



Introduction to the EPOCH Collaborative Group: Methodology for comparisons between international birth cohorts

INRICH Paris June 2023

Jennifer J. McGrath, PhD, MPH

Concordia University, Montreal, Canada

Mission

To elucidate pathways underlying child health inequalities from an international perspective and use this policy-relevant information to effectively guide knowledge mobilization



EPOCH

Elucidating Pathways of Child Health Inequalities

Seven Birth Cohorts



Sweden

ABIS

All Babies in Southeast Sweden
(Alla Barn I Sydöstra Sverige)



The Netherlands

GenR

Generation R



Australia

LSAC

Longitudinal Study of Australian Children



United Kingdom

MCS

Millennium Cohort Study



Canada

NLSCY

National Longitudinal Study of Children & Youth



Quebec

QLSCD

Quebec Longitudinal Study Child Development
(Étude Longitudinale du développement des enfants du Québec)










USA

USNLSY

US National Longitudinal Study of Youth

Sampling & Characteristics

	Sampling	Baseline	Age 10
	ABIS All children born in defined region of Sweden invited.	Birth n = 17,055 1997 – 1999	10-12 yrs n = 16,365 96% complete
	GenR Pregnant women in Rotterdam who visited midwife or obstetrician invited.	Birth to 4 yrs n = 9,749 2002 – 2006	9-10 yrs n = 7,393 75.8% complete
	LSAC National random sampling; 10% postcodes excluding remote; in Universal health care database.	Birth to 1 yr n = 5,107 <i>*Cohort B</i> 2004	10-11 yrs n = 3,764 73.9% complete
	MCS All children alive & living in UK at age 9 mos and eligible to receive child benefit eligible.	9 mos n = 18,552 2000	10-11 yrs n = 13,354 71.6% complete
	NLSCY Sampling stratified by province to select representative sample of children in Canada.	Birth to 11 mos n = 2,976 <i>*Cycle 6</i> 2000 – 2004	10 yrs n = 1,356 60.9% complete
	QLSCD All singleton live births excluding First Nations, very premature or sex unknown.	6 mos n = 2,120 1997	10 yrs n = 1,334 63% complete
	USNLSY Offspring of NLSY79 cohort, which was population representative at origin.	Birth n = 3,657 1988 – 1996	10 yrs n = 2,976 81.4% complete

Socioeconomic Status (SES)

Harmonization

- SES Exposure at birth or early life (within first 5 years)

Household Income

- Local currency & \$Purchasing Power Parity (2000)
- Household income net of tax & transfers or gross income
- Equalized, if possible (weighted by household members*)
- Tertiles or Quintiles
- Low - Poorest (Q1), Middle (Qs 2-4), High - Richest (Q5)

Maternal Education

- International Standard Classification of Education (ISCED)
- Low (0-II), Middle (III-IV), High (V-VIII)

Purchasing Power Parity

\$PPP

- Rates of currency conversion that equalize purchasing power of different currencies by eliminating differences in price levels between countries.
- Facilitates comparison across countries into harmonized metric that provides more accurate and interpretable estimate about country's overall standard of living.
- \$PPP provided by OECD for year 2000



Example – Litre of Milk

- France 2.30 euros (€)
 - USA 2.00 dollars (\$)
 - $\$PPP = 2.30 / 2.00 = 1.15$
- (∴ For every 1 \$, 1.15 €)

Baseline SES Exposure - \$PPP



	Income	Poor Q5	Middle Q2-4	Rich Q1	Gini
ABIS	Net Not equivalized	< 25,749	25,748 - 37,844	> 37,845	27.2



GenR	Net Not equivalized	< 20,472	20,472 - 49,133	> 49,133	29.8
-------------	------------------------	----------	-----------------	----------	------



LSAC	Gross Not equivalized	< 24,596	24,544 - 65,624	> 65,676	33.1
-------------	--------------------------	----------	-----------------	----------	------



MCS	Net Yes (OECD)	< 9,478	9,515 - 33,265	> 33,265	37.0
------------	-------------------	---------	----------------	----------	------



NLSCY	Gross Not equivalized	< 24,834	24,834 - 66,224	> 66,225	31.3
--------------	--------------------------	----------	-----------------	----------	------

