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Socioenvironmental sugar promotion and geographical inequalities in dental health of 5-year-old children in England

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Abstract

Objectives: To investigate the relationship between socioenvironmental sugar promotion and geographical inequalities in the prevalence of dental caries amongst 5-year-olds living across small areas within England.

Methods: Ecological data from the National Dental Epidemiology Programme (NDEP) 2018–2019, comprising information on the percentage of 5-year-olds with tooth decay (≥1 teeth that are decayed into dentine, missing due to decay, or filled), and untreated tooth decay (≥1 decayed but untreated teeth), in lower-tier local authorities (LAs) of England. These were analysed for association with a newly developed Index of Sugar-Promoting Environments Affecting Child Dental Health (ISPE-ACDH). The index quantifies sugar-promoting determinants within a child's environment and provides standardized scores for the index, and its component domains that is, neighbourhood-, school- and family-environment, with the highest scores representing the highest levels of sugar promotion in lower-tier LAs ($N=317$) of England. Linear regressions, including unadjusted models separately using index and each domain, and models adjusted for domains were built for each dental outcome.

Results: Participants lived across 272 of 317 lower-tier LAs measured within the index. The average percentage of children with tooth decay and untreated tooth decay was 22.5 (SD: 8.5) and 19.6 (SD: 8.3), respectively. The mean index score was (0.1 [SD: 1.01]). Mean domain scores were: neighbourhood (0.02 [SD: 1.03]), school (0.1 [SD: 1.0]), and family (0.1 [SD: 0.9]). Unadjusted linear regressions indicated that the LA-level percentage of children with tooth decay increased by 5.04, 3.71, 4.78 and 5.24 with increased scores of the index, and neighbourhood, school and family domains, respectively. An additional model, adjusted for domains, showed that this increased percentage predicted by neighbourhood domain attenuated to 1.37, and by family domain it increased to 6.33. Furthermore, unadjusted models indicated that the LA-level percentage of children with untreated tooth decay increased by 4.72, 3.42, 4.45 and 4.97 with increased scores of the index, and neighbourhood, school, and family domains, respectively. The model, adjusted for domains, showed that this increased percentage predicted by neighbourhood domain attenuated to 1.24 and by family domain rose to 6.47. School-domain was not significantly associated with either outcome in adjusted models.

Conclusions: This study reveals that socioenvironmental sugar promotion, particularly within neighbourhood- and family-environments, may contribute to geographical inequalities in dental caries in children. Further research involving data on individual-level dental outcomes and confounders is required.

KEYWORDS

child, environment, family, health inequities, oral health, residence characteristics, schools, social determinants of health, sugars

1 | INTRODUCTION

Globally and within England, dental caries (tooth decay) is recognized as a major public health problem.[1,2] The global burden of disease (GBD) 2017 study estimated that 2.3 billion (95% uncertainty interval (UI): 2.1–2.5 billion) and 532 million (95% UI: 443–622 million) individuals suffer from untreated dental caries in permanent and deciduous teeth, respectively.[1] In 2010, costs incurred for dental treatments worldwide were estimated at US$298 billion with indirect expenses of US$144 billion.[3] Dental caries is more prevalent in children under 12 years of age,[4] and impacts their day-to-day life and health, through to pain, difficulty in eating and sleeping, missed school days.[5] Consequently, understanding the key contributors to dental caries in children is a public health priority.

Within England, the recent national surveys of 5-year-olds,[6,7] have reported marginal declines in the prevalence of dental caries, despite the free dental care at the point of delivery for children within the National Health Service (NHS).[8] These surveys further reveal striking inequalities in the burden of the disease across different geographical regions and small areas within England. Routine care for dental caries involving, preventive and restorative care to maintain a natural dentition of children, is provided in primary dental care sector of NHS. Children with extensive untreated tooth decay, requiring speciality care for extracting single or multiple teeth under general anaesthesia or sedation, are treated in secondary care hospitals.[9] In 2021–2022, 63% tooth extractions in 0- to 19-year-olds attending hospitals were due to dental caries.[10] This is challenging for parents and children and costly to the NHS. Strikingly, caries-related tooth extraction rate was 3.5 times higher in children living in most deprived areas than those living in affluent neighbourhoods.[10] The COVID-19 pandemic has further increased these inequalities with access to dentists markedly reduced.[11] The geographical inequalities in the disease prevalence, and uptake of care highlight the importance of understanding contextual determinants of dental caries in children.

