

Online data supplement

Social inequalities in wheezing in children: Findings from the UK Millennium Cohort Study

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This data supplement contains additional information on the methods employed in the study. In addition, further plots and results are presented.

Methods

As sensitivity analyses we repeated the analysis using household socioeconomic position (higher of mother/father using UK National Statistics socioeconomic class, four categories), to see if the patterns differed. Furthermore making use of a supplementary question about frequency of wheezing we repeated the analysis including only those children considered to have more severe wheezing, classified as 4 or more episodes of wheezing in the past year. In a final supplementary analysis we also explored the change in the SEC gradient in the mediation model using the relative index of inequality (RII) approach [1].

Table S1: Longitudinal typologies of wheeze

Longitudinal typologies of wheeze 0=no wheeze; 1=wheeze						
Typology #1 (analysis typology)	Typology #2	9m (taken to health prof. for wheeze)	3y (wheeze in last 12m)	5y (wheeze in last 12m)	7y (wheeze in last 12m)	Frequency
Never	Never	0	0	0	0	66.0% (7540)
Early remitting	Gone by seven	1	0	0	0	3.14 (359)
Early remitting	Gone by seven	1	1	0	0	1.05 (120)
Early remitting	Gone by seven	1	1	1	0	0.54 (62)
Early remitting	Gone by seven	0	1	0	0	8.7 (989)
Early remitting	Gone by seven	0	1	1	0	3.7 (418)
Persistent/relapsing	Late onset >3	0	0	1	1	2.9 (326)
Persistent/relapsing	Late onset >3	0	0	0	1	2.9 (336)
Persistent/relapsing	Always	0	1	1	1	3.82 (436)
Persistent/relapsing	Always	1	1	1	1	0.56 (64)
Persistent/relapsing	Relapse by seven	0	1	0	1	1.3 (149)
Persistent/relapsing	Relapse by seven	1	0	0	1	0.3 (34)
Persistent/relapsing	Relapse by seven	1	1	0	1	0.2 (26)
Persistent/relapsing	Relapse by seven	1	0	1	1	0.2 (22)
Transient/intermittent	Transient	0	0	1	0	4.4 (498)
Transient/intermittent	Intermittent	1	0	1	0	0.3 (39)

Results

Table S2: Relative risk ratios (RRR) for early and persistent wheeze (all coefficients)

1. Maternal education
2. Maternal education + sex + ethnicity
3. Maternal education + sex + ethnicity + maternal age at birth of child
4. Maternal education + sex + ethnicity + maternal age at birth of child+ maternal atopy
5. Maternal education + sex + ethnicity + maternal age at birth of child+ maternal atopy + maternal BMI
6. Maternal education + sex + ethnicity + maternal age at birth of child+ maternal atopy + smoking in pregnancy
7. Maternal education + sex + ethnicity + maternal age at birth of child+ maternal atopy + smoking in pregnancy + LBW
8. Maternal education + sex + ethnicity + maternal age at birth of child+ maternal atopy + smoking in pregnancy + LBW + preterm
9. Maternal education + sex + ethnicity + maternal age at birth of child+ maternal atopy + smoking in pregnancy + LBW + preterm + C-section
10. Maternal education + sex + ethnicity + maternal age at birth of child+ maternal atopy + smoking in pregnancy + LBW + preterm + C-section + breast-feeding
11. Maternal education + sex + ethnicity + maternal age at birth of child+ maternal atopy + smoking in pregnancy + LBW + preterm + C-section + breast-feeding + postnatal environment (ETS, grime, damp, pets, siblings, childcare)