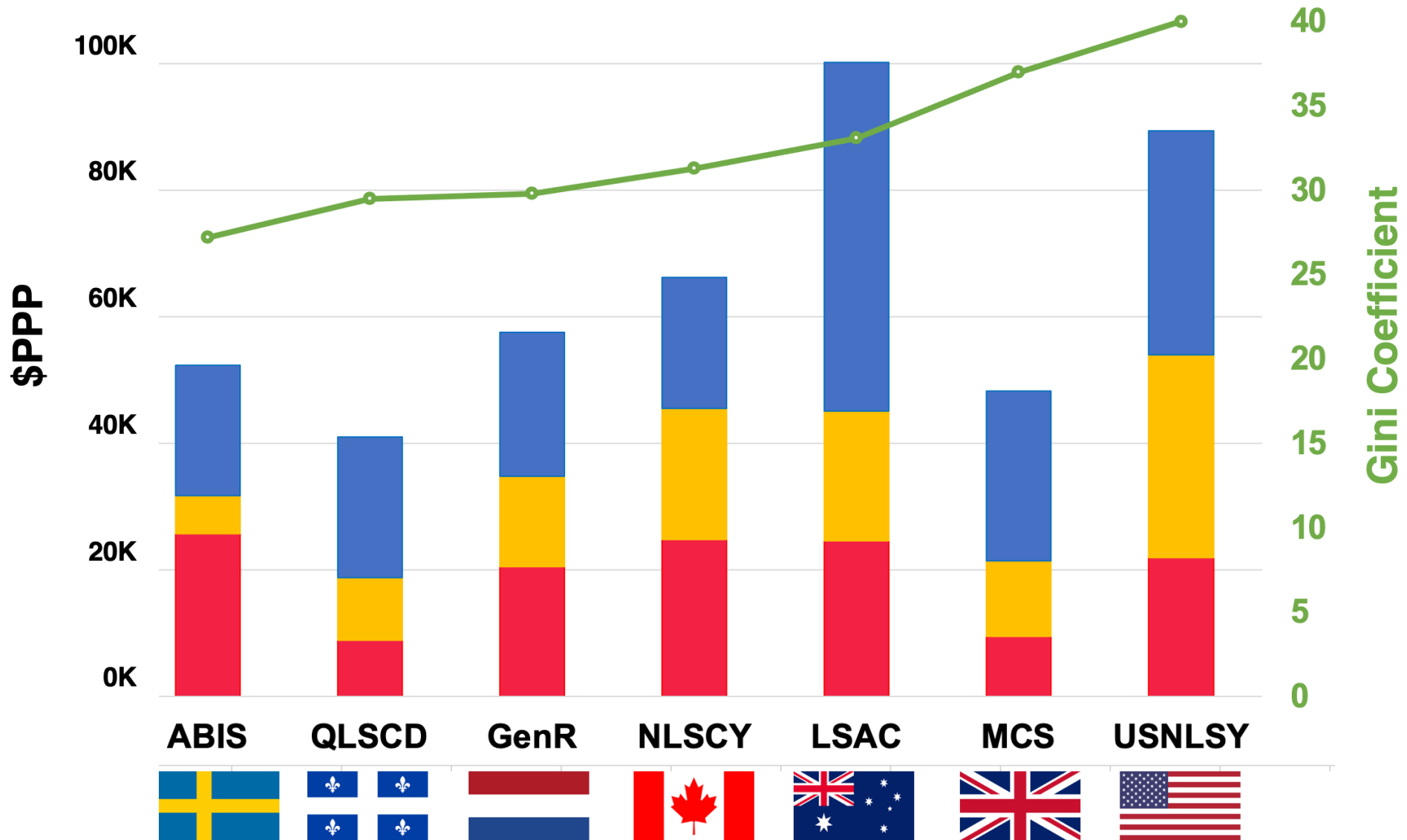


QLSCD	Gross Yes (OECD)	< 8,921	8,967 - 28,547	> 28,679	29.5
--------------	---------------------	---------	----------------	----------	------



USNLSY	Net Not equivalized	< 21,967	21,968 - 86,064	> 86,065	40.0
---------------	------------------------	----------	-----------------	----------	------

