The Impact of the COVID-19 pandemic on birth counts in selected Latin American Countries

Everton E. C. de Lima[1]
Camila F. Soares[2]
Tacildo Araújo[2]
Luiz Neto[2]
Mateus Risso[3]
Victor Garcia-Guerrero[4]
Emerson Baptista[4]
Charles Mpoca[2]
Maria Winkler-Dworak[5]
Cristiano Torezzan[6]
Rodolfo C. Pacagnella[7]

Abstract

Many Latin American countries (LAC) had been profoundly affected by the COVID-19 crisis. In this study, we use vital statistics from 2018 to 2022 in selected LACs—Brazil, Costa Rica, Cuba, and Mexico—to investigate the pandemic's impact on birth counts. We observed a decrease in birth counts, particularly pronounced among less educated and younger mothers, with Brazil as example. Conversely, Brazil and Costa Rica experienced increased birth counts among 40+ years old more educated women. Two shifts in reproductive behavior emerged: pandemic-induced uncertainties prompted delays in motherhood among less educated and younger women, while women aged 35 and older, particularly those from higher socioeconomic strata, expedited their reproductive plans. In Cuba, the COVID-19 crisis disrupted pre-pandemic reproductive trends, particularly affecting less educated mothers. In contrast, Mexico witnessed an accelerated decline in birth counts. In summary, the pandemic's influence on LACs birth counts displayed variations across socioeconomic and groups.

Keywords: Birth counts, COVID-19, Latin America countries

[1] Corresponding author, Associate Professor at College of Philosophy and Human Sciences (IFCH) and research scientist at Population Studies Center (NEPO) at University of Campinas (UNICAMP). Email: evertone@unicamp.br.
[2] PhD-student at University of Campinas (UNICAMP).
[3] Undergraduate student at University of Campinas (UNICAMP).
[4] Professor at El Colegio de México, Mexico City, Mexico.
[5] Research scientist at Vienna Institute of Demography.
[6] Associate Professor at Department of Obstetrics and Gynecology, University of Campinas (UNICAMP).
[7] Associate Professor at School of Applied Sciences (FCA), University of Campinas (UNICAMP).

Introduction

Starting from mid-March 2020, the first cases of the COVID-19 disease were reported in major urban centers of Brazil. Initially, the virus was identified in economically vibrant areas and popular tourist destinations such as São Paulo and Rio de Janeiro. Subsequently, the pandemic rapidly extended its reach to various underdeveloped regions across the country (Castro et al., 2021; Lima et al., 2021a; Lima et al., 2021b).

During the early months of the pandemic, the Brazilian Federal government did not formulate a centralized strategy to address the escalating numbers of infections and fatalities within the nation (Lima et al., 2021b). Consequently, the responsibility to combat this novel disease, including the imposition of lockdowns and other restrictions on population mobility, fell upon the shoulders of state governors and municipal mayors (Abrucio et al., 2020).

However, this decentralized approach to controlling the spread of COVID-19 exacerbated existing regional health disparities and accentuated differences in mortality rates among various socioeconomic groups (Lui et al., 2021). Not only Brazil but many countries in the Latin American and Caribbean (LAC) region experienced a significant increase in excess mortality due to the pandemic (Lima et al., 2021b).

In addition, worldwide, the initial attention was given to the pandemic effects on mortality, and all the research efforts focused on understanding the changes in mortality and morbidity profiles caused by the COVID crisis (Lima et al. 2021b). For instance, in several Latin American and Caribbean (LAC) nations, there were significantly elevated levels of excess mortality and reductions in life expectancy, particularly in the less developed regions of each country. This phenomenon had substantial repercussions on mortality rates, with notable impacts observed in countries like Peru and Ecuador (Lima et al., 2021b).

Researchers have embarked on studies examining the pandemic's influence on fertility outcomes, primarily within high-income countries (Aassve et al., 2021; Sobotka et al., 2023). Nevertheless, there is a relative scarcity of knowledge regarding the pandemic's repercussions on birth rates, especially within the context of low- and middle-income countries.

Within this context, the theoretical discourse revolves around both the positive and negative implications of the pandemic on fertility. Several potential positive effects can

be delineated, including extended periods of quarantine leading to increased sexual activity among couples and reduced access to contraception, particularly among lower socioeconomic strata. These factors may contribute to a rise in unplanned pregnancies, thereby potentially elevating fertility rates rather than suppressing them (Coutinho et al., 2020). In contrast, the adverse effects of the pandemic can be categorized into direct and indirect consequences (Sobotka et al., 2023). Due to the economic uncertainties, health concerns, and extended periods of lockdown, couples may consciously choose to regulate their pregnancies. These are regarded as the pandemic's direct impacts on fertility (Aassve et al., 2020; Settersten et al., 2020; Kearney and Levine, 2020). For instance, data from high-income countries indicate that there has been a noticeable decrease in births, with some regions experiencing declines of up to 20% compared to 2019, e.g., Spain (Fallesen & Cozzani, 2023).

