



OPRU Briefing Paper - Estimating inequalities in childhood obesity and modelling the potential impact on inequalities of population interventions on early years risk factors: Evidence from UK cohort studies (July 2023)

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Key message

- Inequalities in childhood obesity are marked and have widened in recent years. Early risk factors (such as smoking in pregnancy and breastfeeding behaviours) have been linked to subsequent obesity. The social patterning of these risk factors (with disadvantaged groups having higher levels of smoking in pregnancy and not initiating breastfeeding) is likely to be an important driver of inequalities in childhood obesity. However, we do not know how policy interventions seeking to address these modifiable behaviours might affect inequalities in childhood obesity.
 - This research, using longitudinal data from a national cohort (the Millennium Cohort Study, MCS) and two regional cohorts (Southampton Women's Survey, SWS; Born in Bradford, BiB), demonstrated obesity inequalities, which increased as the children in the cohorts grew older.
 - A novel causal mediation framework was used in two of the cohorts (MCS and SWS) to simulate the impact on obesity inequalities at 6-7 years of hypothetical population interventions targeting: i. smoking in pregnancy; and ii. smoking in pregnancy and non-initiation of breastfeeding. The hypothetical interventions changed levels of maternal smoking in pregnancy and breastfeeding initiation across the population to match levels reported by the most advantaged households (in effect, reducing levels of smoking in pregnancy and increasing initiation of breastfeeding). In both cohorts, these changes appreciably reduced inequalities in later childhood obesity, suggesting that interventions focusing on early risk factors hold promise for policy initiatives to tackle obesity inequalities.
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Executive summary

Background

Inequalities in childhood obesity are marked and have widened in recent years. Early risk factors (such as smoking in pregnancy and breastfeeding behaviours) have been linked to subsequent obesity. The social patterning of these risk factors (with disadvantaged groups having higher levels of smoking in pregnancy and not initiating breastfeeding) is likely to be an important driver of inequalities in childhood obesity. However, we do not know how policy interventions seeking to address these modifiable behaviours might affect inequalities in childhood obesity.

This research, using longitudinal data from a national cohort (the Millennium Cohort Study, MCS) and two regional cohorts (Southampton Women's Survey, SWS; Born in Bradford, BiB), demonstrated obesity inequalities, which increased as the children in the cohorts grew older.

Executive summary

A novel causal mediation framework was used in two of the cohorts (MCS and SWS) to simulate the impact on obesity inequalities at 6-7 years of hypothetical population interventions targeting: i. smoking in pregnancy; and ii. smoking in pregnancy and non-initiation of breastfeeding. The hypothetical interventions changed levels of maternal smoking in pregnancy and breastfeeding initiation across the population to match levels reported by the most advantaged households (in effect, reducing levels of smoking in pregnancy and increasing initiation of breastfeeding). In both cohorts, these changes appreciably reduced inequalities in later childhood obesity, suggesting that interventions focusing on early risk factors hold promise for policy initiatives to tackle obesity inequalities.

Aims

To use longitudinal cohort data to: i. describe inequalities in obesity from childhood to adolescence; and ii. to simulate the potential impact on childhood obesity inequalities at 6-7 years (an age at which inequalities are becoming more apparent) of interventions that reduce smoking in pregnancy and increase breastfeeding initiation across the population to levels reported by the most advantaged social households.

Executive summary

What we did

Prevalence of obesity (using the UK90 cut off) according to socioeconomic circumstances at birth (household income or maternal education) were estimated in the UK Millennium Cohort Study (at 3, 5, 7, 11, 14 and 17 years), the Born in Bradford study (at 3, 5, 7 and 10 years) and in the Southampton Women's Survey (at 2, 3, 4, 6 and 8 years).

Early years interventions were then simulated in two of the cohorts, the Millennium Cohort Study and the Southampton Women's Survey (Born in Bradford data will be analysed separately to account for differences in drivers of inequalities by ethnicity in a cohort that comprises a substantial number of families of Pakistani origin).

