characterics. The social characteristic variables were obtained through questionnaire applied to women who had children under 24 months old. The data collected included: age, race, work, formal education level and participation in the conditional Family Income Program.

The contextual indicators included socioeconomic and health services-related indicators. They were obtained from several databases from the National Demographic Census carried out in 2010 by the Brazilian Institute of Geography and Statistics (IBGE). Per capita income is an indicator used to identify the degree of economic development of a country or region. It is the ratio obtained from the sum of the whole population salaries per total of inhabitants. The poverty proportion is the quantity of inhabitants with monthly family income per person below BRL 140 in 2010 divided by the population in the same year. The Gini index is used to measure social inequality through income distribution. The human development index was transcribed from the *Human Development Atlas* provided by the Brazilian agency of United Nations Development Program (http://www.pnud.org.br). The human development index (HDI) is a composite indicator that includes the education level, longevity and income, and it is usually used by the United Nations for comparing the quality of life level at an international basis. The same method used worldwide was applied to all municipalities in Brazil.

Indicators related to health services were obtained from the Brazilian Health Informatics Department (http://www.datasus.gov.br). The primary health care services are organized by the Family Health Program. The indicators related to the primary health care system refers to the number of health services and the investments in primary care in municipalities: quantity of health care facilities per 10,000 inhabitants and investments in primary care per inhabitant. Figure 1 shows all of these variables.

Figure 1

Levels of analysis and respective variables and sources in the 2nd cycle of the Brazilian National Program to Improve Access and Quality in Primary Care (2nd PMAQ-AB cycle), 2013.

Level 1
City context

- Social context
  - Human development index (HDI)
  - Gini index
  - Per capita income
  - Poverty

- Health system characteristics
  - Number of health care facilities per 10,000 inhabitants
  - Investments in primary care per capita

  Source:
  Brazilian Institute of Geography and Statistics (IBGE)
  Brazilian Ministry of Health

Level 2
Women individual characteristics

- Age
- Race (skin color)
- Work
- Education
- Family Income Program

  Source:
  Dataset of the Brazilian National Program to Improve Access and Quality in Primary Care (PMAQ-AB)

Dependent variables (outcomes)

- Prenatal care appointments
- HIV exams in prenatal care
- Exams for syphilis detection in prenatal care

Data analysis

The data analysis was performed using version 20.0 of the statistical software SPSS (https://www.ibm.com/) for the analyses. The three outcomes were initially analyzed according to the independent variables at both levels, namely individual and contextual (city). The prevalence is depicted in absolute and relative values in each category and the effect was estimated through the prevalence ratios (PR) and their respective 95% confidence intervals (95%CI). Variables with significant associations in this bivariate analysis were fit in a multilevel mixed-effect Poisson regression model. In the first step, the contextual effect was evaluated from a null model using the likelihood ratio (LR) test to verify the significance, and afterwards two models were tested with only the individual level and with both the individual and contextual levels.

Poisson modelling has been used in several studies to estimate adjusted PR from categorical outcomes. We chose multilevel Poisson regression models with robust standard errors because they are a good alternative to estimate such PR. Logistic regressions must be avoided since this would have implied estimations of odds ratios (OR) as a risk measure, and OR are not the most suitable measure when the prevalence of the variable is higher than 15%. In addition, controlling for confounding variables is not equivalent for the two measures [24].

Ethical clearance

Ethical clearance was not required because the data obtained from the Brazilian National Health Information System of the Ministry of Health were public, aggregated and anonymous. Written consent was not obtained because the data were public and aggregated at municipal level. This study was based on secondary data obtained from publicly available datasets (http://dab.saude.gov.br/portaldab/ape_pmaq.php), therefore, it did not require ethical approval. The individual data came from the public database of the PMAQ-AB approved by the Ethics Committee of the Federal University of Rio Grande do Sul under the protocol n. 21904. Patient information was anonymous and de-identified prior to analysis.

Results

Table 1 shows results for bivariate analysis regarding the three outcomes studied related to both individual and contextual covariates. For the variable "having less than six prenatal care appointments", significant associations for education level (years of schooling) and participation in cash transfer programs were observed as individual effects. All contextual effects except the Gini index showed significant associations. "Do not perform HIV tests in prenatal care" and "do not perform syphilis detection tests in prenatal care" were significantly associated with both individual and contextual variables, except for "health care facilities per 10,000 inhabitants".

In order to verify the combined effect of both individual and contextual covariates, all variables with significant associations were fit into a two-level multilevel analysis with mixed effects. As the first step, all outcomes were fitted in a null model to verify the contextual effect. Additionally, collinearity analysis of the explanatory variables was also performed, showing that "per capita income" and "percentage of poverty" were highly correlated, between them and with HDI, and thus they were excluded from the multiple analysis. In Tables 2, 3 and 4, it is possible to observe that there were significant effects of context (city level) for all outcomes, as the LR test was significant for all of them. We then performed a multilevel analysis from these null models including both contextual and individual levels.

Tables 2, 3 and 4 show results for these models according to the three outcomes. Considering "having less than six prenatal care appointments" (Table 2), model 1 with only individual level reveals that education and enrollment in cash transfer programs remained significant. These two variables maintained significance in the full model when the contextual variables were included. Only HDI representing the contextual effect maintained significance. The city-level variance dropped from 0.049 to 0.042 indicating an important between-city effect.

