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Rapid changes in birth counts in Brazilian major cities during the COVID-19 pandemic

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Abstract

Since the beginning of the coronavirus pandemic, Brazil has been among the countries that have been heavily affected by this novel disease. From March 2020 onwards, records of deaths in Brazil increased as the number of COVID-19 infections skyrocketed. Consequently, many studies have tried to explain how this illness has affected the overall number of deaths since the start of the pandemic, and have examined the question of whether mortality related to COVID-19 has led to reductions in life expectancy. However, at the time of writing, there have been few empirical analyses of the effects of the pandemic on births. In this study, we sought to investigate whether the COVID-19 pandemic influenced the recent birth counts of six large cities in Brazil by assessing the most up-to-date vital statistics data that are available. Using data from the municipal health departments of these cities, we compared the number of monthly births from October–December 2020 and January–March 2021 with the number of new-borns in similar months and years before the pandemic. Our results show that there was a strong decline in the number of births in some of the cities analysed, and that most of the reductions occurred among women around the age of 30 years old. It appears that because of the uncertainty surrounding the pandemic, women have been postponing or foregoing the realisation of their fertility intentions, which may have led to a temporary baby bust in some cities of Brazil. However, the COVID-19 pandemic was not found to be associated with faster reductions in births in all Brazilian cities. Indeed, in the

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cities of Rio de Janeiro and Belo Horizonte, the decreasing trend in birth counts appears to have slowed down, or even reversed.

Keywords: COVID-19 pandemic; birth count changes; Brazilian cities

1 Context of the COVID-19 pandemic in Brazil

In early 2020, several cases of COVID-19 emerged in different regions of the world, after a number of cases were observed in Europe and the United States (Burki, 2020; Muñoz, 2020; Rodriguez-Morales et al., 2020). The COVID-19 pandemic has profoundly affected many aspects of our daily lives, and, as Settersten et al. (2020) has pointed out, family-related behaviours may have been significantly altered due to the pandemic.

During the pandemic, Brazil has attracted the world's attention, as the country's executive leadership has encouraged people to go out, and has generally advocated for relaxing social-distancing measures. As a result, the numbers of infections and deaths have been high across Brazil, turning the country into the epicentre of the disease, and prompting international media coverage of the pandemic conditions in this South American country (Lima et al., 2021a). At the same time, the tensions caused by poor political and sanitary conditions in Brazil have raised concerns among the scientific community, and have led to the publication of a number of studies on the demographic costs of deaths, excess mortality and potential reductions in life expectancy due to COVID-19 in Brazil (Castro et al., 2021a, 2021b; Lima et al., 2021a, 2021b).

In Brazil, the COVID-19 pandemic started in the country's two largest cities: São Paulo and Rio de Janeiro. Both of these cities are located in the most developed region in the south-east of the country, and they are also the most developed municipalities in Brazil in terms of health care access and the quality of medical facilities (Lima et al., 2021a; see also Figure A.1 in the appendix). Due to tourism traffic and business travel, especially from Europe, these two cities had their first contact with the virus in March 2020 (Lima et al., 2021a). Gradually, however, COVID-19 cases spread to other cities and regions of the country. At the beginning of 2021, the country was setting daily mortality records. In the month of March 2021, the daily average number of deaths from the disease reached values above 3000 (Consórcio de veículos de imprensa, 2021). In the state of São Paulo, for example, the average number of deaths was above 800 per day; while in the city of São Paulo, the average number of deaths was more than 200 per day until the beginning of April (Prefeitura de São Paulo, 2021). In addition, similar surges in COVID-19 deaths were reported in other large cities across the country. As a result of these developments, Brazil's mortality levels were higher in 2020 than in previous years (França et al., 2020; Marinho et al., 2021). According to CONASS (2021), Brazil registered 22% more deaths in 2020 than in previous years, with excess mortality varying across geographical regions, from 38% in the south-east to 9%

in the south. In the first semester of 2021, there were 62% more deaths in Brazil than there were in the same period of the previous years. During this period, the highest excess mortality levels were reported in the south-eastern region (45%), and the lowest levels were reported in the country's mid-western region (9%).

With the pandemic out of control in much of the country, and no prospect of this public health crisis coming to an end over the short term, we may wonder what effects the pandemic has had on other demographic indicators, such as on births and fertility trends. Initial speculations in the media have suggested that the lockdowns could lead to an increased number of births as couples spend more time together in their homes (Sobotka et al., 2021). However, past empirical evidence has shown that exogenous shocks on populations can have negative effects on fertility, including outbreaks of infectious diseases, such as the Zika virus epidemic in Brazil in 2015–2016; and the economic turbulence caused by the global financial crisis of 2007–2008, which affected short-term fertility developments in most developed nations (Comolli, 2017; Marteleto et al., 2020; Rangel et al., 2020; Sobotka et al., 2011). Additionally, some scholars have argued that during uncertain times, couples may be expected to postpone or revise their childbearing plans and intentions (Vignoli et al., 2020).

