

# Social inequalities and childhood mortality in Brazil: A longitudinal study of over 13 million live births using the Brazilian Deprivation Index

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**Mortality risk increased with higher municipal deprivation for under-5, under-1, and neonates. Children in the poorest municipalities were 23%, 28%, and 47% more likely to die within these age groups, respectively, compared to those in the least deprived areas.**

## BACKGROUND

Under-5 mortality is a crucial indicator of a country's health and living conditions, reflecting vulnerability to social, health, and economic determinants. Identifying existing inequities helps guide public health planning. We aimed to estimate childhood mortality rates according to the Brazilian Deprivation Index (IBP) in a cohort of over 13 million newborns in Brazil.

## METHODS

This study used linked data on live births (SINASC) and deaths (SIM) in Brazil from 2004-2018, merged with municipal-level IBP data. Newborns followed up to age 5 years, death, or Dec 31, 2018. IBP was categorized into five population-weighted quintiles, from least (richest) to most (poorest) deprived. Cox proportional regression models calculated crude and adjusted Hazard Ratios (HRs) and 95% confidence intervals (CI) for the association between IBP and all-cause under-5 mortality rates by age subgroups.

## RESULTS

13,178,376 under-5 children were included, with 169,919 (1.3%) deaths. Mortality risk increased with higher municipal deprivation for under-5, under-1, and neonates (Table). Neonates presented the highest risk, with children in the poorest municipalities 47% more likely to die within the first 28 days of life than those in the least deprived municipalities. In post-neonates and children aged 1-4 years, the risk of death was higher in less deprived municipalities, showing a protective direction in more deprived areas.

**Table. Crude and adjusted hazard ratios (HRs) for the association between Brazilian Deprivation Index (IBP) and mortality younger than age 5 years, by age group.**

Age group	Children of 1st quintile of IBP (LEAST deprivation)	Children of 2nd quintile of IBP	Children of 3rd quintile of IBP	Children of 4th quintile of IBP	Children of 5th quintile of IBP (GREATER deprivation)
<b>Under-5 years</b>					
Participants	17830/169905 (10.5%)	21445/169905 (12.6%)	31712/169905 (18.7%)	38261/169905 (22.5%)	60657/169905 (35.7%)
HR (95% CI)	1 (ref)	1.00 (0.98-1.02)	<b>1.04 (1.02-1.06)</b>	<b>1.05 (1.03-1.07)</b>	<b>1.15 (1.14-1.17)</b>
Adjusted HR (95% CI)	1 (ref)	<b>1.03 (1.01-1.05)</b>	<b>1.04 (1.02-1.06)</b>	<b>1.08 (1.06-1.10)</b>	<b>1.23 (1.21-1.25)</b>
<b>Age 1-4 years</b>					
Participants	2112/20117 (10.5%)	2340/20117 (11.6%)	3570/20117 (17.7%)	4336/20117 (21.6%)	7759/20117 (38.6%)
HR (95% CI)	1 (ref)	<b>0.92 (0.87-0.98)</b>	0.98 (0.92-1.03)	0.98 (0.93-1.04)	<b>1.20 (1.14-1.26)</b>
Adjusted HR (95% CI)	1 (ref)	<b>0.94 (0.88-0.996)</b>	<b>0.93 (0.88-0.99)</b>	<b>0.91 (0.86-0.96)</b>	1.01 (0.96-1.07)
<b>Under-1 year (&lt;365 days)</b>					
Participants	15718/149788 (10.5%)	19105/149788 (12.8%)	28142/149788 (18.7%)	33925/149788 (22.7%)	52898/149788 (35.3%)
HR (95% CI)	1 (ref)	1.00 (0.98-1.02)	<b>1.04 (1.02-1.06)</b>	<b>1.06 (1.04-1.08)</b>	<b>1.17 (1.14-1.19)</b>
Adjusted HR (95% CI)	1 (ref)	<b>1.03 (1.01-1.05)</b>	<b>1.05 (1.03-1.07)</b>	<b>1.10 (1.08-1.13)</b>	<b>1.28 (1.25-1.31)</b>
<b>Post-neonatal (28-364 days)</b>					
Participants	5343/46376 (11.5%)	6121/46376 (13.2%)	8759/46376 (18.9%)	10110/46376 (21.8%)	16043/46376 (34.6%)
HR (95% CI)	1 (ref)	<b>0.94 (0.91-0.97)</b>	<b>0.95 (0.92-0.99)</b>	<b>0.92 (0.89-0.96)</b>	<b>1.03 (1.003-1.07)</b>
Adjusted HR (95% CI)	1 (ref)	<b>0.96 (0.92-0.997)</b>	<b>0.93 (0.89-0.96)</b>	<b>0.89 (0.86-0.92)</b>	<b>0.96 (0.92-0.993)</b>
<b>Neonatal (from birth to 27 days)</b>					
Participants	10375/103412 (10.0%)	12984/103412 (12.6%)	19383/103412 (18.7%)	23815/103412 (23.1%)	36855/103412 (35.6%)
HR (95% CI)	1 (ref)	1.03 (0.999-1.05)	<b>1.09 (1.06-1.11)</b>	<b>1.12 (1.10-1.15)</b>	<b>1.24 (1.21-1.27)</b>
Adjusted HR (95% CI)	1 (ref)	<b>1.06 (1.03-1.09)</b>	<b>1.11 (1.08-1.14)</b>	<b>1.22 (1.18-1.25)</b>	<b>1.47 (1.43-1.51)</b>

Model adjusted for the variables: year of birth (triennium), mode of delivery, birth weight, gestational age, number of prenatal appointments according to gestational age, maternal age, number of living children, maternal race or skin colour, and Bolsa Familia Programme status. HR=hazard ratio.

## CONCLUSIONS

Our cohort database reflects the poorest half of the Brazilian population, yet significant disparities in childhood mortality rates persist among highly deprived municipalities. Although under-5 mortality in Brazil decreased until 2015, most deaths remain preventable, often due to life-threatening conditions at birth. The neonatal period accounts for about 55% of under-5 deaths, emphasizing the importance of pregnancy, childbirth, and postpartum care. Conversely, the survival of post-neonates and children aged 1-4 years is most affected by living conditions, income, education, sanitation, access to clean water, and healthcare services, improved by expanded primary care coverage.

This study underscores the need to sustain life-protecting policies and introduce new public policies addressing social determinants of health to ensure long-term impact on reducing childhood mortality and achieving the Sustainable Development Goals (SDGs).

## ADDITIONAL KEY INFORMATION

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