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Maternity in adolescence in Brazil: high fertility rates and stark inequalities across municipalities and regions

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Abstract

Adolescent childbearing is a major public health challenge in Brazil, with a fertility rate of 43.6 births per thousand girls aged 15-19 years in 2022. This study investigated inequalities in adolescent fertility rates (AFR) across Brazilian municipalities, utilizing data from the National Live Births Information System (SINASC) and the 2022 Demographic Census. Analyses included births between 2020 and 2022, excluding municipalities with fewer than 50 births in the 3 years. Municipal AFRs were compared with the average rate in countries classified by income level (high, upper-middle, lower-middle, and low income) and described according to the Brazilian Deprivation Index and population size. Inequalities within each geographic region were assessed using the mean absolute difference to the regional mean and range. Substantial disparities in AFR across regions were found, with the North and Northeast exhibiting the highest estimates, while the South and Southeast showed comparatively lower rates. The Midwest presented intermediate values. We found vast inequalities between municipalities, revealed by graphs and summary measures. A small proportion of municipalities, concentrated in the North region, experience exceptionally high AFR. A strong association between social vulnerability and early childbearing was also identified. Municipalities with higher levels of deprivation had markedly higher AFR, underscoring the influence of broader socio-economic factors on adolescent fertility. The results emphasize the need for targeted interventions and policies that address these underlying contextual determinants to reduce fertility rates among girls in Brazil effectively.

Keywords: Live Birth, Adolescent Motherhood, Fertility Rate, Health inequalities, Brazil

Introduction

Adolescent childbearing remains a major public health challenge in Brazil. According to World Bank estimates, in 2022, Brazil's adolescent fertility rate (AFR) was estimated at 43.6 births per thousand girls aged 15-19, [1] surpassing its BRICS counterparts Russia, India, and China with a maximum AFR of 16.3. Brazil's rate is also considerably higher than among its peer countries of upper-middle-income, whose average is 27.8.

The high AFR in Brazil is in contrast with the low total fertility rate, 1.6 in 2023, below the replacement fertility rate, [2] and the high accessibility of contraception, revealed by the large proportion of women of reproductive age using modern contraceptives - 84% in 2019. [3] This suggests that family planning programs are not adequately reaching adolescents, or that those living in unfavorable contexts with limited life opportunities and access to education or health services are more likely to have an early pregnancy. [4]

Having a child in adolescence has numerous adverse outcomes affecting health, education, and economic stability. Health risks include higher instances of complications such as anemia, preterm labor, and low birth weight infants due to the physiological immaturity of young mothers. [5–7] Educationally, teenage mothers often face significant setbacks, including higher dropout rates and limited academic achievement, which, in turn, restrict future opportunities. [8–11] Economically, young mothers are more likely to experience financial instability and poverty as they face challenges securing stable employment due to disrupted education and parenting responsibilities. [12,13] Thus, adolescent childbearing is an undesirable outcome for the girl and her family and society, which will have a lower level of social development. Additionally, it is essential to note that the risks associated with pregnancy for younger (less than 14) and older (15-19) adolescents are quite different, the first group implying, according to Brazilian law, statutory rape. Therefore, despite the smaller number, adolescents under 14 should not be ignored when studying adolescent childbearing.

Although several individual-level factors might influence adolescent fertility, such as educational achievement [14] and an intergenerational effect, [15] subnational inequalities and community and contextual characteristics have been highlighted as some of the various aspects that affect its occurrence. [4,16,17]

Therefore, identifying who childbearing adolescents are, where they live, and what drives it is essential to understanding the process and designing policies to decrease adolescent fertility rates.

This study investigated inequalities in AFR across Brazilian municipalities using data from the national live birth registration system. The study aimed to expose the disparities in these rates between municipalities and regions, identify areas with the highest occurrence, and assess the association between social vulnerability and early childbearing.