Early	1	2	3	4	5	6	7	8	9	10	11
Degree plus	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
diploma	0.91	0.90	0.87	0.86	0.85	0.83	0.83	0.83	0.83	0.79*	0.82
A levels	0.84	0.84	0.79*	0.78*	0.77*	0.75**	0.74**	0.75*	0.75*	0.72**	0.75*
GCSE A-C	1.20*	1.19*	1.09	1.09	1.07	0.99	0.98	0.98	0.98	0.90	0.95
GCSE D-G	1.30*	1.30*	1.11	1.12	1.09	0.97	0.97	0.97	0.97	0.87	0.93
None	1.50***	1.54***	1.33**	1.34**	1.30*	1.11	1.10	1.10	1.11	0.98	1.06
Male		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Female		0.87*	0.87*	0.85*	0.85**	0.86*	0.85**	0.86*	0.86*	0.86*	0.86*
White		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
mixed		1.17	1.15	1.17	1.16	1.16	1.15	1.15	1.15	1.22	1.18
indian		0.66	0.65	0.70	0.70	0.78	0.76	0.77	0.77	0.81	0.79
pakistani and bangladeshi		0.81	0.80	0.88	0.87	1.02	1.01	1.03	1.03	1.06	1.06
black or black british		1.25	1.27	1.32	1.29	1.34	1.32	1.32	1.32	1.45	1.36
other ethnic group		0.43*	0.43*	0.45*	0.45*	0.51	0.50	0.51	0.51	0.55	0.55
14-19 (maternal age)			1.71***	1.61***	1.64***	1.47**	1.48**	1.48**	1.50**	1.37*	1.54**
20-24			1.45***	1.39**	1.39**	1.30*	1.30*	1.31*	1.32*	1.23	1.30*
25-29			1.31**	1.29**	1.29**	1.24*	1.25*	1.25*	1.26*	1.20	1.25*
30-34			1.10	1.10	1.10	1.08	1.08	1.08	1.09	1.07	1.09
35-40			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
40+			1.82**	1.84**	1.83**	1.81**	1.80**	1.81**	1.80**	1.82**	1.80**
Asthma or eczema				1.49***	1.48***	1.46***	1.46***	1.46***	1.46***	1.47***	1.47***
Asthma and eczema				1.76***	1.74***	1.72***	1.72***	1.72***	1.71***	1.77***	1.76***
Underweight					1.15	1.11	1.10	1.10	1.10	1.11	1.10
Normal					1.00	1.00	1.00	1.00	1.00	1.00	1.00
Overweight					1.10	1.10	1.11	1.11	1.10	1.09	1.09
Obese					1.18	1.20	1.20	1.20	1.19	1.16	1.16

Morbidly obese					1.54*	1.60*	1.60*	1.58*	1.56*	1.50*	1.48*
Never smoked						1.00	1.00	1.00	1.00	1.00	1.00
Smoked before pregnancy						1.23*	1.23*	1.24*	1.24*	1.22*	1.23*
Smoked during pregnancy						1.49***	1.47***	1.48***	1.49***	1.42***	1.42***
Low birthweight							1.30*	0.99	0.98	0.97	0.99
Preterm delivery <37								1.64***	1.62***	1.62***	1.60**
C-section									1.09	1.07	1.09
Never breastfed										1.00	1.00
BF one week or less										0.98	0.99
BF 1 - 6 weeks										0.94	0.95
BF 6 weeks - 6 months										0.79*	0.78*
>6 months										0.70***	0.72***
ETS at 9 months											0.95
Damp at 9 months											1.14
"Grime" at 9 months											1.14
Pets											0.96
One child											1.00
2-3											1.23**
4 + children											0.96
Informal childcare											1.11
Formal childcare											1.33***
Persistent	1	2	3	4	5	6	7	8	9	10	11
Degree plus	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
diploma	1.00	1.00	1.01	1.00	0.98	0.96	0.96	0.96	0.96	0.92	0.92
A levels	0.91	0.91	0.92	0.92	0.90	0.87	0.87	0.87	0.88	0.85	0.84
GCSE A-C	1.12	1.11	1.14	1.13	1.10	1.03	1.02	1.02	1.02	0.94	0.93
GCSE D-G	1.31	1.30	1.36*	1.37*	1.32	1.19	1.18	1.19	1.19	1.07	1.05
None	1.29*	1.29	1.34*	1.34*	1.30	1.14	1.11	1.12	1.13	1.00	0.97
Male		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Female		0.63***	0.63***	0.61***	0.61***	0.61***	0.61***	0.61***	0.62***	0.61***	0.62***
White		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
mixed		1.06	1.07	1.11	1.10	1.09	1.09	1.08	1.08	1.15	1.11
indian		1.05	1.04	1.17	1.18	1.31	1.25	1.27	1.27	1.35	1.26
pakistani and bangladeshi		1.08	1.07	1.25	1.23	1.43	1.41	1.44	1.45	1.50*	1.40
black or black british		0.91	0.89	0.95	0.93	0.96	0.94	0.94	0.93	1.03	0.97
other ethnic group		0.93	0.93	1.03	1.04	1.14	1.11	1.13	1.12	1.20	1.11
14-19 (maternal age)			0.75	0.67*	0.70	0.63*	0.64*	0.64*	0.65*	0.59**	0.56**
20-24			0.93	0.87	0.88	0.81	0.82	0.82	0.83	0.78	0.76*
25-29			0.89	0.87	0.87	0.83	0.84	0.84	0.85	0.81	0.81
30-34			0.88	0.88	0.88	0.87	0.87	0.87	0.87	0.86	0.86
35-40			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

