

Temporal live births trend analysis considering reproductive age during pregnancy

Análise da tendência temporal de nascidos vivos considerando a idade reprodutiva durante a gestação

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- Alana Vitória Escritori Cargnin¹
- Camila Moraes Garollo Piran¹
- Natan Nascimento de Oliveira¹
- Rosana Rosseto de Oliveira¹
- Claudiana Ribeiro da Silva Araújo¹
- Maria de Fátima Garcia Lopes Merino¹
- Marcela Demitto Furtado¹

¹Universidade Estadual de Maringá.
Maringá, PR, Brazil.

Corresponding author:

Alana Vitória Escritori Cargnin
Avenida Colombo, 5790 - Campus Universitário
Bloco 002, sala 001. CEP: 87020-900.
Maringá, PR, Brazil.
E-mail: alanaescritori@gmail.com

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ASSOCIATE EDITOR: Suellen Cristina Dias Emidio

ABSTRACT

Objective: to analyze the temporal live births trend by Brazilian regions and states, considering reproductive age during pregnancy. **Methods:** epidemiological, ecological study using data obtained from the Live Birth Information System and population estimates. Birth data were analyzed according to maternal age, 10 to 19 years, 20 to 34 years and ≥ 35 years. **Results:** a total of 25,385,841 live births were analyzed, among women aged 10 to 35 years or older in Brazil, with the highest occurrence of births in the age group of 20 to 34 years, corresponding to 928.15 per 1,000 women with a downward trend ($p \leq 0.001$). Birth rate's spatial distribution analysis by maternal age strata demonstrated a downward trend in almost all Brazilian states between the ages of 10 and 19 and an increase in the ≥ 35 age group. **Conclusion:** births in the maternal age group of 20 to 34 showed higher rates, however with a decreasing trend. Pregnancies at the extremes of reproductive age during adolescence showed a decreasing trend and at > 35 years showed an upward trend. **Contributions to practice:** it contributes to the planning of public policies to meet the needs of a pregnancy at the extremes of reproductive life.

Descriptors: Reproductive Behavior; Maternal Age; Women's Health; Health Information Systems.

RESUMO

Objetivo: analisar a tendência temporal de nascidos vivos por regiões e estados brasileiros, considerando a idade reprodutiva durante a gestação. **Métodos:** estudo epidemiológico, do tipo ecológico, com dados obtidos no Sistema de Informação de Nascidos Vivos e estimativas populacionais. Analisaram-se dados de nascimentos conforme a idade materna, 10 a 19, 20 a 34 e ≥ 35 anos. **Resultados:** foram analisados 25.385.841 nascimentos vivos, entre mulheres de 10 a 35 anos ou mais no Brasil, sendo a maior ocorrência de nascimentos na faixa etária de 20 a 34 anos, correspondente a 928,15 a cada 1.000 mulheres com tendência de queda ($p \leq 0,001$). A análise de distribuição espacial das taxas de nascimentos por estratos de idade materna demonstrou tendência de redução em quase todos os estados brasileiros entre 10 a 19 anos e aumento na faixa etária ≥ 35 anos. **Conclusão:** os nascimentos na faixa etária materna de 20 a 34 anos apresentaram maiores taxas, entretanto com tendência decrescente. Já a gestação nos extremos da idade reprodutiva durante a adolescência apresentou tendência decrescente e com > 35 anos houve tendência de aumento. **Contribuições para a prática:** contribui para o planejamento de políticas públicas para suprir necessidades em uma gestação nos extremos da vida reprodutiva.

Descritores: Comportamento Reprodutivo; Idade Materna; Saúde da Mulher; Sistemas de Informação em Saúde.

Introduction

Worldwide, the proportion of women who become pregnant at the extremes of reproductive age, that is, before the age of 20 and at the age of 35 or over, has increased considerably, posing a serious public health problem, due to perinatal outcomes associated with these pregnancies⁽¹⁾.

Teenage pregnancy is considered a public health problem in some developing countries, affecting social and biological aspects⁽²⁾. The global teenage pregnancy rate is estimated at 46 births per 1,000 girls. In relation to national data, every seventh baby is born to a teenage mother, and 48 babies are born to teenage mothers every hour. A worrying fact is the number of babies with mothers up to 14 years old, which accounted for 19,330 births in 2019, which means that every 30 minutes, a girl between 10 and 14 years old becomes a mother⁽³⁾. A higher frequency of low birth weight and prematurity was evidenced in children of adolescents, with their occurrence commonly associated with low socioeconomic conditions of most of them⁽⁴⁾.

