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# Cohort profile: maternal and child health and parenting practices during the COVID-19 pandemic in Ceará, Brazil: birth cohort study (Iracema-COVID)

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## ABSTRACT

**Purpose** Maternal and child health and parenting practices during the COVID-19 pandemic in Ceará (Iracema-COVID) is a longitudinal, prospective population-based birth cohort designed to understand the effects of the pandemic and social withdrawal in maternal mental health, child development and parenting practices of mothers and families.

**Participants** A sample of mothers who gave birth in July and August 2020 (n=351) was enrolled in the study in January 2021. Interviews were conducted by telephone. Data were collected through standardised questionnaires that, in addition to sociodemographic and economic data, collected information on breast feeding, mental health status and COVID-19.

**Findings to date** Results from the first wave show that the majority of participants have 9–11 years of schooling (54.4%; 95% CI 61.0 to 70.9) and are of mixed race (71.5%; 95% CI 66.5 to 76.0). At the time of the survey, 27.9% of the participants were out of the labor force (95% CI 23.5 to 32.9) and 78.6% reported a decrease in family income after restrictions imposed due to the pandemic (95% CI 74.0 to 82.6). The prevalence of maternal common mental disorder symptoms was 32.5% (95% CI 27.8 to 37.6).

**Future plans** Follow-up visits are planned to occur every 6 months for the next five years (2021–2025). Additional topics will be included in future waves (eg, food insecurity and parenting practices). Communication strategies for bonding, such as picture cards, pictures of mothers with their children and phone calls to the participants, will be used to minimise attrition. Results of this prospective cohort will generate novel knowledge on the impact of the COVID-19 pandemic on maternal and child health and parenting practices in a population of women and children living in fifth largest city of Brazil.

## STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Pioneering study following mothers who were pregnant and delivered a baby during the COVID-19 pandemic.
⇒ First study in Brazil to evaluate the pandemic effects on mother–child dyads.
⇒ Low representativeness of women from higher socioeconomic status.

## INTRODUCTION

COVID-19, caused by the SARS-CoV-2 virus, was declared a pandemic on 11 March 2020.[1] It has affected healthcare in several ways, including access to and utilisation of maternal and child health services. Children and mothers are not getting the care they need, which may have long-term and sometimes fatal consequences.[2] Among pregnant and postpartum women, limited social support, physical isolation and fear of COVID-19 exposure or infection for themselves or their newborn babies affect maternal mental health.[3] The Iracema-COVID study is a population-based birth cohort followed in Fortaleza, the capital city of Ceará state, located in the northeast region of Brazil. Currently, Fortaleza has an estimated population of 2 703 391 inhabitants, and its Human Development Index in 2010 was 0.754.[4] In 2020, the Municipal Health Secretariat registered 31 970 births.[5]

In Brazil, few cohort studies are designed to investigate health outcomes in mother–child dyads. The pioneering initiative in Brazil was the Pelotas Birth Cohort (in the Southern state of Rio Grande do Sul), which started in 1982 and continues to follow children born in the city's hospitals at regular intervals of 11 years. It was launched to provide detailed information on temporal trends in maternal and child health, nutrition, health behaviour

and child development, among others.[6] In the cities of Ribeirão Preto (1978/1979, 1994 and 2010), state of São Paulo, and São Luis (1997/98, 2010), state of Maranhão, five Brazilian birth cohorts are currently active. The first studies of both cities started as investigations of perinatal health and later transformed into cohort studies.[7] In 2015, the Maternal and Child Health and Nutrition in Acre, Brazil (MINA-Brazil) study was launched, which is the first population-based birth cohort followed in the Brazilian Amazon.[8]

The Iracema-COVID cohort was designed to provide novel insights into the consequences of COVID-19, and its associated physical distancing measures, to pregnant women and their newborns in a northeast Brazilian capital city. The study targets women who were pregnant during a period of lockdown in the city and had their children in July–August 2020. Specifically, the goal is to evaluate the influence of the COVID-19 pandemic and physical distancing on maternal mental health, parenting and child development in Fortaleza. Early childhood (from birth to 5 years of age) is a critical period when experiences, discoveries and affection are carried through life, providing opportunities for the child's cognitive and physical development,[9] and facilitating the growth of children as happy, independent and resilient adults.