A causal mediation framework was used to model the relationships between socioeconomic circumstances at birth, early risk factors (i. smoking in pregnancy in isolation; ii. the combination of smoking in pregnancy and not initiating breastfeeding) and obesity at 6-7 years, accounting for confounders. The adjusted association between income and obesity after accounting for baseline confounders, was compared to the association between income and obesity after simulating an intervention that changed the levels of these early risk factors in each cohort to that of the most advantaged households. This comparison allows for an estimation of the change in the relationship between socioeconomic circumstances and obesity that would follow such population interventions.

Summary of findings

- ✓ Across the cohorts, obesity was more common among children from disadvantaged households, and inequalities increased as children grew older.
 - ✓ Simulating interventions that: i. changed levels of smoking in pregnancy in isolation; and ii. changed levels of both smoking in pregnancy and breastfeeding initiation in the whole population to match levels reported in the most advantaged households, reduced inequalities in childhood obesity, with a greater reduction if both risk factors were intervened upon in combination.
 - ✓ Consistent results were demonstrated independently in national (MCS) and regional (SWS) cohorts. To illustrate, in the MCS childhood obesity prevalence at 7 years was 8.9% in the highest income quintile households and 13.9% in the lowest income households. The difference in obesity prevalence between these groups narrowed from 5.0% to 2.8% after simulating an intervention on smoking in pregnancy and breastfeeding, a relative reduction in inequalities of 44%.
 - ✓ Given the challenges of conducting population interventions, modelling simulated interventions can provide useful insights for policy-makers. In particular, the levels of smoking in pregnancy and breastfeeding initiation modelled were realistic, reflecting levels observed in advantaged households in these cohorts.
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Background

Research context

Enhancing our understanding of the causes and intersectionality of inequalities is a cross-cutting theme of Policy Research Units and a high priority for the Department of Health and Social Care and National Institute of Health Research. In Autumn 2021, the ICH workstream of OPRU proposed a long-term project that sought to investigate the origins of inequalities in childhood obesity and the known risk factors that may act to widen (or narrow) disparities in obesity.

This project has several key areas of focus:

- A detailed description of the social patterning of obesity and its key risk factors, and the development and persistence of inequalities in obesity across childhood.
- An assessment of how sources of disadvantage or risk factors may accumulate and how this accumulation may impact on obesity.
- The intersectionality of inequalities in obesity i.e., the extent to which some groups have greater (or lesser) rates of obesity compared to what you might expect.
- Disparity analysis which assesses the extent to which policy interventions addressing early years risk factors may decrease population inequalities in childhood obesity.

This briefing paper reports on detailed descriptives of the social patterning of obesity and its key risk factors and preliminary disparity analyses, which consider the impact of modifying early life risk factors of smoking in pregnancy and initiation of breastfeeding and observing the impacts on inequalities in childhood obesity using national and regional cohort data.

Background

Inequalities in childhood obesity

Childhood obesity is socially patterned, with lower levels of obesity found in advantaged groups compared to the most disadvantaged groups.¹ These inequalities have widened in recent years.² Since childhood obesity tracks into later life³ and obesity is associated with subsequent morbidity and mortality,⁴ it is likely that inequalities in childhood obesity will result in inequalities in both adult obesity and wider health outcomes. In this context, it is important to identify modifiable risk factors for obesity that may provide a focus for public health interventions. Potential early risk factors include smoking in pregnancy^{5,6} and breastfeeding initiation.^{7,8} Both factors are socially patterned and contribute to the development of obesity inequalities.⁹

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Background

Although smoking in pregnancy and breastfeeding behaviours are modifiable, the extent to which policy interventions targeting these risk factors would decrease obesity inequalities is unknown. Population-level interventions are difficult to conduct and evaluate. An alternative approach is to simulate interventions using longitudinal population cohort data. In this research, we apply a novel causal mediation framework,^{10,11} to estimate the impact on obesity inequalities of hypothetical interventions that change the levels of smoking in pregnancy and breastfeeding initiation in all households to match those observed in the most advantaged households. These simulations have real-world, policy relevance, since the levels of smoking in pregnancy and breastfeeding initiation being modelled have been achieved by the most advantaged households in the cohorts included in this research.