Baseline SES Exposure - \$PPP




Maternal Education

ISCED





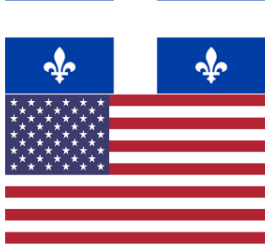
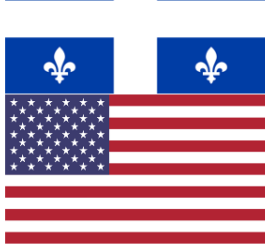
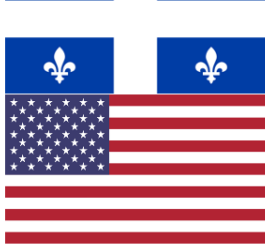
- International Standard Classification of Education
- UNESCO Institute of Statistics
- Maternal Education - years of education at birth of child

Classification



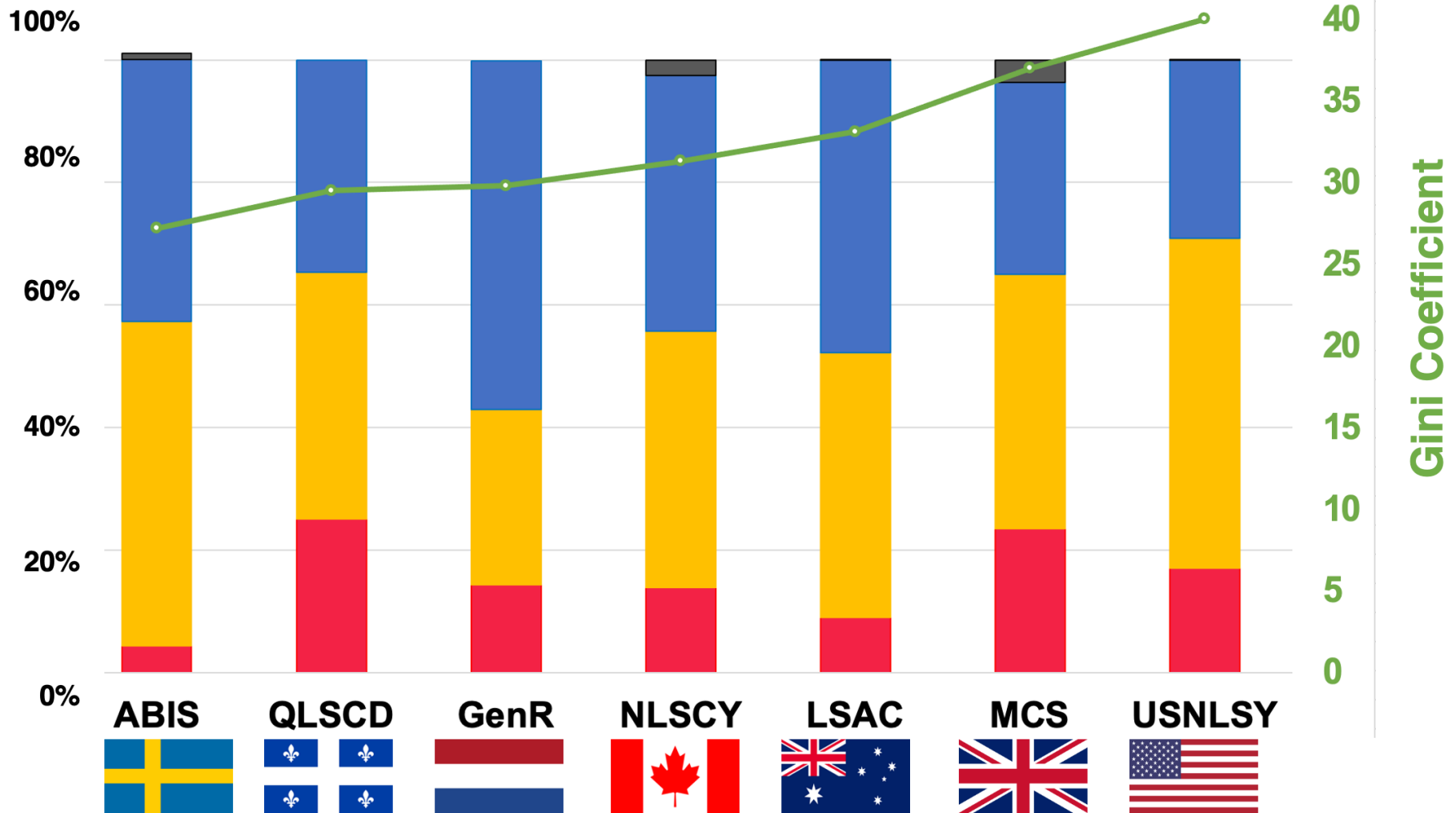
Category	ISCED	Levels	Cumulative
○ Low	0 to 2	Early childhood education Primary education Lower secondary education	0 to 9 yrs
○ Middle	3 to 4	Upper secondary education Post-secondary non-tertiary	10 to 14 yrs
○ High	5 to 8	Short-cycle tertiary education Bachelor's or equivalent Master's or equivalent Doctoral or equivalent	15 yrs +

