Nationwide routine data cohorts in Brazil: challenges and highlights

Mauricio Barreto, Maria Yury Ichihara, Julia Pescarini, Enny Paixao,
Daiane Machado, Elzo Pinto Junior and Denise Pimenta

WCE
WORLD CONGRESS OF EPIDEMIOLOGY 2024

Summary of presentation

Overview of routine social and health data in Brazil;

Process of creating two cohorts of linked routinely collected data from a middle-income country

Example of using the cohort to address pressing research problems

- Social determinants of health and health inequalities
- Infectious disease
- Evaluation of social policies
- Mental health
- Evaluation of health interventions

Public engagement

Future endeavours

Brazil in a nutshell

- A large South American country (8.5 million Km2)
- Population of ~215 million inhabitants (47% white, 52 % black, 0.5% indigenous, 0.5% other)
- Urban areas concentrate 84% of the population,
- Brazil is a federation composed of 26 states, one federal district, and the 5,570 municipalities
- High level of Social Inequality
- The climate of Brazil comprises a wide range of weather conditions
- Home to 60% of the Amazon rainforest, and great biodiversity

Cidacs: Center for the Integration of Data and Knowledge for Health

Cidacs is a center created to conduct and promote **interdisciplinary research** to produce **knowledge**, develop new scientific **methodologies** and promote professional **training** using linked large-scale databases and high-performance computational resources in a secure environment.

- **Founded: 2016**
- **TWO Cohorts of millions of Brazilian individuals**

International Journal of Population Data Science (2019) 4:2:04

International Journal of Population Data Science

Journal Website: www.ijpds.org

IJPDS International Journal of Population Data Science

Swansea University Prifysgol Abertawe

The Centre for Data and Knowledge Integration for Health (CIDACS): Linking Health and Social Data in Brazil

Barreto, ML[1,2*], Ichihara, MY[1,2], Almeida, BA[1], Barreto, ME[1,3], Cabral, L[1], Fiaccone, RL[1,4], Carreiro, RP[1], Teles, CAS[1], Pitta, R[1], Penna, GO[1,5,6], Barral-Netto, M[1], Ali, MS[1,7,8], Barbosa, G[1], Denaxas, S[9], Rodrigues, LC[1,8], and Smeeth, L[1,8]

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Brazil Health and Social Data Ecosystem

Administrative data generated by government agencies are received, processed, linked and used to create specific cohorts, which may later support research initiatives in a variety of areas related to public health

Social and Health Policies

Health Outcomes

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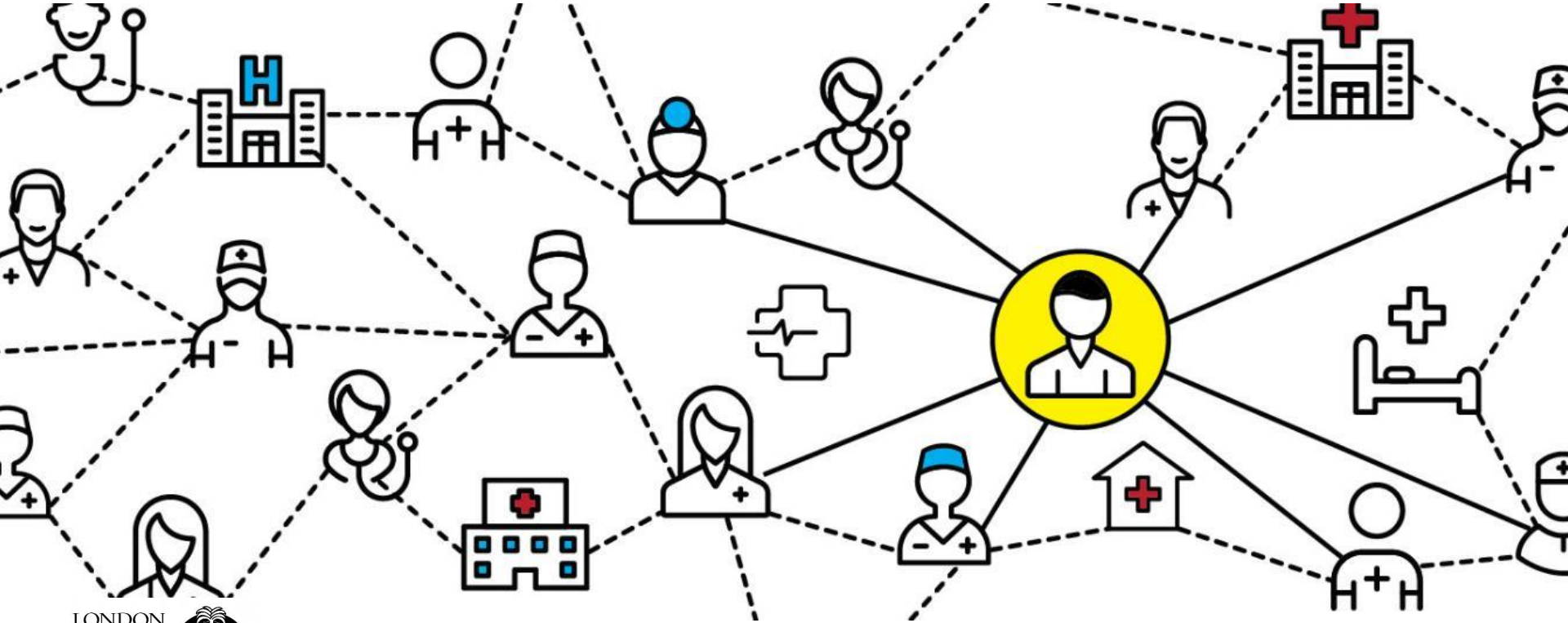
Fragmentation



Data linkage

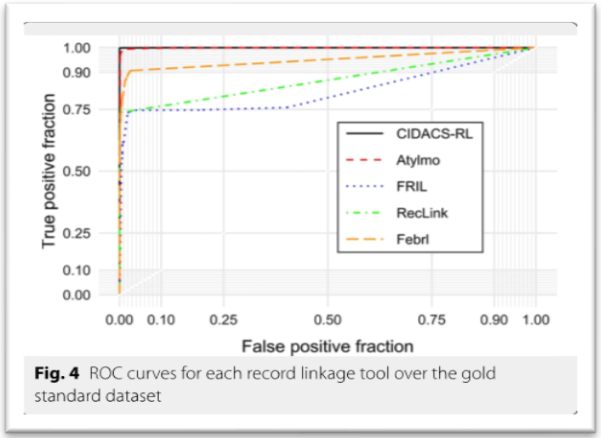
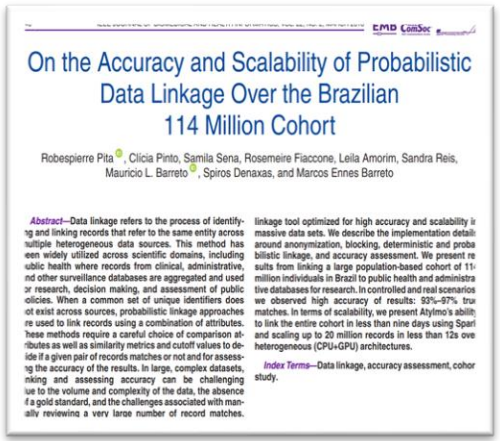


Fig. 4 ROC curves for each record linkage tool over the gold standard dataset



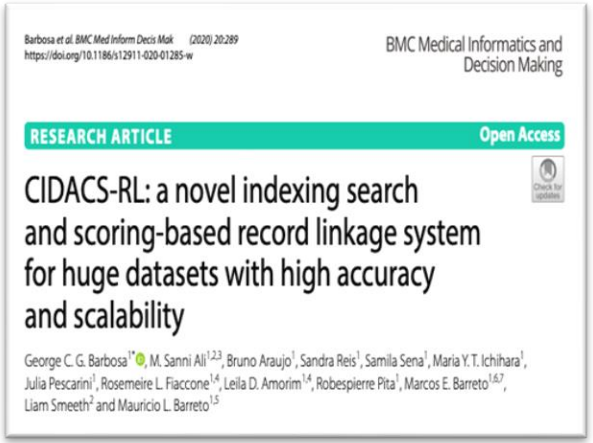
On the Accuracy and Scalability of Probabilistic Data Linkage Over the Brazilian 114 Million Cohort

Robespierre Pita, Clicia Pinto, Samila Sena, Rosemeire Fiaccone, Leila Amorim, Sandra Reis, Mauricio L. Barreto, Spiros Denaxas, and Marcos Ennes Barreto

Abstract—Data linkage refers to the process of identifying and linking records that refer to the same entity across multiple heterogeneous data sources. This method has been widely utilized across scientific domains, including public health where records from clinical, administrative, and other surveillance databases are aggregated and used for research, decision making, and assessment of public policies. When a common set of unique identifiers does not exist across sources, probabilistic linkage approaches are used to link records using a combination of attributes. These methods require a careful choice of comparison attributes as well as similarity metrics and cutoff values to decide if a given pair of records matches or not and for assessing the accuracy of the results. In large, complex datasets, linking and assessing accuracy can be challenging due to the volume and complexity of the data, the absence of a gold standard, and the challenges associated with manually reviewing a very large number of record matches.

linkage tool optimized for high accuracy and scalability in massive data sets. We describe the implementation details around anonymization, blocking, deterministic and probabilistic linkage, and accuracy assessment. We present results from linking a large population-based cohort of 11 million individuals in Brazil to public health and administrative databases for research. In controlled and real scenarios we observed high accuracy of results: 93%–97% true matches. In terms of scalability, we present Atylmo's ability to link the entire cohort in less than nine days using Spark and scaling up to 20 million records in less than 12s over heterogeneous (CPU+GPU) architectures.

Index Terms—Data linkage, accuracy assessment, cohort study.



Barbosa et al. BMC Med Inform Decis Mak (2020) 20:289
https://doi.org/10.1186/s12911-020-01285-w

BMC Medical Informatics and Decision Making

RESEARCH ARTICLE Open Access

CIDACS-RL: a novel indexing search and scoring-based record linkage system for huge datasets with high accuracy and scalability

George C. G. Barbosa, M. Sanni Ali, Bruno Araujo, Sandra Reis, Samila Sena, Maria Y. T. Ichihara, Julia Pescarini, Rosemeire L. Fiaccone, Leila D. Amorim, Robespierre Pita, Marcos E. Barreto, Liam Smeeth and Mauricio L. Barreto

Table 1 Threshold analysis for each record linkage tool

Method*	Threshold (TH)	Pairs above TH	Sensitivity	Specificity	FPs above TH	FNs below TH(%)	PPV
CIDACS-RL	0.8827056	3026 (46.86)	99.87	99.94	2 (0.07)	4 (0.13)	99.93
Atylmo	8777	3005 (46.54)	98.91	99.39	21 (0.70)	33 (1.09)	99.30
RecLink	0.8075590	2243 (34.74)	73.75	99.71	10 (0.45)	795 (26.25)	99.55
Febrl	3722604	2832 (43.86)	90.58	97.40	89 (3.14)	285 (9.41)	96.86
FRILL	48	2351 (36.41)	74.66	97.36	90 (3.83)	767 (25.33)	96.17

*Execution time (in minutes): CIDACS-RL < 1, Atylmo = 28, RecLink < 1, FRIL = 7, and Febrl = 130

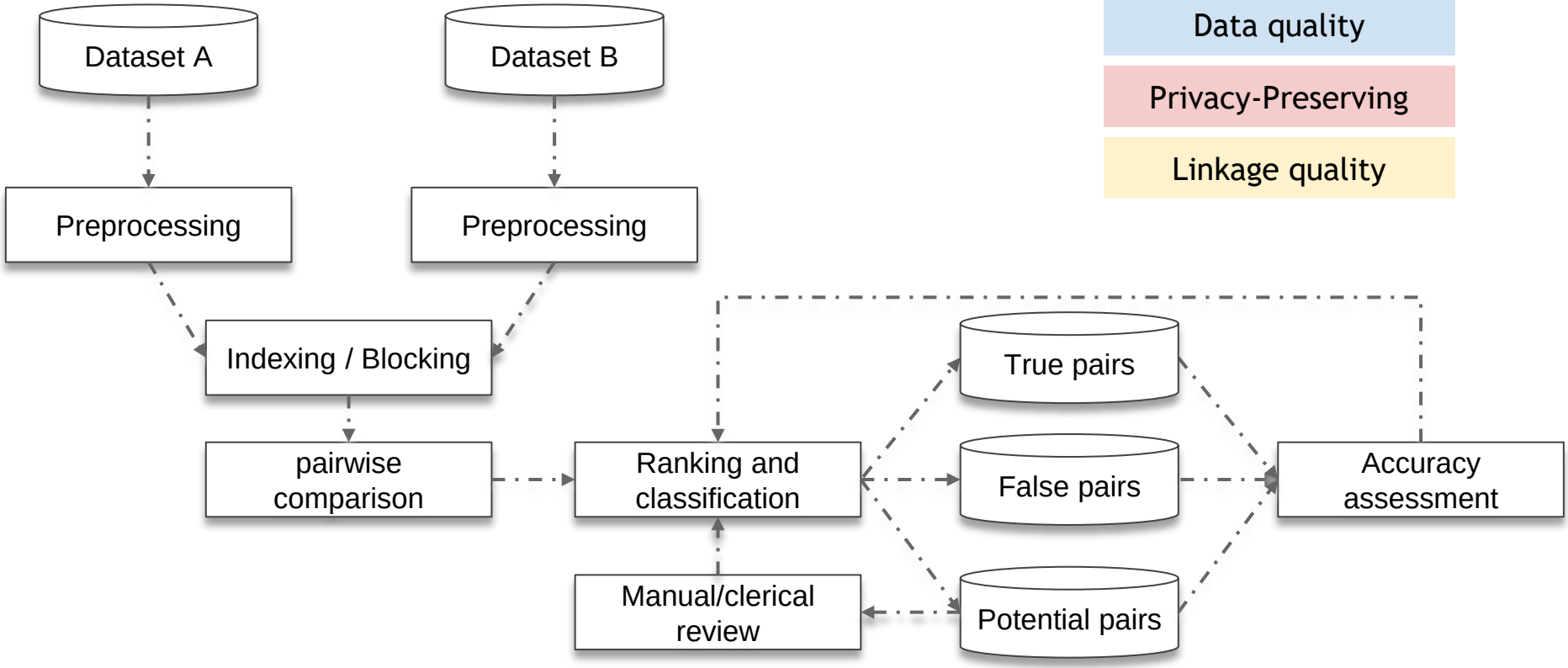
Typical record linkage pipeline

Scalability

Data quality

Privacy-Preserving

Linkage quality



Generic pipeline of a score-based record linkage

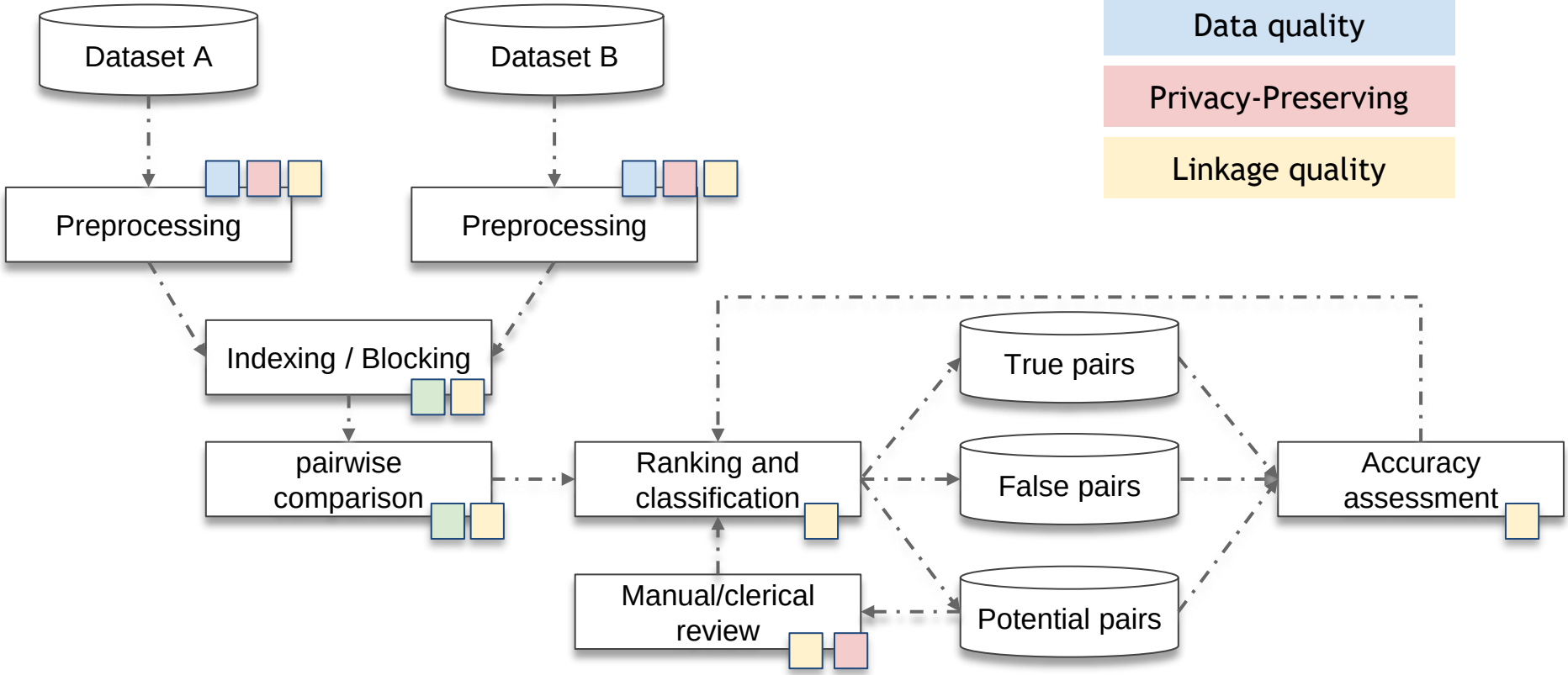
Typical record linkage pipeline

Scalability

Data quality

Privacy-Preserving

Linkage quality



Generic pipeline of a score-based record linkage process/algorithm

cidacsRL

Data quality heterogeneity

Scalability

Accuracy

Bias

a novel iterative deterministic record linkage algorithm based on a combination of indexing search and scoring algorithms (provided by Elasticsearch) [...] for huge datasets, with higher accuracy, improved scalability, and substantially shorter execution time compared to other existing linkage tools.

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CIDACS-RL: a novel indexing search and scoring-based record linkage system for huge datasets with high accuracy and scalability

George C. G. Barbosa, M. Sanni Ali, Bruno Araujo, Sandra Reis, Samila Sena, Maria Y. T. Ichihara, Julia Pescarini, Rosemeire L. Fiaccone, Leila D. Amorim, Robespierre Pita, Marcos E. Barreto, Liam Smeeth & Mauricio L. Barreto

BMC Medical Informatics and Decision Making **20**, Article number: 289 (2020) | Cite this article

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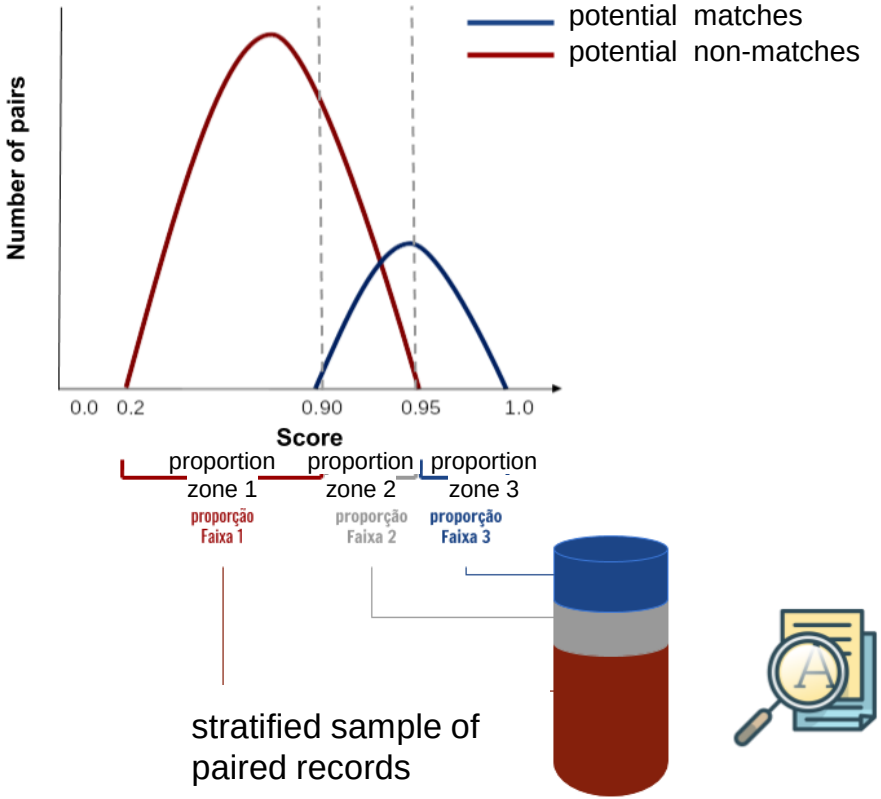
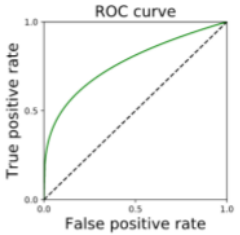
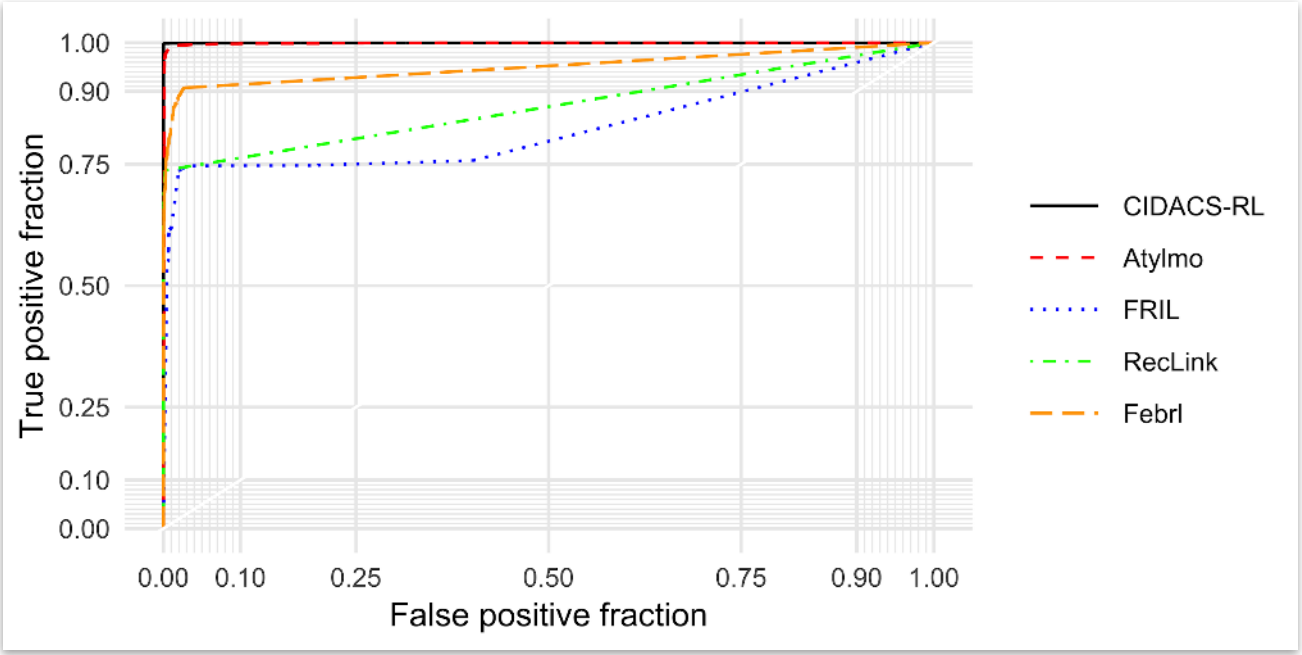
- Data quality heterogeneity
- Scalability
- Accuracy
- Bias





