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Article

Correlation Between Adolescent Pregnancy and Social Determinants of Health in Ceará Between 2014 and 2023: An Ecological Study

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ABSTRACT
Adolescent pregnancy poses high risks for both pregnant adolescents and their babies, particularly in contexts of social vulnerability, and is a global public health problem. The objective of this study was to investigate the relationship between adolescent pregnancy and social determinants of health in the state of Ceará. This is an ecological study conducted using data obtained from SINASC, IBGE, and e-Gestor APS for the period from 2014 to 2023. A total of 202,241 cases of adolescent pregnancy were recorded, with Fortaleza accounting for 47,335 cases. The annual average number of cases was 20.224,1 ± 4.699,81, with an exponential decline observed over the years. The proportion of adolescent pregnancies relative to total pregnancies in Ceará fell from 20.70% in 2014 to 12.04% in 2023. Correlation analyses revealed significant associations between teenage pregnancy and socioeconomic, educational, and health variables. Despite these advances, teenage pregnancy remains a public health concern, requiring intersectoral policies and access to adequate health and education services.
Keywords: teenage pregnancy; social determinants of health; primary health care.

RESUMO
A gravidez na adolescência apresenta elevados riscos tanto para as gestantes quanto para os bebês, principalmente em contextos de vulnerabilidade social, sendo um problema de saúde pública global. O objetivo deste estudo foi investigar a relação entre gravidez na adolescência e determinantes sociais da saúde no estado do Ceará. Trata-se de um estudo ecológico, realizado com dados obtidos do SINASC, do IBGE e do e-Gestor APS, no período de 2014 a 2023. Foram registrados 202.241 casos de gravidez na adolescência, com Fortaleza destacando-se com 47.335 casos. A média anual de casos foi de 20.224,1 ± 4.699,81, observando-se um declínio exponencial ao longo dos anos. A proporção de gestações em adolescentes em relação ao total de gestações no Ceará caiu de 20,70% em 2014 para 12,04% em 2023. As análises de correlação revelaram associações significativas entre a gravidez na adolescência e variáveis socioeconômicas, educacionais e de saúde. Apesar dos avanços, a gravidez na adolescência ainda é uma preocupação de saúde pública, demandando políticas intersetoriais e acesso a serviços de saúde e educação adequados.
Palavras-Chave: gravidez na adolescência; determinantes sociais da saúde; atenção primária à saúde.

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Introduction

Adolescence is a transitional period between childhood and adulthood, characterized by intense physiological, behavioral, psychological, anatomical, and social changes (Bittar and Soares 2020), encompassing the age group of 10 to 19 years, while youth encompasses individuals aged 15 to 24 (Beckwith et al. 2024). In 2023, the global birth rate among adolescents aged 15 to 19 was estimated at 41.3 live births per 1,000 adolescents in this age group. In Latin America and the Caribbean, this rate was 51.4 per thousand, remaining among the highest in the world (WHO 2024). In Brazil, in the same year, 289,093 births were recorded among adolescents aged 15 to 19, accounting for 11.39% of all births in the country, in addition to 13,932 births among girls aged 10 to 14, equivalent to 0.55% of the total (Brazil 2025).

Although the incidence of teenage pregnancy has declined over the years in Brazil, the recurrence rate remains around 20% (Assis et al. 2022). Pregnancy at this stage of life can jeopardize the future prospects of adolescents and their children and contribute to the perpetuation of the cycle of poverty and the widening of social inequalities (Fernandes et al. 2024). From a psychosocial perspective, it can affect young women's educational and professional trajectories, reducing their chances of completing their studies and entering the formal labor market, in addition to being associated with lower incomes in adulthood (Ferreira et al. 2026).

Factors such as low educational attainment, limited access to quality health care, unfavorable socioeconomic conditions, and a lack of family support can increase the vulnerability of these adolescents and hinder reproductive planning and adequate prenatal care (Wellings et al. 2016). Added to these factors are inadequate prenatal care (Domingues et al. 2015), unintended pregnancy (Ajayi et al. 2021), and short intervals between pregnancies (Vieira et al. 2016).

Thus, adolescent pregnancy constitutes a global public health problem, being associated with maternal complications, such as anemia and preeclampsia/eclampsia, and adverse neonatal outcomes, such as preterm birth and low birth weight (Abate et al. 2025). These complications may be more pronounced in pregnancies occurring before age 15 or around the time of menarche, with repercussions for maternal and child health and for the life course of adolescents (Sámano et al. 2025).

In light of the repercussions of adolescent pregnancy, intersectoral health and education initiatives have been developed in Brazil. Among these, the Health in Schools Program (PSE) stands out, integrating health and education initiatives in the school setting, including those focused on sexual and reproductive health. In the context of maternal and child care, the Stork Network was established with the aim of expanding access to family planning and ensuring care during pregnancy, labor, childbirth, and childhood (Brazil 2014).