Regarding the outcomes related to absence of tests in prenatal care (HIV and syphilis detection), the results of multilevel analysis were quite similar (Tables 3 and 4). In relation to the contextual effects, the variables that represent health care services (population rate of health care facilities and investments in primary care) lost their significance in the full model, while HDI and the Gini index remained significant. Considering the individual effects, educational level was significant for both outcomes.

It is also important to emphasize the direction of the effects in the final models. For the outcome "having less than six prenatal care appointments", HDI and enrollment in cash transfer programs presented a protective effect, which means that women enrolled in cash transfer programs and also living in cities with low HDI had a higher probability to be assisted with a higher number of appointments in prenatal care. Conversely, having low education level could represent higher chance to not achieve the ideal number of prenatal care appointments. Nevertheless, for the outcomes related to performing tests in prenatal care, the worst conditions, such as contextual (HDI > 0.694, $p < 0.001$; Gini index $\geq$ 0.521, $p < 0.001$) and individual (> 8 years of schooling, $p < 0.001$), showed a risk effect.

Table 1

Bivariate associations between outcomes and the independent variables according to the levels in the 2nd cycle of the Brazilian National Program to Improve Access and Quality in Primary Care (2nd PMAQ-AB cycle), 2013.

	Outcomes								
	Less than 6 prenatal care appointments			No HIV tests in prenatal care			No tests for syphilis detection in prenatal care		
	n (%)	PR (95%CI)	p-value	n (%)	PR (95%CI)	p-value	n (%)	PR (95%CI)	p-value
Individual level									
Age (years)									
15-19	203 (19.4)	1.00		97 (8.0)	1.00		231 (21.1)	1.00	
20-29	839 (17.9)	0.93 (0.81; 1.06)	0.143	302 (5.5)	0.69 (0.55; 0.86)	< 0.001	657 (13.1)	0.62 (0.54; 0.71)	< 0.001
30 and more	422 (16.8)	0.87 (0.75; 1.01)	0.067	106 (3.5)	0.43 (0.33; 0.57)	< 0.001	229 (8.2)	0.39 (0.33; 0.46)	< 0.001
Race (skin color)									
White	391 (17.1)	1.00		104 (3.7)	1.00		260 (10.2)	1.00	
Black or mixed	1,030 (17.9)	1.04 (0.94; 1.16)	0.439	386 (5.7)	1.53 (1.24; 1.89)	< 0.001	824 (13.3)	1.30 (1.14; 1.49)	< 0.001
Education (years of schooling)									
8 and above	971 (16.7)	1.00		281 (4.0)	1.00		669 (10.4)	1.74 (1.56; 1;95)	< 0.001
Up to 8	493 (20.5)	1.23 (1.12; 1.36)	< 0.001	223 (8.0)	1.97 (1.66; 2.34)	< 0.001	447 (18.1)		
Work									
Yes	347 (17.5)	1.00		103 (4.2)	1.00		223 (10.0)	1.00	
No	1,117 (17.8)	1.02 (0.91; 1.14)	0.743	402 (5.5)	1.23 (1.05; 1.60)	0.016	894 (13.4)	1.34 (1.17; 1.54)	< 0.001
Family Income Program									
No	820 (19.2)	1.00		213 (4.1)	1.00		539 (11.3)	1.00	
Yes	642 (16.2)	0.84 (0.77; 0.93)	< 0.001	290 (6.3)	1.53 (1.28; 1.81)	< 0.001	576 (14.0)	1.24 (1.11; 1.38)	< 0.001
City level									
HDI									
0.695 and above	771 (21.0)	1.00		162 (3.6)	1.00		412 (9.8)	1.00	
Up to 0.694	691 (15.2)	0.76 (0.66; 0.79)	< 0.001	342 (6.6)	1.84 (1.53; 2.20)	< 0.001	704 (15.0)	1.52 (1.36; 1.71)	< 0.001
Gini index									
Up to 0.520	726 (17.2)	1.00		216 (4.3)	1.00		483 (10.6)	1.00	
0.521 and above	736 (18.4)	1.07 (0.97; 1.17)	0.156	288 (6.1)	1.41 (1.19; 1.68)	< 0.001	633 (14.6)	1.38 (1.24; 1.54)	< 0.001
Per capita income (BRL)									
554 and more	782 (21.3)	1.00		157 (3.5)	1.00		405 (9.7)	1.00	
Up to 553.99	680 (14.9)	0.70 (0.64; 0.77)	< 0.001	347 (6.6)	1.91 (1.59; 2.30)	< 0.001	711 (15.0)	1.55 (1.38; 1.74)	< 0.001
Poverty									
Up to 13.7%	764 (21.0)	1.00		144 (3.2)	1.00		372 (8.9)	1.00	
13.8% and above	698 (15.2)	0.72 (0.66; 0.79)	< 0.001	360 (6.9)	2.15 (1.78; 2.59)	< 0.001	744 (15.7)	1.77 (1,57; 1.99)	< 0.001
Health care facilities per 10,000 inhabitants									
1.46 and above	693 (16.4)	1.00		250 (5.1)	1.00		538 (12.0)	1.00	
Up to 1.45	768 (19.4)	1.18 (1.08; 1.30)	< 0.001	249 (5.2)	1.03 (0.87; 1.23)	0.706	571 (13.0)	1.01 (0.97; 1.21)	0.133
Investments in primary care (BRL per capita)									
38.48 and above	724 (16.4)	1.00		301 (5.9)	1.00		620 (13.4)	1.00	
Up to 38.47	737 (19.3)	1.17 (1.07; 1.29)	0.001	203 (4.4)	0.75 (0.63; 0.89)	0.001	496 (11.6)	0.87 (0.78; 0.97)	0.015

95%CI: 95% confidence interval; HDI: human development index; PR: prevalence ratio.

