# Mothers and their pregnancies: a comparison of three population-based cohorts in Southern Brazil

## Mães e suas gestações: uma comparação de três coortes de base populacional no Sul do Brasil

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## Abstract

*Mothers from the 1982, 1993 and 2004 Pelotas birth cohorts were compared across biological, socioeconomic, demographic and reproductive characteristics. Women in the 2004 cohort had higher levels of education, gained more weight during pregnancy, and were heavier at the beginning and end of their pregnancy than mothers who gave birth in 1993 and 1982. There was an important increase in obesity rates (body mass index > 30kg/m2) over the 22 years of the study. Mean parity decreased from 1.3 in 1982 to 1.1 in 2004, with a growing proportion of primiparas and a decline in the proportion of women with ≥ 4 children. The mean birth interval increased from 33.5 months in 1982 to 65.7 in 2004. Smoking during pregnancy decreased from 35.6% in 1982 to 25.1% in 2004. As with other characteristics, the change in smoking status differed according to income, with higher reductions among the wealthiest (from 24.9% to 8.7%) than among the poorest mothers (from 43.7% to 33.6%). In general terms, between 1993 and 2004 there was a decrease in the prevalence of maternal risk factors for unfavorable perinatal outcomes.*

*Parity; Smoking; Reproductive Medicine; Cohort Studies*

## Introduction

In 1982, all 6,011 births that took place in the city of Pelotas, Southern Brazil, were monitored, and mothers were interviewed while still in the maternity ward. At this stage, a series of data were collected, including information on demographic, biological, socioeconomic, and reproductive variables. This perinatal study laid the groundwork for a subsequent cohort study, the 1982 Pelotas birth cohort (Pelotas, Rio Grande do Sul State, Brazil) [1].

Two further perinatal studies were undertaken 11 and 22 years later, with the goal of evaluating potential changes in maternal-child health indicators relating to social and health-care related transformations. Thus two new cohorts began, namely the 1993 and 2004 Pelotas birth cohorts. For these studies, we interviewed all mothers living in the urban area of Pelotas, who gave birth to 5,304 and 4,287 children in 1993 and 2004, respectively [2].

The importance of studying maternal characteristics during pregnancy has to do with the fact that intrauterine life conditions play a fundamental role in morbidity and mortality during childhood [3]. More recently, based on Barker's hypothesis, this important finding has been extended to later periods of life with the recognition of associations between characteristics at birth and prevalence of chronic diseases during childhood [4]. Some of the maternal characteris-

tics that influence the results of pregnancy were investigated in the three cohorts. The present article is a follow-up to that published by Tomasi et al. [5], in 1996, and compares the socioeconomic, demographic, anthropometric, and behavioral characteristics of Pelotas mothers in 1982, 1993, and 2004.

## Methods

Detailed descriptions of the methods employed in these studies are available elsewhere [2]. In the three cohorts, the mother's skin color was classified by interviewers based on observation. Maternal smoking was defined as the consumption of at least one cigarette per day, every day in any of the trimesters of pregnancy. In the 1982 and 1993 cohorts, maternal anthropometric information was taken from two sources: weight at the beginning of pregnancy was transcribed from the mother's card, when available, or self-reported by the mother; and final weight and height were obtained in the maternity ward, prior to delivery. In 2004, both weights (initial and final) were transcribed from the mother's card, when available, or were self-reported by the mother. Final weight was considered as the last entry on the card. Maternal height was measured at home, during the three-month follow-up. The same model of anthropometer was used in all three cohorts. Maternal weight at the beginning of pregnancy was used to calculate the pre-gestational body mass index (BMI). Birth intervals were calculated as the time difference between the births of the cohort child and the preceding one, primiparas excluded. Reproductive history variables that were investigated included parity (number of previous newborns including live and still-births), one or more abortions, still-births, low birth weight babies (birth weight below 2,500g) and c-sections. The gestational risk was calculated based on the score proposed by Chamberlain et al. [6], and adapted for use in this study [7]. This score classifies risk according to demographic characteristics (age 20-29 years, 0 points; 30-34 years, 1 point; and under 20 or over 35 years, 2 points); parity (1-2 children, 0 points; 0 or 3 children, 1 point; 4 or more children, 2 points); history of abortion, neonatal death, and stillbirth (4 points each); low birth weight (2 points); family income (more than 6 times the monthly minimum wage, 0 points; 3.1 to 6 times, 1 point; and under 3 times, 2 points); previous morbidity (history of diabetes, 4 points); nutritional status (mother's height < 150cm, 1 point); lifestyle (smoking, 1 point); and marital status (without partner, 2 points). Mothers with scores between 0 and 2 were considered

