Low Infant Birth Weight in Brazil

A Historical Data Analysis Approach

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# 1. Abstract

This cross-sectional study uses linear models to understand disparities in infant birth weight in relation to maternal skin color, age, parity, and nationality in Rio de Janeiro, Brazil’s first public maternity hospital, the Maternidade Laranjeiras (now Maternidade Escola) in the 1920s. It finds that infants born to women of color (either Black, “*preta,*” or mixed-race, “*parda*”) had lower birth weights than infants born to White women, whether Brazilian or immigrant. I hypothesize these differences were related to the historical legacies of slavery, only abolished in 1888, including race-based socioeconomic inequality and possible epigenetic effects from the lived experience of racism, on population health in Brazil.

# 2. Introduction

At four in the morning on November 17, 1922, Virginia Maria da Conceição, a twenty-six-year-old Black (“*preta*”) woman gave birth to a stillborn daughter in Rio de Janeiro, Brazil’s first public maternity hospital, the Maternidade Laranjeiras (now called Maternidade Escola). This was Conceição’s fifth birth; prior, she had delivered three full-term infants vaginally and one premature infant, born at seven months gestational age. According to the hospital records, Conceição had had a “good” pregnancy, with a relatively easy delivery. After arriving, she remained in the first stage of labor (“dilatação”) for five hours. The second stage of labor (“expulsão”) lasted thirty minutes. She delivered the placenta ten minutes later. The unnamed stillborn girl weighed 3180 grams at birth, a normal weight for a full-term infant and around 150 grams higher than the average weight for female infants and for Black infants born at the hospital in the 1920s. But, as the hospital records detailed, Conceição did not take home a healthy baby; rather, “hereditary syphilis,” as the fetal autopsy noted, was the cause of intrauterine stillbirth.[[1]](#footnote-21)

Virginia Maria da Conceição’s experience with syphilis and stillbirth demonstrates the precarious state of maternal-infant health in early twentieth-century Brazil. I use Conceição’s tragic but all too common story of poor perinatal and neonatal outcomes as a jumping off point to explore the historical legacy of slavery on maternal-infant health in Brazil.

Public health and medical research over the past twenty years has shown that while race is a social construct and thus biological fiction, its social consequences – namely racism and its potential effects – have far-reaching influences on health and disease patterns, particularly in countries with high levels of race-based inequality.[[2]](#footnote-22) Contemporary studies in Brazil have shown that non-White mothers give birth to infants at lower birth weights than their White counterparts.[[3]](#footnote-25) Mothers with lower education levels and lower socioeconomic status also give birth to infants at lower birth weights.[[4]](#footnote-28)

These trends also hold true in the United States, the other major slave society in the Americas, where today Black newborns have lower birth weights than White newborns, with trends worsening over time.[[5]](#footnote-30) Racism is a major factor in these outcomes, as studies demonstrate that U.S.-born Black women have infants with lower birth weights and higher rates of pre-term birth than Black immigrant women.[[6]](#footnote-32) Other racial groups, whether U.S. or foreign-born, also face similar trends, although more research is needed to understand confounding factors.[[7]](#footnote-37) Understanding these patterns within and across communities is important as low birth weight is associated with higher rates of infant mortality in the first year of life and possible health problems over the life course.[[8]](#footnote-39)

Scholars across disciplines have argued that racialized health disparities in countries with histories of race-based chattel slavery, including the United States, are longstanding and tied to the unequal and violent social relations produced under that institution.[[9]](#footnote-41) In Brazil, most historical studies of health under slavery and in its aftermath remain descriptive in nature and have not tested any quantitative associations between the institution’s legacies, including both race-based socioeconomic inequality and the deleterious effects of racism, and maternal-infant health outcomes.[[10]](#footnote-46)

Here, I aim to fill this gap by examining infant birth weight in relation to maternal skin color, age, parity, and nationality in the Maternidade Laranjeiras, which opened in 1904 and provided free gynecological and obstetric care to the then-capital city’s poor and working-class women.

In exploring differences in infant birth weight according to maternal skin color in early twentieth-century Brazil, my aim is not to reify race as a genetic or epigenetic phenomenon. In our current postgenomic era, in which “race” as a biological category has been thoroughly debunked, the possibility for centuries-old patterns of hierarchical scientific thinking remains very real.[[11]](#footnote-47) Discussions of the potential effects of racism on epigenetic markers is one area where this essentialization can occur. Contemporary research on epigenetic markers stemming from common experiences can create essentialist racial thinking just as past, debunked research into any genetic existence of race did.[[12]](#footnote-48) Poor Black women like Virginia Maria da Conceição and her children were not “pathologically” different or part of permanently “damaged” communities (socially or biologically) but rather were living the consequences of centuries of chattel slavery and its aftermath.[[13]](#footnote-49)

This paper aims to provide some basic quantitative associations of the health status of the descendants of enslaved individuals in post-abolition Brazil to demonstrate the failures of the state to fully incorporate African-descended individuals into political, economic, and social life and to substantiate the qualitative findings from other researchers on health disparities stemming from slave societies, disparities that existed but did not wholly determine the lives of people like Virginia Maria da Conceição.

## 2.1 Background

Brazil imported over four million enslaved Africans during the nearly four centuries of the existence of chattel slavery in the country.[[14]](#footnote-51) It was also the last country to abolish slavery (1888) in the Western Hemisphere. In the nineteenth century, population health was poor for all people, but particularly so for enslaved individuals, who not only experienced the epidemic diseases such as cholera, plague, and yellow fever that affected the entire population, but also suffered from severe nutritional deficiencies.[[15]](#footnote-52)

In the immediate aftermath of the abolition of slavery, which coincided with the implementation of the country’s first republican form of government in 1889, no state-run efforts to incorporate formerly enslaved, African-descended peoples into civil and political life occurred.[[16]](#footnote-54) Scholars have shown how Black and mixed-race Brazilians were incarcerated at higher rates, had lower educational and literacy levels, and had worse health outcomes including infant mortality than their White and White immigrant counterparts.[[17]](#footnote-55)

Yet recent studies also show an overall improvement in human welfare during this period, measured in increased height at the population level, particularly in Brazil’s southeastern region, where Rio de Janeiro is located.[[18]](#footnote-56) The early twentieth century was a period of advancement in both the provision of clinical care and the implementation of public health initiatives in Brazil and across the globe. Improved sanitation measures helped stem infectious disease outbreaks and improve quality of life.[[19]](#footnote-58) Although infant mortality rates declined from the nineteenth century, the major advancements in clinical medicine that provided a sustained improvement in maternal mortality, stillbirth, and infant mortality rates, including blood transfusions and antibiotics, did not come about until the late 1930s and early 1940s.[[20]](#footnote-59) Worldwide, the combination of these advancements in medical care and overall improvements in nutrition resulted in dramatic and sustained drops in maternal and infant mortality after World War II.[[21]](#footnote-60)