Table 2

Multilevel mixed-effect Poisson regression analysis for the outcome "having less than six prenatal care appointments" in the 2nd cycle of the Brazilian National Program to Improve Access and Quality in Primary Care (2nd PMAQ-AB cycle), 2013.

	Null model (n = 8,238)		Model 1 (n = 8,226)		Model 2 (n = 8,186)	
	PR (95%CI)	p-value	PR (95%CI)	p-value	PR (95%CI)	p-value
City level						
HDI up to 0.694					**0.72** (0.63; 0.82)	< 0.001
Gini index 0.521 and more					1.10 (0.98;1 .23)	0.093
Health care facilities/Inhabitants up to 1.45					1.09 (0.97; 1.23)	0.148
Ivenstiments in primary care per capita up to BRL 38.47					0.95 (0.82; 1.08)	0.429
Individual level						
Up to 8 years of schooling			**1.31** (1.17; 1.46)	< 0.001	**1.32** (1.18; 1.48)	< 0.001
Family Income Program (enrolled)			**0.79** (0.71; 0;88)	< 0.001	**0.85** (0.76; 0.95)	0.003
Fixed effects: intercept (95%CI)	-1.75 (-1.81; -1.69)		-1.72 (-1.81; -1.64)		-1.65 (-1.78; -1.51)	
Random effects	**Variance (95%CI)**		**Variance (95%CI)**		**Variance (95%CI)**	
City level	0.049 (0.015; 0.162)		0.045 (0.013; 0.160)		0.042 (0.013; 0.130)	
LR test (χ^2; p-value)	3.78; 0.026		3.40; 0.033		5.02; 0.012	

95%CI: 95% confidence interval; HDI: human development index; LR: likelihood ratio; PR: prevalence ratio.

Notes: significant values are in bold. Model 1 for the individual variables only, model 2 for individual and city levels.

Table 3

Multilevel mixed-effect Poisson regression analysis for the outcome "no HIV tests in prenatal care" in the 2nd cycle of the Brazilian National Program to Improve Access and Quality in Primary Care (2nd PMAQ-AB cycle), 2013.

	Null model (n = 9,749)		Model 1 (n = 9,518)		Model 2 (n = 9,515)	
	PR (95%CI)	p-value	PR (95% CI)	p-value	PR (95%CI)	p-value
City level						
HDI up to 0.694					**1.59** (1.22; 2.06)	< 0.001
Gini index 0.521 and more					**1.48** (1.21; 1.82)	< 0.001
Ivenstiments in primary care per capita up to BRL 38.47					1.03 (0.81; 1.31)	0.799
Individual level						
Black or mixed			**1.39** (1.11; 1.74)	0.004	**1.26** (1.01; 1.58)	0.043
Up to 8 years of schooling			**1.79** (1.48; 2.16)	< 0.001	**1.78** (1.47; 2.16)	< 0.001
Do not work			1.13 (0.90; 1.42)	0.277		
Familiy Income Program (enrolled)			**1.22** (1.01; 1.48)	0.041	1.12 (0.92; 1.36)	0.266
Fixed effects: intercept (95%CI)	-3.23 (-3.38; -3.08)		-3.88 (-4.17; -3.59)		-4.15 (-4.49; -3.81)	
Random effects	**Variance (95% CI)**		**Variance (95%CI)**		**Variance (95%CI)**	
City level	0.690 (0.463; 1.027)		0.619 (0.403; 0.950)		0.564 (0.358; 0.888)	
LR test (χ^2; p-value)	43.87; < 0.001		36.66; < 0.001		30.70; < 0.001	

95%CI: 95% confidence interval; HDI: human development index; LR: likelihood ratio; PR: prevalence ratio.

Notes: significant values are in bold. Model 1 for the individual variables only, model 2 for individual and city levels.

Table 4

Multilevel mixed-effect Poisson regression analysis for the outcome "no tests for syphilis detection in prenatal care" in the2nd cycle of the Brazilian National Program to Improve Access and Quality in Primary Care (2nd PMAQ-AB cycle), 2013.