The definition of the adolescence age group is established by the World Health Organization (WHO), which delimits it to the second decade of life, that is, from 10 to 19 years old. Legal instruments are being implemented to protect the fundamental right to health of adolescents⁽⁵⁾.

In relation to the pregnancy of women aged 35 or over, pregnancies called late or at an advanced maternal age, a greater susceptibility to pathological changes is identified, with increased risks to the fetus, therefore, such age can be considered a risk factor⁽⁶⁾. The increase in the mean maternal age may be associated with progress in perinatal management, advances in assisted reproductive technologies and the increasing insertion of women in the labor market⁽⁷⁾.

However, contrary to what is observed for younger women, there are no public policies specifically aimed at women with Advanced Maternal Age.

Specialized care is configured in general guidelines and manuals from the Ministry of Health, such as those aimed at managing high-risk pregnancy, abortion, prenatal care and the postpartum period⁽⁸⁾.

It is important to highlight that there are sustainable development goals (SDGs), focused on reducing maternal mortality, which requires thinking about what actions can help achieve the proposed targets for such a reduction. In view of the above, this study is justified by the importance of monitoring the pregnancy trend at the extremes of life, in order to reduce the risks for both groups (pregnant teenagers, and pregnant women of advanced maternal age) enabling the development of public policies aimed at the needs of these pregnant women, and collaborating with the SDGs⁽⁹⁾.

The need for research focusing on maternal health is highlighted, given the relevance of the topic due to the impact that pregnancy has on the life of the woman, the fetus and the community in general. Furthermore, with social changes that have occurred over time, the profile of births in Brazil may have changed, which may impact strategies for preventing unfavorable outcomes and maternal and child care. In this context, knowing the evolution of births occurring in the country, and possible regional disparities, can be an important tool for managers and health professionals. Thus, the objective of the present study was to analyze the temporal live births trend by Brazilian regions and states, considering reproductive age during pregnancy.

Methods

This is an epidemiological, ecological study on live birth rates by maternal age group, using data from the Live Birth Information System, for the period from 2011 to 2021, for the period 2011 to 2021, with the Brazilian regions and their states as the units of analysis.

Data collection took place in June 2023, through Live Birth Information System and population estimates, with data available on the website of the Information Technology Department of the Unified Health System.

The mothers' ages were divided into three age groups: 10 to 19 years old, 20 to 34 years old and 35 years old and over. This stratification was based on the World Health Organization's definition, in which teenage pregnancy is defined as one that occurs between the ages of ten and nineteen, whereas late pregnancy or at an advanced maternal age is understood as one that occurs in women of the same age or over 35 years old⁽⁵⁾.

The variables analyzed were, as follows: maternal age strata, regions and Brazilian states. Birth rates were calculated using the ratio between the number of live births, according to the mother's age group, and the population of women in each year and location, multiplied by 1,000.

For the temporal trend analysis, the Prais-Winsten generalized linear analysis model was used, considering the years assessed (2011 to 2021) as independent variables (X) and gestational rates as dependent variables (Y). Thus, the adjustment line between the points of the time series, whose trend we intended to estimate, used the following equation: $Y = \beta_0 + \beta_1 X$. In order to reduce the heterogeneity of variances in the residuals of the temporal regression analysis, the logarithmic transformation (log10) of the Y values was applied. A significance level of 5% was adopted. The data were organized in Microsoft Office Excel® software spreadsheets and statistical analyzes were carried out using R software, version 3.6.2.

To carry out the spatial distribution of pregnancy rates, the cartographic base of Brazil with State borders was used, which is available online in shapefile (SHP) on the website of the Brazilian Institute of Geography and Statistics. The purpose of constructing choropleth maps was to demonstrate the chronological distribution of the mean pregnancy rate by age

group, coefficient, and trend in Brazilian states over three-year periods (2011 to 2013, 2016 to 2018, 2019 to 2021). The figures were constructed using QGIS 3.14 software.

The research respected the guidelines set out by the National Health Council of the Ministry of Health, through Resolution No. 466/12. As this is public domain data, there was no need for evaluation by the Standing Committee on Ethics in Research with Human Beings.

Results

A total of 25,385,841 live births to mothers residing in Brazil, occurring between 2011 and 2021, were analyzed. The highest occurrence of births in the country was in the age group of 20 to 34 years, corresponding to 928.15 per 1,000 women with a decreasing trend ($p < 0.001$), followed by the adolescent age group (10 to 19 years), also with a downward trend ($p = 0.002$). In the age group of advanced women (35 years or more), there was an increasing trend ($p = 0.022$) in pregnancies, with a mean rate of 9.46 (Table 1).

