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Trends and factors associated with advanced maternal age in Brazil

Tendências e fatores associados a idade materna avançada no Brasil

Tendencias y factores asociados a la edad materna avanzada en Brasil

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Abstract
Considering the social, economic, and public health relevance of advanced maternal age (AMA), this study aimed to examine temporal and regional patterns and the impact of socioeconomic factors (education, marital status, income, and health service access) on birth rates in Brazil. A cross-sectional observational analytical approach was used with data from DATASUS and IBGE (2000–2019). Descriptive and statistical analyses of demographic and socioeconomic variables were performed. The results show a rising trend of AMA in Brazil, with maternal education level and marital status significantly associated with this increase. Most women received excellent prenatal care, although little information is available to assess the quality of this care in most cases. Annual GDP per capita was highly correlated with childbirth to women with AMA. Finally, the number of deaths of women with late pregnancies varied greatly between Brazilian regions, being highest in the Southeast and Northeast. These findings emphasize the need for health policies targeting women of late reproductive age, ensuring access to quality care. Understanding the dynamics of late motherhood is vital for shaping effective reproductive health and family planning strategies that address regional and socioeconomic disparities.
Keywords: Late motherhood; Birth rate; Pregnancy; Social determinants; Economic determinants.

Resumo
Considerando a relevância social, econômica e para a saúde pública da idade materna avançada (IMA), este estudo teve como objetivo examinar os padrões temporais e regionais e o impacto de fatores socioeconômicos (escolaridade, estado civil, renda e acesso a serviços de saúde) sobre as taxas de natalidade no Brasil. Utilizou-se uma abordagem analítica observacional transversal com dados do DATASUS e do IBGE (2000-2019). Foram realizadas análises descritivas e estatísticas das variáveis demográficas e socioeconômicas. Os resultados mostram uma tendência

crescente de IMA no Brasil, com escolaridade materna e estado civil significativamente associados a esse aumento. A maioria das mulheres recebeu uma excelente assistência pré-natal, embora haja pouca informação disponível para avaliar a qualidade dessa assistência. O PIB per capita anual apresentou alta correlação com o nascimento de mulheres com IMA. Por fim, o número de óbitos de mulheres com gestações tardias variou bastante entre as regiões brasileiras, sendo maior no Sudeste e Nordeste. Esses achados reforçam a necessidade de políticas de saúde voltadas para mulheres em idade reprodutiva tardia, garantindo acesso a cuidados de qualidade. Compreender a dinâmica da maternidade tardia é vital para a formulação de estratégias eficazes de saúde reprodutiva e planejamento familiar que abordem as disparidades regionais e socioeconômicas.
Palavras-chave: Maternidade tardia; Taxa de natalidade; Gravidez; Determinantes sociais; Determinantes econômicos.

Resumen
Considerando la relevancia social, económica y para la salud pública de la edad materna avanzada (EMA), este estudio tuvo como objetivo examinar los patrones temporales y regionales y el impacto de los factores socioeconómicos (educación, estado civil, ingresos y acceso a servicios de salud) en las tasas de natalidad en Brasil. Se empleó un enfoque analítico observacional transversal con datos de DATASUS e IBGE (2000-2019). Se realizaron análisis descriptivos y estadísticos de variables demográficas y socioeconómicas. Los resultados muestran una tendencia ascendente de la EMA en Brasil, con una asociación significativa entre el nivel de educación materna y el estado civil. La mayoría de las mujeres recibieron atención prenatal de excelencia, aunque existe poca información disponible para evaluar la calidad de esta atención. El PIB anual per cápita mostró una alta correlación con los nacimientos de mujeres con EMA. Finalmente, el número de muertes de mujeres con embarazos tardíos varió considerablemente entre las regiones brasileñas, siendo mayor en el sureste y el noreste. Estos hallazgos enfatizan la necesidad de políticas de salud dirigidas a las mujeres en edad reproductiva avanzada, garantizando el acceso a atención de calidad. Comprender la dinámica de la maternidad tardía es fundamental para diseñar estrategias eficaces de salud reproductiva y planificación familiar que aborden las disparidades regionales y socioeconómicas.
Palabras clave: Maternidad tardía; Tasa de natalidad; Embarazo; Determinantes sociales; Determinantes económicos.