	Null model (n = 8,904)		Model 1 (n = 8,705)		Model 2 (n = 8,700)	
	PR (95%CI)	p-value	PR (95%CI)	p-value	PR (95%CI)	p-value
City level						
HDI up to 0.694					1.39 (1.18; 1.64)	< 0.001
Gini index 0.521 and more					1.39 (1.22;1.59)	< 0.001
Ivenstiments in primary care per capita up to BRL 38.47					1.12 (0.97; 1.31)	0.130
Individual level						
Age group 20-29 years			0.62 (0.53; 0.73)	< 0.001	0.62 (0.53; 0.73)	< 0.001
Age group 30 years and more			0.37 (0.31; 0.45)	< 0.001	0.38 (0.31; 0.46)	< 0.001
Black or mixed			1.19 (1.03; 1.37)	0.016	1.11 (0.96; 1.28)	0.152
Up to 8 years of schooling			1.71 (1.50; 1.94)	< 0.001	1.70 (1.50; 1.93)	< 0.001
Do not work			1.07 (0.91; 1.25)	0.400		
Family Income Program (enrolled)			1.17 (1.03; 1.34)	0.015	1.10 (0.97; 1.25)	0.139
Fixed effects: intercept (95%CI)	-2.16 (-2.24; -2.08)		-2.05 (-2.27; -1.82)		-2.33 (-2.57; -2.01)	
Random effects	**Variance (95%CI)**		**Variance (95%CI)**		**Variance (95%CI)**	
City level	0.259 (0.167; 0.404)		0.166 (0.089 ;0.309)		0.141 (0.070; 0.282)	
LR test (χ^2; p-value)	38.00; < 0.001		16.19; < 0.001		12.63; < 0.001	

95%CI: 95% confidence interval; HDI: human development index; LR: likelihood ratio; PR: prevalence ratio.

Notes: significant values are in bold. Model 1 for the individual variables only, model 2 for individual and city levels.

Discussion

This study assessed the individual and contextual determinants of access to tests for HIV and syphilis in prenatal care in Brazil. The indicators used of having less than six prenatal care appointments, having no HIV tests in prenatal care, and no tests for syphilis detection in prenatal care represent essentially graded levels of access to health services, as well as the quality of such services.

Prenatal care appointments must be performed in primary healthcare. In Brazil, the protocols of the Ministry of Health [6,7,25] recommend that prenatal care should begin at 12th gestational week, with a minimum of six appointments during follow-up. Furthermore, there should be two HIV and syphilis serological tests during pregnancy. These appointments provide multiple opportunities to offer HIV and VDRL counseling and testing. Some studies [12,26,27] have reported that several other strategies are needed for pregnant women to accept HIV testing, such as counseling for HIV and syphilis testing, invitation cards to the male partners with syphilis screening and concomitant treatment. In this study, the distribution of the three outcomes was highly influenced by the socioeconomic position at individual level, which remained significant even after accounting for contextual effects.

Among individual level characteristics, the variable "having less than six prenatal care appointments" was associated with educational level and enrollment in cash transfer programs. In other words, irrespective of the contextual situation, being a woman with less than 8 years of schooling, no work, and participating in cash transfer programs emerges to be the best predictor to access prenatal care.

Conditional cash transfer programs are interventions that transfer cash from governments to poor households with the requirement that parents abide and keep focused on health and education for their children. The conditional cash transfer programs are becoming an important strategy for alleviating poverty and to reduce inequalities in low-income and middle-income in some countries, and the conditions encourage the use of existing health and education services. In Brazil, the Bolsa

Familia program reached all 5,565 Brazilian municipalities (approximately 25% of the Brazilian population) and enrolled 13.6 million families in 2016 [16].

Low level of education and income, access to health services, absence of prenatal care, sexual orientation, multiplicity of sexual partners, history of sexually transmitted diseases (STD), irregular use of condoms, and being a woman have been shown to be relevant to the risk of HIV transmission and it is a challenge regarding prevention, treatment and effectiveness of public policies in response to these demands [28,29,30,31].

All of these women in this study are potentially dependent on the Brazilian Unified National Health System (SUS) for prenatal care, as they cannot afford private services. In Brazil, the use of the health service is often associated with socioeconomic variables [11,14,32]. Thus, in the equity perspective, it is important to include this population with greater social vulnerability, including childbearing age women and their families, in prevention, promotion, monitoring and follow-up actions regarding sexual and reproductive health by the family health team [30,33].

The importance of prenatal care and an adequate number of appointments has already been demonstrated in other studies [11,18,34,35], thus enabling timely implementation of care protocols for preventing vertical transmission.

These results also reveal inequalities in access to prenatal care. The higher risk of inadequate quantity of appointments in prenatal care was observed among women with less education and enrolled in cash transfer program. Similar inequalities have been described in other studies in Africa [15] and India [36]. Thus, poor Brazilian women are not likely to carry out the adequate quantity of appointments in prenatal care.

At the city level, only the HDI maintained significance. The likelihood of having less than six prenatal care appointments was more observed among women who live in cities with high HDI, where 21% of women have less than six appointments, while this percentage is lower (15.2%) in low HDI municipalities. In other words, primary care utilization is most frequently used by the poorest population, so these women are potentially more dependent on the health system. The government policies are aimed at increasing access, especially in primary health care through the Family Health Program. Thus, it has helped to improve equity in health care access in Brazil [37], and consequently there is a more equitable use in areas covered by the Family Health Program [38].