In Ceará, the PSE and the Stork Network have been developed with consideration for local particularities and regional disparities, within a context marked by socioeconomic inequalities and varying levels of social vulnerability (IPECE 2021). Understanding the social determinants of health associated with adolescent pregnancy is essential for informing prevention and care strategies tailored to the population's needs, given the influence of social, economic, and environmental conditions on health (Carrapato et al. 2017).

In this regard, the importance of an interdisciplinary approach that integrates health, education, social assistance, and public policies—while taking into account territorial and regional specificities—is highlighted. Thus, this study aimed to investigate the relationship between teenage pregnancy and the social determinants of health in the state of Ceará, considering socioeconomic, educational, and health access factors.

Methodology

This is a quantitative, retrospective, ecological study conducted between March and July 2025, using secondary data from the Information System on Live Births (SINASC) (Brazil 2025a), the Brazilian Institute of Geography and Statistics (IBGE) (IBGE 2022), and the e-Gestor Primary Health Care (e-Gestor APS) (Brazil 2025b), covering the period from 2014 to 2023. The data used are publicly available and were obtained through the official electronic platforms of the respective institutions, without the need for registration or authentication. The analysis focused on live births to adolescent mothers aged 10 to 19 residing in the state of Ceará, stratified into the age groups 10 to 14 and 15 to 19 years.

The information extracted from SINASC included the number of live births to adolescent mothers, the number of prenatal visits, type of delivery, gestational age, type of pregnancy, and the presence of congenital anomalies. A descriptive analysis was performed, presenting measures of central tendency, variability, and frequency distributions. To compare the distribution of the number of live births among independent groups defined by the categories of each pregnancy-related variable, the nonparametric *Kruskal–Wallis* test was used.

The annual percentage change in the number of live births was calculated relative to the immediately preceding year, with 2014 used as the reference year for the first change, corresponding to 2015.

The data obtained from the IBGE included socioeconomic and educational variables, namely: per capita household income, the Gini Index, the Human Development Index (HDI), the Basic Education Development Index (Ideb) for the final years of elementary and high school, and the proportion of households with internet access. It should be noted that the HDI was available through 2021 and was correlated with cases of teenage pregnancy up to that period. The IDEB was analyzed in alternate years (2015, 2017, 2019, 2021, and 2023), and correlations were performed with the cases corresponding to those years. Data on Estimated Potential Coverage of Primary Health Care (PHC) were obtained through the e-Gestor PHC system, using the indicator calculated based on the potential coverage capacity of the teams relative to the IBGE population estimate.

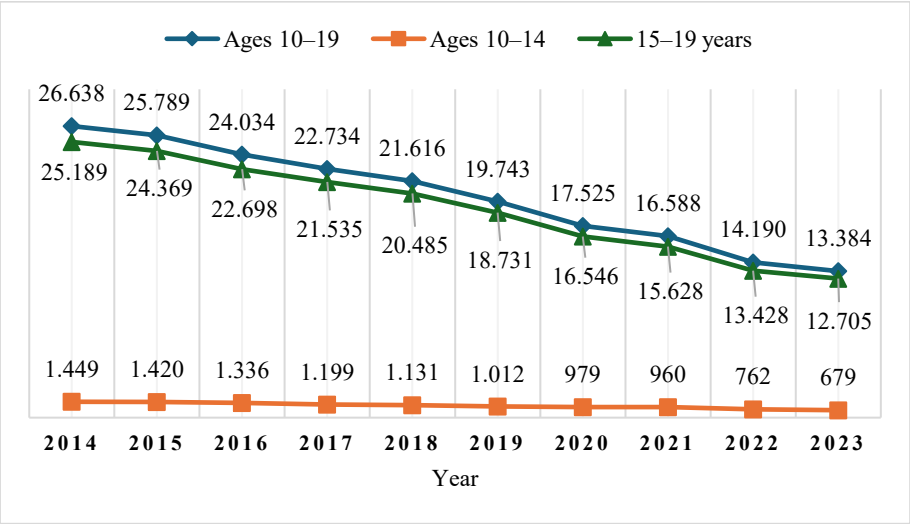
Prior to the correlation analyses, the normality of the data was assessed using the *Shapiro–Wilk* test. Variables with a normal distribution (per capita income, Gini index, proportion of households with internet access, Ideb, and HDI) were correlated with the number of live births to adolescent mothers using *Pearson's* correlation coefficient. For primary health care (PHC) coverage, which exhibited a non-normal distribution, *Spearman's* correlation coefficient was used. The analyses were performed using JASP *software*, version 0.19.3.0, with a 95% confidence level ($p < 0.05$).

Because the study used exclusively secondary, aggregated data in the public domain without individual identification of participants, it was exempt from review by a Research Ethics Committee, as provided for in Resolution No. 510/2016 of the National Health Council (Brazil 2016).