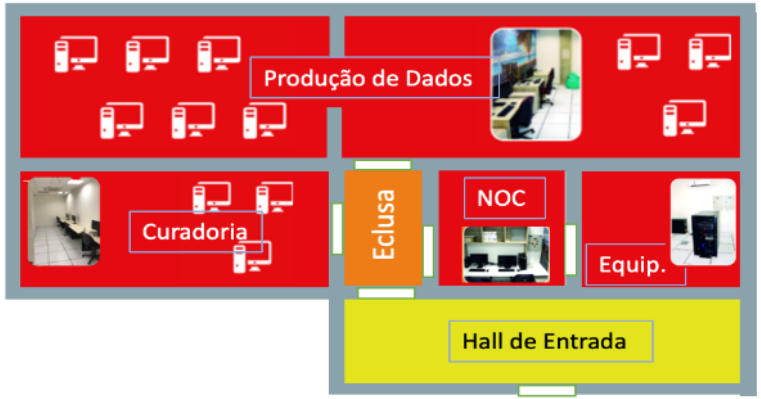
cidacsRL

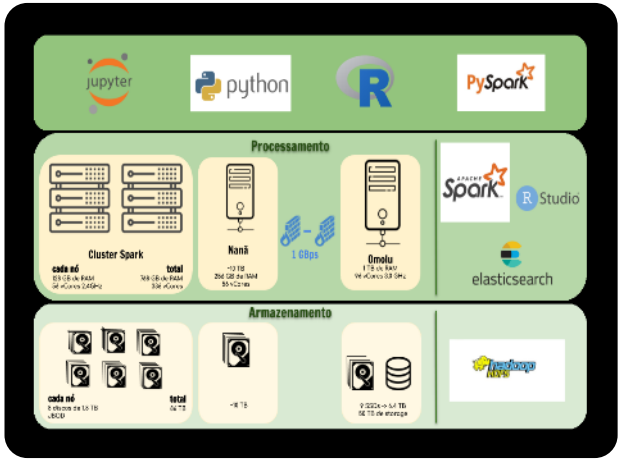
- Data quality heterogeneity
- Scalability
- Accuracy
- Bias



Computational resources

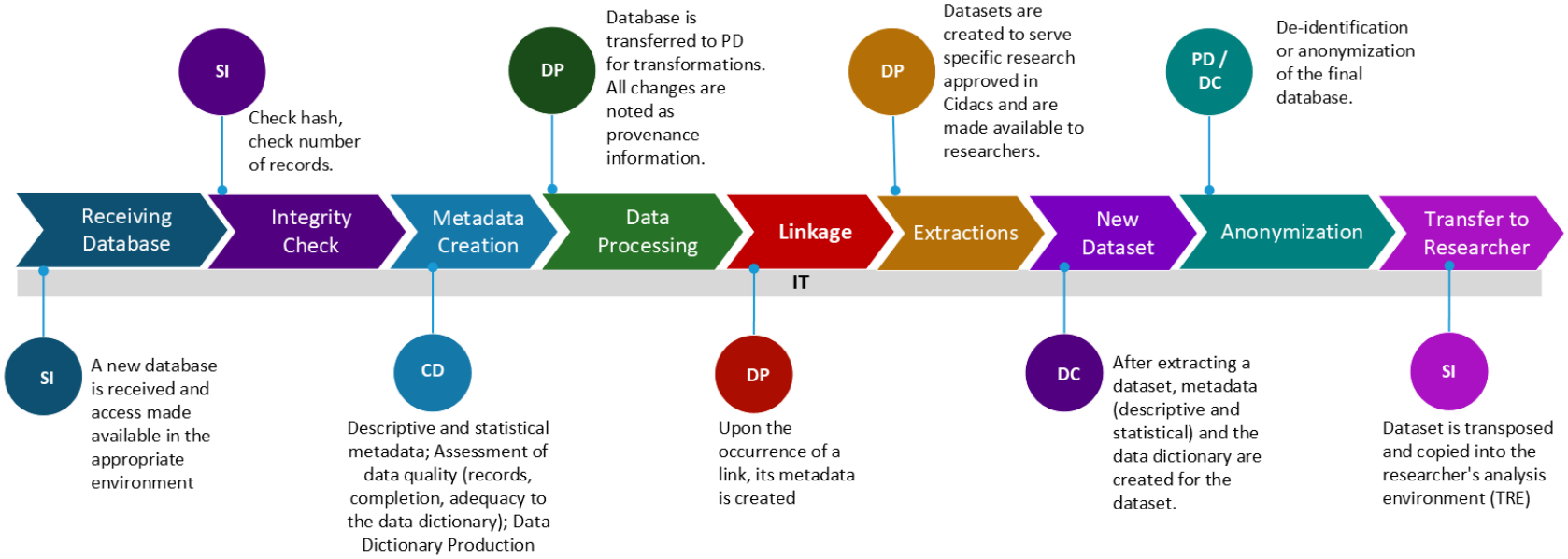
Safety room for data integration





Datacenter Container

Overall data management workflow



Legend:
DC – Data Curatorship Team
SI – Security Information Team
DP – Data Production Team
IT – Information Tecnological Team

Unified Registry for Social Programmes (CadUnico)

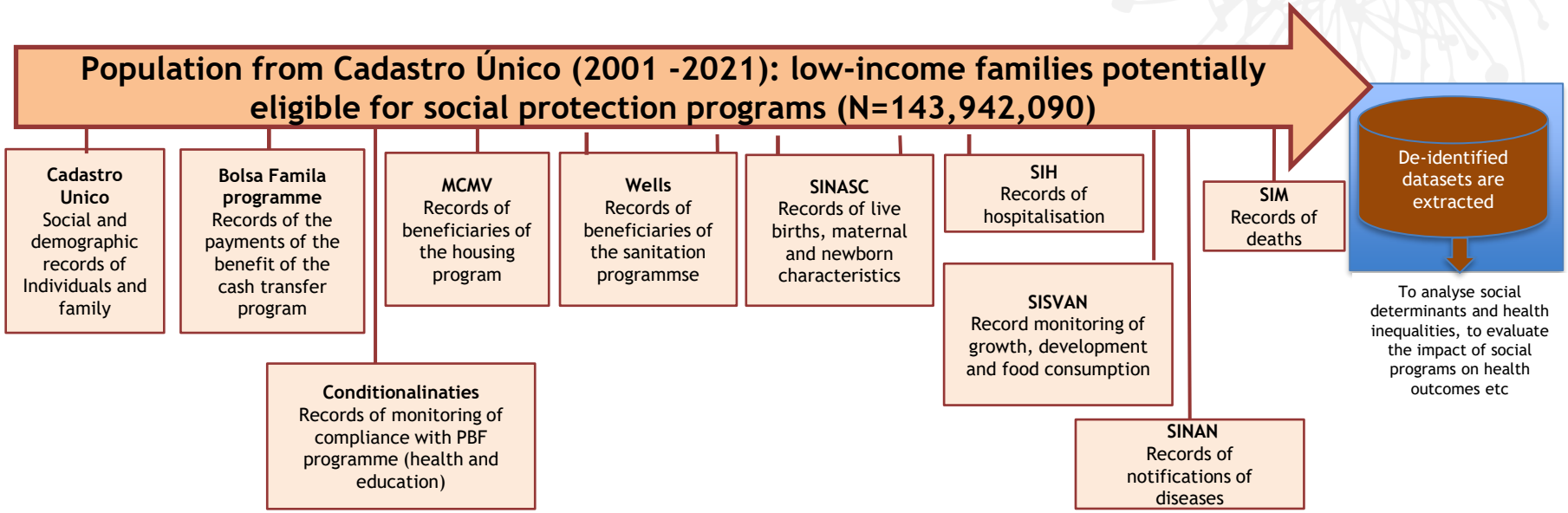
- Open/dynamic cohort from 2001 to 2021
- Cohort baseline: First registry of each individual and their family in CadÚnico

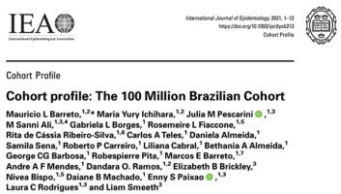
Coorte de 100 milhões de brasileiras

Individual level variables
✓ Age (at time of application)
✓ Sex
✓ Marital status
✓ Relationship to the person responsible for the household
✓ Race/Ethnicity
✓ Literacy status
✓ Level of education
✓ Employment status
✓ Household income (monthly)
✓ Individual income (monthly)
✓ Indigenous, *quilombola*, and other traditional population groups
✓ Experiencing homelessness?
✓ Place of birth

bles
f family residence
y residence
ily residence
ooring material
✓ Household type
✓ Household water supply
✓ Sewage disposal system
✓ Electricity
✓ Waste collection
✓ Sidewalks around household
✓ Number of individuals in the household
✓ Number of rooms in the household

The 100 million Brazilians Cohort





Cohort Profile

Cohort profile: The 100 Million Brazilian Cohort

Mauricio L Barreto,[1,2]* Maria Yury Ichihara,[1,2] Julia M Pescarini,[1,3] M Sanni Ali,[1,3,4] Gabriela L Borges,[1] Rosemeire L Fiaccone,[1,5] Rita de Cássia Ribeiro-Silva,[1,6] Carlos A Teles,[1] Daniela Almeida,[1] Samila Sena,[1] Roberto P Carreiro,[1] Liliana Cabral,[1] Bethania A Almeida,[1] George CG Barbosa,[1] Robespierre Pita,[1] Marcos E Barreto,[1,7] Andre A F Mendes,[1] Dandara O. Ramos,[1,2] Elizabeth B Brickley,[2] Nivea Bispo,[1,5] Daiane B Machado,[1] Enny S Paixao,[1,3] Laura C Rodrigues[1,3] and Liam Smeeth[3]

Who is in the cohort?

Open/dynamic cohort from 2001 to 2018

Cohort baseline: First registry of each individual and its family in Cadastro Único

Young population (at entry)

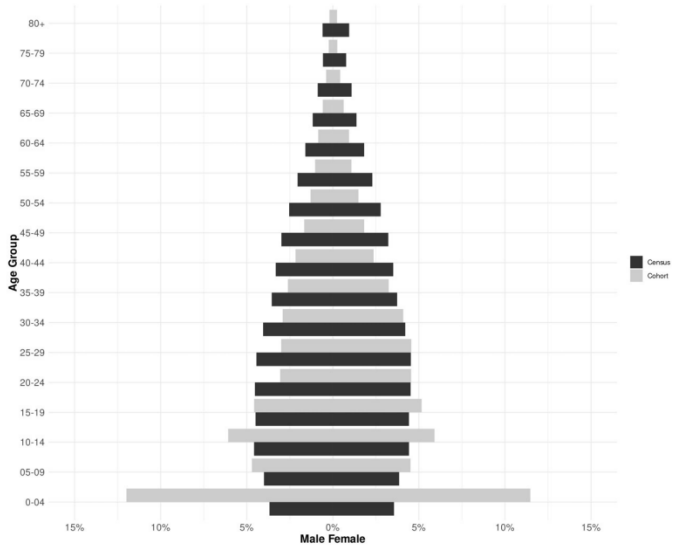


Figure 2 Comparison of the age and sex structure of the 100 Million Brazilian Cohort population ($N = 131\,697\,800$) and the Brazilian population for 2010 ($N = 190\,732\,694$)

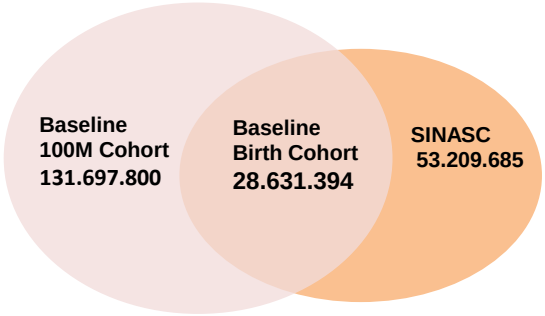
Characteristics	N	%
Social and Demographic		
Sex (N=131,697,800)		
Male	62671718	47.6
Female	69026082	52.4
Race/Ethnicity (N=131,697,800)		
White	40473922	30.7
Black	8696072	6.6
Brown	73478974	55.8
Asian	537530	0.4
Indigenous	769372	0.6
Missing	7741930	5.9
Residence (N=131,697,800)		
Urban	96864452	73.5
Rural	31425827	23.9
Missing	3407521	2.6
Schooling for individuals ≥ 16 years of age (N=70,063,532)		
Never Attended School	8577155	12.2
Preschool	120598	0.2
Literacy year (year before elementary school)	580315	0.8
Elementary School	20635490	29.5
Middle School	15924112	22.7
High School	13456622	19.2
Higher Education	1356688	1.9
Missing/Invalid	9412552	13.4

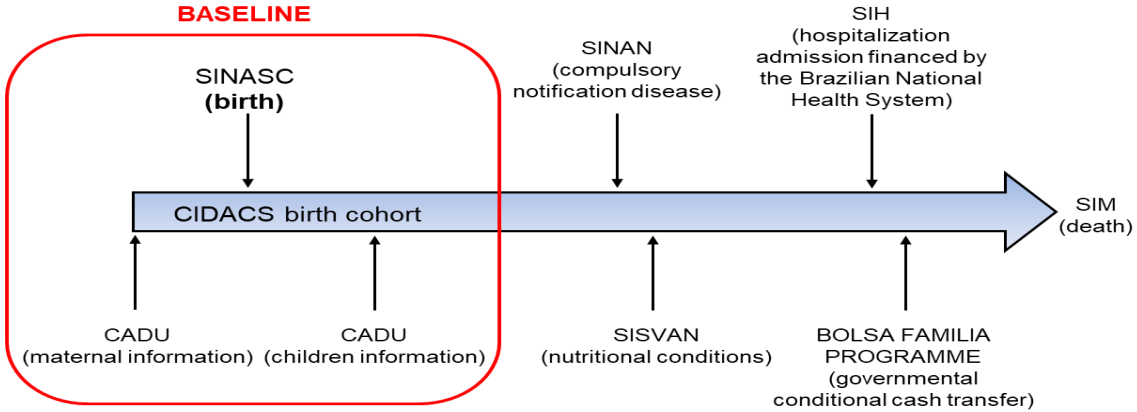
Cidacs Birth Cohort

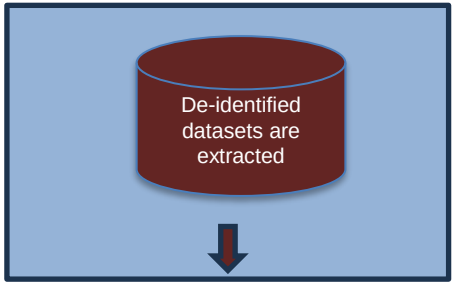
International Journal of Epidemiology, 2021, 37–38h
doi: 10.1093/ije/dyaa255
Advance Access Publication Date: 30 December 2020
Cohort Profile

Cohort Profile

Cohort Profile: Centro de Integração de Dados e Conhecimentos para Saúde (CIDACS) Birth Cohort







Describe the relationships between prenatal events and early childhood development and examine key factors that influence child and maternal well-being over time

Cidacs Birth Cohort

The characteristics of mothers and children in the CIDACS Birth Cohort were compared with the characteristics of the non-linked population of mothers and children registered in SINASC.

mothers are younger and unmarried

mothers with 8 years or more of schooling

Children were more likely vaginal delivery

Children from minority ethnic backgrounds were included in the cohort.

- 83413 Indigenous children

- 37441 children born in Quilombo communities descended from African Brazilian fugitive slaves

Characteristics	Births outside CIDACS cohort		CIDACS birth cohort	
	n	(%)	*n*	(%)
Maternal age				
8–20 years	3 010 017	15.23	6 159 307	24.95
20–34 years	14 225 523	71.99	16 499 140	66.84
35–49 years	2 524 681	12.78	2 024 292	8.20
Missing/inconsistent	29 429	0.15	12 878	0.05
Marital status				
Single/widow/divorced	8 361 271	42.95	14 072 538	58.02
Married/union	11 104 701	57.05	10 181 772	41.98
Missing/inconsistent	323 678	1.64	441 307	1.79
Maternal education				
None	323 204	1.67	530 371	2.20
1–3 years	1 264 181	6.55	2 418 072	10.04
4–7 years	4 353 070	22.55	8 558 396	35.54
≥8 years	13 360 026	69.22	12 574 177	52.22
Missing/inconsistent	489 169	2.47	614 601	2.49
Method of delivery				
Vaginal	8 341 386	42.25	14 668 584	59.52
Caesarean section	11 400 142	57.75	9 975 810	40.48
Missing/inconsistent	48 122	0.24	51 223	0.21

Key research agenda

- Social and Environmental Determinants of Health and Health Inequalities
- Infectious disease in the general and vulnerable population
- Assessment of the Impact of Social Policies on Health
- Assessment of the Impact of Health Programs and Interventions
- Data Governance, Science and Society
- Knowledge Dissemination and Societal Engagement

Social inequalities in health in Brazil: Evidences from the use of Cidacs Epidemiological Cohorts

Dr Maria Yury T Ichihara

Social inequalities on health in Brazil

Population living below the poverty line

The richest 1% of Brazilians earn an average monthly income 32.5 times greater than the income of the poorest half of the country's population (IBGE, 2022)

Source: World Bank. PovcalNet: an online analysis tool for global poverty monitoring. 2020. Available at: http://iresearch.worldbank.org/PovcalNet/home.aspx. Accessed 16 November 2022.
Notes: Percentage (%) of population living on less than US$1.90 or less than US$3.20 per day, based on 2011 purchasing power parity (PPP), up to 2020. See Methodology for more information on the indicators.

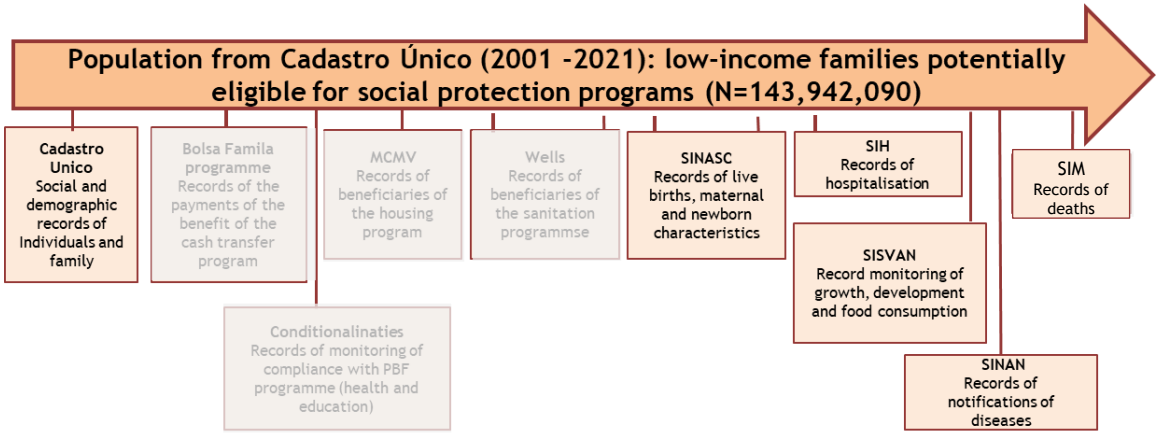
Experiences of ***discrimination and racism*** are important social determinants of health for certain groups such as Black and Indigenous Peoples, LGBTQ and others;

In Brazil, ***social injustices*** lead to poor outcomes in maternal and child health for Black and Indigenous populations, including greater risks of pregnancy-related complications; decreased access to antenatal, delivery, and postnatal care; and higher childhood mortality rates

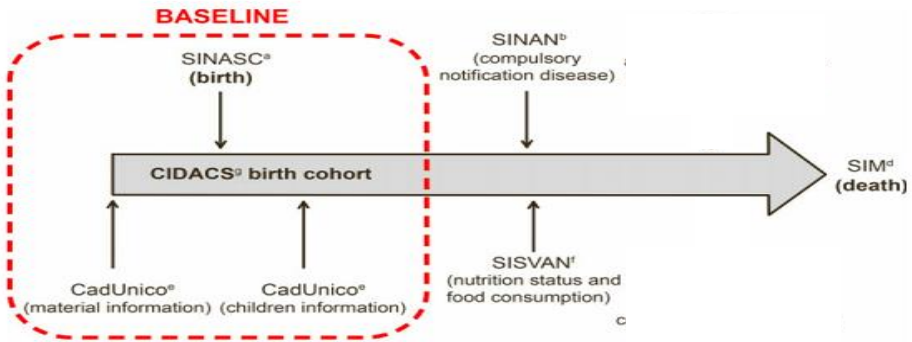
Inequalities can be assessed through analyzing disaggregated data

Analysis of the effects of sociodeterminants and inequalities on health using Cidacs Epidemiological Cohorts

Coorte de 100 milhões de brasileiros



Coorte de Nascimentos



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Social determinants related to AIDS-related outcomes

The effects of social determinants of health on acquired immune deficiency syndrome in a low-income population of Brazil: a retrospective cohort study of 28.3 million individuals

Inaconma Luz,[a,b] Andrea F. Silva,[a,c] Nathalia S. Guimarães,[a] Laio Magno,[d] Julia Pescarini,[c,e] Rodrigo V. R. Anderle,[a] Maria Yury Ichihara,[a] Mauricio L. Barreto,[a,c] Carlos A. S. Teles Santos,[a] Louisa Chencinер,[f,g,h] Luis Eugênio Souza,[a] James Macinko,[i] Ines Dourado,[a] and Davide Rasella[a,j,*]

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The Lancet Regional Health - Americas 2023;24: 100554
Published Online 17 July 2023
https://doi.org/10.1016/j.lana.2023.100554

Summary

Background Social determinants of health (SDH) include factors such as income, education, and race, that could significantly affect the human immunodeficiency virus and acquired immunodeficiency syndrome (HIV/AIDS). Studies on the effects of SDH on HIV/AIDS are limited, and do not yet provide a systematic understanding of how the various SDH act on important indicators of HIV/AIDS progression. We aimed to evaluate the effects of SDH on AIDS morbidity and mortality.