to be low gestational risk; those between 3 and 7 points, intermediate risk; and those who scored 8 points or more, high risk.

Quantitative variables were analyzed using Student's t test for differences in means. To test for differences between proportions, in the case of qualitative/categorical variables, we used the chi-squared test. All analyses were stratified by family income categories, defined as a multiple of the minimum wage earned during the month prior to the child's birth (≤ 1; 1.1-3; 3.1-6; 6.1-10, and >10 times the minimum wage). All analyses were performed using the Stata Statistical Package (Stata Corp., College Station, USA).

The study protocol was approved by the Medical Research Ethics Committee of the Federal University of Pelotas. In 1982 and 1993, verbal consent was obtained from mothers for participation in the study. In 2004 written consent was also requested.

## Results

In 2004, the births of 4,287 children in Pelotas represented a reduction of 19% and 29% compared with the 5,304 and 6,011 births that took place in 1993 and 1982 respectively.

There was no difference in mean maternal age between the years studied (Table 1). The trend towards older mean age in higher income classes, already observed in the earlier cohorts, was also seen in 2004. However, in 2004, mothers from the highest income group were on average approximately two years older than higher income mothers from the two previous decades (30.6 vs. 28.9 years). In 2004, 25% of higher income mothers were older than 34 years, compared to 17.1% and 14.5% in 1993, and 1982, respectively.

Across these two decades, there was an increase in the proportion of mothers in the extreme age groups (under 20 and over 34 years). In 2004, the percentage of adolescent mothers was higher than in the other two cohorts, although absolute numbers declined from 908 mothers in 1982 to 769 mothers in 2004.

In the three populations, the wide majority of mothers were white. However, the proportion of black/mixed mothers increased with time, from 17.9% in 1982 to 22.8% in 1993 and to 27.2% in 2004 (Table 1). As in the two previous cohorts, there was a strong association in 2004 between skin color and family income, with black/mixed mothers being concentrated in the lower income groups.

There was an important reduction in the prevalence of smoking during pregnancy, from 35.6% in 1982 to 33.4% in 1993 and 25.1% in

Table 1

Age, skin color, and smoking habits of mothers according to family income. Pelotas, Southern Brazil, 1982 (n = 6,011), 1993 (n = 5,304), and 2004 (n = 4,287).