Results

Initially, the results are presented in general terms for the 10–19 age group, with the aim of characterizing the distribution of records during the analyzed period. Next, the analyses are presented stratified into two age groups—10 to 14 years and 15 to 19 years—examining separately maternal and gestational characteristics and their correlations with socioeconomic, educational, and health-care access variables.

Between 2014 and 2023, 202,241 live births to adolescent mothers aged 10 to 19 were recorded in Ceará. Fortaleza had the highest absolute number, with 47,335 records, corresponding to approximately 23.41% of the total observed in the state. During the period analyzed, the annual average was 20,224.1 (± 4,699.81) live births, with a median of 20,679.5. Over the course of the historical series, there was a reduction of approximately 49.75% in the annual number of live births to adolescent mothers, falling from 26,638 in 2014 to 13,384 in 2023 (Graph 1).



1 Chart: Annual distribution of the number of live births to adolescent mothers in Ceará, by age group, 2014–2023. Source: Adapted from Brasil (2025).

Between 2014 and 2023, 10,927 live births to adolescent mothers aged 10 to 14 were recorded in Ceará, with an annual average of 1,092.7 (± 249.71). The highest number occurred in 2014, with 1,449 births, and the lowest in 2023, with 679, corresponding to a reduction of approximately 53.1% over the historical series (Figure 1). Table 1 presents the pregnancy characteristics for this age group, including the number of prenatal visits, type of delivery, gestational duration, type of pregnancy, and presence of congenital anomalies.

Most adolescents had seven or more prenatal visits (60.48%) and delivered vaginally (56.57%). Singleton pregnancies predominated (97.97%), as did pregnancies lasting between 37 and 41 weeks (72.76%), while 95.07% of live births had no congenital anomalies. Records classified as "Unknown," referring to the absence of information for the respective variable in SINASC, had the lowest percentages across all analyzed variables (Table 1).

Table1 : Maternal profile of adolescent women aged 10 to 14 years in Ceará (2014–2023)

	Variables	Mean ± SD	n (%)	Median	p
I		Number of Prenatal Visits			
	None	19.2 ± 6.77	192 (1.76)	19	0.001*
	1–3	92.3 ± 35.68	923 (8.45)	84.5	
	4–6	316.4 ± 131.42	*3,164 (28.95)*	294	
	7 or more	660.9 ± 99.16	*6,609 (60.48)*	665.5	
	Not reported	3.9 ± 2.02	39 (0.36)	3	
II		Type of Delivery			
	Vaginal	618.1 ± 167.1	*6,181 (56.57)*	621	0.001*
	Cesarean	473.7 ± 91.08	*4,737 (43.35)*	453.5	
	Not reported	0.9 ± 0.94	9 (0.08)	0.5	
III		Gestational Age (weeks)			
	<22	3.1 ± 2.88	31 (0.28)	3	0.001*
	22–27	17.4 ± 6.75	174 (1.59)	17.5	
	28–31	27.6 ± 7.5	276 (2.52)	27	
	32–36	166.6 ± 36.88	*1,666 (15.24)*	163.5	
	37–41	794.8 ± 181.1	*7,948 (72.76)*	782	
	42 or more	40.7 ± 19.32	407 (3.72)	36.5	
	Not reported	42.5 ± 21.97	425 (3.89)	39	
IV		Type of Pregnancy			
	Single	1,070.5 ± 255.16	*10,705 (97.97)*	*1,035*	0.001*
	Pair	10.7 ± 6.92	107 (0.98)	9.5	
	Triple or more	0.3 ± 0.67	3 (0.03)	0	
	Not reported	11.2 ± 18.34	112 (1.02)	2.5	
V		Congenital Anomalies			
	Yes	11.70 ± 5.12	117 (1.07)	10	0.001*
	No	1,038.9 ± 257.4	*10,389 (95.07)*	1,000.5	
	Not reported	42.1 ± 18.18	421, , (3.86)	35.5	

Source: Adapted from Brazil (2025). SD: standard deviation; p: p-value from the *Kruskal-Wallis* test; *: statistically significant, considering $p < 0.05$.

Among adolescents aged 15 to 19, a decrease in the annual number of live births was observed over the period from 2014 to 2023. The number of records fell from 25,189 in 2014 to 12,705 in 2023, with an annual average of 19,131.4 (± 4,211.9) live births. Considering the entire historical series analyzed, from 2014 to 2023, there was a reduction of approximately 49.57% in the annual number of live births to adolescent mothers in this age group (Figure 1).

