

INTRODUCTION

Simultaneous exposure to metals in early life is a public health concern, as is investigating sources to reduce the effects in childhood and adulthood.

Lead, Arsenic, mercury, and cadmium are significant environmental pollutants; they are listed by the Agency for Toxic Substances and Disease Registry (ATSDR) as a Priority Substance in public health. Considering the combination of frequency, toxicity, and potential for human exposure (Araujo, 2020).

Determining heavy metals in urine has been the subject of continuous interest in the biomedical and environmental sciences. Due to its simple collection form, this matrix is widely used for estimating metal exposure, mainly in children (Mahugija et al, 2028).

Aim: Analyze co-exposure to lead, arsenic, mercury, and cadmium from birth to 6th month related to the mother's sociodemographic characteristics and breastfeeding.

Methods

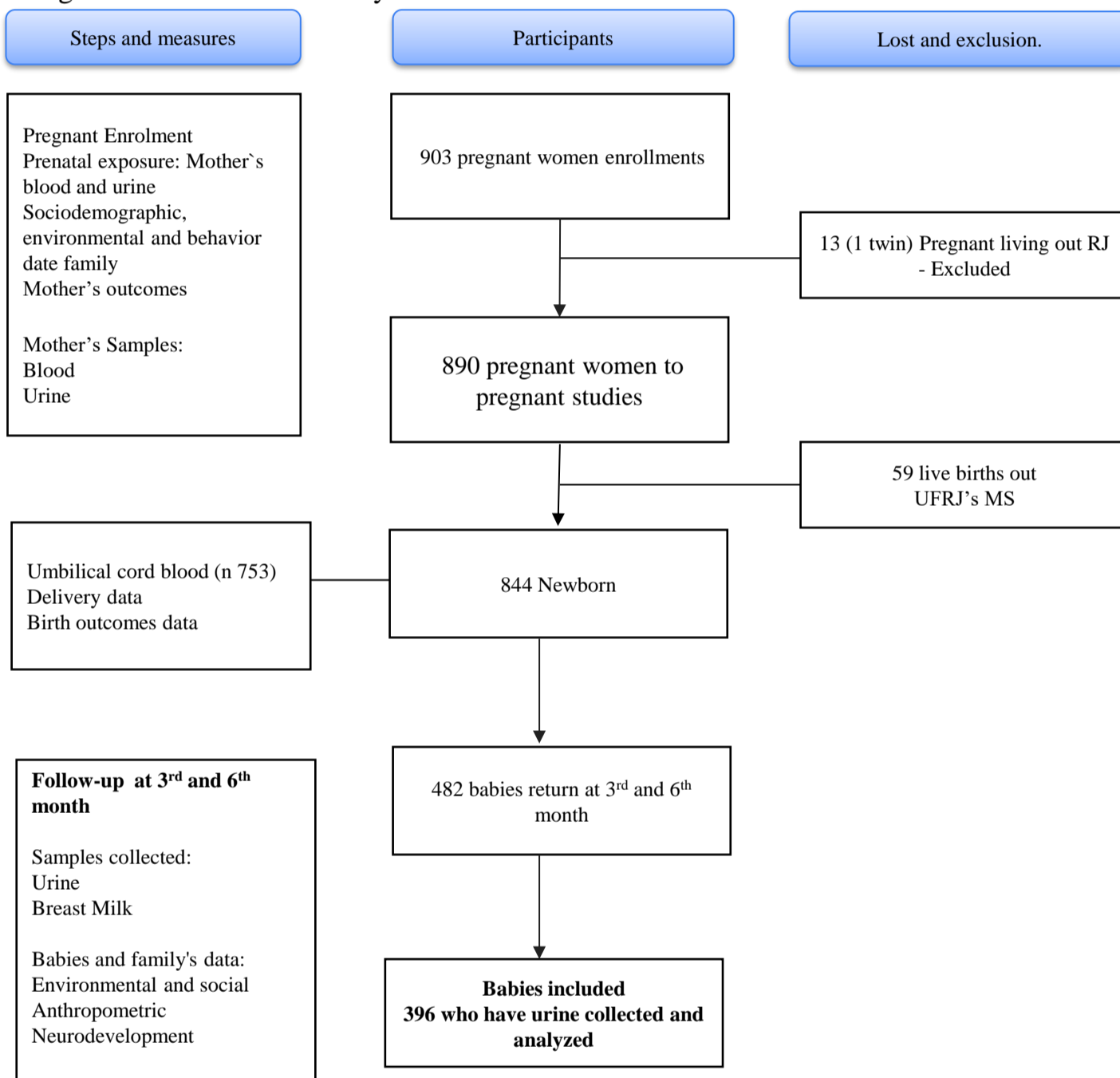
The data were obtained from the PIPA Project, a birth cohort study in an urban population of Rio de Janeiro, Brazil. This analysis includes 396 children who returned for follow-up at 3 and 6 months of age, whose families did not change address, and whose urine samples were analyzed in each follow-up (3 and 6 months).

