ORIGINAL ARTICLE

Baseline Maternal and Newborn Variables in a Birth Cohort Study in Southern Brazil

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Academic Editor: Alidianne Fábia Cabral Cavalcanti

ABSTRACT

Objective: Describe baseline maternal and newborn variables in a birth cohort study. **Material and Methods:** A birth cohort study was conducted in Canoas, Brazil. Sociodemographic, behavioral, anthropometric, and clinical baseline variables from mothers and newborns were collected cross-sectionally at the University Hospital's maternity. Maternal data included age, level of education, family structure, smoking, number of prenatal appointments, type of delivery, gestational age, and any comorbidity. Child data included sex, birth weight, length, head circumference, and breastfeeding in the first hour of life. Data were described as absolute and relative frequency, central tendency, and dispersion measures. **Results:** The baseline sample comprised 1181 mother-child pairs. Average maternal education (SD) was 9.7 (2.3) years, with 28.3% of mothers not reaching secondary education while 12% were adolescents; number of prenatal appointments was at least 6 in 85.3%, while 58.8% of mothers had comorbidities. Cesarean delivery represented 43.2% of births, with 27.7% of pregnancies not reaching 37 weeks. The prevalence of low birth weight was 6.3%, and 77.1% of children breastfed in the first hour of life. **Conclusion:** Baseline data present indicators that should be the subject of public policies and health services programs, with emphasis on a reasonable proportion of mothers with low levels of education and smokers and a high proportion of maternal comorbidities and cesarean deliveries.

Keywords: Epidemiology; Postpartum Period; Infant, Newborn; Birth Cohort.

Introduction

In 2015, the United Nations proposed an agenda with 17 goals for improving the lives of individuals – the Sustainable Development Goals – to be achieved by 2030. The main specific goals are to reduce maternal mortality, eliminate preventable deaths of children under five years of age, and ensure universal coverage of health care services [1]. Moreover, the World Health Organization (WHO) recently updated global guidelines, addressing the best times and content of care for pregnant women and newborns and recommendations on what health professionals should perform interventions and provide care [2]. At the same time, the WHO adopted in 2021 a historic resolution recognizing that oral health should be firmly embedded within the noncommunicable disease (NCD) agenda due to the high burden of untreated oral diseases that affect almost half of the world's population [3].

Brazil has recently undergone a rapid demographic, economic, nutritional, and epidemiological transition, which has enormously impacted maternal and child health. In this context, there is a growing interest in the suggestion that exposures in early life have long-term consequences for health into adolescence and adulthood, particularly for NCDs [4]. Most evidence demonstrating that early life experiences strongly influence general and oral disease later in life comes from birth cohort studies [5]. Cohort studies provide an understanding of the natural history and causality of diseases from early in life and thus constitute an essential tool for identifying determinants of health and disease, serving as the basis for advances in the health of a population.

In 2019, a workshop was held in Bangkok involving coordinators of some of the longest-running oral health birth cohort studies in low-middle and high-income countries [6]. One special highlight from the meeting was the need for new birth cohort studies and training for the next generation of researchers, which is essential for increasing the knowledge of early life exposures and their consequences [5]. In March 2024, a discussion during the International Association for Dental Research (IADR) workshop held in New Orleans, United States (Oral Health Birth Cohort studies: lessons learned from old established cohorts to leverage the new generation of researchers), described the experience of well-established OHBCS and reinforced the importance of birth cohort studies, especially data collection with methodologically appropriate instruments. Recognizing the prevalence of exposure early in life can help draw attention to socioeconomic, behavioral, and biological vulnerabilities that deserve special attention from health services. This information is beneficial as exposures are likely to vary between regions.

Therefore, the present study aimed to describe baseline maternal and newborn variables in a Canoas, southern Brazil, birth cohort study.

Material and Methods

Study Design and Participants

The present study describes cross-sectional exposures collected based on a birth cohort study. Recruitment of the mothers and the collection of baseline variables were performed at the Canoas University Hospital in Canoas (HU), southern Brazil. Situated in the metropolitan area of Porto Alegre, this hospital operates as part of Brazil's public healthcare system (Sistema Único de Saúde - SUS). It is affiliated with the 'Baby-Friendly Hospital Initiative,' a global endeavor led by the World Health Organization and the United Nations Children's Fund (UNICEF), aimed at fostering infant health and well-being right from birth. Data collection was performed from June 2022 to March 2023. Women were recruited sequentially by the research

team until the sample size required for the cohort baseline was completed. The exclusion criteria were not residing in Canoas, Rio Grande do Sul, Brazil, and being isolated due to the SARS-CoV-2 virus.