By the 1920s, at least in Brazil’s large cities, public maternity hospitals, established in the previous three decades, had grown in number and size as obstetricians and public health officials worked to provide prenatal care and hospitalize labor and delivery.[[22]](#footnote-61) Dedicated maternity hospitals such as Laranjeiras were central to this hospitalization process. There, obstetricians and gynecologists began implementing surgical advances in the realm of women’s medicine.[[23]](#footnote-62) Underlying these structural and technological changes was the scientific motherhood movement, supported by both physicians and elite women, which harnessed advances in medical knowledge and public health infrastructure to support a technocratic model towards pregnancy and motherhood. This ideology relied on essentialized notions of gender and race, foregrounding physicians’ scientific authority.[[24]](#footnote-63)

At the same time, old racial hierarchies based on legal status morphed into new “scientific” ways to categorize humans based on skin color. In Brazil, with a large Black and mixed-race population, early twentieth-century racist thinkers first embraced a theory of “whitening” in which they believed that racial mixture would eventually lead to a White population and then more preventive eugenic theories in the 1920s and 1930s that focused on improving environmental factors rather than coercively restricting reproduction through sterilization.[[25]](#footnote-64) Although some eugenicists called for sterilization of “unfit” citizens, they never couched these discussions in explicitly racial terms.[[26]](#footnote-65) In the end, however, whiteness still remained a cultural and social “goal” even if the state did not engage in coercive measures of reproductive control.

Maternidade Laranjeiras, which was the teaching hospital for the obstetrics and gynecology program at Rio de Janeiro’s medical school, was ground zero for the intersection of these forces. Laranjeiras provided gynecological and obstetric care free of charge; its clientele came from the city’s poor and working classes.[[27]](#footnote-66) The majority of patients were women of color defined as either Black or mixed race, and the majority of White patients were immigrants. Because most clinical notes were short – only those that described surgical births such as cesarean sections, or in the case of Virginia Maria da Conceição included the fetal autopsy report, had longer notes – they do not show if racist thought affected how physicians, all male and mostly White, practiced medicine.[[28]](#footnote-67) Although the notes show no direct evidence of racist medical practice, the hospital space was one of gender and racial hierarchy – not separate from Brazilian society but its microcosm.

This study builds on an important body of work in economic history that uses hospital records to explore historical trends in birth weights.[[29]](#footnote-68) It also dialogues with studies in the human sciences that hypothesize an intergenerational effect of the poor health conditions, including poor nutrition and excessive workloads, experienced by enslaved individuals on their descendants across multiple generations.[[30]](#footnote-72)

## 2.2 Analysis

I analyzed a unique sample of 2845 recorded clinical visits to Maternidade Laranjeiras between June 1922 and May 1926. I extracted the sample from Brazil’s premier obstetrics and gynecology journal, the *Revista de Gynecologia e d’Obstetricia* (RGO). The journal published obstetricians’ and gynecologists’ clinical observations, analyses of new surgical techniques, and professional proceedings. Between June 1922 and May 1926, RGO also published the monthly clinical reports of all women treated at Laranjeiras.[[31]](#footnote-76)

Relying on the dataset, I ask whether the legacy of slavery, both as possible intergenerational inheritance patterns or as contemporary experiences of discrimination in a post-abolition society, affected the health of infants born in the first public maternity hospital in 1920s Brazil using birth weight as a proxy for general fetal and neonatal health. I quantify how maternal race, nationality, age, and parity explain racial disparities in infant birth weight.

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| Table 1: Summary Statistics   | **Characteristic** | **N** | **N = 2,845**1 | | --- | --- | --- | | Color | 2,695 |  | | Black |  | 763 (28%) | | Mixed Race |  | 788 (29%) | | White |  | 1,144 (42%) | | Ancestry | 2,695 |  | | Afro-Descent |  | 1,551 (58%) | | Euro-Descent |  | 1,144 (42%) | | Parity | 2,836 |  | | Multiparous |  | 1,681 (59%) | | Nulliparous |  | 1,155 (41%) | | Maternal Age | 2,783 | 25.3 (5.8) | | Combined Nationality | 2,773 |  | | European |  | 416 (15%) | | Latin American |  | 12 (0.4%) | | Middle Eastern |  | 3 (0.1%) | | Brazilian |  | 2,342 (84%) | | Birth Outcome | 2,761 |  | | Abortion |  | 89 (3.2%) | | Interventionist |  | 183 (6.6%) | | Natural |  | 2,429 (88%) | | Operative |  | 60 (2.2%) | | Maternal Outcome | 2,829 |  | | Discharged |  | 2,802 (99%) | | Death |  | 23 (0.8%) | | Hospital transferal |  | 4 (0.1%) | | Fetal Outcome | 2,666 |  | | Live Birth |  | 2,440 (92%) | | Stillbirth or Neonatal Death |  | 226 (8.5%) | | Sex | 2,534 |  | | F |  | 1,153 (46%) | | M |  | 1,381 (54%) | | Birth Length (cms) | 2,405 | 48.3 (3.9) | | Birth Weight (grms) | 2,384 | 3,087 (567) | | Black (grms) | 643 | 3,037 (507) | | Mixed-Race (grms) | 675 | 3,064 (579) | | White (grms) | 950 | 3,133 (590) | | Female (grms) | 1,074 | 3,038 (561) | | Male (grms) | 1,270 | 3,137 (552) | | 1n (%); Mean (SD) | | | |

Table 1 provides summary statistics for the sample. When comparing White patients to all patients of color by combining Black and mixed-race categories, 1551 (58%) were of African descent (defined as *preta* or *parda*) and 1144 (42%) were of European descent (*branca*). First-time mothers (“nulliparous”) were 41% of the sample (n = 2836). Perhaps they would return to Laranjeiras, or another maternity hospital, to give birth to their future children, demonstrating the process of hospitalization of childbirth in real time. Most mothers were Brazilian. Of the total sample (n = 2773), 84% were Brazilian. Most immigrants were European.