Research indicates that the geographical inequalities in child dental health are associated with the differences in their immediate social environments, as measured by the levels of deprivation in children's area of residence,[12,13] and related to socioenvironmental factors including, physical, social, cultural, financial and political factors,[14] influencing behaviours and outcomes related to their dental health.[15] However, these factors that constitute children's immediate social environments remain underexplored, and there remains a dearth of evidence about their exact contribution to child dental health outcomes and subsequent inequalities.

Free sugar intake is a key contributor to the occurrence of dental caries.[16] However, evidence suggests that individuals from poor socioeconomic backgrounds consume higher amounts of sugar than individuals from higher socioeconomic backgrounds, indicating a plausible role of contextual factors in how people consume sugar.[17,18] Studies suggest that the socioenvironmental factors in different environmental settings including, neighbourhood (e.g. sugar-selling retail outlets, neighbourhood deprivation and urbanization),[19–21] school (e.g. quality of education, staff support and school management),[22] and family (e.g. parents' socioeconomic conditions, education and support),[20,23] where children reside, educate and spend most of their time, significantly influence their sugar intake thereby affecting their dental health. However, the influence of varying distributions of such socioenvironmental factors of sugar promotion across different areas in England is poorly understood. The link between contextual inequalities in sugar promotion, as a collective effect of the socioenvironmental factors of sugar promotion, and geographical inequalities in dental health of children, particularly in the prevalence of dental caries, remains unexplored and unquantified.

This study aimed to investigate the relationship between socioenvironmental sugar promotion and geographical inequalities in the prevalence of dental caries amongst 5-year-olds living across small areas within England.

2 | METHODS

This study involved secondary analyses of ecological data,[24] acquired from two key sources: a national survey on child dental health,[6] and a multidimensional index,[25] developed using 10 national data sources including, Ordnance survey- Points of Interest (September 2020), Indices of Multiple Deprivation (2019), Office for National Statistics population estimates (mid-2019), Office for Standards in Education, Children's Services and Skills (Ofsted)- School Inspections

(October 2020), Department for Education- School, Pupils and their Characteristics (2019–2020), Department for Work and Pensions data on children living in low income and universal credit receipts (2019–2020), Children's Dental Health Survey (2013), Census (2011) and Census boundary data (2011).

2.1 | National Dental Epidemiology Programme (NDEP)- Oral Health Survey of 5-year-olds in England 2018–2019

This was the fifth national survey of the NDEP of the previous Public Health England (PHE) undertaken in 2018–2019.[6] PHE coordinated this survey across England through collaboration with the British Association for the Study of Community Dentistry (BASCD) for training and calibrating the examiners to ensure robust survey methodology.[26] As part of this survey, local authorities (LAs),[27] commissioned local dental providers to collect clinical information on dental caries prevalence in 5-year-olds attending state-funded schools. The survey data,[6] were published in 2020 at the LA-level, which are small geographical areas designed for the administrative purposes in England (Appendix S1; Figure 1). In this study, the lower-tier and single-tier LA-level (hereafter, lower-tier LA-level) data were considered.[28] A total of 272 of 317 lower-tier LAs across England participated in the NDEP survey.

2.2 | Measures of experience of dental caries

The NDEP 2018–2019 data contained two key variables for use in this study: 1. the percentage of 5-year-old children with tooth decay in lower-tier LAs, and 2. the percentage of children with untreated tooth decay in lower-tier LAs.[6] Table 1 provides a detailed description of these variables.