Methods

This study utilized data from the Brazilian Live Births Information System (*Sistema de Informação sobre Nascidos Vivos*, SINASC) [18] for 2020 to 2022, sourced from OpenDataSUS. [19] Additionally, population statistics by sex and age from the 2022 Brazilian Census were acquired from the Brazilian Institute of Geography and Statistics. [20]

Adolescent fertility rates (AFR) were computed by dividing the number of births to adolescents aged 10-14 and 15-19 years between 2020 and 2022 in each municipality by three times the corresponding population estimated by the 2022 Brazilian Demographic Census to annualize the rate. Municipalities with fewer than 50 births over the three years were excluded from the analysis. When estimating median and mean AFR by groups of municipalities, the rates were weighted by the size of the corresponding population.

For comparative purposes, and given the lack of classification cut-off points, AFR bands were created for the group aged 15-19 based on mean AFR corresponding to different World Bank country income levels. These bands used the mean AFRs as midpoints: high-income (11.2 births per thousand), upper-middle-income (27.8), lower-middle-income (44.7), and low-income (94.0), as per the World Bank 2022 estimates (API_SP.ADO.TFRT_DS2_en_excel_v2_898).[1]

Municipal inequality within the country's geographic regions (North, Northeast, Southeast, South, and Midwest) was assessed using two indicators: the mean absolute difference to the regional mean (MADM) and the range. MADM is defined as $\sum|y_i - \bar{y}|/_N$, where y_i is the municipal AFR, $\bar{y}$ is the regional mean, and N is the number of units within each region. The range was calculated as the maximum minus the minimum value within the regions.

The Brazilian Deprivation Index (*Índice Brasileiro de Privação*, IBP)[21] was used to assess the municipal deprivation level. This multidimensional indicator combines data on (i) the percentage of households earning less than half the Brazilian minimum wage, (ii) the percentage of individuals aged seven and above who are illiterate, and (iii) the percentage of the population without adequate access to sewage, clean water, and waste collection, and lacking bathroom/shower facilities. The index does not include child mortality or life expectancy, like the Human Development Index, which may be affected by the level of AFR. The latest available version of this index is based on data from the 2010 Brazilian Census. Municipalities were ranked by the IBP and divided into five equally sized groups, unweighted by population, to ensure an equal number of units in each group rather than an equal population count. Furthermore, population size (categorized into <5, 5-, 10-, 50-, 100+ thousand people) was explored as a potential predictor of AFR, providing additional context to the observed fertility patterns.

The estimation of AFR by IBP quintiles and municipality size by geographic region employed linear regression models, including an interaction between the predictors and region, with interaction terms tested for significance. All the statistical analyses and graphs were done with Stata (StataCorp. 2023. Stata Statistical Software: Release 18. College Station, TX: StataCorp LLC.).

The SINASC data is public, provided by the Ministry of Health through its online portal (https://datasus.saude.gov.br/transferencia-de-arquivos/). All information related to parturients and livebirths is anonymized, eliminating the need for approval from an Ethics Committee in Research. The use of this data was in accordance with Resolution No. 466, dated December 12, 2012, from the National Health Council (CNS), which regulates research involving human subjects.

Results

A total of 7,968,916 birth records spanning 2020-2022 were retrieved from SINASC. Of these, 49,325 (0.62%) births were to girls aged 10-14 and 1,012,640 (12.7%) to adolescents aged 15-19. Age was missing in only 141 records. After excluding 68 municipalities with fewer than 50 births to adolescents (aged 10-19), the final analytical sample consisted of 5,502 municipalities (98.8%).

The median municipal AFR for girls aged 10-14 was 1.9 births per thousand, while the median for those aged 15-19 was substantially higher, at 43.3 births per thousand, ranging from zero to 201 per thousand. The AFR distribution for the 15-19 age group resembled a right-skewed Gaussian distribution (Figure 1), indicating a small proportion but relevant number of municipalities with very high AFRs. Figure 1 also indicates that 22% of the municipalities fell within the low-income AFR band (estimates higher than 65 births per thousand), and 47% fell within the lower-middle income band. Only 28% fell within Brazil's own upper-middle-income band and 3% in the high-income band.

