Technical appendix: Childhood obesity: is where you live important?

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Acknowledgements

We would like to thank our external advisers:

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Methods

Rapid literature review

We conducted a rapid literature review to identify themes and measures at the local authority level that have previously been shown to be associated with childhood obesity. We searched MEDLINE, Embase and the Social Sciences Citation Index (SSCI) for recent peer-reviewed articles using search terms developed iteratively, to return a pragmatic number of relevant publications. Initially, the searches identified a considerable number of articles and so, as part of the iterative steps, we decided to take a 'review of reviews' approach where we would only identify those publications that were themselves reviews (see Table 1 for the search terms).

We followed a process to refine the number of articles the searches returned (see Figure 1). We reviewed the titles of the articles and excluded those relating to countries that are not part of the Organisation for Economic Co-operation and Development (OECD) and those that were unrelated to the topic. We reviewed the abstracts of the remaining articles for relevance and suitability, before selecting our final 16 full texts for review (see Table 2 in the 'Supporting data' section for details of these articles). We also conducted a 'snowball' search[1] to identify any further relevant articles. No further articles were included for review following this additional search.

In addition, we reviewed the existing conceptual models around child health and development (see Table 3 in the 'Supporting data' section for the models reviewed). From all these publications, we gathered themes and measures relating to local authority characteristics that were proposed as being associated with childhood obesity.

[1] A snowball search looks at the references in the literature identified in the original search to see if there are any more publications that are relevant to the work that the original search didn't identify.

Table 1: Database search terms for MEDLINE, Embase and the Social Sciences Citation Index (SSCI), with numbers of publications identified (n) where available

Database	Search step 1	Search step 2	Search step 3	Search step 4	Search step 5
Ovid MEDLINE(R) (1946 to April 2019)	((obes$ and child$) adj5 (region$ or local area$ or communit$ or neighbour$ or populat$ or environment$ or social determinant$)).ti. (414)	1 and review$.ti,ab. (46)	2 not (india$ or africa$ or chin$).ti,ab. (45)	limit 3 to (English language and humans and yr="2014-current") (19)	
Embase (1974 to 3 May 2019)	((obes$ and child$) adj5 (region$ or local area$ or communit$ or neighbour$ or populat$ or environment$ or social determinant$)).ti. (649)	1 and review$.ti,ab. (46)	2 not (india$ or africa$ or chin$).ti,ab. (72)	limit 3 to (English language and humans and yr="2014-current") (34)	limit 4 to embase (18)
SSCI	TITLE: ((obes* and child*)) AND TITLE: ((region* or local area* or communit* or neighbour* or populat* or environment* or social determinant*)) AND TITLE: (review*)	1 refined by: LANGUAGES: (ENGLISH) AND [excluding] COUNTRIES/REGIONS: (PEOPLES R CHINA)	Timespan: 2014–19. Indexes: SSCI.		

Figure 1: Process of identification of peer-reviewed publications relating to childhood obesity, with attrition

Database search = 48

Title review excluded:
- Non-OECD countries
- Not related to childhood obesity

Remaining = 20

Abstract review excluded:
- No local-level determinants
- Not a review

Final = 16
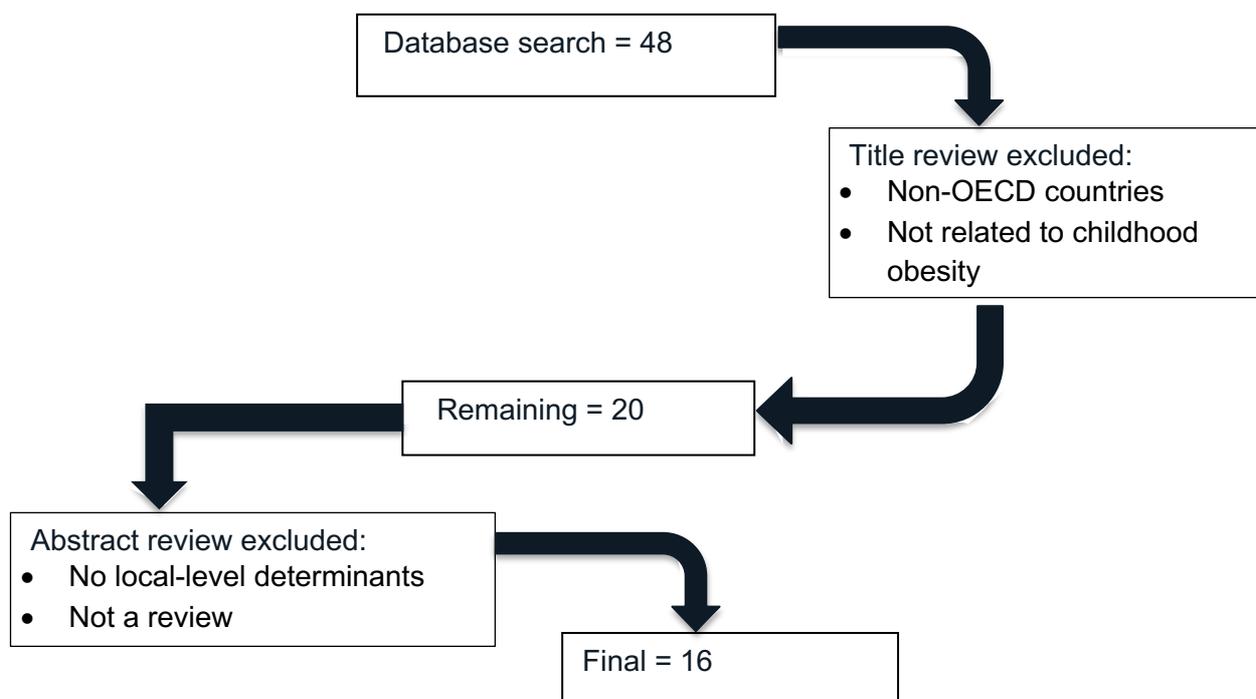
Quantitative analysis

Obesity data

Information on childhood obesity in England is collected through the National Child Measurement Programme and published by NHS Digital. During the school academic year, trained health care professionals measure the height and weight of children in state schools in Reception (at age four or five) and in Year 6 (at age 10 or 11). Their Body Mass Index (BMI) is then calculated and compared to 1990 reference values, which take age and sex into account, to assign children into the following categories: underweight, healthy weight, overweight, obese or severely obese. The prevalence or proportion of overweight or obese children is then calculated from the number of children measured. These data are published at lower-tier local authority level based on the residence of the child. We aggregated the data to the upper-tier local authority level. We gathered data for 2010/11 to 2018/19, with the latter used as our main outcome year.

Local authority characteristics

For local authority characteristics, we used search engines to identify any real-world data that could represent the themes and suggested measures from the literature review. A full breakdown of the local authority characteristics that we were able to gather and from which data sources is available in Tables 4 and 5 in the 'Supporting data' section. Key sources include: the Ministry of Housing, Communities and Local Government; the Office for National Statistics; and Public Health England.