| Variable | Family income (as a multiple of the minimum wage) | | | | | All | p |
|---|---|---|---|---|---|---|---|
| | ≤ 1 | 1.1-3 | 3.1-6 | 6.1-10 | > 10 | | |
| Age (years completed) | | | | | | | |
| Mean | | | | | | | |
| 1982 | 24.3 | 25.4 | 27.0 | 28.2 | 28.9 | 25.8 | < 0.001 |
| 1993 | 24.6 | 25.6 | 26.4 | 28.0 | 28.9 | 26.0 | < 0.001 |
| 2004 | 24.0 | 25.7 | 27.2 | 28.7 | 30.6 | 26.1 | < 0.001 |
| < 20 (%) | | | | | | | |
| 1982 | 25.3 | 16.8 | 6.7 | 5.5 | 2.1 | 15.3 | < 0.001 |
| 1993 | 22.6 | 19.6 | 15.6 | 8.0 | 7.5 | 17.4 | < 0.001 |
| 2004 | 28.3 | 21.0 | 12.3 | 7.3 | 3.9 | 18.9 | < 0.001 |
| > 34 (%) | | | | | | | |
| 1982 | 8.3 | 9.4 | 12.1 | 13.5 | 14.5 | 10.2 | < 0.001 |
| 1993 | 6.9 | 10.5 | 11.7 | 17.2 | 17.1 | 11.1 | < 0.001 |
| 2004 | 8.5 | 13.0 | 14.7 | 19.1 | 25.0 | 13.5 | < 0.001 |
| White skin (%) | | | | | | | |
| 1982 | 68.0 | 81.7 | 90.2 | 96.4 | 98.5 | 82.1 | < 0.001 |
| 1993 | 66.1 | 76.5 | 78.2 | 87.2 | 95.6 | 77.2 | < 0.001 |
| 2004 | 63.3 | 68.8 | 82.4 | 85.0 | 93.3 | 72.8 | < 0.001 |
| Smoking in pregnancy (%) | | | | | | | |
| 1982 | 43.7 | 36.4 | 32.3 | 20.3 | 24.9 | 35.6 | < 0.001 |
| 1993 | 40.3 | 36.6 | 28.6 | 24.7 | 22.8 | 33.4 | < 0.001 |
| 2004 | 33.6 | 28.0 | 17.8 | 11.4 | 8.7 | 25.1 | < 0.001 |

2004 (Table 1). Of the reduction registered between 1982 and 2004, roughly 80% occurred in the last 11 years. As for the remaining characteristics, changes in smoking prevalence varied markedly according to family income: between 1982 and 2004, the rate of reduction was almost threefold higher among higher income mothers (from 24.9% to 8.7%) than among poorer mothers (from 43.7% to 33.6%).

The proportion of mothers shorter than 150 cm, which had fallen drastically between 1982 and 1993 across all income groups, increased again in 2004. Between 1993 and 2004, there was an increase from about 5% to 9% in the proportion of mothers shorter than 150cm. Mean height also increased in the first period, and fell approximately 1cm between 1993 and 2004.

Important differences were observed between the three groups of mothers with respect to weight before and at the end of pregnancy. Mothers giving birth in 2004 were significantly heavier at the beginning and end of pregnancy than those from 1982 and 1993, across all income groups (Table 2). The mean BMI increased from 22.7 in 1982 to 22.8 in 1993 and to 24.2 in 2004.

And, compared to mothers from 1982 and 1993, 2004 mothers gained an average of 600g and 800g more during pregnancy, respectively. Paradoxically, there was a reduction in the percentage of mothers considered thin (< 50kg) at the beginning of pregnancy, and an increase in the proportion of those that gained less than 9kg. The increase observed in 2004 in the proportion of mothers that gained less than 9kg occurred in the extreme income categories, being more marked among poorer women. Figure 1 shows the evolution of pre-pregnancy BMI in the three cohorts. There was a marked increase in obesity (BMI > 30kg/m²) in the 22-year period (from 4.4% in 1982 to 4.9% in 1993 and 10.7% in 2004).

There was a reduction in the mean number of previous children among mothers from 2004, in comparison with those from 1993 and 1982 (from 1.3 children in the first two cohorts to 1.1 in the latter) (Table 3). Although this reduction occurred across all income groups, the more marked decrease was found among mothers from families earning more than three times the monthly minimum wage (a mean reduction of roughly 50%). Primiparas, who in 1982 and 1993 corresponded

Table 2

Maternal anthropometric measures and weight gain during pregnancy according to family income. Pelotas, Southern Brazil, 1982 (n = 6,011), 1993 (n= 5,304), and 2004 (n= 4,287).