Table 1 – Trend in pregnancy rates among women in Brazil, according to age group from 2011 to 2021. Maringá, PR, Brazil, 2023

Location/ Age (years)	Mean rate	Coefficient	Standard Error	R ²	p-value [†]	Trend [‡]
Brazil						
10 - 19	30.53	-0.84	-1.0386; -0.6394	0.96	0.002	↓
20-34	928.16	-54.99	-56.0194; -53.9617	1.00	<0.001	↓
≥35	9.46	0.13	0.083; 0.1778	0.95	0.022	↑

Source: Ministry of Health Live Birth Information System, 2011-2021
^{*}Value of the coefficient of determination; [†]Significant trend is the model that obtained $p < 0.05$; [‡]Increasing; ↓Descending

In relation to the Brazilian regions, in the North Region, there is a tendency for a reduction in the groups aged 10 to 19 years and 20 to 34 years

($p \leq 0.001$), respectively. Among the age group of 35 years and over, there was an increasing trend ($p = 0.003$).

In the Brazilian Northeast, there was a decreasing trend in the 10 to 19 years and 20 to 34 age groups ($p \leq 0.001$), respectively. Whereas among those aged 35 and over, there was an increasing trend ($p \leq 0.001$). In the Central-West, there was a decreasing trend ($p = 0.005$) from 10 to 19 years old and an increasing trend ($p = 0.004$) in the age group of 35 years and over.

In the analysis of the Southeast and South regions, a decreasing trend was observed in the age group from 10 to 19 years old ($p = 0.004$ and $p = 0.005$, respectively). Between 20 and 34 years old, the Southeast region showed a decreasing trend ($p = 0.033$). In the age group of 35 years and over, both regions showed an increasing trend ($p = 0.14$; $p = 0.018$) (Table 2).

In the analysis of the spatial distribution of live birth rates according to maternal age strata, a reduction trend was observed in almost all Brazilian states in the age group of 10 to 19 years, except Roraima with an increasing trend with a mean rate varying between 40, 9 to 54.8 (coefficient $-0.69 \mid 0.59$).

In relation to the age group from 20 to 34 years old, the increasing trend was concentrated in Roraima, Mato Grosso and Santa Catarina, with a variation in the rate between 88.7 and 106.3 (coefficient $-0.27 \mid 1.09$).

In the age group of 35 years and over, a downward trend was observed in Acre, with a rate varying from 10.38 to 15.04 (coefficient $-0.13 \mid 0.05$). Rio de Janeiro, Sergipe and Amapá showed a stationary trend and the other Brazilian states showed an increasing trend with a rate between 8.01 and 15.04 (Figure 1).

Table 2 – Trend in pregnancy rates among women, according to age group and region of residence from 2011 to 2021. Maringá, PR, Brazil, 2023

Region/Age (years)	Mean rate	Coefficient	Standard Error	R2*	p-value†	Trend‡
North						
10 - 19	44.90	-0.91	-1.0537; -0.776	0.99	<0.001	↓
20-34	87.95	-0.91	-0.9522; -0.8704	0.99	<0.001	↓
≥35	10.15	0.10	0.0782; 0.1281	0.99	0.002	↑
Northeast						
10 - 19	33.79	-0.79	-0.9499; -0.6351	0.98	<0.001	↓
20-34	75.53	-0.63	-0.7295; -0.5358	0.99	<0.001	↓
≥35	8.91	0.14	0.1151; 0.17	0.97	<0.001	↑
Southeast						
10 - 19	25.30	-0.90	-1.1429; -0.6633	0.92	0.004	↓
20-34	74.88	-0.70	-0.972; -0.4201	0.98	0.032	↓
≥35	9.63	0.10	0.0382; 0.1661	0.92	0.144	↑
South						
10 - 19	25.83	-0.89	-1.1292; -0.6479	0.93	0.005	↓
20-34	77.30	-0.15	-0.4062; 0.0976	0.98	0.555	-
≥35	9.45	0.16	0.1061; 0.2183	0.93	0.017	↑
Midwest						
10 - 19	31.95	-0.87	-1.0992; -0.6335	0.95	0.004	↓
20-34	82.62	-0.12	-0.3976; 0.1606	0.98	0.681	-
≥35	9.67	0.22	0.163; 0.2788	0.91	0.004	↑