Substantial regional disparities in AFRs were evident. For young adolescents aged 10-14, the North region exhibited a median AFR nearly four times higher than the South. The region median AFR estimates (in births per thousand) were, in decreasing order, 4.0 (North), 2.8 (Northeast), 2.0 (Midwest), 1.2 (Southeast), and 1.1 (South). Ten municipalities across the country presented AFRs of 20 or more (Figure 2A).

Among adolescents aged 15-19, the North region's median AFR (77.1) was more than double that of the South (35.0) (Table 1 and Figure 2B). The individual municipal AFRs varied widely within each region, all of them encompassing municipalities with low and high AFR levels. A considerable 148 municipalities presented AFRs of 100 or more for girls 15-19 years.

Figure 2B also presents the percentage of municipalities in each AFR band for the 15-19 age group. The North region showed the highest percentage of municipalities (76%) falling within the low-income AFR band, contrasting with the Southeast and South regions, which exhibited a more favorable distribution, although still with half of municipalities within the lower-middle and low-income bands. None of the regions had most municipalities within Brazil’s upper-middle income band.

Measures of municipal inequalities within regions seen in the graphs are presented in Table 2. For girls 10-14, the North and Midwest regions showed the highest inequalities, with MADM values markedly higher compared to the other regions. For adolescents 15-19, North and Midwest also presented the highest MADM values, but not so detached from the Northeast and South regions. The measures confirm the visual impression of high inequalities in all five regions. The ranges, highest to lowest differences, were greater than 100 births per thousand in three regions, a huge gap.

Municipal deprivation was strongly associated with AFR (Figure 3 and Supplementary Material, Tables S1 and S2). The regression model (including IBP, geographic region, and their interaction) explained 64.6% of the AFR variability in the 15-19 age group. Except for the North region, the AFR levels for the same deprivation quintile in each region were not very different. Also, a somewhat similar increase in AFR with deprivation was observed. In the North region, we found systematically higher AFR in each IBP quintile than in other regions, except for the least deprived group with only one municipality. Note that no municipalities in the South region were in the most deprived group. The Midwest region presented a much higher AFR for the most deprived group, but this estimate is based on only three municipalities.

Municipality size presented a statistically significant association with AFR for girls aged 15-19 but with a much smaller magnitude than deprivation. Generally, we observed an inverted U-shaped association with maximum AFR in municipalities with populations between 10 and 50 thousand people. These results are presented in the Supplementary Material, Figure S1 and Tables S3 and S4. We added population size to a model including IBP to assess the additional explanatory power of municipal size to IBP. Population size was still significant when adjusted for deprivation, but the model R^2 increased by only 0.4 percentage points (data not shown).

Discussion

This study reveals significant inequalities in adolescent fertility rates across more than five thousand Brazilian municipalities in 2020-2022. There were striking inequalities in AFR across municipalities in the country as a whole and within geographical regions, which have more homogeneous populations.

A comparison of AFR in adolescents 15-19 with countries of different income levels revealed that 70% of Brazilian municipalities present rates above those of upper-middle-income countries (UMICs), Brazil's own level. The situation is critical in the North region, where 98% of municipalities are above the UMICs range. We have also shown that a large proportion of the municipal variability in AFRs is explained by the level of municipal deprivation, which offers an important clue as to what can be done to reduce the high rates observed.

The strong effect of municipal deprivation on AFRs underscores the crucial role of socioeconomic factors and human development in adolescent childbearing. Other studies have reported on the association between AFR and poverty and lack of access to health services [22] and low education. [23] Our findings align with previous literature that described the heterogeneous national distribution of births to adolescent girls across Brazil and the association between these births and contextual measures, such as the municipal Human Development Index and income inequality, as measured by the Gini coefficient. [16,24] Addressing poverty, improving access to education – particularly for girls – and enhancing family planning services should be central to effective interventions. Additionally, the lack of long-term perspectives for an improved quality of life may hamper adolescents' ability to plan ahead and lead them to more immediate solutions, such as childbearing in search of heightened social status, security, and companionship. [25]

The consistently higher AFRs in the North region, across all levels of deprivation, highlight the complex interplay of socioeconomic factors and other potential region-specific influences. These factors may include cultural norms, accessibility of healthcare services, and availability of family planning resources. [24] Factors such as a higher proportion of Indigenous populations, remoteness, limited access to health services, and higher levels of deprivation warrant further investigation.