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Aims

Research questions

- What are the inequalities in childhood obesity in each of the cohorts?
- Do inequalities change between childhood and adolescence?
- Would, and to what extent, the socioeconomic gradient in obesity at 6-7 years reduce if hypothetical interventions could change the levels of maternal smoking in pregnancy and breastfeeding initiation in across all households to match those reported in the most advantaged households?
- Would intervening on both risk factors have a larger effect on obesity inequalities than an intervention that targeted smoking in pregnancy in isolation?

AIM: To explore socioeconomic inequalities in childhood obesity in three diverse longitudinal datasets: the UK-representative Millennium Cohort Study (MCS) and two regional English cohorts: Born in Bradford (BiB) and the Southampton Women's Survey (SWS).

Methods

Overview

- We investigated socioeconomic inequalities in obesity (using the UK90¹² cut off based on z-scores for BMI) during childhood and adolescence using data from national and regional cohort studies.
- We then adopted a causal mediation framework in two of the cohort studies to model the impact on inequalities in obesity at 6-7 years of hypothetical population interventions that resulted in the levels of early risk factors in all households matching those observed in the most advantaged households in each cohort. Born in Bradford will be analysed separately to account for differences in drivers of inequalities by ethnicity in a cohort that comprises a substantial number of families of Pakistani origin.

Methods

Data sources

- The Millennium Cohort Study (MCS) is a nationally-representative longitudinal cohort of approximately 19,000 children born 2000-2002. Families were first interviewed when the children were 9 months old and cohort members and their families have been followed-up at 3, 5, 7, 11, 14 and 17 years of age.
- The Southampton Women's Survey (SWS) is a prospective cohort study of mothers and children that recruited 12,583 Southampton women aged 20 to 34 years from the general population when not pregnant between 1998 and 2002. Between 1998 and 2007, 3,158 participants became pregnant and delivered liveborn singleton infants. The survey followed up children with home visits at 6 months, 1, 2, and 3 years of age; further samples of children were seen at 4, 6-7 and 8-9 years.
- The Born in Bradford (BiB) cohort is a longitudinal study investigating child health and development launched in 2007, consisting of over 13,000 children and their families in Bradford. The city has a high population of ethnic minorities, and about 45% of the families recruited are of Pakistani origin. The study also includes a significant proportion of families living in economic deprivation. The first wave of data was collected from mothers during pregnancy, and subsequent waves have collected data on children up to 12 years of age.

Methods

Obesity inequalities

- Available measures of socioeconomic circumstances varied between cohorts. In MCS, a measure of equivalised household income quintiles (recorded at 9 months) was used; in both BiB and SWS, measures of maternal highest educational qualification were used (recorded at their respective baseline waves), although the categorisation of this variable differed between the two cohorts because of question differences and the need to collapse some categories due to small numbers.
- In all three cohorts, BMI was calculated from measured heights and weights, with obesity defined using the UK90 age and sex-specific cut off. The highest 5th centile of BMI was adopted as it is policy-relevant and comparable to other data sets.
- Graphs are used to show the proportion of children living with obesity by socioeconomic circumstances for comparable ages in each cohort, where these data were available. In MCS, inequalities are shown for obesity assessed at 3, 5, 7, 11, 14 and 17 years; in BiB, at 3, 5, 7 and 10 years; and in SWS, at 2, 3, 4, 6 and 8 years.