On the contrary, we can also delineate indirect repercussions of the pandemic, encompassing the postponement of union formation, an escalation in relationship disruptions, diminished sexual activity among young individuals (Lehmiller et al., 2020), in conjunction with elevated opportunity costs for families and challenges in balancing their children's education at home with their other caregiving responsibilities, given the constraints of stay-at-home measures. Additionally, there has been a temporary loss of familial support from grandparents during periods of isolation for couples (Sobotka et al., 2023). These concerns and anxiety-inducing factors not only influence contraceptive practices but may also be associated with reduced libido and alterations in reproductive system functioning.

In summary, these multifaceted factors have the potential to alter couples' behavior and have had an impact on birth counts during the pandemic, particularly when examining the fertility intentions of distinct socioeconomic groups. To comprehensively understand the impact of the pandemic on recent reproductive trends in four Latin American and Caribbean (LAC) countries—Brazil, Costa Rica, Cuba, and Mexico, we utilize a dataset encompassing monthly birth records from both the pre-pandemic (spanning the entire years of 2018 and 2019 until October 2020) and the pandemic periods (from November to December 2020 through the end of 2022). Our analysis aims to investigate the potential impacts of COVID-19 on birth counts, with particular emphasis on the final two months of 2020 and the subsequent period up to the conclusion of 2022. This focus arises from the consideration that the consequences of the pandemic may become evident

approximately nine to ten months following its onset. In the ensuing sections, we will introduce the dataset and elucidate the analytical models employed to assess changes in birth counts during the COVID-19 crisis.

Data and Methods

In the context of Brazil, our study leverages microdata pertaining to birth counts, which have been meticulously compiled by the Ministry of Health and are accessible to the public through DATASUS (2023). This dataset comprehensively records information at the municipal level, employing a decentralized model for data collection. The primary responsibility for collecting data on birth counts, along with various socio-economic characteristics of mothers, lies with the Municipal Health Departments (Lima et al., 2021c).

In the case of Costa Rica, Cuba, and Mexico, we have gathered vital statistics data and vital information directly from the respective statistical offices of each country. In Costa Rica, the data source is INEC (2023), while in Cuba, it is ONEI (2023). For Mexico, we obtained the data from the National Institute of Statistics and Geography, INEGI (2023). In all instances, the data comprises monthly birth counts categorized according to various socioeconomic characteristics of mothers. Table 1 provides a concise summary of each data source, along with the available timeframe.

Tabl1: Birth counts data sources for Brazil, Costa Rica, Cuba and Mexico, 2018 – 2022.

Country	Data source	Period of data
Brazil	DATASUS (Departamento de informática do Sistema Único de Saúde do Brasil)	2018-2022
Costa Rica	INEC (Instituto Nacional de Estadística y Censos)	2018-2022
Cuba	ONEI (Oficina Nacional de Estadística e Informacion)	2018-2021
Mexico	INEGI (Instituto Nacional de Estadística y Geografía)	2018-2021

In this study, we have compiled monthly birth counts spanning from 2018 to the end of 2022, with a breakdown according to the age of mothers and their educational attainment. To enhance data quality and reduce potential sources of noise in the monthly birth counts, we have categorized maternal education into three distinct groups: those with 0 to 7 years of education, those with 8 to 11 years of schooling, and those with 12 or more years of education.

Our analysis begins by examining variations in monthly birth counts, as denoted by the formula *[B(t + 1) – B(t)]/B(t)*. Where, *B* represents the monthly birth counts in year *t*. We segment our analyses into two distinct periods: pre-pandemic, corresponding to pregnancies occurring before the onset of the pandemic, and pandemic births, which pertain to pregnancies initiated after the pandemic commenced. We conducted several comparisons to assess variations in monthly births:

- Monthly births in 2019 (for the entire year) were compared to monthly births in 2018 (for the entire year), representing pre-pandemic variations in birth counts.
- Monthly births in 2020 (for the entire year) were compared to monthly births in 2019 (for the entire year), reflecting pre-pandemic variations in birth counts from January to October, and pre- vs. pandemic variations from November to December.
- Monthly births from January 2021 to October 2021 were compared to monthly births from January 2020 to October 2020, and monthly births from November 2021 to December 2021 were compared to monthly births from November 2019 to December 2019, indicating pre- vs. pandemic variations in birth counts.
- Lastly, January 2022 to October 2022 was compared to January 2020 to October 2020, and November 2022 to December 2022 was compared to November 2019 to December 2019, representing pre- vs. pandemic variations in birth counts.