The number of births to adolescents aged 10-14 is particularly concerning despite being a small proportion among all births. We found 49,325 births to girls in this age group in 2020-2022, an average of 16,441 births per year. According to Brazilian legislation, these pregnancies are considered the result of statutory rape, prompting immediate and vigorous actions to eliminate such births with initiatives to protect girls and ensure their sexual and reproductive rights. In cases where society fails to avoid an under-15 pregnancy, easy and quick access to legal abortion, when this is their choice, should be guaranteed.

This study benefits from the high coverage of SINASC data, nearly universal institutional delivery in all social groups and municipalities, minimal missing values, a national scope, and a large sample size. However, as an ecological study relying on secondary data, the research has limited capacity to explore individual-level factors influencing adolescent fertility. Further research integrating mixed-methods approaches could augment the understanding of these complex relationships. Our analyses focused on live births, thus not including stillbirths, miscarriage, and abortion. Consequently, we do not present a full picture of adolescent pregnancy, although most events are certainly represented here. The relatively small number of municipalities in the most deprived quintiles in certain regions limits the generalizability of findings for those contexts. Note that we used a deprivation index (IBP) developed with the 2010 Census data since an updated version is not yet available. Therefore, changes in municipal deprivation since 2010 are not captured in our analysis. Even so, the association found was clear and strong.

The findings highlight the importance of developing regionally tailored policies and programs, as a “one-size-fits-all” approach is unlikely to be effective. A multifaceted strategy is necessary to address the significant regional disparities and the influence of socioeconomic factors on adolescent fertility rates across Brazilian municipalities. Future research should focus on identifying specific contextual factors that contribute to high rates in particular regions. This research can guide interventions that are regionally focused and culturally sensitive, aiming to empower girls and their families.

To effectively tackle adolescent childbearing, interventions must be comprehensive and multi-sectoral, addressing root causes beyond just family planning. For instance, qualitative research could explore cultural norms and beliefs influencing adolescent fertility in the North region and other deprived areas. By prioritizing these tailored interventions, we can work towards reducing adolescent childbearing, thereby saving and improving girls' lives, enhancing their social contributions, and increasing social capital.

