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| **Table 1- Descriptive statistics for arsenic, cadmium, lead and mercury concentrations in maternal and umbilical cord blood, Rio de Janeiro, Brazil, 2018.** | | | | | | | | | | |
| **Metal** | **Sample** | **GM (95% CI)** | **Min.** | **P25** | **Median** | **P75** | **P90** | **P95** | **Max** | **R\*** |
| **Arsenic (µg/L)** | **mb** | 9.46 (7.61-11.18) | 0.33 | 8.27 | 9.89 | 11.79 | 17.47 | 11.80 | 36.48 | 0.87 |
|  | **ucb** | 10.07 (9.17-10.98) | 5.06 | 8.29 | 10.27 | 11.93 | 15.37 | 12.06 | 19.94 |  |
| **Cadmiun (µg/L)** | **mb** | 0.29 (0.18-0.43) | 0.01 | 0.13 | 0.30 | 1.11 | 2.09 | 1.29 | 9.97 | 0.76 |
|  | **ucb** | 0.32 (0.21-0.46) | 0.01 | 0.15 | 0.33 | .81 | 2.33 | 0.83 | 4.88 |  |
| **Lead (µg/dL)** | **mb** | 3.83 (3.32-4.43) | 1.32 | 2.54 | 4.41 | 5.46 | 7.11 | 5.55 | 12.41 | 0.78 |
|  | **ucb** | 3.81 (3.81-4.53) | 1.43 | 2.42 | 3.39 | 4.86 | 13.42 | 4.90 | 16.03 |  |
| **Mercury (µg/L)** | **mb** | 0.90 (0.74-1.11) | 0.38 | 0.61 | 0.76 | 1.41 | 2.77 | 1.42 | 13.32 | 0.64 |
|  | **ucb** | 0.95 (0.82-1.11) | 0.42 | 0.69 | 0.88 | 1.30 | 2.64 | 1.30 | 3.74 |  |
| Maternal blood n=49 and Cord blood n=46; GM=geometric mean; CI= confidence interval; Mean= aritmetic mean; SD= standard error; mb=maternal blood. ucb= umbilical cord blood; \*Spearman's correlation (p valor<0.001); Metal limits of quantification:Arsenic 0.01 μg/L.; Cadmiun 0.006 μg/L. Lead 0.05 μg/L; Mercury Hg 0.02 μg/L. | | | | | | | | | | |

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| **Table 2 - Arsenic, cadmium, lead and mercury concentrations in maternal blood and umbilical cord blood and maternal sociodemographic characteristics, Rio de Janeiro, Brazil, 2018.** | | | | | | | | | | | | | | | | | | | |
|  | **Arsenic µg/ L** | | | |  | **Cadmium µg/ L** | | | |  | **Lead µg/dL** | | | |  | **Mercury µg/ L** | | | |
|  | **Maternal blood** | | **Cord blood** | |  | **Maternal blood** | | **Cord blood** | |  | **Maternal blood** | | **Cord blood** | |  | **Maternal blood** | | **Cord blood** | |
| **Mother age** (years) | **R** | **p a** | **R** | **p a** |  | **R** | **p a** | **R** | **p a** |  | **R** | **p a** | **R** | **p a** |  | **R** | **p a** | **R** | **p a** |
| 28.54 ± 7.07\* | -0.10 | 0.51 | 0.09 | 0.54 |  | -0.05 | 0.71 | 0.12 | 0.45 |  | 0.15 | 0.29 | **0.29** | **0.05** |  | 0.17 | 0.25 | **0.34** | **0.02** |
| ***Per capita* income (US$)** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 257±167.38\* | -0.10 | 0.54 | 0.06 | 0.70 |  | -0.12 | 0.45 | 0.04 | 0.78 |  | -0.21 | 0.18 | -0.07 | 0.67 |  | -0.07 | 0.64 | 0.18 | 0.26 |