Finally, we conducted a decomposition analysis to gain a deeper understanding of the educational patterns underlying changes in fertility across different age groups.

Education and age decomposition of birth counts

Building upon prior analyses conducted by Lima et al. (2022), we extended our investigation to ascertain whether shifts in birth counts displayed variations contingent on both maternal education and age during the COVID-19 pandemic. To accomplish this, we conducted a meticulous disaggregation of our analysis by categorizing births into discrete maternal age groups and educational attainment levels. In this section of our analysis, we applied an adapted iteration of Das Gupta's decomposition model (1991), a methodology renowned for disentangling crude birth counts with respect to their impacts on each maternal age group (as detailed in Das Gupta, 1993), within specific education categories.

In its initial formulation, we posit that the overall monthly birth rate of a population (P) can be deconstructed into the influence of six abbreviated maternal age categories denoted as α, β, γ, δ, ε, and η. These categories represent the effects of alterations in monthly birth rates within each educational group, corresponding to the age brackets of 15–19, 20–24, 25–29, 30–34, 35–39, and 40+ years, respectively. Additionally, in the scenario where we have a population observed at two different time periods, denoted as P1 and P2, the birth counts within each population can be expressed as P1 = F(A, B, C, D, E, F) and P2 = F(a, b, c, d, e, f) during time period 1 and time period 2, respectively. Here, A, B, . . . , F and a, b, . . . , f signify the birth counts for the maternal age groups 15–19, 20–24, 25–29, 30–34, 35–39, and 40+ in times 1 and 2, correspondingly. Using Das Gupta (1993) we can estimate the 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 educational and age group.

Preliminary results and further steps

To facilitate visualization, we will exclusively present the findings pertaining to two specific age groups: women aged 15 to 24 years and mothers aged 35 and above (next figures 1 to 4). It is pertinent to mention that estimations of birth variations have been computed for the remaining age brackets, namely 25-29 and 30-34 years[8]. Nevertheless, the current focus is on scrutinizing alterations in reproductive behaviors among the age extremes of the reproductive period. This analysis is motivated by the bimodal and polarized fertility patterns that Latin American countries have recently witnessed (Lima et al., 2018).

Throughout the pandemic, Brazil exhibited a distinct polarization in reproductive behaviors. Young mothers with lower educational attainment (0 to 7 years of schooling) experienced an accelerated decline in fertility, notably from October 2021 through 2022. Conversely, among women aged 40 and above, as well as those with higher education (12 or more years of schooling), an opposing trend emerged, characterized by a consistent increase in birth counts, evident through positive variations. This upward trajectory was observable from the outset of year 2021. A somewhat analogous, albeit less pronounced, phenomenon is discernible among women aged 35 and older, who also exhibited positive variations in birth counts.

[8] Birth count variations among these age groups are less noticeable.

Figure 1: Variations in birth counts before and during the pandemic in Brazil among women aged 15-24 and 35+, categorized by their educational levels.