The literature suggests that the pandemic could have both positive and negative effects on fertility. In terms of the potential negative effects, Sobotka et al. (2021) have argued that the pandemic may directly and indirectly affect the number of births in a population, which would, in turn, reduce fertility rates. The direct effects of the pandemic include an increased likelihood of couples voluntarily deciding to use birth control because they are struggling with economic uncertainties, concerns about the health consequences of the pandemic and increased stress related to lockdowns (Aassve et al., 2020; Kearney and Levine, 2020; Settersten et al., 2020). The indirect effects may include the postponement of unions or relationship disruptions caused by long periods of social distancing measures, which might reduce the frequency of sexual intercourse among young people (Lehmiller et al., 2020) because they have fewer chances to meet; the increased opportunity costs of families who are having to adjust to homeschooling and providing other forms of care to their children who are staying at home; and the loss of contact with grandparents, and of their availability to provide childcare. All of these factors may have reduced the chances of pregnancy during the pandemic.

On the other hand, Coutinho et al. (2020) have argued that there are several factors that could positively affect fertility rates during the pandemic. The authors divided these factors into two groups: first, those related to difficulties and a loss of access to sexual and reproductive health services; and, second, those related to issues of social distancing, such as sexual and gender violence, mental health problems and the evaluation of the costs of parenting. Thus, it is possible that long periods of quarantine in association with greater sexual exposure and the loss of access to contraception could increase fertility rates instead of depressing them, including in countries like Brazil, where half of pregnancies are considered unplanned (Theme-Filha et al., 2016). Moreover, other scholars have posited that being quarantined in stressful environments (with increased alcohol abuse, stress and financial difficulties) may lead to more domestic violence, which could, in turn, lead to more unplanned pregnancies (Ferrero, 2020; Theme-Filha et al., 2016).

In this context of speculative hypotheses about how the pandemic could affect fertility trends in Brazil, we aim to investigate recent birth developments in six Brazilian municipalities for which we have publicly available data. We focus on the association between the numbers of births at the start of the pandemic (23–29 March 2020) and the probable reduction (or increase) in birth counts nine months later and in the following period. Our strategy is to compute the monthly birth counts in the last three months of 2020 and in the first three months of 2021, and to compare them with the numbers of births in the years before the COVID-19 pandemic. Additionally, we give a general overview of some fertility measures, such as total fertility rates (TFR), age-specific fertility rates (ASFRs) and mean age at birth, that we can use to better understand the most recent fertility developments in these selected municipalities before the COVID-19 pandemic started. Moreover, for the pandemic period, we estimate the percentage changes in birth counts by trimester, and then decompose the contributions of different age groups to the changes in birth counts during the years 2020 and 2021. Our aim is determine whether women of different ages responded to the pandemic differently.

While the present analysis is addressing a question that might imply causality between the COVID-19 pandemic and changes in birth counts, we are neither assuming nor investigating a such a causal relationship; instead, we are evaluating whether there was an association between the two phenomena. Indeed, given that the birth counts in Brazil have been declining in recent years, it could be argued that any reductions (or increases) in birth counts nine months after the onset of the pandemic are simply the result of the natural course of fertility decline in the country, and cannot be attributed to the effects of the COVID-19 pandemic. However, in this study, we argue that the pandemic may have accelerated (or slowed down) these normal developments in birth rates.

2 Data sources and methodological approach

2.1 Description of birth data sources and their availability

In Brazil, birth records are made available to the public by the Ministry of Health and the National Brazilian Statistical Office (IBGE). Both provide online access to birth records, including information from birth registries on age and sex, as well as other demographic information, such as the ages and the educational levels of the mother and the father, the ethnicity of the mother and other socio-economic indicators.

The Brazilian National Statistical Office collects vital statistics from across the country, bringing together all of the records of live births reported by the Civil

Registry of Natural Persons and Notary offices, and publishing this information on the webpage of the IBGE Automatic Recovery System (SIDRA, 2021). Until the end of the first semester 2021, this vital statistical source only provided birth count information for the years prior to 2020 (ibid). Hence, we use this dataset only to verify the consistency of the birth data drawn from other sources.

The Ministry of Health compiles birth count information and makes it publicly available via the Live Birth Information System (SINASC, 2021). The ministry uses a decentralised model, gathering information on births reported by the state health departments. The birth certificates are then distributed by the ministry to the state health departments, which, in turn, distribute them to the municipal health departments. The municipal health departments manage the distribution of these birth certificates to health facilities, civil registry offices, forensic medicine institutes, and so on (Lima et al., 2021c). These departments also compile the initial information on birth counts. Thus, for certain cities and states, it is possible to access information on births in the early months of 2021 (Lima et al., 2021c). This information is mainly available in places where the vital statistical system is locally well organised, and can quickly provide reliable information on births and deaths, even during the pandemic period.