Figures

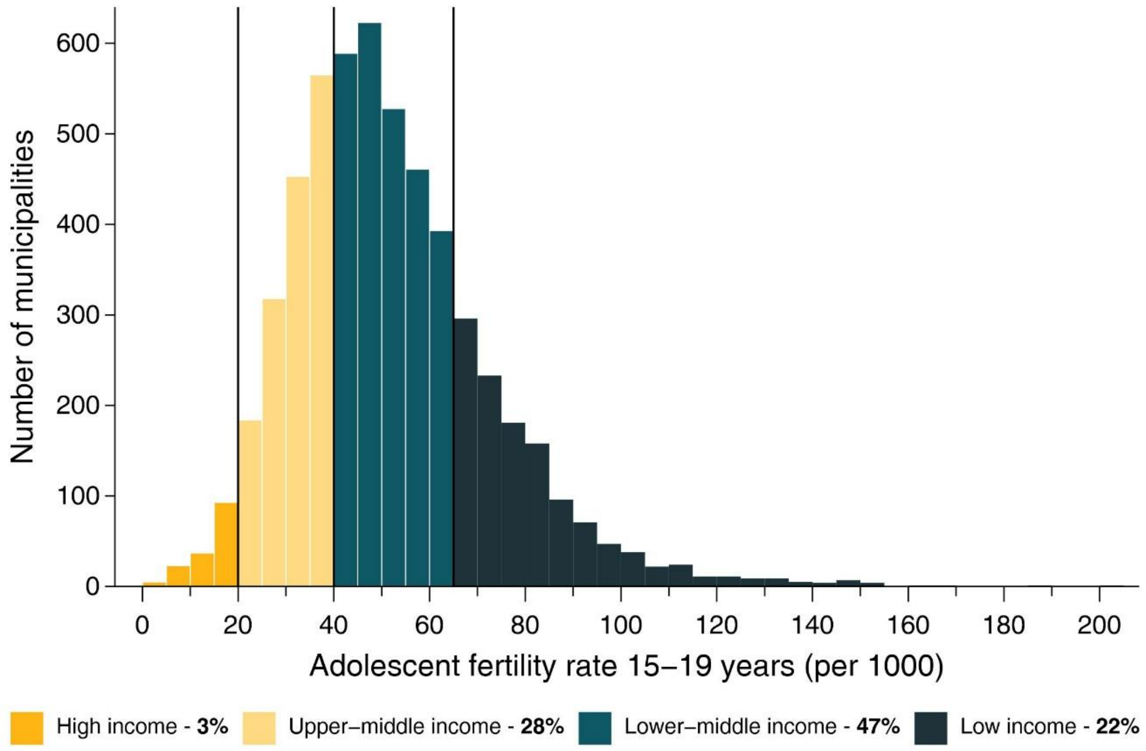

Figure 1 – Adolescent fertility rate (15-19 years) distribution across 5,502 Brazilian municipalities. The histogram is divided into bands according to the mean AFR values in high, upper-middle, lower-middle, and low-income countries. In the legend, next to the band labels, we indicate the percentage of municipalities that fall in each band. Brazil, 2020-2022.