## COHORT DESCRIPTION

### Recruitment

Women who had delivered an infant in July or August 2020 were identified through the Live Birth Information System (*Sistema de Informações sobre Nascidos Vivos*). Mothers who lived in Fortaleza, gave birth at public hospitals (75% of all births), were older than 18 years of age and had complete address information were eligible for the study (n=3567). Women who gave birth in private hospitals were deemed ineligible due to not having their contact information available in public records. The sample was designed to be representative of Fortaleza at the administrative district level (SR (*Secretaria Regional*)) and to detect a prevalence of 45.7% of maternal common mental disorders (CMDs),[10] with a margin of error of 5% and 95% confidence interval (n=352). Of the 3567 mothers who gave birth in July and August 2020, 352 were sampled for the study (figure 1). Anticipating refusals and attrition over time, we also randomly selected 371 women to be

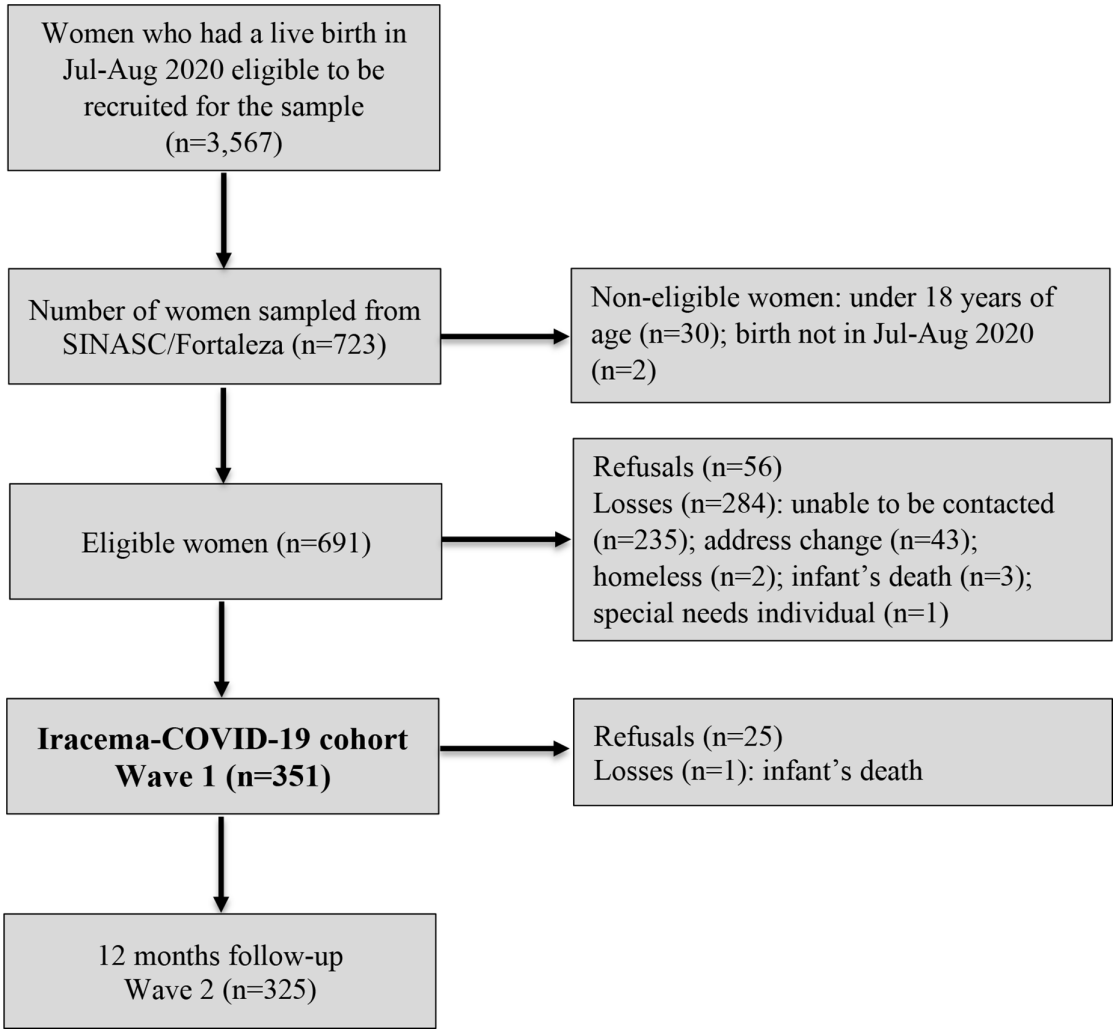



**Figure 1** Flow chart of the Iracema-COVID cohort participation.

included as needed. All sample calculations were done using the GSAMPLE module in Stata (StataCorp. 2019, Stata Statistical Software: Release V.16, StataCorp LP).

### Data collection

Data collection for the first wave (6 months after birth) started on 8 January 2021, interviewing mothers who had children in July 2020, and those who had children in August 2020 started to be contacted on 6 February 2021. Interviews followed a structured questionnaire and were conducted by telephone. Yet, due to a drastic increase in the number of COVID-19 cases in Fortaleza early in 2021, it was necessary to pause the interviews between 3 March and 19 April. Interviews restarted on 20 April, and data collection of the first wave was completed on 18 July 2021.

A total of 12 interviewers, with experience in household data collection in Ceará, were trained to conduct the phone interviews. Each interviewer received a list of interviewees that included: name of the mother, age, date of birth of the child, telephone number and address of the participant. Our goal was to achieve a sample size of 352. Interviewers made up five attempts to contact participants.