We also had access to pseudonymised record-level Hospital Episode Statistics through a data-sharing agreement with NHS Digital. We used this to construct bespoke indicators at upper-tier local authority level on hospital admissions for dental caries among children, as the equivalent data published by Public Health England had data suppression rules applied.

Data preparation

Most of the data were already published at upper-tier local authority level but, in some cases, we had to aggregate to this level from the lower-tier local authority or lower layer super output area level. If raw counts were available, we recalculated the values; otherwise, we averaged the values. We also chose to combine the Isles of Scilly with Cornwall and the City of London with Hackney, to help manage the issue of small numbers from these areas and because many existing data collections already did this, which meant that data were not available for the four local authorities individually.

We assessed the completeness of all the local authority characteristics that we gathered and pooled multiple years of data if there were missing data for a particular local authority. If multiple years of data were not available, then we created two versions of the characteristics, imputing the mean, median or mode for the missing values, and kept the best-fitting version. This was required for the data on the proportion of children who were inactive – seven local authorities had missing data and no alternative years of data were available at the time of the analysis.

We also looked for outliers in the local authority characteristics and pooled data if we felt that a particular year of data had unusual data points. This was particularly relevant for the

data on local authority spending where some local authorities had isolated large spends, presumably for one-off projects.

Analysis

We initially used summary statistics and plotting to examine the prevalence of overweight or obese Reception and Year 6 children at both a national and a local authority level, as well as looking at variation in the local authority characteristics (see Tables 12 and 13 in the 'Supporting data' section for descriptive statistics of the fully adjusted model variables). As the prevalence data were normally distributed, we used linear regression modelling to assess whether there was any association between the local authority characteristics identified and the prevalence of childhood 0verweight or obesity at the local authority level. We modelled Reception and Year 6 children (four- and five-year-olds, and 10- and 11-year-olds, respectively) separately as the local authority characteristics associated with childhood obesity could be different for the two age groups.

In the first instance we constructed unadjusted models looking at the association between each local authority characteristic individually and the prevalence of overweight or obese children (see Tables 6, 7, 16 and 17 in the 'Supporting data' section). We then produced a set of models using all the characteristics in each of the five themes identified by the literature review that we were able to gather data for, as well as the additional socioeconomic and demographic theme (see Tables 6 and 7 in the 'Supporting data' section). We applied stepwise selection both forwards and backwards, with the Akaike information criterion determining which set of characteristics in each theme best explained the local authority prevalence of childhood overweight and obesity. We ensured these theme models were free from strong multicollinearity, using Pearson's coefficient and the variance inflation factor. We also excluded overlapping local authority characteristics – where characteristics represented the same topic or were drawn from the same source (for example, the individual domains of the Index of Multiple Deprivation contribute to the overall deprivation score, so the overall score was not included in models alongside the individual domains).

Finally, we built a full model using all the remaining characteristics from each of the themes and again applied stepwise selection to ensure only characteristics that added something to the model were retained, as well as checking for multicollinearity (see Tables 8 and 10 in the 'Supporting data' section). We tested the robustness of these results by checking for influential data points and rerunning the models with the relevant local authorities excluded (see Tables 14 and 15 in the 'Supporting data' section). We also adjusted for multiple p-value tests using the false discovery rate, the results of which are included in the relevant tables.

To determine the relative importance of each of the characteristics in the final model for explaining variation in childhood obesity, we added each characteristic to the models in order of importance – based on the univariate R-squared measures. We then calculated the increase in the R-squared following addition of the new variables and assigned this as the proportion of variance explained by each characteristic (see Tables 9 and 11 in the 'Supporting data' section). We conducted all analyses with R version 3.6.1 in RStudio.

Supporting data

Full-text-review articles

Table 2: The final 16 peer reviewed publications identified by the search strategy

Article title	Author(s) and year	Journal	DOI
Influence of neighbourhood safety on childhood obesity: a systematic review and meta-analysis of longitudinal studies	An and others, 2017	*Obesity Reviews*	10.1111/obr.12585
Cost-effectiveness of community-based childhood obesity prevention interventions in Australia	Ananthapavan and others, 2019	*International Journal of Obesity*	10.1038/s41366-019-0341-0
Links between the organization of the family home environment and child obesity: a systematic review	Bates and others, 2018	*Obesity Reviews*	10.1111/obr.12662://WOS:000430084300008
Biological, environmental, and social influences on childhood obesity	Campbell, 2016	*Pediatric Research*	10.1038/pr.2015.208
Environmental components of childhood obesity prevention interventions: an overview of systematic reviews	Cauchi and others, 2016	*Obesity Reviews*	10.1111/obr.12441
Examining the obesogenic attributes of the family childcare home environment: a literature review	Francis and others, 2018	*Journal of Obesity*	10.1155/2018/3490651
A systematic review of the effectiveness of individual, community and societal level interventions at reducing socioeconomic inequalities in obesity amongst children	Hillier-Brown and others, 2014	*BMC Public Health*	10.1186/1471-2458-14-834://WOS:000340817700001
Barriers and facilitators to initial and continued attendance at community-based lifestyle programmes among families of overweight and obese children: a systematic review	Kelleher and others, 2017	*Obesity Reviews*	10.1111/obr.12478://WOS:000397269500005
A systematic review of neighbourhood economic context on child obesity and obesity-related behaviours	Kim and others, 2019	*Obesity Reviews*	10.1111/obr.12792://WOS:000457771000005
Examining the evidence for policy and environmental strategies to prevent childhood obesity in black communities: new directions and next steps	Kumanyika and others, 2014	*Obesity Reviews*	10.1111/obr.12206
A review of the literature on the social and environmental factors which influence children (aged 3–5 years) to be obese/overweight and the	McMullan and Keeney, 2014	*Health Education Journal*	10.1177/0017896912471034://WOS:000331391100004

Article title	Author(s) and year	Journal	DOI
accuracy of parental perceptions			
A review of promising multicomponent environmental child obesity prevention intervention strategies by the Children's Healthy Living Program	Nigg and others, 2016	*Journal of Environmental Health*	
Home environmental influences on childhood obesity in the Latino population: a decade review of literature	Ochoa and Berge, 2017	*Journal of Immigrant and Minority Health*	10.1007/s10903-016-0539-3://WOS:000395620800025
The role and impact of community health workers in childhood obesity interventions: a systematic review and meta-analysis	Schroeder and others, 2018	*Obesity Reviews*	10.1111/obr.12714://WOS:000444802800005
The longitudinal relationship between community programmes and policies to prevent childhood obesity and BMI in children: the Healthy Communities Study	Strauss and others, 2018	*Pediatric Obesity*	10.1111/ijpo.12266
Implementation of intersectoral community approaches targeting childhood obesity: a systematic review	van der Kleij and others, 2015	*Obesity Reviews*	10.1111/obr.12273://WOS:000354366200002