| **Education (**years) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 14 (5-19) \*\* | -0.01 | 0.93 | 0.01 | 0.93 |  | -0.05 | 0.75 | 0.17 | 0.27 |  | -0.14 | 0.35 | 0.07 | 0.65 |  | -0.17 | 0.23 | -0.06 | 0.68 |
| **Ethnicity** | **GM (CI 95%)** | **p b** | **GM (CI 95%)** | **p b** |  | **GM (CI 95%)** | **p b** | **GM (CI 95%)** | **p b** |  | **GM (CI 95%)** | **p b** | **GM (CI 95%)** | **p b** |  | **GM (CI 95%)** | **p b** | **GM (CI 95%)** | **p b** |
| Non-white-71.4%(35)\*\*\* | 9.41 (7.07 -11.15) | 0.84 | 10.39 (9.22-11.48) | 0.55 |  | **0.37** (0.21-0.66) | **0.04** | 0.39 (0.23-0.63) | 0.08 |  | 3.73 (3.15-4.41) | 0.67 | 3.87 (3.19-4.81) | 0.96 |  | 0.94 (0.74-1.24) | 0.78 | 0.98 (0.83-1.19) | 0.40 |
| White - 28.6%(14)\*\*\* | 9.96 (7.89-12.54) |  | 9.80 (8.13-11.92) |  |  | **0.15** (0.09-0.25) |  | 0.19 (0.10-0.37) |  |  | 3.97 (2.98-5.05) |  | 3.69 (2.63-5.17) |  |  | 0.82 (0.61-1.13) |  | 0.91 (0.66-1.28) |  |
| **Tobacco exposure** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| No - 63.3%(31)\*\*\* | 10.62 (8.92-12.72) | 0.58 | 10.66 (9.30-12.15) | 0.12 |  | 0.30 (0.16-0.56) | 0.72 | 0.37 (0.24-0.57) | 0.69 |  | 4.09 (3.34-9.99) | 0.24 | 3.96 (3.21-4.79) | 0.30 |  | 0.96 (0.75-1.27) | 0.44 | 0.90 (0.75-1.09) | 0.78 |
| Yes - 36.7%(18)\*\*\* | 9.59 (8.33-11.14) |  | 9.31 (8.28-10.47) |  |  | 0.27 (0.14-0.50) |  | 0.37 (0.24-0.57) |  |  | 3.50 (2.89-4.24) |  | 3.61 (2.65-5.15) |  |  | 0.84 (0.64-1.12) |  | 1.03 (0.80-1.36) |  |
| **Alcohol consumption** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| No -50.0%(25)\*\*\* | 8.65 (5.78-11.95) | 0.16 | 9.98 (8.68-11.36) | 0.50 |  | 0.24 (0.11-0.51) | 0.79 | 0.32 (0.17-0.59) | 0.88 |  | 3.67(2.93-4.63) | 0.66 | 3.62 (2.90-4.57) | 0.39 |  | 0.84 (0.62-1.26) | 0.40 | 0.89 (0.76-1.06) | 1.00 |
| Yes - 50.0%(25)\*\*\* | 10.24 (8.78-11.90) |  | 10.15 (8.90-11.48) |  |  | 0.34(0.20-0.57) |  | 0.32(0.19-0.54) |  |  | 3.97(3.37-4.69) |  | 3.98 (3.06-5.17) |  |  | 0.95 (0.77-1.20) |  | 10.01(0.78-1.32) |  |
| Maternal blood n=49 and Cord blood n=46; \* Arithmetic mean (±SD); \*\* Median minimum-maximum; \*\*\* frequency (count); GM=Geometric Mean; CI= confidence interval;R= Spearman's correlation; a Spearman's p value; b U Mann-Whitney test p value. | | | | | | | | | | | | | | | | | | | |

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| **Table 3- Descriptive characteristics of birth outcomes and correlations with metal concentrations in maternal blood and umbilical cord blood, Rio de Janeiro, Brazil, 2018.** | | | | | | | | | | | | | | | | | | | |