Methods A retrospective cohort of 28.3 million individuals was evaluated over a 9-year period (from 2007 to 2015). Multivariable Poisson regression, with a hierarchical approach, was used to estimate the effects of SDH—at the individual and familial level—on AIDS incidence, mortality, and case-fatality rates.

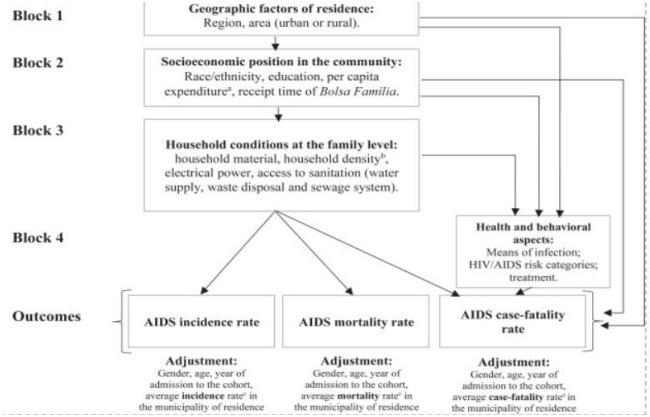
Findings A total of 28,318,532 individuals, representing the low-income Brazilian population, were assessed, who had a mean age of 36.18 (SD: 16.96) years, 52.69% (14,920,049) were female, 57.52% (15,360,569) were pardos, 34.13% (9,113,222) were white/Asian, 7.77% (2,075,977) were black, and 0.58% (154,146) were indigenous. Specific socioeconomic, household, and geographic factors were significantly associated with AIDS-related outcomes. Less wealth was strongly associated with a higher AIDS incidence (rate ratios—RR: 1.55; 95% confidence interval—CI: 1.43–1.68) and mortality (RR: 1.99; 95% CI: 1.70–2.34). Lower educational attainment was also greatly associated with higher AIDS incidence (RR: 1.46; 95% CI: 1.26–1.68), mortality (RR: 2.76; 95% CI: 1.99–3.82) and case-fatality rates (RR: 2.30; 95% CI: 1.31–4.01). Being black was associated with a higher AIDS incidence (RR: 1.53; 95% CI: 1.45–1.61), mortality (RR: 1.69; 95% CI: 1.57–1.83) and case-fatality rates (RR: 1.16; 95% CI: 1.03–1.32). Overall, also considering the other SDH, individuals experiencing greater levels of socioeconomic deprivation were, by far, more likely to acquire AIDS, and to die from it.

Interpretation In the population studied, SDH related to poverty and social vulnerability are strongly associated with a higher burden of HIV/AIDS, most notably less wealth, illiteracy, and being black. In the absence of relevant social protection policies, the current worldwide increase in poverty and inequalities—due to the consequences of the COVID-19 pandemic, and the effects of war in the Ukraine—could reverse progress made in the fight against HIV/AIDS in low- and middle-income countries (LMIC).

Funding National Institute of Allergy and Infectious Diseases (NAIDS), National Institutes of Health (NIH), US Grant Number: 1R01AI152938.

28.3 million Brazilians records, from 2007 to 2015

HIV/AIDS alone has caused more than 40.1 million deaths worldwide since its onset



Illiterate people had:

46% higher risk of becoming an **AIDS case**
176% higher risk of an AIDS-related death and
130% higher case-fatality rate among PLWA compared to those with completed higher education

Black people had:

53% higher risk of becoming an AIDS case
69% higher risk of an AIDS-related death and Among PLWA, individuals, **16% higher case-fatality rates** than those who self-identified as white or of Asian heritage

Inequalities on perinatal outcomes among international migrants

Travel Medicine and Infectious Disease
Volume 57, January–February 2024, 102672

Perinatal health outcomes of international migrant women in Brazil: A nationwide data linkage study of the CIDACS birth cohort (2011–2018)

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Abstract

Background

We investigated perinatal outcomes among live births from international migrant and local-born mothers in a cohort of low-income individuals in Brazil.

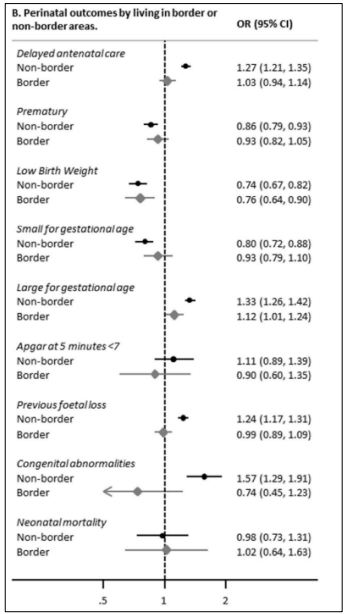
Methods

We linked nationwide birth registries to mortality records and socioeconomic data from the CIDACS Birth Cohort and studied singleton live births of women aged 10–49 years from 1st January 2011 to 31st December 2018. We used logistic regressions to investigate differences in antenatal care, adverse pregnancy outcomes, and neonatal (i.e., ≤28 days) mortality among international migrants compared to non-migrants in Brazil; and explored the interaction between migration, race/ethnicity and living in international border municipalities.

Results

We studied 10,279,011 live births, of which 9469 (0.1%) were born to international migrants. Migrant women were more likely than their Brazilian-born counterparts to have a previous foetal loss (ORadj: 1.16, 1.11–1.22), a delayed start of antenatal care (i.e., beyond 1st trimester) (1.22, 95%CI:1.16–1.28), a newborn who is large for gestational age (1.29, 1.22–1.36), or a newborn with congenital anomalies (1.37, 1.14–1.65). Conversely, migrant women were less likely to deliver prematurely (0.89, 0.82–0.95) or have a low birth weight infant (0.74, 0.68–0.81). There were no differences in neonatal mortality

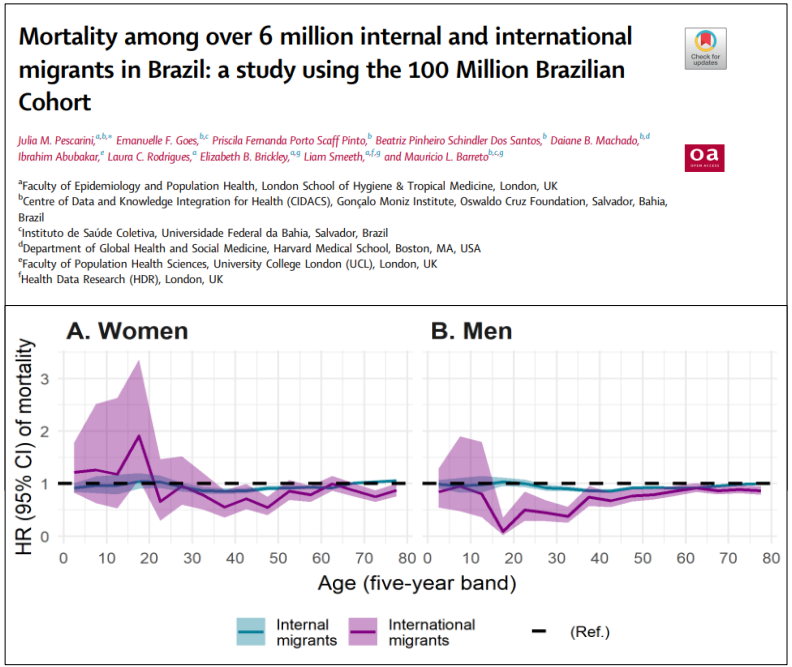
From **more than 10 million live births**, 9469 were born to international migrants



- **Migrant pregnant people:** higher risk of previous stillbirth, less access to antenatal care, and ther children with higher rates on congenital abnormalities.
- **Indigenous migrants living in bordering municipalities:** higher risk for poor perinatal outcomes than their Brazilian-born counterparts
- **Live births from Black pregnant migrants living in non-border municipalities:** greater risk of congenital abnormalities and neonatal mortality.

cidacs Centro de Integração de Dados e Conhecimentos para Saúde | FIOCRUZ | Bahia

Inequalities of all-cause and cause-specific age-standardised mortality rates among migrants



Mortality among over 6 million internal and international migrants in Brazil: a study using the 100 Million Brazilian Cohort

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Age specific crude HR for all-cause mortality

- **Internal migrants:** similar all-cause mortality but variations by migration status, age, and sex for specific causes of death

  Internal migrant **males and females** generally have **lower mortality** rates over the different age groups

- **International migrants:** young international migrant women had higher mortality rates, especially for maternity-related causes than their Brazilian-born counterparts.

  International migrant **men** had lower violence-related mortality rates

Social determinants on small newborns mortality

The Lancet Regional Health - Americas 3 (2021) 100045

Contents lists available at ScienceDirect

The Lancet Regional Health - Americas

journal homepage: www.elsevier.com/locate/lana

Research paper

Risk of mortality for small newborns in Brazil, 2011-2018: A national birth cohort study of 17.6 million records from routine register-based linked data

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ARTICLE INFO

Article history:
Received 24 June 2021
Revised 19 July 2021
Accepted 6 August 2021
Available online 20 August 2021

ABSTRACT

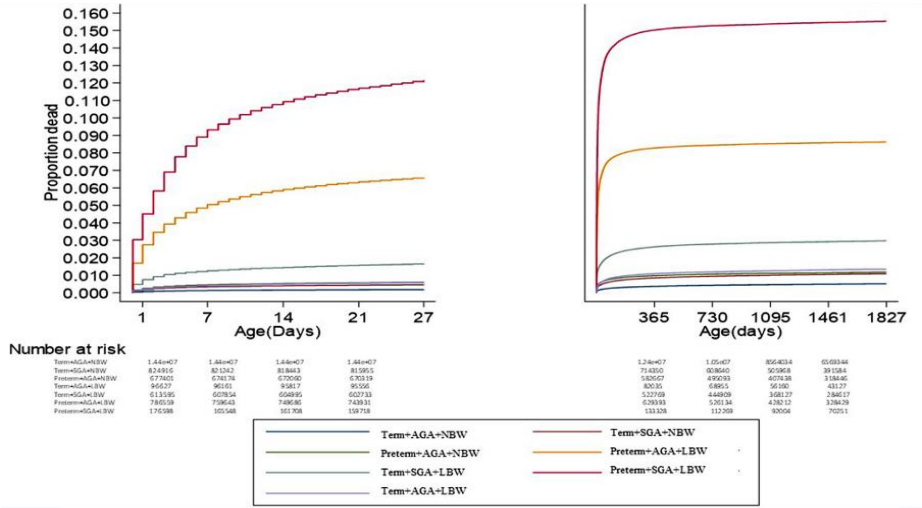
Background: Preterm birth (<37 weeks), low birth weight (LBW,<2500g), and small for gestational age (SGA,<10th centile of birth weight for gestational age and sex) are markers of newborn vulnerability with a high risk of mortality. We estimated the prevalence of phenotypes combining these three markers and quantified the mortality risk associated with them.

Methods: Population-based cohort study using routine register-based linked data on all births and deaths in Brazil from January 1, 2011, to December 31, 2018. We estimated the prevalence of preterm, LBW, and SGA individually and for phenotypes combining these characteristics. The mortality risk associated with each phenotype: early neonatal, late neonatal, post-neonatal, infant, 1–4 years, and under five years was quantified using mortality rates and hazard ratios (HRs) with 95% confidence interval (CI) were estimated using Cox proportional hazard models.

Findings: 17,646,115 live births were included. Prevalence of preterm birth, LBW and SGA were 9.4%, 9.6% and 9.2%, respectively. Neonatal mortality risk was 16-fold (HR=15.9; 95% CI:15.7–16.1) higher for preterm compared to term, 3 times higher (HR=3.4; (95% CI:3.3–3.4) for SGA compared to adequate for gestational age (AGA), and >25 times higher for LBW (HR=25.8; (95% CI:25.5-26.1) compared to normal birth weight (NBW). 18% of all live births were included in one of the small vulnerable newborn phenotypes. Of those 8.2% were term-SGA (4.7%NBW, 3.5%LBW), 0.6% were term-AGA-LBW, 8.3% preterm-AGA (3.8%NBW, 4.5%LBW) and 1.0% preterm-SGA-LBW. Compared to term-AGA-NBW, the highest mortality risk was for preterm-LBW phenotypes (HR=36.2(95%CI 35.6-36.8) preterm-AGA-LBW, HR=62.0(95%CI 60.8–63.2) preterm-SGA-LBW). The increased mortality risk associated with vulnerable newborn phenotypes was highest in the first month of life, with attenuated but continued high risk in the post-neonatal period and 1–4 years of age.

17,64 million live births were included (2011-2018)
Detailed evidences of vulnerable newborn phenotypes by combining preterm, SGA, and LBW

The prevalence of prematurity, SGA and LBW was higher in mothers **younger than 20 years** (20.7%) and **older than 35 years** (20.3%), among **indigenous and black** (22.2%; 20.2% respectively), **widows and single mothers** (19.4%; 19.0% respectively), and **less educated women** (25.4%)



Preterm, LBW and SGA newborns, simultaneously, were the most vulnerable, with **62 times greater mortality risk** compared to term babies who were not LBW or SGA

Growth trajectories of children in a LMIC: changes in Brazilian context

Recent changes in growth trajectories: a population-based cohort study of over 5 million Brazilian children born between 2001 and 2014

Carolina Santiago-Vieira,[a,c,e] Gustavo Velasquez-Melendez,[a] Rita de Cássia Ribeiro-Silva,[b,c] Elizabete de Jesus Pinto,[d,c] Maurício L. Barreto,[c] and Leah Li[f,*]

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Summary

Background There is limited evidence on recent trends in childhood growth trajectories in Low-/middle-income countries. We investigated how age-trajectories for height and Body Mass Index (BMI) have changed among Brazilian children born in two different time periods after 2000.

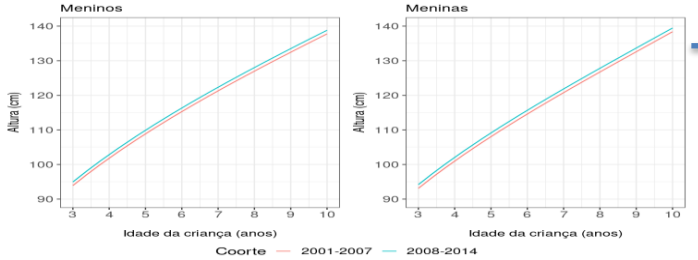
Methods We used a population-based cohort (part of the "Cohort of 100-Million Brazilians") created by the linkage of three Brazilian administrative databases: the Cadastro Único of the Federal Government, the National System of Live Births and the National Nutritional and Food Surveillance System. We included longitudinal data on 5,750,214 children who were 3 to <10 years of age and born between 2001 and 2014 (20,209,133 observations). We applied fractional polynomial models with random-effects to estimate mean height and BMI trajectories for children.

Findings Compared to children born in 2001–2007, the cohort born in 2008–2014 were on average taller, by a z-score of 0.15 in boys and 0.12 in girls. Their height trajectories shifted upwards, by approximately 1 cm in both sexes. Levels of BMI increased little, by a z-score of 0.06 (boys) and 0.04 (girls). Mean BMI trajectories also changed little. However, the prevalence of overweight/obesity increased between cohorts, e.g., from 26.8% to 30% in boys and 23.9%–26.6% in girls aged between 5 and <10 years.

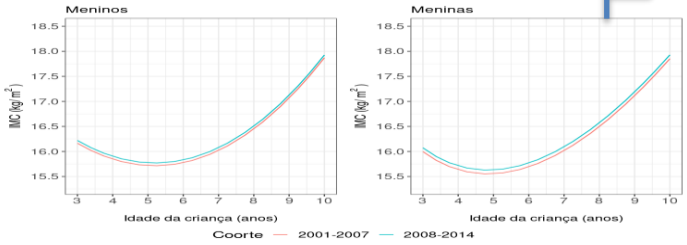
Interpretation An increase of 1 cm in mean height of Brazilian children during a short period indicates the improvement in maternal and child health, especially those from low-income families due to the new health and welfare policies in Brazil. Although mean BMI changed little, the prevalence of child overweight/obesity slightly increased and remained high.

Funding This work was supported by National Council for Scientific and Technological Development – CNPq; Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – CAPES; National Institute for Health Research (NIHR) Great Ormond Street Hospital Biomedical Research Centre; Society for the Study of Human Biology; Fundação de Amparo à Pesquisa do Estado de Minas Gerais – FAPEMIG; Departamento de Ciência e Tecnologia da Secretaria de Ciência, Tecnologia, Inovação e Complexo da Saúde do Ministério da Saúde - Decit/SECTICS/MS. The study also used resources from the Centre for Data and Knowledge Integration for Health (CIDACS), which receives funding from the Bill & Melinda Gates Foundation, the Wellcome Trust, the Health Surveillance Secretariat of the Ministry of Health and the Secretariat of Science and Technology of the State of Bahia (SECTI-BA).

A population cohort of 5.75 million Brazilian children aged 3 to under 10 years (2001-2014)



Height increased by 1 cm on average



0,08 kg/m2

The prevalence of child overweight remained high with a small increase

There is a need to develop strategies for interventions early in life to prevent the development of obesity

Ethnoracial inequalities on adverse birth and neonatal outcomes

Ethno-racial inequalities on adverse birth and neonatal outcomes: a nationwide, retrospective cohort study of 21 million Brazilian newborns

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The Lancet Regional Health - Americas 2024;37: 100833
Published Online xxx https://doi.org/10.1016/j.lana.2024.100833

Summary

Background Ethno-racial inequalities are critical determinants of health outcomes. We quantified ethnic-racial inequalities on adverse birth outcomes and early neonatal mortality in Brazil.

Methods We conducted a cohort study in Brazil using administrative linked data between 2012 and 2019. Estimated the attributable fractions for the entire population (PAF) and specific groups (AF), as the proportion of each adverse outcome that would have been avoided if all women had the same baseline conditions as White women, both unadjusted and adjusted for socioeconomics and maternal risk factors. AF was also calculated by comparing women from each maternal race/skin colour group in different groups of mothers' schooling, with White women with 8 or more years of education as the reference group and by year.

Findings 21,261,936 newborns were studied. If all women experienced the same rate as White women, 1.7% of preterm births, 7.2% of low birth weight (LBW), 10.8% of small for gestational age (SGA) and 11.8% of early neonatal deaths would have been prevented. Percentages preventable were higher among Indigenous (22.2% of preterm births, 17.9% of LBW, 20.5% of SGA and 19.6% of early neonatal deaths) and Black women (6% of preterm births, 21.4% of LBW, 22.8% of SGA births and 20.1% of early neonatal deaths). AF was higher in groups with fewer years of education among Indigenous, Black and *Parda* for all outcomes. AF increased over time, especially among Indigenous populations.

Interpretation A considerable portion of adverse birth outcomes and neonatal deaths could be avoided if ethnic-racial inequalities were non-existent in Brazil. Acting on the causes of these inequalities must be central in maternal and child health policies.

Funding Bill & Melinda Gates Foundation and Wellcome Trust.

Keywords: Low birth weight; Prematurity; Small for gestational age; Newborn; Health inequalities

Introduction

Racial inequalities are a persistent barrier to maternal and child health in Brazil. With adverse outcomes disproportionately affecting Black and Indigenous women and children.[1,2] The legacy of slavery and colonialism has left deep-rooted consequences for Black and Indigenous populations in Brazil by defining life conditions, civil rights and access to services. Here, we understand Racism from a systemic perspective, as it encapsulates all its manifestations and processes that create and sustain racial inequalities.[3] There is vast documentation of the racialized disparities in socioeconomic conditions,[4] healthcare access[5,6] and health outcomes in the Brazilian population[7] and, even under policies such as the National Policy of Integral Health for Black Population and the National Policy of Attention

21,26 million Brazilian newborns were studied

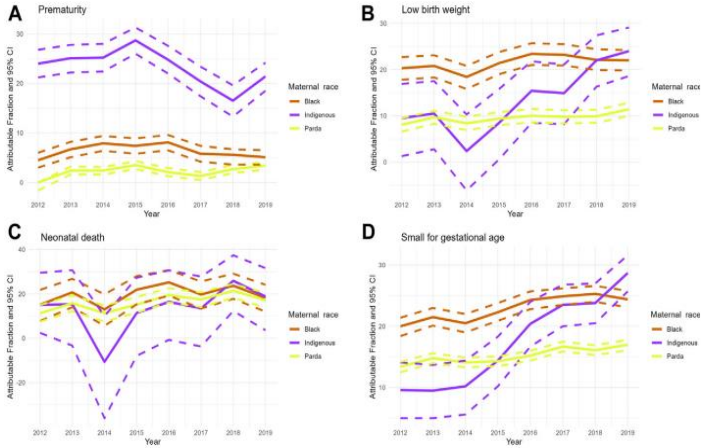


Fig. 5: Attributable fractions trends of preterm birth, LBW, SGA and early neonatal mortality by maternal race/skin colour group.

AF increased over time, greater among Indigenous populations

Percentage of preventable outcomes: 1.7% of preterm births, 7.2% of low birth weight (LBW), 10.8% of small gestational age (SGA) and 11.8% of early neonatal deaths

Percentages preventable were higher

ON Indigenous: PT-22.2%; LBW-17.9%; SGA-20.5%; Early neonatal deaths- 19.6%

ON Black women: PT-6%; LBW-21,4%; SGA-22,8%; Early neonatal deaths- 20,1%

Among Indigenous, Black and *Parda* with **fewer years of education** for all outcomes.