Prenatal care services are the key to eliminating mother-to-child transmission of both HIV and syphilis through counseling and testing in pregnant women. Regarding the outcomes of absence of tests in prenatal care (HIV and syphilis detection), the individual effect remained significant, especially concerning the educational level, but there was also a contextual effect at the city level. In both cases, the likelihood of absence of HIV and syphilis tests was more observed among women living in cities with low HDI, and with greater income inequality (Gini index). Inequalities have been described in other studies related to socioeconomic indicators in Africa [15,26] and India [36].

The Brazilian Ministry of Health recommends a second serological test for HIV and syphilis [6,25], while the World Health Organization (WHO) [39] suggests a serological test for syphilis and HIV for more than 90% of pregnant women; nevertheless, the Pan American Health Organization (PAHO) [40] proposes a coverage of 95%. The frequency of tests in Brazil depends on the country's regions [11,18,41].

In Brazil, it is recommended to request HIV and syphilis tests during the prenatal care. The serological HIV and syphilis tests are performed in secondary care. Studies in Spain, Brazil and Colombia also demonstrated that there is inequality in health care among care levels. The inequity in health care utilization is more concentrated in the secondary level [13,14,42,43]. Studies in Brazil also showed difficulties in implementing rapid tests in primary care [33,44,45]. The different results might be explained by the long waiting barrier to access secondary care in the brazilian healthcare system [13,43].

It is suggested to increase the offer of rapid tests in primary health care during prenatal care, as well as professional qualification for performing the tests and counseling, as well as access to treatment [46]. It is also necessary to qualify the information system to provide information on prenatal care and all exams performed by the pregnant woman at all levels of care in order to promote the integration of women's health policies, of STD-HIV, and the child [30,46], thus, reinforcing the role of primary care in care coordination. A systematic review of the literature on HIV testing in Europe [47] showed barriers at the patient level, at the health care provider level and institutional barriers at the policy level.

Elimination of mother-to-child transmission of both HIV and syphilis requires early access to quality prenatal care for all pregnant women, and a combined approach to these diseases is recommended by WHO to promote better mother and infant health [37].

A study in South Africa [48] suggests a lack of functional integration in the mother-to-child transmission of HIV and congenital syphilis prevention program in prenatal care. Quality improvement of these programs could make a difference in reducing maternal and infant morbidity and mortality caused by both syphilis and HIV. Studies have shown the importance of ensuring that syphilis and HIV screening are performed simultaneously on all pregnant women through an integrated program [9,10], besides the integration between the prevention program of mother-to-child transmission services, postnatal care – and other HIV care and treatment services for HIV-infected mothers and children – and HIV-exposed infants during post delivery [49]. In Brazil, the policy suggests integration between maternal health care and child care through the Stork Network Program to prevent vertical transmission of both HIV and syphilis [33,44].

Cuba was the first country to eliminate mother to child transmission of HIV and has shown that it is possible to implement the measures recommended by PAHO/WHO to prevent vertical transmission, such as: early access to prenatal care, HIV testing, treatment and breastfeeding substitution, as part of an equitable, accessible, and universal health system in which maternal and child health programs are integrated with HIV programs .

This study has some strengths and limitations. One of the strengths is the comprehensiveness of the survey with national coverage in primary health care from which the data were extracted. In addition, the independent variables in the city context were extracted from official national population censuses and Brazilian Ministry of Health databases. On the other hand, a possible selection bias cannot be excluded regarding the women included in this study, since only women who had prenatal care in the evaluated primary health care facilities were considered. Secondly, there is a memory bias because women who had children up to 2 years old were included.

The main results reported herein have important implications to public health, especially for prenatal care. A core principle of the SUS states that the distribution of health services must be based on equity, which means a positive discrimination in terms of priorities. The existence of inequalities in the access to HIV and syphilis tests in prenatal care are expressed at both the individual and city levels, and therefore requires more effort to reorganize the health care model.

Conclusions

Despite the increased prenatal coverage, the results reveal inequalities in access to prenatal care appointments and to HIV and syphilis tests. They were associated with individual socioeconomic position, mainly education, of Brazilian pregnant women. In addition to this individual effect, a city-level contextual effect represented by HDI and the Gini index was observed for the absence of tests in prenatal care (HIV and syphilis detection). There have been problems in implementing the recommendations of the protocols and the missed opportunity of tests during the prenatal care, which probably contribute to the vertical transmission of HIV and syphilis infection. Therefore, late diagnosis is an important factor in explaining the incidence of AIDS and syphilis in children and is one of the biggest obstacles to preventing the vertical transmission of HIV and syphilis. These findings indicate the importance of strengthening HIV and syphilis infection control programs during pregnancy.

Contributors

Additional informations

ORCID: Claudia Helena Soares de Morais Freitas (0000-0003-0265-5396); Franklin Delano Soares Forte (0000-0003-4237-0184); Maria Helena Rodrigues Galvão (0000-0003-1344-2863); Ardigleusa Alves Coelho (0000-0001-8869-3793); Angelo Giuseppe Roncalli (0000-0001-5311-697X); Sonia Maria Ferreira Dias (0000-0001-5085-0685).