1. Introduction

Brazil belongs to a group of countries classified as emerging economies and has experienced a reversal of its age pyramid. In other words, in these countries, mortality and birth rates have declined significantly, as the population has become older (Wong & Carvalho, 2006). This phenomenon also directly affects Advanced Maternal Age (AMA), which can be defined as pregnancy at age 35 or older (Frederiksen et al., 2018; Pinheiro et al., 2019). AMA, late motherhood, or geriatric pregnancy can be attributed to these older women, whether primigravidae or not, delaying pregnancy due to lifestyle choices or underlying subfertility (Guedes & Canavarro, 2014). In recent decades, the average age of conception and childbearing among women in the AMA has increased in developed and developing countries. In the United States, for example, the birth rate for women aged 35–39 increased from 45.9 per 1,000 women in 2010 to 52.7 per 1,000 women in 2019 (Hamilton et al., 2020), and in 2018 alone, women over 35 years accounted for 17% of all births in the country (Lu et al., 2025).

The decision to postpone motherhood can be influenced by several factors, such as women's integration into the labor market, the desire for independence and financial and professional stability, and the extension of study time (Johnstone et al., 2021; Silva da Cunha et al., 2022). In addition, access to and improvement of contraceptive methods contribute to late pregnancy and, consequently, to a decline in the birth rate (Aldrighi et al., 2018). The advent of new technologies and better access to health services allow women who become pregnant after the peak of their childbearing years to take fewer risks associated with pregnancy (Ferreira et al., 2023). Pregnancy at an advanced age can, therefore, also have positive factors. Women who postpone motherhood usually have better socioeconomic conditions, which can contribute to better prenatal care and a more favorable environment for the child's development. Studies have shown that these women tend to have a higher level of education, better financial resources, and more frequent access to high-quality medical care (Ladak et al., 2024).

However, many studies have highlighted that AMA is associated with a significant increase in obstetric complications, such as gestational diabetes, hypertension, preeclampsia, and the need for cesarean sections (Cleary-Goldman et al., 2005; Kenny et al., 2013). Infants born to older mothers have a greater risk of stillbirth, preterm birth, low birth weight, and

neonatal complications (Glick et al., 2021; Lean et al., 2017). Importantly, many of these increased risks appear to be independent of maternal comorbidities (Bahtiyar et al., 2006). In addition, AMA may be associated with an increased risk of postpartum complications. For example, Yogev et al. (2010) reported a strong association between AMA and postpartum hemorrhage, fever, the need for blood transfusions, and prolonged hospitalization. Gilboa et al. (2023) reported that maternal age over 40 years was an independent risk factor for acute kidney injury and new-onset postpartum preeclampsia. These factors may contribute to increased maternal mortality in AMA, but little is known about how this mortality evolves, dependent on or independent of medical advances.

Studies on late motherhood are, therefore, highly important because of their far-reaching social, economic, and health policy implications. As the average age of women at the time of motherhood increases, challenges arise in terms of fertility, maternal and child health, and the demographic structuring of society (Correa-de-Araujo & Yoon, 2021; Glick et al., 2021). Undoubtedly, knowledge of these circumstances is crucial for the development of effective public policies to promote reproductive health, family planning, and population balance. Although late childbearing may reflect advances in women's reproductive autonomy, it poses challenges to maternal and fetal health. Identifying factors associated with AMA is particularly important in developing countries such as Brazil.

To date, only a few studies have analyzed the factors associated with late pregnancy in Brazil (Martinelli et al., 2019, 2021). Da Silva et al. (2013) studied the birth weights of live births in a city in southern Brazil (Porto Alegre, Rio Grande do Sul) and reported that women who had children over the age of 35 were more likely to have children with low birth weights. Figueirêdo et al. (2014) found an association between AMA and a greater prevalence of preterm birth compared to pregnant women in the younger age group. A study by Martinelli et al. (2019) found that potentially fatal complications during pregnancy, childbirth, or the first week after birth were more common in AMA than in women aged 20 to 29 years. In a cross-sectional study of 2,394 postpartum women between 2011 and 2012, Nogueira da Gama et al. (2022) reported no association between AMA and the incidence of preterm birth, regardless of whether it was spontaneously induced or provider initiated. Martinelli et al. (2021) used data from 2,510 postpartum women with AMA and found that, compared with multiparous women, only 20.2% of them were primiparous but had higher education, higher economic class, and healthier maternal habits (fewer smokers and alcoholic beverage consumers).

Little is known about the influence of socioeconomic factors related to AMA in Brazil, and no studies have used an approach that separates the country's macroregions to understand the situation of women who experience late pregnancy. Studying the causes and consequences of late motherhood can not only reveal the current demographic and epidemiological reality of women with AMA but also provide valuable insights for interventions and health services that meet the needs of women at different stages of their reproductive lives and ensure their well-being and that of future generations. Given this, the present study analyzed demographic data to identify temporal and regional patterns of late motherhood in Brazil, particularly among women aged 35 to 49. In addition, the effects of socioeconomic predictors such as education, marital status, per capita income, and economic values related to access to public health services policies on AMA were examined. We hypothesize that late maternity has increased in all regions of Brazil and that socioeconomic variables such as Gross Domestic Product (GDP) per capita and women's education level influence rates of late motherhood. The deaths of women with AMA were also investigated.