If phone numbers had changed and mothers could not be reached at their informed home address, the interviewer contacted the reference health unit (*Unidade Básica de Saúde*) and the community health agent (*Agente Comunitário de Saúde*) to investigate whether the mother or child had attended the unit and to receive logistic support from the agent to locate the mother's address. Not all changes in telephone numbers and addresses could be resolved. Our final sample included 351 women.

The second wave (12-month follow-up) was conducted by the same interviewers between July and October 2021. Differently from the first wave, interviews were done in person at the participant's house. All data were collected using the REDCap platform.[11] Response rate during the second wave was 92.6% (n=325), with 0.3% losses and 7.1% refusals. There was no statistically significant difference in response rate among SRs (SR 1: 95.3%, SR 2: 95.5%, SR 3: 89.1%, SR 4: 90.0%, SR 5: 97.8%, SR 6: 87.2%, p=0.085).

### Questionnaires and measures

On the first wave, the structured questionnaire had 95 questions organised in 10 thematic blocks (table 1): (A) home environment and maternal sociodemographic characteristics: SR, neighbourhood, number of people living in the house, number of children and adolescents living in the house, age (years), self-reported skin colour, marital status, living with a partner, religion and other children's age; (B) maternal CMDs; (C) maternal health: self-reported diagnosis of diabetes and hypertension, COVID-19 testing and results, smoke and alcohol consumption, and other health conditions; (D) maternal working condition: worked with a formal arrangement, continued working after the pandemic began, own income and/or family income affected by the pandemic; (E) gestation and birth characteristics: presence of a companion (infant's father or a family member) during birth, prenatal medical appointments and type of delivery; (F) infant's vaccination status at 6 months; (G) maternal and infant's postnatal medical appointments; (G) infant feeding patterns; (I) family support; and (J) socioeconomic status.

The standardised Self-Report Questionnaire (SRQ-20) was used to gather information on the prevalence of CMD.[12] It screens for CMD disorders but does not establish a diagnosis. It was included to assess whether physical isolation imposed by COVID-19 affected the mental health of pregnant women. SRQ-20 has been validated in