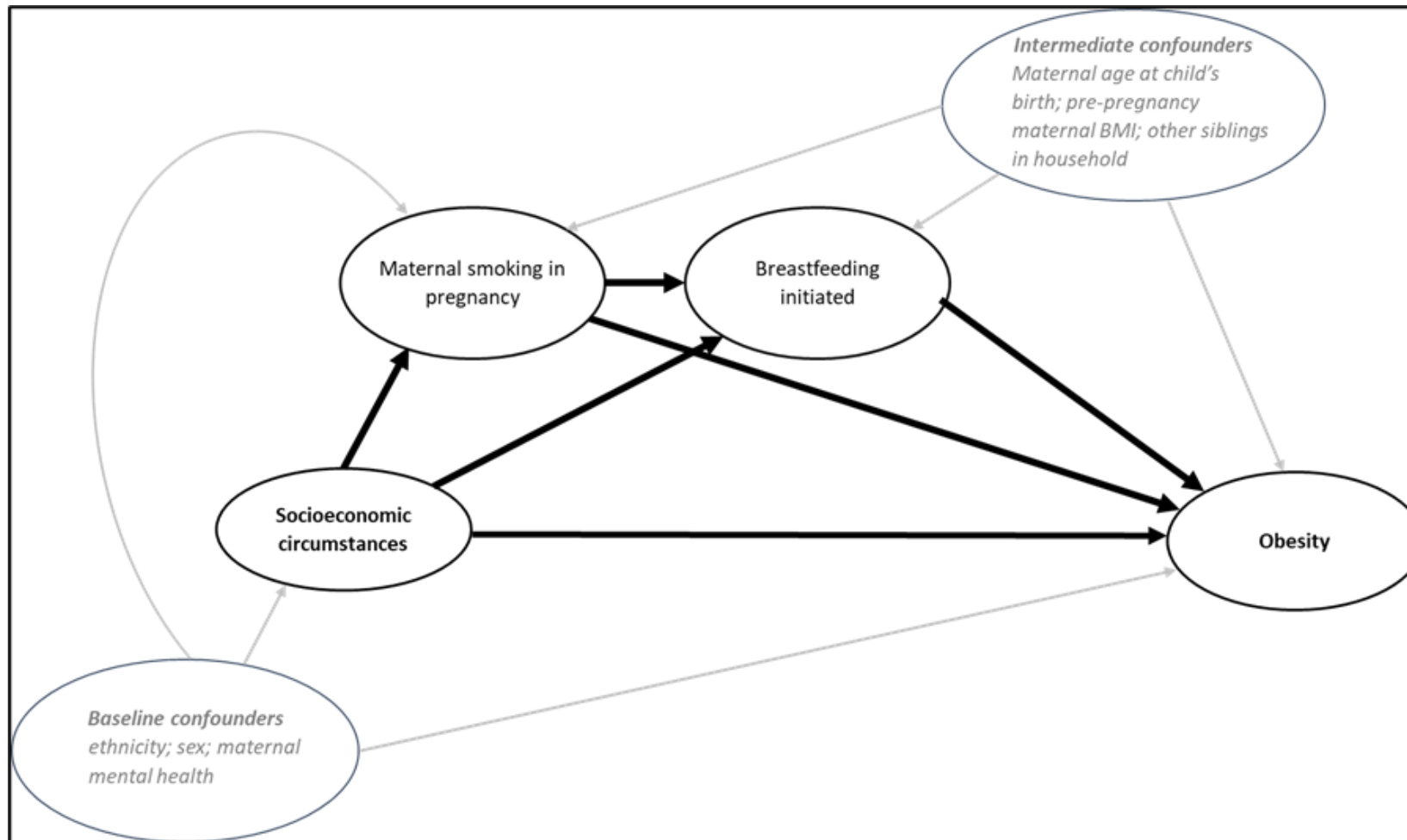
Methods

Simulating population interventions within a causal mediation framework

- A causal diagram (Figure 1) shows the hypothesised relationships between variables in the mediation analysis.
- This mediation framework indicates that the causal pathway between socioeconomic circumstances (the exposure) and obesity (the outcome) is partially the consequence of early risk factors (mediators), which are more common in socially disadvantaged groups and are on the pathway between exposure and outcome.
- By reducing levels of these mediating early risk factors in the disadvantaged groups, inequalities in obesity should also reduce. The diagram also includes theory-informed confounding variables, temporally positioned as either baseline or intermediate confounders, which are accounted for to provide more accurate estimates of the relationship between socioeconomic circumstances and obesity.
- The variables included from the two studies in which the modelling was carried out (MCS and SWS) are detailed in Table 1. MCS and SWS were analysed separately using complete case samples with no missing data on any of the variables included in the models. In the MCS sample, those who had been born prematurely were also excluded.