For this study, we use information from municipal health departments[1] to compile monthly birth counts according to the age of the mother for six Brazilian municipalities: Belo Horizonte, Curitiba, Fortaleza, Rio de Janeiro, Salvador and São Paulo (see Figure A.1 in the appendix for the spatial distribution of these cities according to their respective macro-regions). We have chosen to focus on these six cities because they provide a good overview of the effects of the pandemic in the country, as each of them is located in a different region of Brazil, has a different level of socio-economic development and experienced the onset of the pandemic at a different point in time. For example, the cities of Belo Horizonte, Rio de Janeiro and São Paulo are located in the socio-economically developed south-eastern region of the country, which accounts for more than 50% of Brazil's GDP (da Lima and de Ramos, 2010). The city of Curitiba, which is located in the southern region of the country, is considered the city in Brazil that offers the highest quality of life in terms of job opportunities and access to basic health and education services (COMEC, 2012). Meanwhile, Fortaleza and Salvador are located in the historically

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[1] The Municipal Health departments linked to the Live Birth Information System of the Ministry of Health (SINASC, 2021) have the follow webpages for each city:

Belo Horizonte: http://tabnet.saude.mg.gov.br/deftohtm.exe?def/nasc/nascr.def.

São Paulo: http://tabnet.saude.prefeitura.sp.gov.br/cgi/deftohtm3.exe?secretarias/saude/TABNET/sinasc/nascido.def

Rio de Janeiro: http://tabnet.rio.rj.gov.br/cgi-bin/dh?sinasc/definicoes/sinasc_apos2005.def

Curitiba: http://www.tabnet.sesa.pr.gov.br/tabnetsesa/dh?sistema/sinasc99diante/nascido_99diante

Salvador: http://www.tabnet.saude.salvador.ba.gov.br/deftohtm.exe?sivitais/sinasc/nascido.def

Fortaleza: http://extranet.saude.ce.gov.br/tabulacao/deftohtm.exe?sim/nascido.def. Please note that some webpages might not be accessible outside of Brazil.

less developed north-eastern region of Brazil (Chein et al., 2007). Moreover, as all of these urban areas have more than one million inhabitants, and are among Brazil's largest cities, the chances that they will experience fluctuations in births caused by a small number of events occurring in each month are low. In addition to meeting the population size criteria, these cities are the only ones in Brazil that have made publicly available preliminary birth counts for the early months of 2021.

An alternative source of information on vital statistics that has attracted attention and publicity in Brazil during the pandemic is the Civil Registry Transparency Portal[2] (Portal Transparência in Portuguese). Accessible since 2018 and maintained by the National Association of Registrars for Individuals (ARPEN, 2021), this portal is a publicly accessible website that provides vital statistics on births, marriages and deaths. Although this source provides information on monthly birth counts for the years 2020 and 2021, after comparing the three data sources (see Figure A.2 in the appendix), we decided to not use the ARPEN data because we found too many inconsistencies between the portal's birth counts and those of SINASC and SIDRA.

2.2 Methods

First, we estimated general fertility measures for the six municipalities; i.e., TFR, AGFRs and the average age at childbirth broken down by years prior to the pandemic. Second, we compared relative differences in birth counts by quarters for the years 2017 to 2021, while giving special attention to the trimesters of October to December (important for comparisons between 2020 and previous years) and January to March (for 2021 comparisons) of each year, according to the formula: $[B(t+1) - B(t)]/B(t)$. This enabled us to control for the effects of birth seasonality in each year. Finally, we performed a decomposition exercise to better understand the age patterns of the fertility changes.

2.3 Age decomposition of birth counts

We have monthly birth data by the mother's age that give us the opportunity to explore more dimensions of the changes in birth counts in the six cities. This analysis is important, especially considering that before the pandemic, fertility in Brazil was generally concentrated at certain maternal ages (Lima et al., 2018; Rios-Neto et al., 2018). Thus, it could be informative to investigate whether the patterns of

[2] This data source is not considered an official source of vital statistics, and all information from this source comes from the Civil Registry Information Centre. The information is collected via notary offices, and the informant submits the birth certificates to the Civil Registry Service Unit responsible for registering the event (Lima et al., 2021c). One advantage of this source of vital information that it makes the birth count data available to a broader public relatively quickly. This practice has been criticised, as the raw data may not be cleaned, and could have biases that can lead to wrong interpretations.

changes in birth counts varied according to the mother's age during the COVID-19 pandemic. Hence, we also explore the association between the COVID-19 pandemic and changes in birth counts, but this time by disaggregating our analysis by births into different maternal age groups. In this part of the analysis, we have applied an adaptation of Das Gupta (1991) decomposition model that separates crude births counts in terms of the effects in each maternal age group (in Das Gupta, 1993).

The numbers of monthly births at ages below 15 and above 44 years old are too small, and can thus be disregarded. In its original formulation, we assume that the total monthly births of a population (R) can be separated as the effect of six maternal abridged ages α, β, γ, δ, ε, η, where $\alpha, \beta, \dots, \eta$ represent the effects of changes in monthly births attributed to the age groups 15–19, 20–24, 25–29, 30–34, 35–39 and 40–44, respectively.

Suppose we have a population in two different time periods (R_1 and R_2), each of which can assume birth count values of $R_1 = F(A, B, C, D, E, F)$ and $R_2 = F(a, b, c, d, e, f)$ in the population during time$_1$ and in the same population in time$_2$, where $A, B, \dots, F$ and $a, b, \dots, f$ represent the birth counts for the maternal age groups 15–19, 20–24, 25–29, 30–34, 35–39 and 40–44 in times 1 and 2, respectively.