**Table 1** Number of participants and collected data, including maternal and infant health indicators, of women who had a live birth in July or August 2020 – Iracema-COVID cohort, Fortaleza, Brazil, 2021

| Variable/instrument | First wave recruitment (children were 6 months) | Second wave 12-month follow-up |
|---|---|---|
| Sociodemographic profile | ✓ | ✓ |
| Self-Report Questionnaire (SRQ-20) | ✓ | ✓ |
| Women's healthcare conditions | ✓ | ✓ |
| Questionnaire about women's working conditions and the impact of the pandemic on individual and Family income | ✓ | |
| Prenatal care and delivery conditions | ✓ | |
| Infant's vaccination status questionnaire | ✓ | ✓ |
| Puerperal care conditions | ✓ | |
| Breastfeeding practices | ✓ | ✓ |
| Family support characteristics | ✓ | |
| Socioeconomic status – Brazil's Economic Classification Criteria (*Critério de Classificação Econômica Brasil*) | ✓ | |
| Parental practices (PAFAS) | | ✓ |
| Child development (CREDI) | | ✓ |
| Child mental health | | ✓ |
| Food insecurity (EBIA) | | ✓ |

Source: created by the authors.
CREDI, Caregiver Reported Early Development Instruments; EBIA, Escala Brasileira de Insegurança Alimentar; PAFAS, Parenting and Family Adjustment Scales; SR, Fortaleza's Administrative Districts (Secretarias Regionais).

the Brazilian context and consists of 20 items with yes/no answers referring to the last 30 days. Each affirmative answer is scored with a value of 1, with a final score ranging from 0 (no probability of CMD) to 20 (extreme probability).[13]

The Brazilian Economic Classification Criteria (CCEB) scale was considered to compute a proxy of socioeconomic status. The CCEB scale is commonly used in surveys in Brazil.[14] It is an instrument that computes a summary index of socioeconomic status from information on household characteristics (number of bathrooms and paid housekeeper), ownership of home appliances (computer, dishwasher, laundry and dryer machine, refrigerator, freezer, DVD player and microwave) and vehicles (motorcycle and car), and education of the head of the household. The index is summarised into six socioeconomic strata categorised as A (richest), B1, B2, C1, C2 and D/E (poorest), and an estimation of monthly household income is provided for each: A (monthly income of US$4053.68), B1 (US$1922.41), B2 (US$1019.55), C1 (US$569.20), C2 (US$337.66) and D/E (US$153.67)[14] (monthly income in US dollars calculated using the exchange rate of 11 December 2021, 1 US$=5.61 Reais).

The second wave included all questions from the first wave but also added standardised instruments to assess three specific topics: (A) child development, using the Caregiver Reported Early Development Instruments (CREDI)[15]; (B) parenting practices, using the Parenting and Family Adjustment Scales (PAFAS)[16]; and (C) food security, using the Brazilian Food Insecurity Scale (*Escala Brasileira de Insegurança Alimentar* (EBIA))[17] (table 1).

CREDI is an instrument that comprises a set of caregiver-reported items that measure motor, cognitive, language and socioemotional skills of children under 3 years of age. We used CREDI's long form, an instrument designed for large-scale research.[15] PAFAS consists of two scales validated to measure parenting practices and parent and family adjustment. It provides six independent scores that evaluate parenting inconsistency, coercive practices, positive encouragement, relationship, and parental and family adjustments.[16] EBIA is a 14-item scale validated to evaluate food insecurity perception. Each affirmative answer scores 1 point, and families are classified into food secure (0 points) or insecure – insecurity is further classified as mild (1–5 points), moderate (6–9 points) and severe (10–14 points).[17]

### Communication strategies

To facilitate enrolment and minimise loss to follow-up, we created an identity of the project that combined different strategies. First, we created a project logo (figure 2) and a folder with the goals of the project. Those were distributed electronically to all participants during the first wave. Second, cohort member cards were distributed to each woman enrolled in the study. Third, the interviewers contacted family members listed as secondary contact and neighbours of mothers who were not located during the second wave to find their current address and conduct the interview.

### Patient and public involvement

The participants were not involved in the study's design or conduction. Included mothers have been informed of the project's goals and results via WhatsApp messages.

## FINDINGS TO DATE

### Sample characteristics

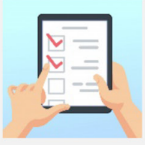
Table 2 shows the characteristics of women (and their infants) enrolled in the Iracema-COVID cohort study. At baseline (wave 1, 6 months after childbirth), maternal mean age was 28.4 years, ranging from a minimum of 18 and a maximum of 48 years and at the 12-month follow-up (wave 2) maternal mean age was 29.4 (19 minimum, 49 maximum). Most mothers interviewed in the first wave were married or living with a partner (66.1%; 95% CI 61.0 to 70.9), reported skin colour as brown or mixed-race (71.5%; 95% CI 66.5 to 76.0) and had 9–11 years of formal education (54.4%; 95% CI 49.2 to 59.6).