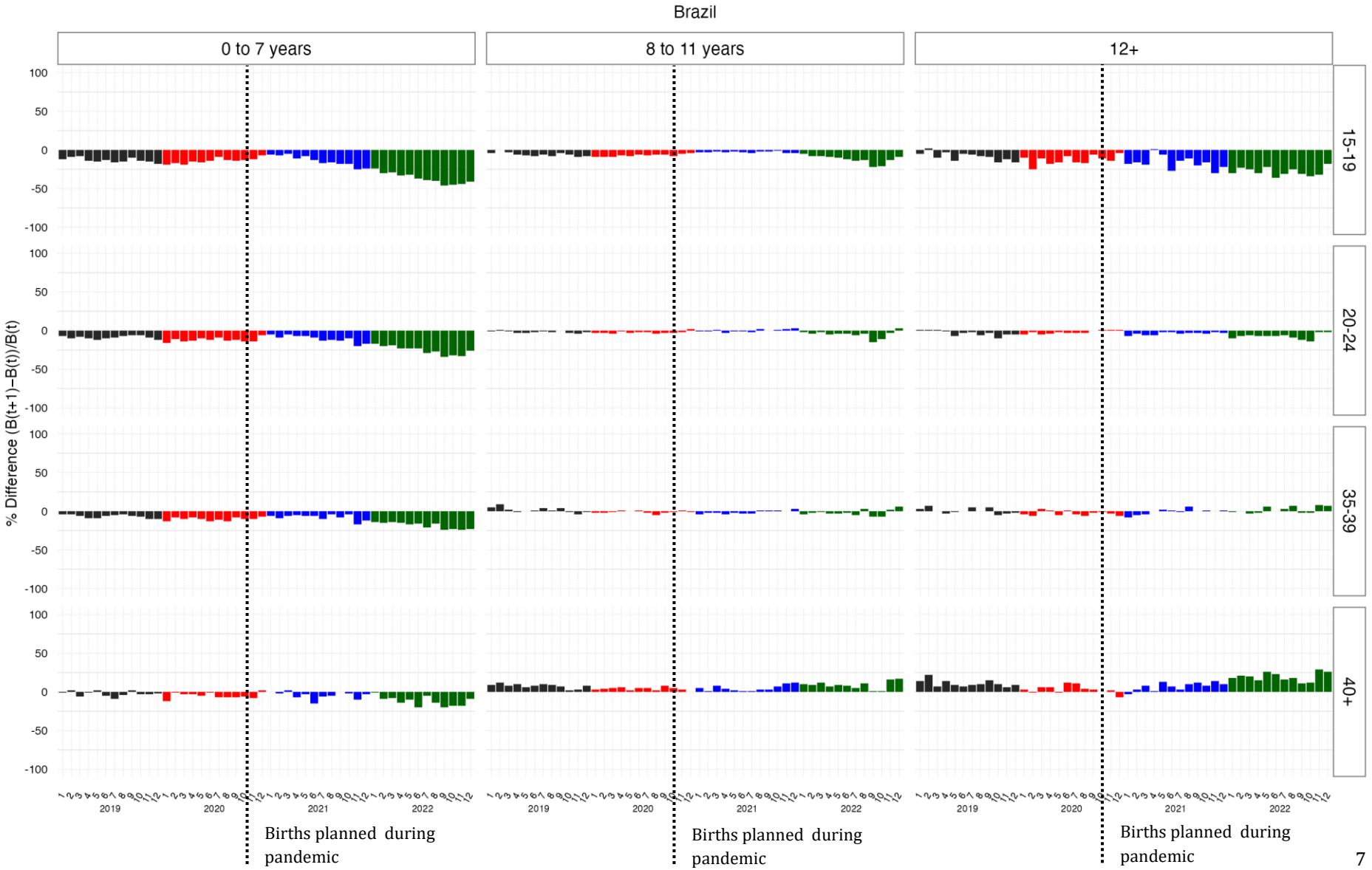
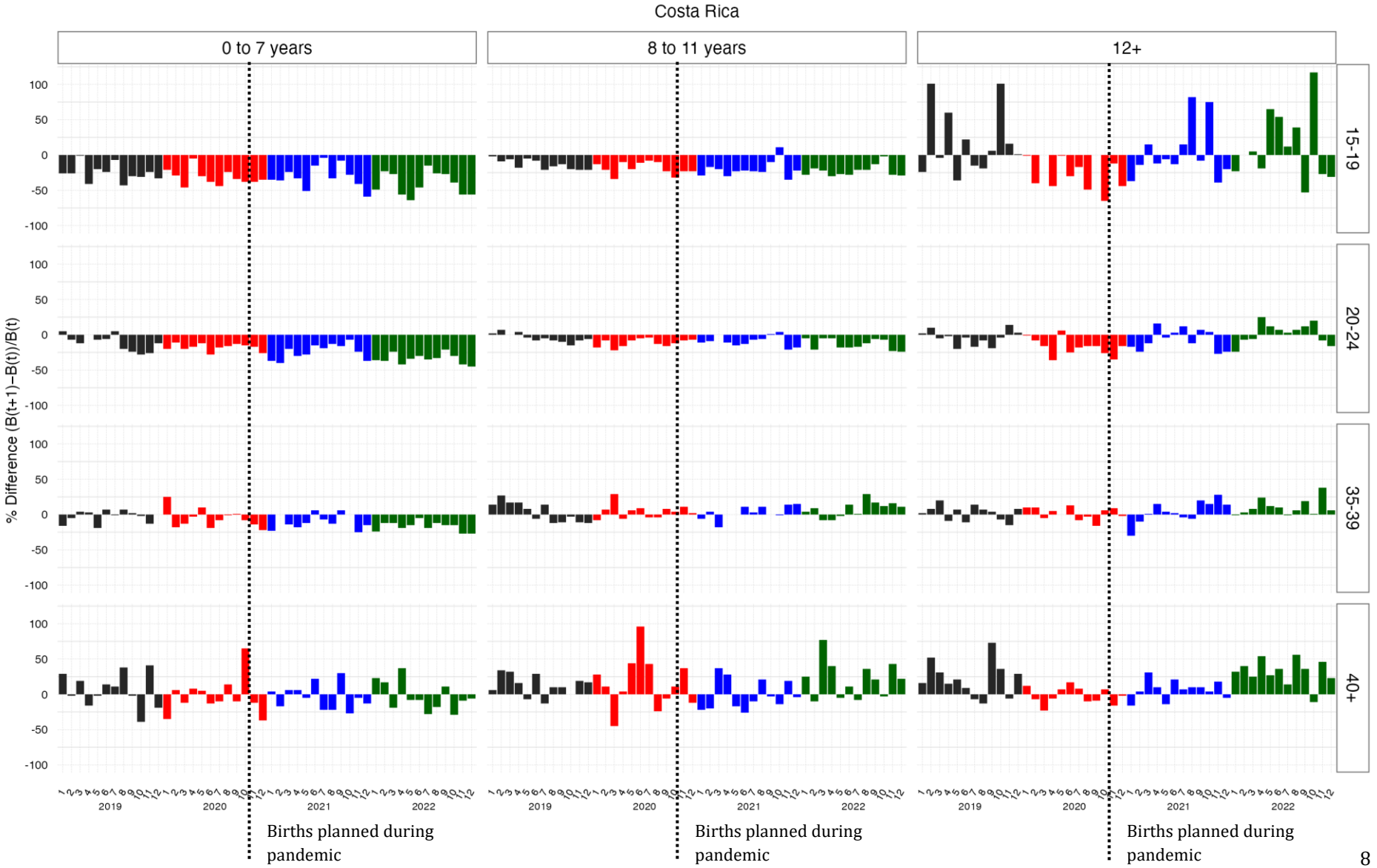