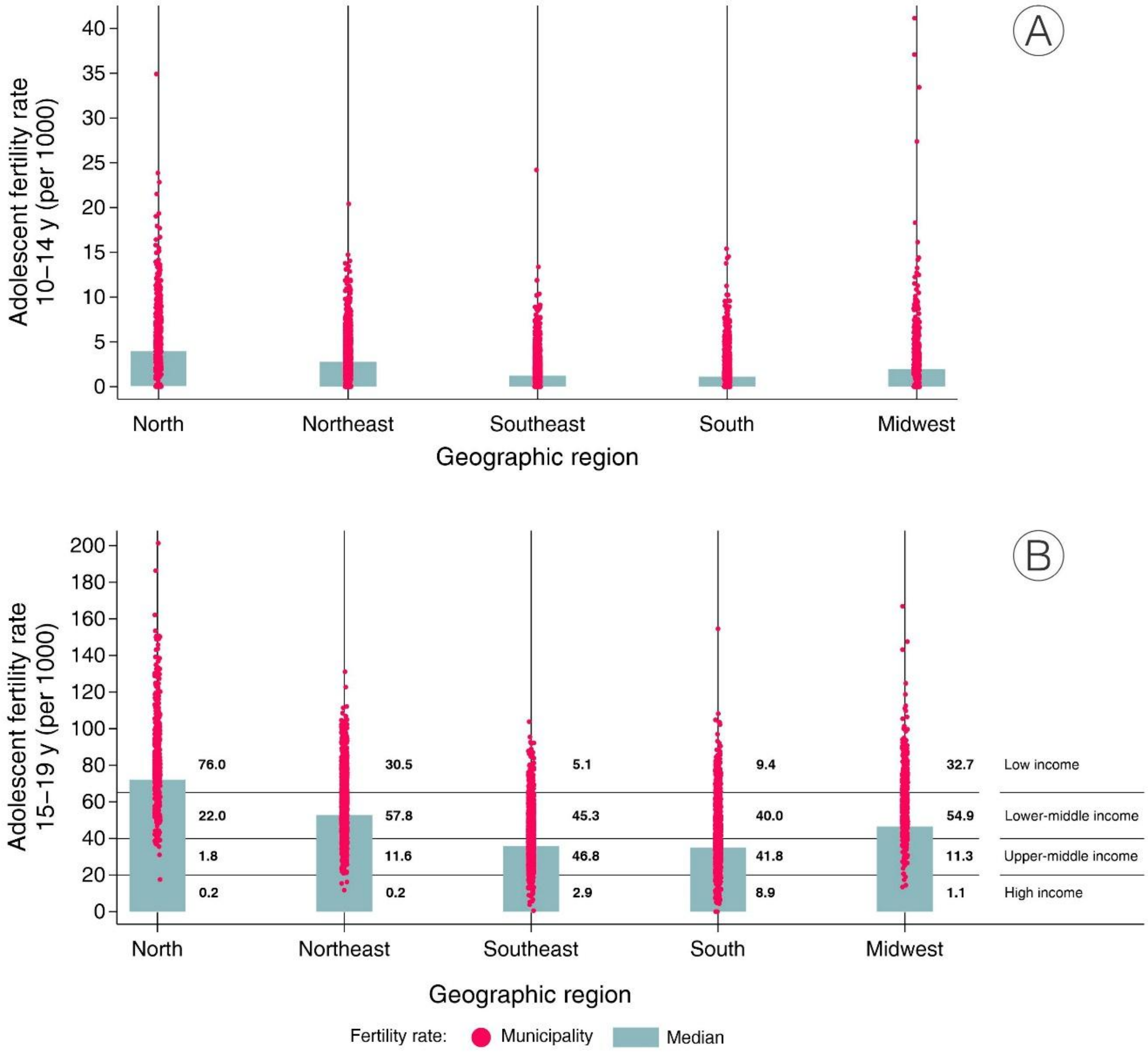

Figure 2 – Adolescent fertility rates for 5,502 Brazilian municipalities by geographic region, plus the median rate for each region. The top graph (A) shows rates for adolescents 10-14 years, and the bottom graph (B) for adolescents 15-19 years. Graph B also shows the percentages of municipalities in each fertility rate band defined by the mean rates of high, upper-middle, lower-middle, and low-income countries. Brazil, 2020-2022.