Of all reproductive outcomes (n = 2761), 88% were natural deliveries. If we exclude spontaneous abortion from the sample (n = 2672), 91% of outcomes were natural deliveries. The remaining 9% were interventionist or operative deliveries. These included forceps and cesarean sections.[[32]](#footnote-78)

For patients who went to the clinic to deliver their infant (thus excluding those suffering from spontaneous abortions), 23 died. The Maternal Mortality Ratio (MMR), calculated as:

where maternal deaths (MD) are divided by 10,000 live births (LB), was 94.26%. For those same years, the MMR for the city of Rio de Janeiro was 65.65%.[[33]](#footnote-79) This is a stark difference, but we must take into account differential levels of recording. Hospital rates could have reflected a registration effect, as all births and deaths were recorded in the hospital, whereas reporting at the city level was less reliable.[[34]](#footnote-80) Rio de Janeiro’s vital statistics were still poorly defined and intermittently collected in the 1920s.[[35]](#footnote-81) Thus, the city’s rates were probably higher. Nonetheless, the difference demonstrates that delivering in the presence of licensed clinicians did not necessarily improve outcomes for the mother and supports other historical studies that interventionist obstetric procedures could be detrimental to maternal-infant health before the rise of antibiotics and blood transfusions.[[36]](#footnote-82)

The mean stillbirth rate (SBR) (excluding spontaneous abortion but including intrapartum death defined here as stillbirth) for the hospital, calculated as:

where the total number of stillbirths (SB) is divided by 1000 total births (TB), was 84.8%. We can compare this to the mean SBR for the city of Rio de Janeiro for the same period, which was 73.68%.[[37]](#footnote-83) Again, registration effects could explain the higher hospital rates.

The sex ratio at birth (SRaB) is calculated as:

where the total number of live male births (M) is divided by by 100 live female births (F) in a given period.

The sex ratio was 1.2: there were 120 male live births per 100 female live births at this specific clinic. This is much higher than the current range of between 103 and 107 male births per 100 female births.[[38]](#footnote-84) Historically, a skewed sex ratio suggests that preferential infanticide or abortion was occurring – parents were more likely to terminate a pregnancy or kill an infant if it was a female. Contrary to popular belief, this practice occurred in both Asian and European countries, although no evidence of it exists for the Americas.[[39]](#footnote-85) However, this explanation does not hold for a maternity clinic in which women were seeking care to deliver their infants. The skewed sex ratio deserves further study.

Table 2 provides the mean birth weights for the Maternidade Laranjeiras sample, stratified by sex and maternal skin color in comparison with both current-day birth weights from various regions in Brazil and historical studies on birth weight across the Americas and in New Zealand.

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| Table 2: Mean Birth Weights   | **Sample** | **Year** | **Mean (grams)** | **Source** | | --- | --- | --- | --- | | Antebellum US South (estimated enslaved) | <1850 | 2320 | Steckel, 1986, 174, 182 | | Rio de Janeiro (Black singletons) | 1922-26 | 3037 | Maternidade Laranjeiras | | Rio de Janeiro (female singletons) | 1922-26 | 3038 | Maternidade Laranjeiras | | Rio de Janeiro (Mixed-race singletons) | 1922-26 | 3064 | Maternidade Laranjeiras | | Rio de Janeiro (singletons all) | 1922-26 | 3087 | Maternidade Laranjeiras | | Riberão Preto, São Paulo, Brazil | 1994 | 3115 | Silva, 1998, 77 | | Rio de Janeiro (Black singletons, mothers incomplete K-12) | 1999-2001 | 3122 | Leal, 2006, 469 | | Rio de Janeiro (White singletons) | 1922-26 | 3133 | Maternidade Laranjeiras | | Rio de Janeiro (male singletons) | 1922-26 | 3137 | Maternidade Laranjeiras | | Rio de Janeiro (Mixed-race singletons, mothers incomplete K-12) | 1999-2001 | 3154 | Leal, 2006, 469 | | São Paulo, Brazil (live) | 1993-98 | 3155 | Monteiro, 2000, 31 | | Pelotas, Rio Grande do Sul, Brazil (live singletons) | 2004 | 3167 | Silveira, 2019, i48 | | Pelotas, Rio Grande do Sul, Brazil (live singletons) | 1993 | 3169 | Silveira, 2019, i48 | | Baltimore (Black singletons) | 1897-1935 | 3183 | Costa, 2004, 1065 | | Rio de Janeiro (Black singletons, mothers complete K-12) | 1999-2001 | 3185 | Leal, 2006, 470 | | Rio de Janeiro (White singletons, mothers incomplete K-12) | 1999-2001 | 3186 | Leal, 2006, 469 | | Pelotas, Rio Grande do Sul, Brazil (live singletons) | 2015 | 3198 | Silveira, 2019, i48 | | Pelotas, Rio Grande do Sul, Brazil (live singletons) | 1982 | 3201 | Silveira, 2019, i48 | | Rio de Janeiro (Mixed-race singletons, mothers complete K-12) | 1999-2001 | 3210 | Leal, 2006, 470 | | Rio de Janeiro (White singletons, mothers complete K-12) | 1999-2001 | 3218 | Leal, 2006, 470 | | Riberão Preto, São Paulo, Brazil | 1978-79 | 3234 | Silva, 1998, 77 | | Boston (in hospital) | 1886-1900 | 3330 | Ward, 1993, 148-9 | | Philadelphia (all) | 1848-73 | 3375 | Goldin, 1989, 363-5 | | Philadelphia (live) | 1848-73 | 3403 | Goldin, 1989, 363-5 | | Wellington, NZ (singleton live female) | 1907-22 | 3403 | Roberts, 2014, 156, 158 | | Baltimore (white singletons) | 1897-1935 | 3423 | Costa, 2004, 1065 | | New York (singeltons) | 1910-31 | 3463 | Costa, 1998, 991-2 | | Wellington, NZ (singleton live) | 1907-22 | 3467 | Roberts, 2014, 156, 158 | | Boston (at home) | 1884-1900 | 3479 | Ward, 1993, 148-9 | | Boston | 1872-1900 | 3480 | Ward, 1993, 148-9 | | Wellington, NZ (singleton live male) | 1907-22 | 3531 | Roberts, 2014, 156, 158 | |

As we can see, Black infants born at the Maternidade Laranjeiras had the lowest mean birth weight (3037 grams) compared to all other historical samples except for estimated enslaved birth weights in the antebellum US South, which scholars have since called into question for being too low.[[40]](#footnote-88) Black infants born at Laranjeiras were almost 150 grams lighter than Black infants born at the Johns Hopkins hospital during an equivalent time period. Yet, they were less than 100 grams lighter than Black infants born to mothers with incomplete K-12 schooling in early twenty-first century Rio de Janeiro. White infants born at Laranjeiras had a mean birth weight of 3133 grams, slightly more than 50 grams lighter than White infants born to mothers with incomplete K-12 schooling in early twenty-first century Rio de Janeiro. Yet they were nearly 300 grams lighter than White infants born at the Johns Hopkins hospital during an equivalent time period (3423 grams). As other scholars have shown, mean birth weights in the past were not drastically lower than today, and Laranjeiras fits this pattern, with birth weights relatively close to those of contemporary Brazilian infants even if lower than infants born in the United States or New Zealand during the same time period.[[41]](#footnote-89)