2.3 | A multidimensional Index of Sugar-Promoting Environments Affecting Child Dental Health (ISPE-ACDH)

This newly developed index measures area-level sugar promotion by quantifying varying distributions of the socioenvironmental factors of sugar consumption in children living across small geographical areas in England.[25] The index was developed at Middle-layer Super Output Areas (MSOAs) level,[29] census-based areas in England (Appendix S2; Figure 2), and further aggregated to population-weighted LA-level scores for this study,[30] since the MSOA-level data on dental outcomes were not publicly available for entire England. This index quantifies the distribution of 16 sugar-related socioenvironmental factors, relevant to 5- to 11-year-olds, across three dimensions or domains including, neighbourhood, school and family environment (Figure 1), identified via two structured reviews of systematic reviews and primary research concerning childhood obesity and dental caries.[25] It comprises 30 indicators categorized into 10 sub-domains and 3 domains (Figure 2).[25]

Appendix S3 Table 1 details datasets and mathematical formulae utilized for calculating indicators. The index was developed through adaptation and a combination of multidisciplinary methods used in the development of three multidimensional indices in the UK.[30–32] The methodology was further informed by a technical framework by Nardo et al,[33] and a conceptual framework by Allik and colleagues.[34] Details about index validation are described in Appendix S4 and published in the first author's PhD thesis.[25]

TABLE 1 Description of the variables on dental outcomes available within the National Dental Epidemiology Programme (NDEP)- oral health survey 2019 data on 5-year-olds.[6]

Variable name	Description of the variable
The percentage of 5-year-old children with tooth decay in a lower-tier local authority	Percentage of 5-year-olds with experience of visually obvious tooth decay (also known as %d3mft) Tooth decay was defined as having one or more teeth that are obviously decayed (tooth decay extending to the dentine layer which can be detected by visual observation alone), missing due to tooth decay or filled (also known as d3mft). The percentage of those with tooth decay within a lower-tier local authority was calculated as follows: The percentage of 5-year-olds with tooth decay = [(Number of 5-year-olds in a given local authority with at least one tooth decayed, missing or filled)/(Number of 5-year-olds examined for a given local authority)] × 100
The percentage of children with untreated tooth decay in a lower-tier local authority	Percentage of 5-year-olds with experience of visually obvious but untreated tooth decay (also known as %d3t) Untreated tooth decay was defined as having one or more teeth that are obviously decayed to the level of dentine but are untreated (also known as d3t). The percentage of those with untreated tooth decay within a lower-tier local authority was calculated as follows: The percentage of 5-year-olds with untreated tooth decay = [(Number of 5-year-olds in a given local authority with at least one tooth decayed but untreated tooth)/(Number of 5-year-olds examined for a given local authority)] × 100