|  | **Arsenic µg/ L** | | | |  | **Cadmium µg/ L** | | | |  | **Lead µg/dL** | | | |  | **Mercury µg/ L** | | | |
|  | **Maternal blood** | | **Cord blood** | |  | **Maternal blood** | | **Cord blood** | |  | **Maternal blood** | | **Cord blood** | |  | **Maternal blood** | | **Cord blood** | |
| **Birth weight (kg)** | **R** | **pa** | **R** | **pa** |  | **R** | **pa** | **R** | **pa** |  | **R** | **pa** | **R** | **pa** |  | **R** | **pa** | **R** | **pa** |
| 3.3 ± 0.5\* | 0.08 | 0.61 | 0.09 | 0.54 |  | 0.01 | 0.96 | 0.06 | 0.71 |  | 0.00 | 1.00 | 0.04 | 0.79 |  | 0.16 | 0.28 | 0.05 | 0.75 |
| **Gestational age (weeks)** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 39 (36-41) \*\* | 0.12 | 0.43 | 0.03 | 0.84 |  | **-0.25** | **0.08** | -0.21 | 0.16 |  | -0.19 | 0.19 | -0.18 | 0.23 |  | -0.19 | 0.19 | **-0.24** | **0.10** |
| **Gender** | **GM (95% CI)** | **pb,c** | **GM (95% CI)** | **pb,c** |  | **GM (95% CI)** | **pb,c** | **GM (95% CI)** | **pb,c** |  | **GM (95% CI)** | **pb,c** | **GM (95% CI)** | **pb,c** |  | **GM (95% CI)** | **pb,c** | **GM (95% CI)** | **pb,c** |
| Male- 62.0%(31)\*\*\* | 10.39 (9.10-11.75) | 0.33 | 10.26 (9.21-11.35) | 0.39 |  | 0.27 (0.16-0.46) | 0.75 | 0.32 (0.19-0.54) | 0.91 |  | 3.51 (2.93-4.24) | 0.16 | 3.59(2.86-4.65) | 0.36 |  | 0.94 (0.73- 1.23) | 0.49 | 0.96 (0.77-1.18) | 0.82 |
| feFale- 38.0% (19)\*\*\* | 8.11 (4.85-11.98) |  | 9.77 (8.12-11.69) |  |  | 0.32 (0.14-0.72) |  | 0.31 (0.17-0.62) |  |  | 4.41 (3.56-5.46) |  | 4.20 (3.30-5.48) |  |  | 0.83(0.63-1.14) |  | 0.94 (0.76-1.16) |  |
| **Apgar 5** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ≥8 - 98.0% (49)\*\*\* | 9.46 (7.79- 11.19) | 0.14 | 10.07 (9.17-11.02) | - |  | 0.29 (0.18-0.44) | 0.29 | 0.32 (0.21-0.47) | - |  | 3.83 (3.33-4.40) | 0.67 | 3.81 (3.21-4.55) | - |  | 0.90 (0.75-1.12) | 0.26 | 0.95 (0.82-1.12) | - |
| <8 - 2.0% (1)\*\*\*d | - |  | - |  |  | - |  | - |  |  | - |  | - |  |  | - |  |  |  |
| **Preterm birth (34-37 weeks)** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| No - 94.0% (47)\*\*\* | 9.28 (7.57-11.01) | 0.30 | 9.91 (9.01-10.84) | 0.11 |  | 0.28 (0.18-0.44) | 0.40 | 0.32 (0.22-0.49) | 0.91 |  | **3.76 (3.30-4.38)** | **0.05** | 3.70 (3.11-4.44) | 0.16 |  | 0.90 (0.74-1.11) | 0.71 | 0.94 (0.81-1.10) | 0.83 |
| Yes - 6.0% (3)\*\*\* | 14.48 (11.24-18.65) |  | 14.17 (11.40-17.60) |  |  | 0.47 (0.15-1.48) |  | 0.38 (0.12-1.20) |  |  | **5.72 (5.64-5.81)** |  | 7.23 (4.00-13.07) |  |  | 0.88 (0.38-2.00) |  | 1.24 (0.55-2.83) |  |