Conceptual models

Table 3: Conceptual models investigated

Article or report title	Author(s) and year	Journal or organisation	DOI
The Ecology of Human Development: Experiments in nature and design	Bronfenbrenner, 1979	Harvard University Press	N/A
Neighbourhood effects influencing early childhood development: conceptual model and trial measurement methodologies from the Kids in Communities Study	Goldfeld and others, 2015	*Social Indicators Research*	10.1007/s11205-014-0578-x
Kids in Communities Study (KiCS) study protocol: a cross-sectional mixed-methods approach to measuring community-level factors influencing early child development in Australia	Goldfeld and others, 2017	*BMJ Open*	10.1136/bmjopen-2016-014047
Foundational Community Factors for Early Childhood Development: A report on the Kids in Communities Study	Goldfeld and others, 2018	Murdoch Children's Research Institute	N/A
Toward a social care program of research: a population-level study of neighborhood effects on child development	Kershaw and others, 2007	*Early Education and Development*	10.1080/10409280701610929

Early Child Development: A powerful equalizer: Final report	Lori and others, 2007	World Health Organization	N/A	
The Total Environment Assessment Model of Early Child Development	Siddiqi and others, 2007	World Health Organization	N/A	
The Kids in Community Study: Measuring community level factors influencing children's development: Phase 1: Methodologies and Measurements Pilot Study	Talya and others, 2010	Murdoch Children's Research Institute	N/A	

Local authority characteristics and sources

Table 4: Suggested themes and measures, with identified characteristics

Theme	Measure	Identified characteristic	Year(s)	Source
Obesogenic community environment	Convenience foods	Fast-food outlets	2014, 2017	Public Health England
		Access to fast food	2017	Consumer Data Research Centre
	Neighbourhood walkability	Adults who walk for leisure	2015/16 – 2018/19	Sport England
		Average road distance to primary school from the Index of Multiple Deprivation	2015	Ministry of Housing, Communities and Local Government
		Average road distance to a store from the Index of Multiple Deprivation	2015	Ministry of Housing, Communities and Local Government
	Public recreation opportunities	Inactive children	2017/18	Sport England
		Active adults	2015/16 – 2017/18	Sport England
		Accessible woodland	2015	Public Health England
		Access to active green space	2017	Consumer Data Research Centre
		Access to passive green space[2]	2017	Consumer Data Research Centre
		Children living in the worst areas for access to blue space[3]	2017	Consumer Data Research Centre
		Annual mean concentration of human-made fine particulate matter, adjusted to account for population exposure	2010–17	Public Health England
		Concentration of the four pollutants nitrogen dioxide, benzene, sulphur dioxide and particulates, indicator from the Index of Multiple Deprivation	2015	Ministry of Housing, Communities and Local Government

[2] Passive green space includes public parks, gardens, playing fields, golf courses, allotments or community growing spaces and cemeteries. It excludes play spaces, bowling greens, tennis courts and religious grounds because these areas are not considered to enhance the 'green' environment, often being behind fences etc.

[3] Blue space are outdoor environments – either natural or manmade – that prominently feature water and are accessible to people.

Theme	Measure	Identified characteristic	Year(s)	Source
		Rural/urban classification	2011	Department for Environment, Food and Rural Affairs
		Leisure centre access	2017	Consumer Data Research Centre
		Local authority net expenditure on children's physical activity	2014/15 – 2018/19	Ministry of Housing, Communities and Local Government
		Local authority net expenditure on children's obesity	2014/15 – 2018/19	Ministry of Housing, Communities and Local Government
		Local authority net expenditure on open spaces	2010/11 – 2018/19	Ministry of Housing, Communities and Local Government
		Local authority net expenditure on sports development and community recreation	2010/11 – 2018/19	Ministry of Housing, Communities and Local Government
		Local authority net expenditure on sports and recreation facilities	2010/11 – 2018/19	Ministry of Housing, Communities and Local Government
Home environment	Shared family meals	–	–	–
	Sedentary relaxation and entertainment	–	–	–
Childhood stress	Adverse childhood experiences	Children in need of help and protection	2012/13 – 2018/19	Department for Education
Breastfeeding	Breastfeeding	Infants breastfed at 6 to 8 weeks	2010/11 – 2018/19	Public Health England
Socioeconomic disadvantage	Maternal depression	–	–	–
	Poorer individual diet	Hospital admissions for dental caries	2004/05 – 2018/19	NHS Digital
	Family food routines	–	–	–
Obesogenic characteristics of the early years child care environment	Environment for early years care	–	–	–
Neighbourhood safety	Crime	Recorded crime	2003–18	Office for National Statistics
		Crime domain score from the Index of Multiple Deprivation (includes violence, burglary, theft and criminal damage)	2015	Ministry of Housing, Communities and Local Government
	Road safety	Rate of road traffic accidents involving death or personal injury to pedestrians or cyclists indicator from the Index of Multiple Deprivation	2015	Ministry of Housing, Communities and Local Government

Table 5: Sources of additional socioeconomic and demographic characteristics

Theme	Measure	Identified characteristic	Year(s)	Source
Socioeconomic/ demographic	Child poverty	Children living in households in receipt of out-of-work benefits	2010–17	Department for Work and Pensions
		Children in low-income families	2006–16	HM Revenue and Customs
	Health	Health domain score from the Index of Multiple Deprivation (includes years of potential life lost, comparative illness and disability ratio, acute morbidity, and mood and anxiety disorders)	2015	Ministry of Housing, Communities and Local Government
	Education	Children's education score from the Index of Multiple Deprivation (includes Key Stage attainment, secondary school absence, staying on in education post 16 and entry to higher education)	2015	Ministry of Housing, Communities and Local Government
		Adult skills indicator score from the Index of Multiple Deprivation	2015	Ministry of Housing, Communities and Local Government
	Spend on childhood services	Local authority net expenditure on early years	2010/11 – 2018/19	Ministry of Housing, Communities and Local Government
		Local authority net expenditure on children's prescribed 0–5 services	2014/15 – 2019/20	Ministry of Housing, Communities and Local Government
		Local authority net expenditure on children's non-prescribed 0–5 services	2014/15 – 2019/20	Ministry of Housing, Communities and Local Government
	Ethnicity	Children on the primary school pupil roll with a minority ethnic background	2010–18	Department for Education
		Population with a non-white ethnic background	2011	Office for National Statistics
	Housing quality	Housing condition indicator score from the Index of Multiple Deprivation (proportion of social and private homes that fail to meet the decent homes standard)	2015	Ministry of Housing, Communities and Local Government
		Central heating indicator score from the Index of Multiple Deprivation	2015	Ministry of Housing, Communities and Local Government
		Housing affordability indicator score from the Index of Multiple Deprivation	2015	Ministry of Housing, Communities and Local Government