The sample size was calculated based on the primary outcome of the cohort study – the occurrence of dental caries in early childhood – and the main independent variable – the number of sweetened foods and beverages consumed at 12 months of age (categorized in quintiles, with the lowest quintile corresponding to non-exposed infants). The parameters of the sample calculation were a 90% power, 95% confidence level, 4:1 ratio of exposed (other quintiles) to non-exposed, 40% outcome among non-exposed, and relative risk of 1.5, resulting in a sample of 431 children. Twenty percent was added to enable multivariable analysis, leading to a required sample of 518 children. Considering a possible dropout rate of 30% in the first and 20% in the second year of life, the required sample size was 925 children.

Data Collection

Data were collected from the patient records of both the newborns and mothers as well as through interviews with the mothers in the maternity ward of the hospital. The following variables were collected through interviews with the mothers: mother's age (in years, subsequently categorized); mother's schooling (in years, subsequently categorized); family structure (nuclear - mother and father raising the child together - or non-nuclear); first child (yes or no); the number of residents in the home; mother's smoking (never smoked, smoked and quit or smokes) and breastfeeding in the first hour of life (yes or no);. The child's records were used to collect the following baseline variables: sex (male or female); birth weight (in grams, subsequently categorized); length at birth (in centimeters, subsequently categorized); head circumference (in centimeters, subsequently categorized); number of prenatal appointments; gestational age (in weeks, subsequently categorized); mother's comorbidities (yes or no/if yes, specify); and type of delivery (normal or cesarean).

Training of Interviewers and Examiners

To ensure the quality of the data collected, the researchers who conducted the interviews were previously trained by the coordination of the research team in eight-hour sessions. The research team was composed of graduate students in dentistry, coordinated by an experienced Professor in Pediatric Dentistry.

Ethical Aspects

The Human Research Ethics Committees of Pontifical Catholic University of Rio Grande do Sul (Opinion N. 5.859.378) and Lutheran University of Brazil (Opinion N. 5.378.250) approved the study. Children's parents were clarified regarding the survey. Mothers gave written informed consent prior to research procedures.

Statistical Analysis

Statistical analysis was performed using Statistical Package for the Social Sciences, version 20.0 (IBM Statistics Inc, Chicago, USA). Qualitative variables were described as absolute and relative frequency, and quantitative variables were expressed as measures of central tendency (mean, median) and dispersion (standard deviation, 25th and 75th percentile).

■ Results

From June 2022 to March 2023, 1,386 mother-child pairs were assessed for eligibility, with 164 children excluded due to admission to the neonatal ICU and 16 mothers due to serious illness. One thousand two hundred six mothers were invited to start the cohort, with 25 refusing. Thus, the sample of the present study, which comprised the initial cohort, was 1,181 children.

Table 1 shows the sociodemographic, behavioral, and clinical characteristics of mothers. Maternal age ranged from 13 to 47 years, while 12.0% of mothers were teenagers. Maternal level of education ranged from 0 to 19 years, with a mean (SD) of 9.7 (2.3), with 28.3% not reaching secondary education. The family structure was nuclear for 88.5% of families. Among the behavioral variables, it was observed that 14.2% of mothers were smokers, while the number of prenatal consultations had an average (SD) of 8.8 (3.3), with 14.7% of mothers not reaching the target of at least six consultations. Gestational age ranged from 30 to 42 weeks, with 27.7% not reaching 37 weeks, while 43.2% of births occurred from cesarean deliveries. Comorbidities were recorded in 58.8% (n = 694) of the mothers, with a predominance of systemic arterial hypertension (20.7%), urinary tract infection (14.4%), gestational diabetes mellitus (10.6%), syphilis (9.1%) and pre-eclampsia (6.6%).

Table 1. Sample distribution according to the mothers' sociodemographic, behavioral, and clinical characteristics.

Variables	N	%	Mean	SD	Minimum	Maximum	Median	P25-P75
Overall	1181	100.0						
Sociodemographic								
Maternal Age			26.8	6.4	13	47	26	22−31
< 20 years	141	12.0						
20-35 years	898	76.0						
> 35 years	142	12.0						
Maternal Level of Education			9.7	2.3	0	19	11	8−11
≤ 8 years	334	28.3						
9-11 years	694	58.7						
≥ 12 years	153	13.0						
First Child								
Yes	440	37.3						
No	741	62.7						
Family Structure								
Nuclear	1042	88.5						
Non-nuclear	136	11.5						
Number of Residents in the Home			4.3	1.4	2	14	4	3−5
≤3	342	29.0						
4	396	33.5						
≥5	443	37.5						
Behavioral								
Maternal Smoking								
Smoker	167	14.2						
Ex-smoker	234	19.8						
Non-smoker	779	66.0						
Number of Prenatal Appointments			8.8	3.3	1	21	9	7−11
< 6	174	14.7						
≥ 6	1007	85.3						
Clinical								
Type of Delivery								
Normal	667	56.8						
Cesarean	508	43.2						
Gestational Age (weeks)			38.4	1.5	30	42	39	37−39
< 37 weeks	327	27.7						
≥ 37 weeks	854	72.3						
Any Comorbidity	694	58.8						
Hypertension	245	20.7						