Figure 2: Variations in birth counts before and during the pandemic in Costa Rica among women aged 15-24 and 35+, categorized by their educational levels.



Costa Rica exhibits some similarities to Brazil; however, the variations in birth counts among less educated young mothers before and during the pandemic do not differ significantly. In 2022, among the highly educated women, we observed a pattern akin to that seen in Brazil—an increase in variations across all age groups. It is essential to exercise caution when interpreting the data for the 15-19 age group and those with 12 or more years of education. These groups typically comprise a limited number of cases in this country, thus rendering the results susceptible to substantial fluctuations that may affect their reliability. However, when examining the subsequent age group, specifically mothers aged 20-24, the variations in birth counts exhibit a fluctuating pattern with no distinct trend observed both before and during the pandemic.

When considering the highly educated women aged 40 and above as a comparative group, it is noteworthy that until October 2020, variations in birth counts were predominantly negative or in close proximity to zero. However, in 2022, we observed a consistent trend of positive variations in the number of births throughout most of the year.

An interesting observation emerges in the case of Cuba, where the pandemic has disrupted reproductive plans, particularly among less educated women. For instance, young mothers aged 15-19 exhibited a declining trend in birth counts in the pre-pandemic period. However, during the COVID-19 crisis, there was a notable shift with positive variations in birth counts observed in several months of 2021. This same pattern is also noticeable among mothers aged 20-24 and those aged 40 and above. When examining the remaining age and educational groups, we see no substantial differences in birth counts were evident before and during the pandemic. Furthermore, it is important to observe that during the pandemic, Mexico stands out as the only country displaying a consistent pattern of declining birth counts across all age groups and educational levels.

Figure 3: Variations in birth counts before and during the pandemic in Cuba among women aged 15-24 and 35+, categorized by their educational levels.