Baseline SES Exposure - Educ

	Missing	Low	Middle	High
 ABIS	1%	4.4%	52.9%	42.8%
 GenR	0%	14.3%	28.6%	57.0%
 LSAC	0.05%	9.0%	43.2%	47.8%
 MCS	3.7%	23.5%	41.5%	31.3%
 NLSCY	2.5%	13.8%	41.9%	41.8%
 QLSCD	0%	25.1%	40.2%	34.7%
 USNLSY	0.1%	17.0%	53.9%	29.1%

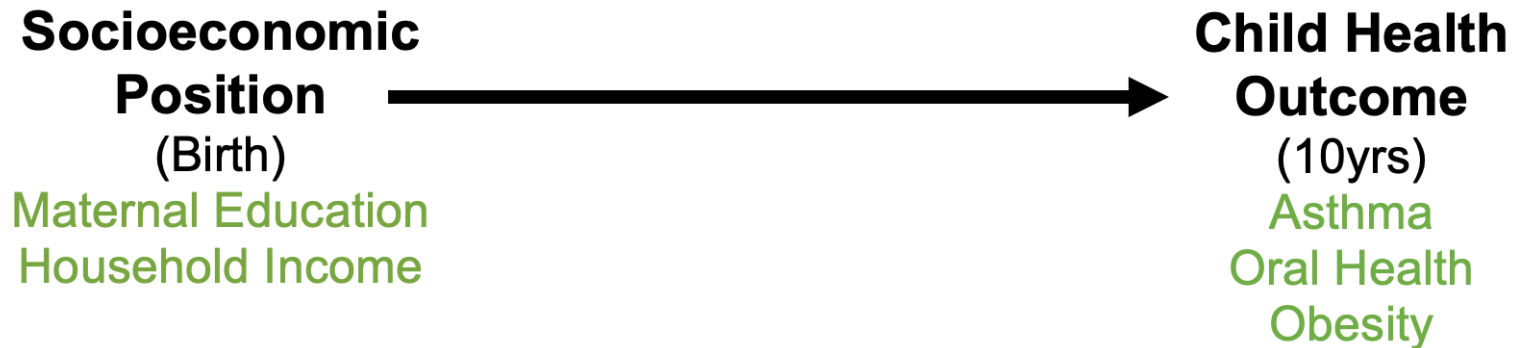
Baseline SES Exposure - Educ

Maternal Education



Guiding Research Question

Is SES exposure during early childhood linked to health inequalities during late childhood across different country settings?



Baseline Confounding Variables

Baseline confounders selected to reduce to potential confounding bias in estimation of the effects of interest.

Ethnicity

- Ethnic Majority / Born in country / Not an immigrant
- Ethnic Minority / Born outside country / Immigrant

Maternal Age at Birth

- <20 yrs, 20-29 yrs, 30-39 yrs, 40+ yrs

Child Sex *(No cohorts distinguish sex from gender)*

- Male, Female

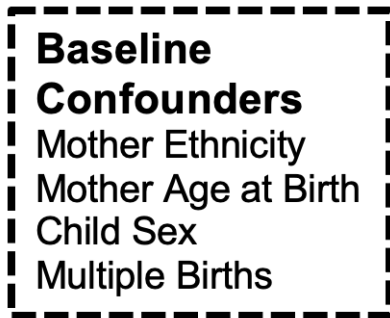
Multiple Births

- Yes, No

DAG

Baseline confounders selected to reduce to potential confounding bias in estimation of the effects of interest.