## 2.3 Statistical analysis

I use Ordinary Least Squares (OLS) to estimate the relationship of maternal variables on infant birth weight. In the supplemental analysis available online, I include results from logistic models that estimated the relationship of maternal variables on infant birth weight as a categorical variable (either normal birth weight, NBW, or low birth weight, LBW, according to current WHO classifications), and in line with some studies on birth weight.[[42]](#footnote-91) Most logistic model results were insignificant, and thus I exclude them here. In my main models, I employ birth weight as a continuous variable in line with both current and historical studies.[[43]](#footnote-94) Due to the lack of comprehensive information on gestational age in these data, I do not consider birth weight in reference to gestational age, as is best practice for disentangling pre-term birth (PTB) from low birth weight (LBW).[[44]](#footnote-99) I discuss this constraint in the discussion below. The covariates include maternal age (recorded as a continuous variable in years), maternal skin color, gestational status, and maternal nationality.

I ran four linear models: two in which I categorized maternal skin color into two ancestral groups: White (Euro-descent), the reference group, and non-White (Afro-descent), and two in which I categorized maternal skin color according to the hospital records’ original racial classifications: White (the reference group), Black, and mixed race. Racial terminology in Brazil was, and continues to be, complex and dynamic.[[45]](#footnote-101) Racial categories and skin color exist on a spectrum rather than a Black-White binary.[[46]](#footnote-102) Analyzing both specific categories of skin color and more general categories of ancestry can help address these different understandings of race and is also in line with recent studies, which look at all African-descended peoples as a group and then stratify by racial mixing.[[47]](#footnote-103)

Yet, neither the records’ reporting of maternal skin color nor my own reclassification of the skin color of the mothers in this study can fully serve as a proxy for maternal health. Assuming so runs the potential of reifying intra-group differences at the expense of inter-group ones. Yet, given the limited historical data available, I run these models understanding the inherent limitations of using skin color as a category at all and as a proxy for health status in particular.

The simple linear regression model is as follows:

whereas BW is birth weight in grams, MA is maternal ancestry (Euro-descent, Afro-descent), and is the error term.

The multiple linear regression model is as follows:

whereas BW is birth weight in grams, MA is maternal ancestry (Euro-descent, Afro-descent), Gest is gestational status (nulliparous or multiparous), Age is maternal age in years, and is the error term. Results for both models are displayed in Table 3.

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| Table 3: Model 1 and 2 Results   |  | **Model 1** | | **Model 2** | | | --- | --- | --- | --- | --- | | **Characteristic** | **Beta**1 | **SE**2 | **Beta**1 | **SE**2 | | (Intercept) | 3,188\*\*\* | 17.6 | 3,179\*\*\* | 70.8 | | Age |  |  | 2.7 | 2.22 | | ModifiedColor |  |  |  |  | | Euro-Descent | — | — | — | — | | Afro-Descent | -97\*\*\* | 22.9 | -83\*\* | 26.8 | | ModifiedNationality |  |  |  |  | | European |  |  | — | — | | Latin American |  |  | 48 | 166 | | Middle Eastern |  |  | 501 | 492 | | Brazilian |  |  | -27 | 36.4 | | ModifiedStatus |  |  |  |  | | Multiparous |  |  | — | — | | Nulliparous |  |  | -111\*\*\* | 25.2 | | No. Obs. | 1,919 |  | 1,919 |  | | R² | 0.009 |  | 0.026 |  | | 1\*p<0.05; \*\*p<0.01; \*\*\*p<0.001 | | | | | | 2SE = Standard Error | | | | | |

The second two models are also simple and multiple linear regressions. However, in these two models, I maintained maternal skin color as the original three categories recorded in the hospital records, White (the reference group), Black, and mixed race to see if there is differential outcomes for Black and mixed-race women. The simple linear regression model is as follows:

whereas BW is birth weight in grams, MC is maternal skin color (White, Black, and mixed race), and is the error term. Results are displayed in Table 4.

The multiple linear regression model is as follows:

whereas BW is birth weight in grams, MC is maternal skin color (White, Black and mixed race), Gest is gestational status (nulliparous or multiparous), Nat is maternal nationality (Brazilian, Latin American, European, Middle Eastern), Age is maternal age in years, and is the error term. Results are displayed in Table 4.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Table 4: Model 3 and 4 Results   |  | **Model 3** | | | **Model 4** | | | | --- | --- | --- | --- | --- | --- | --- | | **Characteristic** | **Beta**1 | **SE**2 | **Statistic** | **Beta**1 | **SE**2 | **Statistic** | | (Intercept) | 3,188\*\*\* | 17.6 | 181 | 3,181\*\*\* | 70.8 | 44.9 | | Age |  |  |  | 2.6 | 2.22 | 1.18 | | Color |  |  |  |  |  |  | | White | — | — | — | — | — | — | | Black | -108\*\*\* | 27.5 | -3.92 | -96\*\* | 30.7 | -3.12 | | Mixed Race | -88\*\* | 27.1 | -3.24 | -72\* | 30.3 | -2.36 | | ModifiedNationality |  |  |  |  |  |  | | European |  |  |  | — | — | — | | Latin American |  |  |  | 48 | 166 | 0.290 | | Middle Eastern |  |  |  | 501 | 492 | 1.02 | | Brazilian |  |  |  | -27 | 36.4 | -0.739 | | ModifiedStatus |  |  |  |  |  |  | | Multiparous |  |  |  | — | — | — | | Nulliparous |  |  |  | -111\*\*\* | 25.2 | -4.42 | | No. Obs. | 1,919 |  |  | 1,919 |  |  | | R² | 0.010 |  |  | 0.027 |  |  | | 1\*p<0.05; \*\*p<0.01; \*\*\*p<0.001 | | | | | | | | 2SE = Standard Error | | | | | | | |

All models demonstrate an association between maternal skin color and infant birth weight, with Euro-descended women (either as Euro-descended or as White, the reference group) having infants with higher birth weights than Afro-descended women (either as Afro-descended, Black, or mixed race). Age and nationality were not significant. Women who were nulliparous (delivering their first child) had infants with lower birth weights, which is an association still found today.[[48]](#footnote-106)

# 3. Discussion and Conclusion

The intrauterine environment is a critical determinant of infant birth weight. Infectious disease, alcohol or drug use, smoking, heavy physical work, and inadequate prenatal care can all influence birth weight. Maternal nutrition can as well, although the relationship is nonlinear in that the pregnant body protects the fetus at the expense of the mother.[[49]](#footnote-110) A threshold of malnutrition must be met before there is an adverse affect on fetal growth. Other factors include maternal age, parity, and birth spacing, as well as gestational age. We can imagine that poorer women performed physically taxing jobs that required them to stand for long periods of time, including as washerwomen, domestic help, and street vendors.[[50]](#footnote-111) Generalized poverty might have influenced maternal nutrition, as well as the ability to access prenatal care.