2. Methodology

2.1 Data Collection

In this descriptive ecological study with a cross-sectional, retrospective, quantitative analytic approach (Pereira et al.

2018) using simple descriptive statistics with data classes separated by age range and values of relative percentual frequency and statistical analysis. We used a secondary database obtained through the platform of the Department of Informatics of the Unified Health System (DATASUS) of Brazil, which is regularly collected according to the Protocol for Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) (Benchimol et al., 2015). The Brazilian Ministry of Health is responsible for the dissemination of epidemiological information collected in the country through the Notifiable Diseases Information System (SINAN) and the Live Births Information System (SINASC) (Brasil - Ministério da Saúde, 2024). These data are treated ethically, as the files are publicly accessible, and their configuration preserves the identification of individuals and thus maintains confidentiality.

To assess the epidemiological profile of women who had children above the peak of childbearing age, we separated the data according to three age groups: 1) between 35 and 39 years (advanced maternal age – AMA); 2) between 40 and 44 years (very advanced maternal age – VAMA); and 3) between 45 and 49 years (extremely advanced maternal age – EAMA) (Claramonte Nieto et al., 2019; Kanmaz et al., 2019). Thus, for each of the three groups, data on the number of live births between 2000 and 2019 were obtained for Brazil and by macro-regions of the country (north, northeast, central-west, southeast, south), separating them according to (1) year of birth, (2) mother's level of education (years in school: one to seven years of study, eight to 11 years of study, more than 12 years of study), (3) mother's marital status, and (4) adequacy of prenatal care. For didactic purposes, in this study, we considered women with incomplete elementary education to be between 1 and 7 years of school age, those with complete elementary education (incomplete high school) between 8 and 11 years of school age, and those with complete high school equal to or greater than 12 years. Data on deaths of women of childbearing age and maternal deaths for the three age groups were also obtained for the same period (2000 to 2019) for Brazil and the five macroregions. Importantly, this study did not intend to assess the parity of women (single- or multiparous).

In addition, economic data on GDP per capita for the five macroregions (north, northeast, central west, southeast, and south) of Brazil for the years 2000 to 2019 were obtained from the Brazilian Institute of Geography and Statistics (IBGE – Instituto Brasileiro de Geografia e Estatística, 2024b). Additionally, through the Regional Accounts System available on the IBGE website, we collected the gross regional expenditure values: 1) “Total economic activities”; 2) “Electricity and gas, water, sewage, waste management, and decontamination activities”; 3) “Public administration, defense, education and health, and social security”. The data for the Brazilian Regional Accounts series are prepared by the National Accounts Coordination (CONAC) together with the Research Directorate of the Brazilian Government and are in the public domain.

2.2 Statistical analysis

Descriptive analyses of the data were performed, and the data were presented in the form of lines and bar graphs for better visualization of the results. To assess whether the number of children increased significantly over the years for the three groups of women with AMA (35 to 39 years; 40 to 44 years; and 45 to 49 years), we performed three nonlinear least squares regressions using the number of children per year as the dependent variable (Y) and the years as the independent variable (X). After graphical analysis of the data distribution, exponential models (Yi = A^bxi) were adjusted for the first two age groups (35 to 39 years; 40 to 44 years), and a quadratic model (Yi = A+Bxi+Cx²) was used for the last age group (45 to 49 years). Where *Y*i represents the estimated mean value for the number of children, in the i-th observation; A represents the asymptotic or maximum value estimated for each scenario; B is the abscissa of the inflection point, the point of maximum growth, from which the deceleration of the characteristic under study occurs; and xi is the i-th year of measurement. The parameter estimation was performed by minimizing the sum of squared errors, which results in nonlinear systems of normal equations, which do not have an explicit solution, requiring the use of an iterative process. Gauss-Newton iterative process was used,

which is the standard for the "nonlinear least squares" function - nls(), present in the statistical software R (R Core Team R, 2020).

To verify whether the number of births in the three groups of women with AMA is related to the increase in annual GDP per capita as well as with the three gross regional expenditure values of each macroregion of Brazil (north, northeast, central-west, southeast, and south), Pearson correlations were performed in the statistical software R (R Core Team R, 2020). To assess whether the number of maternal deaths of women over childbearing age is increasing, decreasing, or stable over the years for Brazil and for the five macro-regions, simple regressions were performed using generalized linear models (GLSs), also in the statistical software R (R Core Team R, 2020). In this case, the annual maternal deaths for women between 35 and 49 years old was obtained for each macroregion and Brazil and used as the dependent variable (Y), while the years represented the independent variable (X). For GLS, the assumption of data normality was verified via the Shapiro-Wilk test, and homogeneity of variances was verified via the Levene test, in addition to graphical analysis of the residuals. All the data met the assumptions for the analyses. The significance level was considered $p<0.05$ in all cases.