Ethnoracial disparities in childhood trajectories in Brazil

Benes Matos da Silva *et al. BMC Pediatrics* (2024) 24:103
https://doi.org/10.1186/s12887-024-04550-3

BMC Pediatrics

RESEARCH Open Access

Ethnoracial disparities in childhood growth trajectories in Brazil: a longitudinal nationwide study of four million children

Helena Benes Matos da Silva[1,2*†], Rita de Cássia Ribeiro-Silva[1,2], Juliana Freitas de Mello e Silva[2†], Irina Chis Ster[3], Poliana Rebouças[2], Emanuelle Goes[2], Maria Yury Ichihara[2], Andréa Ferreira[2,4], Julia M. Pescarini[5], Rosemeire Leovigildo Fiaccone[6], Enny S. Paixão[5] and Maurício L. Barreto[2]

Abstract

Background The literature contains scarce data on inequalities in growth trajectories among children born to mothers of diverse ethnoracial background in the first 5 years of life.

Objective We aimed to investigate child growth according to maternal ethnoracial group using a nationwide Brazilian database.

Methods A population-based retrospective cohort study employed linked data from the CIDACS Birth Cohort and the Brazilian Food and Nutrition Surveillance System (SISVAN). Children born at term, aged 5 years or younger who presented two or more measurements of length/height (cm) and weight (kg) were followed up between 2008 and 2017. Prevalence of stunting, underweight, wasting, and thinness were estimated. Nonlinear mixed effect models were used to estimate childhood growth trajectories, among different maternal ethnoracial groups (White, Asian descent, Black, Pardo, and Indigenous), using the raw measures of weight (kg) and height (cm) and the length/height-for-age (L/HAZ) and weight-for-age z-scores (WAZ). The analyses were also adjusted for mother's age, educational level, and marital status.

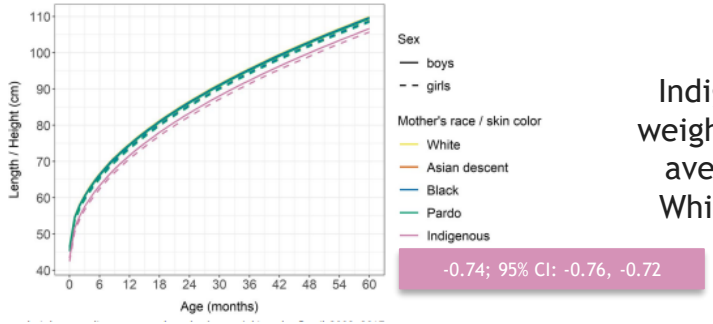
Results A total of 4,090,271 children were included in the study. Children of Indigenous mothers exhibited higher rates of stunting (26.74%) and underweight (5.90%). Wasting and thinness were more prevalent among children of Pardo, Asian, Black, and Indigenous mothers than those of White mothers. Regarding children's weight (kg) and length/height (cm), those of Indigenous, Pardo, Black, and Asian descent mothers were on average shorter and weighted less than White ones. Regarding WAZ and L/HAZ growth trajectories, a sharp decline in average z-scores was evidenced in the first weeks of life, followed by a period of recovery. Over time, z-scores for most of the subgroups analyzed trended below zero. Children of mother in greater social vulnerability showed less favorable growth.

Conclusion We observed racial disparities in nutritional status and childhood growth trajectories, with children of Indigenous mothers presenting less favorable outcomes compared to their White counterparts. The strengthening of policies aimed at protecting Indigenous children should be urgently undertaken to address systematic ethnoracial health inequalities.

†Helena Benes Matos da Silva and Juliana Freitas de Mello e Silva contributed equally to this work.

*Correspondence:
Helena Benes Matos da Silva

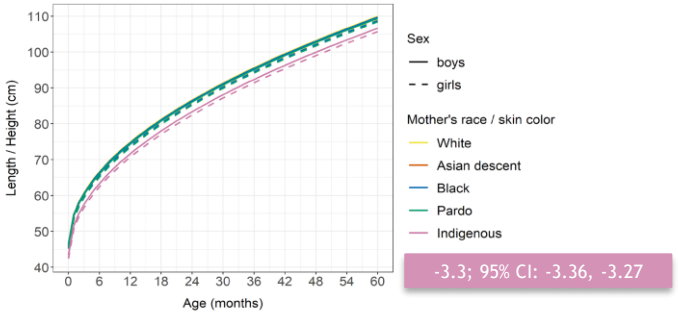
A total of **4,090,271 children** were included in the study (2008-2017)



-0.74; 95% CI: -0.76, -0.72

Indigenous children weighed less grams on average than their White counterparts

Estimated average weight by child's sex and mother's race/ethnicity. Brazil, 2008-2017



-3.3; 95% CI: -3.36, -3.27

Indigenous children were on average 3.3 cm (95% CI: −3.36, −3.27) shorter than their White counterparts.

Estimated average height by child's sex and mother's race/ethnicity. Brazil, 2008-2017

Wasting and thinness were higher among children of Pardo, Asian, Black, and Indigenous mothers than those of White mothers.Children of Indigenous mothers exhibited higher rates of stunting (26.74%) and underweight (5.90%)

Ethnoracial inequalities and child mortality in Brazil

Ethnoracial inequalities and child mortality in Brazil: a nationwide longitudinal study of 19 million newborn babies

Poliana Rebouças, Emanuelle Goes, Julia Pescarini, Dandara Ramos, Maria Yury Ichihara, Samila Sena, Rafael Veiga, Laura C Rodrigues, Maurício L Barreto, Enny S Paixão

Summary

Background Racism is a social determinant of health inequities. In Brazil, racial injustices lead to poor outcomes in maternal and child health for Black and Indigenous populations, including greater risks of pregnancy-related complications; decreased access to antenatal, delivery, and postnatal care; and higher childhood mortality rates. In this study, we aimed to estimate inequalities in childhood mortality rates by maternal race and skin colour in a cohort of more than 19 million newborns in Brazil.

Methods We did a nationwide population-based, retrospective cohort study using linked data on all births and deaths in Brazil between Jan 1, 2012, and Dec 31, 2018. The data consisted of livebirths followed up to age 5 years, death, or Dec 31, 2018. Data for livebirths were extracted from the National Information System for livebirths, SINASC, and for deaths from the Mortality Information System, SIM. The final sample consisted of complete data for all cases regarding maternal race and skin colour, and no inconsistencies were present between date of birth and death after linkage. We fitted Cox proportional hazard regression models to calculate the crude and adjusted hazard ratios (HRs) and 95% CIs for the association between maternal race and skin colour and all-cause and cause-specific younger than age 5 mortality rates, by age subgroups. We calculated the trend of HRs (and 95% CI) by time of observation (calendar year) to indicate trends in inequalities.

Findings From the 20 526 714 livebirths registered in SINASC between Jan 1, 2012, and Dec 31, 2018, 238 436 were linked to death records identified from SIM. After linkage, 1 010 871 records were excluded due to missing data on maternal race or skin colour or inconsistent date of death. 19 515 843 livebirths were classified by mother's race, of which 224 213 died. Compared with children of White mothers, mortality risk for children younger than age 5 years was higher among children of Indigenous (HR 1·98 [95% CI 1·92–2·06]), Black (HR 1·39 [1·36–1·41]), and Brown or Mixed race (HR 1·19 [1·18–1·20]) mothers. The highest hazard ratios were observed during the post-neonatal period (Indigenous, HR 2·78 [95% CI 2·64–2·95], Black, HR 1·54 [1·48–1·59]), and Brown or Mixed race, HR 1·25 [1·23–1·27]) and between the ages of 1 year and 4 years (Indigenous, HR 3·82 [95% CI 3·52–4·15]), Black, HR 1·51 [1·42–1·60], and Brown or Mixed race, HR 1·30 [1·26–1·35]). Children of Indigenous (HR 16·39 [95% CI 12·88–20·85]), Black (HR 2·34 [1·78–3·06]), and Brown or Mixed race mothers (HR 2·05 [1·71–2·45]) had a higher risk of death from malnutrition than did children of White mothers. Similar patterns were observed for death from diarrhoea (Indigenous, HR 14·28 [95% CI 12·25–16·65]; Black, HR 1·72 [1·44–2·05]; and Brown or Mixed race mothers, HR 1·78 [1·61–1·98]) and influenza and pneumonia (Indigenous, HR 6·49 [95% CI 5·78–7·27]; Black, HR 1·78 [1·62–1·96]; and Brown or Mixed race mothers, HR 1·60 [1·51–1·69]).

Interpretation Substantial ethnoracial inequalities were observed in child mortality in Brazil, especially among the Indigenous and Black populations. These findings demonstrate the importance of regular racial inequality assessments and monitoring. We suggest implementing policies to promote ethnoracial equity to reduce the impact of racism on child health.

Funding MCTI/CNPq/MS/SCTIE/Decit/Bill & Melinda Gates Foundation's Grandes Desafios Brasil,

Lancet Glob Health 2022; 10: e1453–62

See Comment page e1369

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There is a lack of literature on ethnoracial inequalities in childhood mortality in Brazil.

Our findings provide a better understanding of mortality inequalities by ethnicity in Brazil, identifying substantial disparities between groups by age and cause of death

- Mortality less than age 5 years was 39% and 19% higher among children of Black and Brown or Mixed race mothers than children of White mothers.
- Indigenous mothers were 98% more likely to die than those of White mothers in the first 5 years of life
- When broken down by cause, racial inequalities were more marked on poverty-related causes such as malnutrition and diarrhoea.

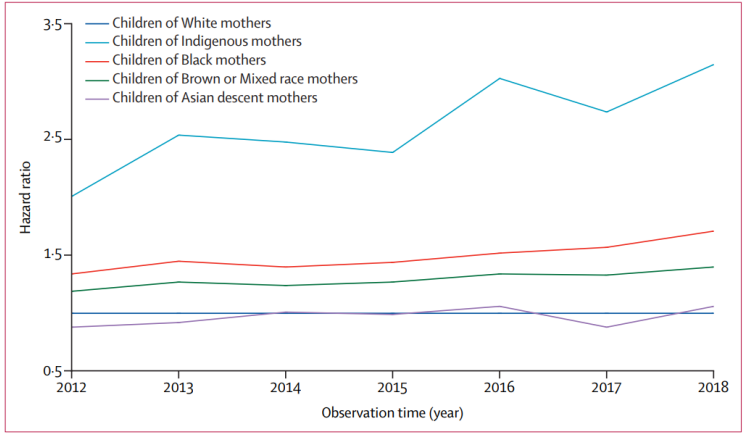

Figure 2: Trends in hazard ratio for mortality in children younger than 5 years, by calendar year

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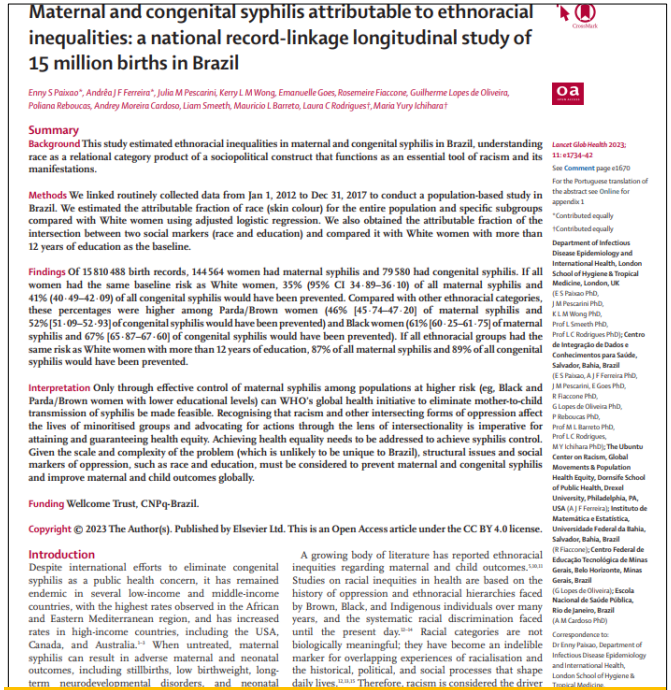
Maternal and congenital syphilis attributable to ethnoracial inequalities



Maternal and congenital syphilis attributable to ethnoracial inequalities: a national record-linkage longitudinal study of 15 million births in Brazil

Enny S Paixao*, Andréa J F Ferreira*, Julia M Pescarini, Kerry L M Wong, Emanuelle Goes, Rosemeire Fiaccone, Guilherme Lopes de Oliveira, Poliana Reboucas, Andrey Moreira Cardoso, Liam Smeeth, Mauricio L Barreto, Laura C Rodrigues†, Maria Yury Ichihara†

Summary

Background This study estimated ethnoracial inequalities in maternal and congenital syphilis in Brazil, understanding race as a relational category product of a sociopolitical construct that functions as an essential tool of racism and its manifestations.

Methods We linked routinely collected data from Jan 1, 2012 to Dec 31, 2017 to conduct a population-based study in Brazil. We estimated the attributable fraction of race (skin colour) for the entire population and specific subgroups compared with White women using adjusted logistic regression. We also obtained the attributable fraction of the intersection between two social markers (race and education) and compared it with White women with more than 12 years of education as the baseline.

Findings Of 15 810 488 birth records, 144 564 women had maternal syphilis and 79 580 had congenital syphilis. If all women had the same baseline risk as White women, 35% (95% CI 34·89–36·10) of all maternal syphilis and 41% (40·49–42·09) of all congenital syphilis would have been prevented. Compared with other ethnoracial categories, these percentages were higher among Parda/Brown women (46% [45·74–47·20] of maternal syphilis and 52% [51·09–52·93] of congenital syphilis would have been prevented) and Black women (61% [60·25–61·75] of maternal syphilis and 67% [65·87–67·60] of congenital syphilis would have been prevented). If all ethnoracial groups had the same risk as White women with more than 12 years of education, 87% of all maternal syphilis and 89% of all congenital syphilis would have been prevented.

Interpretation Only through effective control of maternal syphilis among populations at higher risk (eg, Black and Parda/Brown women with lower educational levels) can WHO's global health initiative to eliminate mother-to-child transmission of syphilis be made feasible. Recognising that racism and other intersecting forms of oppression affect the lives of minoritised groups and advocating for actions through the lens of intersectionality is imperative for attaining and guaranteeing health equity. Achieving health equality needs to be addressed to achieve syphilis control. Given the scale and complexity of the problem (which is unlikely to be unique to Brazil), structural issues and social markers of oppression, such as race and education, must be considered to prevent maternal and congenital syphilis and improve maternal and child outcomes globally.

Funding Wellcome Trust, CNPq-Brazil.

Lancet Glob Health 2023; 11: e1734–42

See **Comment** page e1670

For the Portuguese translation of the abstract see Online for appendix 1

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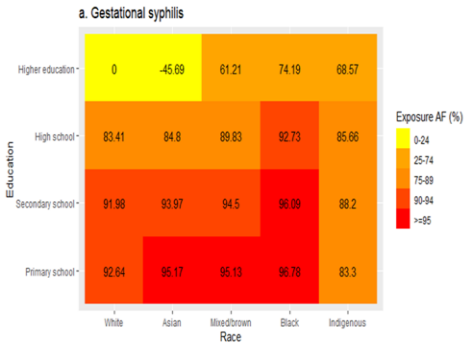
Introduction

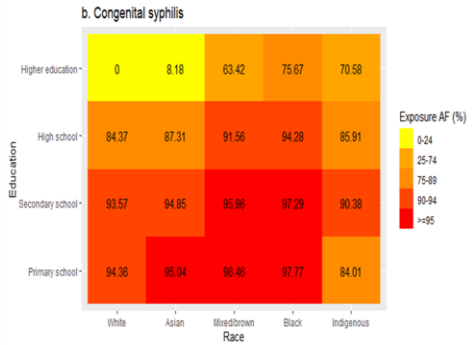
Despite international efforts to eliminate congenital syphilis as a public health concern, it has remained endemic in several low-income and middle-income countries, with the highest rates observed in the African and Eastern Mediterranean region, and has increased rates in high-income countries, including the USA, Canada, and Australia.[1–3] When untreated, maternal syphilis can result in adverse maternal and neonatal outcomes, including stillbirths, low birthweight, long-term neurodevelopmental disorders, and neonatal

A growing body of literature has reported ethnoracial inequities regarding maternal and child outcomes.[3,10,11] Studies on racial inequities in health are based on the history of oppression and ethnoracial hierarchies faced by Brown, Black, and Indigenous individuals over many years, and the systematic racial discrimination faced until the present day.[12–14] Racial categories are not biologically meaningful; they have become an indelible marker for overlapping experiences of racialisation and the historical, political, and social processes that shape daily lives.[12,13,15] Therefore, racism is considered the driver

More than 15 million live births records, **144,564 had maternal syphilis and 79,580** had congenital syphilis (2012 -2017)

- The risk of GS and CS was higher among black and mixed-race women and them also less likely to receive adequate treatment and were diagnosed later than white women
- 40% of all SG and 45% of all SC would have been prevented if all women experienced the syphilis rates of white women
- A high risk for GS and CS was observed due to the intersection of low education in black women.





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Maternal and congenital syphilis attributable to ethnoracial inequalities

ETHNICITY & HEALTH
https://doi.org/10.1080/13557858.2023.2245183

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The intersection of race/ethnicity and socioeconomic status: inequalities in breast and cervical cancer mortality in 20,665,005 adult women from the 100 Million Brazilian Cohort

Emanuelle F. Góes[a*], Joanna M. N. Guimarães[a*], Maria da Conceição C. Almeida[b], Ligia Gabrielli[c,d], Srinivasa Vittal Katikireddi[e], Ana Clara Campos[a], Sheila M. Alvim Matos[d], Ana Luísa Patrão[f], Ana Cristina de Oliveira Costa[g], Manuela Quaresma[h], Alastair H. Leyland[e], Mauricio L. Barreto[a,d], Isabel dos-Santos-Silva[h**] and Estela M. L. Aquino[d**]

[a]Centre for Data and Knowledge Integration for Health (CIDACS), Gonçalo Moniz Institute, Oswaldo Cruz Foundation, Bahia, Brazil; [b]Gonçalo Moniz Institute, Oswaldo Cruz Foundation, Salvador, Brazil; [c]Centro de Diabetes e Endocrinologia da Bahia, Secretaria de Saúde do Estado da Bahia, Bahia, Brazil; [d]Instituto de Saúde Coletiva, Universidade Federal da Bahia, Salvador, Brazil; [e]MRC/CSO Social & Public Health Sciences Unit, University of Glasgow, Glasgow, UK; [f]Center for Psychology, Faculty of Psychology and Education Science, University of Porto, Porto, Portugal; [g]Programa de Pós-graduação em Saúde Coletiva do Instituto René Rachou/FIOCRUZ Minas; [h]Faculty of Epidemiology and Population Health, London School of Hygiene & Tropical Medicine, London, UK

ABSTRACT

Objectives: There is limited evidence regarding the impact of race/racism and its intersection with socioeconomic status (SES) on breast and cervical cancer, the two most common female cancers globally. We investigated racial inequalities in breast and cervical cancer mortality and whether SES (education and household conditions) interacted with race/ethnicity.

Design: The 100 Million Brazilian Cohort data were linked to the Brazilian Mortality Database, 2004–2015 (n = 20,665,005 adult women). We analysed the association between self-reported race/ethnicity (White/'Parda'(Brown)/Black/Asian/Indigenous) and cancer mortality using Poisson regression, adjusting for age, calendar year, education, household conditions and area of residence. Additive and multiplicative interactions were assessed.

Results: Cervical cancer mortality rates were higher among Indigenous (adjusted Mortality rate ratio = 1.80, 95%CI 1.39–2.33), Asian (1.63, 1.20–2.22), 'Parda'(Brown) (1.27, 1.21–1.33) and Black (1.18, 1.09–1.28) women vs White women. Breast cancer mortality rates were higher among Black (1.10, 1.04–1.17) vs White women. Racial inequalities in cervical cancer mortality were larger among women of poor

ARTICLE HISTORY
Received 20 December 2022
Accepted 1 August 2023

KEYWORDS
Racism; racial inequalities; socioeconomic status; cancer; mortality; intersectionality; Brazil

More than 20 million adult women (2004-2015)

Table 2. Mortality rate ratios from cervical and breast cancer associated with race/ethnicity. 100 Million Brazilian Cohort (2004-2015), N = 20,665,005 women aged 18–100 years.

	Cervical cancer – MRR (95%CI)		Breast cancer - MRR (95%CI)	
Variables	Model 1	Model 2	Model 1	Model 2
Race/ethnicity				
White	1.00	1.00	1.00	1.00
'Parda'(Brown)	1.31 (1.25–1.38)	1.27 (1.21–1.33)	0.83 (0.80–0.87)	0.86 (0.82–0.89)
Black	1.22 (1.13–1.32)	1.18 (1.09–1.28)	1.09 (1.03–1.15)	1.10 (1.04–1.17)
Asian descent	1.58 (1.17–2.14)	1.63 (1.20–2.22)	0.75 (0.55–1.03)	0.77 (0.55–1.08)
Indigenous	1.99 (1.56–2.54)	1.80 (1.39–2.33)	0.49 (0.35–0.70)	0.63 (0.44–0.91)
Education level (years)				
>9 years		1.00		1.00
6–9		1.80 (1.63–1.98)		0.98 (0.92–1.05)
<=5		2.57 (2.34–2.81)		0.99 (0.93–1.05)
P-for linear trend		<0.001		0.843
Adequate household conditions*				
3 or 4		1.00		1.00
1 or 2		1.33 (1.25–1.41)		0.81 (0.76–0.85)
None		1.53 (1.38–1.70)		0.75 (0.67–0.84)
P-for linear trend		<0.001		<0.001

Abbreviations: MRR, Mortality rate ratio; CI, Confidence interval.
*Availability of adequate facilities for water supply, sewage disposal, waste disposal/garbage collection, and electricity supply (see Methods section and Supplemental material 1).
Model 1: adjusted for age and calendar year.
Model 2: Model 1 + education level, household conditions and area of residence (rural vs urban).

Cervical cancer mortality was higher among indigenous women (1.80, 95%CI 1.39–2.33), Asian (1.63, 1.20–2.22), mixed race (1.27, 1.21–1.33), and black women (1.18, 1.09–1.28) compared with white women. It was higher among poor women.