In the descriptive analysis of the pregnancy characteristics of adolescents aged 15 to 19 (Table 2), it was observed that the majority attended seven or more prenatal visits (65.34%) and had a vaginal delivery (54.38%). Singleton pregnancies were predominant (97.80%) and typically lasted between 37 and 41 weeks (78.52%), while twin pregnancies (1.22%) and triplets or more (0.02%) were rare. Regarding congenital anomalies, 94.83% of live births did not have this condition, while 0.96% did. Records classified as "Unknown" accounted for low percentages in the analyzed variables.

Table 2: Maternal profile of adolescent women aged 15 to 19 in Ceará (2014–2023)

	Variables	Mean ± SD	n (%)	Median	p
I	Number of Prenatal Visits				
	None	285 ± 85.1	2,850 (1.49)	258	0.001*
	1–3	1,207.4 ± 421.65	12,074 (6.31)	1,169	
	4–6	5,072.9 ± 1,889.2	50,729 (26.52)	4,956	
	7 or more	12,500.8 ± 1,869.53	125,008 (65.34)	13,166	
	Not reported	65.3 ± 20.13	653 (0.34)	61.5	
II	Type of Delivery				
	Vaginal	10,401.1 ± 2,777.3	104,011 (54.38)	10,932	0.001*
	Cesarean	8,703.3 ± 1,462.4	87,033 (45.48)	8,642.5	
	Not reported	27 ± 15.45	270 (0.14)	30	
III	Gestational Age (weeks)				
	<22	17.7 ± 4.42	177 (0.09)	18	0.001*
	22–27	139.4 ± 28.51	1,394 (0.72)	143	
	28–31	272 ± 66.35	2,720 (1.43)	274.5	
	32–36	2,156.5 ± 465.3	21,565 (11.28)	2,115.5	
	37–41	15,022.7 ± 2,987.96	150,227 (78.52)	15,643	
	42 or more	847.9 ± 352.91	8,479 (4.43)	833.5	
	Not reported	675.2 ± 344.54	6,752 (3.53)	580.5	
IV	Type of Pregnancy				
	Single	17.546,6 ± 6.523,49	175,466 (97.80)	19,060	0.001*
	Pair	219.2 ± 52.31	2,192 (1.22)	220.5	
	Triple or more	2.9 ± 3.01	29 (0.02)	2	
	Not reported	172.4 ± 247.85	1,724 (0.96)	30.5	
V	Congenital Anomalies				
	Yes	182.7 ± 31.7	1,827 (0.96)	186	0.001*
	No	18,145.7 ± 3,987.27	181,457 (94.83)	18,400	
	Not reported	803 ± 278.9	8,030 (4.21)	806	

Source: Adapted from Brazil (2025). SD: standard deviation; p: p-value from the *Kruskal-Wallis* test; *: statistically significant, considering $p < 0.05$.

After characterizing the records in the two age groups, the percentage change between consecutive years was analyzed to detail the pattern of decline over the time series (Figure 2). The percentages represented the change relative to the immediately preceding year, with 2014 used as the reference for calculating the first change in 2015. In the 10–14 age group, annual reductions ranged from 1.9% in 2021 to 20.6% in 2022, while in the 15–19 age group, they ranged from 3.3% in 2015 to 14.1% in 2022. Although a reduction occurred in all the years analyzed, its magnitude fluctuated, being most pronounced in 2022 in both age groups. In 2023, the percentages decreased to 10.9% among 10- to 14-year-olds and 5.4% among 15- to 19-year-olds, with no reversal of the downward trend in absolute numbers, as shown in Figure 1.

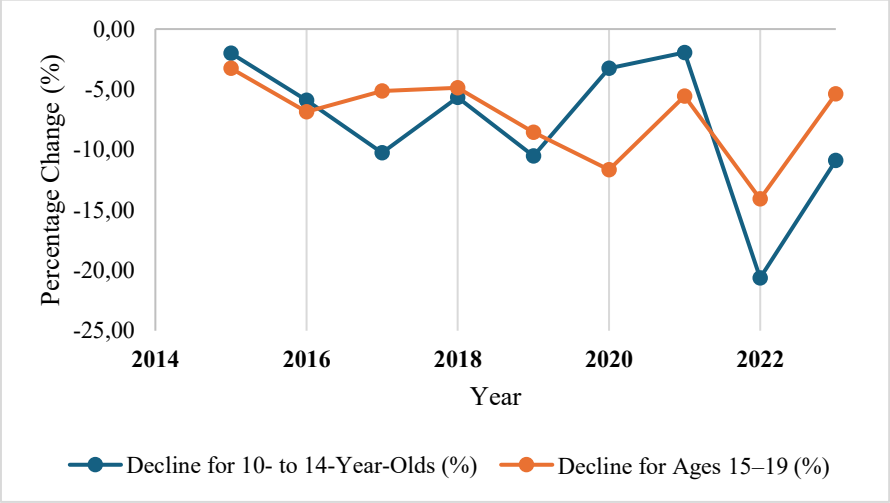


Figure 2 : Annual percentage change in the number of live births to adolescent mothers in Ceará, by age group, 2015–2023. Source: Authors