Methods

Figure 1. Causal diagram of the hypothesised relationships between socioeconomic circumstances, maternal smoking in pregnancy, breastfeeding initiation and child obesity



Methods

Table 1. Description of MCS and SWS variables used in the mediation analysis

	MCS	SWS
Exposure: Socioeconomic circumstances	Household Income (9m wave), equivalised for household composition	Maternal highest educational qualification (pre-pregnancy wave)
Mediator 1: Smoking in pregnancy (yes, no)	Retrospective report (9m wave)	Derived across waves (e.g. 11 weeks / 34 weeks pregnant)
Mediator 2: Breastfeeding initiation (yes, no)	Retrospective report (9m wave)	Retrospective (6m)
Outcome: Obesity	Measured heights and weights; UK90 cut-off (7y)	Measured heights and weights; UK90 cut-off (6y)
Confounders:		
Child's sex (baseline)	9m wave	Obstetric data
Child's ethnicity (baseline)	9m wave	6y wave
Maternal mental health (baseline)	Malaise inventory (9m wave)	GHQ-12 (pre-pregnancy wave)
Maternal age at child's birth (intermediate)	9m wave	6m wave
Maternal pre-pregnancy BMI (intermediate)	Retrospective report (9m)	Pre-pregnancy wave
Whether any other siblings in the household (intermediate)	9m wave	Not included

Methods

Modelling the impact of hypothetical interventions (2 stages)

1. The relationship between socioeconomic circumstances (either household income [MCS] or maternal highest level of education [SWS]) and obesity (UK90 cut-off) was estimated, accounting for baseline confounders. This provided an adjusted population average prevalence of obesity at each level of socioeconomic circumstances. In all three cohorts, BMI was calculated from measured heights and weights, with obesity defined using the UK90 age and sex-specific cut off. The highest 5th centile of BMI was adopted as it is policy-relevant and comparable to other data sets.
2. A hypothetical intervention was simulated by setting the risk factor (mediator) distribution for the cohort sample (representing the population) to match that observed in the most advantaged households (those in the highest income quintile [in MCS] or where the mother was educated to Higher National Diploma (HND) or Degree level [in SWS]). The relationship between socioeconomic circumstances and obesity was then re-estimated, accounting for the new mediator distribution and baseline and intermediate confounders.

Methods

Modelling the impact of hypothetical interventions

- In both stages, inequalities were expressed as differences in obesity prevalence (risk differences) for each level of socioeconomic circumstances (income or maternal education) compared to the baseline obesity prevalence in the most advantaged households in each sample. This mediation framework indicates that the causal pathway between socioeconomic circumstances (the exposure) and obesity (the outcome) is partially the consequence of early risk factors (mediators), which are more common in socially disadvantaged groups and are on the pathway between exposure and outcome.
- The change in obesity inequalities between the two stages reflected the impact of the hypothetical intervention at each level of socioeconomic circumstances in comparison to the obesity prevalence among children in most advantaged households. This is expressed in terms of absolute change following the hypothetical intervention and as a percentage of the original difference in obesity prevalence between each socioeconomic group versus the most advantaged households.
- The temporal sequence of the risk factors (smoking in pregnancy preceding breastfeeding behaviour) provided an opportunity to first estimate the impact of smoking in pregnancy on childhood obesity inequalities in isolation, and then to estimate the joint effect of smoking in pregnancy and breastfeeding initiation. However, it was not possible to isolate the impact of breastfeeding initiation in joint models.