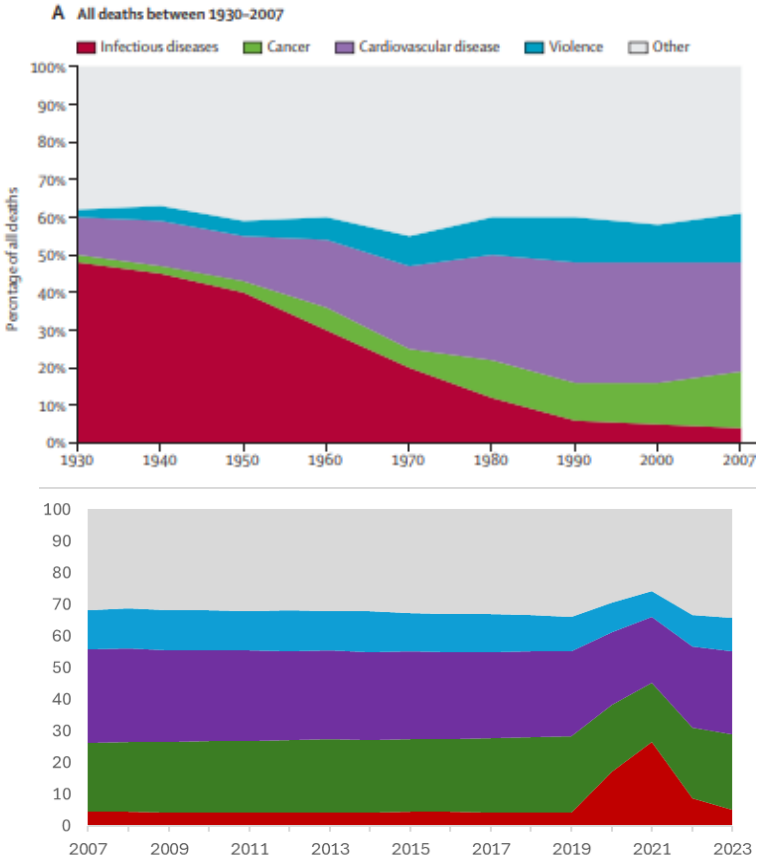
Breast cancer mortality was higher among black women (1.10, 1.04–1.17) compared with white women

Infectious disease in the general and vulnerable population

Dr Enny Paixao

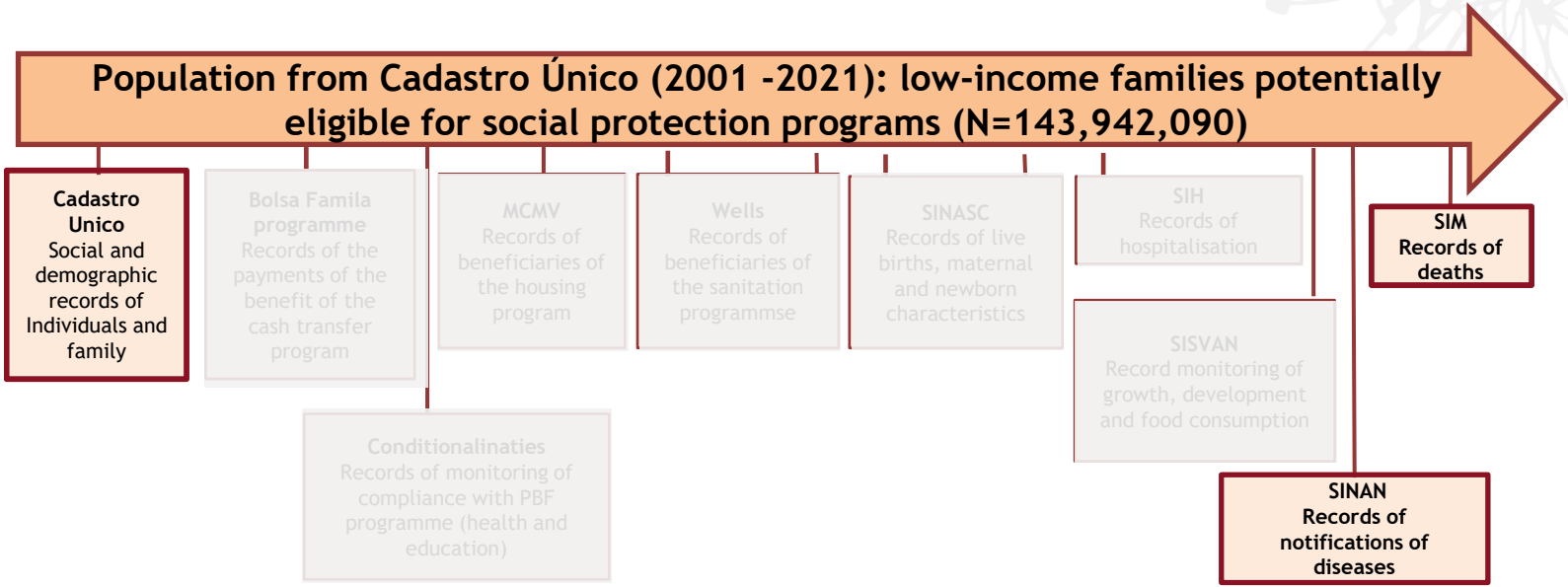
Infectious disease in Brazil

- Infectious diseases are still a public health problem in Brazil, despite from 50% to 5% in the past 80 years.
- The emergence and re-emergence of infectious disease is a threat worldwide and a reality in Brazil
- What is the impact of infectious disease on infected individuals? What about vulnerable populations such as pregnant women and their newborns?



The 100 million Brazilians Cohort

Coorte de 100 milhões de brasileiros



What is the risk of death following a Chikungunya infection?

- The IRR of death within 7 days of chikungunya symptom onset was **8.40** (95% CI 4.83–20.09) and decreased **to 2.26** (1.50–3.77) at 57–84 days.

- Increased the risk of death by **diabetes** RR 3·74, 95% CI 1·33–16·93 **and ischaemic heart disease** RR 3.66, 1.25–13.96 in the first 28 days.

- For **kidney disease**, RR at 85–168 was 2.75, 95% CI 1.09–8.54.

Risk of death following chikungunya virus disease in the 100 Million Brazilian Cohort, 2015–18: a matched cohort study and self-controlled case series

Thiago Cerqueira-Silva, Julia M Pescarini, Luciana L Cardim, Clémence Leyrat, Heather Whitaker, Carlos Alexandre Antunes de Brito, Elizabeth B Brickley, Manoel Barral-Netto, Maurício L Barreto, Maria G Teixeira, Viviane S Boaventura, Enny S Paixão

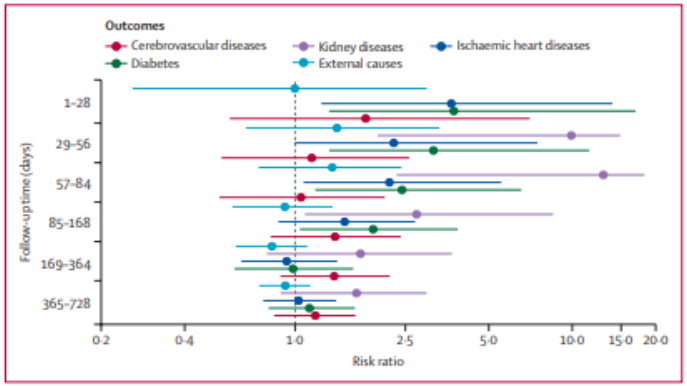


Figure 2: **Estimated risk ratios for deaths due to specific causes, comparing groups exposed and unexposed to chikungunya virus disease in each risk period**
The risk ratio for kidney diseases within 28 days of symptom onset could not be estimated because there were no events in the unexposed group. Deaths due to external causes, which are not causally associated with chikungunya virus disease, were used as an outcome-negative control.[18] The x axis is plotted on a logarithmic scale.

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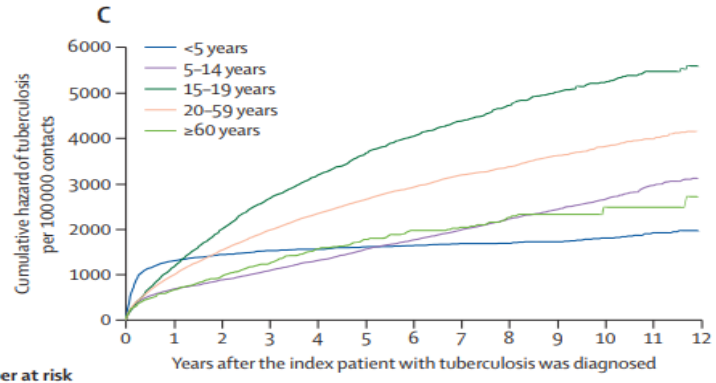
What is the incidence and clinical determinants of tuberculosis among contacts?

- The tuberculosis incidence among contacts was, **16-times** higher than the incidence in the general population.

- For children younger than 5 years, the incidence was **62-times** higher among cohabitants than non-cohabitants.

Incidence and risk factors of tuberculosis among 420 854 household contacts of patients with tuberculosis in the 100 Million Brazilian Cohort (2004–18): a cohort study

Priscila F P S Pinto, Camila S S Teixeira, Maria Yury Ichihara, Davide Rasella, Joilda S Nery, Samila O L Sena, Elizabeth B Brickley, Maurício L Barreto, Mauro N Sanchez*, Julia M Pescarini**



Number at risk			
<5 years	32 373	19 548	7384
5–14 years	124 599	65 865	17 444
15–19 years	58 767	23 237	4765
20–59 years	183 604	71 861	16 423
≥60 years	21 611	7008	1232

THE LANCET
Infectious Diseases
Volume 17, Issue 9, September 2017, Pages 957-964

Articles

Symptomatic dengue infection during pregnancy and the risk of stillbirth in Brazil, 2006–12: a matched case-control study

Enny S Paixão MSc [a, b, c], Prof Maria da Conceição N Costa PhD [b], Prof Maria Glória Teixeira PhD [b, c], Katie Harron PhD [a], Prof Marcia Furquim de Almeida PhD [d], Prof Mauricio L Barreto PhD [c, d], Prof Laura C Rodrigues PhD [a, c]

- Main findings:
- Dengue in general
- [mOR] 1·9, 95% CI 1·6-2·2- random sample of ten control (live born) for each case

- Severe dengue
- [mOR] 4·9, 95% CI 2·3-10·2;

Coorte de Nascimentos

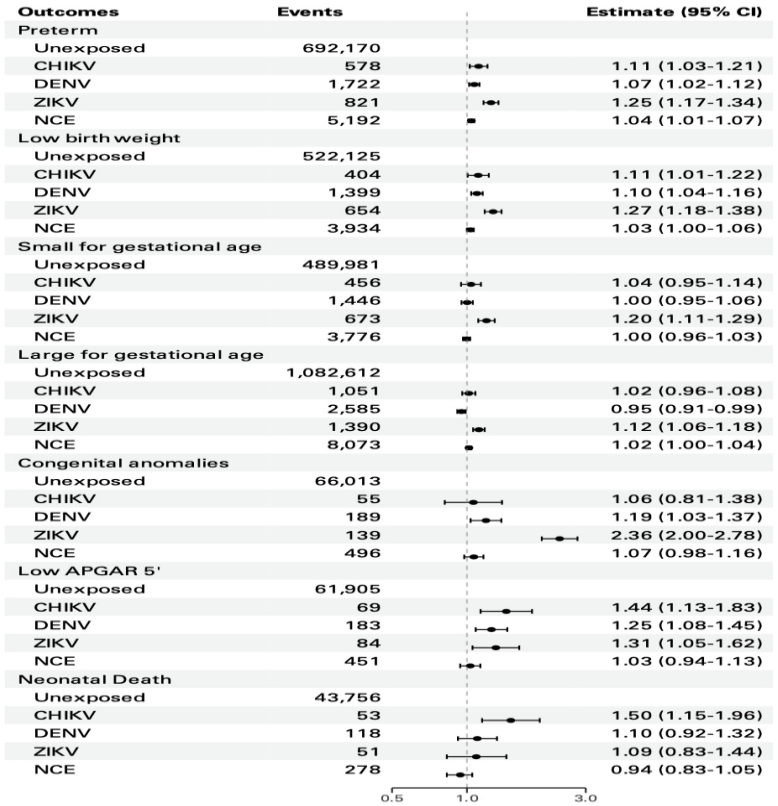
Interpretation Symptomatic dengue infection during pregnancy is associated with an increased risk of fetal death. We recommend further epidemiological and biological studies of the association between dengue and poor birth outcomes to measure the burden of subclinical infections and elucidate pathological mechanisms.

What is risk of adverse perinatal outcomes of pregnant women with symptomatic chikungunya, dengue, and Zika?

- Symptomatic maternal **chikungunya** was associated with an increased risk of **preterm birth** (HR: 1.10, 95% CI 1.01-1.19), **low Apgar score** (1.40, 1.10-1.40), and **neonatal death** (1.49, 1.14-1.95).

- Symptomatic maternal **dengue** was associated with **preterm birth** (1.07, 1.02-1.12), **low birth weight** (1.09, 1.03-1.15), congenital anomalies (1.17, 1.02-1.35), **and low Apgar score** (1.25, 1.08-1.45.

- Symptomatic maternal **Zika** was associated with all **adverse birth outcomes.**



ORIGINAL ARTICLE

Mortality from Congenital Zika Syndrome — Nationwide Cohort Study in Brazil

Enny S. Paixao, Ph.D., Luciana L. Cardim, Ph.D., Maria C.N. Costa, M.D., Ph.D., Elizabeth B. Brickley, Ph.D., Rita C.O. de Carvalho-Sauer, M.Sc., Eduardo H. Carmo, M.D., Ph.D., Roberto F.S. Andrade, Ph.D., Moreno S. Rodrigues, Ph.D., Rafael V. Veiga, Ph.D., Larissa C. Costa, Ph.D., Cynthia A. Moore, M.D., Ph.D., Giovanny V.A. França, Ph.D., et al.

The NEW ENGLAND JOURNAL of MEDICINE

11.5 million live births, of which, **3,308** babies born with confirmed or probable CZS.

Babies born with CZS were at **>11x greater risk** of death during first three years of life than those born without.

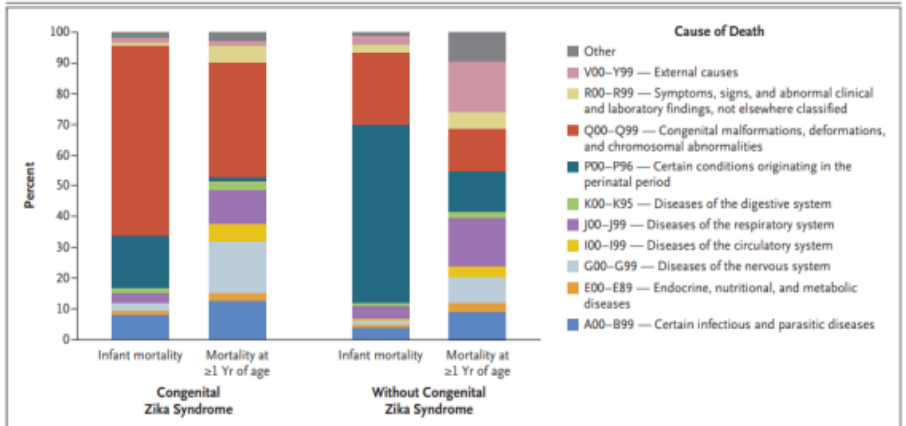


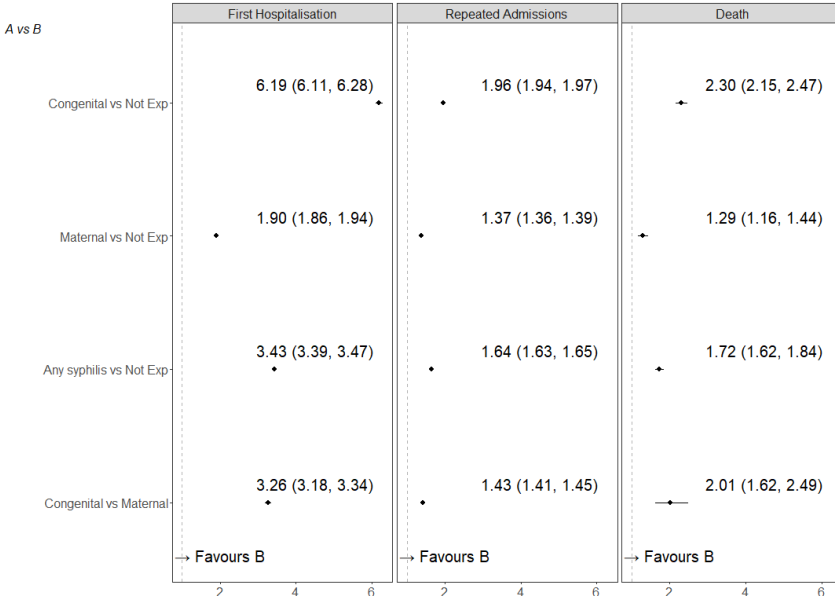
Figure 3. Causes of Death, According to Congenital Zika Syndrome Status, in Brazil (2015–2018).

Causes of death were categorized according to chapter in the *International Classification of Diseases, 10th Revision*. The analysis of infant mortality included deaths at or before 364 days of age.

What is risk of hospital admission and deaths among those with congenital syphilis?

- Children with congenital syphilis had 6.19 (95%CI 6.11-6.28) increase in the hazard **of first hospitalisation**, while those exposed to maternal syphilis had 1.90 (95%CI 1.86-1.94) increase.

- The highest hazard ratio was observed **in the first month of life, reaching an 11-fold (95%CI** 11.36-11.70) increase among those with congenital syphilis.



Seeds
Study of Early-life Exposures during Developmental Stages

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What is risk of maternal deaths after dengue infection during pregnancy?

- Dengue increased the risk of maternal death by 3 times (95%CI,1.5-5.8) and dengue haemorrhagic fever increased the risk of maternal death by **450 times** (95%CI,186.9-1088.4) when compared to mortality of pregnant women without dengue.

Number of cases of dengue during pregnancy (N) and Odds Ratio (crude and adjusted) for the association between dengue during pregnancy by severity of disease and maternal death. Brazil, 2007–2012.

Outcome	Mild dengue Odds Ratio (95% Confidence Interval)	Complicated dengue Odds Ratio (95% Confidence Interval)	Haemorrhagic fever Odds Ratio (95% Confidence Interval)
Maternal Mortality[§]			
Frequency	3	2	5
Crude	0.8 (0.3–2.3)	28.7 (8.2–99.7)	274.5 (115.3–653.8)
Adjusted	0.95 (0.3–3.3)	27.3 (5.5–136.3)	451 (186.9–1088.4)

Open in a separate window

Adjusted for age, education and mode of delivery.

Effects of social policies on health

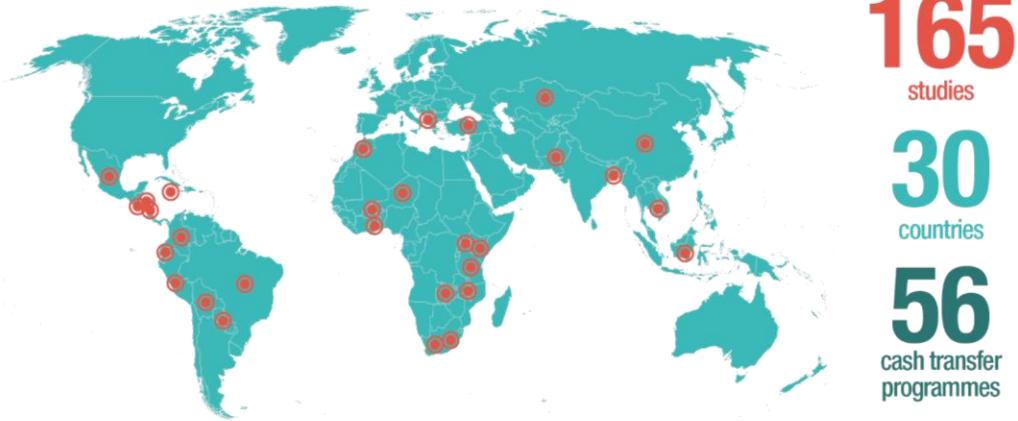
Dr Julia Moreira Pescarini

What are social policies?

- Policies, actions, programmes, or initiatives that are intended to address and improve social problems

- Social protection are part of the social policies targeted to specific population groups aiming to reduce poverty and exclusion

- If such transfers are not to everyone, who are the targeted groups?



"Cash transfers are defined as the provision of assistance in the form of cash ***to the poor or to those who face a probable risk of falling into poverty in the absence of the transfer.****" (World Bank)*

Social protection system in Brazil

Bolsa Familia Programme

Conditional cash transfers

Eligibility

i. Extremely poor

(≤89 BRL monthly per capita income in 2019)

ii. Poor

(≤178 BRL monthly per capita income in 2019) and at least one child/adolescent (0-17yrs) or pregnant woman.