Thus, if we are interested in knowing what share of the total monthly changes in birth counts between times 1 and 2 can be attributed to the number of births in a specific maternal age group, e.g., the percentage share of births to women aged 15–19 years old (*α-effect*) in the changes in total birth counts between the two periods, we apply the following Das Gupta (1993) decomposition method in its original formulation. As an example, let us consider the number of births to women aged 15–19 years old:

$$\beta\gamma\delta\varepsilon\eta\text{-standardised total : in time}_1 = Q(A), \tag{1}$$

$$\text{in time}_2 = Q(a), \tag{2}$$

so that

$$\alpha\text{-}\mathit{effect} = Q(a) - Q(A) \tag{3}$$

Where:

$$\begin{aligned}
Q(A) = Q(A; b, c, d, e, f, B, C, E, F) &= [F(A, b, c, d, e, f) + F(A, B, C, D, E, F)]/6 \\
&+ [F(A, b, c, d, e, F) + F(A, b, c, d, E, f) + F(A, b, c, D, e, f) \\
&+ F(A, b, C, d, e, f) + F(A, B, c, d, e, f) + F(A, B, C, D, E, f) \\
&+ F(A, B, C, D, e, F) + F(A, B, C, d, E, F) + F(A, B, c, D, E, F) \\
&+ F(A, b, C, D, E, F)]/30 + [F(A, b, c, d, E, F) + F(A, b, c, D, e, F) \\
&+ F(A, b, c, D, E, f) + F(A, b, C, d, e, F) + F(A, b, C, d, E, f) \\
&+ F(A, b, C, D, e, f) + F(A, B, c, d, e, F) + F(A, B, c, d, E, f) \\
&+ F(A, B, c, D, e, f) + F(A, B, C, d, e, f) + F(A, B, C, D, e, f) \\
&+ F(A, B, C, d, E, f) + F(A, B, C, d, e, F) + F(A, B, c, D, E, f) \\
&+ F(A, B, c, D, e, F) + F(A, B, c, d, E, F) + F(A, b, C, D, E, f) \\
&+ F(A, b, C, D, e, F) + F(A, b, C, d, E, F) + F(A, b, c, D, E, F)]/60,
\end{aligned} \tag{4}$$

Table 1:
Total fertility rates of six selected cities of Brazil, 2017–2020

	Year and TFR Value			
City	**2017**	**2018**	**2019**	**2020**
Belo Horizonte	1.43	1.42	1.38	1.28
São Paulo	1.71	1.69	1.63	1.53
Rio de Janeiro	1.88	1.84	1.72	1.65
Curitiba	1.44	1.41	1.37	1.27
Fortaleza	1.51	1.48	1.45	1.36
Salvador	1.71	1.68	1.66	1.55

Source: Birth data provided by Ministry of Health (SINASC, 2021) and population information based on projections from the Laboratorio de Estimativas e Projeções Populacionais da UFRN - LEPP (Freire et al., 2019).

For $Q(a)$, the same expression as that in (4) with A is replaced by a. Other standardised factor effects (considering other age groups) follow directly from 1–4.

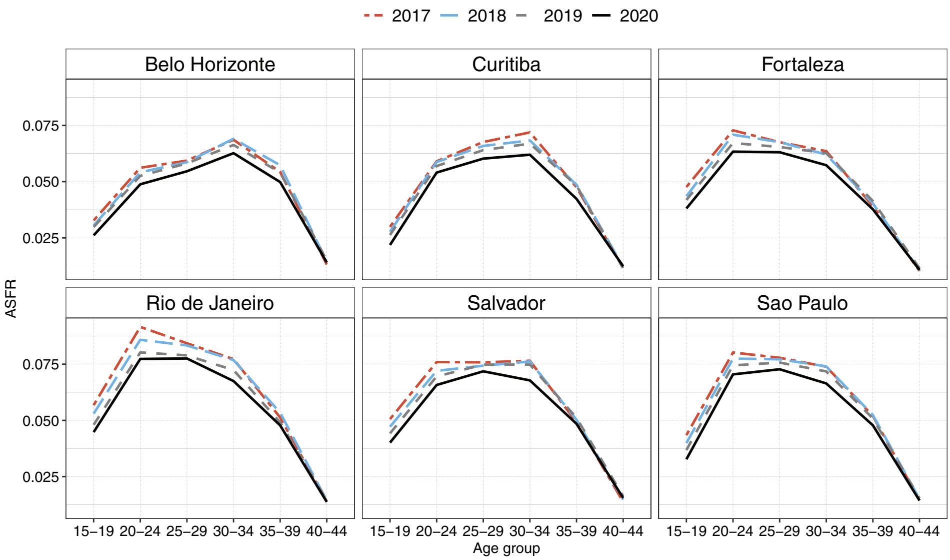
3 Results

First, we present the outcomes of a number of measures of fertility for the analysed cities: namely, the TFR, ASFRs and the mean age at birth. This gives us an overview of how the fertility schedules in these cities were developing before the pandemic started. In addition, we note that these six major cities underwent the fertility transition process relatively quickly, starting in the 1960s (Alves, 1994; Carvalho and Brito, 2005). Thus, in many Brazilian municipalities, the total fertility rates are now below the replacement level (Yazaki, 2003).