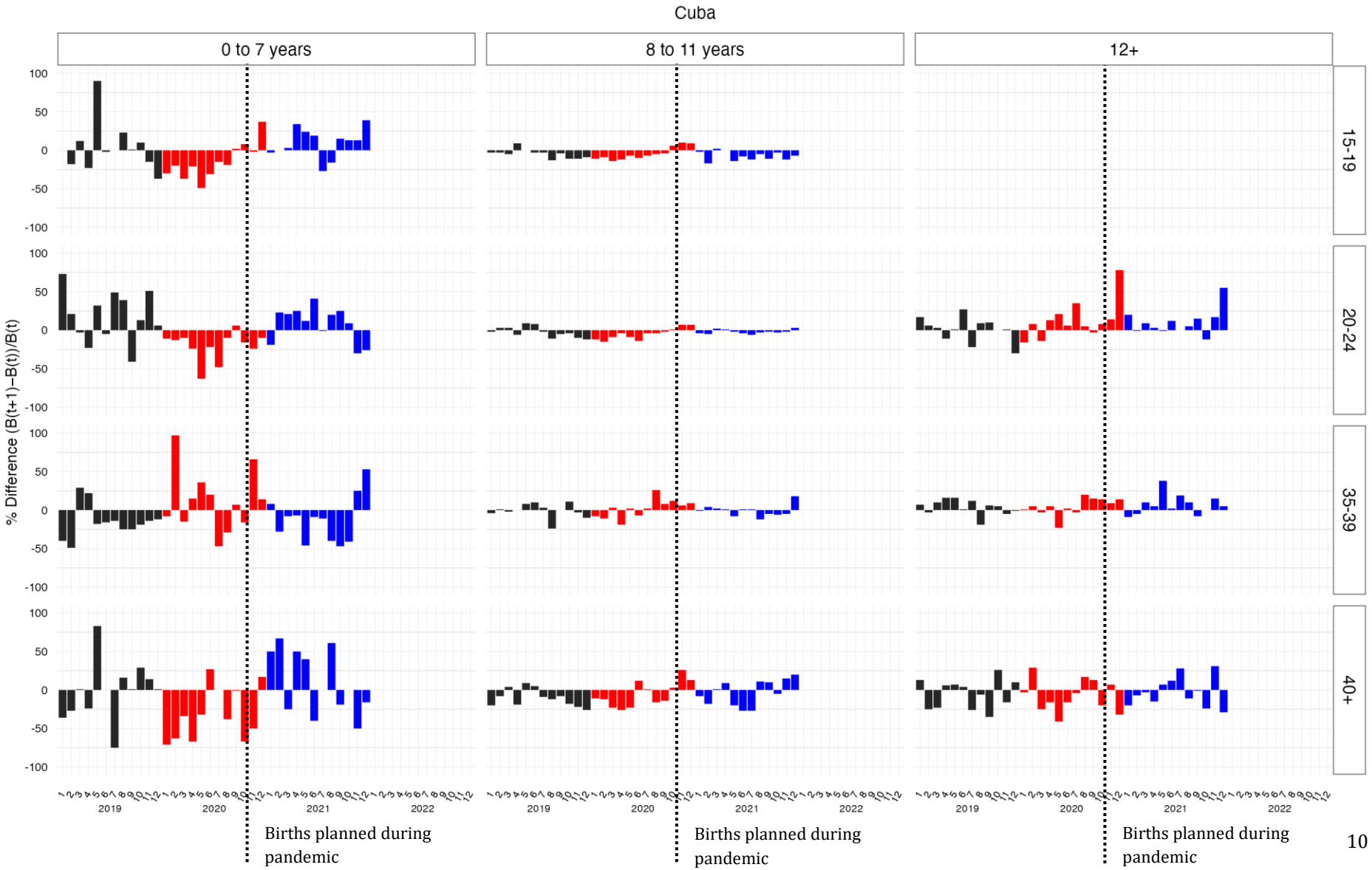
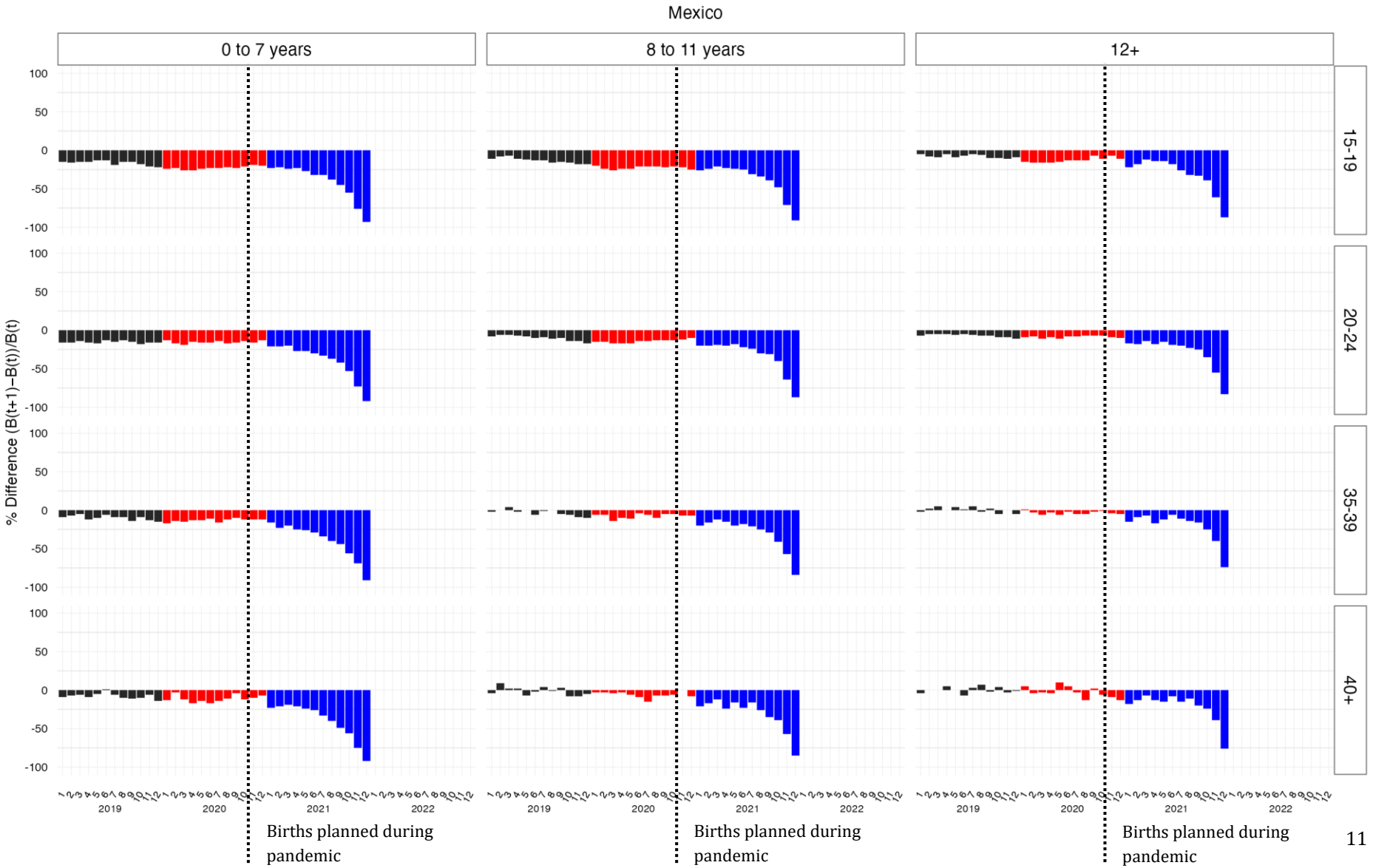