3. Results

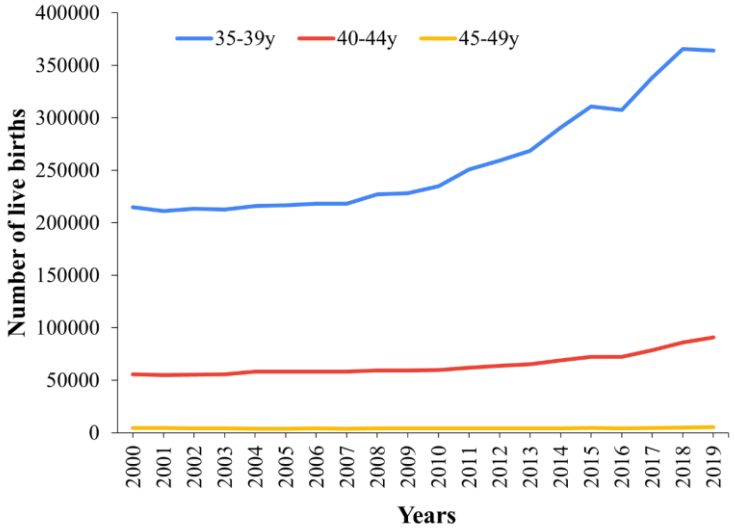
In Brazil, women aged 35 to 39 had more children (78.91%) than women aged 40 to 44 (19.77%) and those aged 45 to 49 (1.32%) (Figure 1). There was a significant increase in the number of births for the three groups of women above childbearing age, with coefficients of determination (R^2) of 0.89 (Model 1 – women aged 35 to 39), 0.84 (Model 2 – women aged 40 to 44), and 0.81 (Model 3 – women aged 45 to 49) (Table 1). Over the twenty years (2000 – 2019), 14.54% of children born in Brazil were to women between 35 and 49 years old, while 63.75% were to women between 20 and 29 years old, and 21.72% were to women between 30 and 34 years old (according to the SINAN database).

Table 1. Estimates of the parameters of the polynomial equation adjusted to express the relationship between the number of children born annually for each of the three groups of women with advanced maternal age (Model 1 - women between 35 and 39 years; Model 2 - women between 40 and 44 years; Model 3 - women between 45 and 49 years). Values of $p<0.05$ are significant.

	Coefficient	Parameter	Standard Error	T Value	Pr (>|t|)	R^2
Model 1	A	183700	6259	29.36	<0.001	0.89
	B	0.0338	0.002637	12.82	<0.001	
Model 2	A	50110	1600	31.33	<0.001	0.84
	B	0.02575	0.002551	10.09	<0.001	
Model 3	A	4627.986	95.625	48.397	<0.001	0.81
	B	-157.556	23.328	-6.754	<0.001	
	C	9.666	1.185	8.155	<0.001	

Source: Authors.

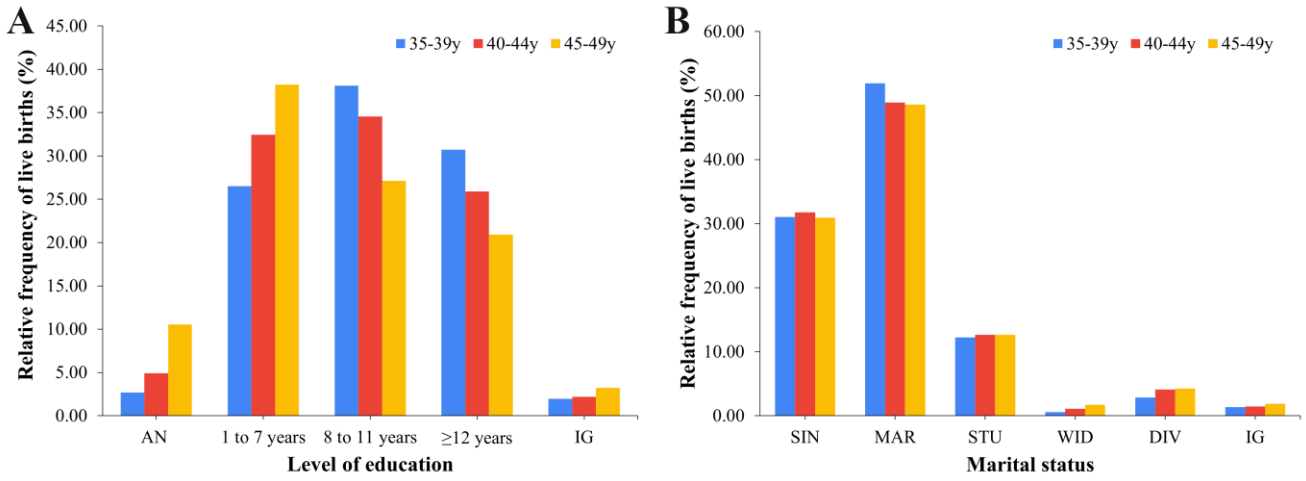
Figure 1. Number of live births for women with advanced maternal age (between 35 and 49 years) between 2000 and 2019 in Brazil.