Because the hospital records excluded information on maternal health factors, we don’t know which contributed to racial disparities in infant birth weight. One possible cause that we do have some data for is syphilis. Like Costa found for early twentieth-century Baltimore, higher syphilis rates among African-descended women in Rio de Janeiro might have explained repeated pregnancy loss, whether a miscarriage or stillbirth, as was the case of Virginia Maria da Conceição. Studies demonstrate that syphilis increases adverse birth outcomes including increased risk of LBW and PTB.[[51]](#footnote-112) The clinical records that comprise this dataset did not consistently record syphilis rates. Scholars have shown how medical and public health professionals viewed it as an important cause of adverse health outcomes and even a possible “scourge” on the future of the Brazilian race.[[52]](#footnote-114) Although I don’t have accurate rates for Laranjeiras, city-wide rates from the 1930s can provide some context for the prevalence of the disease among pregnant women. Of all prenatal syphilis exams performed between 1935 and 1938 at public clinics or hospitals across the city, not stratified by maternal skin color, 7.92% came back positive.[[53]](#footnote-115)

New discussions of epigenetic markers associated with the lived experience of racism might also be applicable here. Studies have connected racial disparities in pregnancy outcomes, including PTB and LBW, with the accumulation of stress over the pregnant person’s life course (and the life courses of their ancestors), mediated through epigenetic mechanisms. Although there is no genetic basis for race, experiences of racism can result in the accumulation of stressors that can be expressed epigenetically and lead to adverse pregnancy and health outcomes across generations through transgenerational epigenetic inheritance.[[54]](#footnote-116) Yet, it is crucial to remember that these are not deterministic processes but can be counteracted by social and political interventions that address the root causes of racism and its effects on health.[[55]](#footnote-117)

All models based on historical data must contend with limited sample sizes, missing data, and imprecise measures of health and nutrition.[[56]](#footnote-118) In this study, a major limitation was the original published clinical notes’ exclusion of gestational age. Thus, the birth weight variable captured both smaller babies born at term (low weight at-term infants, or small for gestational age) and pre-term infants, or those born before 37 weeks gestation. We are thus unable to know how many of these infants were low birth weight at term.[[57]](#footnote-120) This limits our ability to understand the relationship between maternal variables and infant birth weight as pre-term infants are more likely to have lower birth weights.[[58]](#footnote-121) Given the absence of accurate technological techniques for determining gestational age in the past, this limitation is inherent to any historical inquiry into birth weights, although other historical studies have datasets that include gestational age.[[59]](#footnote-122) I assume that infants at risk for pre-term birth (PTB) were also at-risk for LBW.

Lack of data on maternal nutrition and health status, which cannot be corrected for by using maternal skin color as a proxy for overall health, is a major impediment to understanding the true relationship between maternal variables and infant birth weight in this study. Given the paucity of historical understandings of current-day health disparities in maternal-infant health in post-abolition Brazil, this paper demonstrates the need for more research into quantitative associations between skin color and health in the past.