| Variable | Family income (as a multiple of the minimum wage) | | | | | All | p |
| --- | --- | --- | --- | --- | --- | --- | --- |
| | ≤ 1 | 1.1-3 | 3.1-6 | 6.1-10 | > 10 | | |
| Height (cm) | | | | | | | |
| Mean | | | | | | | |
| 1982 | 154.6 | 156.2 | 157.5 | 158.3 | 159.6 | 156.4 | < 0.001 |
| 1993 | 158.0 | 159.3 | 160.6 | 162.1 | 162.0 | 159.8 | < 0.001 |
| 2004 | 157.6 | 158.3 | 160.0 | 161.5 | 161.5 | 158.8 | < 0.001 |
| < 150 (%) | | | | | | | |
| 1982 | 16.1 | 10.8 | 7.8 | 6.5 | 3.4 | 10.8 | < 0.001 |
| 1993 | 8.5 | 4.9 | 3.1 | 1.6 | 1.3 | 4.6 | < 0.001 |
| 2004 | 11.7 | 10.3 | 5.8 | 3.7 | 2.4 | 8.8 | < 0.001 |
| Pre-pregnancy weight (kg) | | | | | | | |
| Mean | | | | | | | |
| 1982 | 53.7 | 55.7 | 56.9 | 57.0 | 56.9 | 55.7 | < 0.001 |
| 1993 | 56.5 | 57.8 | 59.3 | 60.1 | 59.1 | 58.2 | < 0.001 |
| 2004 | 58.7 | 61.1 | 62.1 | 62.9 | 61.8 | 61.0 | < 0.001 |
| < 50 (%) | | | | | | | |
| 1982 | 36.7 | 28.4 | 23.8 | 19.6 | 18.0 | 27.9 | < 0.001 |
| 1993 | 23.1 | 17.5 | 12.1 | 7.4 | 8.1 | 15.7 | < 0.001 |
| 2004 | 25.8 | 19.2 | 14.2 | 12.2 | 10.8 | 18.5 | < 0.001 |
| End-of-pregnancy weight (kg) | | | | | | | |
| Mean | | | | | | | |
| 1982 | 64.1 | 67.4 | 69.8 | 70.0 | 70.6 | 67.5 | < 0.001 |
| 1993 | 67.5 | 69.1 | 71.3 | 73.2 | 72.2 | 69.9 | < 0.001 |
| 2004 | 70.2 | 73.5 | 75.2 | 76.7 | 75.6 | 73.5 | < 0.001 |
| < 55 (%) | | | | | | | |
| 1982 | 15.6 | 9.4 | 4.5 | 5.4 | 3.0 | 9.1 | < 0.001 |
| 1993 | 11.1 | 7.7 | 4.7 | 2.6 | 2.6 | 6.8 | < 0.001 |
| 2004 | 9.0 | 4.8 | 2.2 | 0.8 | 1.5 | 4.7 | < 0.001 |
| Pre-gestational BMI (kg/m²) | | | | | | | |
| Mean | | | | | | | |
| 1982 | 22.4 | 22.8 | 22.9 | 22.8 | 22.3 | 22.7 | 0.002 |
| 1993 | 22.6 | 22.8 | 23.0 | 22.9 | 22.5 | 22.8 | 0.07 |
| 2004 | 23.6 | 24.4 | 24.4 | 24.2 | 23.7 | 24.2 | < 0.001 |
| Weight gain (kg) | | | | | | | |
| Mean | | | | | | | |
| 1982 | 10.5 | 11.5 | 12.8 | 12.9 | 13.2 | 11.8 | < 0.001 |
| 1993 | 11.1 | 11.2 | 11.9 | 13.0 | 13.1 | 11.6 | < 0.001 |
| 2004 | 11.4 | 12.2 | 13.2 | 13.6 | 13.7 | 12.4 | < 0.001 |
| < 9 (%) | | | | | | | |
| 1982 | 36.5 | 30.4 | 20.3 | 16.7 | 14.9 | 27.4 | < 0.001 |
| 1993 | 31.3 | 30.5 | 27.1 | 19.5 | 18.1 | 28.0 | < 0.001 |
| 2004 | 36.7 | 31.1 | 24.1 | 18.6 | 22.4 | 29.4 | < 0.001 |

to a little over one-third of all mothers, in 2004 accounted for more than 40% of the entire cohort. The proportion of primiparas increased in all income strata, but was more marked among richer mothers.

At the same time, the proportion of mothers with four or more children fell across all income groups, with no cases registered among the richest income category. These findings show an inverse trend to that observed between the first

two cohorts, when the proportion of primiparas had decreased (from 39.2% to 35.2%) and that of mothers with four or more children had increased (from 9.2% to 11.4%) (Table 3).