| **Birth Weight Adequacy for Gestational Age** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| AGA -75.6% (34) \*\*\* | 9.37 (6.85-11.70) | 0.88 | 10.12 (9.03-11.23) | 0.73 |  | 0.31 (.18-0.53) | 0.27 | 0.36 (0.21-0.60) | 0.31 |  | 3.67 (3.03-4.50) | 0.92 | 3.71 (2.93-4.79) | 0.52 |  | 0.93 (0.76-1.16) | 0.11 | 10.0 (0.82-1.23) | 0.27 |
| SGA- 11.1% (5) \*\*\* | 10.01 (6.78-15.09) |  | 9.60 (6.45-14.26) |  |  | 0.13 (0.03-0.64) |  | 0.14 (0.05-0.35) |  |  | 3.62 (2.52-5.14) |  | 3.30 (2.61-4.02) |  |  | 0.52 (0.38-0.77) |  | 0.68 (0.52-0.98 |  |
| LGA-13.3% (6) \*\*\* | 10.40 (6.53-15.80) |  | 10.52 (7.53-13.68) |  |  | 0.19 (0.05-0.62) |  | 0.29 (0.066-0.88) |  |  | 4.15 (3.31-5.20) |  | 4.63 (3.17-8.24) |  |  | 1.18 (0.55-3.99) |  | 0.93 (0.59-1.46) |  |
| Maternal blood n=49 and Umbilical cord blood n=46; \* Arithmetic mean (±SD); \*\* Median minimum-maximum); \*\*\* frequency (count); GM= Geometric mean; CI= Confidence Interval; R= Spearman's corelation; AGA -Appropriate for gestational age; SGA- Small for gestational age; LGA-Large for gestational age; a Spearman's p value bU Mann-Whitney test p value (gender.apgar 5. preterm birth); c Kruskal Wallis test p value (birth weight adequacy for gestational age); d for apgar <8 there is no value for the concentration of metals in maternal blood and umbilical cord. | | | | | | | | | | | | | | | | | | | |

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| |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Table 4- Maternal and birth characteristics between “not fail” and “fail” groups,**  **Rio de Janeiro, Brazil, 2018.** | | | | | | **Mother characteristics** | **“not fail”** | **“fail”** | **p value** | | **Mother age (years) a** | 29.91±6.32 | 25.88±7.87 | 0.06e | | ***Per capita* income (US$) a** | 264.49±173.97 | 241.68±157.96 | 0.68e | | **Education (years) b** | 14 (12-14) | 14 (12-16) | 0.78f | | **Ethnicity c** |  |  |  | | Non-white | 22 | 13 | 0.74g | | White | 10 | 4 |  | | **Tobacco exposure c** |  |  |  | | No | 18 | 13 | 0.22h | | Yes | 14 | 4 |  | | **Alcohol consumption c** |  |  |  | | No | 16 | 9 | 1.00h | | Yes | 17 | 8 |  | | **Birth characteristics** |  |  |  | | **Birth weight (kg) a** | 3.4±0.6 | 3.2±0.4 | 0.19e | | **Gestational age (weeks) b** | 39.0 (38-40) | 39 (38-39) | 1.11f | | **Gender c** |  |  |  | | Male | 22 | 9 | 0.73h | | Female | 11 | 8 |  | | **Apgar 5 c** |  |  |  | | ≥8 | 32 | 17 | 1.00g | | <8 c | 1 | 0 |  | | **Preterm birth (<37 weeks) c** |  |  |  | | No | 32 | 15 | 0.26g | | Yes | 1 | 2 |  | | **Birth Weight Adequacy for Gestational