Regarding socioeconomic status, 43.3% (95% CI 8.2 to 48.6) of participants were classified in the poorest strata, D/E. Formal labour market participation was reported by 27.9% (95% CI 23.5 to 32.9) of women, and of those, 75.5% (95% CI 65.9 to 83.1) continued working after the COVID-19 pandemic physical distancing was imposed. Over 60% of mothers (62.1%; 95% CI 56.9, 67.1) and 75% of families (78.6%; 95% CI 74.0, 82.6) had their income reduced by the COVID-19 pandemic.

At delivery, 57.3% (95% CI 53.0 to 62.4) of women had C-sections and 53.6% (95% CI 48.3 to 58.7) were allowed a birth companion. The prevalence of puerperal health appointments was 90.6% (95% CI 87.1 to 93.2); 56.8% (95% CI 51.2 to 62.2) had five or more clinical visits and 1.3% (95% CI 0.5 to 3.3) had none. From 6 to 12 months of age, 72.0% (95% CI 66.9 to 76.6) of children had a medical or nurse appointment. Regarding vaccines, 92.9% (95% CI 89.7 to 95.1) of mothers declared that their child had an updated immunisation schedule; this number declined to 81.8% (95% CI 77.3 to 85.7) on wave 2.

With regards to COVID-19, by the time of the second wave, 70.7% (95% CI 65.5 to 75.4) of mothers reported having received at least one dose of the vaccine. In addition, 42.8% (95% CI 37.5 to 48.2) had been tested for COVID-19, and 36.0% (95% CI 28.4 to 44.3) of those had had a positive result. Among children, 15.4% (95% CI 11.8 to 19.7) had been tested, and 6.2% of those (95% CI 2.0 to 18.1) were positive for COVID-19.

Among infants included in the second wave, 44.3% (95% CI 39.0 to 49.8) had been sick within the previous 30 days; influenza or cold were the most common causes (45.8%; 95% CI 37.8 to 54.1). Over 14% (14.2%, 95% CI 10.8 to 18.4) had been hospitalised since birth, 15.2% (95% CI 7.2 to 29.1) of those due to respiratory failure.


| 1st wave<br>Jan - Jul 2021 | Execution Scheme |
|---|---|
|  <br>Questionnaires | Carried out through telephone interviews, due to the sanitary conditions for coping with the COVID-19 pandemic, with women who had a live birth in Jul-Aug 2020. |
| **2nd wave<br>Aug - Out 2021** | |
|  <br>Questionnaires | Women who had a live birth in Jul-Aug 2020 and participated on the 1st wave were visited at home by trained interviewers that applied standardized questionnaires. |

**Source:** Created by the authors

**Figure 2** Schematic representation of the Iracema-COVID cohort design and measures. Fortaleza, Brazil, 2021.

The Iracema-COVID cohort started in January 2021. To date, we have concluded an analysis (now under review) on breastfeeding (BF) practices that contrasted patterns observed in Fortaleza in 2017 to those revealed by the Iracema-COVID study. Results suggest a change in infant feeding patterns at 6 months, with a decrease in complementary BF (64.0% vs 48.4%, p=0.037), an increase in predominant BF (2.2% vs 13.4%, p<0.001) and similar prevalence of exclusive BF (8.1% vs 8.5%, p=0.790). In addition, we analysed maternal CMD in 2017 and during the COVID-19 pandemic, according to the SRQ-20, showing an increase in CMD prevalence among mothers (17.6% vs 32.5%, p<0.001).

## Future plans

Subsequent interviews are planned every 6 months until the year 2025 with a similar approach: in-person interviews with a structured questionnaire including the PAFAS, CREDI, SRQ and EBIA instruments. Given the dataset available, our cohort study aims at continuing the use of a life-cycle approach to recognise the impacts of the COVID-19 pandemic from the early stages of life. A major challenge for scientific knowledge in context of pandemic is the investigation of factors that influence child development and maternal mental health for promoting appropriate measures and mitigating the impacts of the pandemic on this population.