1. Octacilio Rolindo, “Registo da clinica obstetrica da Faculdade de Medicina do Rio de Janeiro a cargo do Prof. Fernando Magalhães de Dezembro 1922,” *Revista de Gynecologia e D’Obstetricia* 17, no. 1 (1923): 542–44. [↑](#footnote-ref-21)
2. Maurizio Meloni et al., “A Biosocial Return to Race? A Cautionary View for the Postgenomic Era,” *American Journal of Human Biology* 34, no. 7 (2022): e23742, <https://doi.org/10.1002/ajhb.23742>; Claudia Travassos and David R. Williams, “The Concept and Measurement of Race and Their Relationship to Public Health: A Review Focused on Brazil and the United States,” *Cadernos de Saúde Pública* 20 (June 2004): 660–78, <https://doi.org/10.1590/S0102-311X2004000300003>. [↑](#footnote-ref-22)
3. Kwame A. Nyarko et al., “Explaining Racial Disparities in Infant Health in Brazil,” *American Journal of Public Health* 103, no. 9 (2013): 1675–84; George L. Wehby et al., “Disparities in Birth Weight and Gestational Age by Ethnic Ancestry in South American Countries,” *International Journal of Public Health* 60, no. 3 (2015): 343–51, <https://doi.org/10.1007/s00038-014-0639-6>; Cássia Simeão Vilanova et al., “The Relationship Between the Different Low Birth Weight Strata of Newborns with Infant Mortality and the Influence of the Main Health Determinants in the Extreme South of Brazil,” *Population Health Metrics* 17 (November 2019): 15, <https://doi.org/10.1186/s12963-019-0195-7>. [↑](#footnote-ref-25)
4. Wehby et al., “Disparities in Birth Weight”; George L. Wehby and Jorge S. López-Camelo, “Maternal Education Gradients in Infant Health in Four South American Countries,” *Maternal and Child Health Journal* 21, no. 11 (2017): 2122–31, <https://doi.org/10.1007/s10995-017-2327-7>; Vilanova et al., “The Relationship.” [↑](#footnote-ref-28)
5. Elizabeth A. Pollock et al., “Trends in Infants Born at Low Birthweight and Disparities by Maternal Race and Education from 2003 to 2018 in the United States,” *BMC Public Health* 21, no. 1 (2021): 1117, <https://doi.org/10.1186/s12889-021-11185-x>. [↑](#footnote-ref-30)
6. Paula Braveman et al., “Explaining the Black-White Disparity in Preterm Birth: A Consensus Statement From a Multi-Disciplinary Scientific Work Group Convened by the March of Dimes,” *Frontiers in Reproductive Health* 3 (2021): 684207, <https://doi.org/10.3389/frph.2021.684207>; Shondra Loggins Clay et al., “US-Born Black Women and Black Immigrant Women: An Exploration of Disparities in Health Care and Sociodemographic Factors Related to Low Birth Weight,” *Journal of Racial and Ethnic Health Disparities* 10, no. 6 (2023): 3031–38, <https://doi.org/10.1007/s40615-022-01477-2>; Mosi Adesina Ifatunji et al., “Black Nativity and Health Disparities: A Research Paradigm for Understanding the Social Determinants of Health,” *International Journal of Environmental Research and Public Health* 19, no. 15 (2022): 9166, <https://doi.org/10.3390/ijerph19159166>; Safyer McKenzie-Sampson et al., “Maternal Nativity and Risk of Adverse Perinatal Outcomes Among Black Women Residing in California, 2011-2017,” *Journal of Perinatology* 41, no. 12 (2021): 2736–41, <https://doi.org/10.1038/s41372-021-01149-9>. [↑](#footnote-ref-32)
7. Diana Montoya-Williams et al., “Nativity and Perinatal Outcome Disparities in the United States: Beyond the Immigrant Paradox,” *Seminars in Perinatology* 46, no. 8 (2022): 151658, <https://doi.org/10.1016/j.semperi.2022.151658>. [↑](#footnote-ref-37)
8. Andrey Moreira Cardoso, Ricardo Ventura Santos, and Carlos E. A. Coimbra Jr., “Mortalidade infantil segundo raça/cor no Brasil: o que dizem os sistemas nacionais de informação?” *Cadernos de Saúde Pública* 21 (2005): 1602–8, <https://doi.org/10.1590/S0102-311X2005000500035>; Vilanova et al., “The Relationship.” [↑](#footnote-ref-39)
9. Rana Asali Hogarth, “The Myth of Innate Racial Differences Between White and Black People’s Bodies: Lessons From the 1793 Yellow Fever Epidemic in Philadelphia, Pennsylvania,” *American Journal of Public Health* 109, no. 10 (2019): 1339–41, <https://doi.org/10.2105/AJPH.2019.305245>; Grazyna Jasienska, “Low Birth Weight of Contemporary African Americans: An Intergenerational Effect of Slavery?” *American Journal of Human Biology: The Official Journal of the Human Biology Council* 21, no. 1 (2009): 16–24, <https://doi.org/10.1002/ajhb.20824>; Deirdre Cooper Owens and Sharla M. Fett, “Black Maternal and Infant Health: Historical Legacies of Slavery,” *American Journal of Public Health* 109, no. 10 (2019): 1342–45, <https://doi.org/10.2105/AJPH.2019.305243>; Richard H. Steckel, “Birth Weights and Infant Mortality Among American Slaves,” *Explorations in Economic History* 23, no. 2 (1986): 173–98, <https://doi.org/10.1016/0014-4983(86)90012-4>. [↑](#footnote-ref-41)
10. Okezi T. Otovo, *Progressive Mothers, Better Babies: Race, Public Health, and the State in Brazil, 1850-1945* (Austin: University of Texas Press, 2016); Cassia Roth, “Black Nurse, White Milk: Breastfeeding, Slavery, and Abolition in 19th-Century Brazil,” *Journal of Human Lactation* 34, no. 4 (2018): 804–9; Cassia Roth, “Birthing Life and Death: Women’s Reproductive Health in Early Twentieth-Century Rio de Janeiro,” *História, Ciências, Saúde-Manguinhos* 25, no. 4 (2018): 921–41; Cassia Roth, *A Miscarriage of Justice: Women’s Reproductive Lives and the Law in Early Twentieth-Century Brazil* (Stanford, CA: Stanford University Press, 2020); Lorena Féres da Silva Telles, *Teresa Benguela e Felipa Crioula estavam grávidas: maternidade e escravidão no Rio de Janeiro (1830-1888)* (São Paulo: Editora Unifesp, 2022). [↑](#footnote-ref-46)
11. Eram Alam, Dorothy Roberts, and Natalie Shibley, eds., *Ordering the Human: The Global Spread of Racial Science* (New York: Columbia University Press, 2024); Rob DeSalle and Ian Tattersall, *Troublesome Science: The Misuse of Genetics and Genomics in Understanding Race* (New York: Columbia University Press, 2018); Dorothy Roberts, *Fatal Invention: How Science, Politics, and Big Business Re-create Race in the Twenty-First Century* (New York: The New Press, 2011). [↑](#footnote-ref-47)
12. Meloni et al., “A Biosocial Return to Race?” [↑](#footnote-ref-48)
13. Eve Tuck, “Suspending Damage: A Letter to Communities,” *Harvard Educational Review* 79, no. 3 (2009): 409–28, <https://doi.org/10.17763/haer.79.3.n0016675661t3n15>. [↑](#footnote-ref-49)
14. Herbert S. Klein and Francisco Vidal Luna, *Slavery in Brazil* (Cambridge: Cambridge University Press, 2009). [↑](#footnote-ref-51)