As in 1982 and 1993, the highest prevalence of high risk pregnancies occurred among the poorest mothers. The mean birth interval, which had increased by more than two years between 1982 and 1993, continued to increase between 1993 and 2004. In 1993, the mean period between current and last pregnancies had been about five years; in 2004, this period increased to about five-and-a-half years. The difference between wealthier and poorer mothers also increased in the period, from four to 16 months between 1982 and 1993, and then to 22 months in 2004, the birth interval being always greater among richer mothers. Regarding reproductive history, with the exception of the proportion of mothers with a history of abortions, which remained stable in relation to the 1993 cohort, the remaining variables show an increase in the proportion of previous still-births and low-birthweight or c-section births. As for the latter, the prevalence of a previous history of c-sections almost tripled in the last two decades, from 12.7% in 1982 to 33.5% in 2004.

## Discussion

The use of the same methodology and similar data collection instruments in the three cohorts ensured the comparability of the populations under study. However the fact that information was collected by means of interviews may be a weakness in the study due to the possibility of information bias. Noteworthy among the changes that occurred in the maternal profile across the three cohorts is the fact that the decrease in the number of births observed between 1982 and 1993 was further intensified between 1993 and 2004. Despite the increase in the urban population, from 274,285 inhabitants in 1993 [2] to 300,952 in 2004 (http://pt.wikipedia.org/wiki/Pelotas#Economia, accessed on 07/Sep/2006), the number of births fell by 28%. This corresponds to a reduction in the crude birth rate from 21.9 per 1,000 in 1982 to 14.2 per 1,000 in 2004, a 35% decrease.

In addition to this decrease in parity, significant positive changes were seen in schooling, as described in a previous article [2], smoking, pre-pregnancy and end-of-pregnancy weight, and weight gained during pregnancy. Some of these changes continued the trends already observed during the first decade, as was the case for the reductions in the illiteracy rate and smoking prevalence and the increases in pre-pregnancy

Figure 1

Pre-pregnancy body mass index (kg/m2) in the 1982 (n = 6,011), 1993 (n = 5,304) and 2004 (n = 4,287) cohorts. Pelotas, Southern Brazil.
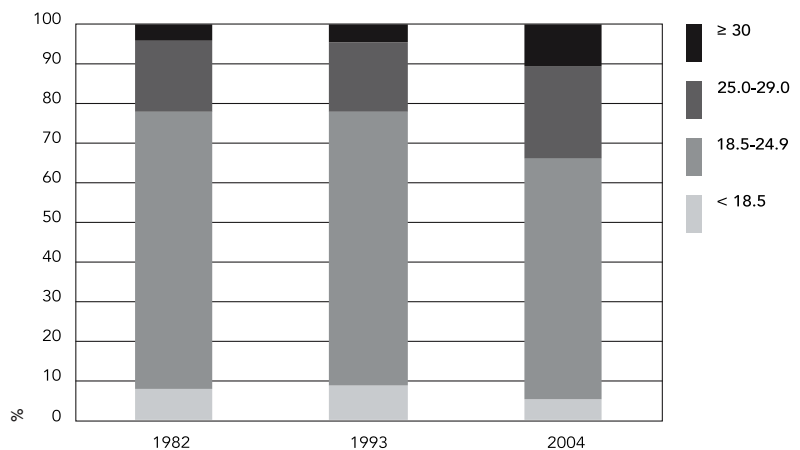


and end-of-pregnancy weights and BMI. Mean weight gain during pregnancy, which had decreased between the first two cohorts, increased in the last 11 years. We shall discuss these trends below.

In the last fifteen years there was a decrease in the proportion of smokers in Brazil [8]. The reduction observed between 1993 and 2004 probably reflects the impact of public policies for controlling tobacco consumption. As was the case for other indicators evaluated in the present supplement [9], the marked reduction in smoking, especially amongst mothers of a higher socioeconomic level, suggests the effects of inverse equity [10], by which new messages in public health initially reach those in better socioeconomic conditions, and only later reach the poorer population.