Ultimately, the Iracema-COVID prospective cohort study will collect critical data to generate new knowledge on the effects of the pandemic on maternal and child health, and child development, informing novel policies to mitigate those effects in Fortaleza, Ceará.

## Strengths and limitations

The Iracema-COVID cohort is a pioneering study that will carry out a longitudinal follow-up of mothers who were pregnant and delivered a baby during a period of strict physical isolation due to the COVID-19 pandemic. It is the first study in Brazil to evaluate the pandemic effects on mother–child dyads in the first year of the child's life. Another strength of the study is the fact that the team has the logistical support of community health agents (*Agentes Comunitários de Saúde*) and health unit agents to enable reaching out to participants enrolled in the study.

One limitation is the low representativeness of women from higher socioeconomic status, as the study did not

**Table 2** Characteristics of women and infants recruited for Iracema-COVID cohort collected during the first wave (baseline study–6 months after birth), Fortaleza, Brazil, 2021

| Variables | First wave – 6 months (n=351) | | Second wave – 12 months (n=325) | |
|---|---|---|---|---|
| | n | % (95% CI) | n | % (95% CI) |
| Fortaleza's administrative regions (SR*) | | | | |
| SR 1 | 43 | 12.3 (9.2 to 16.1) | – | – |
| SR 2 | 44 | 12.5 (9.5 to 16.4) | – | – |
| SR 3 | 55 | 15.7 (12.2 to 19.9) | – | – |
| SR 4 | 30 | 8.5 (6.0 to 12.0) | – | – |
| SR 5 | 93 | 26.5 (22.1 to 31.4) | – | – |
| SR 6 | 86 | 24.5 (20.3 to 29.3) | – | – |
| Age (years) | (Min: 18/max: 48/mean= 28.4) | | (Min: 19/max: 49/mean= 29.4) | |
| <20 | 24 | 6.8 (4.6 to 10.0) | 17 | 5.2 (3.3 to 8.3)2 |
| 20–24 | 81 | 23.1 (19.0 to 27.8) | 74 | 22.8 (18.5 to 27.7) |
| 25–29 | 103 | 29.3 (24.8 to 34.3) | 94 | 28.9 to 34.1 |
| 30–34 | 72 | 20.5 (16.6 to 25.1) | 67 | 20.6 to 25.4 |
| >34 | 71 | 20.2 (16.3 to 24.8) | 73 | 22.5 (18.2 to 27.3) |
| Marital status | | | | |
| Single | 113 | 32.2 (27.5 to 37.3) | 142 | 43.7 (38.4 to 49.2) |
| Married/stable union | 232 | 66.1 (61.0; 70.9) | 168 | 51.7 (46.2; 57.1) |
| Divorced/widower | 6 | 1.7 (0.8; 3.8) | 15 | 4.6 (2.8; 7.5) |
| Education (years) | | | | |
| 0–8 | 102 | 29.1 (24.5 to 34.0) | 75 | 23.1 (18.8 to 28.0) |
| 9–11 | 191 | 54.4 (49.2 to 59.6) | 211 | 64.9 (59.6 to 69.9) |
| >11 | 58 | 16.5 (13.0 to 20.8) | 39 | 12.0 (8.9 to 16.0) |
| Race/skin colour | | | | |
| White | 62 | 17.7 (14.0 to 22.0) | – | – |
| Brown | 251 | 71.5 (66.5; to 6.0) | – | – |
| Black | 38 | 10.8 (8.0 to 14.5) | – | – |
| Socioeconomic status* (*Critério Brasil* – CCEB† 2021) | | | | |
| A (wealthiest) | 3 | 0.9 (0.3 to 2.6) | – | – |
| B1 | 2 | 0.6 (0.1 to 2.3) | – | – |
| B2 | 20 | 5.7 (3.7 to 8.7) | – | – |
| C1 | 52 | 14.8 (11.5 to 18.9) | – | – |
| C2 | 122 | 34.8 (29.9 to 39.9) | – | – |
| D/E (poorest) | 152 | 43.3 (38.2 to 48.6) | – | – |
| Family income (minimum wage)‡ | | | | |
| Less than 1 | – | – | 95 | 29.6 (24.8 to 34.8) |