Did not adjust for potential mediators on pathway between SES and health outcome in late childhood (i.e., to avoid bias by conditioning on colliders or overcontrolling for effect of SES)



**Socioeconomic
Position**
(Birth)
Maternal Education
Household Income



**Child Health
Outcome**
(10yrs)
Asthma
Oral Health
Obesity

Analytic Approach

Relative Risk

- Relative risks are multiplicative; **convey relative inequality**; show how much more disadvantaged groups are affected relative to wealthier counterparts.

Absolute Risk

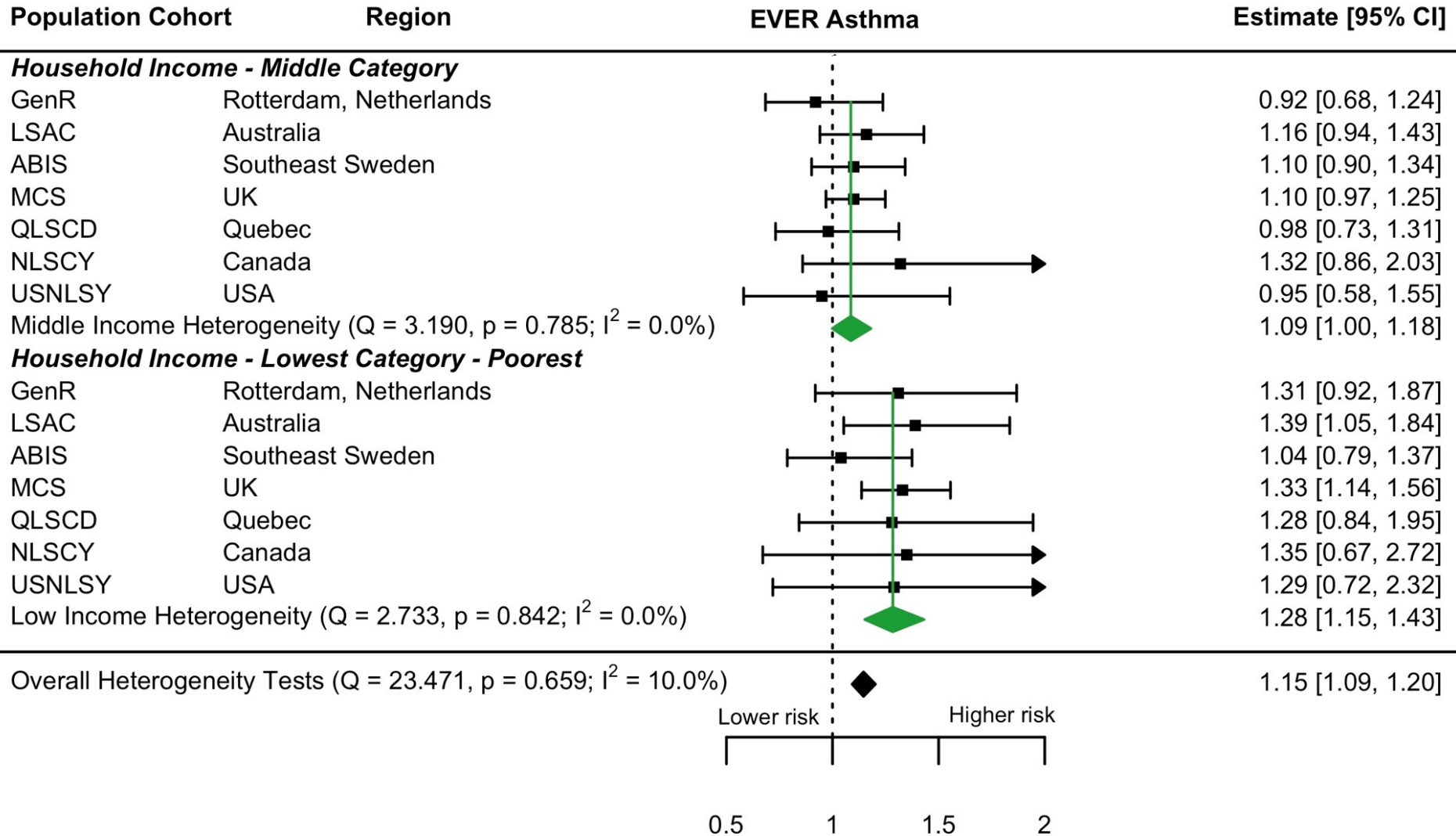
- Reflect the magnitude of a health outcome within a population; absolute risks convey what **percentage of population** is affected.

