

Asthma and child inequalities: Comparison between seven birth cohorts

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Background

 Asthma is one of the most common chronic conditions in childhood. Wide variations exist in the prevalence of childhood asthma worldwide



Between 2000-2003, among 13-14-year old children, prevalence rate of children ever having asthma and wheezing



Background

- Socioeconomic status (SES): household income, caregiver employment, parental education status
- Inconsistent results regarding the association between SES and asthma-related outcomes
- Definitions of SES vary across studies
- Absolute inequality in child asthma-related outcomes provides valuable insights from public health perspectives by accounting for the overall level of asthma prevalence
- Asthma, wheezing/asthma attacks, and use of medication current symptoms and severity of asthma

Study the associations both in relative and absolute terms between maternal education and household income during early childhood and the presence of ever asthma, wheezing/asthma attacks, and asthma with medication control later when the children were aged 9-12 years in six countries

Seven Birth Cohorts

	Sweden	ABIS	All Babies in Southeast Sweden (Alla Barn I Sydöstra Sverige)	n=4026
	The Netherlands	GenR	Generation R	n=4277
* *	Australia	LSAC	Longitudinal Study of Australian Child	n=3759 dren
	United Kingdom	MCS	Millennium Cohort Study	n=13 354
*	Canada	NLSCY	National Longitudinal Study of Childr	n=1356 en & Youth
* *	Quebec	QLSCD	Quebec Longitudinal Study Child Der (Étude Longitudinale du développement des enfan	velopment ts du Québec)
	USA	USNLSY	US National Longitudinal Study of Yo	n=3104 outh

In total, 31 210 children born between 1988 and 2006

Socioeconomic Status (SES)

Household Income

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)

Outcome

- Ever asthma: parent endorsment of whether their child had ever received a diagnosis of asthma by a health professional
- Wheezing/asthma attacks in the past 12 months:
 - attacks/illness of wheezing (Netherlands and Australia)
 - wheezing or whistling (UK, Sweden and Canada)
 - wheezing or an attack of asthma (USA and Quebec)
- Medication control for asthma: ever diagnosis of asthma and asthma-related medication use in the past 12 months
- At child age 10-11 years, 9-10 years in GenR (Netherlands), 10-12 years in ABIS (Sweden)

Statistical analysis

Relative Risk

- Risk Ratios (RRs) estimated using Generalized Linear Model with log link and robust variance estimation
- Unadjusted (bivariate; absolute burden of risk) and Adjusted (controlling for confounding variables to isolate effect of SES) RRs were estimated
- Pooling of RRs from all cohorts and estimation of the I² and Q statistic ranges to evaluate heterogeneity

Absolute Risk

- Slope Index of Inequality (SII) represents absolute difference in prevalence between most and least advantages groups in a population
- Reflect the magnitude of a health outcome within a population; absolute risks convey what percentage of population is affected

Results



Prevalence of children ever experiences asthma

■Yes ■No ■Missing

60.0%

80.0%

100.0%

40.0%

Australia

Netherlands

0.0%

4.3%

0.0%

20.0%

Ever asthma

Maternal Educa	tion - Middle Category		
	don income concegory		
GanR	Rotterdam, Netherlands	<u> </u>	1.06 (0.83, 1.35
LSAC	Australia	i • • •	1.18 [0.98, 1.42
ABIS	Southeast Sweden	H	1.10 (0.93, 1.31
MCS	UK	Hart	1.04 (0.94, 1.16
QLSCD	Quebec	J	1.05 (0.80, 1.38
NESCY	Canada		1.13 (0.74, 1.72
USNLSY	USA	i i i i i i i i i i i i i i i i i i i	0.96 (0.65, 1.41
Middle Education	h Heterogeneity (Q = 1.878, p = 0.9	31; l ² = 0.0%)	1.07 [1.00, 1.15
Maternal Educa	tion - Lowest Category		
GenR	Rotterdam, Netherlands	. h	1.52 (1.16, 2.00
LSAC	Australia		1.38 (1.06, 1.79
ABIS	Southeast Sweden		1 18 10 80, 1 75
MCS	UK		1.20 [1.06, 1.36
OLSCD	Quebec		1 11 10 79 1 56
NESCY	Canada		1 14 /0 70 1 8/
USNESY	LISA		1 12 10 65 1 92
Low Education H	leterogeneity (Q = 3,717, p = 0,715)	1 ² = 0.0%)	1.24 [1.13, 1.37
Household Inco	ome - Middle Category		
GenR	Rotterdam, Netherlands	h	0.92 (0.68, 1.24
LSAC	Australia	h	1.16 (0.94, 1.43
ABIS	Southeast Sweden	→	1.10 (0.90, 1.34
MCS	UK	i-i	1.10 (0.97, 1.25
QLSCD	Quebec		0.98 (0.73, 1.31
NLSCY	Canada	······································	1.32 [0.86, 2.03
USNLSY	USA		0.95 (0.58, 1.55
Middle Income H	leterogeneity (Q = 3.190, p = 0.785;	1 ² = 0.0%)	1.09 [1.00, 1.18
Household Inco	whe - Lowest Category - Poorest	1	
GenR	Rotterdam, Netherlands	⊢	1.31 [0.92, 1.87
LSAC	Australia	· · · · · · · · · · · · · · · · · · ·	1.39 [1.05, 1.84
ABIS	Southeast Sweden	H	1.04 (0.79, 1.37
MCS	UK		1.33 [1.14, 1.58
QLSCD	Quebec	·····	1.28 (0.84, 1.95
NLSCY	Canada		1.35 (0.67, 2.72
USNLSY	USA		1 29 10 72 2 32
Low Income Het	erogeneity (Q = 2.733, p = 0.842; I ²	= 0.0%)	1.28 (1.15, 1.43
Overall Heteroge	eneity Tests (Q = 23.471, p = 0.659;	t ² = 10.0%)	1.15 (1.09, 1.20
		Lower fisk Higher fisk	