Source: Authors.

When assessing the level of education, it is possible to observe that most women with AMA have between one and 12 years of education (elementary school or incomplete or complete high school; Figure 2A). Specifically, women between 35 and 39 years old have a higher level of education, mainly incomplete high school (38.12%) and complete (30.72%), while those between 40 and 44 years old have mostly completed high school (34.54%) or incomplete elementary school (32.46%). Compared to those in other age groups, women who had children between 45 and 49 years old have a lower level of education, and most of them have completed elementary school (38.23%) or incomplete high school (27.11%), with more than 10% being illiterate (Figure 2A).

Figure *2*. Relative frequency of births to women with advanced maternal age (between 35 and 49 years) according to the level of education (A) and marital status (B) between 2000 and 2019 in Brazil. Legend: AN = Illiterate; IG = Ignored (not informed); SIN = Single; MAR = Married; STU = Stable Union; WID = Widow; DIV = Divorced; IG = Unknown (not reported).

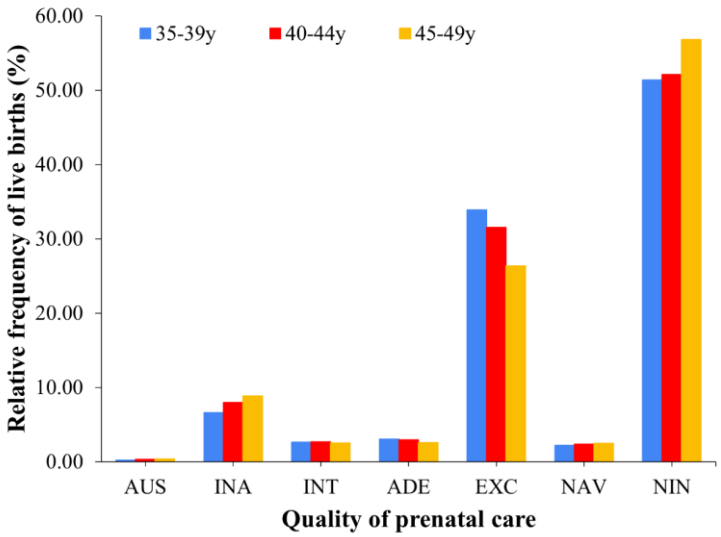


Source: Authors.

Most women with AMA are married (~50%), followed by single women (~31%) and those in a stable union (~12%) (Figure 2B). Although the difference between the three groups is not large, a slightly greater percentage of women with AMA who had children between the ages of 35 and 39 are married (Figure 2B).

Overall, women of advanced maternal age had excellent prenatal care (~31%), but the number of inadequate prenatal care (~8%) is still relatively significant. Furthermore, it should be noted that there is insufficient information to classify the quality of prenatal care for most women with AMA (>50%; Figure 3).

Figure 3. Relative frequency of types of prenatal care performed among women with advanced maternal age (between 35 and 49 years) between 2000 and 2019 in Brazil. Legend: AUS = Absence; INA = Inadequate; INT = Intermediate; ADE = Adequate; EXC = Excellent; NAV = Not assessed; NIN = Not informed.



Source: Authors.

The region of Brazil with the highest number of births to women with AMA is the Southeast, followed by the Northeast and South (Figure 4A). Women in the North and Central-West regions had similar birth rates over the years (Figure 4A). Except for women aged 45–49 in the North and Northeast of Brazil, annual GDP per capita showed a high correlation with the annual number of children born to women with AMA (Table 2). There was a weak or absent correlation between women who had children aged 45–49 in the North and South of the country and the values of 'management' and 'administration', and a strong negative correlation between these same values and the group of women in Northeast Brazil (Table 2).