Relative Risk Analyses

Relative Risk

- **Risk Ratios** (RRs) estimated using Generalized Linear Model with log link and robust variance estimation.
- **Unadjusted RRs** (bivariate; absolute burden of risk)
- **Adjusted RRs** (controlling for baseline confounding variables to isolate effect of SES)

Relative Risk Visualization



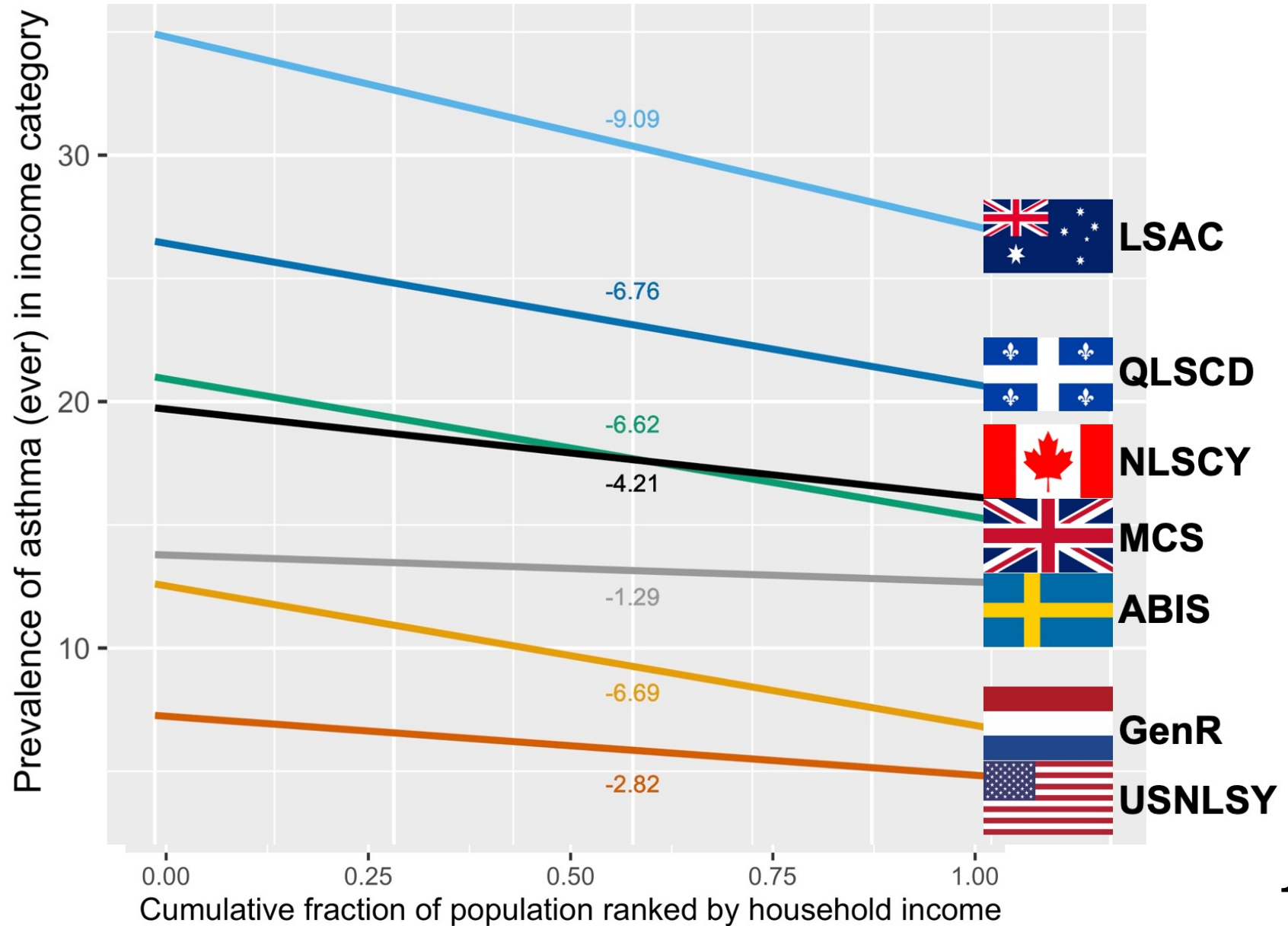
Risk of Ever Asthma relative to Highest SES Group