Risk of Ever Asthma relative to Highest SES Group

Ever asthma



Wheezing/asthma attacks

Population C	chon Region	Wheezing/Attacks	Estimate [55% Ci
Maternal Edu	cation - Middle Category		
GenR	Rotterdam, Netherlands	· · · · · · · · · · · · · · · · · · ·	1.61 [1.16, 2.23
LSAC	Australia	<u>è∎</u> i	1.17 [0.98, 1.40
ABIS	Southeast Sweden	⊢	1.08 (0.89, 1.31
MCS	UK	H	0.96 [0.84, 1.09
QLSCD	Quebec	4 4 1	0.79 [0.34, 1.84
NESCY	Canada	H + + + + + + + + + + + + + + + + + + +	1.12 (0.70, 1.75
USNLSY	USA		1.11 [0.80, 1.54
Middle Educar	tion Heterogeneity (Q = 10.177,	p = 0.117; I ² = 42.6%)	1.11 (0.98, 1.26
Maternal Edu	cation - Lowest Category	and the second secon	0.00040404040404
GenR	Rotterdam, Netherlands	h	1.47 (0.94, 2.29
LSAC	Australia		1.38 11.06, 1.80
ABIS	Southeast Sweden		0.86 (0.52, 1.4)
MCS	UK		1 01 10 86 1 11
OLSCD	Quebec		1 03 10 46 2 3
NISCY	Canada		1 25 10 69, 2 21
LISNESY	USA		1 14 10 72 1 8
Low Education	Heteropeneity (O = 6.613 n =	0.358 12 = 26.0%)	1 14 10 07 1 3
1200000000000000		PORTAGE STATES STATES	101203030308
Household In	come - Middle Category		
GenR	Rotterdam, Netherlands		1.11 [0.71, 1.75
LSAC	Australia	1	1.62 [1.31, 2.0]
ABIS	Southeast Sweden	H(1.21 [0.96, 1.5]
MCS	UK		0.98 [0.84, 1.1-
QLSCD	Quebec	· · · · · · · · · · · · · · · · · · ·	1.16 [0.50, 2.7
NLSCY	Canada	H-1-4	1.23 [0.78, 1.9
USNLSY	USA	: 	1.75 [1.09, 2.8]
Middle Income	e Heterogeneity (Q = 17.288, p =	= 0.008; I ² = 60.5%) ;	1.26 [1.04, 1.5]
Household In	come - Lowest Category - Po	prest	
GenR	Rotterdam, Netherlands	1	1.52 [0.89, 2.60
LSAC	Australia		1.39 [1.05, 1.8
ABIS	Southeast Sweden		0.90 (0.64, 1.2)
MCS	UK	1	1.11 [0.91, 1.35
QLSCD	Quebec		1.45 [0.53, 3.9]
NLSCY	Canada	· · · · · · · · · · · · · · · · · · ·	1.75 10.86, 3.5
USNLSY	USA		1.42 10.80, 2.5
Low Income H	leterogeneity (Q = 6,731, p = 0.3	346: I ² = 23.2%)	1.22 11.03. 1.4
Overall Hetero	poeneity Tests (Q = 44.068, p =	0.020; 12 = 43.9%)	1.18 [1.09, 1.2
		Lower risk Higher risk	10. 17. 1020 • CTEL (19.073)
		L L J L	
		0.5 1 1.5 2	