Figure 4: Variations in birth counts before and during the pandemic in Mexico among women aged 15-24 and 35+, categorized by their educational levels.



In subsequent stages, we plan to employ a decomposition method to ascertain the percentage share contribution of each group (distinguished by age and educational level) to the observed changes in birth count variations. Additionally, our analysis will encompass the application of time series models for birth rate prediction, along with the construction of confidence intervals to enhance the robustness of these estimates.

References

Aassve, A., Cavalli, N., Mencarini, L., Plach, S., and Bacci, M.L. 2020. The COVID-19 pandemic and human fertility. Science, 369(6502): 370-371. https://doi.org/10.1126/science.abc9520.

ABRUCIO, Fernando L. et al. Combate à COVID-19 sob o federalismo bolsonarista: um caso de descoordenação intergovernamental. Revista de Administração Pública, Rio de Janeiro, v. 54, n. 4, p. 663-677, jul./ago. 2020. DOI: 10.1590/0034-761220200354.

Arnstein Aassve, Nicolò Cavalli, Letizia Mencarini, Samuel Plach, Seth Sanders. Early assessment of the relationship between the COVID-19 pandemic and births in high-income countries Proceedings of the National Academy of Sciences Sep 2021, 118 (36) e2105709118; DOI: 10.1073/pnas.2105709118.

Castro, M. C., Kim, S., Barberia, L., Ribeiro, A. F., Gurzenda, S., Ribeiro, K. B., Abbott, E., Blossom, J., Rache, B., & Singer, B. (2021b). Spatiotemporal pattern of COVID-19 spread in Brazil. Science, 372(6544), 821–826. https://doi.org/10.1126/science.abh1558

Coutinho, R. Z., Conceição de Lima, L., Antunes Leocádio, V. and Bernardes, T. 2020. Considerações sobre a pandemia de Covid-19 e seus efeitos sobre a fecundidade e a saúde sexual e reprodutiva das brasileiras. Revista Brasileira De Estudos De População, 37, 1-21. https://doi.org/10.20947/S0102-3098a0130.