The increasing trend in the pre-pregnancy BMI is compatible with the evolution of the nutritional pattern of the Brazilian population. Time trends have demonstrated a decline in infant and adult malnutrition and an increase in prevalence of overweight and obese individuals, the latter being higher in the South and Southeast Regions of Brazil [11]. From the mother's perspective, the most concerning trend is the increase in mean end-of-pregnancy weight and in weight gained during pregnancy registered in the period. The accumulation of weight during pregnancy is one of the independent factors associated with the accumulation of abdominal fat [12] and generalized obesity [13], both of which

Table 3

Reproductive characteristics according to family income. Pelotas, Southern Brazil, 1982 (n = 6,011), 1993 (n = 5,304), and 2004 (n = 4,287).

| Variable | Family income (as a multiple of the minimum wage) | | | | | All | p |
|---|---|---|---|---|---|---|---|
| | ≤ 1 | 1,1-3 | 3,1-6 | 6,1-10 | > 10 | | |
| Parity (previous children) | | | | | | | |
| Mean | | | | | | | |
| 1982 | 1.6 | 1.3 | 1.0 | 1.0 | 1.0 | 1.3 | < 0.001 |
| 1993 | 1.6 | 1.4 | 1.2 | 1.1 | 1.1 | 1.3 | < 0.001 |
| 2004 | 1.4 | 1.3 | 0.8 | 0.7 | 0.6 | 1.1 | < 0.001 |
| Primiparas (%) | | | | | | | |
| 1982 | 37.8 | 39.0 | 42.0 | 38.2 | 37.8 | 39.1 | 0.2 |
| 1993 | 30.4 | 33.9 | 37.9 | 41.0 | 38.1 | 35.1 | < 0.001 |
| 2004 | 41.2 | 39.9 | 48.9 | 54.1 | 56.7 | 43.8 | < 0.001 |
| ≥ 4 children (%) | | | | | | | |
| 1982 | 14.5 | 10.2 | 5.1 | 1.3 | 2.7 | 9.2 | < 0.001 |
| 1993 | 17.6 | 12.3 | 9.0 | 6.4 | 3.6 | 11.4 | < 0.001 |
| 2004 | 11.5 | 8.7 | 3.3 | 2.0 | - | 7.3 | < 0.001 |
| Gestational risk | | | | | | | |
| High (%) | | | | | | | |
| 1982 | 18.4 | 14.5 | 10.1 | 4.5 | 3.1 | 13.2 | < 0.001 |
| 1993 | 18.4 | 15.9 | 10.2 | 6.1 | 5.4 | 13.4 | < 0.001 |
| 2004 | 17.7 | 16.2 | 11.9 | 5.4 | 2.9 | 14.2 | < 0.001 |
| Intermediate (%) | | | | | | | |
| 1982 | 74.4 | 74.6 | 45.1 | 25.6 | 6.4 | 63.0 | < 0.001 |
| 1993 | 71.1 | 73.5 | 51.1 | 35.5 | 32.9 | 61.5 | < 0.001 |
| 2004 | 74.8 | 73.5 | 65.1 | 39.1 | 35.3 | 67.9 | < 0.001 |
| Low (%) | | | | | | | |
| 1982 | 7.1 | 10.9 | 44.8 | 69.9 | 70.5 | 23.9 | < 0.001 |
| 1993 | 10.5 | 1.6 | 38.7 | 58.4 | 61.7 | 25.1 | < 0.001 |
| 2004 | 7.5 | 10.3 | 23.0 | 55.6 | 61.8 | 17.9 | < 0.001 |
| Birth interval (months) | | | | | | | |
| Mean | | | | | | | |
| 1982 | 30.5 | 33.5 | 36.9 | 35.0 | 34.3 | 33.5 | < 0.001 |
| 1993 | 47.2 | 59.2 | 64.3 | 71.4 | 63.2 | 59.0 | < 0.001 |
| 2004 | 53.9 | 63.9 | 76.5 | 84.3 | 75.6 | 65.7 | < 0.001 |
| Reproductive history | | | | | | | |
| ≥ 1 abortion (%) | | | | | | | |
| 1982 | 17.7 | 18.7 | 20.3 | 17.7 | 18.0 | 18.7 | 0.6 |
| 1993 | 26.6 | 27.7 | 28.8 | 32.2 | 29.3 | 28.2 | 0.9 |
| 2004 | 26.6 | 26.9 | 31.3 | 24.8 | 34.3 | 28.0 | 0.4 |
| ≥ 1 still-birth (%) | | | | | | | |
| 1982 | 2.9 | 3.0 | 1.8 | 2.1 | 0.9 | 2.6 | 0.08 |
| 1993 | 3.9 | 2.3 | 3.2 | 1.9 | 2.1 | 2.8 | 0.09 |
| 2004 | 5.7 | 4.4 | 3.5 | 1.6 | - | 4.2 | 0.008 |
| ≥ 1 low-birth weight (%) | | | | | | | |
| 1982 | 16.6 | 10.9 | 8.2 | 5.6 | 5.1 | 10.9 | < 0.001 |
| 1993 | 18.4 | 16.5 | 12.3 | 8.9 | 6.7 | 14.7 | < 0.001 |
| 2004 | 23.2 | 18.4 | 15.4 | 8.8 | 8.6 | 17.9 | < 0.001 |
| ≥ 1 c-section | | | | | | | |
| 1982 | 0.2 | 11.4 | 15.4 | 17.9 | 25.7 | 12.7 | < 0.001 |
| 1993 | 16.0 | 17.8 | 22.3 | 27.9 | 32.1 | 20.1 | < 0.001 |
| 2004 | 29.6 | 32.8 | 32.2 | 48.8 | 54.3 | 33.5 | < 0.001 |