Age c** |  |  |  | | AGA | 20 | 14 | 0.60g | | SGA | 3 | 2 |  | | LGA | 5 | 1 |  | | Maternal blood n=49 and Umbilical cord blood n=46; AGA -Appropriate for gestational age; SGA- Small for gestational age; LGA-Large for gestational age; a Arithmetic mean ± sd ; b Median (Q1-Q3); c =n; e T test; f U Mann -Whitney test; g Fisher Test; h Chii-square test. | | | | | |   **Table 5- Geometric means of metal concentrations in maternal blood and cord blood of the "not fail" and "fail" groups in the DDST-II evaluation, Rio de Janeiro, Brazil, 2018.** | | | | | | | | | | | | | | | | | | | | |
|  |  | **Arsenic µg/ L** | | | |  | **Cadmium µg/ L** | | | |  | **Lead µg/dL** | | | |  | **Mercury µg/ L** | | | |
|  |  | **Maternal blood** | | **Cord blood** | |  | **Maternal blood** | | **Cord blood** | |  | **Maternal blood** | | **Cord blood** | |  | **Maternal blood** | | **Cord blood** | |
|  |  | **GM (CI 95%)** | **p a** | **GM (CI 95%)** | **p a** |  | **GM (CI 95%)** | **p a** | **GM (CI 95%)** | **p a** |  | **GM (CI 95%)** | **p a** | **GM (CI 95%)** | **p a** |  | **GM (CI 95%)** | **p a** | **GM (CI 95%)** | **p a** |
| **Not fail** | 66.0% (33) \* | **8.46** (6.56 -10.36) | **0.02** | 9.43 (8.44 - 10.43) | 0.11 |  | 0.27 (0.17 - 0.48) | 0.92 | 0.31 (0.20 - 0.45) | 0.53 |  | 3.72 (3.18 - 4.32) | 0.81 | 3.53 (2.95 - 4.31) | 0.71 |  | 0.91 (0.71 - 1.22) | 0.72 | 1.01 (0.85 - 1.22) | 0.31 |
| **Fail** | 34.0% (17) \* | **11.85 (**9.44 - 15.31) |  | 11.48 (9.68 - 13.59) |  |  | 0.32 (0.14 - 0.76) |  | 0.34 (0.14 - 0.81) |  |  | 4.05 (3.06 - 5.51) |  | 4.44 (3.22 - 6.42) |  |  | 0.87 (0.64 - 1.24) |  | 0.85 (0.66 - 1.16) |  |
| Maternal blood n=49 and Umbilical cord blood n=46; \* frequency (count);GM= Geometric mean; CI= Confidence Interval ; DDST-II – Denver Development Screening Test-II;\* frequency (count) ; a U Mann-WhitneTesty. | | | | | | | | | | | | | | | | | | | | |

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| **Table 6- Geometric means of metal concentrations in maternal blood and cord blood of the "not fail" and "fail" groups in the DDST-II tool for each assessed domain, Rio de Janeiro, Brazil, 2018.** | | | | | | | | | | | | | | | | | | | |
|  | **Arsenic µg/L** | | | |  | **Cadmium µg/L** | | | |  | **Lead µg/dL** | | | |  | **Mercury µg/L** | | | |
|  | **Maternal blood** | | **Cord blood** | |  | **Maternal blood** | | **Cord blood** | |  | **Maternal blood** | | **Cord blood** | |  | **Maternal blood** | | **Cord blood** | |