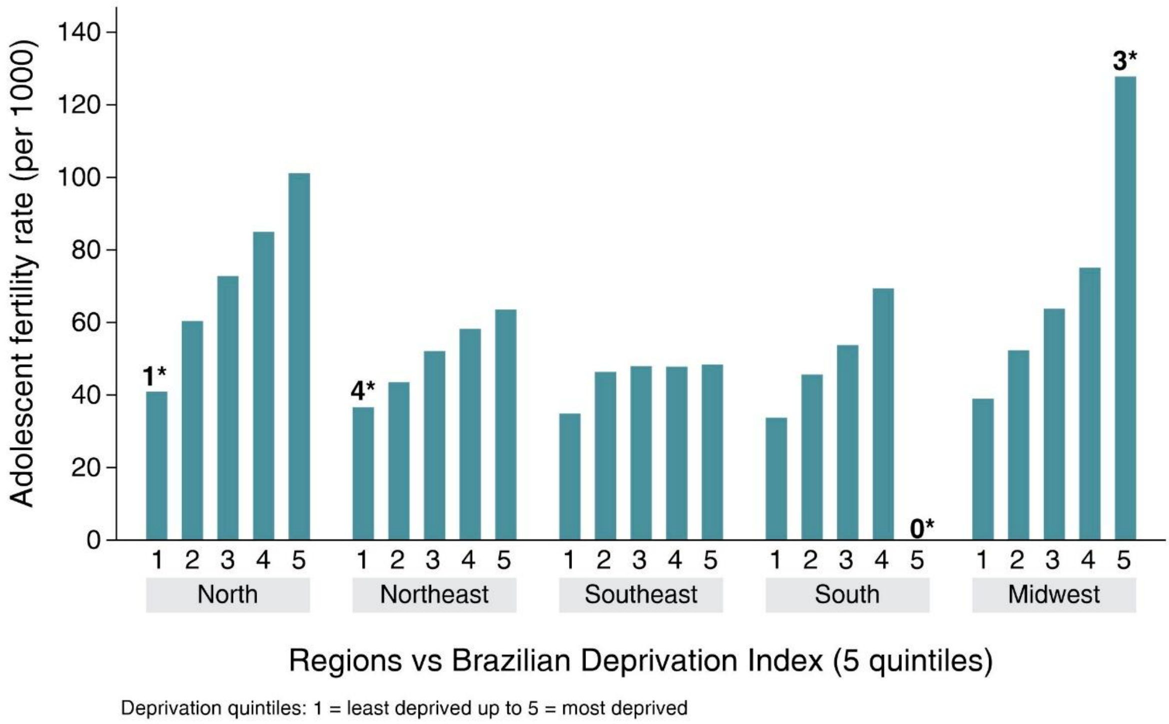

Figure 3 – Mean adolescent fertility rates (15-19 years) for municipalities in each quintile of the Brazilian Deprivation Index by geographic region. Brazil, 2020-2022.

Note: The numbers over some bars indicate the number of municipalities in each group when less than 10.

Tables

Table 1 – Median adolescent fertility rate (15-19 years) by geographic region and at the national level, and number and proportion of municipalities with adolescent fertility rates within bands defined by the mean rate of high-, upper-middle-, lower-middle-, and low-income countries. Brazil, 2020-2022.

Geographic region	N	Median AFR per 1,000	AFR < 20 HIC band %	20 ≤ AFR < 40 UMIC band N (%)	40 ≤ AFR < 65 LMIC band N (%)	AFR ≥ 65 LIC band N (%)
North	450	77.1	0.2	1.8	22.0	76.0
Northeast	1,793	52.8	0.2	11.6	57.7	30.5
Southeast	1,638	35.8	2.9	46.7	45.3	5.1
South	1,162	35.0	8.8	41.8	40.0	9.4
Midwest	459	46.6	1.1	11.3	54.9	32.7
Total	5,502	43.3	2.9	27.6	47.1	22.4

Note: The table includes 5,502 municipalities with 50 or more births to adolescents 10-19 from 2020 to 2022.
HIC = high-income countries, UMIC = upper-middle-income countries, LMIC = lower-middle-income countries, LIC = low-income countries.

Table 2 – Mean absolute difference to the mean (MADM) and range for adolescent fertility rates by geographic region. Brazil, 2020-2022.

Geographic region	**Age 10-14 years**		**Age 15-19 years**	
	MADM	**Range**	**MADM**	**Range**
North	3.1	28.9	20.5	117.6
Northeast	1.7	17.1	13.0	73.8
Southeast	1.3	22.7	10.3	63.6
South	1.6	13.5	13.4	114.0
Midwest	2.3	37.8	14.5	107.5

MADM = mean absolute difference from the mean; range = difference between the maximum and minimum values within the region.