Theme	Measure	Identified characteristic	Year(s)	Source
		Household overcrowding indicator score from the Index of Multiple Deprivation	2015	Ministry of Housing, Communities and Local Government
		Dwellings per person	2015–18	Valuation Office Agency

Staged linear regression model results

Table 6: Reception – standardised coefficients and level of significance for unadjusted, theme-adjusted and fully adjusted linear regression models

Theme	Suggested measure	Characteristic	Year(s)	Unadjusted	Theme adjusted	Fully adjusted
Obesogenic community environment	Convenience foods	Number of fast-food outlets per 1,000 children aged under 5	2017	0.42***	0.32**	0.11
	Neighbourhood walkability	Percentage of adults walking for leisure	2017/18	-0.19*	-0.25*	-0.22**
		Proportion of the under-5s living in areas with the worst road distance to school deprivation score	2015	-0.21**	–	–
		Proportion of the under-5s living in areas with the worst road distance to stores deprivation score	2015	-0.20*	–	–
	Public recreation opportunities	Proportion of inactive children	2017/18	0.21*	-0.10	-0.10
		Proportion of active adults	2016/17	-0.49***	-0.40***	-0.13
		Proportion of the population with accessible woodland within 500m of where they live	2015	0.16*	0.17**	–
		Proportion of the under-5s living in areas with the worst access to active green space	2017	-0.07	0.16	0.15
		Proportion of the under-5s living in areas with the worst access to	2017	-0.02	0.26**	0.25**

Theme	Suggested measure	Characteristic	Year(s)	Unadjusted	Theme adjusted	Fully adjusted
		passive green space				
		Proportion of the under-5s living in areas with the worst access to blue space	2017	-0.03	-0.14*	-0.09
		Average concentration of human-made fine particulate matter	2016	-0.35***	-0.19	–
		Proportion of the population living in rural areas	2011	-0.10	–	–
		Proportion of the under-5s living in areas with the worst access to leisure centres	2017	0.00	–	–
		Local authority net expenditure on physical activity for children per child under 18	2015/16 – 2018/19	0.36***	0.15*	0.08
		Local authority net expenditure on obesity for children per child under 18	2016/17 – 2018/19	0.24**	0.13	0.13*
		Local authority net expenditure on open spaces per person	2014/15 – 2018/19	0.16*	0.11	–
		Local authority net expenditure on sports development and community recreation per person	2014/15 – 2018/19	0.09	–	–
		Local authority net expenditure on sports and recreation facilities per person	2016/17 – 2018/19	0.43***	–	–
Childhood stress	Adverse childhood experiences	Children in need of help and protection per 10,000 children	2016/17	0.34***	0.34***	–
Breastfeeding	Breastfeeding	Percentage of infants breastfed at 6 to 8 weeks after birth	2011/12 – 2014/15	-0.53***	-0.53***	-0.24**
Socioeconomic disadvantage	Poorer individual diet	Hospital admissions for dental caries by children aged 5 and under	2015/16 – 2018/19	0.19*	0.19*	–
Neighbourhood safety	Crime	Recorded crimes per 1,000 population	2018	0.34***	0.52***	–

Theme	Suggested measure	Characteristic	Year(s)	Unadjusted	Theme adjusted	Fully adjusted
	Road safety	Proportion of the population living in areas with worst road traffic accidents involving pedestrians or cyclists deprivation score	2015	-0.07	-0.34**	–
Socioeconomic/ demographic	Child poverty	Proportion of the under-5s living in households in receipt of out-of-work benefits	2016	0.74***	0.55***	0.47***
	Health	Average health domain score from the Index of Multiple Deprivation	2015	0.72***	–	–
	Education	Average children's education deprivation score	2015	0.57***	–	–
		Average adult skills deprivation score	2015	0.66***	0.22**	–
	Spend on childhood services	Local authority net expenditure on early years per child aged under 5	2010/11	0.43***	–	–
		Local authority net expenditure on children's prescribed 0–5 services per child aged under 5	2015/16 – 2018/19	0.27**	–	–
		Local authority net expenditure on children's non-prescribed 0–5 services per child aged under 5	2015/16 – 2018/19	0.33***	–	–
	Ethnicity	Proportion of children on the primary school pupil roll with a minority ethnic background	2018	-0.2*	-0.07	–
	Housing quality	Proportion of the under-5s living in areas with the worst housing condition deprivation score	2015	0.11	0.09	–
		Proportion of the under-5s living in areas with the worst central heating	2015	0.24**	–	–

Theme	Suggested measure	Characteristic	Year(s)	Unadjusted	Theme adjusted	Fully adjusted
		deprivation score				
		Proportion of the under-5s living in areas with the worst housing affordability deprivation score	2015	0.12	–	–
		Proportion of the under-5s living in areas with the worst household overcrowding deprivation score	2015	-0.20*	–	–
		Dwellings per person	2015	0.24**	–	–

Note: P-value: * is significant at the 5% level, ** is significant at the 1% level and *** is significant at the 0.01% level.

Table 7: Year 6 – standardised coefficients and level of significance for unadjusted, theme-adjusted and fully adjusted linear regression models

Theme	Suggested measure	Characteristic	Year(s)	Unadjusted	Theme adjusted	Fully adjusted
Obesogenic community environment	Convenience foods	Proportion of the under-11s living in the worst areas for access to fast-food outlets	2017	0.36***	–	–
	Neighbourhood walkability	Percentage of adults walking for leisure	2017/18	-0.70***	-0.33***	-0.14*
		Proportion of the under-11s living in areas with the worst road distance to school deprivation score	2015	-0.61***	–	–
		Proportion of the under-11s living in areas with the worst road distance to stores deprivation score	2015	-0.63***	-0.13*	–
	Public recreation opportunities	Proportion of inactive children	2017/18	0.39***	–	–
		Proportion of active adults	2015/16	-0.56***	-0.42***	-0.23***
		Proportion of the population with accessible woodland within 500m of where they live	2015	0.01	–	–
		Proportion of the under-11s living in areas with the worst access to	2017	0.29**	0.28***	–