increase with multiple pregnancies. Such an effect is also true among adolescent mothers, as shown by another study carried out in Pelotas with mothers born in 1982 [14]. Across the three cohorts a strong statistical association was observed between BMI and skin color. The prevalence of obesity (BMI ≥ 30) was higher among black/mixed mothers than among their white peers (7% and 3.9% respectively in 1982 – p < 0.001; 6% and 4.5% in 1993 – p = 0.07; and 13.3% and 9.8% in 2004 – p = 0.01). Unlike in 1982 and 1993 when mothers were weighed at the maternity ward, in 2004 the maternal weight at the end of pregnancy was taken from the mother's medical card. Since the last antenatal consultation may have occurred at different gestational ages, the actual final maternal weight in 2004 may have been higher than the recorded weight, thus leading to an underestimation of not only the mean weight at the end of pregnancy but also of weight gain during pregnancy.

Parity decreased along with a consequent increase in the population of primiparas. The number of previous children, including live and stillbirths, which remained stable between the two first cohorts, showed a marked general reduction across all income strata, but especially among richer mothers. This finding, associated with the lack of change in the reported rate of abortions in relation to 1993, suggests the use of effective birth control methods over this period. Indeed, population-based studies including women aged 15-49 years carried out in Pelotas have shown that the prevalence of the use of any birth control method was higher than that found in Brazil as a whole, with the pill and female sterilization being the methods most frequently reported [15,16,17]. Although the global rate of abortions has remained stable over the last eleven years, there was an increase among mothers in the 3.1-6 and > 10 times minimum wage brackets, among whom the highest decrease in parity was also observed.

As in 1982 and 1993, a strong statistical association was observed in 2004 between skin color and income, with higher proportions of black/mixed mothers in the lower income strata. Although errors of hetero-classification may not be completely discarded, the change in the ethnic profile of the pregnant population may impact unfavorably the prevalence of low-birthweight, pre-term, and small-for-gestational age babies [18].

Rather than suggesting an increased risk of becoming pregnant during adolescence, the increase in the proportion of adolescent mothers points to a reduction in the proportional number of pregnant women in other age groups, particularly those aged between 20 and 29. In 1982, 1993, and 2004, in the city of Pelotas, the population of adolescent women between 15 and 19 years of age – which represented 95% or more of the total adolescent mothers in all three cohorts – was 11,355, 11,456, and 14,245, respectively. In each of these years, the number of births per 1,000 adolescents decreased, from 8.0 in 1982 to 7.8 in 1993 and more significantly to 5.4 in 2004. It is possible that this reduction is a reflection of the impact of programs for preventing STD/AIDS, which have been expanded in the city in the last decade.