Risk of Wheezing / Asthma Attacks relative to Highest SES Group

Wheezing/asthma attacks



Medication control

Population 0	Cohort Region	Medication Control Use	Estimate [95% Cl
Maternal Ed	ucation - Middle Category		
GenR	Rotterdam, Netherlands	h.	1.09 (0.78, 1.52
ABIS	Southeast Sweden	H-	0.87 [0.64, 1.18
MCS	UK	⊢ ∎÷i	0.87 [0.69, 1.09
QLSCD	Quebec	—	0.90 [0.60, 1.35
NLSCY	Canada		1.23 (0.62, 2.44
USNLSY	USA		0.90 [0.52, 1.56
Middle Educa	tion Heterogeneity (Q = 2.056	5, p = 0.841; l ² = 0.0%)	0.93 (0.80, 1.0
Maternal Edi	ucation - Lowest Category		10/10/10/10/10/10/10/10/10/10/10/10/10/1
GenR	Rotterdam, Netherlands	i	1.46 (0.99, 2.1)
ABIS	Southeast Sweden	· · ·	1.00 (0.49, 2.0)
MCS	UK	1 to 1	1.13 (0.87, 1.4
QLSCD	Quebec		1.05 [0.65, 1.7
NLSCY	Canada		1.21 (0.48, 3.0
USNLSY	USA	• • • • • • • • •	0.89 (0.38, 2.0
Low Educatio	n Heterogeneity (Q = 2.086, p	= 0.837; 1 ² = 0.0%)	1.16 (0.97, 1.4)
ABIS	Southeast Sweden		0,76 (0.52, 1.1 1.27 (0.88, 1.8
ARIS	Southeast Sweden		1 27 10 88 1 8
MCS	UK	⊢ ;•—i	1.07 (0.83, 1.3
QLSCD	Quebec		0.93 (0.61, 1.4
NLSCY	Canada	· · · · · ·	2.08 [1.02, 4.2
USNLSY	USA	· · · · · · · · · · · · · · · · · · ·	1.11 (0.54, 2.2
Middle Incom	e Heterogeneity (Q = 7.751, p	= 0.170; I ² = 26.0%)	1.06 [0.87, 1.2
Household I	ncome - Lowest Category - I	Poorest	
GenR	Rotterdam, Netherlands	1	1.16 (0.72, 1.8
ABIS	Southeast Sweden		0.94 [0.55, 1.6
MCS	UK	1	1.30 [0.94, 1.8
QLSCD	Quebec		1.23 (0.69, 2.2
NLSCY	Canada		4.33 (1.55, 12.1
USNLSY	USA	+ +	1.14 [0.45, 2.8
Low Income I	Heterogeneity (Q = 6.877, p =	0.230; I ² = 0.0%)	1.25 [1.01, 1.5
Overall Heter	ogeneity Tests (Q = 25,775, p	= 0.312; 1 ² = 8.7%)	1.06 (0.97, 1.1
		0.5 1 1.5 2	

Medication Control Use relative to Highest SES Group

Medication control



Discussion

- Pooled estimate for ever asthma was consistent with increased relative risk by maternal education
- Pooled estimates for wheezing/asthma attacks and asthma medication control were in the expected direction, their confidence intervals crossed unity
- Absolute risk by income and maternal education was in the expected direction for all outcomes and complemented the findings for relative risk, except for wheezing by maternal education in the UK cohort and by income in the Swedish cohort

Prevalence

- The prevalence of child asthma ranged from 8.3% to 29.1%
- Lower than the findings of phase III (2000-2003) of the International Study of Asthma and Allergies in Childhood (ISAAC)
- Data for all cohorts were collected after the ISAAC phase III period, except for the USA cohort that had overlapping years
- Asthma prevalence has plateaued or even decreased in recent years
- Still particularly high in English-speaking countries, Western Europe, and some of the more affluent Asian countries

Absolute inequality

- The largest potential reduction in asthma prevalence, according to higher maternal educational levels, would be observed in Australia and the Netherlands (reduction in asthma: 10% and 8%, respectively)
- Higher household income would be associated with the largest reductions in Australia (reduction in asthma: 9%) as well as Quebec, the Netherlands, and UK (similar reduction in asthma: all 7%)

Homes

- Traditional relation between lower SES and higher asthma prevalence is evident until children are age 9 years
- Among older children and adolescents, mixed results were reported
- As children grow older, a larger portion of their day will be spent in school and the neighborhood. The impact of poor housing conditions, to which children from lower SES families tend to be exposed, may be a less salient risk factor during later childhood

Improving Asthma Control

- Avoid triggers (home, school)
- Increased knowledge for both parents and teachers (e.g., school nurses, specialized asthma nurses)
- Trust in the doctor
- Optimism about the possible effect of the treatment

Thank you