| **Personal social** | **GM (CI 95%)** | **p a** | **GM (CI 95%)** | **p a** |  | **GM (CI 95%)** | **p a** | **GM (CI 95%)** | **p a** |  | **GM (CI 95%)** | **p a** | **GM (CI 95%)** | **p a** |  | **GM (CI 95%)** | **p a** | **GM (CI 95%)** | **p a** |
| Not fail 84.0 %(42)\* | 9.42 (7.36 – 11.35) | 0.67 | 10.12 (9.07 – 11.17) | 0.55 |  | 0.32 (0.20 - 0.52) | 0.48 | 0.32 (0.21 - 0.21) | 0.66 |  | 4.03 (3.44- 4.74) | 0.14 | 3.93 (3.21 - 4.80) | 0.17 |  | 0.93 (0.76 – 1.19) | 0.53 | 1.01 (0.81 – 1.20) | 0.17 |
| Fail 16.0%(8)\* | 9.75 (6.73 – 13.24) |  | 9.74 (7.23 – 12.64) |  |  | 0.13 (0.04 - 0.44) |  | 0.33 (0.15- 0.64) |  |  | 2.75 (2.11 – 3.64) |  | 3.11 (2.23 - 4.47) |  |  | 0.69 (0.54 – 0.88) |  | 0.65 (0.50 – 0.92) |  |
| **Fine motor adaptive** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Not fail 96.0%(48) | 9.37 (7.51 - 11.29) | 0.27 | 9.99 (9.07 – 11.03) | 0.33 |  | 0.28 (0.18 - 0.46) | 0.86 | 0.33 (0.23 - 0.48) | 0.91 |  | 3.91 (3.40 - 4.55) | 0.17 | 3.91 (3.30 - 4.82) | 0.13 |  | 0.91 (0.75 - 1.16) | 0.30 | 0.97 (0.83 - 1.13) | 0.31 |
| Fail 4.0%(2)\* | 11.60 (11.41 - 11.79) |  | 11.91 (10.88 - 13.04) |  |  | 0.42 (0.08 - 2.32) |  | 0.20 (0.01 - 3.95) |  |  | 2.44 (2.37 - 2.52) |  | 2.16 (1.69 - 2.77) |  |  | 0.64 (0.62 - 0.67) |  | 0.67 (0.56 - 0.80) |  |
| **Language** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Not fail 94.0%(47)\* | 9.31 (7.58 - 11.08) | 0.36 | 9.94 (9.11 - 10.91) | 0.33 |  | 0.29 (0.17 - 0.46) | 0.77 | 0.33 (0.21 - 0.50) | 0.48 |  | 3.84 (3.30 - 4.47) | 0.48 | 3.86 (3.28 - 4.67) | 0.59 |  | 0.92 (0.75 - 1.15) | 0.77 | 0.97 (0.83 - 1.14) | 0.15 |
| Fail 6.0%(3)\* | 13.51 (9.79 - 18.65) |  | 13.17 (9.86 - 17.60) |  |  | 0.23 (0.15 - 0.35) |  | 0.20 (0.12 - 0.34) |  |  | 3.53 (2.21 - 5.64) |  | 2.87 (2.07 - 4.00) |  |  | 0.52 (0.39 - 0.70) |  | 0.62 (0.55 - 0.70) |  |
| **Gross motor** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Not fail 80.0%(40)\* | 8.69 (6.96 - 10.51) | 0.07 | 9.56 (8.63 - 10.51) | 0.07 |  | 0.26 (0.15 - 0.41) | 0.77 | 0.29 (0.19 - 0.45) | 0.41 |  | 3.59 (3.11 - 4.11) | 0.31 | 3.48 (2.97 - 4.16) | 0.23 |  | 0.88 (0.72 - 1.14) | 0.80 | 0.93 (0.79 - 1.09) | 0.85 |
| Fail 20.0%(10)\* | 12.75 (10.01 - 17.84) |  | 12.06 (9.89 – 14.96) |  |  | 0.41 (0.15 - 1.18) |  | 0.43 (0.16 - 1.15) |  |  | 4.77 (3.27 – 7.28) |  | 5.21 (3.27 - 8.81) |  |  | 0.95 (0.60 - 1.55) |  | 1.04(0.75 - 1.49) |  |
| Maternal blood n=49 and Umbilical cord blood n=46; \* frequency (count); GM= Geometric mean; CI= Confidence Interval ; DDST-II – Denver Development Screening Test-II; \* frequency (count) ; a U Mann-Whitney test p value. | | | | | | | | | | | | | | | | | | | |