Table 2. Pearson Correlation values (coefficient = r) between GDP per capita, 'management' (amounts spent annually on electricity and gas, water, sewage, solid waste management activities, and decontamination), and 'administration' (amounts spent annually on public administration, defense, education and health, and social security) of each microregion and the number of annual births of children in women with AMA (between 35 and 49 years old) for Brazil, between 2000 and 2019. Classification of coefficients: $|0.3| < r \leq |0.6|$ = Moderate correlation; $|0.6| < r \leq |0.9|$ = Strong correlation; $|0.9| < r < |1|$ = Very strong correlation.

Values	Age	North	Northeast	Midwest	Southeast	South
GDP per capita	35 a 39	0.98	0.96	0.93	0.92	0.97
	40 a 44	0.99	0.95	0.95	0.99	0.99
	45 a 49	0.75	0.48	0.96	0.99	0.97
Management	35 a 39	0.98	0.97	0.98	0.98	0.94
	40 a 44	0.99	0.84	0.97	0.98	0.86
	45 a 49	-0.13	-0.65	0.95	0.98	0.48
Administration	35 a 39	0.99	0.93	0.99	0.96	0.93
	40 a 44	0.97	0.75	0.98	0.94	0.83
	45 a 49	-0.37	-0.72	0.96	0.95	0.43

Source: Authors.

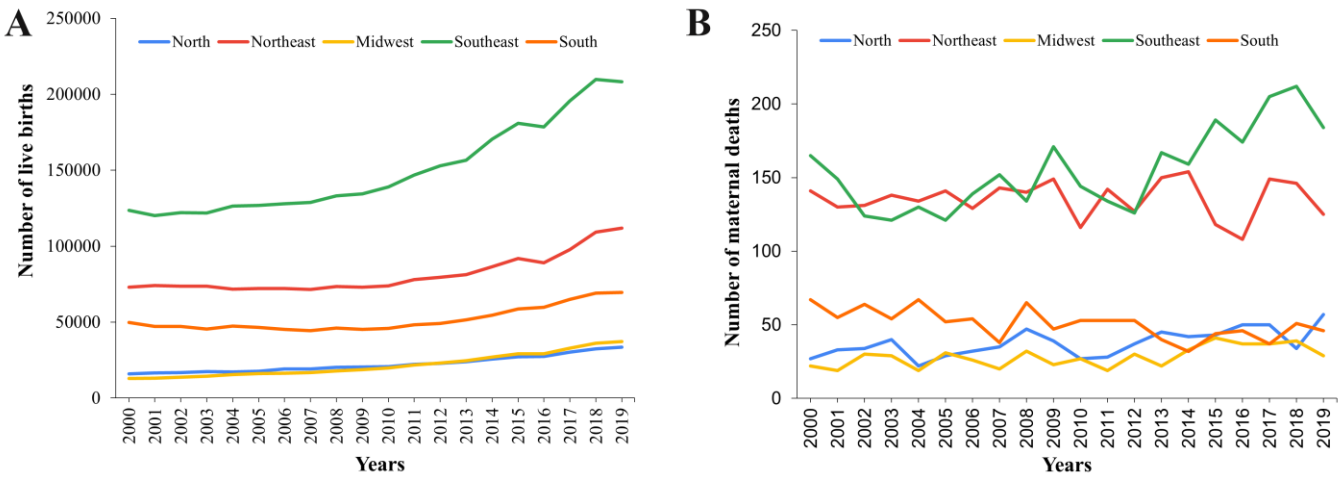
Finally, we found that the number of deaths of women who had late pregnancies (between 35 and 49 years of age) varied greatly between Brazilian regions, with the highest number of deaths occurring in the southeast and northeast regions of the country, followed by the south, north and central-west regions (Figure 4B). Although there was a significant overall increase in the number of maternal deaths in the AMA for Brazil ($p<0.05$), the northeast region did not show any variation over the years ($p>0.05$), in the south region there was a reduction in mortality ($p<0.05$) and in the other regions there was an increase, with emphasis on the central-west, north and southeast, respectively (Table 3).

Table 3. Estimates of the parameters of the generalized linear models (GLM) between the number of maternal deaths of women with advanced maternal age (35 to 49 years) for each of the macro-regions of Brazil and the entire country. Values of $p<0.05$ are significant.

Region	Parameter	Standard Error	T Value	Pr(>|t|)	R^2
North	0.417	0.116	3.605	0.002	0.39
Northeast	-0.029	0.112	-0.26	0.798	-0.05
Midwest	0.505	0.161	3.132	0.005	0.32
Southeast	0.149	0.036	4.147	<0.001	0.46
South	-0.387	0.106	-3.656	0.001	0.39
Total	0.110	0.031	3.562	0.002	0.38

Source: Authors.

Figure 4. Number of births of children (A) and maternal deaths (B) among women of advanced maternal age (between 35 and 49 years) according to the macroregion of Brazil.



Source: Authors.