Regarding socioeconomic indicators, per capita household income in Ceará increased from R$ 616.00 in 2014 to R$ 1,166.00 in 2023. During the same period, the Gini Index fluctuated, ranging from 0.501 in 2014 to 0.511 in 2023, with the highest values recorded in 2019 and 2020 (0.543). The HDI, for which data is available through 2021, rose from 0.710 in 2014 to 0.734 in 2021. In the field of education, between 2015 and 2023, the

Ideb score for the final years of elementary school increased from 4.5 to 5.4, while that for high school rose from 3.4 to 4.4. Regarding access to healthcare, primary healthcare (APS) coverage increased from 82.93% in 2014 to 114.10% in 2023. During the same period, the proportion of households with internet access rose from 31.4% to 89.4%.

Correlation analyses were conducted to investigate the associations between the number of live births to adolescent mothers and socioeconomic, educational, and healthcare access variables. In the 10–14 age group, a strong negative correlation was observed with per capita household income ($r = -0.967$; $p < 0.001$), indicating an association between higher income levels and lower numbers of live births. A similar pattern was observed for the proportion of households with internet access ($r = -0.938$; $p < 0.001$). Primary health care (PHC) coverage also showed a significant inverse association ($r = -0.745$; $p = 0.013$), whereas for the Gini index, the correlation was weak and not statistically significant ($p = 0.500$) (Figure 1).

Educational indicators showed results pointing in the same direction, with strong negative correlations for the Ideb scores in the final years of elementary school ($r = -0.952$; $p = 0.013$) and high school ($r = -0.927$; $p = 0.024$), indicating that higher values of these indicators were associated with lower numbers of live births to mothers aged 10 to 14. The HDI also showed a significant negative association with the outcome analyzed ($r = -0.908$; $p = 0.002$), indicating that higher human development scores were associated with lower numbers of live births in this age group (Figure 1).