15. Mary C. Karasch, *Slave Life in Rio de Janeiro, 1808-1850* (Princeton, NJ: Princeton University Press, 1987); Kenneth F. Kiple, “The Nutritional Link with Slave Infant and Child Mortality in Brazil,” *The Hispanic American Historical Review* 69, no. 4 (1989): 677–90, <https://doi.org/10.2307/2516096>. [↑](#footnote-ref-52)
16. José Murilo de Carvalho, *Os bestializados: o Rio de Janeiro e a República que não foi*, 3rd ed. (São Paulo: Companhia das Letras, 2004). [↑](#footnote-ref-54)
17. Molly C. Ball, *Navigating Life and Work in Old Republic São Paulo* (Gainesville: University of Florida Press, 2020); Brodwyn Fischer, *A Poverty of Rights: Citizenship and Inequality in Twentieth-Century Rio de Janeiro* (Stanford, CA: Stanford University Press, 2008); Otovo, *Progressive Mothers, Better Babies*; Roth, *A Miscarriage of Justice*. [↑](#footnote-ref-55)
18. Daniel Franken, “Anthropometric History of Brazil, 1850-1950: Insights from Military and Passport Records,” *Revista de Historia Economica - Journal of Iberian and Latin American Economic History* 37, no. 2 (2019): 377–408, <https://doi.org/10.1017/S0212610919000077>. [↑](#footnote-ref-56)
19. Robin L. Anderson, “Public Health and Public Healthiness, São Paulo, Brazil, 1876-1893,” *The Journal of the History of Medicine and Allied Sciences* 41 (July 1986): 293–307; Jaime L. Benchimol, *Dos micróbios aos mosquitos: febre amarela e a revolução pasteuriana no Brasil* (Rio de Janeiro: Editora Fiocruz, 1999); Gilberto Hochman, *A era do saneamento: as bases da política de Saúde Pública no Brasil*, 3rd ed. (São Paulo: Hucitec Editora, 2013). [↑](#footnote-ref-58)
20. Roth, *A Miscarriage of Justice*. [↑](#footnote-ref-59)
21. Irvine Loudon, *Death in Childbirth: An International Study of Maternal Care and Maternal Mortality, 1800-1950* (Oxford: Clarendon Press, 1992); Robert Woods, *Death Before Birth: Fetal Health and Mortality in Historical Perspective* (New York: Oxford University Press, 2009). [↑](#footnote-ref-60)
22. Maria Renilda Nery Barreto, “Dar à luz no Rio de Janeiro da *belle époque*: o nascimento das maternidades (1870-1920),” in *Filantropos da nação: sociedade, saúde e assistência no Brasil e em Portugal*, ed. Gisele Sanglard et al. (Rio de Janeiro: Editora Fundação Getúlio Vargas, 2015), 185–202; Maria Renilda Nery Barreto and Samuel Silva Rodrigues de Oliveira, “Cidade, assistência e saúde: as maternidades entre o privado e o público no subúrbio do Rio de Janeiro (1889-1930),” *Delaware Review of Latin American Studies* 17, no. 2 (2016); Anayansi Correa Brenes, “História da parturição no Brasil, século XIX,” *Cadernos de Saúde Pública* 7, no. 2 (1991): 135–49; Ana Paula Vosne Martins, *Visões do feminino: A medicina da mulher nos séculos XIX e XX* (Rio de Janeiro: Editora Fiocruz, 2004); Maria Lúcia Mott, “Assistência ao parto: do domicílio ao hospital (1830-1960),” *Projeto História, São Paulo* 25 (December 2002): 197–219; Roth, *A Miscarriage of Justice*. [↑](#footnote-ref-61)
23. Martins, *Visões do feminino*; Fabíola Rohden, *Uma ciência da diferença: sexo e gênero na medicina da mulher*, 2nd ed. (Rio de Janeiro: Editora Fiocruz, 2009); Cassia Roth and Luiz Antônio Teixeira, “From Embryotomy to Cesarean: Changes in Obstetric Operatory Techniques in Nineteenth- and Twentieth-Century Urban Brazil,” *Bulletin of the History of Medicine* 95, no. 1 (2021): 24–52. [↑](#footnote-ref-62)
24. Susan K. Besse, *Restructuring Patriarchy: The Modernization of Gender Inequality in Brazil, 1914-1940* (Chapel Hill: University of North Carolina Press, 1996); Maria Martha de Luna Freire, *Mulheres, mães e médicos: discurso maternalista no Brasil* (Rio de Janeiro: Editora Fundação Getúlio Vargas, 2009); Ana Paula Vosne Martins, “’Vamos criar seu filho’: os médicos puericultores e a pedagogia materna no século XX,” *História, Ciências, Saúde - Manguinhos* 15, no. 1 (2008): 135–54; Otovo, *Progressive Mothers, Better Babies*. [↑](#footnote-ref-63)
25. Lilia Moritz Schwarcz, *O espetáculo das raças: cientistas, instituições e questão racial no Brasil, 1870-1930* (São Paulo: Companhia das Letras, 1993); Nancy Leys Stepan, *"The Hour of Eugenics": Race, Gender, and Nation in Latin America* (Ithaca, NY: Cornell University Press, 1991). [↑](#footnote-ref-64)
26. Cassia Roth, “The Degenerating Sex: Female Sterilisation, Medical Authority and Racial Purity in Catholic Brazil,” *Medical History* 64, no. 2 (2020): 173–94; Robert Wegner and Vanderlei Sebastião de Souza, “Eugenia ‘negativa,’ psiquiatria e catolicismo: embates em torno da esterilização eugênica no Brasil,” *História, Ciências, Saúde - Manguinhos* 20, no. 1 (2013): 263–88. [↑](#footnote-ref-65)
27. Barreto and Oliveira, “Cidade, assistência e saúde”; Roth, *A Miscarriage of Justice*. [↑](#footnote-ref-66)
28. Roth and Teixeira, “From Embryotomy to Cesarean.” [↑](#footnote-ref-67)
29. Dora L. Costa, “Unequal at Birth: A Long-Term Comparison of Income and Birth Weight,” *The Journal of Economic History* 58, no. 4 (1998): 987–1009, <https://doi.org/10.1017/S0022050700021690>; Dora L. Costa, “Race and Pregnancy Outcomes in the Twentieth Century: A Long-Term Comparison,” *The Journal of Economic History* 64, no. 4 (2004): 1056–86, <https://doi.org/10.1017/S0022050704043086>; Claudia Goldin and Robert A Margo, “The Poor at Birth: Birth Weights and Infant Mortality at Philadelphia’s Almshouse Hospital, 1848–1873,” *Explorations in Economic History* 26, no. 3 (1989): 360–79, <https://doi.org/10.1016/0014-4983(89)90026-0>; Steckel, “Birth Weights and Infant Mortality”; Richard H. Steckel, “Birth Weights and Stillbirth in Historical Perspective,” *European Journal of Clinical Nutrition* 52, no. S2 (1998): S16–20. [↑](#footnote-ref-68)
30. Jasienska, “Low Birth Weight”; Kelycia B Leimert and David M Olson, “Racial Disparities in Pregnancy Outcomes: Genetics, Epigenetics, and Allostatic Load,” *Current Opinion in Physiology* 13 (February 2020): 155–65, <https://doi.org/10.1016/j.cophys.2019.12.003>; Beatriz Nascimento Figueiredo Lebre Martins et al., “The Impact of Colonialism on Head and Neck Cancer in Brazil: A Historical Essay Focussing on Tobacco, Alcohol and Slavery,” *The Lancet Regional Health – Americas* 31 (March 2024), <https://doi.org/10.1016/j.lana.2024.100690>. [↑](#footnote-ref-72)