Sociodemographic information was collected in the third trimester of pregnancy, and information on breastfeeding and food was obtained at follow-up. Inductively mass spectrometry was applied to analyze metals concentrations: Lead (Pb), Mercury (Hg), Arsenic (As), and Cadmium (Cd). The detection limit was 0.1 µg/L. Samples that had creatinine values below 0.03 µg/L or above 3.3 µg/L were excluded.

The detection rates between the segments were compared, and Spearman's test was performed to evaluate the correlation between the metals in each segment. Mann Whitney U test and Kruskal Wallis were applied to compare the metals concentration and socio-demographic factors, water source household, and breastfed.

RESULTS

Figure 1: Flow Chart of study



The study population lives in an urban area and has median low socio-economic conditions. Half of the families live with 0.5 of the minimum income per month defined in Brazil (\$285.00). Most mothers study no more than 12 years, and 56.7% live in slums.

Table 1: Mother's socio-demographic characteristics

| Socio-demographic characteristics | Measure |
|--|--------------------------------|
| percapita family income/month - Median (IQR) | \$ 120.00 (\$72,65 - \$204.32) |
| Live in low-income communities (slums) (yes %) | 56.7% |
| Mother color - No White (Yes %) | 74.2% |
| Mother schooling <12 years | 75.0% |
| Live near intense Traffic area (yes %) | 46.6% |
| Hosehold tobacco exposure | 29.0% |
| Brick house (yes %) | 94.0% |
| Garbage collection (yes %) | 91.3% |
| Sewage treatment (yes %) | 99.0% |

At 3 and 6 months of life, Pb was detected in 93.2% and 96.3% (p=0.100), and As in 97.9% and 99.5% (p=0.100) of children, respectively. The Hg and Cd detection rate increased from 26.2% to 59.2% (p=0.001) and from 55.8% to 72.7% (p=0.001), respectively. At six months, the four metals were detected in 76% of children. There was a positive correlation between concentrations of Hg and As (r=0.13, p= 0.001), Hg and Cd (r=0.12, p= 0.02), and Pb and Cd (r=0.31, p = 0.001).

Table 2: Metals detection rate and concentration at 3rd and 6th month

| Metal | 3 rd month | | | 6 th month | | | P value |
|-------|-----------------------|-----|--------|-----------------------|------|--------|---------|
| | Detection rate | Max | Median | Detection rate | Max | Median | |
| Pb | 93,2% | 7.5 | 0.85 | 96.3% | 6.5 | 0.99 | 0.100 |
| Hg | 26.2% | 6.4 | 1.18 | 59.2% | 5.4 | 0.89 | 0.001 |
| As | 97.6% | 20 | 0.44 | 99.5% | 38.5 | 0.45 | 0.100 |
| Cd | 55.8% | 9.8 | 1.49 | 72.2% | 8.0 | 0.91 | 0.001 |

Breastfeeding was exclusive among 49.1% of babies in their third month and only 10.9% in their sixth month. At three months of age, no significant relationship between metal concentrations and the factors investigated was observed.

In the sixth month, the median concentrations of Hg (p=0.05) and Pb (p=0.005) are higher in exclusively breastfed children. To As no-breastfeed children have higher concentrations (p=0.001), and there is an increase in As median for children eating soup or drinking water (p<0.05). No significant association with any environmental factors analyzed was found for Cd.

Table 3: Associated Factors to Metals at 6th month

| Lead median concentration comparison | | | |
|---|------|-----|---------|
| Factors associated | Yes | No | P value |
| Exclusive Breastfeeding | 1.1 | 0.9 | 0.005 |
| Government assistance | 1.24 | 1.0 | 0.05 |
| Brick house | 1.0 | 1.2 | 0.02 |
| Mercury median concentration comparison | | | |
| Exclusive Breastfeeding | 0.7 | 0.4 | 0.005 |
| Arsenic median concentration comparison | | | |
| Tobacco household exposure | 1.5 | 1.0 | 0.01 |
| Brick house | 1.0 | 1.2 | 0.05 |
| Exclusive Breastfeeding | 0.6 | 1.7 | 0.000 |
| Soup or food with water | 2.0 | 1.1 | 0.001 |

CONCLUSION

More than 70% of the study population had the four studied metals detected in urine at six months of age. Breastfeeding was positively associated with Pb and Hg and negatively associated with Cd. Tobacco exposure and Introducing food, mainly water, were positively associated to As.

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