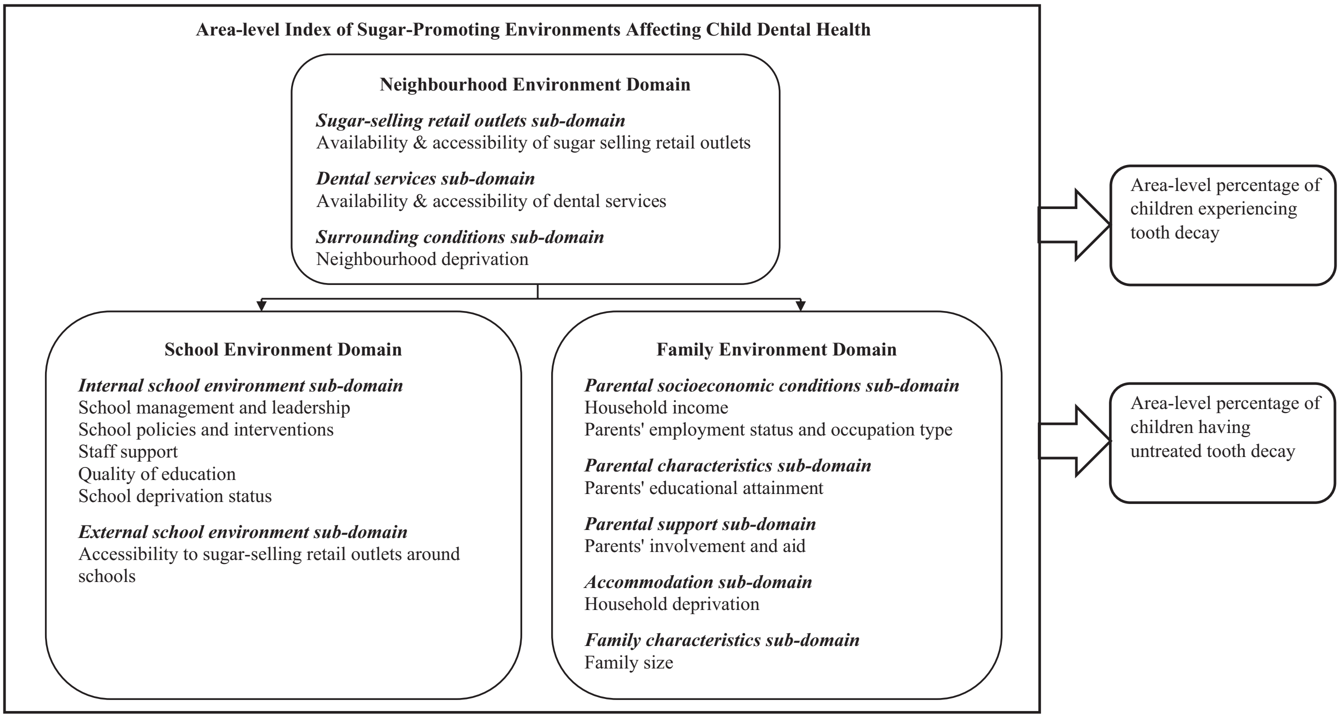

FIGURE 1 A simplified model of the area-level Index of Sugar-Promoting Environments Affecting Child Dental Health.