Source: Ministry of Health Live Birth Information System, 2011-2021

*Value of the coefficient of determination; †Significant trend is the model that obtained $p < 0.05$; ‡↑Increasing; ↓Decreasing; - Stationary

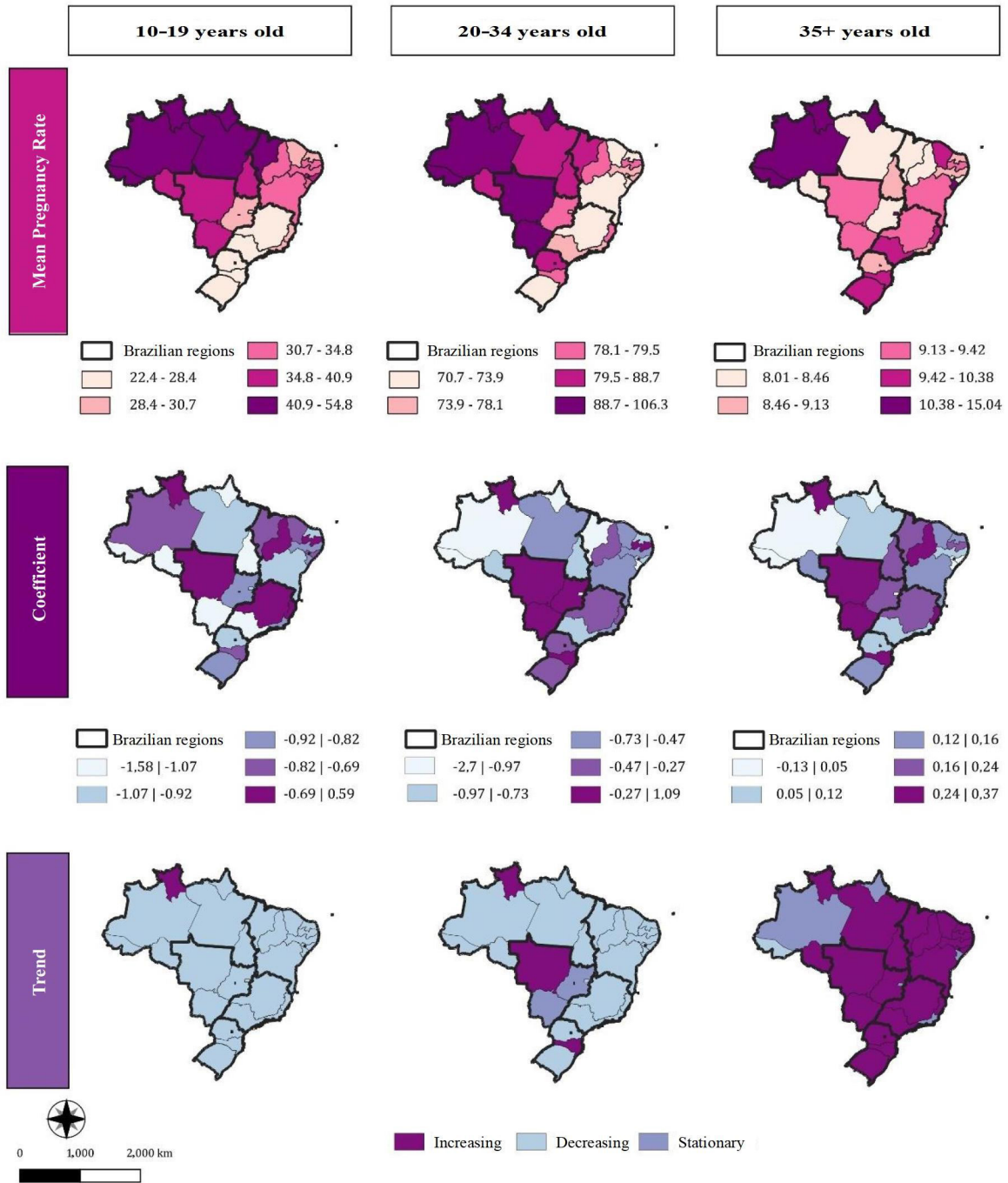


Figure 1 – Spatial distribution of pregnancy rates between Brazilian states, according to age group, from 2011 to 2021. Maringá, PR, Brazil, 2023

Discussion

The analysis of birth trends at different reproductive ages during pregnancy, with special attention to the extremes of reproductive age, is of great importance in order to reduce public health problems and develop strategies to improve maternal and child health. There is notable interest in achieving the global sustainable development objectives proposed for this audience, included in target 3.1 by the United Nations, which aims to, until 2030, reduce the global maternal mortality rate to less than 70 deaths per 100,000 live births. For Brazil, the goal, until 2030, is to reduce the maternal mortality ratio to a maximum of 30 deaths per 100,000 live births⁽⁹⁾.