Acknowledgments

References

1. Joint United Nations Programme on HIV/AIDS. The gap report 2014. Geneva: Joint United Nations Programme on HIV/AIDS; 2014.
2. Departamento de DST, Aids e Hepatites Virais, Secretaria de Vigilância em Saúde, Ministério da Saúde. Política brasileira de enfrentamento da aids: resultados, avanços e perspectivas. Brasília: Ministério da Saúde; 2012.
3. Joint United Nations Programme on HIV/AIDS. Countdown to zero. Global plan towards the elimination of new HIV infections among children by 2015 and keeping their mothers alive – 2011-2015. Geneva: Joint United Nations Programme on HIV/AIDS; 2010.
4. United Nations Children's Fund. Narrowing the gaps to meet the goals. New York: United Nations Children's Fund; 2010.
5. World Health Organization; United Nations Children's Fund. Accountability for maternal, newborn and child survival: the 2013 update. Geneva: WHO Press; 2013.
6. Secretaria de Vigilância em Saúde, Ministério da Saúde. Plano operacional de redução da transmissão vertical do HIV e da sífilis. Brasília: Ministério da Saúde; 2007.
7. Ministério da Saúde. Portaria nº 1.459/201,1 de 24 de junho de 2011. Institui no âmbito do Sistema Único de Saúde – SUS, a Rede Cegonha. Diário Oficial da União 2011; 25 jun.
8. Macedo VC, Bezerra AFB, Frias PG, Andrade CL. Evaluation of measures to prevent vertical transmission of HIV and syphilis in public maternity hospitals in four municipalities in Northeast Brazil. Cad Saúde Pública 2009; 25:1679-92.
9. Balira R, Mabey D, Weiss H, Ross DA, Changalucha J, Watson-Jones D. The need for further integration of services to prevent mother-to-child transmission of HIV and syphilis in Mwanza city, Tanzania. Int J Gynaecol Obstet 2015; 130 Suppl 1:S51-7.
10. Owiredu MN, Newman L, Nzomo T, Kafando GC, Sanni S, Shaffer N, et al. Elimination of mother-to-child transmission of HIV and syphilis: a dual approach in the African region to improve quality of antenatal care and integrated disease control. Int J Gynaecol Obstet 2015; 130 Suppl 1:S27-31.
11. Domingues RMSM, Szwarcwald CL, Souza Jr. PRB, Leal MC. Prenatal testing and prevalence of HIV infection during pregnancy: data from the "Birth in Brazil" study, a national hospital-based study. BMC Infect Dis 2015; 15:100.
12. NyondoAL, Choko AT, Chimwaza AF, Muula AS. Invitation cards during pregnancy enhance male partner involvement in prevention of mother to child transmission (PMTCT) of human immunodeficiency virus (HIV) in Blantyre, Malawi: a randomized controlled open label trial. PLoS One 2015; 10:e0119273.

13. Garcia-Subirats I, Vargas I, Mogollón-Pérez AS, De Paepe P, Silva MRF, Unger JP, et al Barriers in access to healthcare in countries with different health systems. A cross-sectional study in municipalities of central Colombia and northeastern Brazil. Soc Sci Med 2013; 106:204-13.

14. Garcia-Subirats I, Vargas I, Mogollón-Pérez AS, De Paepe P, Silva MRF, Unger JP, et al. Inequities in access to health care in different health systems: a study in municipalities of central Colombia and north-eastern Brazil. Int J Equity Health 2014; 13:10.

15. Ononokpono DN, Odimegwu CO, Imasiku E, Adedini S. Contextual determinants of maternal health care service utilization in Nigeria. Women Health 2013; 53:647-68.

16. Rasella D, Basu S, Hone T, Paes-Sousa R, Ocke-Reis CO, Millett C. Child morbidity and mortality associated with alternative policy responses to the economic crisis in Brazil: a nationwide microsimulation study. PLoS Med 2018; 15:e1002570.

17. Matida LH, Santos NJS, Ramos NA, Gianna MC, Silva MH, Domingues CS, et al. Eliminating Vertical Transmission of HIV in São Paulo, Brazil: progress and challenges. J Acquir Immune Defic Syndr 2011; 57 Suppl 3:S164-70.

18. Domingues RMSM, Hartz ZMA, Dias MAB, Leal MC. Avaliação da adequação da assistência pré-natal na rede SUS do Município do Rio de Janeiro, Brasil. Cad Saúde Pública 2012; 28:425-37.

19. Miranda AE, Rosetti Filho E, Trindade CR, Gouvêa GM, Costa DM, Ge Oliveira T, et al. Prevalência de sífilis e HIV utilizando testes rápidos em parturientes atendidas nas maternidades públicas de Vitória, Estado do Espírito Santo. Rev Soc Bras Med Trop 2009; 42:386-91.

20. Chrestani MAD, Santos IS, Cesar JA, Winckler LS, Gonçalves TS, Neumann NA. Assistência à gestação e ao parto: resultados de dois estudos transversais em áreas pobres das regiões Norte e Nordeste do Brasil. Cad Saúde Pública 2008; 24:1609-18.

21. Dal Fabbro MM, Cunha RV, Paniago AM, Lindenberg AS, Freitas GM, Nogueira SA. Prospective study on the prevention of vertical transmission of HIV in Campo Grande, Mato Grosso do Sul, Brazil, from 1996 to 2001. Braz J Infect Dis 2005; 9:20-7.