Urinary tract infection	170	14.4
Gestational diabetes	125	10.6
Syphilis	108	9.1
Pre-eclampsia	78	6.6
Obesity	54	4.6
Diabetes mellitus	43	3.6
Hypothyroidism	40	3.4
Others	208	17.5

The baseline characteristics of newborns are described in Table 2. The sample of children was equally distributed between genders. Birth weight ranged from 1805 g to 5055 g, with 6.3% of children being underweight. Length at birth ranged from 35 cm to 50 cm, with 30.7% of children presenting length less than 47 cm. Head circumference at birth ranged from 23 cm to 42.5 cm, with 97.6% presenting at least 32 cm. Additionally, 77.1% of the children breastfed in the first hour of life.

Table 2. Distribution of sample according to sociodemographic, behavioral, and clinical characteristics of newborns.

Variables	N	%	Mean	SD	Minimum	Maximum	Median	P25-P75
Overall	1181	100.0						
Sociodemographic								
Sex								
Male	596	50.5						
Female	585	49.5						
Anthropometric								
Birth Weight			3.224	481.0	1.805	5.055	3.210	2.917−3.522
< 2500 g	74	6.3						
2500 g — 4000 g	1041	88.1						
> 4000 g	66	5.6						
Birth Length			48.4	2.5	35.0	50.0	48.5	47−50
< 47 cm	362	30.7						
≥ 47 cm	819	69.3						
Head Circumference at Birth			33.8	1.6	23.0	42.5	34.0	(33−35)
< 32 cm	28	2.4						
≥ 32 cm	1153	97.6						
Behavioral								
Breastfeeding 1st Hour of Life								
Yes	909	77.1						
No	270	22.9						

■ Discussion

The present study investigated the sociodemographic, anthropometric, behavioral, and clinical variables of mothers who had recently given birth and their newborns at a Brazilian universal health care system hospital in Canoas, Rio Grande do Sul, Brazil. Some indicators of maternal and infant health were positive, such as a high proportion of adequate number of prenatal appointments and the high prevalence of breastfeeding in the first hour of life. In contrast, some indicators were negative and deserve further analysis.

Mother's level of education exerts an influence on relevant outcomes of general and oral health, such as increased risk for under-5 mortality [7] and early childhood caries [8]. Despite an increase in maternal education in recent decades, the findings of the present study demonstrate that there is still a significant part of the population very vulnerable, as almost 30% of new mothers have not yet completed elementary school, and only 13% have overcome the barrier of high school. Improving these indicators is essential to enhance the factors

mediating the association between maternal education and attitudes and behaviors that protect child health, such as health beliefs, locus of control, sense of coherence, and self-efficacy [9,10].

Adolescent pregnancy is a global phenomenon with serious health, social, and economic consequences, such as higher risks of eclampsia, puerperal endometritis, systemic infections, and interruption of the woman's education. At the same time, babies from adolescent mothers face higher risks of low birth weight, preterm birth, and severe neonatal conditions [11]. Although the proportion of adolescent mothers in the present study is slightly lower than national rates, it is still worrying, as it exceeds 10%. Preventing pregnancy among adolescents is fundamental to achieving positive health outcomes across the life course and imperative for achieving the SDGs related to maternal and newborn health [11].

Along with education, income, and the social environment, family structuring plays a fundamental role in the healthy development of children [12]. For example, birth cohort studies have suggested that the nuclear family is a protective factor against the early introduction of sugar and the incidence of traumatic dental injuries in the first years of life [13,14]. In the present study, approximately 90% of the sample had a nuclear family (mother and father living together). The literature reports that such a structure involves more outstanding emotional bonds and care for newborns, which assists in resolving children's emotional, behavioral, and cognitive problems [12]. The average number of residents in the home was similar to the national average of three to four people [15].

Smoking, which is the main avoidable cause of diseases and deaths in the world, also poses significant risks during pregnancy, such as miscarriage, premature birth, and neonatal complications [16,17]. Despite knowledge of the dangers, smoking rates remain high among pregnant women [18]. The rate of smoking mothers in the present study is twice as high as the rate of Brazilian women adults who smoke [19] and lower than the smoking prevalence reported worldwide. The proportion of mothers who smoke shows an exposure that must continually be the subject of interventions at a collective and individual level. In infant oral health, maternal smoking is an essential marker of the early introduction of sugar and tooth decay [14,20].