Theme	Suggested measure	Characteristic	Year(s)	Unadjusted	Theme adjusted	Fully adjusted
		active green space				
		Proportion of the under-11s living in areas with the worst access to passive green space	2017	-0.51***	–	–
		Proportion of the under-11s living in areas with the worst access to blue space	2017	0.19*	–	–
		Average air pollution deprivation score	2015	0.52***	–	–
		Proportion of the population living in rural areas	2011	-0.51***	–	–
		Proportion of the under-11s living in areas with the worst access to leisure centres	2017	-0.43***	–	–
		Local authority net expenditure on physical activity for children per child aged under 18	2015/16 – 2018/19	0.36***	0.14**	0.05
		Local authority net expenditure on obesity for children per child aged under 18	2016/17 – 2018/19	0.28**	–	–
		Local authority net expenditure on open spaces per person	2014/15 – 2018/19	0.3**	–	–
		Local authority net expenditure on sports development and community recreation per person	2014/15 – 2018/19	0.24**	–	–
		Local authority net expenditure on sports and recreation facilities per person	2016/17 – 2018/19	0.33***	0.18***	0.08*
Childhood stress	Adverse childhood experiences	Children in need of help and protection per 10,000 children	2016/17	0.35***	0.35***	–
Socioeconomic disadvantage	Poorer individual diet	Proportion of 5-year-olds with experience of visually obvious tooth decay	2014/15	0.50***	0.50***	–
		Hospital admissions for dental caries by children aged 5 and under	2015/16 – 2018/19	0.17*	–	–

Theme	Suggested measure	Characteristic	Year(s)	Unadjusted	Theme adjusted	Fully adjusted
Neighbourhood safety	Crime	Proportion of the under-11s living in areas with the worst crime deprivation score	2015	0.67***	0.82***	–
	Road safety	Average road traffic accidents involving pedestrians or cyclists deprivation score	2015	0.24**	-0.26**	-0.18**
Socioeconomic/ demographic	Child poverty	Proportion of children and young people living in low-income families	2011	0.83***	0.31**	0.55***
	Health	Average health deprivation score	2015	0.65***	0.28**	0.17*
	Education	Average children's education deprivation score	2015	0.31**	–	–
		Proportion of the population living in the worst areas for the adult skills deprivation score	2015	0.60***	0.22**	-0.13
	Spend on childhood services	Local authority net expenditure on early years per child aged under 5	2010/11	0.52***	–	–
		Local authority net expenditure on children's prescribed 0–5 services per child aged under 5	2015/16 – 2018/19	0.29**	–	–
		Local authority net expenditure on children's non-prescribed 0–5 services per child aged under 5	2015/16 – 2018/19	0.29**	–	–
	Ethnicity	Proportion of the population with a minority ethnic background	2011	0.52***	0.37***	0.22**
	Housing quality	Proportion of the population living in areas with the worst housing condition deprivation score	2015	-0.17*	-0.10*	–
		Proportion of the under-11s living in areas with the worst central heating deprivation score	2015	0.12	–	–
		Proportion of the under-11s living in areas with the worst housing affordability deprivation score	2015	0.68***	–	–

Theme	Suggested measure	Characteristic	Year(s)	Unadjusted	Theme adjusted	Fully adjusted
		Proportion of the under-11s living in areas with the worst household overcrowding deprivation score	2015	0.43***	–	–
		Dwellings per person	2018	-0.24**	–	–

Note: P-value: * is significant at the 5% level, ** is significant at the 1% level and *** is significant at the 0.01% level.

Fully adjusted linear regression model results

Table 8: Reception – fully adjusted linear regression model results with false discovery rate (FDR) adjusted p-values

Theme	Characteristic	Coefficient	Standard error	T-statistic	P-value	FDR p-value
–	Intercept	29.73	3.62	8.22	<0.0001	<0.0001
Obesogenic community environment	Number of fast-food outlets per 1,000 children aged under 5	0.06	0.04	1.50	0.1355	0.1478
	Percentage of adults walking for leisure	-0.08	0.03	-2.73	0.0071	0.0172
	Proportion of inactive children	-5.17	3.17	-1.63	0.1051	0.1427
	Proportion of active adults	-7.23	4.61	-1.57	0.1189	0.1427
	Proportion of under-5s living in areas with the worst access to active green space	2.88	1.55	1.85	0.0659	0.1130
	Proportion of under-5s living in areas with the worst access to passive green space	4.94	1.32	3.75	0.0003	0.0011
	Proportion of under-5s living in areas with the worst access to blue space	-2.19	1.39	-1.57	0.1181	0.1427
	Local authority net expenditure on physical activity for children per child aged under 18	0.05	0.03	1.39	0.1661	0.1661
	Local authority net expenditure on obesity for children per child aged under 18	0.05	0.02	2.32	0.0220	0.0441
Breastfeeding	Percentage of infants breastfed at 6 to 8 weeks after birth	-0.04	0.02	-2.82	0.0054	0.0163

Socioeconomic/ demographic	Proportion of under-5s living in households in receipt of out-of-work benefits	21.78	4.44	4.91	<0.0001	<0.0001
R-squared				**65%**		

Table 9: Reception – proportion of the variance explained by each local authority characteristic in the fully adjusted model

Local authority characteristic	Variance explained
Proportion of the under-5s living in households in receipt of out-of-work benefits	54%
Proportion of the under-5s living in areas with the worst access to passive green space	3%
Local authority net expenditure on obesity for children per child aged under 18	2%
Percentage of infants breastfed at 6 to 8 weeks after birth	2%
Proportion of the under-5s living in areas with the worst access to blue space	1%
Local authority net expenditure on physical activity for children per child aged under 18	1%
Proportion of active adults	1%
Number of fast-food outlets per 1,000 children aged under 5	0.4%
Proportion of inactive children	0.3%
Percentage of adults walking for leisure	0.2%
Proportion of the under-5s living in areas with the worst access to active green space	0.1%
Total	**65%**

Table 10: Year 6 – fully adjusted linear regression model results with false discovery rate (FDR) adjusted p-values

Theme	Characteristic	Coefficient	Standard error	T-statistic	P-value	FDR p-value
–	Intercept	51.35	4.67	11.00	<0.0001	<0.0001
Obesogenic community environment	Percentage of adults walking for leisure	-0.09	0.04	-2.25	0.0257	0.0367
	Proportion of active adults	-24.92	5.55	-4.49	<0.0001	<0.0001
	Local authority net expenditure on physical activity for children per child aged under 18	0.06	0.04	1.44	0.1509	0.1509
	Local authority net expenditure on sports and recreation facilities per person	0.06	0.03	2.01	0.0464	0.0579
Neighbourhood safety	Average road traffic accidents involving pedestrians or cyclists deprivation score	-2.69	0.79	-3.39	0.0009	0.0022
Socioeconomic/ demographic	Proportion of children and young people living in low-income families	34.79	5.33	6.53	<0.0001	<0.0001
	Average health deprivation score	1.21	0.51	2.40	0.0179	0.0298

	Proportion of the population living in the worst areas for the adult skills deprivation score	-3.27	1.90	-1.72	0.0879	0.0977
	Proportion of the population with a non-white ethnic background	6.11	1.99	3.07	0.0026	0.0051
R-squared				**84%**		

Table 11: Year 6 – proportion of the variance explained by each local authority characteristic in the fully adjusted model