22. Ministério da Saúde. Programa Nacional de Melhoria do Acesso e da Qualidade da Atenção Básica (PMAQ-AB). Documento síntese para avaliação externa. Brasília: Ministério da Saúde; 2012.

23. Pinto HA, Sousa ANA, Ferla AA. O Programa Nacional de Melhoria do Acesso e da Qualidade da Atenção Básica: várias faces de uma política inovadora. Saúde Debate 2014; 38(N. Especial):358-72.

24. Espelt A, Dell'Olmo MM, Penelo E, Bosque-Prous M. Applied prevalence ratio estimation with different regression models: an example from a cross-national study on substance use research. Adicciones 2016; 14:105-12.

25. Departamento de Ações Programáticas e Estratégicas, Secretaria de Atenção à Saúde, Ministério da Saúde. Manual técnico pré-natal e puerpério: atenção qualificada e humanizada. Brasília: Ministério da Saúde; 2006.

26. Audureau E, Kahn JG, Besson MH, Saba J, Ladner J. Scaling up prevention of mother-to-child HIV transmission programs in sub-Saharan African countries: a multilevel assessment of site-, program- and country-level determinants of performance. BMC Public Health 2013; 13:286.

27. Ezeanolue EE, Obiefune MC, Ezeanolue CO, Ehiri JE, Osuji A, Ogidi AG, et al. Effect of a congregation-based intervention on uptake of HIV testing and linkage to care in pregnant women in Nigeria (baby shower): a cluster randomised trial. Lancet Glob Health 2015; 3:e692-700.

28. Ministério da Saúde. Relatório de progresso da resposta brasileira ao HIV/aids (2010-2011). Brasília: Ministério da Saúde; 2012.

29. Duarte MTC, Parada CMGL, Souza LR. Vulnerability of women living with HIV/AIDS. Rev Latinoam Enferm 2014; 22:68-75.

30. Acosta LMW, Gonçalves TR, Barcellos NT. Coinfecção HIV/sífilis na gestação e transmissão vertical do HIV: um estudo a partir de dados da vigilância epidemiológica. Rev Panam Salud Pública 2016; 40:435-42.

31. Barcellos C, Acosta LMW, Lisboa E, Bastos FI. Surveillance of mother-to-child HIV transmission: socioeconomic and health care cover age indicators. Rev Saúde Pública 2009; 43:1006-14.

32. Ocké-Reis CO, Marmor, TR. The Brazilian National Health System: an unfulfilled promise? Int J Health Plann Manage 2010; 25:318-29.

33. Costa CC, Freitas LV, Sousa DMN, Oliveira LL, Chagas ACMA, Lopes MVO, et al. Congenital syphilis in Ceará: epidemiological analysis of one decade. Rev Esc Enferm USP 2013; 47:152-9.

34. Rodrigues CS, Guimarães MDC, César CC. Missed opportunities for congenital syphilis and HIV perinatal transmission prevention. Rev Saúde Pública 2008; 42:851-8.

35. Veloso VG, Portela MC, Vasconcellos MT, Matzenbacher LA, Vasconcelos AL, Grinsztejn B, et al. HIV testing among pregnant women in Brazil: rates and predictors. Rev Saúde Pública 2008; 42:859-67.

36. Thamattoor U, Thomas T, Banandur P, Rajaram S, Duchesne T, Abdous B, et al. Multilevel analysis of the predictors of hiv prevalence among pregnant women enrolled in annual HIV sentinel surveillance in four states in Southern India. PLoS One 2015; 10:e0131629.

37. Macinko J, Lima-Costa MF. Horizontal equity in health care utilization in Brazil, 1998-2008. Int J Equity Health 2012; 11:33.

38. Fernandes LCL, Bertoldi AD, Barros AJD. Health service use in a population covered by the Estratégia de Saúde da Família (Family Health Strategy). Rev Saúde Pública 2009; 43:595-603.

39. World Health Organization. HIV operational plan 2012-2013. WHO's support to implement the Global Health Sector Strategy on HIV/AIDS. Geneva: World Health Organization; 2012.
40. Pan American Health Organization. Field guide for implementation of the strategy and plan of action for elimination of mother-to-child transmission of hiv and congenital syphilis in the Americas. Washington DC: Pan American Health Organization; 2014.
41. Araújo CL, Shimizu HE, Sousa AI, Hamann EM. Incidence of congenital syphilis in Brazil and its relationship with the Family Health Strategy. Rev Saúde Pública 2012; 46:479-86.
42. Garrido-Cumbrera M, Borrell C, Palència L, Espelt A, Rodríguez-Sanz M, Pasarín MI, et al. Social class inequalities in the utilization of health care and preventive services I Spain, a country with a national health system. Int J Health Serv 2010; 40:525-42.
43. Palència L, Espelt A, Rodríguez-Sanz M, Rocha KB, Pasarín MI, Borrell C. Trends in social class inequalities in the use of health care services within the Spanish National Health System, 1993-2006. Eur J Health Econ 2013; 14:211-9.
44. Lopes ACMU, Araújo MAL, Vasconcelos LDPG, Uchoa FSV, Rocha HP, Santos JR. Implantação dos testes rápidos para sífilis e HIV na rotina do pré-natal em Fortaleza – Ceará. Rev Bras Enferm 2016; 69:54-8.
45. Araújo EC, Monte PCB, Haber ANCA. Avaliação do pré-natal quanto à detecção de sífilis e HIV em gestantes atendidas em uma área rural do estado do Pará, Brasil. Rev Pan-Amazônica Saúde 2018; 9:33-9.
46. MacCarthy S, Hoffmann M, Nunn A, Silva LAV, Dourado I. Barriers to HIV testing, linkage to care, and treatment adherence: a cross-sectional study from a large urban center of Brazil. Rev Panam Salud Pública 2016; 40:418-26.
47. Deblonde J, De Koker P, Hamers FF, Fontaine J, Luchters S, Temmerman M. Barriers to HIV testing in Europe: a systematic review. Eur J Public Health 2010; 20:422-32.
48. Wiegert K, Dinh TH, Mushavi A, Mugurungi O, Kilmarx PH. Integration of prevention of mother-to-child transmission of HIV (PMTCT) postpartum services with other hiv care and treatment services within the maternal and child health setting in Zimbabwe, 2012. PLoS One 2014; 9:e98236.
49. Dinh TH, Kamb ML, Msimang V, Likibi M, Molebatsi T, Goldman T, et al. Integration of preventing mother-to-child transmission of hiv and syphilis testing and treatment in antenatal care services in the Northern Cape and Gauteng Provinces, South Africa. Sex Transm Dis 2013; 40:846-51.