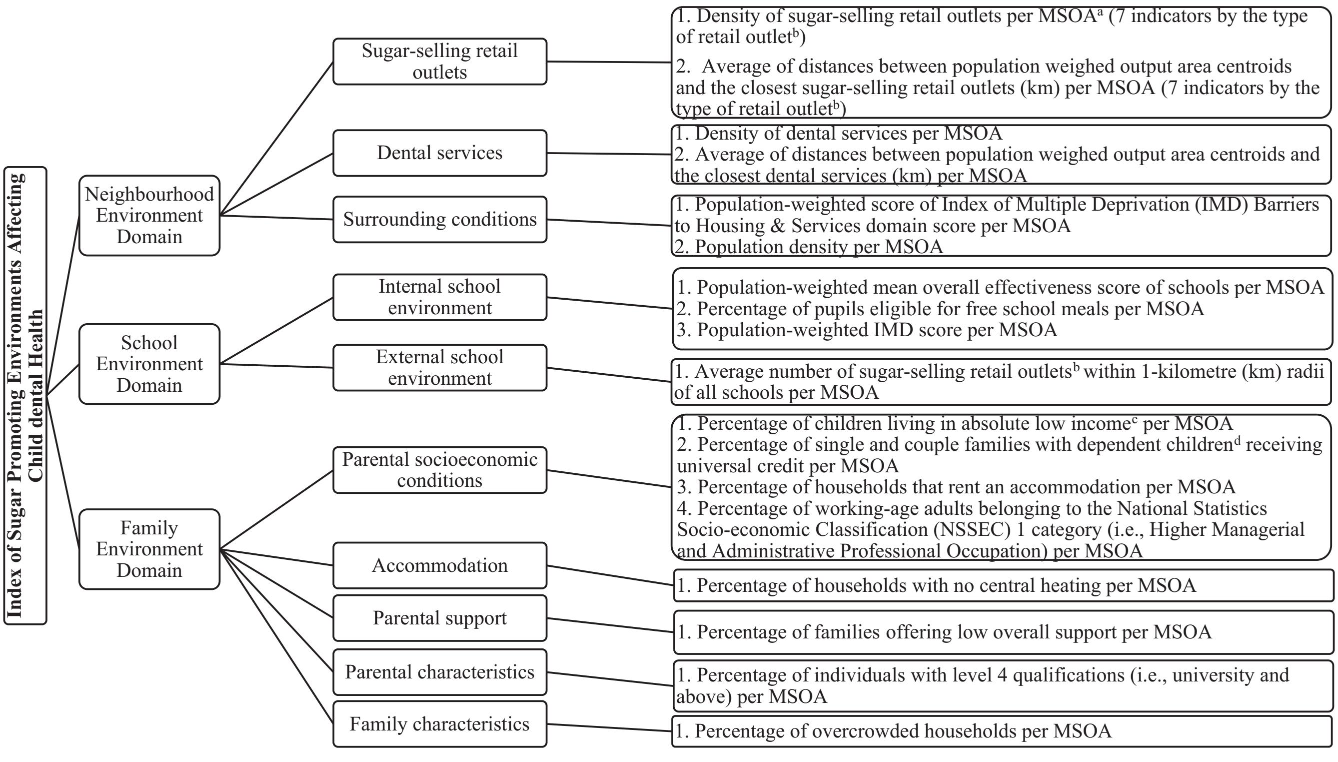

FIGURE 2 A simplified model of the Index of Sugar-Promoting Environments Affecting Child Dental Health illustrating component indicators, their sub-domains and domains. [a]MSOA = Middle-layer Super Output Areas (census-based areas with population range: 5000–15 000 people). [b]Types of sugar-selling retail outlets employed for developing indicators: (1) bakeries, (2) cafes, snack bars, and tea rooms, (3) confectioners, (4) convenience stores, (5) fast-food and takeaways, (6) restaurants, (7) supermarkets. [c]The Department for Work and Pensions (DWP) defines 'absolute low income' as equivalised income (i.e. adjusted for the household size and composition of the family), being lower than 60% of the median income of 2010/11 adjusted for inflation. This is calculated using The Households Below Average Income (HBAI) survey 2019–2020 data informing income of families with dependent children and mid-year population estimates of 2019 from the Office for National Statistics (ONS). [d]The DWP defines 'dependent children' as individuals who are under 16 years of age, or between 16 and 19 years living with parent/s, in full-time education, or unwaged government training, but are not married, in civil partnerships, or living with their partners.

2.4 | Measures of area-level sugar promotion

The index provides standardized scores (mean: 0.0, SD: 1.0) for the cumulative index (range: −2.1 to −2.5), and component domains that is, neighbourhood (range: −1.6 to −3.6), school (range: −2.3 to −2.2) and family (range: −2.2 to −2.5), measuring relative-level of sugar promotion with the highest scores representing highest levels of sugar promotion in lower-tier LAs ($N=317$) in England.[25]

2.5 | Data processing and analyses

Standardized scores of the index and domains were linked to the NDEP 2019 data via lower-tier LAs. The data were cleaned, and 45 of 317 LAs with missing values for the variables on child dental outcomes were omitted from further analyses. Then, data were analysed descriptively to examine the mean, standard deviation (SD), and range of each independent variable (index scores, and domains' scores), and each dependent variable (the lower-tier LA-level percentage of 5-year-olds with tooth decay and with untreated tooth decay). Both dependent variables contained numerical continuous data. Consequently, linear regression analyses were undertaken where unadjusted models were built to separately examine the influence of scores of the index and its individual domains on the percentage of children with tooth decay and with untreated tooth decay.[35] Lastly, two separate linear regression models, adjusted for neighbourhood-, school- and family-environment domains, were built for each dependent variable that is, the percentage of children with tooth decay and with untreated tooth decay.[35] The index score was not included in these models. The index is a cumulative measure of above-mentioned domains and is therefore highly correlated with the domain scores. Any model including the index score alongside the individual domain scores would suffer from multicollinearity, leading to less precise estimates and biased standard errors. All analyses were undertaken using SPPS 26.0.

Since the study involved secondary analyses of pre-existing data with no individual-level identifiers, the university or external ethics committee approval was not required (ETHICS-10161), as evaluated using the University of Portsmouth Ethics Screening Tool. The study adhered to STROBE (https://www.strobe-statement.org/) guidelines.

3 | RESULTS

Table 2 presents the results of the descriptive analysis of the key variables of interest. The survey participants lived across 272 of 317 lower-tier LAs in England. The mean index score was 0.1 (SD: 1.01). The mean scores for neighbourhood, school, and family environment domains were 0.02 (SD: 1.03), 0.1 (SD: 1.0) and 0.1 (SD: 0.9), respectively. This indicated that the subsample of 272 LAs had slightly higher average index and domain scores than the national averages for 317 LAs but did not differ largely. The mean index and domain scores of 45 LAs, for which dental data were unavailable, were 0.0 (SD: 1.0), indicating that the average level of sugar promotion in these LAs did not differ from the national average. The average percentage of children with tooth decay and untreated dental decay was 22.5 (SD: 8.5) and 19.6 (SD: 8.3), respectively.