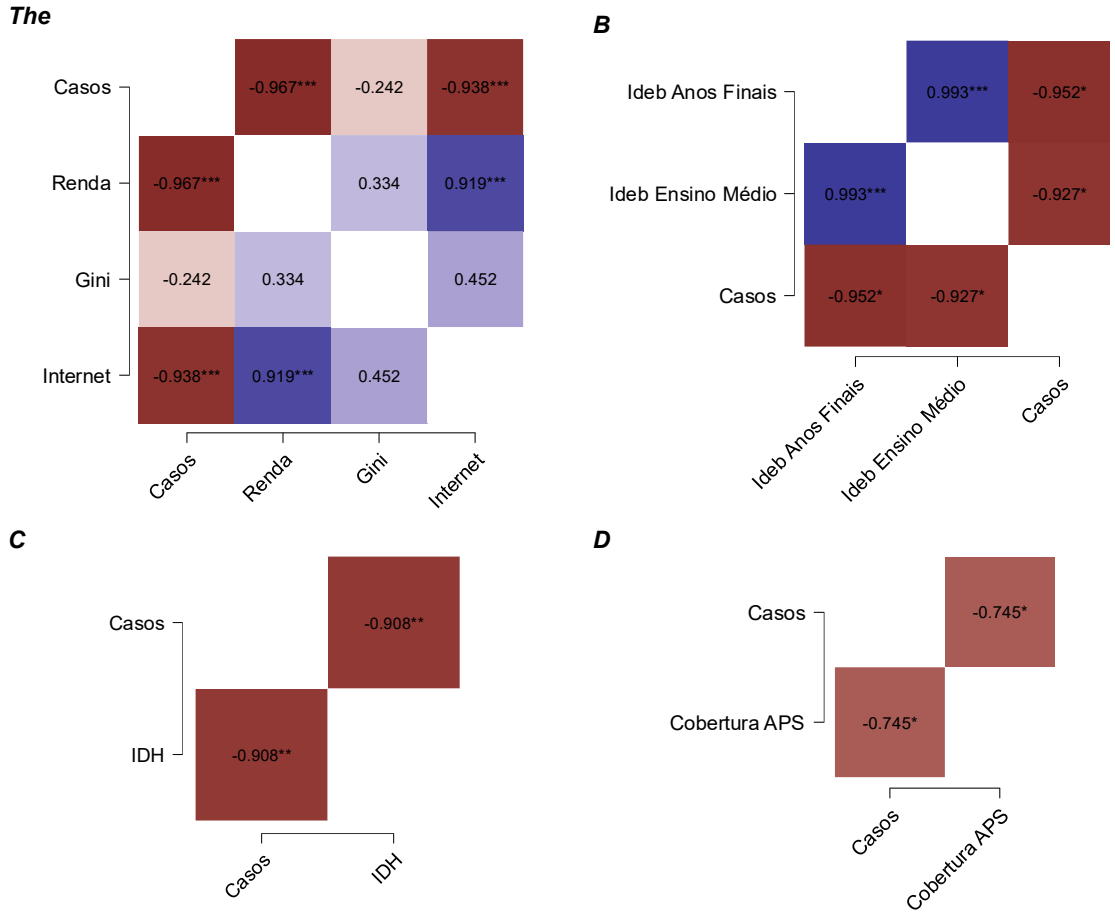


Figure 1 : Heat maps of the correlations between the number of live births to adolescent mothers aged 10 to 14 and socioeconomic, educational, and health care access variables in Ceará, 2014–2023. (A) *Pearson* correlation with per capita household income, proportion of households with internet access, and the Gini Index; (B) *Pearson* correlation with the Basic Education Development Index (Ideb) for the final years of elementary and high school; (C) *Pearson* correlation with the Human Development Index (HDI); and (D) *Spearman* correlation with Primary Health Care (PHC) coverage. *: statistically significant, considering $p < 0.05$, where: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$. Darker colors indicate correlations of greater magnitude, whether positive or negative. Source: Authors.

In the 15–19 age group, a pattern similar to that identified among 10–14-year-olds was observed, with strong negative correlations between the number of live births to adolescent mothers and per capita household

income (r = −0.944; p < 0.001) and the proportion of households with internet access (r = −0.941; p < 0.001). Primary health care (PHC) coverage also showed a significant inverse association (r = −0.745; p = 0.013). In contrast, the correlation with the Gini index was weak and not statistically significant (r = −0.231; p = 0.521) (Figure 2).

Educational indicators followed the same trend, with strong negative correlations for the Ideb score in the final years of elementary school (r = −0.949; p = 0.014) and high school (r = −0.944; p = 0.016), indicating an association between higher values of these indicators and lower numbers of live births to mothers aged 15 to 19. The HDI also showed a significant negative association with the outcome analyzed (r = −0.851; p = 0.007), such that higher values of the indicator were associated with lower numbers of live births in this age group (Figure 2).