Local authority characteristic	Variance explained
Proportion of children and young people living in low-income families	69%
Proportion of active adults	4%
Percentage of adults walking for leisure	6%
Average health domain score from the Index of Multiple Deprivation	2%
Local authority net expenditure on sports and recreation facilities per person	1%
Average road traffic accidents involving pedestrians and cyclists score from the Index of Multiple Deprivation	1%
Proportion of the population with a non-white ethnic background	1%
Local authority net expenditure on physical activity for children per child aged under 18	0.3%
Proportion of the population living in the worst areas for the adult skills score from the Index of Multiple Deprivation	0.1%
Total	**84%**

Descriptive statistics for local authority characteristics, fully adjusted model

Table 12: Reception – descriptive statistics for final-model characteristics and outcome

Theme	Characteristic	Minimum	Median	Maximum	Mean	Standard deviation
Outcome	Percentage of Reception children who were overweight or obese	15.63	22.85	29.65	22.75	2.68
Obesogenic community environment	Number of fast-food outlets per 1,000 children aged under 5	5.93	15.68	38.30	16.38	4.99
	Percentage of adults walking for leisure	24.24	47.77	66.06	47.64	7.22
	Proportion of inactive children	0.20	0.33	0.48	0.34	0.05
	Proportion of active adults	0.63	0.74	0.85	0.74	0.05
	Proportion of the under-5s living in areas with the worst access to active green space	0.02	0.20	0.81	0.24	0.14
	Proportion of the under-5s living in areas with the worst access to passive green space	0.00	0.12	0.71	0.16	0.14

	Proportion of the under-5s living in areas with the worst access to blue space	0.00	0.20	0.72	0.21	0.11
	Local authority net expenditure on physical activity for children per child aged under 18 (£)	0.00	2.49	57.12	4.47	6.90
	Local authority net expenditure on obesity for children per child aged under 18 (£)	0.00	1.86	27.73	3.45	4.45
Breastfeeding	Percentage of infants breastfed at 6 to 8 weeks after birth	16.54	46.15	81.84	47.05	15.11
Socioeconomic/ demographic	Proportion of the under-5s living in households in receipt of out-of-work benefits	0.06	0.16	0.32	0.17	0.06

Table 13: Year 6 – descriptive statistics for final-model characteristics and outcome

Theme	Characteristic	Minimum	Median	Maximum	Mean	Standard deviation
Outcome	Percentage of Year 6 children who were overweight or obese	22.60	35.26	44.93	34.83	4.50
Obesogenic community environment	Percentage of adults walking for leisure	24.24	47.77	66.06	47.64	7.22
	Proportion of active adults	0.63	0.74	0.85	0.74	0.04
	Local authority net expenditure on physical activity for children per child aged under 18	0.00	1.86	27.73	3.45	4.45
	Local authority net expenditure on sports and recreation facilities per person	-16.12	2.16	30.03	3.84	5.74
Neighbourhood safety	Average road traffic accidents involving pedestrians or cyclists deprivation score	0.31	0.70	1.83	0.78	0.30
Socioeconomic/ demographic	Proportion of children and young people living in low-income families	0.07	0.22	0.44	0.22	0.07
	Average health deprivation score	-1.80	0.12	1.51	0.08	0.63
	Proportion of the population living in the worst areas for the adult skills deprivation score	0.00	0.18	0.72	0.21	0.17
	Proportion of the population with a non-white ethnic background	0.01	0.10	0.71	0.16	0.16

Sensitivity analyses

Table 14: Reception – coefficients, level of significance, false discovery rate (FDR) adjusted significance and adjusted R-squared for the fully adjusted models, excluding seven influential local authorities

Theme	Characteristic	Coefficient	Standard error	T-statistic	P-value	FDR p-value
–	Intercept	27.32	3.50	7.81	<0.0001	<0.0001
Obesogenic community environment	Number of fast-food outlets per 1,000 children aged under 5	0.04	0.04	0.97	0.3362	0.4034
	Percentage of adults walking for leisure	-0.07	0.03	-2.27	0.0247	0.0493
	Proportion of inactive children	-3.64	3.03	-1.20	0.2316	0.3473
	Proportion of active adults	-4.58	4.47	-1.02	0.3080	0.4034
	Proportion of the under-5s living in areas with the worst access to active green space	3.27	1.53	2.13	0.0351	0.0601
	Proportion of the under-5s living in areas with the worst access to passive green space	4.57	1.31	3.48	0.0007	0.0020
	Proportion of the under-5s living in areas with the worst access to blue space	-0.53	1.35	-0.40	0.6931	0.6931
	Local authority net expenditure on physical activity for children per child aged under 18	0.03	0.04	0.72	0.4734	0.5164
	Local authority net expenditure on obesity for children per child aged under 18	0.05	0.02	2.50	0.0137	0.0328
Breastfeeding	Percentage of infants breastfed at 6 to 8 weeks after birth	-0.06	0.02	-3.65	0.0004	0.0015
Socioeconomic/ demographic	Proportion of the under-5s living in households in receipt of out-of-work benefits	21.48	4.40	4.88	<0.0001	<0.0001
R-squared				**68%**		

Table 15: Year 6 – coefficients, level of significance, false discovery rate (FDR) adjusted significance and adjusted R-squared for the fully adjusted models, excluding 10 influential local authorities

Theme	Characteristic	Coefficient	Standard error	T-statistic	P-value	FDR p-value
–	Intercept	52.59	4.42	11.90	<0.0001	<0.0001
Obesogenic community environment	Percentage of adults walking for leisure	-0.11	0.04	-3.12	0.0022	0.0045
	Proportion of adults active	-24.41	5.43	-4.50	0.0000	0.0001
	Local authority net expenditure on physical activity for children per child aged under 18	0.08	0.05	1.75	0.0828	0.0828
	Local authority net expenditure on sports and recreation facilities per person	0.06	0.03	2.13	0.0350	0.0435
Neighbourhood safety	Average road traffic accidents involving pedestrians or cyclists deprivation score	-3.30	0.82	-4.03	0.0001	0.0002
Socioeconomic/ demographic	Proportion of children and young people living in low-income families	35.34	5.32	6.65	<0.0001	<0.0001
	Average health deprivation score	1.24	0.50	2.50	0.0135	0.0193
	Proportion of the population living in the worst areas for the adult skills deprivation score	-3.81	1.83	-2.08	0.0391	0.0435
	Proportion of the population with a non-white ethnic background	5.84	1.94	3.01	0.0032	0.0053
R-squared				**88%**		

Additional characteristics tested

Table 16: Reception – additional characteristics tested with year, source, standardised coefficient and level of significance in the unadjusted model

Theme	Suggested measure	Characteristic	Year(s)	Source	Unadjusted coefficient
Obesogenic community environment	Convenience foods	Proportion of the under-5s living in the worst areas for access to fast-food outlets	2017	Consumer Data Research Centre	-0.10
	Neighbourhood walkability	Percentage of adults who walk for travel purposes	2017/18	Sport England	-0.25**
		Average road distance to school deprivation score	2015	Ministry of Housing, Communities and Local Government	-0.17*