Prenatal care consists of a set of actions to promote the health of mothers through information on risk behavior as well as the promotion of breastfeeding and contraception. However, inequalities in the coverage of such care, with low coverage found more often among poorer, more vulnerable women, can lessen the impact on the population as a whole. The number of prenatal appointments reported in the present study is positive, with the majority of women having six or more prenatal appointments per the requirements of the Brazilian Ministry of Health [21].

Maternal reproductive history is another recognized predictor of health and gestational outcomes that should be investigated during prenatal care. Spacing between pregnancies, multiple births, reports of previous miscarriages, low birth weight, and premature birth are some of the well-documented indicators of adverse perinatal events [22]. Among the negative changes in recent decades, a sustained increase in rates of cesarean delivery stands out, which has become more common than natural childbirth in Brazil [23,24]. Although the WHO establishes a rate between 10% and 15%, rates in Brazil reach as high as 60% [25]. The assessment of risks and benefits indicates an increased risk of a set of negative outcomes in cesarean birth [26]. In the present study, almost half of the births were cesarean deliveries, which surpasses the ideal rate established by the WHO and reflects an increasing trend in Brazil. Due to the possibility of scheduling the birth (convenient for obstetricians and mothers), the absence of pain during birth, and the perception of safety, cesarean births are usually more common among wealthy mothers or clients in the private sector [23].

Comorbidities, such as hypertension, urinary tract infection, diabetes, syphilis, and pre-eclampsia, were found in the present study. These conditions increase the probability of unfavorable outcomes for the mother and newborn, such as neonatal death and clinical disease in infants [27]. Of special interest for oral health is congenital syphilis, in which clinical manifestations in children may include dental defects in permanent incisors and first molars [28].

Childbirth is a significant moment in the transition to motherhood, and gestational age is an indicator by which to assess the health of newborns [29,30]. Preterm birth and low birth weight are the main risk factors for neonatal death, especially among mothers with a low family income, low schooling, black or brown skin color, a young age, primiparity, smoking during pregnancy, and the absence of prenatal care [31]. Globally, 16% of children are born with low birth weight (< 2500 g), and 11.1% are born prematurely (less than 37 complete weeks of gestation) [32]. In Brazil, data from the National Health Vigilance System (SINASC) show an 11.4% rate of prematurity, although an increase in premature births has been reported in several Brazilian studies [33]. In the present investigation, the frequency of pregnancies that did not complete 37 weeks was considerably higher (28%) than the national and global averages of prematurity. In contrast, the prevalence of low birth weight in this study (6.3%) was considerably lower than the world average (16%) [32].

The first 28 days of life – when the infant is still considered a newborn – are the most sensitive, and recognizing anthropometric and behavioral variables is essential to establishing and incorporating health promotion policies. Anthropometric measures are part of health vigilance, and numerous procedures and therapies are based on such information to develop the proper prescription. The WHO published growth standards that can be used as parameters for newborns [34,35]. In the present study, the measurements are in line with the growth standards described in the WHO protocols.

Brazil is internationally recognized as an exemplary country in promoting, protecting, and supporting breastfeeding [36]. The World Health Organization recommends that breastfeeding should begin within the first hour of life, especially because this practice is associated with a reduction in neonatal mortality [37]. A cohort study recently demonstrated that breastfeeding in the first hours of life protects against using pacifiers, potentially contributing to preventing several infant oral health outcomes [38,39]. In the present study, approximately 80% of the newborns breastfed during this period. Despite the recognized benefits of breastfeeding, rates of the early onset and prevalence of exclusive breastfeeding among infants less than five months of age remain below 50% in most middle- and low-income countries [40].

The present study has some limitations that deserve to be highlighted. First, the population investigated is not representative of Brazil as a whole. However, the sample was obtained from a hospital in the Unified Health System in a metropolitan region in southern Brazil, which is characterized by a lower socioeconomic level and represents the population that should be a priority in the planning and execution of public health promotion policies. Second, part of the information was obtained from hospital records and, therefore, from personnel not specifically trained for the present investigation, which may have added information bias.

◼ Conclusion

The baseline data collected in the present study are positive in some maternal and newborn indicators. However, a reasonable proportion of mothers with low education and smokers and a high proportion of maternal comorbidities and cesarean births represent a reality that health services must face and indicate the need for

policies and programs to achieve positive maternal and newborn health outcomes, with impact on the long-term course of life.

■ Authors' Contributions

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All authors declare that they contributed to a critical review of intellectual content and approval of the final version to be published.

■ Financial Support

■ Conflict of Interest

The authors declare no conflicts of interest.

■ Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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