It is noteworthy that in 2011, the Ministry of Health established the *Rede Cegonha* aiming to: qualify the maternal and child health services offered in the Unified Health System and ensure women all the rights to reproductive planning and humanized care from pregnancy, childbirth and postpartum period, as well as the birth of the child, providing healthy growth.

Even with the improvement of women's basic rights to sexual and reproductive life, there are still persistent disparities between the profile of women of advanced maternal age and those who are adolescents across the Brazilian territory⁽¹⁰⁾.

The large concentration of gestational rates among women aged 20 to 34 years reflects possible positive obstetric and perinatal results when compared to adolescents and women with advanced maternal age⁽¹¹⁾. A decreasing trend in birth was identified among women aged 20 to 34, possibly because they are at a reproductive age with fewer risks and due to the use of obstetric interventions only when necessary⁽¹²⁾. However, this is not true of the public service at national level, since there is a great disparity between the realities of maternal and child care in Brazil⁽¹³⁾.

Although there may be differences between regions of the country, a research carried out in Piauí identified that extremes in maternal age are factors of

gestational risk, risk at birth and vitality of the newborn. Between 1995 and 2018, it was shown that the frequency of births among women aged ≥ 35 years increased, with greater chances of prematurity and low birth weight⁽¹⁴⁾.

Internationally, women between 20 and 34 years of age had a greater need for cesarean section and cases of prematurity, highlighting the need for prenatal care to help the maturity of the reproductive system and thus gradually reduce adverse outcomes⁽¹⁵⁾.

Pregnancy between the reproductive age of 10 and 19 years may be related to socioeconomic disadvantages⁽¹⁶⁾, which is one of the possible reasons why mean pregnancy rates among this population still remain high in Brazil. However, throughout the study period, there was a decreasing trend in pregnancy among adolescents. This situation may be a reflection of the insertion of the Basic Care Booklet, which presents a topic on "Sexual and Reproductive Health of Adolescents and Young People". This material from the Ministry of Health allows professionals to provide guidance on safe sexual practices, such as the use of condoms and contraceptives⁽¹⁷⁻¹⁸⁾.

The transformations in the lives of teenage mothers can lead them to perceive this scenario as difficult and unsatisfactory, bringing feelings of rejection, sadness, and anguish, which can be explained by their young chronological age to deal with motherhood's responsibilities, in addition to the psychological consequences accompanied by unwanted pregnancy. The unexpected disruption in the social life of a teenager with a child and the absence of social support bring feelings of fear and insecurity which, associated with the intensive care demands of a newborn, reflect overload, tiredness, and irritation. This requires special attention to prevent the emergence or worsening of anxiety and depression, which affect both the mother and the newborn⁽¹⁶⁾.

Pregnant teenagers have a high school dropout rate. Dropping out of school, in addition to compromising the continuity of formal education, results

in lower qualifications and obstacles in life projects. However, teenage pregnancy is not a homogeneous event and depends on the social scenario in which the girl is inserted. In the social classes: middle and upper, the possibility of an early pregnancy tends not to affect schooling and professionalization as much. On the other hand, in the lower social class, adolescents have greater difficulty in continuing and finishing their studies, causing more difficulties in professionalization, especially because, generally, there is no family and social support⁽¹⁹⁾.

The spatial variation of teenage pregnancy in the North, Northeast and Central-West regions of Brazil, where these regions have the highest fertility medians, as well as the largest number of teenage mothers with a low education level, corresponding to less than eight years. These results may point to greater social vulnerability in these regions than in the South and Southeast regions⁽²⁰⁾.

Even if adolescents are sexually active, prevention strategies must be invested in, not only to avoid early pregnancy, but also Sexually Transmitted Infections or even an unsafe abortion that can result in maternal death. Therefore, it is necessary that information about sexual and reproductive health be debated, aiming to minimize prejudices and taboos⁽¹⁷⁾.

When we analyzed the spatial distribution of births between Brazilian states, we noticed a trend towards an increase in pregnancy among adolescents in the state of Roraima, possibly linked to the unequal distribution of the population in the country. A study carried out in Brazil analyzing the spatial variation of teenage pregnancy showed that the northern region has the highest number of teenage mothers in the country⁽²¹⁾.