4. Discussion

AMA is increasing in Brazil, especially for women between 35 and 44 years old. A similar result was reported in the United States (Hamilton et al., 2020). In European countries, the average age for having the first child is increasing and is currently 29.7 years, reaching 31.6 years in countries such as Italy and Spain (Eurostat, 2023). This indicates a change in reproductive behavior, which may reflect socioeconomic changes resulting from female emancipation and the social inclusion of women as citizens in society (Johnstone et al., 2021), especially in developing countries such as Brazil (Silva da Cunha et al., 2022). Currently, women's higher social status directly influences family decisions since motherhood can reduce job market opportunities and career progression, as well as increase living costs (Dias Júnior, 2010; Silva da Cunha et al., 2022). The decision to become a mother is also related to the woman's level of education, career planning, and access to contraceptive methods (Aldrighi et al., 2018; Maloney et al., 2021). However, there are still many stigmas surrounding late pregnancy, which can arise from different sources, including cultural perceptions, health and fertility issues, and personal opinions (De Clercq et al., 2023). In many cultures around the world, women are expected to marry and prioritize having children at a young age. Therefore, there is much social pressure related to motherhood, especially from family members, and those women who choose to have a late pregnancy are judged negatively and are seen as 'irresponsible', disrespecting their traditional role in society (Scala & Orsini, 2022). This pressure has psychological implications that can negatively impact self-esteem and cause anxiety in women who decide to have a late pregnancy (De Clercq et al., 2023).

Although pregnancies at ages ≥ 35 years may be associated with increased risks, such as increased chances of spontaneous abortions, premature birth, chromosomal anomalies (e.g., Down syndrome), hypertension, and gestational diabetes, among other complications (Glick et al., 2021; Saccone et al., 2022), these risks can be monitored and managed through prenatal care. Importantly, fertility declines sharply after the age of 30, and assisted reproductive technology has significantly lower success rates for older women (Mills & Lavender, 2011), but improvements in health conditions resulting from new technologies and monitoring by health teams allow for safer later pregnancy (Sauer, 2015). Careful monitoring during the prenatal period and adequate assistance during labor and delivery can result in maternal and perinatal prognoses similar to those of younger pregnant women (Parada & Tonete, 2009). Therefore, it is important to promote a more balanced understanding of women's reproductive health and choices.

Most women with AMA have some level of education, but it is notable that the older the woman is, the lower her level of education. Other studies have revealed that educational level is a predictor of advanced maternal age (Maloney et al., 2021; Neels et al., 2017). The level of education is a fundamental indicator of socioeconomic status and quality of life, reflecting the relationship between education and the incidence of pregnancy, which can influence both a woman's fertility and knowledge about contraceptive methods. In general, a higher level of education is related to better remuneration (economic condition) and social prestige, which contributes to the delay of motherhood, as women have greater decision-making power over their bodies and their lives (Bruzamarello et al., 2019; Silva da Cunha et al., 2022). As the level of education increases, women reduce their domestic workload, but their commitment to professional work increases (Johnstone et al., 2021). In Brazil, the level of illiteracy has decreased over the years, and women tend to have better educational indicators than men (IBGE – Instituto Brasileiro de Geografia e Estatística, 2024a). Women's higher level of education allows them independence and economic stability, as well as a tendency to form smaller families (fewer children) at an older age.

Although many women who have had children over the age of 34 are single or in stable relationships, most are married. These findings indicate that these women probably have more stable family planning. Marriage brings greater closeness, patience, affection, and companionship to the couple (Bruzamarello et al., 2019), thus promoting greater emotional balance and peace of mind regarding financial stability. Consequently, women can deal with the demands associated with children with greater serenity and equanimity. Furthermore, in a structured family nucleus, individual and social vulnerabilities tend to decrease (Seibel et al., 2017). The active participation of the partner and other family members is seen as a support network that results in positive emotional and behavioral effects (Oliveira & Dessen, 2012) and should be present in the woman's decision to consider pregnancy.

It is important to highlight that although 31% of women who had late pregnancies had excellent prenatal care, many had inadequate prenatal care, and for most of them (more than 50%), there was no information on the quality of prenatal care. Prenatal care guarantees access to diagnostic and therapeutic methods for maternal pathologies and monitoring fetal development and growth, with a minimum number of consultations recommended by the Ministry of Health, is essential to reduce premature births and neonatal mortality, ensuring a safer pregnancy (Leal et al., 2016, 2020). A study carried out by Melo et al. (2015) revealed that the chance of premature birth when prenatal care is inadequate can be up to twice as high, especially when the number of consultations is lower than recommended. However, not only the number but also the quality of consultations for the diagnosis and treatment of gestational complications is directly associated with premature birth (Melo et al., 2015). These factors may be even more important in late motherhood, especially for pregnant women with unfavorable socioeconomic and individual characteristics (Martinelli et al., 2021). There is great inequality in access to and quality of prenatal and childbirth care among users of public services in different regions of Brazil (Leal et al., 2020). Therefore, it is necessary not only to improve the quality of prenatal care but also to collect refined data on the exams and consultations performed on postpartum women so that it is possible to conduct more studies on the risks and challenges of late motherhood.