Resumo

O estudo teve como objetivos avaliar os determinantes sociais do acesso a testes para HIV e sífilis (VDRL) durante a gravidez no Brasil. As variáveis dependentes foram definidas de acordo com o acesso à assistência pré-natal: consultas de pré-natal e testes para HIV e sífilis. As variáveis independentes no primeiro nível foram escolaridade, idade, raça, trabalho e participação no programa Bolsa Família. As variáveis de nível municipal foram o índice de desenvolvimento humano (IDH), índice Gini e indicadores relacionados aos serviços de saúde. Foi realizada uma análise exploratória do efeito de cada nível, através do cálculo de razões de prevalência (RP). Para verificar o efeito do nível individual sobre os níveis individual e contextual, foi construído um modelo multiníveis de regressão de Poisson para efeitos mistos para todos os desfechos. Com relação às consultas de pré-natal, os principais fatores implicados estiveram relacionados ao nível socioeconômico individual (escolaridade e participação no programa Bolsa Família); entretanto, no nível municipal, apenas o IDH manteve significância estatística. A variância no nível municipal diminuiu de 0,049 para 0,042, indicando um importante efeito intermunicipal. Quanto ao desfecho realização dos testes na assistência pré-natal, as piores condições, tais como a condição contextual (IDH > 0,694, p < 0,001; índice Gini ≥ 0,521, p < 0,001) e a individual (> 8 anos, p < 0,001) mostraram um efeito de risco no modelo final. As variáveis relacionadas aos serviços de saúde não mostraram efeitos significativos. Estiveram associadas ao nível socioeconômico individual e a um efeito contextual de nível municipal. Os achados indicam a importância do fortalecimento de programas de controle de HIV e sífilis durante a gravidez.

Acesso aos Serviços de Saúde; Cuidado Pré-Natal; HIV; Sífilis; Transmissão Vertical de Doença Infecciosa

Resumen

Este estudio tiene como fin evaluar los determinantes sociales en el acceso a las pruebas de VIH y VDRL durante el embarazo en Brasil. Las variables dependientes estaban basadas en el acceso al cuidado prenatal: citas durante el cuidado prenatal y pruebas de VIH y sífilis. Las variables independientes en el primer nivel fueron: nivel formal de educación, edad, raza, trabajo y participación en el programa Bolsa Familia. Las variables dentro del nivel de ciudad fueron: índice de desarrollo humano (IDH), índice de Gini, e indicadores relacionados con los servicios de salud. Se realizó un análisis exploratorio, evaluando el efecto de cada nivel mediante el cálculo de la razón de prevalencias (RP). Se construyó una regresión de Poisson multinivel con efectos mixtos para todos los resultados, con el fin de verificar el efecto del nivel individual y en ambos niveles: individual y contextual. En relación con las citas prenatales, los factores principales implicados se relacionaron con la situación socioeconómica individual (nivel de educación y participación en el Programa Bolsa Familia), sin embargo, sólo el IDH mantuvo una relevancia estadística relacionada con el contexto del nivel de la ciudad. La varianza de nivel-ciudad bajó de 0,049 a 0,042, indicando un importante efecto intraciudad. Respecto a los resultados de las pruebas realizadas durante el cuidado prenatal, las peores condiciones como las contextuales (IDH > 0,694, p < 0,001; índice de Gini ≥ 0,521, p < 0,001) e individual (> 8 años de escolarización, p < 0,001) mostraron un efecto riesgo en el modelo final. Las variables informadas a los servicios de salud no indicaron efectos significativos. Estuvieron asociadas con la situación individual socioeconómica y el efecto nivel ciudad contextual. Estos resultados indican la importancia del fortalecimiento de los programas de control de infección por VIH y sífilis durante el embarazo.

Accesibilidad a los Servicios de Salud; Atención Prenatal; VIH; Sífilis; Transmisión Vertical de Enfermedad Infecciosa