Table 3 presents the results of the unadjusted linear regression models for the lower-tier LA-level percentage of 5-year-olds with tooth decay and untreated tooth decay. Additionally, it presents two models, adjusted exclusively for domains of the index, examining the influence of each domain on each area-level measure of experience of dental caries in 5-year-olds.

Models 1, 2, 3 and 4 were unadjusted models which revealed that the index and individual domains were significantly and positively associated with the LA-level percentage of 5-year-olds with tooth decay ($p<.001$). Model 1 indicated that the index explained 35% of the variance, and the percentage of children with tooth decay in the lower-tier LAs significantly increased by 5% with each unit increase in the index score (β: 5.04 [95% CI: 4.23–5.86]). Models 2, 3 and 4 indicated that a unit increase in the scores of neighbourhood, school, and family environment domains was associated with 3.71 (95% CI: 2.79–4.62), 4.78 (95% CI: 3.93–5.62) and 5.24 (95% CI: 4.44–6.04) rise in the percentage of children with tooth decay, respectively.

Model 5, adjusted for domains, predicted that 40% of the variance in the LA-level percentage of children with tooth decay was determined by the domains of the index. This model revealed that the neighbourhood ($p=.009$) and family environment ($p<.001$) domain scores were significantly and positively associated with the percentage of children with tooth decay; and predicted 1.37 (95% CI: 0.35–2.40) and 6.33 (95% CI: 4.14–8.52) increase in this percentage with

TABLE 2 Results of descriptive analysis of variables of interest.

Variables of interest ($n=272$)	Mean	SD	Range: Minimum	Range: Maximum	Total range (difference between max. and min.)
Index score	0.1	1.01	−2.1	2.4	4.5
Neighbourhood domain score	0.02	1.03	−1.6	3.6	5.2
School domain score	0.1	1.0	−2.3	2.2	4.5
Family domain score	0.1	0.9	−2.2	2.5	4.7
Proportion of 5-year-olds with tooth decay	22.5	8.5	1.1	50.9	49.8
Proportion of 5-year-olds with untreated tooth decay	19.6	8.3	1.1	47.7	46.6

TABLE 3 Results of the unadjusted and adjusted linear regression analyses.

Unadjusted linear regression for the lower-tier LA-level percentage of 5-year-olds with tooth decay

Model	Predictor variable	*r* square	Beta	95% Confidence Interval		*p*-Value
				Lower	Upper	
Model 1	Index	.35	5.04	4.23	5.86	<.001*
	Constant		22.54	21.73	23.36	<.001*
Model 2	Neighbourhood domain	.19	3.71	2.79	4.62	<.001*
	Constant		22.54	21.63	23.46	<.001*
Model 3	School domain	.32	4.78	3.93	5.62	<.001*
	Constant		22.54	21.70	23.38	<.001*
Model 4	Family domain	.38	5.24	4.44	6.04	<.001*
	Constant		22.54	21.74	23.34	<.001*

Unadjusted linear regression for the lower-tier LA-level percentage of 5-year-olds with untreated tooth decay

Model	Predictor variable	*r* square	Beta	95% confidence Interval		*p*-Value
				Lower	Upper	
Model 6	Index score	.32	4.72	3.90	5.53	<.001*
	Constant		19.60	18.78	20.42	<.001*
Model 7	Neighbourhood domain	.17	3.42	2.51	4.32	<.001*
	Constant		19.60	18.69	20.50	<.001*
Model 8	School domain	.29	4.45	3.62	5.29	<.001*
	Constant		19.60	18.76	20.44	<.001*
Model 9	Family domain	.36	4.97	4.17	5.76	<.001*
	Constant		19.60	18.80	20.39	<.001*

Multiple linear regression for the lower-tier LA-level percentage of 5-year-olds with tooth decay (adjusted for domains)