Southeast Brazil, followed by the Northeast and South, are the macroregions with the highest number of women with late pregnancies. This fact is directly related to the population size of women in these regions. For example, a similar pattern by region was also observed for children born with spina bifida (Campos et al., 2021) and heart disease (Barros et al., 2023). Regional inequalities in Brazil are known not only for socioeconomic status but also for the quality of health services (Massuda et al., 2018), healthy life expectancy (Szwarcwald et al., 2016) and early birth rates (de Andrade et al., 2022). Socioeconomic disparities between Brazilian regions reinforce the need for regional studies to determine the different needs for actions and public policies for health promotion, prevention, and care.

In general, both annual GDP and other economic indicators of management and administration are directly related to

the number of women with AMA in Brazil. Some exceptions were found for women aged 45 to 49 in the north, northeast, and south of the country. Socioeconomic factors are also significant predictors of premature birth rates in the North and Northeast of Brazil (de Andrade et al., 2022). Socioeconomic resources increase with the age of women and their families, which may favor an increase in AMA. Economic development is directly related to the quality of and access to health services (Victora et al., 2011), so it is important to understand the social and economic disparities of each region to develop targeted public policies.

There was an increase in the number of deaths of women with AMA in Brazil, but there was great variation between regions. In the southern region, mortality decreased significantly, whereas in the central west, north, and southeast regions, mortality significantly increased. Oliveira et al. (2024) studied maternal mortality in different regions of Brazil and reported that most deaths occurred among women between 30 and 39 years, with a significant reduction in the southern region and a significant increase in the north and southeast regions of the country. Our results were slightly different because we individualized the groups of women with late motherhood and used a different (longer) period. In the southern region of Brazil, the population has excellent levels of socioeconomic development, and the implementation of the Rede Cegonha within the country's public health system (Sistema Único de Saúde - SUS) led to advances in prenatal, childbirth, and postpartum care, resulting in a reduction in adverse maternal and neonatal outcomes (Silva de Souza et al., 2022). The populations in the northern region of the country have less access to health and education, being a region with a lower socioeconomic level (de Jesus et al., 2022). The southeast region, with the largest number of hospitals, has become a reference center, receiving more serious cases that evolve to death (Silva de Souza et al., 2022). Importantly, the central-west region presented the greatest increase in mortality of women with late pregnancies, which may indicate neglect in the health care of these women.

Although the dominant narrative is that late motherhood is related to intended pregnancy, more research is needed to understand these factors. For example, in a study conducted in the United States, Maloney et al. (2021) found that one-third of pregnancies in women over the age of 35 were unintended. This may be because women aged 35 and over are increasingly engaging in sexual activity without contraception or sterility (Finer & Philbin, 2014). Therefore, epidemiological research on AMA is of paramount importance as it provides more knowledge to health professionals, contributing significantly to a deeper understanding of birth patterns and, therefore, helping to guide health policies that aim to improve the monitoring and care of these pregnant women. Better management strategies and interventions that can minimize the risks associated with late pregnancies and promote better outcomes for mothers and babies need to be discussed. Because of the risks of late pregnancy, women who wish to become pregnant at an advanced maternal age should be encouraged to optimize their health in preparation for pregnancy.

5. Conclusion

AMA is increasing in Brazil, and mothers' level of education and marital status are associated with this increase. The increasing participation of women in different sectors of society, especially in politics and the labor market, combined with the desire for financial and professional stability, has contributed significantly to the postponement of motherhood. In addition, access to education and health services plays a crucial role in this scenario, directly influencing women's reproductive decisions. It is important to emphasize the importance of collecting data on health determinants, such as the level of prenatal care provided during pregnancy, to assess other health determinants such as infant mortality rate, premature births, and childhood comorbidities. Understanding these determinants is essential for guiding public policies aimed at promoting reproductive health, as well as family planning. There are few studies related to late motherhood in underdeveloped countries, and new studies can help us understand the most important determinants in different cultures and the challenges faced by

different populations. Furthermore, the lack of research and data on this topic leaves women aged 35 or older who are interested in becoming mothers without information about the risks and challenges of late pregnancy. Future research should consider other economic and social aspects to understand late pregnancy and ensure the well-being of women and future generations.

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