As we show in Table 1, the TFR has fallen to very low levels in Belo Horizonte, Curitiba and Fortaleza, to values of 1.28, 1.27 and 1.36, respectively. The total fertility rates in São Paulo, Rio de Janeiro and Salvador are a bit higher, at 1.53, 1.65 and 1.55, respectively. It is important to bear in mind that these values assume that there is no underreporting of births. Nevertheless, the National Brazilian Statistical Office, applying capture-recapture methods and record linkage to the birth datasets from the Ministry of Health and IBGE, have estimated that the rate of underreporting of births was less than 2.5% in the six selected cities between 2016 and 2018.[3]

[3] Estimated percentages of births that are unreported in the six cities for the years 2016, 2017 and 2018, respectively, Fortaleza: 0.89%, 0.66% and 2.49%; Salvador: 0.47%, 0.39% and 0.47%; Belo Horizonte: 0.61%, 0.43% and 0.37%; Rio de Janeiro: 0.73%, 0.16% and 0.21%; São Paulo: 0.04%, 0.02% and 0.04%; and Curitiba: 0.10%, 0.07% and 0.04% (IBGE, 2018).

Figure 1:
Age-specific fertility rates in six major cities of Brazil. 2017–2020



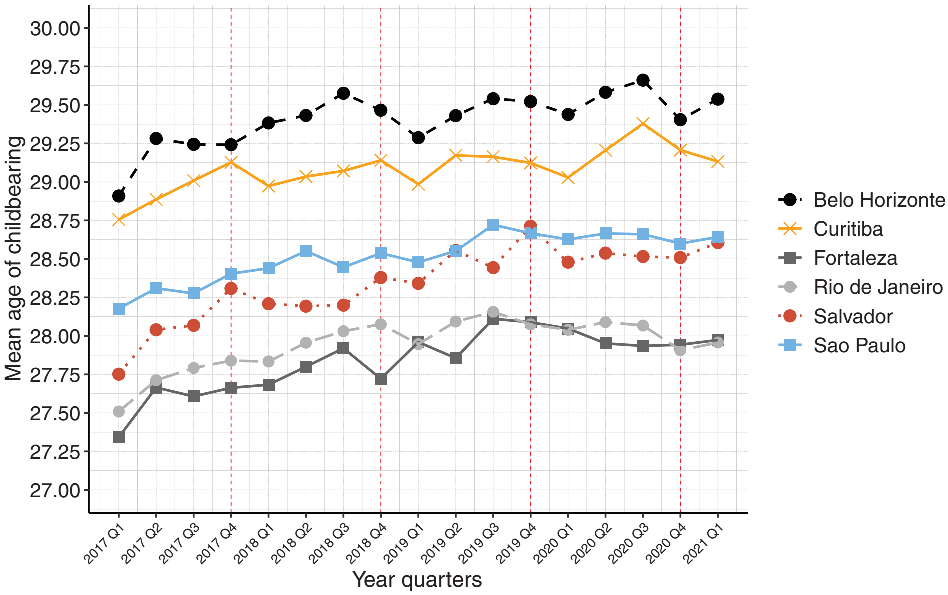
Source: Birth data provided by Ministry of Health (SINASC, 2021) and population information based on projections from the Laboratório de Estimativas e Projeções Populacionais da UFRN - LEPP (Freire et al., 2019).

Between 2017 and 2018, the age-specific fertility rates (ASFRs) in all of the selected cities changed, but not as much as they did in 2020 (in Figure 1). For example, in the cities of Belo Horizonte and Curitiba in 2019, fertility was highest around the ages of 30–34 years old. However, in 2020, the highest ASFRs were at earlier ages in these cities. This means that if we want to get a clearer picture of the effects of the pandemic on birth numbers, we need to consider the mother's age in our further analysis.

In Figure 2, we also illustrate the relative changes in the mother's age by looking at the evolution of the mean age of childbearing (MACB)[4] in periods before the pandemic. The developments in the MACBs are shown by trimesters from years 2017 to 2021. Hence, we can see that in a period of three years, the mean age of childbearing has increased in all of the analysed cities, with the values increasing by 0.37 (in Curitiba) to 0.86 (in Salvador) years from the first quarter of 2017 (2017.Q1) to the first quarter of 2021 (2021.Q1). Thus, in these cities, the mean

[4] As defined by United Nations, the mean age of mothers at the birth of their children if women were subject throughout their lives to the age-specific fertility rates observed in a given year. (https://www.un.org/en/development/desa/population/publications/dataset/fertility/age-childbearing.asp).

Figure 2:
Quarterly mean age at childbearing between age groups 15–44 in six major cities of Brazil. 2017–2021



Source: Birth data provided by the Ministry of Health (SINASC, 2021) and the population information is based on projections from the Laboratório de Estimativas e Projeções Populacionais da UFRN - LEPP (Freire et al., 2019).