What we found

Figure 2. Inequalities in obesity, the Millennium Cohort Study

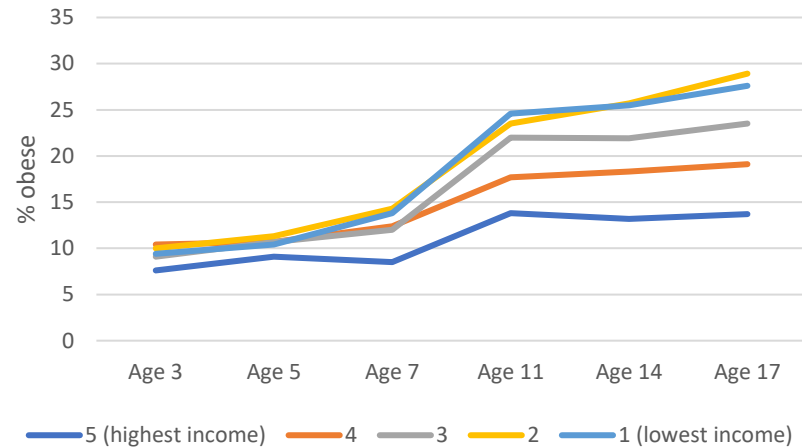


Figure 3. Inequalities in obesity, the Born in Bradford study

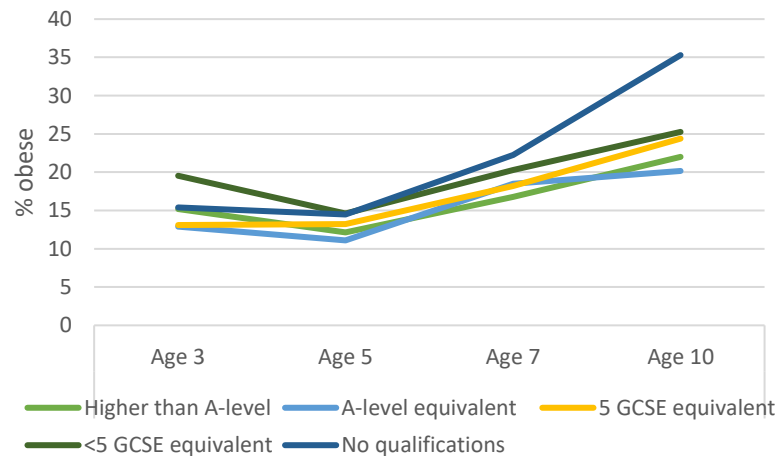
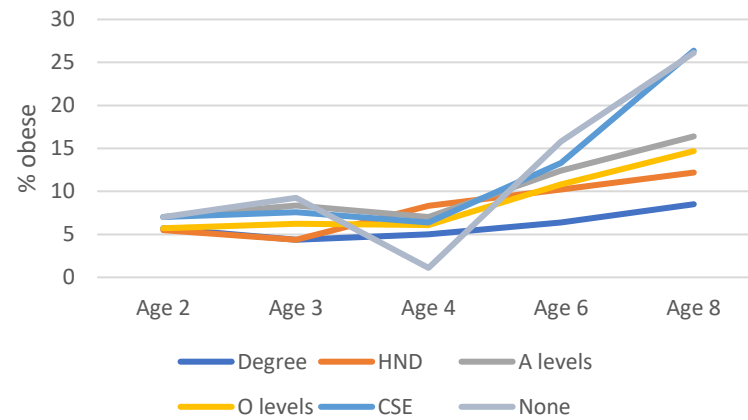


Figure 4. Inequalities in obesity, the Southampton Women's Survey



Obesity inequalities

- Socioeconomic inequalities in obesity were observed in all three cohorts (Figures 2-4), with a lower prevalence of obesity among children living in more socially advantaged households. In all cohorts, obesity inequalities increased as the children grew older.

What we found

Mediation modelling: MCS

- In the MCS (Table 2), the adjusted population average prevalence of obesity before any intervention was 8.9% in the highest income quintile and 13.9% in the lowest income quintile (resulting in a risk difference between these income groups of 5%). Following the hypothetical intervention on smoking in pregnancy, the risk difference in obesity prevalence between highest and lowest income quintiles fell to 3.4%, a 32% relative change in obesity prevalence between these income groups.

Table 2. Smoking in pregnancy simulated intervention impact on inequalities in obesity at 7 years in the MCS

	Population prevalence	Observed risk difference (A)	Intervention risk difference (B)	A – B	A – B (% change)
1 (highest income)	8.9	-	-	-	-
2	12.9	4.0 (2.0-5.9)	3.5 (1.3-5.7)	0.5 (-0.2-1.1)	12.5
3	13.6	4.7 (2.1-7.3)	3.7 (0.3-7.3)	1.0 (-0.3-2.3)	21.3
4	13.0	4.0 (1.5-6.4)	2.8 (0.2-5.6)	1.2 (0.5-1.8)	30.0
5 (lowest income)	13.9	5.0 (3.5-6.4)	3.4 (1.5-5.2)	1.6 (1.0-2.1)	32.0

What we found

Mediation modelling: MCS

- A hypothetical intervention on both smoking in pregnancy and breastfeeding initiation led to a further reduction in inequalities (Table 3). The difference in obesity prevalence between highest and lowest income quintiles reduced from 5% to 2.8%, a 44% relative change following the hypothetical intervention.