Continued

**Table 2** Continued

| Variables | First wave – 6 months (n=351) | | Second wave – 12 months (n=325) | |
|---|---|---|---|---|
| | n | % (95% CI) | n | % (95% CI) |
| 1–2 | – | – | 171 | 53.3 (47.8 to 58.7) |
| 3 or more | – | – | 55 | 17.1 (13.4 to 21.7) |
| Working arrangements (2020) | | | | |
| Formal (CLT§) | 139 | 39.6 (34.6 to 44.8) | – | – |
| Informal/autonomous | 114 | 32.5 (27.8 to 37.6) | – | – |
| Not working | 98 | 27.9 (23.5 to 32.9) | – | – |
| Continued working formally (CLT§) after March (physical distancing start) n=98 | | | | |
| No | 24 | 24.5 (16.9 to 34.1) | – | – |
| Yes | 74 | 75.5 (65.9 to 83.1) | – | – |
| Maternal income reduction after physical distancing begun | | | | |
| No | 133 | 37.9 (32.9 to 43.1) | – | – |
| Yes | 218 | 62.1 (56.9 to 67.1) | – | – |
| Family income reduction after physical distancing begun | | | | |
| No | 75 | 21.4 (17.4 to 26.0) | – | – |
| Yes | 276 | 78.6 (74.0 to 82.6) | – | – |
| Maternal medical appointment | | | | |
| No | 143¶ | 40.7 (35.7 to 46.0) | 212** | 65.2 (59.9 to 70.2) |
| Yes | 208¶ | 59.3 (54.0 to 64.3) | 113** | 34.8 (29.8 to 40.1) |
| Type of delivery | | | | |
| Vaginal | 150 | 42.7 (37.6 to 48.0) | – | – |
| C-section | 201 | 57.3 (53.0 to 62.4) | – | – |
| Presence of birth companionship in the delivery room | | | | |
| No | 163 | 46.4 (41.3 to 51.7) | – | – |
| Yes | 188 | 53.6 (48.3 to 58.7) | – | – |
| Infant's medical/nurse appointment | | | | |
| No | 33¶ | 9.4 (6.8 to 12.9) | 91** | 28.0 (23.4 to 33.1) |
| Yes | 318¶ | 90.6 (87.1 to 93.2) | 234** | 72.0 (66.9 to 76.6) |
| Number of medical/nurse appointment | | | | |
| 1–2 | 51 | 16.1 (12.4 to 20.6) | 101 | 43.2 (36.9 to 49.6) |
| 3–4 | 82 | 25.9 (21.3 to 31.0) | 53 | 22.6 (17.7 to 28.5) |
| 5 or more | 180 | 56.8 (51.2 to 62.2) | 80 | 34.2 (28.4 to 40.5) |
| Did not attend any appointments | 4 | 1.3 (0.5 to 3.3) | – | – |
| Health professional evaluation of the child's weight after birth | | | | |
| Normal weight | 285 | 81.2 (76.7 to 85.0) | – | – |
| Underweight | 17 | 4.8 (3.0 to 7.7) | – | – |