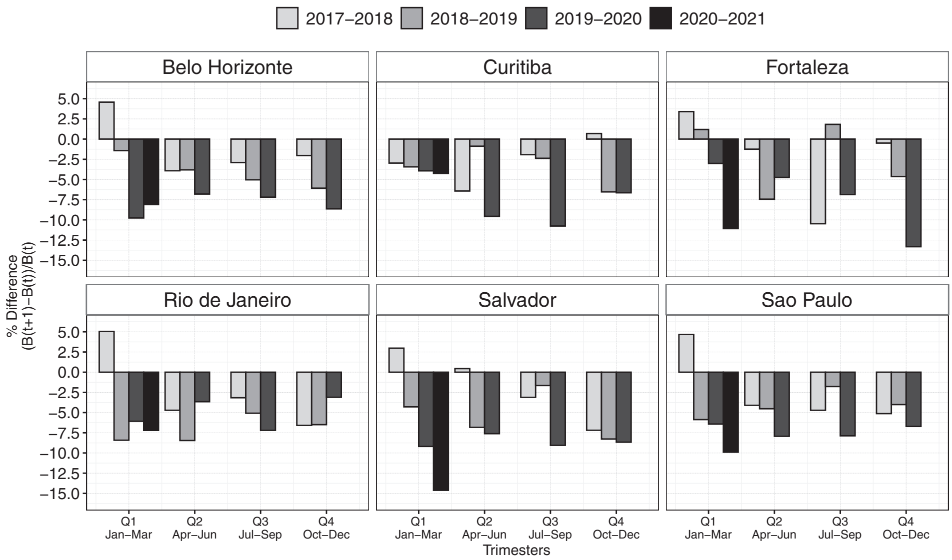
age of childbearing increased by almost half a year to nearly one year in a very short period of time.

While we analyse the associations between the COVID-19 pandemic and the recent changes in birth counts, an overview of the outcomes of these three fertility measures in the six cities is needed us to help us better understand past fertility developments. In particular, it is important to keep in mind that before the start of the COVID-19 crisis, these municipalities were experiencing changes in the shape of their fertility trends, and had below-replacement fertility.

Figure 3 shows the percentage relative differences in birth counts for the selected cities. This time, we compare the number of births in the trimesters of the years affected by the COVID-19 pandemic (2020 and 2021) with the corresponding quarters of the previous years, which were not affected by this public health crisis. The main aim here is to investigate whether there was a substantial change in relative birth counts, especially eight to nine months after the onset of the pandemic; i.e., in Q4 2019–2020 and Q1 2020–2021.

With a few exceptions these results show a decline in birth counts in all of the analysed cities. If we compare the relative differences in the most recent years, i.e.,

Figure 3:
Relative differences in monthly births in six major cities of Brazil. 2017–2021



Source: SINASC (2021). See Footnote 1 for details.

Q1 in 2019–2020 (grey bars) and Q1 in 2020–2021 (light blue bars), with the first trimester of 2021, we see that the number of new-borns has decreased in Curitiba, Fortaleza, Salvador and São Paulo. This decline was especially pronounced in the north-eastern cities of Fortaleza and Salvador. In the case of Salvador, there were 15% fewer births in the first trimester of 2021 than there were in the same period of previous years.

In Fortaleza, the decreasing trend in birth counts further accelerated during the pandemic. When we compare the first trimesters, we observe that birth counts went from declining by 2.5% in 2019–2020 to decreasing by more than 10% in 2020–2021. In addition, when we compare the fourth quarters, we see that birth counts went from decreasing by 5% in 2018–2019 to declining by more than 12% in 2019–2020. This pattern appears to indicate that between the months of October to December 2020 and January to March 2021, the onset of the pandemic was associated with an acceleration of the process of the decline in birth counts that was already underway in this city.

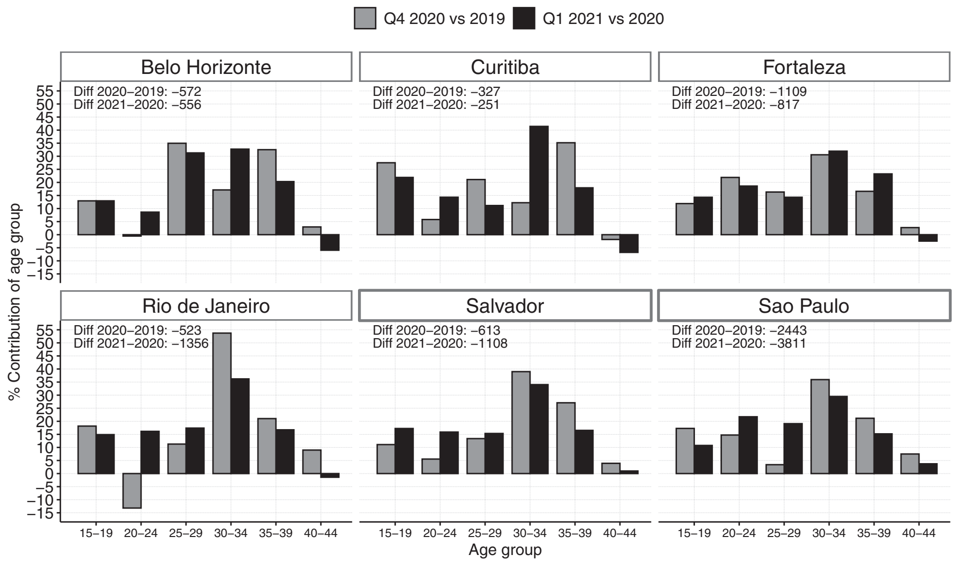
On the other hand, when we look at the differences between the cities only in the first quarter of the years, we see that Rio de Janeiro and Belo Horizonte represent exceptions, as in these cities the decreasing trend in birth counts was more modest, or even slowed down during the pandemic. In Rio de Janeiro, for example, we see that the decline in birth counts went from 6% to 7.5% (grey and light blue bars, respectively); however, if we follow the trend back to previous periods, we find that a bigger drop in birth counts occurred in Q1 2018–2019 (dark blue bar). In Belo Horizonte, we even see a slowdown in the process of the decline in birth counts when we consider the differences between the two last periods.