40+			0.95	0.97	0.96	0.96	0.95	0.95	0.95	0.96	0.96
Asthma or eczema				1.79***	1.77***	1.76***	1.76***	1.76***	1.77***	1.78***	1.79***
Asthma and eczema				2.68***	2.65***	2.62***	2.62***	2.62***	2.61***	2.69***	2.67***
Underweight					1.07	1.04	1.02	1.02	1.02	1.02	1.01
Normal					1.00	1.00	1.00	1.00	1.00	1.00	1.00
Overweight					1.21*	1.22*	1.23*	1.23*	1.21*	1.20	1.20*
Obese					1.28	1.30	1.30	1.31	1.27	1.25	1.25
Morbidly obese					1.44	1.48	1.48	1.47	1.42	1.37	1.36
Never smoked						1.00	1.00	1.00	1.00	1.00	1.00
Smoked before pregnancy						1.33**	1.32**	1.33**	1.33**	1.32**	1.31**
Smoked during pregnancy						1.42***	1.40***	1.41***	1.41***	1.35**	1.32**
Low birthweight							1.51**	1.14	1.11	1.10	1.10
Preterm delivery <37								1.66**	1.61**	1.61**	1.60**
C-section									1.20*	1.18	1.18
Never breastfed										1.00	1.00
BF one week or less										0.88	0.89
BF 1 - 6 weeks										0.93	0.94
BF 6 weeks - 6 months										0.70***	0.70**
>6 months										0.73**	0.73**
ETS at 9 months											1.08
Damp at 9 months											1.11
"Grime" at 9 months											1.09
Pets											0.86*
One child											1.00
2-3											0.99
4 + children											0.92
Informal childcare											0.96
Formal Formal childcare											0.88

Table S3: Relative risk ratios (RRR) for early and persistent wheeze by maternal education adjusted for smoking and breast feeding; and environmental factors

	Early wheeze			Persistent wheeze		
	Baseline	Baseline+smoking +breasfeeding	Baseline+ environmental factors	Baseline	Baseline+smoking +breasfeeding	Baseline+ environmental factors
Degree plus	1.00	1.00	1.00	1.00	1.00	1.00
	(1.00-1.00)	(1.00-1.00)	(1.00-1.00)	(1.00-1.00)	(1.00-1.00)	(1.00-1.00)
Diploma	0.90	0.81	0.93	1.00	0.94	0.99
	(0.72-1.14)	(0.64-1.03)	(0.73-1.18)	(0.76-1.33)	(0.71-1.25)	(0.74-1.33)
A-levels	0.82	0.74**	0.86	0.93	0.85	0.91
	(0.66-1.01)	(0.60-0.91)	(0.70-1.07)	(0.72-1.20)	(0.66-1.10)	(0.70-1.18)
GCSE A-C	1.19*	0.96	1.26**	1.12	0.95	1.10
	(1.02-1.40)	(0.80-1.14)	(1.07-1.50)	(0.91-1.37)	(0.77-1.18)	(0.89-1.35)
GCSE D-G	1.33*	0.96	1.39**	1.23	0.97	1.20
	(1.06-1.67)	(0.75-1.24)	(1.10-1.77)	(0.93-1.62)	(0.72-1.32)	(0.90-1.60)
None	1.53***	1.07	1.64***	1.32*	0.98	1.26
	(1.26-1.86)	(0.86-1.33)	(1.33-2.02)	(1.04-1.67)	(0.75-1.29)	(0.96-1.64)

Sensitivity analyses

Repeating the analysis using occupational social class, rather than maternal education as the measure of SEC produced similar results, but the occupational class difference for persistent wheeze was not completely explained in the fully adjusted model (table S4). Repeating the analysis to include only those children with more severe wheezing (>4 episodes per year) produced similar results in terms of the mediation of inequalities (table S5). The educational gradient in early wheezing, as measured by the RII, follows a similar pattern to the gap, and becomes non-significant in the adjusted model (figure S1).

Table S4: Relative risk ratios (RRR) for early and persistent wheeze by occupational social class

1. Maternal education
2. Maternal education + sex + ethnicity
3. Maternal education + sex + ethnicity + maternal age at birth of child
4. Maternal education + sex + ethnicity + maternal age at birth of child+ maternal atopy
5. Maternal education + sex + ethnicity + maternal age at birth of child+ maternal atopy + maternal BMI
6. Maternal education + sex + ethnicity + maternal age at birth of child+ maternal atopy + smoking in pregnancy
7. Maternal education + sex + ethnicity + maternal age at birth of child+ maternal atopy + smoking in pregnancy + paterm
8. Maternal education + sex + ethnicity + maternal age at birth of child+ maternal atopy + smoking in pregnancy + preterm + C-section
9. Maternal education + sex + ethnicity + maternal age at birth of child+ maternal atopy + smoking in pregnancy + preterm + C-section + breast-feeding
10. Maternal education + sex + ethnicity + maternal age at birth of child+ maternal atopy + smoking in pregnancy + preterm + C-section + breast-feeding + postnatal environment (ETS, grime, damp, pets, siblings)