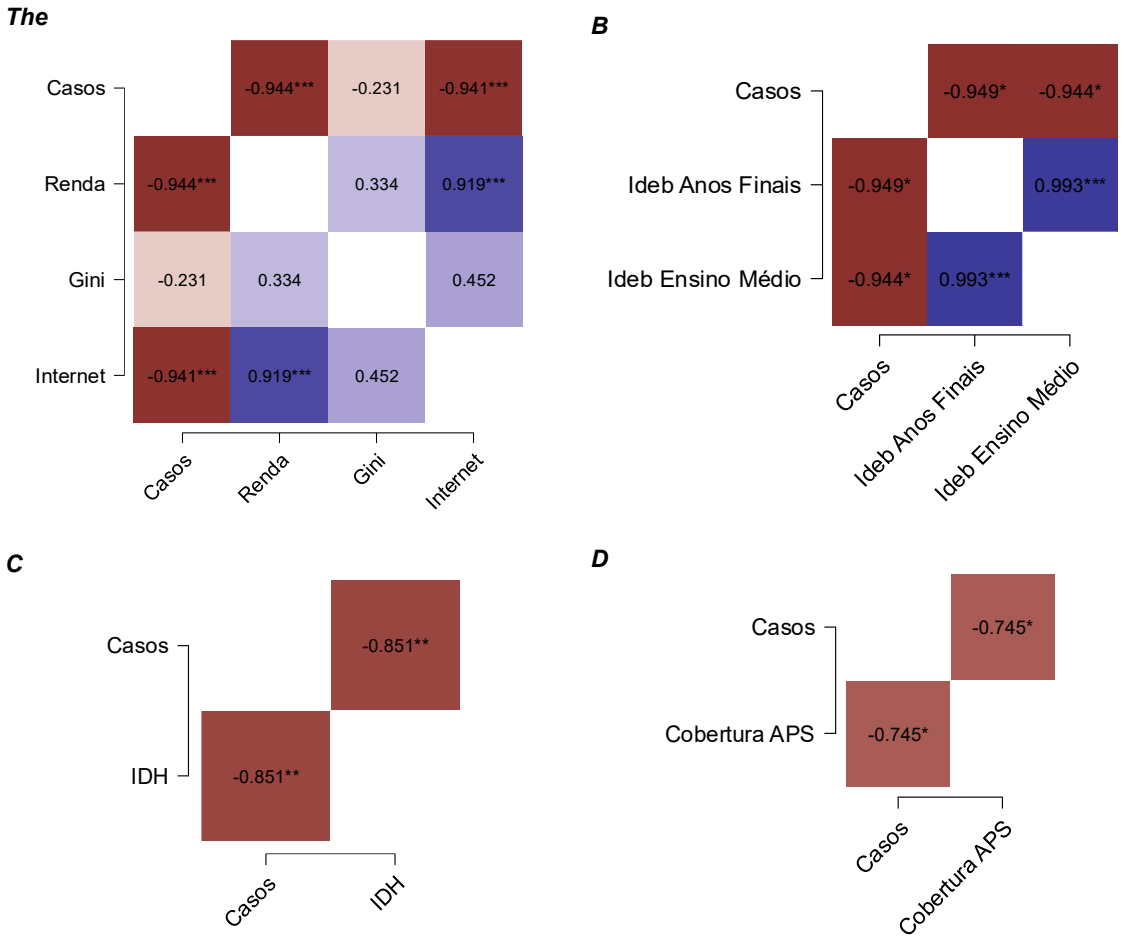


Figure 2 : Heat maps of the correlations between the number of live births to adolescent mothers aged 15–19 and socioeconomic, educational, and health-access variables in Ceará, 2014–2023. (A) *Pearson* correlation with per capita household income, proportion of households with internet access, and the Gini Index; (B) *Pearson* correlation with the Basic Education Development Index (Ideb) for the final years of elementary and high school; (C) *Pearson* correlation with the Human Development Index (HDI); and (D) *Spearman* correlation with Primary Health Care (PHC) coverage. *: statistically significant, considering p < 0.05, where: *p < 0.05; **p < 0.01; ***p < 0.001. Darker colors indicate correlations of greater magnitude, whether positive or negative. Source: Authors.

Discussion

The findings of this study revealed a significant reduction in the number of live births to adolescent mothers in Ceará between 2014 and 2023, both in the 10–14 age group and in the 15–19 age group. Although the magnitude of this reduction varied from year to year, the persistence of negative annual changes throughout the entire time series demonstrates a continuing downward trend, which was more pronounced among adolescents aged 10 to 14. This trend indicates a significant change in the profile of births among ad s in the state, although the continued occurrence of births, even among the youngest adolescents, highlights the relevance of this phenomenon to public health.

Consistent with these results, an ecological study conducted in Maringá, Paraná, using data from 2000 to 2015, identified a significant downward trend in teenage pregnancies among girls aged 10 to 19. In the 15–19 age group, although the overall trend was also downward, a slight increase was observed toward the end of the time series, though rates remained below those recorded at the beginning of the period (Lopes et al. 2020). A similar trend was identified in the nine states of Brazil's Northeast region between 2008 and 2017, with a 20.8% reduction in the number of live births to adolescent mothers aged 10 to 19 and a decline in both age groups, with the largest decrease observed among those aged 15 to 19 (20.9%). The authors attributed this trend to the expansion of the Family Health Strategy, the activities carried out by the PSE, and increased access to contraceptive methods, emphasizing the need to strengthen policies and services targeting this population (Oliveira et al. 2022).

Regarding the profile of adolescents and pregnancy characteristics, the findings were similar to those described in national studies and in northeastern Brazil, with a predominance of seven or more prenatal visits, vaginal delivery, singleton pregnancies, and births between 37 and 41 weeks, as well as a higher frequency of adolescents aged 15 to 19 with 8 to 11 years of schooling (Melo et al. 2022; Pacó and Rabelo 2022; Monteiro et al. 2026). In the present study, however, the proportion of births between 37 and 41 weeks was lower among adolescents aged 10 to 14 (72.76%) than among those aged 15 to 19 (78.52%), a finding consistent with recent Brazilian evidence of a higher incidence of preterm birth among younger adolescent mothers (Oliveira et al. 2025).

In this context, the importance of prenatal care for pregnancy outcomes is highlighted, as it enables monitoring of the pregnancy and early identification of conditions associated with adverse outcomes. Inadequate prenatal care is associated with a higher risk of preterm birth and low birth weight, reinforcing the importance of quality care for maternal and child health (Mohammadi et al. 2023).

When interpreting correlations, the sign of the coefficient indicates the direction of the association between the variables: positive values represent direct relationships, in which both tend to vary in the same direction, while negative values indicate inverse relationships, in which an increase in one variable tends to be accompanied by a decrease in the other. The magnitude of the coefficient expresses the strength of the association; it is stronger the closer its value is to −1 or +1 and weaker the closer it is to zero; however, correlation does not imply causation (Schober and Boer 2018).

The analyses revealed associations between lower numbers of live births to adolescent mothers and higher values for per capita household income, internet access, the Ideb, and the HDI, suggesting that more favorable socioeconomic and educational conditions may be related to a lower incidence of teenage pregnancy. This relationship is supported by the literature: Pinto et al. (2023) found that municipalities with higher scores on the education component of the HDI tend to have lower rates of teenage pregnancy, while Monteiro et al. (2019) observed lower proportions of live births to teenage mothers in Brazilian regions with higher HDI scores, such as the South, Southeast, and Midwest. In this context, education takes on particular importance, since higher levels of schooling are associated with a reduction in the incidence of teenage pregnancies (Bruno et al. 2021).