In the south-eastern region, São Paulo is the only city in which we observe a slight acceleration of the process of the decline in birth counts, especially in the first trimester of 2021. When we compare the Q1 differences across all periods, we see that birth counts went from increasing by 5% in 2017–2018 (red bar) to decreasing by 6% between 2018–2019 and 2019–2020 (dark blue and grey bars), and to declining by 10% in 2020–2021 (light blue bar). In Curitiba, the city located in the southern region, we observe decreases in the birth counts in the first trimester of all the years considered, although this decline was more gradual than it was in the other municipalities. We also find that in Curitiba, the onset of the pandemic did not seem to be associated with any large changes in birth counts. In other words, it appears that the COVID-19 crisis did not alter the natural fertility decline that was already underway in this city. As a final analysis, Figure 4 presents the results of the Das Gupta decomposition of total birth counts for mothers aged 15–44 years old. This time, we decompose the percentage share differences of each maternal age group to the total decline in births during the period affected by the pandemic. The main idea here is to see whether the changes in the number of births in each period varied by maternal age group. Or, in other words, we investigate whether the share of the changes in birth counts varied according to the maternal age. If this was indeed the case, then it is possible that some groups of women have been (in)voluntarily changing their reproductive behaviour during the pandemic period.

As we can see in Figure 4, the differences between birth counts (comparing Q4 in 2020 with Q4 in 2019 and Q1 in 2021 with Q1 in 2020) were negative in all of the cities, which probably indicates that the process of the decline in birth counts was already underway in these locations. In addition, we find that the relative share of the fertility decline varied across age groups, but that in all of the cities, the biggest contribution in percentage differences is found around the age of 30 years old. For example, if we consider the differences in the first trimesters of 2021 and 2020, we see that 30–40% of the reduction in the number of new-borns was attributable to women aged 30 to 34, and that this age group contributed the most to the decrease in the number of births during this period in all of the cities studied.

In addition, when we compare the percentage contributions of age groups to the birth count differences from Q4 (2020–2019) to Q1 (2021–2020), we find small fluctuations in these numbers in the municipalities of Fortaleza, Salvador and São Paulo. However, in the cities of Salvador and São Paulo, we see marked increases in these percentage contributions, especially for the 20–24-year-olds (in Salvador, the contribution of this age group increased from 5% in Q4 to 16% in Q1) and the 25–29-year-olds (in São Paulo, the contribution of this age group increased from 3% in Q4 to 19% in Q1). Meanwhile, in Rio de Janeiro, we find that most of the variations in birth counts are attributed to 30- to 34-year-old mothers, but also that the contribution of this age group declined from 55% in Q4 to almost 35% in Q1.

Figure 4:
Decomposition of absolute differences in total births of mothers aged 15–44 from Q4 2019 to Q4 2020 and from Q1 2020 to Q1 2021 by age group contribution in Brazil's six major cities



Source: SINASC (2021). See Footnote 1 for details.

On the other hand, in Belo Horizonte and Curitiba, the contribution of the 30–34-year-old mothers to the absolute differences in total births increased, respectively, from 16% to 32% and 10% to 35% between Q4 (2020 vs. 2019) and Q1 (2021 vs. 2020). We further note that Belo Horizonte is the only city where the group of 25–29-year-olds also played an important role in the variations in birth counts.

4 Discussion

During the coronavirus pandemic, countries around the world have faced considerable social challenges, with most countries being forced to adapt to a new set of circumstances due to the effects of COVID-19. Worldwide, the number of deaths has increased considerably since the start of the pandemic, and from the beginning of 2020 until the first months of 2021, Brazil became one of the world leaders in numbers of COVID-19 cases and deaths. In response to this health crisis, many studies have investigated the patterns of deaths by region and by age, and have tried to determine which socio-economic groups have been most affected by this pandemic.

Recently, researchers have been devoting more attention to another demographic component of the crisis: i.e., the effects of the pandemic on women's fertility (Marteleto et al., 2020). It is generally assumed that birth numbers have been negatively affected by the economic uncertainties and health issues associated with the pandemic, as well as by the stress related to lockdowns and quarantines (Aassve et al., 2020; Kearney and Levine, 2020; Settersten et al., 2020). In addition, the postponement of unions or relationship disruptions, a reduction in the frequency of sexual intercourse among young people (Lehmiller et al., 2020) and the consequences of many other pandemic-related restrictions may have directly or indirectly affected people's reproductive plans.