Table 3. Smoking in pregnancy and breastfeeding initiation simulated intervention impact on inequalities in obesity at 7 years in the MCS

	Population prevalence	Observed risk difference (A)	Intervention risk difference (B)	A – B	A – B (% change)
1 (highest income)	8.9	-	-	-	-
2	12.9	4.0 (2.8-5.1)	3.3 (1.3-5.2)	0.7 (-0.4-1.8)	17.5
3	13.6	4.7 (3.7-5.7)	3.5 (1.3-5.7)	1.2 (-0.1-2.4)	25.5
4	13.0	4.0 (2.5-5.5)	2.4 (0.5-4.3)	1.5 (0.8-2.2)	40.0
5 (lowest income)	13.9	5.0 (3.1-6.8)	2.8 (0.9-4.7)	2.1 (2.0-2.3)	44.0

What we found

Mediation modelling: SWS

- Despite differences between samples and measures, SWS findings were consistent with those in MCS. In the SWS (Table 4), it was only possible to use a three-category marker of maternal education in the mediation models due to small numbers of cases for some categories of educational qualification when the sample was restricted to complete cases (no missing data on the variables included in models) for the mediation analysis. The adjusted population average prevalence of obesity was elevated for children whose mothers were educated below degree/HND level. For the smoking in pregnancy intervention analysis, the adjusted prevalence of obesity was 5.3% in the degree/HND group and 10.1% in the O level/Certificate of Secondary Education (CSE)/none group (a risk difference between these groups of: 4.8%). Following the hypothetical intervention, the risk difference between these groups fell to 3.6%; a 25% relative change.

Table 4. Smoking in pregnancy simulated intervention impact on inequalities in obesity at 6 years in the SWS

	Population prevalence	Observed risk difference (A)	Intervention risk difference (B)	A – B	A – B (% change)
Degree/HND	5.3	-	-	-	-
A level	12.5	7.1 (3.7-10.5)	6.6 (2.7-10.5)	0.5 (-1.0-2.0)	7.0
O level/CSE/None	10.1	4.8 (1.8-7.8)	3.6 (-0.2-7.3)	1.2 (-0.9-3.3)	25.0

What we found

Mediation modelling: SWS

- Hypothetical interventions on both smoking in pregnancy and breastfeeding initiation led to a greater reduction in inequalities (Table 5). The difference between degree/HND and O level/CSE/None groups reduced to 3.3%; a 29.8% relative change in the difference in obesity prevalence between these groups following the intervention.

Table 5. Smoking in pregnancy and breastfeeding initiation simulated intervention impact on inequalities in obesity at 6 years in the SWS

	Population prevalence	Observed risk difference (A)	Intervention risk difference (B)	A – B	A – B (% change)
Degree/HND	5.5	-	-	-	-
A level	12.6	7.2 (3.5-10.8)	6.1 (1.7-10.5)	1.0 (-1.2-3.2)	15.3
O level/CSE/None	9.8	4.7 (1.4-8.1)	3.3 (-0.9-7.5)	1.4 (-1.1-4.0)	29.8

Discussion

Summary:

- Socioeconomic inequalities in childhood obesity were shown across three national and regional UK cohorts (MCS, SWS and BiB), with inequalities widening as children grew older, a finding that is consistent with trends observed elsewhere, including in the National Child Measurement Programme (NCMP).¹³
- Intervention simulations were modelled independently in two of the cohorts (MCS and SWS) within a causal mediation framework, focusing on early risk factors that are associated with childhood obesity and are more prevalent in disadvantaged households (smoking in pregnancy and not initiating breastfeeding). In each cohort, the change to the levels of these risk factors modelled across the entire sample reflected levels reported in the most socioeconomically advantaged group. An intervention on smoking in pregnancy had a sizeable impact on obesity inequalities in both cohorts. However, a larger reduction in inequalities occurred when simulating interventions targeting both smoking in pregnancy and breastfeeding initiation. While these findings hold promise, the evidence points to inequalities remaining even if the levels of these risk factors were equalised across all households.