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SUPPLEMENTARY MATERIAL

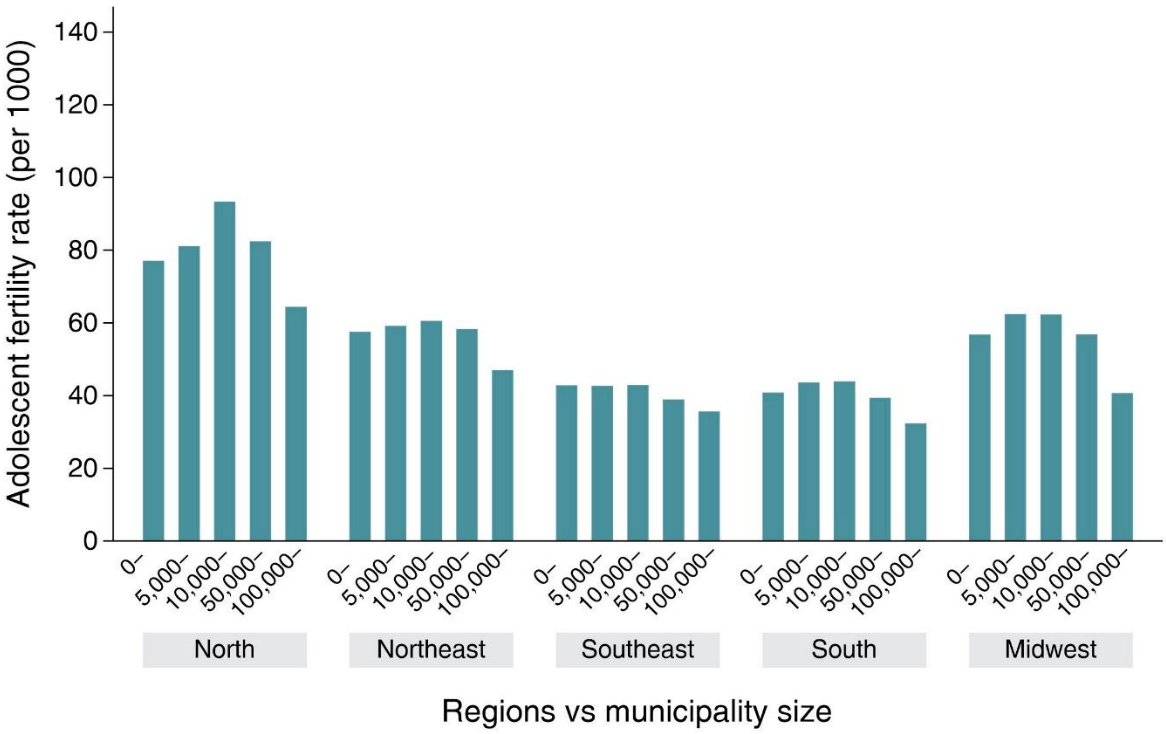

Figure S1 - Mean adolescent fertility rates (15-19 years) for municipalities in each population size group by geographic region. Brazil, 2020-2022.

Table S1 – Adolescent fertility rates (births per 1,000 adolescent girls aged 15-19) by geographic region and Brazilian Deprivation Index (IBP) quintiles.

	Brazilian Deprivation Index (quintiles)				
Geographic region	**Q1 Least deprived**	**Q2**	**Q3**	**Q4**	**Q5 Most deprived**
North	40.9	60.4	72.8	85.0	101.1
Northeast	36.6	43.5	52.1	58.2	63.5
Southeast	34.9	46.4	48.0	47.8	48.4
South	33.8	45.7	53.8	69.4	N/A
Midwest	39.0	52.3	63.8	75.1	127.8

Note: estimates derived from a linear regression model including geographic region, IBP quintiles, and their interaction (all p values < 0.001). The R^2 for the model was 0.646.

Table S2 – Number of municipalities in each Brazilian Deprivation Index (IBP) quintile and geographic region.

	Brazilian Deprivation Index (quintiles)				
Geographic region	**Q1 Least deprived**	**Q2**	**Q3**	**Q4**	**Q5 Most deprived**
North	1	19	104	193	132
Northeast	4	21	127	686	955
Southeast	646	491	312	167	22
South	411	416	305	27	0
Midwest	26	136	253	40	3

Note: Five municipalities did not have an IBP estimate.

Table S3 – Adolescent fertility rates (births per 1,000 adolescent girls aged 15-19) by geographic region and municipality size.

	Municipality size (total population)				
Geographic region	**0-**	**5,000-**	**10,000-**	**50,000-**	**100,000-**
North	77.1	81.1	93.4	82.4	64.4
Northeast	57.5	59.2	60.6	58.3	47.0
Southeast	42.9	42.7	42.9	38.9	35.6
South	40.9	43.6	43.9	39.4	32.4
Midwest	56.8	62.4	62.3	56.8	40.7

Note: estimates derived from a linear regression model including geographic region, groups of municipality size, and their interaction (all p values < 0.001). The R^2 for the model was 0.564.

Table S4 – Number of municipalities in each population size group and geographic region.

	Municipality size (total population)				
Geographic region	**0-**	**5,000-**	**10,000-**	**50,000-**	**100,000-**
North	92	66	221	45	26
Northeast	247	372	999	111	64
Southeast	367	374	640	108	149
South	412	262	378	55	55
Midwest	138	96	181	19	25

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