Other sociodemographic factors, such as place of residence, marital status, adolescents' educational level, parents' educational attainment, and family communication about sexual and reproductive health, may also be related to the occurrence of teenage pregnancy (Kassa et al. 2018). Engaging in paid work and the use of contraceptive methods were identified as protective factors, while unplanned pregnancy was associated with a higher probability of pregnancy among women under 19 years of age (Pinheiro et al. 2019).

Regarding PHC coverage, the inverse association observed in this study reinforces the importance of Primary Health Care in organizing and ensuring continuity of care, especially given its role as the gateway to and coordinator of health care (Silva et al. 2020). In this context, greater coverage may encourage adolescents to seek out health services and expand access to initiatives for the promotion, guidance, and care related to sexual and reproductive health.

In addition to socioeconomic and healthcare conditions, the literature also discusses the relationship between maternal age and obstetric and neonatal outcomes. In an ecological study conducted in Blumenau, Santa Catarina, using DATASUS data from 2000 to 2011, adolescent pregnancy was associated with preterm birth, low birth weight, lower Apgar scores at one and five minutes, and the presence of congenital an , as well as characteristics such as lower educational attainment, unmarried marital status, fewer prenatal visits, singleton pregnancy, and vaginal delivery (Dias et al. 2020).

Among the outcomes analyzed in the present study, congenital anomalies accounted for a low percentage in both age groups. Although the literature describes associations between adolescent pregnancy and certain

types of these conditions—especially non-chromosomal ones—this relationship is not consistent when congenital malformations are considered as a whole (Ahn et al. 2022; Chen et al. 2022). The result observed in Ceará is consistent with the low frequency reported nationally, at approximately 1% of live births; however, this percentage should be interpreted with caution given the possibility of underreporting in the SINASC (Gomes et al. 2025).

In this regard, the occurrence of adverse perinatal and neonatal outcomes should not be attributed exclusively to maternal age, since conditions of social vulnerability—such as socioeconomic status and access to quality health care—can also influence these outcomes. The risks tend to be more pronounced among pregnant women aged 10 to 14, while among those aged 15 to 19, they may approach those observed in older women (Akseer et al. 2022; Farias et al. 2020).

Adolescent pregnancy, as an expression of multiple vulnerabilities, requires an intersectoral, locally tailored approach that is sensitive to regional inequalities (Fernandes et al. 2024), especially in states such as Ceará, where territorial and social challenges persist, but where there are also examples of integrated policies aimed at reducing inequalities (Ribeiro et al. 2023). In this context, health and education professionals can work in an intersectoral manner to provide information aimed at promoting safe sexual behaviors, using active health education methods and communication strategies tailored to the specific needs of adolescents (Silva et al. 2021).

This study has limitations inherent to the ecological design and the use of secondary data, which must be considered when interpreting the findings. The associations identified from aggregated data do not allow for the establishment of causal relationships or the inference that the patterns observed at the population level occur in the same way at the individual level. Furthermore, SINASC records are subject to incompleteness, underreporting, and possible inconsistencies in the completion of variables. Despite these limitations, the scope of the historical data series and the joint analysis of socioeconomic, educational, and health access indicators made it possible to characterize different dimensions associated with adolescent pregnancy in Ceará.

In light of these findings, we recommend the development of studies with individualized approaches that take into account local and regional specificities, thereby allowing for a deeper understanding of the factors related to adolescent pregnancy. In the context of public policy, it is important to emphasize the need for intersectoral initiatives that integrate health, education, social assistance, and youth policies, while strengthening sex education in schools and fostering dialogue about sexual and reproductive health among adolescents, families, and guardians (Moura et al. 2021). Although a reduction in live births to adolescent mothers has been observed over the historical series, maintaining and improving these strategies remains necessary to expand access to information, health services, and conditions that foster informed reproductive choices.

Conclusion

A reduction in the number of live births to adolescent mothers in Ceará was observed between 2014 and 2023, most pronounced in the 10–14 age group, although the magnitude of this decline varied over the time series and became less pronounced in 2023. Among the youngest adolescents, a lower proportion of births occurred between 37 and 41 weeks and a higher frequency between 32 and 36 weeks, highlighting differences in gestational profiles across age groups. Lower numbers of live births were significantly associated with higher levels of per capita household income, internet access, primary health care (PHC) coverage, and educational quality indicators, demonstrating the relationship between this phenomenon and socioeconomic, educational, and health access factors. These findings reinforce the importance of continuing policies and initiatives aimed at adolescents' sexual and reproductive health. However, the ecological study design and the use of secondary data do not allow for the establishment of causal relationships, indicating the need for studies with individual-level approaches to deepen our understanding of the factors involved.

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