Benefits

I. **i. Fixed: R$ 89 BRL per family**

II. **ii. Variable:**

i. Per breastfeeding women or children up to 15 years old

ii. Per adolescents 16-17yrs

III. **Supplement: to overcome extreme poverty threshold**

Conditions

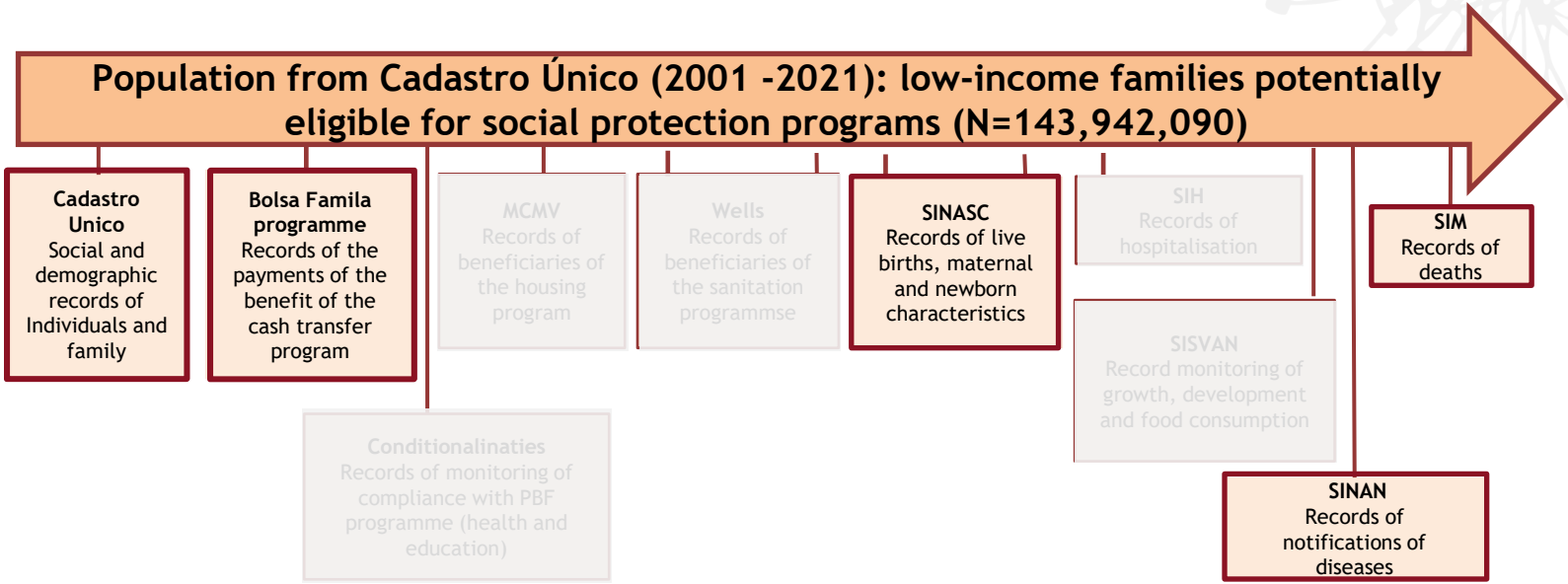
I. School attendance

II. Health uptake (children and pregnant woman)

III. Social services

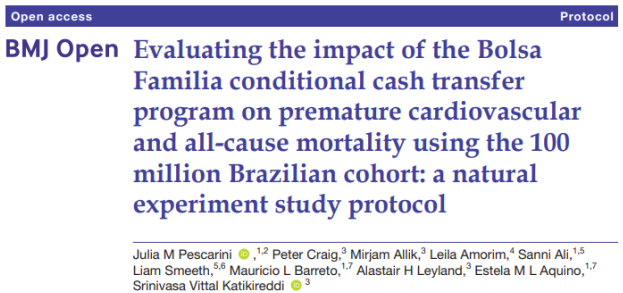
Barreto et al 2021
https://doi.org/10.1093/ije/dyab213

The 100 million Brazilians Cohort



Summary of protocols

Bolsa Familia Programme



Open access Protocol

BMJ Open

Evaluating the impact of the Bolsa Familia conditional cash transfer program on premature cardiovascular and all-cause mortality using the 100 million Brazilian cohort: a natural experiment study protocol

Julia M Pescarini [1,2] Peter Craig,[3] Mirjam Allik,[3] Leila Amorim,[4] Sanni Ali,[1,5] Liam Smeeth,[5,6] Mauricio L Barreto,[1,7] Alastair H Leyland,[3] Estela M L Aquino,[1,7] Srinivasa Vittal Katikireddi [3]

PLOS ONE

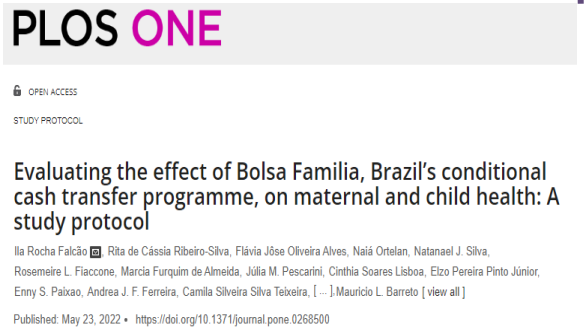
OPEN ACCESS

STUDY PROTOCOL

Evaluating the impact of social determinants, conditional cash transfers and primary health care on HIV/AIDS: Study protocol of a retrospective and forecasting approach based on the data integration with a cohort of 100 million Brazilians

Davide Rasella, Gabriel Alves de Sampaio Morais, Rodrigo Volmir Anderle, Andréa Ferreira da Silva, Iracema Lua, Ronaldo Coelho, Felipe Alves Rubio, Laio Magno, Daiane Machado, Julia Pescarini, Luis Eugênio Souza, James Macinko, Inês Dourado

Published: March 22, 2022 • https://doi.org/10.1371/journal.pone.0265253



PLOS ONE

OPEN ACCESS

STUDY PROTOCOL

Evaluating the effect of Bolsa Familia, Brazil's conditional cash transfer programme, on maternal and child health: A study protocol

Ila Rocha Falcão, Rita de Cássia Ribeiro-Silva, Flávia Jôse Oliveira Alves, Naiá Ortelan, Natanael J. Silva, Rosemeire L. Fiaccone, Marcia Furquim de Almeida, Júlia M. Pescarini, Cinthia Soares Lisboa, Elzo Pereira Pinto Júnior, Enny S. Paixao, Andrea J. F. Ferreira, Camila Silveira Silva Teixeira, [...], Mauricio L. Barreto [view all]

Published: May 23, 2022 • https://doi.org/10.1371/journal.pone.0268500

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How the best way of evaluating the causal effect of social policies?

- Randomised controlled trial (RCT)
  - Not possible after the policy is implemented
- Quasi-experiments: alternative designs using observation data

"naturally occurring variation in exposure to identify the impact of the event on an outcome of interest" (Craig, 2017)

Benefits

Good external validity and limits problems with internal validity

Long-term effects and rarer outcomes

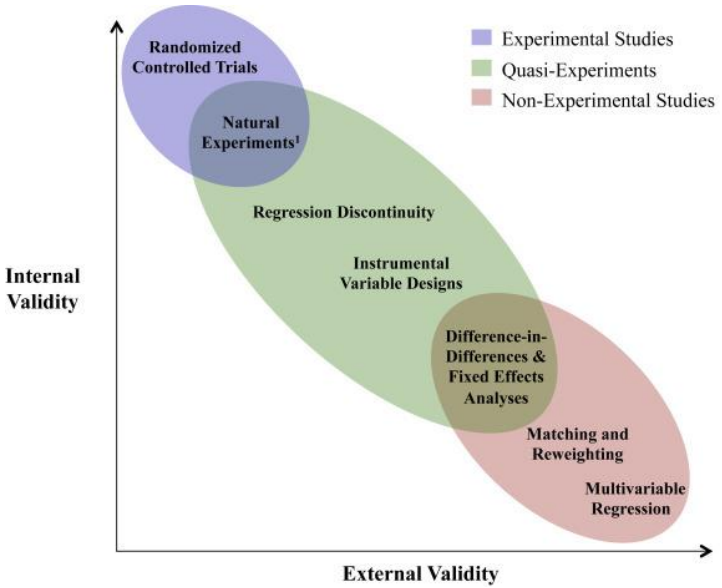
"Lower cost" and fast

Challenges

Finding comparison groups

Susceptible to unmeasured confounders

(Barninghausen et al 2017)



Key studies on the health effects of BFP using the 100 Million Brazilians Cohort - 1

Bolsa Familia Programme

IEA International Epidemiological Association

International Journal of Epidemiology, 2022, 1847–1861
https://doi.org/10.1093/ije/dyac188
Advance Access Publication Date: 28 September 2022
Original article

Cardiovascular Risk Factors

Impact of Brazil's Bolsa Família Programme on cardiovascular and all-cause mortality: a natural experiment study using the 100 Million Brazilian Cohort

Julia M Pescarini ,[1,2]* Desmond Campbell,[3] Leila D Amorim,[4] Ila R Falcão,[1] Andrêa JF Ferreira,[1] Mirjam Allik,[3] Richard J Shaw ,[3] Deborah C Malta,[5] M Sanni Ali,[2] Liam Smeeth,[2,6] Mauricio L Barreto,[1,7] Alastair Leyland ,[3] Peter Craig,[3†] Estela ML Aquino[7†] and Srinivasa Vittal Katikireddi [3†]

Short-term impact on CVD mortality
-4%

PLOS MEDICINE

RESEARCH ARTICLE

Conditional cash transfer program and child mortality: A cross-sectional analysis nested within the 100 Million Brazilian Cohort

Dandara Ramos[1,2]*, Nívea B. da Silva[1,3], Maria Yury Ichihara[1,2], Rosemeire L. Fiaccone[1,3], Daniela Almeida[1,4], Samila Sena[1], Poliana Rebouças[1,2], Elzo Pereira Pinto Júnior[1], Enny S. Paixão[1,5], Sanni Ali[1,5], Laura C. Rodrigues[1,5], Maurício L. Barreto[1,2]

Impact on under-5 mortality
-17%

Key studies on the health effects of BFP using the 100 Million Brazilians Cohort - 2

Bolsa Familia Programme

JAMA Network Open

Original Investigation | Public Health

Association of Conditional Cash Transfers With Maternal Mortality Using the 100 Million Brazilian Cohort

Flávia Jóse O. Alves, PhD; Dandara Ramos, PhD; Enny S. Paixão, PhD; Ila R. Falcão, PhD; Rita de Cássia Ribeiro-Silva, PhD; Rosemeire Fiaccone, PhD; Davide Rasella, PhD; Camila Teixeira, PhD; Daiane Borges Machado, PhD; Aline Rocha, PhD; Marcia F. de Almeida, PhD; Emanuelle F. Goes, PhD; Laura C. Rodrigues, PhD; Maria Yury Ichihara, PhD; Estela M. L. Aquino, PhD; Mauricio L. Barreto, PhD

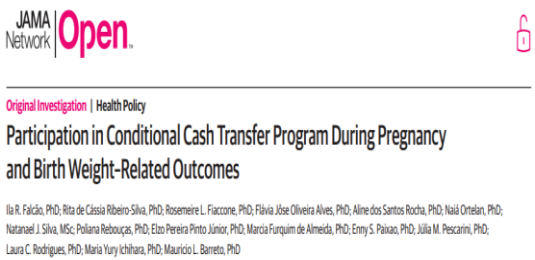
Ortelan et al. BMC Public Health (2024) 24:713
https://doi.org/10.1186/s12889-024-18152-2

BMC Public Health

RESEARCH Open Access

Evaluating the relationship between conditional cash transfer programme on preterm births: a retrospective longitudinal study using the 100 million Brazilian cohort

Naiá Ortelan[1,7*], Márcia Furquim de Almeida[2], Elzo Pereira Pinto Júnior[1], Nivea Bispo[1,3], Rosemeire L. Fiaccone[1,3], Ila Rocha Falcão[1], Aline dos Santos Rocha[1], Dandara Ramos[1,4], Enny S. Paixão[1,5], Rita de Cássia Ribeiro-Silva[1,6], Laura C. Rodrigues[1,5], Mauricio L. Barreto[1,4†] and Maria Yury T. Ichihara[1†]



JAMA Network Open

Original Investigation | Health Policy

Participation in Conditional Cash Transfer Program During Pregnancy and Birth Weight-Related Outcomes

Ila R. Falcão, PhD; Rita de Cássia Ribeiro-Silva, PhD; Rosemeire L. Fiaccone, PhD; Flávia Jóse Oliveira Alves, PhD; Aline dos Santos Rocha, PhD; Naiá Ortelan, PhD; Natanael J. Silva, MSc; Poliana Rebouças, PhD; Elzo Pereira Pinto Júnior, PhD; Marcia Furquim de Almeida, PhD; Enny S. Paixao, PhD; Júlia M. Pescarini, PhD; Laura C. Rodrigues, PhD; Maria Yury Ichihara, PhD; Mauricio L. Barreto, PhD

Impact on maternal mortality
- 18%

Impact on preterm births
- 30%

Impact on low birth weight
- 11%

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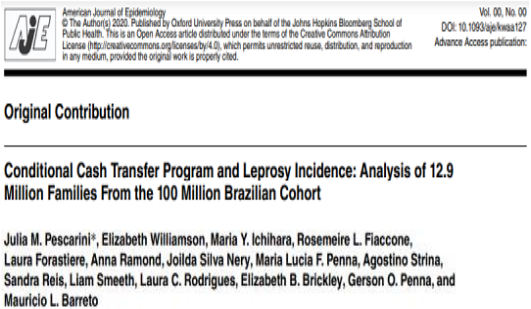
Key studies on the health effects of BFP using the 100 Million Brazilians Cohort - 3

Bolsa Familia Programme

THE LANCET
Infectious Diseases

Effect of a conditional cash transfer programme on leprosy treatment adherence and cure in patients from the nationwide 100 Million Brazilian Cohort: a quasi-experimental study

Julia M Pescarini, PhD [a] · Elizabeth Williamson, PhD [b,c] · Joilda S Nery, PhD [f] · Anna Ramond, PhD [d] · Maria Yury Ichihara, PhD [a] · Rosemeire L Fiaccone, PhD [a,g] · Prof Maria Lucia F Penna, PhD [h] · Prof Liam Smeeth, PhD [c,e] · Prof Laura C Rodrigues, PhD [d] · Prof Gerson O Penna, PhD [i,†] · Elizabeth B Brickley, PhD [d,†] · Prof Mauricio L Barreto, PhD [a,f,†] Show less



American Journal of Epidemiology
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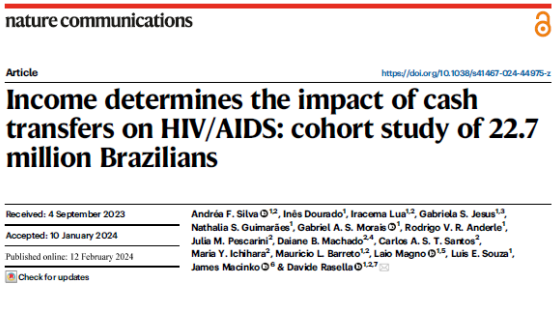
Vol. 00, No. 00
DOI: 10.1093/aje/kwaa127
Advance Access publication:

Original Contribution

Conditional Cash Transfer Program and Leprosy Incidence: Analysis of 12.9 Million Families From the 100 Million Brazilian Cohort

Julia M. Pescarini*, Elizabeth Williamson, Maria Y. Ichihara, Rosemeire L. Fiaccone, Laura Forastiere, Anna Ramond, Joilda Silva Nery, Maria Lucia F. Penna, Agostino Strina, Sandra Reis, Liam Smeeth, Laura C. Rodrigues, Elizabeth B. Brickley, Gerson O. Penna, and Mauricio L. Barreto



nature communications

Article
https://doi.org/10.1038/s41467-024-44975-z

Income determines the impact of cash transfers on HIV/AIDS: cohort study of 22.7 million Brazilians

Received: 4 September 2023
Accepted: 10 January 2024
Published online: 12 February 2024
Check for updates

Andréa F. Silva [1,2], Inês Dourado [1], Iracema Lua [1,2], Gabriela S. Jesus [1,3], Nathalia S. Guimarães [1], Gabriel A. S. Morais [1], Rodrigo V. R. Anderle [1], Julia M. Pescarini [2], Daiane B. Machado [2,4], Carlos A. S. T. Santos [2], Maria Y. Ichihara [2], Mauricio L. Barreto [1,2], Laio Magno [1,5], Luis E. Souza [1], James Macinko [6] & Davide Rasella [1,2,7]

Impact on leprosy
+26% cure

Impact on leprosy
-14% incidence

Impact on HIV
- 41% incidence
-25% case fatality rates

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How we are conducting our evaluations using quasi-experimental designs?

- Good understanding of the policy/programme and its implementation
- Clear theoretical understanding of intended and unintended effects (e.g., logic model)
- Study protocol (use of multiple methods relying in different assumptions)
- Constantly improving our methods
- Publishing open data
- Sharing our findings with policymakers and the community to inform better policies

Leveraging Real-World Data for Mental Health: Uncovering Insights on Suicide, Violence, and Psychiatric Outcomes

Dr. Daiane B Machado

NIH National Institute of Mental Health

R01MH128911

- When we consider rare events, such as suicide, these large datasets enable us to investigate phenomena that would be impossible to study with smaller samples.
- This is particularly important for understanding rare but critical events in mental health that require vast amounts of data to uncover patterns and potential risk factors.
- The broader view provided by real-world data can contribute to developing more targeted interventions and policies to address these critical issues.

Does cash transfers prevent suicide?

The 100 million Brazilians Cohort

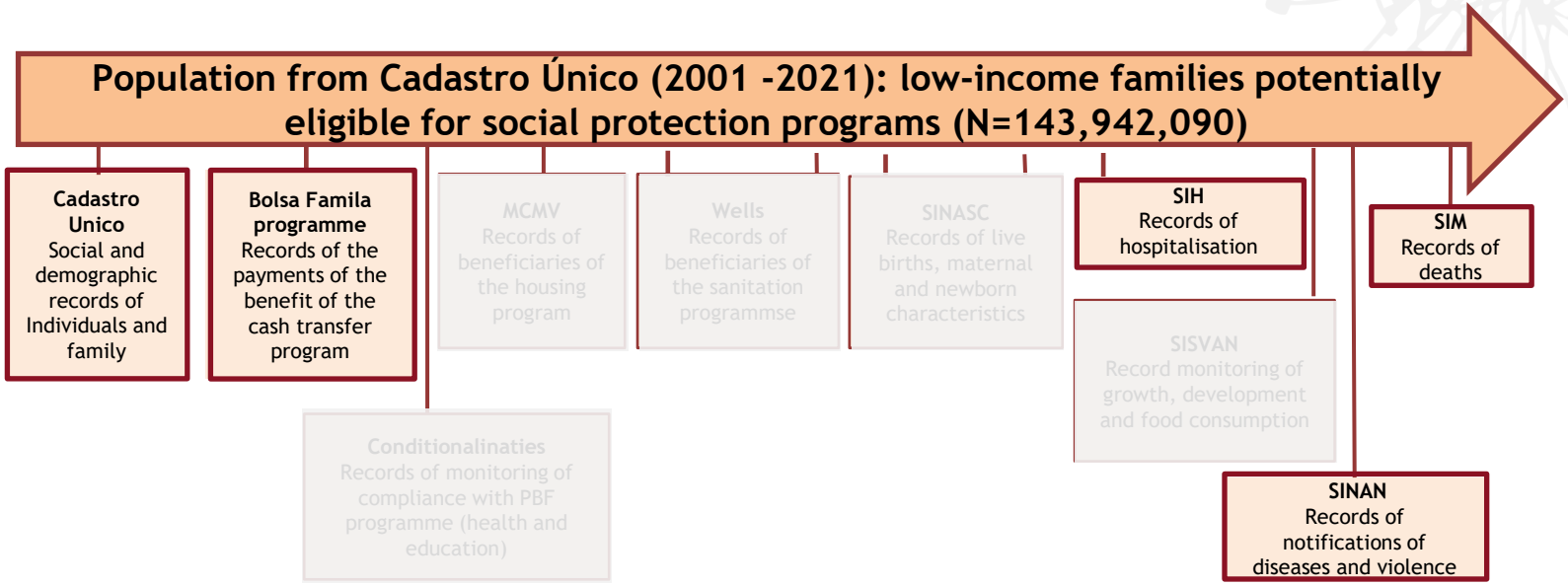

Table 2 Suicide incidence rate for BFP participation, overall, by sex and age group, in the original and matched cohorts from 2004-2015.

	Original cohorts (N=76,532,158)					Matched cohorts (N=69,707,312)				
	Non-BFP	(95%CI)	BFP	(95%CI)	% Diff	Non-BFP	(95%CI)	BFP	(95%CI)	% Diff
Overall rate	10.69	(10.51, 10.87)	5.39	(5.32, 5.47)	198.1	11.09	(10.41, 11.81)	5.53	(5.44, 5.61)	200.7
Person-year	131300000		358200000			8729883		296500000		
Sex										
Male	18.40	(18.04, 18.76)	8.94	(8.80, 9.08)	205.9	21.08	(19.97, 22.25)	9.10	(8.95, 9.26)	231.6
Person-year	55411219		171300000			6200044		143600000		
Female	5.06	(4.90, 5.22)	2.15	(2.08, 2.21)	235.7	5.56	(5.04, 6.11)	2.17	(2.08, 2.24)	256.2
Person-year	75904097		186900000			7506223		152900000		
Age groups										
10-24 years old										
Person-year										
25-59 years old										
Person-year										
60 years old or older										
Person-year										

*Estimated rates (per 100 0

Table 3. Suicide incidence rate ratio (IRR) for BFP participation in the matched and original cohorts, from 2004-2015.

Confounder adjustment	Data	N	Estimated incidence rate ratio (95% CI) from a Poisson regression model	p-value
Unadjusted	Entire cohort	76,532,158	0.50 (0.49, 0.52)	<0.001
Unadjusted with IPTW	Entire cohort (after exc. missing data)	62,766,964	0.43 (0.41, 0.44)	<0.001
Adjusted[1]	Entire cohort (after exc. missing data)	62,766,964	0.44 (0.43, 0.45)	<0.001
Adjusted with IPTW[2]	Entire cohort (after exc. missing data)	62,766,964	0.44 (0.42, 0.45)	<0.001
PS-matching[3]	PS-matched cohort	69,707,312	0.39 (0.37, 0.41)	<0.001

Incidence rate ratio estimated using Poisson regression, adjusted for age, sex, education level, unemployment, living alone, location of residence, and household characteristics, as a proxy for socio-economic status (water supply; waste; construction materials; sanitation; and crowding), and year of cohort baseline registration.
[2]Incidence rate ratio estimated using Poisson regression, accounting for the inverse of the probability of receiving treatment weighting (IPTW) given age, sex, education level, unemployment, living alone, location of residence, and household characteristics, as a proxy for socio-economic status (water supply; waste; construction materials; sanitation; and crowding), and year of cohort baseline registration.
[3]Incidence rate ratio estimated using Poisson regression after propensity score matching - pairs where the propensity score is matched for age, sex, education level, unemployment, living alone, location of residence, and household characteristics, as a proxy for socio-economic status (water supply; waste; construction materials; sanitation; and crowding), and year of cohort baseline registration.

PLOS MEDICINE

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OPEN ACCESS PEER-REVIEWED
RESEARCH ARTICLE

Relationship between the Bolsa Família national cash transfer programme and suicide incidence in Brazil: A quasi-experimental study

Daiane Borges Machado, Elizabeth Williamson, Julia M. Pescarini, Flavia J. O. Alves, Luís F. S. Castro-de-Araujo, Maria Yury Ichihara, Laura C. Rodrigues, Ricardo Araya, Vikram Patel, Maurício L. Barreto

Version 2 Published: May 18, 2022 • https://doi.org/10.1371/journal.pmed.1004000

56% decreased suicide risk among beneficiaries

Do conditional cash transfers reduce mortality in people hospitalised with psychiatric disorders? A cohort study of the Brazilian Bolsa Família Programme

Main findings

- The incidence rate of SUD hospitalizations in the BFP beneficiaries was 32.52 per 100,000 person-years (95%CI: 32.09-32.96), while in the non-BFP group, it was 37.10 per 100,000 person-years (95%CI:36.57-37.65).