Absolute Risk Analyses

Absolute Risk

- Slope Index of Inequality (SII) represents absolute difference in prevalence between most and least advantages groups in a population.
- Linear regression-based index that accounts for socioeconomic distribution of population, thereby excluding the size of the socioeconomic groups as a source of variability in estimating magnitude of inequalities in health.

Absolute Risk Visualization



Child Health Outcomes

- **ADHD**
(Spencer et al, PLOS One, 2022)
- **Obesity***
(White et al, International Journal of Obesity, 2022)
- **Activity Limiting Conditions**
(Spencer et al, J of Epidemiology & Community Health, 2022)
- **Oral Health***
(Goldfeld et al, PLOS One, 2022)
- **Asthma***
(Yang-Huang et al, Under Review)
- **Physical Activity / Movement Behaviours**
(Gauvin et al, In Preparation)
- **Sleep**
(McGrath et al, In Preparation)
- **Emotional / Psychological / Behavioural**
(Lebena et al, In Preparation)

EPOCH Prioritization

- Socioeconomic Position (SEP) Harmonization
- Early SEP Exposure & Late Childhood Outcomes
 - Obesity
 - Oral Health
 - Asthma
 - Activity Limiting Conditions
 - ADHD
 - Sleep
 - Physical Activity / Movement
 - Emotional / Psychological
 - Self-Rated Health
 - Injuries
 - Learning / Cognitive
 - Stress / Life Events
- Mediation Models (Mechanism / Pathway / DAG)
- Trajectories / Growth / Time Series
- Multilevel Models (Neighborhood)

EPOCH Collaborative Group

Yara Abu Awad (Concordia University, Canada & Swiss Federal Statistics Office)

Pär Andersson White (Crown Princess Victoria Children's Hospital, Sweden)

Guannan Bai (Erasmus MC, The Netherlands)

Philippa Bird (Bradford Institute for Health Research, UK)

Susan A. Clifford (The University of Melbourne, Australia)

Åshild Faresjö (Linköping University, Sweden)

Tomas Faresjö (Linköping University, Sweden)

Kate L. Francis (Royal Children's Hospital, Australia)

Lise Gauvin (Centre de recherche du CHUM & Université de Montréal, Canada)

Sharon Goldfeld (The Royal Children's Hospital Melbourne, Australia)

Jeremy D. Goldhaber-Fiebert (Stanford University, USA)

Andrea Lebena (Linköping University, Sweden)

Johnny Ludvigsson (Linköping University, Sweden)

Wolfgang Markham (University of Warwick, UK)

Katie McBain (The University of Melbourne, Australia)

Jennifer J. McGrath (PI, Concordia University, Canada)

Fiona K. Mensah (The University of Melbourne, Australia)

Béatrice Nikiéma (Université de Montréal, Canada)

Elodie O'Connor (Royal Children's Hospital, Australia)

Kate Pickett (co-PI, University of York, UK)

Hein Raat (co-PI, Erasmus MC, The Netherlands)

Louise Séguin (co-PI, Université de Montréal, Canada)

Nicholas J. Spencer (co-PI, University of Warwick, UK)

Sue Woolfenden (University of New South Wales & Sydney Children's Hospital, Australia)

Junwen Yang-Huang (Erasmus MC, The Netherlands)

Yueyue You (Erasmus MC, The Netherlands)



CIHR IRSC



Canadian Institutes of Health Research
Instituts de recherche en santé du Canada