The growing trend towards a widening of birth intervals is consistent with the findings of decreased parity and with the frequent use of effective birth control, as previously discussed. The mean birth interval in 2004 was quite wide – 65.7 months – with a median interval of 54.7 months. Current recommendations suggest a minimum interval of at least 2-3 years between births in order to reduce the risk of health complications among mothers and their children [19]. The difference observed between wealthier and poorer mothers may be due to the more consistent use of birth control among the wealthier population, possibly due to higher difficulties in access to these methods among the poor.

Mean height among Pelotas mothers in 1993 and 2004 was higher than that found for the country as a whole in 1996 (156.3cm) [16], compatible with the greater stature of mothers in the Southern Region. The 1cm reduction in mean height between 1993 and 2004 is noteworthy, since it goes against the trend observed between 1982 and 1993, as well as that reported for the country as a whole [16]. The increased prevalence of mothers shorter than 150cm is consistent with what was observed in terms of mean height. Such reduction is unlikely to be a result of measuring techniques, since the anthropometric equipments and procedures used in the three cohorts were the same. Since the reduction in mean height was observed across all income groups, and among black/mixed (158.6cm) and white (158.8cm) women, it is also unlikely that this was a result of changes in the socioeconomic profile of pregnant women. A recent study has shown a decrease in average height trends among army recruits in the southern half of the State of Rio Grande do Sul [20]. This subject is worthy of further in-depth studies aimed at determining whether the trend towards increasing stature is effectively being reverted in this region, which has been undergoing an intense economic crisis since the 1990s [21].

Finally, it is worth noting the increase in the number of previous c-sections, which is consistent with the findings of the 1996 National Survey of Demography and Health (PNDS). The

analysis of this trend and its determinants are further explored in another article in this supplement [22].

The changes identified between the three cohorts provide evidence of the social modifications that characterized pregnant women in the city of Pelotas in the last two decades. These changes will affect both the perinatal outcomes of pregnancy as well as the newborn child's health [23,24,25].

### Resumo

*As mães das coortes de nascimentos de Pelotas de 1982, 1993 e 2004 foram comparadas em relação a características biológicas, sócio-econômicas, demográficas e reprodutivas. As mães da coorte de 2004 tinham escolaridade mais alta, ganharam mais peso durante a gestação e pesavam mais no início e final da gestação, comparadas com as mães de 1993 e 1982. Houve um aumento importante nas taxas de obesidade (índice de massa corporal >30kg/m²) ao longo dos 22 anos do estudo. A paridade média diminuiu de 1,3 em 1982 para 1,1 in 2004, com um aumento na proporção de mulheres primíparas e um declínio na proporção de mulheres com ≥ 4 crianças. O intervalo médio entre nascimentos aumentou de 33,5 meses em 1982 para 65,7 em 2004. O hábito de fumar durante a gravidez diminuiu de 35,6% em 1982 para 25,1% m 2004. Assim como outras características, a mudança no tabagismo mostrou diferenças de acordo com renda familiar, com uma redução menor nas mães de maior renda (de 24,9% para 8,7%), comparadas com as mais pobres (de 43,7% para 33,6%). Em termos gerais, entre 1993 e 2004 houve uma diminuição na prevalência de fatores de risco maternos para desfechos perinatais desfavoráveis.*

*Paridade; Tabagismo; Saúde Reprodutiva; Estudos de Coortes*

### Contributors

I. S. Santos designed the research question and wrote the first draft of the article. A. Matijasevich conducted the analyses. A. J. D. Barros, A. Matijasevich, E. Tomasi, R. S. Medeiros, M. R. Domingues, A. D. Bertoldi, F. C. Barros and C. G. Victora contributed to the analysis of the findings and assisted with the editing of the article.

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