- 22% reduction of the SUD hospitalizations incidence rate ratio among the BFP beneficiaries.

Table 3. IRR of *SUD hospitalizations among *BFP beneficiaries in the original and weighting cohorts, Brazil, 2008-2015

Confounder adjustment	N	Estimated IRR (95% CI) from a Poisson regression model	p-value
IPTW weighting	30,556,848	0.83 (0.81, 0.85)	0.000
Unadjusted	35,002,823	0.93 (0.91, 0.95)	0.000
Adjusted	25,805,305	0.97 (0.95, 0.99)	0.000
SIPTW weighting	25,805,305	0.93 (0.91, 0.95)	0.000
Kernel Weighting	25,805,219	0.83 (0.81, 0.85)	0.000

*SUD (Substance use disorder); BFP (Bolsa Família Program)

Does cash transfers prevent suicide?

How about vulnerable populations?

Impact of the Bolsa Familia cash transfer program on specific populations, patients with (A) severe mental health disorders and (B) interpersonal violence victims

A) Hospitalized patients

- BFP was associated with reduced overall mortality (HR 0.93, 95% CI 0.87,0.98, p 0.018) and mortality due to natural causes (HR 0.89, 95% CI 0.83, 0.96, p <0.001).
- Reduction in suicide (HR 0.90, 95% CI 0.68, 1.21, p=0.514) was observed, although it was not statistically significant.
- The BFP's effects on overall mortality were more pronounced in females and younger individuals.

Does cash transfers prevent suicide?

Why?
What are the mechanisms that link cash transfers with reduced suicide?

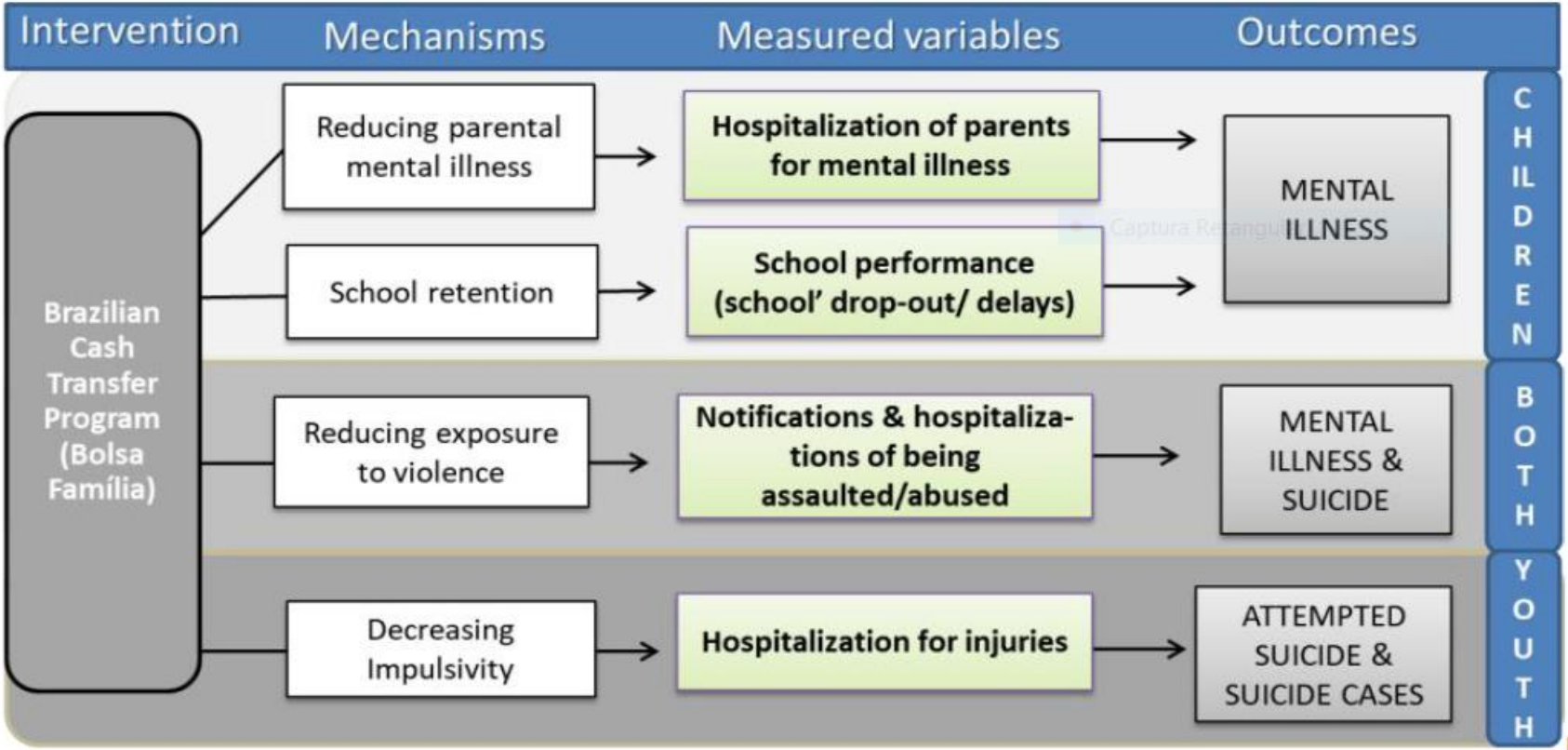


Figure 1: *Potential mechanisms and pathways through which the Bolsa Família Program (BFP) may affect mental health-related hospitalizations and suicide among children and youth.*

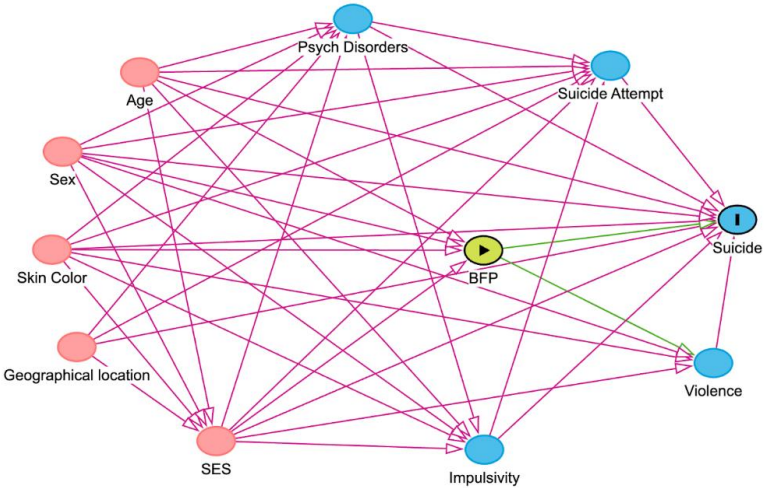
Causal mechanism studies

Pathways between a Social Intervention Program, Violence, Impulsivity, Mental Disorders, and Suicide: A Modeling Analysis Using the 100 Million Brazilian Cohort

Gilciane Ceolin, Ph.D
Join lead author

Patrícia Fortes, Ph.D
Join lead author

Supplemental Figure 2: Direct Acyclic Graph



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Social Determinants

Household exposure studies

What factors are associated with youth psychiatric hospitalization in the 100 Million Brazilian Cohort?

Does having a psychiatric hospitalization **index case** in the household increase the likelihood of another resident subsequently being admitted for the same or another psychiatric condition?

Maternal mental health studies

What is the risk of adverse pregnancy outcomes between women with a history of severe mental illness (defined as a hospitalization for mental disorders before and/or during pregnancy) and women without such a history?

Suicide determinants

Social determinants of suicide attempt (SINAN, SIH) and suicide

VIOLENCE

What are the risk factors for IPV?

Risk factors associated with youth psychiatric hospitalizations: a multilevel approach using data from the 100 Million Brazilian Cohort

Main findings

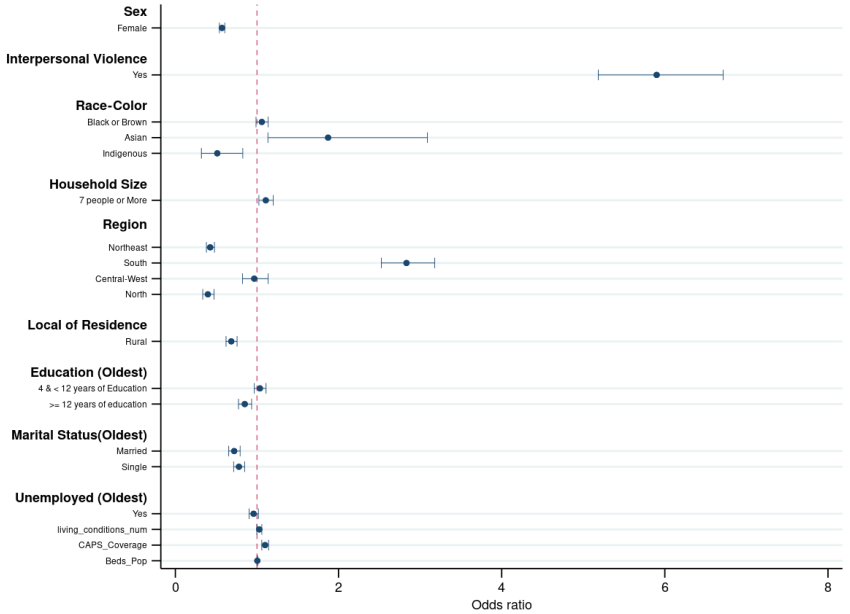
- Violence stands out as the most significant risk factor for psychiatric hospitalizations among youth.

- 229.8 per 100,000 person-years (95%CI: 221.25-238.61) incidence rate among young people who had suffered interpersonal violence

X

- 14.89 per 100,000 person-years (95%CI: 14.68-15.11) among those who had not.

Figure 1. Adjusted multilevel logistic regression results for youth psychiatric hospitalizations, Brazil, 2008-2018



The risk of suicide, all-cause, and specific-cause mortality following a suicide in the household: a population-based study using the 100 Million Brazilian Cohort

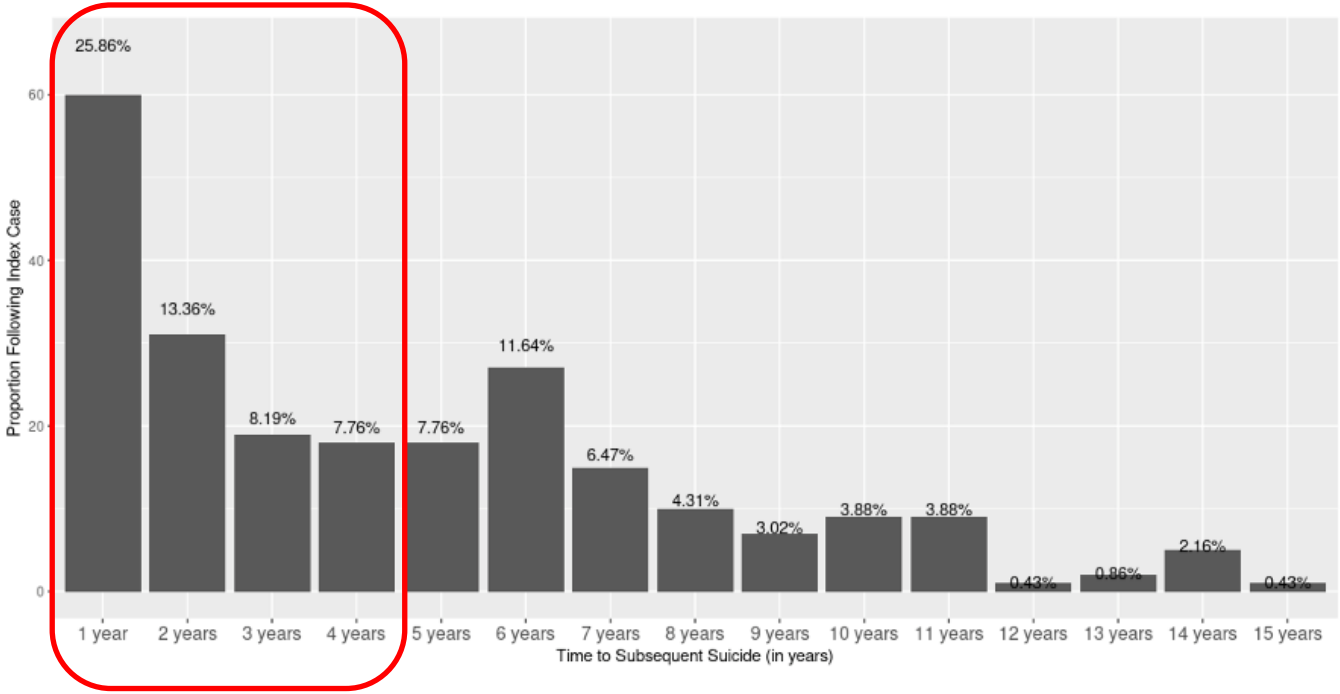
Main findings

- Having a family member who died by suicide increases one's own risk by fourfold (Double the risk of in HIC)

- Dose-response

- first year (26%)
- second (13%)
- third (8%)
- fourth years (8%)

Figure 2: Proportion of subsequent suicide (N=232) in years since the index suicide cases



55% of cases

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Hospitalisation by mental disorders and adverse pregnancy outcomes: a population-based linkage study of the 100 million Brazilian cohort

Maternal psychiatric disorders can impact their children, leading to a heightened risk of

- (1) Preterm birth,
- (2) Early term birth,
- (3) Low Birth Weight,
- (4) Small for gestational age,
- (5) Congenital anomaly

What have we answered up to now?

Suicide

1. In Brazil having a family member who died by suicide increases double the risk compared to HIC

Mental Health

4. Poverty and Violence stands out as the most significant risk factors for poor mental health

5. The impact of maternal psychiatric hospitalization can extend beyond the mother and affect her children.

Programs

6. The Bolsa Família Program (BFP) is not only associated with decreased suicide but also decreased hospitalizations due to alcohol and drug abuse,

7. And decrease deaths among specific populations, such as severe psychiatric disorders – tertiary prevention

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FINAL REMARKS

01

Suicide and Self-Harm:

By leveraging real-world data, we can better identify patterns related to suicide attempts and self-harm across diverse populations, uncovering under-researched risk factors and protective variables.

02

Psychiatric Hospitalizations:

Large datasets enabled us to examine the factors that lead to hospitalization for mental health conditions, allowing for a more nuanced understanding of how socio-economic conditions, healthcare access, and social isolation interact to influence psychiatric emergencies.

03

Long-Term Outcomes of Mental Health Interventions:

Real-world data allows for the tracking of individuals over time, enabling the assessment of long-term mental health interventions and their effectiveness in preventing relapse or further deterioration of mental health.

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More than ever, an intersectoral approach, including financial protection, will be imperative to enhance global mental health and prevent suicide.

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PHC

Primary Health Care
and its Effects on
Population Health

Cidacs-PHC: Primary Healthcare and its Effects on Population Health

Dr Elzo Pinto Junior

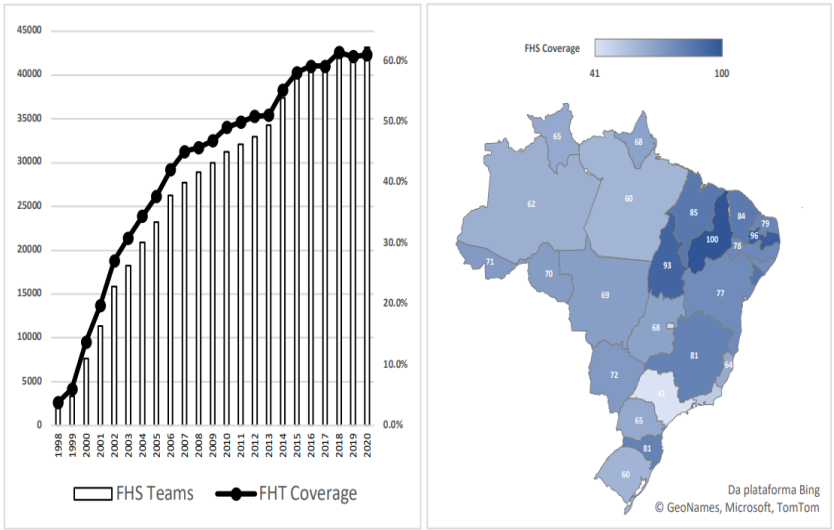
PHC in Brazil: a brief overview

- The **Brazilian Primary Health Care System is part of the Brazilian Unified Health System (SUS)**, which was structured according to the principles of universal coverage and health as a right of all citizens.

- Provides **a broad range of primary health care services** delivered by a **multidisciplinary team (physician, nurse, dentist, nursing assistant, dental assistant, and community health Workers).**

- Family Health Teams (FHTs) are supposed to work under the aegis of primary health care principles: **providing basic health care, promoting health activities and preventing diseases, as well as referring those in need to other levels of care.**

Figure 2: Number of FHS teams and percentage of population covered



Notes: data originally from MoH – PHC indicator panel. For the map, we used data on coverage as of January of 2020.

The 100 million Brazilians Cohort

Coorte de 100 milhões de brasileiros

Population from Cadastro Único (2001 -2021): low-income families potentially eligible for social protection programs (N=143,942,090)

Cadastro Unico
Social and demographic records of Individuals and family

Bolsa Famila programme
Records of the payments of the benefit of the cash transfer program

Conditionalinaties
Records of monitoring of compliance with PBF programme (health and education)

This dataset enables the identification of the PHC facilities visited by mothers and children

MCMV
Records of beneficiaries of the housing program

Wells
Records of beneficiaries of the sanitation programmse

SINASC
Records of live births, maternal and newborn characteristics

SIH
Records of hospitalisation

SISVAN
Record monitoring of growth, development and food consumption

SINAN
Records of notifications of diseases

SIM
Records of deaths

Primary Health Care Data
Large dataset about infrastructure and work process delivered by PHC teams in Brazil

- **Planning and Organization**
- **Infrastructure and Supplies**
- **Antenatal Care Quality**
- **Child Care Quality**

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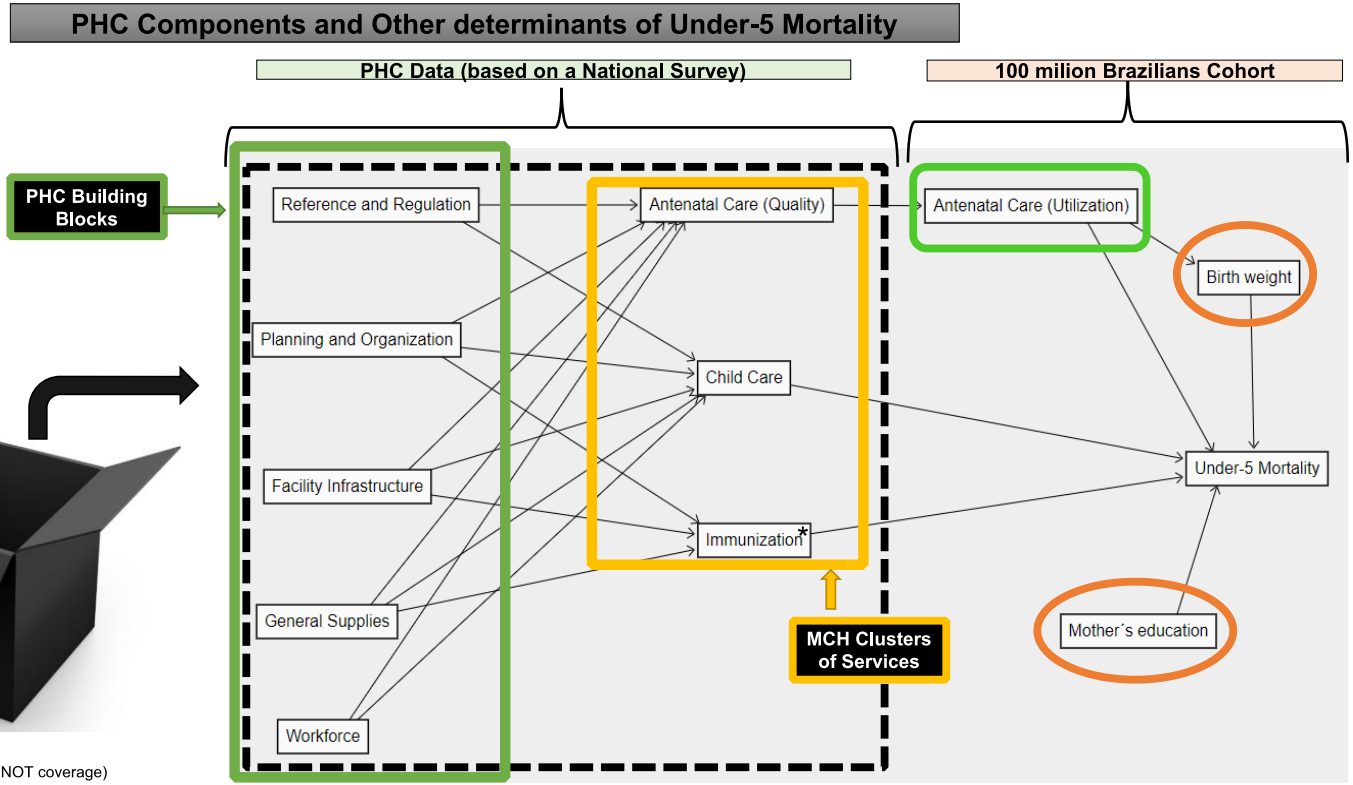
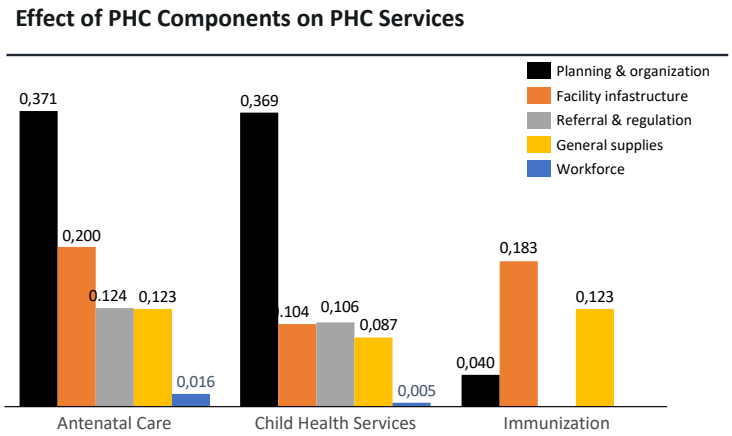
Unlocking the 'PHC Black Box' and understanding its relationship with under-5 mortality

An example of the 'data plasticity' using the 100 million Brazilians Cohort



*Immunization infrastructure (NOT coverage)

Planning and Organization has the strongest Effect on Quality of Care for Most PHC Services in Brazil



Key Findings

Planning and Organization has the largest effect on both Antenatal Care and Child Health Services

Facility infrastructure also significantly affects Antenatal Care and Child Health Services

Workforce has a weaker effect than expected

- Much of how the workforce is organized is already captured in Planning and Organization and Referral and Regulation
- PHC Workforce quantity and composition are distributed relatively uniformly in Brazil

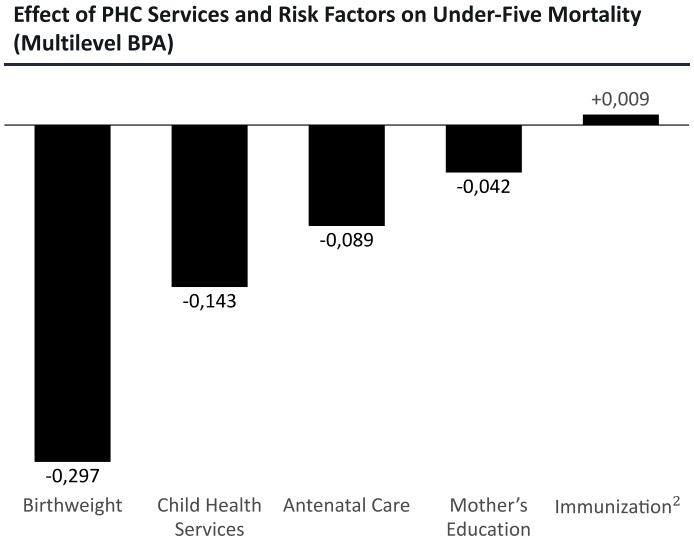
Implications

- **Investing in improving Planning and Organization practices** has the potential to have a stronger effect on the quality of Child Health Services than investing in other components in Brazil

What is Planning and Organization?