31. For complete information on the source, see Roth, *A Miscarriage of Justice*; Cassia Roth, “Violência obstétrica na Maternidade de Laranjeiras: fontes para pesquisas futuras,” in *Medicalização do parto: saberes e práticas*, ed. Luiz Antonio Teixeira et al. (São Paulo: Hucitec Editora, 2020), 211–36. My Github repository, in particular, the Supplemental\_Materials file, includes summary information on data processing, exploratory analysis, and model fitting. All materials, including the data set, are open access and reproducible, with instructions on the schematic of the workflow available online. See Cassia Roth, “Maternidade Laranjeiras” (https://github.com/cp-roth/Roth-ML-project.git: Roth-ML-project, 2024). [↑](#footnote-ref-76)
32. Roth, *A Miscarriage of Justice*; Roth, “’Violência obstétrica’.” [↑](#footnote-ref-78)
33. Roth, “Birthing Life and Death”; Roth, *A Miscarriage of Justice*. [↑](#footnote-ref-79)
34. Loudon, *Death in Childbirth*. [↑](#footnote-ref-80)
35. Roth, *A Miscarriage of Justice*. [↑](#footnote-ref-81)
36. Goldin and Margo, “The Poor at Birth.” [↑](#footnote-ref-82)
37. Roth, *A Miscarriage of Justice*; Roth, “Birthing Life and Death.” [↑](#footnote-ref-83)
38. Hannah Ritchie and Max Roser, “Gender Ratio,” *Our World in Data*, March 2024. [↑](#footnote-ref-84)
39. Gregory Hanlon, “Routine Infanticide in the West 1500–1800,” *History Compass* 14, no. 11 (2016): 535–48, <https://doi.org/10.1111/hic3.12361>. [↑](#footnote-ref-85)
40. Costa, “Race and Pregnancy Outcomes.” [↑](#footnote-ref-88)
41. Costa, “Unequal at Birth”; Costa, “Race and Pregnancy Outcomes”; Goldin and Margo, “The Poor at Birth.” [↑](#footnote-ref-89)
42. World Health Organization, *International Classification of Diseases, Eleventh Revision (ICD-11)* (Geneva: World Health Organization, 2022); Ila R. Falcão et al., “Factors Associated with Low Birth Weight at Term: A Population-Based Linkage Study of the 100 Million Brazilian Cohort,” *BMC Pregnancy and Childbirth* 20, no. 1 (2020): 536, <https://doi.org/10.1186/s12884-020-03226-x>; Nyarko et al., “Explaining Racial Disparities”; Enny S. Paixao et al., “Risk of Mortality for Small Newborns in Brazil, 2011-2018: A National Birth Cohort Study of 17.6 Million Records from Routine Register-Based Linked Data,” *The Lancet Regional Health – Americas* 3 (November 2021), <https://doi.org/10.1016/j.lana.2021.100045>; A. A. Silva et al., “Trends in Low Birth Weight: A Comparison of Two Birth Cohorts Separated by a 15-Year Interval in Ribeirão Preto, Brazil.” *Bulletin of the World Health Organization* 76, no. 1 (1998): 73–84; Wehby et al., “Disparities in Birth Weight”; Wehby and López-Camelo, “Maternal Education Gradients.” [↑](#footnote-ref-91)
43. Theresa Andrasfay and Noreen Goldman, “Intergenerational Change in Birthweight: Effects of Foreign-born Status and Race/Ethnicity,” *Epidemiology* 31, no. 5 (2020): 649, <https://doi.org/10.1097/EDE.0000000000001217>; Costa, “Unequal at Birth”; Costa, “Race and Pregnancy Outcomes”; Richard J. David and James W. Collins, “Differing Birth Weight Among Infants of U.S.-Born Blacks, African-Born Blacks, and U.S.-Born Whites,” *New England Journal of Medicine* 337, no. 17 (1997): 1209–14, <https://doi.org/10.1056/NEJM199710233371706>; Maria do Carmo Leal, Silvana Granado Nogueira da Gama, and Cynthia Braga da Cunha, “Desigualdades sociodemográficas e suas conseqüências sobre o peso do recém-nascido,” *Revista de Saúde Pública* 40 (June 2006): 466–73, <https://doi.org/10.1590/S0034-89102006000300015>; Mariangela F Silveira et al., “Low Birthweight and Preterm Birth: Trends and Inequalities in Four Population-Based Birth Cohorts in Pelotas, Brazil, 1982–2015,” *International Journal of Epidemiology* 48, no. Supplement\_1 (2019): i46–53, <https://doi.org/10.1093/ije/dyy106>. [↑](#footnote-ref-94)
44. Clare L. Cutland et al., “Low Birth Weight: Case Definition & Guidelines for Data Collection, Analysis, and Presentation of Maternal Immunization Safety Data,” *Vaccine* 35, no. 48Part A (2017): 6492–6500, <https://doi.org/10.1016/j.vaccine.2017.01.049>. [↑](#footnote-ref-99)
45. Paulina L. Alberto, *Terms of Inclusion: Black Intellectuals in Twentieth-Century Brazil* (Chapel Hill: University of North Carolina Press, 2011); Travassos and Williams, “The Concept and Measurement of Race.” [↑](#footnote-ref-101)
46. Edward E. Telles, *Race in Another America: The Significance of Skin Color in Brazil* (Princeton, NJ: Princeton University Press, 2006). [↑](#footnote-ref-102)
47. Nyarko et al., “Explaining Racial Disparities”; Wehby et al., “Disparities in Birth Weight.” [↑](#footnote-ref-103)
48. Renato T. Souza et al., “Risk Stratification for Small for Gestational Age for the Brazilian Population: A Secondary Analysis of the Birth in Brazil Study,” *Scientific Reports* 10 (September 2020): 14725, <https://doi.org/10.1038/s41598-020-71252-y>. [↑](#footnote-ref-106)
49. Costa, “Unequal at Birth”; Steckel, “Birth Weights and Infant Mortality.” [↑](#footnote-ref-110)
50. Sandra Lauderdale Graham, *House and Street: The Domestic World of Servants and Masters in Nineteenth-Century Rio de Janeiro* (Austin: University of Texas Press, 1992). [↑](#footnote-ref-111)
51. Helena Benes Matos da Silva et al., “Syphilis in Pregnancy and Adverse Birth Outcomes: A Nationwide Longitudinal Study in Brazil,” *International Journal of Gynecology & Obstetrics* 166, no. 1 (2024): 80–89, <https://doi.org/10.1002/ijgo.15561>. [↑](#footnote-ref-112)
52. Sérgio Carrara, *Tributo a vênus: a luta contra a sífilis no Brasil, da passagem do século aos anos 40* (Rio de Janeiro: Editora Fiocruz, 1996). [↑](#footnote-ref-114)
53. J. P. Fontenelle, *A saude publica no Rio de Janeiro: Districto Federal, 1937 e 1938* (Rio de Janeiro, n.d.), 275. [↑](#footnote-ref-115)
54. Leimert and Olson, “Racial Disparities in Pregnancy Outcomes.” [↑](#footnote-ref-116)
55. Meloni et al., “A Biosocial Return to Race?” [↑](#footnote-ref-117)
56. Franken, “Anthropometric History of Brazil”; Steckel, “Birth Weights”; Evan Roberts and Pamela Wood, “Birth Weight and Adult Health in Historical Perspective: Evidence from a New Zealand Cohort, 1907–1922,” *Social Science & Medicine* 107 (2014): 154–61, <https://doi.org/10.1016/j.socscimed.2014.02.015>. [↑](#footnote-ref-118)
57. Falcão et al., “Factors Associated with Low Birth Weight.” [↑](#footnote-ref-120)
58. Cutland et al., “Low Birth Weight.” [↑](#footnote-ref-121)
59. Costa, “Unequal at Birth”; Costa, “Race and Pregnancy Outcomes”; Goldin and Margo, “The Poor at Birth.” [↑](#footnote-ref-122)