Early wheeze	1	2	3	4	5	6	7	8	9	10
Managerial & professional	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Intermediate	1.14	1.22*	1.17	1.18	1.15	1.08	1.12	1.12	1.09	1.07
Routine & manual	1.42***	1.44***	1.29***	1.28***	1.30***	1.22**	1.18*	1.18*	1.12	1.09
Never worked & long-term unemployed	1.22	1.47**	1.22	1.24	1.34*	1.14	1.20	1.21	1.12	1.05
Persistent wheeze	1	2	3	4	5	6	7	8	9	10
Managerial & professional	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Intermediate	0.96	0.98	1.00	1.01	1.01	0.98	0.99	1.00	0.97	0.98
Routine & manual	1.31**	1.33**	1.38***	1.39***	1.37**	1.26*	1.30*	1.30**	1.24*	1.25*
Never worked & long-term unemployed	1.16	1.11	1.18	1.19	1.17	1.19	1.13	1.12	1.05	1.04

Table S5: Relative risk ratios (RRR) for early and persistent SEVERE wheeze by maternal education adjusted for smoking and breast feeding; and environmental factors

	Early wheeze			Persistent wheeze		
	Baseline	Baseline+smoking +breasfeeding	Baseline+ environmental factors	Baseline	Baseline+smoking +breasfeeding	Baseline+ environmental factors
Degree plus	1.00	1.00	1.00	1.00	1.00	1.00
	(1.00-1.00)	(1.00-1.00)	(1.00-1.00)	(1.00-1.00)	(1.00-1.00)	(1.00-1.00)
Diploma	0.87	0.80	0.91	1.16	1.06	1.17
	(0.69-1.10)	(0.63-1.01)	(0.72-1.15)	(0.85-1.58)	(0.77-1.45)	(0.84-1.61)
A-levels	0.79*	0.73**	0.83	1.26	1.13	1.23
	(0.64-0.97)	(0.59-0.90)	(0.67-1.03)	(0.97-1.64)	(0.86-1.49)	(0.93-1.62)
GCSE A-C	1.15	0.95	1.22*	1.28*	1.05	1.25
	(0.98-1.35)	(0.80-1.14)	(1.03-1.44)	(1.03-1.57)	(0.85-1.31)	(0.99-1.57)
GCSE D-G	1.32*	1.00	1.39**	1.29	0.99	1.26
	(1.06-1.65)	(0.78-1.29)	(1.10-1.76)	(0.97-1.71)	(0.73-1.34)	(0.93-1.71)
None	1.41***	1.07	1.52***	1.30*	0.99	1.21
	(1.15-1.72)	(0.86-1.33)	(1.22-1.90)	(1.01-1.67)	(0.75-1.32)	(0.91-1.60)

Table S6: Relative risk ratios (RRR) for early and persistent wheeze by maternal education; unadjusted and fully adjusted estimates, stratified by presence of childhood eczema status

	RRR	p	Lower	upper
Early wheeze, unadjusted, no history of eczema				
diploma	0.94	0.65	0.73	1.22
A levels	0.74	0.02	0.57	0.96
GCSE A-C	1.25	0.02	1.04	1.51
GCSE D-G	1.20	0.19	0.91	1.59
None	1.56	0.00	1.25	1.95
Persistent wheeze, unadjusted, no history of eczema				
diploma	1.14	0.43	0.82	1.59
A levels	0.96	0.80	0.70	1.32
GCSE A-C	1.15	0.21	0.92	1.45
GCSE D-G	1.41	0.04	1.01	1.96
None	1.46	0.01	1.10	1.92
Early wheeze, adjusted, no history of eczema				
diploma	0.85	0.23	0.64	1.11
A levels	0.65	0.00	0.49	0.85
GCSE A-C	0.95	0.66	0.76	1.19
GCSE D-G	0.82	0.21	0.60	1.12
None	1.03	0.84	0.78	1.35
Persistent wheeze, adjusted, no history of eczema				
diploma	1.01	0.97	0.71	1.43
A levels	0.85	0.33	0.61	1.18
GCSE A-C	0.88	0.31	0.68	1.13
GCSE D-G	1.05	0.80	0.72	1.53
None	0.94	0.74	0.67	1.34
Early wheeze, unadjusted, history of eczema*				
diploma	0.75	0.24	0.46	1.22
A levels	1.16	0.54	0.72	1.86
GCSE A-C	0.99	0.94	0.67	1.44
GCSE D-G	1.63	0.03	1.04	2.54
None	1.31	0.35	0.74	2.32
Persistent wheeze, unadjusted, history of eczema*				
diploma	0.62	0.12	0.34	1.13
A levels	0.76	0.38	0.41	1.40
GCSE A-C	0.96	0.87	0.62	1.50
GCSE D-G	1.02	0.95	0.59	1.75
None	0.86	0.62	0.47	1.57

*N=1849