This component represents the actions necessary to coordinate the PHC team and other assets to deliver any PHC services effectively. It includes indicators about the frequency of team meetings, self-monitoring, and evaluation practices, and mapping/surveying the population they serve.

The model estimates a strong effect of birth weight and Child Health Services on Child Survival



1. Note that the lack of relationship for immunization is not statistically significant and is likely due to highly uniform vaccine coverage in Brazil, as well as rarity of deaths due to diseases preventable via immunization 2. Not statistically significant at 10%

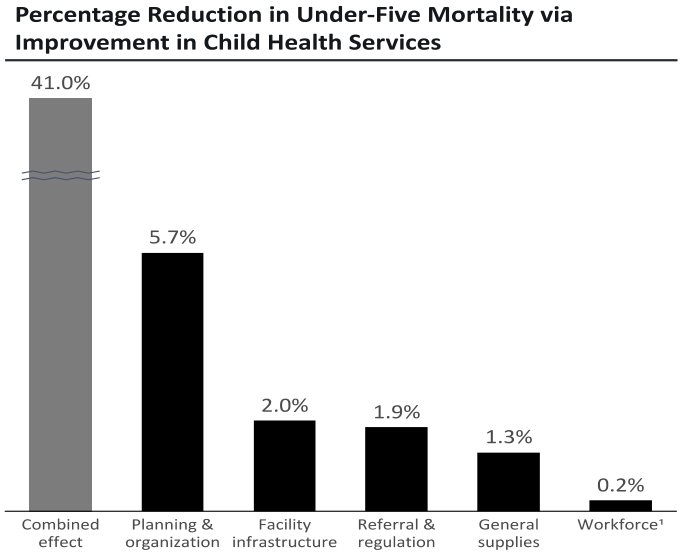
Key Findings

- **Birthweight** is the strongest determinant of under-five mortality in the model
- Among PHC factors, the availability and quality of **Child Health Services** is the strongest direct determinant of under-five mortality
- **Immunization** services has a statistically insignificant effect on under-five mortality in the model
  - Lack of relationship likely due to highly uniform vaccine coverage in Brazil

Implications

- **These results are consistent with typical effect sizes for each determinant**
- **This helps to validate the model itself, demonstrating that it quantifies risks accurately compared with alternative study designs**

"Improved planning and organizational activities quality translates into a 5.7% reduction in predicted child mortality. However, an overall improvement in PHC can reduce under-5 mortality by 41%!



Combined effect result is based on modeled assumptions. The large difference in results is likely accounted for by non-linear effects, meaning that there are accelerating marginal returns in improving the quality of services.

Key Findings

- **Predictive modeling estimates a 5.7% reduction in child mortality if Planning and Organization improved from hypothetically low quality (10th percentile) to high quality (90th percentile).**

Notable Observation

- These estimates reflect mortality reduction in the scenario where *one* PHC component was improved.
- Under the scenario when *all* components were improved, a 41% reduction in predicted child mortality was observed.
- This indicates that **the combined effect of the whole PHC system (41%) is larger than the sum of individual components (11%)[1]**

Implications

- **This modeling tool can simulate the lives that could be saved through various interventions, including packages of interventions.**
- **It demonstrates the relative importance of Planning and Organization in terms of avoidable mortality, but also system-wide improvements, based on health system maturity in Brazil.**

Key takeaways for Brazil and the World

New insights about **which PHC components influence health** the most in Brazil

- Relative comparison between workforce, supplies, infrastructure, referrals, and planning
  - Planning and organization outweighs other PHC components in Brazil (**soft**)
  - Facility infrastructure remains an important factor in Brazil (**hard**)
- Among PHC factors, the availability and quality of Child Health Services is the strongest direct determinant of under-five mortality

A better understanding of **how to measure PHC** systems and their effect on health

- Operational indicators that track with their corresponding components, for example, for planning and organization:
  - Frequency of team meetings
  - Non-clinical infrastructure
  - Monitoring and evaluation practices
- A reproducible model for understanding how PHC components contribute to health
  - These indicators are the most consistent metrics of performance in Brazil, and offer a model for other countries to explore
  - This modeling framework can now be adapted to other countries, even with more limited data

Public Engagement with Science at Cidacs: Connecting 100 Million Brazilian Cohort and Society

Dr Denise Pimenta

How can we ensure that research projects utilizing the "100 Million Brazilian Cohort" are connected with the actual needs and demands of Brazilian society?

Our challenges

- Navigating the country's vast cultural diversity
- Addressing deep social inequalities
- Bridging the gap between scientific advancements and public understanding
- Combating disinformation and rebuilding trust in science
- Ensuring the inclusion of voices often excluded from public debates
- Fostering meaningful dialogue with diverse audiences

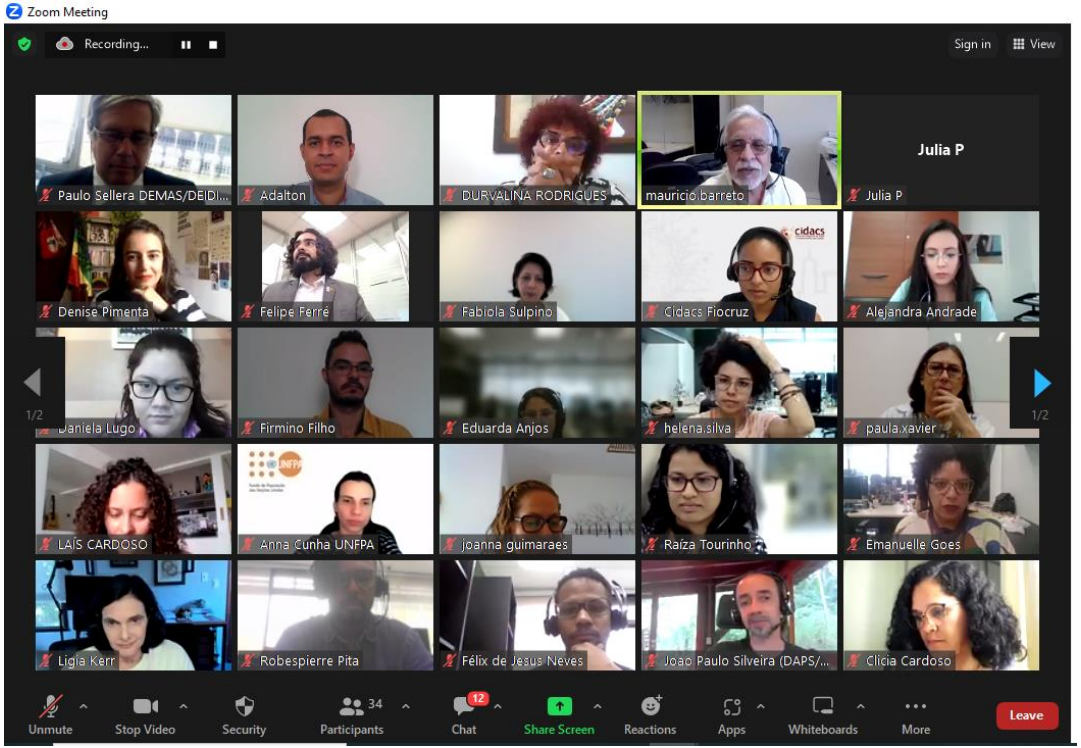
Coorte de 100 milhões de brasileiros

Bringing together "100 Million Brazilian Cohort" and Public Engagement

Foundation of Cidacs' Public Engagement Strategy

Including voices commonly excluded from public debates from the beginning of the research process
Dialogue involving different audiences;
Exchange of different experiences of stakeholders;
Improving the quality of research.

Our approach



Inform
Consult
Involve
Colaborate

Public engagement process

Pre-Engagement

- Planning
- Mapping of participants
- Preparation of research team
- Development of communication materials to support engagement

Engagement

- Establishment of contact
- Dissemination of material
- Organizing and conducting integration and dialogue activities
- Actively listening to shared experiences and sharing of scientific knowledge

Post-Engagement

- Discussions among research team members
- Updating of participants on research outcomes
- Production of novel results and dissemination of findings
- Continuous evaluation

Case 1 - Mental Health of Youth

Project: **“Impact of social determinants and income transfers on the mental health of young people”**

Public engagement objective: **Co-production of recommendations for local and national policies regarding mental health among youth**

Participants: **3 Educators from a community school in Salvador (BA)**

Activities

- International seminar with researchers and participants sharing experiences (+100 attendees)
- Workshop series to exchange scientific knowledge and educator experiences related to mental health among students;
- Issue recommendations to deliver to local policymakers based on research and experiences;
- Development of a dissemination strategy.

Current status: Production of recommendations

Case 2 - Gestational and congenital syphilis in vulnerable populations

Project: **Determinants of occurrence of gestational syphilis and its adverse effects on the conceptus and impact of social policies on these health problems. Brazil, 2001-2018**

Public engagement objective: **Facilitate dialogue between researchers and participants to enable knowledge exchange**

Participants: **Policymakers, black women and representatives of indigenous groups, NGOs, health professionals and researchers**

Activities

- 5 Webinars with 1,000+ attendees;
- 2 Technical meetings with policymakers in the indigenous area (10 participants
- Technical meetings with black women and indigenous representatives, health professionals and specialists to discuss dissemination (7 participants)
- Dissemination products (videos, policy briefing, website, data journalism, press release)

Impacts

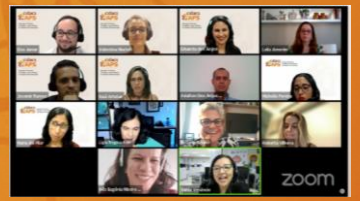
- Stakeholder recommendations to researchers and validation of results
- Invitation to project leader to participate in a federal government event on STI
- 150+ downloads of our policy briefing


Reunião Paralela, Comitê Consultivo Sedhi
Cidacs, Salvador-Brasil, setembro de 2023

Public Engagement in other projects

Themes

Covid-19
Mental health
Social and environmental determinants
Common Data Model
PHC
Syphilis



Participants

Policymakers
Community groups and NGO's
Intergovernamental institutions
Health professionals
Teachers
Media

Activities

Technical meetings
Workshops
Webinars
Discussion groups

Products and outcomes

Documentary
Paper
Co-production of recomendations
Dissemination pieces

Impacts

Impacts in research and dissemination pieces
Uses of our studies by participants
Public engagement studies at Cidacs

CIDACS NEW INITIATIVES

Data Platform to study environmental and climate effects on Health

cidacsClima
Plataforma de Dados Climáticos, Ambientais e de Saúde

Objective 3. Expand and update the *100 Million Brazilian* and *CIDACS Birth Cohorts* and develop the *CIDACS Climate and Environmental Platform*

- Extend and expand the geocoding of data in the *100 Million Brazilian* and *CIDACS Birth Cohorts*
- Update the the *100 Million Brazilian* and *CIDACS Birth Cohorts* to include new data up to 2023.
- Develop a fully functional *CIDACS Climate and Environmental Platform*
  - Hydrometeorological, reanalysis, and satellite imagery data

Plataforma de dados climáticos ambientais no CIDACS: Exemplos

Dados medidos in situ pelo INMET	Modelo de Reanálise ERA 5 LAND	Modelo de Reanálise VAN DONKELLAR	MAPBIOMAS
Período: 2000-presente (diário). Download: município e UF. Variáveis: • Temperatura: max - min - média - ponto orvalho • Precipitação Total • Vel e direção do vento • Pressão à Superfície • Umidade Relativa	Período: 2000-presente (diário). Download: município e UF. Variáveis: • Temperatura: max - min - média - ponto orvalho • Precipitação Total • Comp do vento: u e v • Pressão à Superfície • Umidade Relativa	Período: 2000-presente (mensal). Download: município e UF. Modelo: V5GL01.HybridPM25 Variável: • PM2.5 • NO2	Período: 2000-presente (mensal/anual). Download: município e UF. Variáveis: Uso e ocupação do solo Cicatriz de fogo Cobertura de água

Agnes Soares, coordenadora geral de Vigilância em Saúde Ambiental do Ministério da Saúde

AIMS:

Develop a Climate and Environmental Data Platform at CIDACS.

Integrate Brazil's georeferenced environmental and climate data into an accessible platform, interoperable with existing national health and socioeconomic data.

Generate new knowledge on the links between climate and health that are currently unavailable from existing dissipated and unlinked resources and inform mitigation and adaptation responses.

cidacsClima
Plataforma de Dados Climáticos, Ambientais e de Saúde

Coorte de 100 milhões de brasileiros

Coorte de Nascimentos

Summary of data colection and processing:

Data type	Database (Agency)	Scale	Period	Main variables	Status
Weather Stations	BDMEP (INMET)	381 conventional and 635 automatic	2000-present, daily	Precipitation, atmospheric pressure, temperature, relative humidity, wind, evaporation, insolation, cloudiness, and evapotranspiration	**Collected and Processed**
	CEMADEN	Automatic and rain gauge stations	2013-present, daily	Precipitation and disasters records	**In progress**
	ANA	Rain gauge stations	2000-present, daily	Precipitation	**In progress**
Reanalysis Models	ERA5-LAND (ECMWF)	Resol: 0.1° x 0.1°	2000-2022, daily	2m air temperature (maximum, minimum, mean, dew point, wet bulb, DTR), wind speed and direction, surface pressure, relative humidity and precipitation.	**Collected and processed**
	CAMS (ECMWF)	Resol: 0.75° x 0.75°	2003-2022, daily	Particulate Material ($PM_{1.0}$, $PM_{2.5}$, PM_{10}), total aerosol optical depth (TAOD), carbon monoxide (CO), nitrogen dioxide (NO_2), nitrogen monoxide (NO), and ozone (O_3)	**Collected and processed**
Satellite Image	Mapbiomas	30 m x 30 m	Annual	Land use and Land change	**In progress**

Gentilmente cedidos pelo Danielson

Summary of data colection and processing:

Data type	Database (Agency)	Scale	Period	Main variables	Status
Satellite Image	Land/Aqua (CPTEC/INPE)	Sensor: MODIS	2000-present, daily	Fires and deforestation, urban growth, land occupation	**In queue**
	Combined Land/Aqua (NASA)	Sensor: MODIS	2000-present, daily	Normalized difference vegetation index (NDVI), albedo, land surface temperature, sea surface temperature	**In queue**
	SUOMI-NPP (NASA)	Sensor: VIIRS	2000-present, daily	Electric light at night	**In queue**
Blended datasets	Surface PM2.5 and NO2 (WUSTL)	Resol: 0.01° x 0.01°	2000-2019, monthly	$PM_{2.5}$, NO_2	**Partially Collected and Processed**
	MERGE (CPTEC)	Resol: 0.1° x 0.1°	2000-present, daily	Precipitation	**In progress**
Gridded station	BR-DWGD	Resol: 0.1° x 0.1°	2000-2022, daily	Total precipitation, Maximum, minimum and mean air temperature, Solar radiation, Relative Umidity, Wind speed at 2 meters, Evapotranspitarion.	**Collected and processed**

Gentilmente cedidos pelo Danielson

CIDACS NEW INITIATIVES

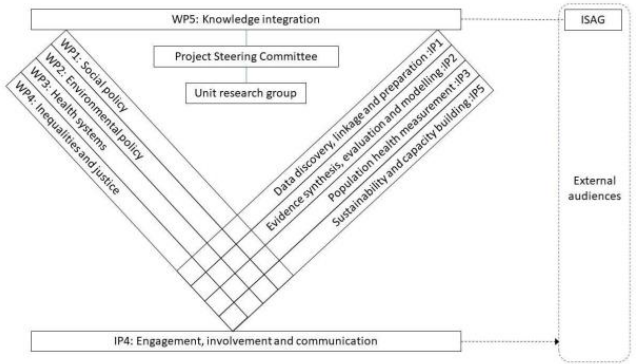
Data Platform to study environmental and climate effects on Health

NIHR GLOBAL HEALTH RESEARCH UNIT ON SOCIAL AND ENVIRONMENTAL DETERMINANTS OF HEALTH INEQUALITIES (2022-2027)

SEDHI
NIHR Unit in Social and Environmental Determinants of Health Inequalities

Our vision

- Over the next five years, we plan to be global leaders, focused on Latin America, in harnessing existing databases by integrating them to evaluate the impact of social and environmental policies on health and health inequalities, and the extent to which these can be affected by the health system.



Ministério da Saúde FIOCRUZ Fundação Oswaldo Cruz Instituto Gonçalo Moniz
cidacs Centro de Integração de Dados e Conhecimentos para Saúde
MRC/CSO Social and Public Health Sciences Unit
MRC Medical Research Council
Chief Scientist Office
University of Glasgow
FUNDED BY NIHR National Institute for Health Research
UIDE
London School of Hygiene & Tropical Medicine
St George's University of London

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Updates on international partnerships

PROBLEMS AND WEAKNESSES OF USING LINKED ADMINISTRATIVE DATA FOR BUILDING LARGE NATIONWIDE COHORTS

- **Data not collected for research purposes**
  Lack of relevant variables

- **Changes in how the data is collected over time**
  While the data are standardized across the country, some collection instruments have changed at some point, creating a need for harmonization.

- **Missing Values**
  Depending on the database lots or few missing data. For instance, in CADU, a considerable proportion of
  missing values in some variables, such as the occupation of family members and family characteristics,
  however, the description of all individuals in the household (e.g., gender, age, and ethnicity) and variables
  such as income, are highly complete.

PROBLEMS AND WEAKNESSES OF USING LINKED ADMINISTRATIVE DATA FOR BUILDING LARGE NATIONWIDE COHORTS

- **Misclassification and Selection biases**

  Selection and misclassification biases may be introduced in exposure and outcomes in three stages in the course of the assemblage of the cohort: registering and recording people's life events and use of services, linkage across administrative databases, and cleaning and coding variables from derived datasets.

- **Do not include all population or a random sample of it, but the poorest part of the population**

  In the Brazilian cohorts, it covers only the poorest part of the Brazilian population.

- **Register occurs when contact with service is provided**

  Mild outcomes or outcomes not routinely registered will not be included

- **Data Governance** (access, security, privacy, ethical and legal issues)

- **Computational Resources**

PROBLEMS AND WEAKNESSES OF USING LINKED ADMINISTRATIVE DATA FOR BUILDING LARGE NATIONWIDE COHORTS

- **Data quality and standardized data collection throughout the country**

  1.The quality and coverage of health data has improved; 2. Brazil, despite being a large and federative country, the data collection forms for different purposes are standardized(death, birth, hospitalization etc)

- **Nationwide Data Coverage, including all ages and ethnical groups**

  Possible to study minoritized population groups as well as traditional groups

- **Possibility to link data from multiple sources (health, social, environmental, climate)**

  Routine data is very often spread in silos with a connection between them. It links health, social, and environmental data from multiple sources. This adds enormous value to existing health data. Answer questions not possible with an isolated database

- **Quality of the Data Linkage**

  The linkage (deterministic or probabilistic) is conducted with very powerful and accurate software developed in-house and adapted to the Brazilian data ecosystem (Cidacs-RL)

ADVANTAGES AND STRENGTHENS OF USING LINKED ADMINISTRATIVE DATA FOR BUILDING LARGE NATIONWIDE COHORTS

- **Large Sample size**

  Large sample sizes allow several analytical advantages, such as the analysis of rare events; It is possible to study rare exposure and rare outcomes simultaneously; Increase the statistical power of the study, allowing for more precise estimates of associations and enabling subgroup analyses such as age, gender, ethnicity, geographies, etc.

- **Overcome classical epidemiological challenges**
  - Eliminates the risk of **recall bias** for important variables, which is a problem if data collection relies on self-reports of service use (e.g., hospitalization or childbirth). Participants and the data collector do not know the research question to be put for the data
  - Very low attrition rates – immigration from Brazil is negligible among the poorest populations

- **Using longitudinal individual data could overcome limitations of the time-series analysis**

- **Cost reduction**

  Costs involved in data collection with comparable-sized primary studies are reduced. Cost of the infrastructure.

Last words!

In Brazil, the CIDACS experience has shown that using health and social administrative databases for research and evaluation is a unique tool for improving the understanding of the health problems of the Brazilian population!

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