Theme	Suggested measure	Characteristic	Year(s)	Source	Unadjusted coefficient
		Proportion of the population living in areas with the worst road distance to school deprivation score	2015	Ministry of Housing, Communities and Local Government	-0.21*
		Average road distance to store deprivation score	2015	Ministry of Housing, Communities and Local Government	-0.13
		Proportion of the population living in areas with the worst road distance to store deprivation score	2015	Ministry of Housing, Communities and Local Government	-0.19*
	Public recreation opportunities	Average air pollution deprivation score	2015	Ministry of Housing, Communities and Local Government	-0.05
		Proportion of the under-5s living in areas with the worst air pollution deprivation score	2015	Ministry of Housing, Communities and Local Government	-0.04
		Proportion of the population living in areas with the worst air pollution deprivation score	2015	Ministry of Housing, Communities and Local Government	-0.04
Neighbourhood safety	Crime	Average crime deprivation score	2015	Ministry of Housing, Communities and Local Government	0.22**
		Proportion of the under-5s living in areas with the worst crime deprivation score	2015	Ministry of Housing, Communities and Local Government	0.30**
		Proportion of the population living in areas with the worst crime deprivation score	2015	Ministry of Housing, Communities and Local Government	0.26**
	Road safety	Average road traffic accidents involving pedestrians or cyclists deprivation score	2015	Ministry of Housing, Communities and Local Government	-0.05
		Proportion of the under-5s living in areas with the worst road traffic accidents involving pedestrians or cyclists deprivation score	2015	Ministry of Housing, Communities and Local Government	-0.06
Socioeconomic/ demographic	Deprivation	Average deprivation score	2015	Ministry of Housing, Communities and Local Government	0.65***
		Proportion of the under-5s living in areas with the worst deprivation score	2015	Ministry of Housing, Communities and Local Government	0.64***
		Proportion of the population living in areas with the worst deprivation score	2015	Ministry of Housing, Communities and Local Government	0.61***

Theme	Suggested measure	Characteristic	Year(s)	Source	Unadjusted coefficient
	Child poverty	Proportion of children living in low-income families	2015	HM Revenue and Customs	0.58***
		Average employment deprivation score	2015	Ministry of Housing, Communities and Local Government	0.73***
		Proportion of the under-5s living in areas with the worst employment deprivation score	2015	Ministry of Housing, Communities and Local Government	0.68***
		Proportion of the population living in areas with the worst employment deprivation score	2015	Ministry of Housing, Communities and Local Government	0.67***
		Average income deprivation score	2015	Ministry of Housing, Communities and Local Government	0.64***
		Proportion of the under-5s living in areas with the worst income deprivation score	2015	Ministry of Housing, Communities and Local Government	0.63***
		Proportion of the population living in areas with the worst income deprivation score	2015	Ministry of Housing, Communities and Local Government	0.60***
		Average income deprivation affecting children score	2015	Ministry of Housing, Communities and Local Government	0.56***
		Proportion of the under-5s living in areas with the worst income deprivation affecting children score	2015	Ministry of Housing, Communities and Local Government	0.59***
		Proportion of the population living in areas with the worst income deprivation affecting children score	2015	Ministry of Housing, Communities and Local Government	0.53***
	Health	Proportion of the under-5s living in areas with the worst health deprivation score	2015	Ministry of Housing, Communities and Local Government	0.62***
		Proportion of the population living in areas with the worst health deprivation score	2015	Ministry of Housing, Communities and Local Government	0.61***
	Education	Proportion of the under-5s living in areas with the worst children's education deprivation score	2015	Ministry of Housing, Communities and Local Government	0.48***
		Proportion of the population living in areas with the worst children's education deprivation score	2015	Ministry of Housing, Communities and Local Government	0.47***

Theme	Suggested measure	Characteristic	Year(s)	Source	Unadjusted coefficient
		Proportion of the under-5s living in areas with the worst adult skills deprivation score	2015	Ministry of Housing, Communities and Local Government	0.62***
		Proportion of the population living in areas with the worst adult skills deprivation score	2015	Ministry of Housing, Communities and Local Government	0.6***
		Average education deprivation score	2015	Ministry of Housing, Communities and Local Government	0.64***
		Proportion of the under-5s living in areas with the worst education deprivation score	2015	Ministry of Housing, Communities and Local Government	0.58***
		Proportion of the population living in areas with the worst education deprivation score	2015	Ministry of Housing, Communities and Local Government	0.57***
	Spend on childhood services	Local authority net expenditure on public health per person	2015/16 – 2018/19	Ministry of Housing, Communities and Local Government	0.41***
		Local authority net expenditure on children's social care per child aged under 18	2014/15 – 2018/19	Ministry of Housing, Communities and Local Government	0.33***
		Local authority net expenditure on Sure Start per child aged under 5	2015/16 – 2018/19	Ministry of Housing, Communities and Local Government	0.06
	Ethnicity	Proportion of the population with a minority ethnic background	2011	Office for National Statistics	-0.17*
		Proportion of children on the primary school roll with an Asian ethnic background	2018	Department for Education	-0.17*
		Proportion of the population with an Asian ethnic background	2011	Office for National Statistics	-0.19*
		Proportion of children on the primary school roll with a black ethnic background	2018	Department for Education	-0.04
		Proportion of the population with a black ethnic background	2011	Office for National Statistics	-0.05
	Housing quality	Average housing condition deprivation score	2015	Ministry of Housing, Communities and Local Government	0.06
		Proportion of the population living in areas with the worst housing condition deprivation score	2015	Ministry of Housing, Communities and Local Government	0.08

Theme	Suggested measure	Characteristic	Year(s)	Source	Unadjusted coefficient
		Average central heating deprivation score	2015	Ministry of Housing, Communities and Local Government	0.20*
		Proportion of the population living in areas with the worst central heating deprivation score	2015	Ministry of Housing, Communities and Local Government	0.24**
		Average housing affordability deprivation score	2015	Ministry of Housing, Communities and Local Government	-0.03
		Proportion of the population living in areas with the worst housing affordability deprivation score	2015	Ministry of Housing, Communities and Local Government	0.07
		Average household overcrowding deprivation score	2015	Ministry of Housing, Communities and Local Government	-0.14
		Proportion of the population living in areas with the worst household overcrowding deprivation score	2015	Ministry of Housing, Communities and Local Government	-0.18*

Note: P-value: * is significant at the 5% level, ** is significant at the 1% level and *** is significant at the 0.01% level.