The growing trend of births among women of advanced maternal age, as a result of seeking financial stability and out of concern, is aimed at providing the needs and providing comfort to the child and the family. They aim for a solid relationship that awakens the desire to get pregnant, a professional career and the search for specialization, as well as the work itself,

which demands a lot of time and the fact that motherhood demands its own time for each woman, feelings, perceptions, and social constructions related to motherhood.

Therefore, the postponement of motherhood can be explained by several factors, highlighting the insertion of women in the job market, dedication to academic and professional training, the prioritization of financial independence and even social and economic factors⁽²²⁾.

Another factor that may be associated with the increase in pregnancies at an advanced maternal age is the improvement in assisted reproduction techniques. These techniques give many women who choose to "get pregnant" after the age of 35 an option when they encounter difficulties through natural means as a result of the progressive decline in fertility with advancing age⁽²³⁾.

Maternal age over 35 years has been considered by the Ministry of Health as a factor that exposes the risk of fetal death, ectopic pregnancy, gestational trophoblastic disease, spontaneous abortion, chromosomal anomalies, congenital anomalies, multiple pregnancy, perinatal morbidity (higher rates of low birth weight and preterm births), previous diabetes mellitus and gestational diabetes mellitus, pre-eclampsia, thyroid disorders, low placental insertion, placental abruption, dystocia, and cesarean section. Thus, these women can be stratified into medium risk or intermediate risk, needing to attend the prenatal camp both in Primary Health Care and in the high-risk outpatient clinic⁽²⁴⁾.

When trends in births among women over 35 years of age were verified in Brazilian states, once again homogeneity was noted in the Brazilian territory. Therefore, postponing motherhood should be considered not only from the positive side of women's protagonism and empowerment, but it should be known to women that, by postponing pregnancy, other needs and potential health risks may emerge⁽²⁵⁾. Women who become pregnant at an advanced maternal age are more likely to have unfavorable maternal

and fetal outcomes compared to younger women, and those who choose never to become pregnant may have a greater risk of some types of cancer, such as breast cancer⁽²⁵⁻²⁶⁾.

In relation to women with advanced maternal age, those classified as being at higher risk than women under the age of 35 are included. Women with very advanced maternal age, corresponding to ≥ 45 years, have an even higher risk of hypertensive pregnancy disorders, cesarean section and postpartum hemorrhage than women aged ≥ 35 years⁽²⁷⁾. Therefore, knowledge about the level of pregnancy risk during certain reproductive ages can be a valuable counseling tool for women.

Study limitations

Among the limitations of the present study, we can mention the use of secondary data, due to the incompleteness of some records and the fact that data from 2022 were not used. Even so, recent research shows that the coverage of information on live births presents a comprehensiveness of more than 90% in the quality of the notification. Furthermore, the data from this study were subjected to relevant statistical tests that made it possible to understand the problem in focus.

Contributions to practice

These findings can contribute to the planning of public policies that aim to meet the needs of pregnancies at the extremes of reproductive life, considering that despite the decreasing trend in pregnancies during adolescence, the number is still very high, revealing weaknesses that require greater attention. Whereas for late pregnancies there is a growing trend demonstrating the need for adaptation to better support these pregnant women in order to reduce the risk of complications for the binomial.

The study provides reflections and allows professionals to understand the current profile of pregnant women in Brazilian states and can intervene early in prenatal care, childbirth and even in the care of the newborn, with the aim of alleviating situations that expose mothers and babies to potential risks.

Conclusion

It was evident that the age group from 20 to 34 years old had higher mean pregnancy rates when compared to other age groups, however with a decreasing trend, demonstrating a reduction in women's interest in gestation in this period of life. In relation to the adolescent age group (10 to 19 years old), pregnancy rates are still high, however, with a tendency to reduce during the period studied. Advanced maternal age (35 years or more) has increased in Brazil, showing an increasing trend in almost all Brazilian states.

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Authors' contributions

Conception and design or analysis and interpretation of data: Cargnin AVE, Piran CMG, Oliveira NN, Oliveira RR, Furtado MD.

Manuscript writing or relevant critical review of the intellectual content; Final approval of the version to be published and Responsibility for all aspects of the text in guaranteeing the accuracy and integrity of any part of the manuscript: Cargnin AVE, Piran CMG, Oliveira NN, Oliveira RR, Araújo CRS, Merino MFGL, Furtado MD.

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