In this context, using the available data from municipal health departments, we examined the effects of the pandemic on the numbers of births in six cities of Brazil representing the main regions of the country. We compared monthly birth counts from the end of 2020 until the beginning of 2021 in the selected municipalities with the birth counts from periods before the start of the pandemic. It is also important to bear in mind that especially in Brazil's largest cities, women have had below replacement level fertility since the middle of the 2000–2010 period (Berquó and Cavenaghi, 2014; Castanheira and Kohler, 2015), and more and more women are postponing childbearing (Lima et al., 2018; Rios-Neto et al., 2018). Hence, we did not assume that the recent observed changes in birth counts were caused by the pandemic. Instead, we evaluated whether there was an association between the two phenomena; in other words, whether the existing fertility trends in these cities accelerated (or slowed down) during the COVID-19 pandemic.

Our findings suggest that in the north-eastern cities of Salvador and Fortaleza, the fertility rates are likely to decline even further. Moreover, given the declines we found, we expect fertility in these cities to reach levels close to the lowest-low rates in 2021 and in the upcoming years. However, we also observed that during the pandemic period, the decline in birth counts in Rio de Janeiro and Belo Horizonte slowed down or even reversed its course relative to the previous decreasing trend. Although the decline in birth counts in São Paulo accelerated in 2021, an association between the COVID-19 pandemic and a speeding up of the process of fertility decline was not found throughout the country. In addition, we showed that during the first trimester of 2021, 30- to 34-year-old women contributed the most out of all age groups to the reproductive changes we observed in all six cities.

While there are other issues that could be analysed, we faced some barriers to addressing these questions. First, there is a lack of good quality educational data that would enable us to disentangle the effects of inequality on reproduction among different socio-economic groups. Thus, we were unable to verify whether women with fewer years of education have been more affected by problems related to the supply of contraceptive methods during the pandemic, and have therefore had more unplanned pregnancies over the short term. Additionally, we could not determine whether better educated women have been controlling and postponing fertility more than their less educated counterparts during the COVID-19 pandemic. We may speculate that young women from low socio-economic backgrounds are especially likely to rely on contraception methods provided by public health services (Gonçalves et al., 2019; Martins et al., 2006; Trindade et al., 2021), and thus that the number of births among this group will increase in the near future, as they have difficulties accessing reproductive health services during the pandemic. Additionally, previous studies have found inequalities in the age distribution of first births, with the fertility curve showing two peaks at the ages of 20 and 30 years old: the first for the lower socio-economic group and the second for the higher socio-economic group (Lima et al., 2018; Rios-Neto et al., 2018). We also assume that these fertility inequalities have been accentuated during the COVID-19 pandemic. Second, these preliminary data are still subject to revision, even though the variations in birth numbers are not large enough to change the overall trends. To address this issue, we used data from the first three months only, while leaving room for additional data quality assessment. Updated data are always necessary in these studies.

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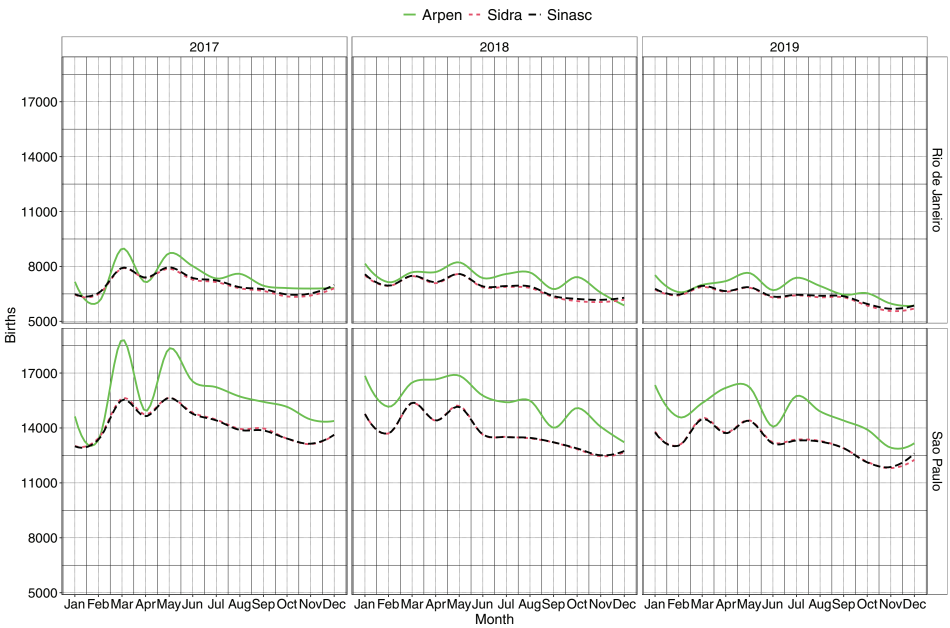
Appendix

Figure A.1:
Localisation of the six selected cities distributed according to the five Brazilian macro-regions in 2021. The date when the first COVID-19 death was reported is in parentheses

Figure A.2:
Comparison between monthly births by three data sources. Municipalities of São Paulo and Rio de Janeiro, 2017–2019



Source: ARPEN (2021), SIDRA (2021) and SINASC (2021).