Table 17: Year 6 – additional characteristics tested with year, source, standardised coefficient and level of significance in the unadjusted model

Theme	Suggested measure	Characteristic	Year(s)	Source	Unadjusted coefficient
Obesogenic community environment	Convenience foods	Number of fast-food outlets per 1,000 children aged under 11	2014	Public Health England	0.30**
	Neighbourhood walkability	Percentage of adults who walk for travel purposes	2012/13	Sport England	0.28**
		Average road distance to school deprivation score	2015	Ministry of Housing, Communities and Local Government	-0.58***
		Proportion of the population living in areas with the worst road distance to school deprivation score	2015	Ministry of Housing, Communities and Local Government	-0.60***
		Average road distance to store deprivation score	2015	Ministry of Housing, Communities and Local Government	-0.54***
		Proportion of the population living in areas with the worst road distance to store deprivation score	2015	Ministry of Housing, Communities and Local Government	-0.62***
	Public recreation opportunities	Proportion of the under-11s living in areas with the worst	2015	Ministry of Housing, Communities and Local Government	0.51***

Theme	Suggested measure	Characteristic	Year(s)	Source	Unadjusted coefficient
		air pollution deprivation score			
		Proportion of the population living in areas with the worst air pollution deprivation score	2015	Ministry of Housing, Communities and Local Government	0.51***
		Average concentration of human-made fine particulate matter	2014	Public Health England	0.35***
Neighbourhood safety	Crime	Average crime deprivation score	2015	Ministry of Housing, Communities and Local Government	0.66***
		Proportion of the population living in areas with the worst crime deprivation score	2015	Ministry of Housing, Communities and Local Government	0.65***
		Recorded crimes per 1,000 population	2018	Office for National Statistics	0.55***
	Road safety	Proportion of the under-11s living in areas with the worst road traffic accidents involving pedestrians or cyclists deprivation score	2015	Ministry of Housing, Communities and Local Government	0.16*
		Proportion of the population living in areas with the worst road traffic accidents involving pedestrians or cyclists deprivation score	2015	Ministry of Housing, Communities and Local Government	0.16
Socioeconomic/ demographic	Deprivation	Average deprivation score	2015	Ministry of Housing, Communities and Local Government	0.78***
		Proportion of the under-11s living in areas with the worst deprivation score	2015	Ministry of Housing, Communities and Local Government	0.74***
		Proportion of the population living in areas with the worst deprivation score	2015	Ministry of Housing, Communities and Local Government	0.74***
	Child poverty	Proportion of the under-11s living in households in receipt of out-of-work benefits	2010	Department for Work and Pensions	0.82***
		Average employment deprivation score	2015	Ministry of Housing, Communities and Local Government	0.69***
		Proportion of the under-11s living in areas with the worst employment deprivation score	2015	Ministry of Housing, Communities and Local Government	0.63***
		Proportion of the population living in areas with the worst employment deprivation score	2015	Ministry of Housing, Communities and Local Government	0.64***

Theme	Suggested measure	Characteristic	Year(s)	Source	Unadjusted coefficient
		Average income deprivation score	2015	Ministry of Housing, Communities and Local Government	0.83***
		Proportion of the under-11s living in areas with the worst income deprivation score	2015	Ministry of Housing, Communities and Local Government	0.78***
		Proportion of the population living in areas with the worst income deprivation score	2015	Ministry of Housing, Communities and Local Government	0.79***
		Average income deprivation affecting children score	2015	Ministry of Housing, Communities and Local Government	0.83***
		Proportion of the under-11s living in areas with the worst income deprivation affecting children score	2015	Ministry of Housing, Communities and Local Government	0.78***
		Proportion of the population living in areas with the worst income deprivation affecting children score	2015	Ministry of Housing, Communities and Local Government	0.77***
	Health	Proportion of the under-11s living in areas with the worst health deprivation score	2015	Ministry of Housing, Communities and Local Government	0.51***
		Proportion of the population living in areas with the worst health deprivation score	2015	Ministry of Housing, Communities and Local Government	0.51***
	Education	Proportion of the under-11s living in areas with the worst children's education deprivation score	2015	Ministry of Housing, Communities and Local Government	0.13
		Proportion of the population living in areas with the worst children's education deprivation score	2015	Ministry of Housing, Communities and Local Government	0.14
		Average adult skills deprivation score	2015	Ministry of Housing, Communities and Local Government	0.58***
		Proportion of the under-11s living in areas with the worst adult skills deprivation score	2015	Ministry of Housing, Communities and Local Government	0.59***
		Average education deprivation score	2015	Ministry of Housing, Communities and Local Government	0.48***
		Proportion of the under-11s living in areas with the worst education deprivation score	2015	Ministry of Housing, Communities and Local Government	0.39***

Theme	Suggested measure	Characteristic	Year(s)	Source	Unadjusted coefficient
		Proportion of the population living in areas with the worst education deprivation score	2015	Ministry of Housing, Communities and Local Government	0.40***
	Spend on childhood services	Local authority net expenditure on public health per person	2015/16 – 2018/19	Ministry of Housing, Communities and Local Government	0.64***
		Local authority net expenditure on children's social care per child aged under 18	2014/15 – 2018/19	Ministry of Housing, Communities and Local Government	0.43***
		Local authority net expenditure on Sure Start per child aged under 5	2015/16 – 2018/19	Ministry of Housing, Communities and Local Government	0.07
	Ethnicity	Proportion of children on the primary school roll with a minority ethnic background	2016	Department for Education	0.51***
		Proportion of children on the primary school roll with an Asian ethnic background	2010	Department for Education	0.46***
		Proportion of the population with an Asian ethnic background	2011	Office for National Statistics	0.47***
		Proportion of children on the primary school roll with a black ethnic background	2018	Department for Education	0.46***
		Proportion of the population with a black ethnic background	2011	Office for National Statistics	0.46***
	Housing quality	Average housing condition deprivation score	2015	Ministry of Housing, Communities and Local Government	-0.07
		Proportion of the under-11s living in areas with the worst housing condition deprivation score	2015	Ministry of Housing, Communities and Local Government	-0.14
		Average central heating deprivation score	2015	Ministry of Housing, Communities and Local Government	0.11
		Proportion of the population living in areas with the worst central heating deprivation score	2015	Ministry of Housing, Communities and Local Government	0.11
		Average housing affordability deprivation score	2015	Ministry of Housing, Communities and Local Government	0.49***
		Proportion of the population living in areas with the worst housing affordability deprivation score	2015	Ministry of Housing, Communities and Local Government	0.65***

Theme	Suggested measure	Characteristic	Year(s)	Source	Unadjusted coefficient
		Average household overcrowding deprivation score	2015	Ministry of Housing, Communities and Local Government	0.42***
		Proportion of the population living in areas with the worst household overcrowding deprivation score	2015	Ministry of Housing, Communities and Local Government	0.42***

Note: P-value: * is significant at the 5% level, ** is significant at the 1% level and *** is significant at the 0.01% level.

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