Das Gupta, P. (1991). Decomposition of the difference between two rates and its consistency when more than two populations are involved. Mathematical Population Studies, 3(2), 105–125. https://doi.org/10.1080/08898489109525329

Das Gupta, P. (1993). Standardization and decomposition of rates: A user's manual. US Department of Commerce, Economics and Statistics Administration, Bureau of the Census,https://www2.census.gov/library/publications/1993/demographics/p23-186.pdf

Fallesen, P. & Cozzani, M. Partial fertility recuperation in Spain two years after the onset of the COVID-19 pandemic. Demographic Research. V. 49, A.17, p. 465–478.

for CRVS Systems. Link: https://crvssystems.ca/sites/default/files/assets/images/06%20EN%20CRVS%20in%20Conflict%2C%20Emergencies%20and%20Fragile%20Settings_Brazil_WEB.pdf

Kearney, M. S. and Levine, P. 2020. Half a million fewer children? The coming COVID baby bust. Report, Brookings, 14 March 2021 https://www.brookings.edu/research/half-a-million-fewer-children-the-coming-covid-baby-bust.

Lehmiller, J., Garcia, J., Gesselman, A. and Mark, K. 2020. Less sex, but more sexual diversity: Changes in sexual behavior during the COVID-19 coronavirus pandemic. Leisure Sciences, 43:1-2, 295-304. https://doi.org/10.1080/01490400.2020.1774016

Lima, Everton E. C., Kryštof Zeman, Tomáš Sobotka, Mathias Nathan, and Ruben Castro. "The Emergence of Bimodal Fertility Profiles in Latin America." Population and Development Review 44, no. 4 (2018): 723–43.

Lima, E. E. C., Gayawan, E., Baptista, E. A., & Queiroz, B. L. (2021a). Spatial pattern of COVID-19 deaths and infections in small areas of Brazil. PLoS ONE. https://doi.org/10.1371/journal.pone.0246808.

Lima, E.E.C., Vilela, E.A., Peralta, A. et al. Investigating regional excess mortality during 2020 COVID-19 pandemic in selected Latin American countries. Genus 77, 30 (2021b). https://doi.org/10.1186/s41118-021-00139-1

Lima, E.E.C, Gonzaga, M.R., Freire, F.H.M.A. & Queiroz, B.L. (2021c) Alternative Information Sourceson Deaths in Brazil in the Contextof the COVID-19 Pandemic. In: The Compendium of Good Practices:Harnessing Civil Registration and Vital Statistics (CRVS) Systems in Conflict, Emergencies, and FragileSettings was developed by the Centre of Excellence for Civil Registration and Vital StatisticsSystems in collaboration with Open Data Watch. CENTRE OF EXCELLENCE

Lui, Lizandro et al. Disparidades e heterogeneidades das medidas adotadas pelos municípios brasileiros no enfrentamento à pandemia de Covid-19. Trabalho, Educação e Saúde [online]. 2021, v. 19 [Acessado 14 Dezembro 2021] , e00319151. Disponível em: <https://doi.org/10.1590/1981-7746-sol00319>. Epub 10 Mar 2021. ISSN 1981-7746. https://doi.org/10.1590/1981-7746-sol00319.

Rangel MA, Nobles J, Hamoudi A. Brazil's Missing Infants: Zika Risk Changes Reproductive Behavior. Demography. 2020;57(5):1647-1680. doi:10.1007/s13524-020-00900-9.

Settersten, R.A., Bernardi, L., Härkönen, J., Antonucci, T.C., Dykstra, P.A., Heckhausen, J., Kuh, D., Mayer, K.U., Moen, P., Mortimer, J.T., Mulder, C.H., Smeeding, T.M., Van der Lippe, T., Hagestad, G.O., Kohli, M., Levy, R., Schoon, I. and Thomson, E. 2020. Understanding the

effects of Covid-19 through a life course lens. Advances in Life Course Research, 45. https://doi.org/10.1016/j.alcr.2020.100360.

Sobotka, T., Jasilioniene, A., Galarza, A. A., Zeman, K., Nemeth, L., and Jdanov, D. 2023. Pandemic Roller-Coaster? Birth Trends in Higher-Income Countries During the COVID-19 Pandemic. Population and Development Review.