Continued

**Table 2** Continued

| Variables | First wave – 6 months (n=351) | | Second wave – 12 months (n=325) | |
|---|---|---|---|---|
| | n | % (95% CI) | n | % (95% CI) |
| Overweight | 18 | 5.1 (3.2 to 8.0) | – | – |
| N/A | 31 | 8.8 (6.3 to 12.3) | – | – |
| Updated immunisation schedule | | | | |
| No | 25 | 7.1 (4.9 to 10.3) | 58 | 17.9 (14.1 to 22.5) |
| Yes | 326 | 92.9 (89.7 to 95.1) | 266 | 82.1 (77.5 to 85.9) |
| Mother received COVID-19 vaccine | | | | |
| No | – | – | 95 | 29.3 (24.6 to 34.5) |
| Yes | – | – | 229 | 70.7 (65.5 to 75.4) |
| Mother has been tested for COVID-19 | | | | |
| No | 236 | 67.2 (62.1 to 72.0) | 186 | 57.2 (51.8 to 62.5) |
| Yes | 115 | 32.7 (28.0 to 37.9) | 139 | 42.8 (37.5 to 48.2) |
| Was positive for COVID-19 | | | | |
| No | 74 | 64.3 (55.1 to 72.6) | 89 | 64.0 (55.7 to 71.6) |
| Yes | 41 | 35.7 (27.4 to 44.9) | 50 | 36.0 (28.4 to 44.3) |
| Has the child been tested for COVID-19 | | | | |
| No | – | – | 275 | 84.6 (80.3 to 88.2) |
| Yes | – | – | 50 | 15.4 (11.8 to 19.7) |
| Was the child positive for COVID-19 | | | | |
| No | – | – | 45 | 93.8 (81.9 to 98.0) |
| Yes | – | – | 3 | 6.2 (2.0 to 18.1) |
| Breastfeeding status | | | | |
| Never breast fed | – | – | 19 | 5.8 (3.8 to 9.0) |
| Weaned | – | – | 114 | 35.1 (30.1 to 40.4) |
| Still breast feeding | – | – | 192 | 59.0 (53.6 to 64.3) |
| Child was sick during the last 30 days | | | | |
| No | – | – | 181 | 55.7 (50.2 to 61.0) |
| Yes | – | – | 144 | 44.3 (39.0 to 49.8) |
| Main causes of illness during the last 30 days | | | | |
| Influenza/cold | – | – | 66 | 45.8 (37.8 to 54.1) |
| Fever | – | – | 23 | 16.0 (10.8 to 23.0) |
| Throat pain/infection | – | – | 12 | 8.3 (4.8 to 14.2) |
| Other | – | – | 43 | 29.9 (22.9 to 37.9) |
| Has been hospitalised since birth | | | | |
| No | – | – | 279 | 85.8 (81.6 to 89.2) |
| Yes | – | – | 46 | 14.2 (10.8 to 18.4) |

Continued

**Table 2** Continued

| Variables | First wave – 6 months (n=351) | | Second wave – 12 months (n=325) | |
|---|---|---|---|---|
| | n | % (95% CI) | n | % (95% CI) |
| Main causes of hospitalisation | | | | |
| Respiratory failure | – | – | 7 | 15.2 (7.2 to 29.1) |
| Asthma/bronchitis | – | – | 5 | 10.9 (4.5 to 24.0) |
| Pneumonia | – | – | 5 | 10.9 (4.5 to 24.0) |
| Other | – | – | 29 | 63.0 (48.0 to 75.9) |

*SR – Fortaleza's Administrative District (*Secretaria Regionais*).
†Stratified according to the Brazilian Socioeconomic Classification Criteria.
‡Brazilian Minimum Wage 2021: $192.
§CLT – Brazilian Consolidation of Labor Laws.
¶After delivery.
**After the 6-month interview.

recruit women who delivered in private hospitals. While this may introduce selection bias, our results will inform policies for those most in need. There were 56 refusals in the first wave, and 278 eligible women were not located. The difficulty in locating eligible women is likely associated with high telephone and address change (some women had moved to a different city). However, since we drew a much larger list of eligible women than needed for the study, we were able to obtain the necessary sample size to guarantee representativeness at the SR level.

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**Collaborators** The Iracema-COVID cohort data are not openly available. For potential collaboration, interested researchers should contact the principal investigators Marcia C Castro (mcastro@hsph.harvard.edu) and Márcia M T Machado (marciamachadoufc@gmail.com) to propose a research plan that will be evaluated by the Iracema-COVID research committee.

**Contributors** Designed Iracema-COVID and planned the study design: MMTM and MCC. Data analysis and interpretation: MMTM, MCC, SF-A and DABSA. Drafted the manuscript: MMTM, DABSA, SF-A, FAO and MCC. Data curation: FAO, GdSdS, SF-A and DABSA. All authors contributed to the manuscript's review and have approved its final version.

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**Patient consent for publication** Not applicable.

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