Strengths of the work:

- Analyses were carried out across cohorts, allowing comparisons to be made between them in terms of inequalities and impacts of simulated interventions.
- Potential impacts on inequalities in child obesity of interventions for early risk factors were modelled based on changing patterns of these behaviours to match realistic levels, as reported by the most affluent groups in each cohort.
- Longitudinal data allowed exposure, mediator and outcome variables to be measured temporally.
- Height and weight data were objectively measured, and rich data on mediators and confounders were available.

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Discussion

Limitations of the work:

- There were differences between cohorts in terms of measurement and ages children were followed up, limiting comparability.
- Most variables were reported by the child's mother, and many were reported retrospectively, and therefore the possibility of bias cannot be discounted.
- While mediation analyses used longitudinal data and accounted for plausible confounding variables, data were observational and results may have been affected by unmeasured confounding and causality cannot be assumed.
- Simulations modelled the potential impact of hypothetical interventions on the mediating risk factors (smoking in pregnancy and breastfeeding initiation). These analyses did not require specification of the details of any real-world intervention that would lead to these changes.

Implications for policy:

- Childhood obesity inequalities were demonstrated in national and regional UK cohort studies.
 - Mediation analyses carried out separately in two of the cohorts, simulating the effects of hypothetical interventions targeting smoking in pregnancy and breastfeeding initiation, reduced inequalities in mid-childhood substantially.
 - These results suggest that early interventions have the potential to contribute to a reduction in social inequalities in childhood obesity.
 - A separate challenge will be the identification and implementation of effective interventions targeting these behaviours.
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The views expressed in this publication are those of the authors and not necessarily those of the NHS, the National Institute for Health Research, the Department of Health and Social Care or its arm's length bodies, and other Government Departments.

Appendix 1:

Table A1.1. Overall prevalence of exposure, mediator and outcome variables: MCS, complete case sample (n=10643)

	%
Household income at 9m, quintiles	
1 (High)	19.5
2	20.8
3	20.0
4	20.4
5 (low)	19.4
Obesity at 7y	
Yes	12.5
No	87.5
Smoking in pregnancy	
Yes	30.9
No	69.1
Breastfeeding initiation	
No	27.8
Yes	72.2

Table A1.2: Overall prevalence of exposure, mediator and outcome variables: SWS, complete case sample (n=992)

	%
Maternal education at baseline	
HND or Degree	32.5
A level	33.5
O level / CSE / None	34.1
Obesity at 6y	
Yes	9.4
No	90.6
Smoking in pregnancy	
Yes	10.7
No	89.3
Breastfeeding initiation	
No	12.8
Yes	87.2

Appendix 2:

Table A2.1. Associations between household income (exposure), mediator variables (smoking in pregnancy and breastfeeding initiation) and obesity (outcome): MCS, complete case sample (n=10643)

		Obesity at 7y %
Household income at 9m	1 (Highest quintile)	8.8
	2	12.7
	3	13.5
	4	13.1
	5 (Lowest quintile)	14.2
Smoking in pregnancy	Yes	13.5
	No	12.0
Breastfeeding initiation	No	14.8
	Yes	11.6

Table A2.2. Associations between household income (exposure) and smoking in pregnancy and breastfeeding initiation (mediators): MCS, complete case sample (n=10643)

		Smoking in pregnancy (Yes) %	Breastfeeding initiation (No) %
Household income at 9m	1 (Highest quintile)	13.4	11.4
	2	20.3	15.2
	3	30.4	26.2
	4	40.1	35.5
	5 (Lowest quintile)	50.7	51.2

Appendix 2:

Table A2.3. Associations between maternal education (exposure), smoking in pregnancy and breastfeeding initiation (mediators) and obesity (outcome): SWS, complete case sample (n=992)

		Obesity at 6y %
Maternal education at baseline	HND or Degree	5.3
	A level	12.6
	O level / CSE / None	10.1
Smoking in pregnancy	Yes	14.2
	No	8.8
Breastfeeding initiation	No	12.6
	Yes	8.9

Table A2.4. Associations between maternal education (exposure) and smoking in pregnancy and breastfeeding initiation (mediators): SWS, complete case sample (n=992)

		Smoking in pregnancy (Yes) %	Breastfeeding initiation (No) %
Maternal education at baseline	HND or Degree	3.7	4.0
	A level	9.6	12.1
	O level / CSE / None	18.3	22.3