Model	Predictor variable	*r* square	Beta	95% Confidence Interval		*p*-Value
				Lower	Upper	
Model 5	Neighbourhood domain	.40	1.37	0.35	2.40	.009*
	School domain		−1.93	−4.27	0.41	.1
	Family domain		6.33	4.14	8.52	<.001*
	Constant		22.08	21.29	22.88	<.001*

Multiple linear regression for the lower-tier LA-level percentage of 5-year-olds with untreated tooth decay (adjusted for domains)

Model	Predictor variable	*r* square	Beta	95% Confidence Interval		*p*-Value
				Lower	Upper	
Model 10	Neighbourhood domain	.37	1.24	0.23	2.27	.017*
	School domain		−2.30	−4.63	0.03	.05
	Family domain		6.47	4.29	8.66	<.001*
	Constant		19.16	18.37	19.95	<.001*

*$p < 0.05$.

an increased unit of score, respectively. While school environment domain scores showed a negative association with the percentage of children with tooth decay, this was not a statistically significant association ($p = .1$).

Models 6, 7, 8, 9 were unadjusted models which highlighted that the index and individual domains were significantly and positively associated with the LA-level percentage of 5-year-olds with untreated tooth decay ($p < .001$). Model 6 demonstrated that the index explained 32% of the variance in the percentage of 5-year-olds with untreated tooth decay, and this percentage raised by 4.72 (95% CI: 3.90–5.53) with an increased score of the index. Models 7, 8 and 9 predicted the rise of 3.42 (95% CI: 2.51–4.32), 4.45 (95% CI: 3.62–5.29), and 4.97 (95% CI: 4.17–5.76) in the percentage of children with untreated tooth decay with an increased score of neighbourhood, school and family environment domains, respectively.

Model 10 showed that the domains explained 37% of the variance in the LA-level percentage of children with untreated tooth decay. In this model, neighbourhood ($p = .017$), and family environment ($p < .001$) domain scores were statistically significantly and positively associated with the percentage of children with untreated tooth decay. This model predicted that this percentage raised by 1.24 (95% CI: 0.23–2.27) and 6.47 (95% CI: 4.29–8.66) with an increased score of the neighbourhood, and family-environment domain, respectively. School environment domain, albeit being statistically insignificant ($p \geq .05$), showed a negative association with this above-mentioned percentage.

4 | DISCUSSION

This study indicated that the percentage of 5-year-old children with tooth decay was significantly greater in the areas with higher levels of sugar promotion. Further investigation revealed that an increase in the area-level sugar promotion remained positively associated with the percentage of children who did not receive treatment despite suffering from tooth decay in LAs. Together, these findings demonstrate a plausible contribution of area-level socioenvironmental sugar promotion to the burden of dental caries in 5-year-old children, and subsequent geographical inequalities in their dental health in England. Additionally, the findings suggest that a differing level of influence of sugar promotion depends on the type of environment (family, neighbourhood and school). It would appear that while the dental health of 5-year-olds as related to sugar promotion is impacted by both family and neighbourhood environments, the former has a greater impact on the percentage of children with tooth decay (4.9% difference) and with untreated tooth decay (5.2% difference).

This study has some weaknesses. First, the development of the index relied on the availability of suitable data to compute the indicators.[33] Most-recent datasets were utilized and Geographic Information System, small area synthetic estimation[36] and data aggregation techniques were employed where data were not readily available. The use of pre-existing data averted individual recall, and selection biases.[37] Second, the NDEP 2019 data,[6] did not offer information on individual-level socioeconomic conditions and oral health behaviours of children. This limited understanding of the causality of dental caries. Third, while the prevalence of dental caries in LAs may have changed by 2019–20 when data for some indicators of the index were collected, geographical patterns for dental outcomes and most indicators (e.g. availability of retail outlets and dental surgeries, area-level deprivation) remained similar. Nevertheless, data from different time-points employed for the index and dental outcomes may have influenced the findings. However, these datasets provided invaluable information on area-level sugar promotion that is not routinely and collectively available for England. Fourth, the comparing the relationship between sugar promotion and child dental outcomes at different geographical levels was not possible as NDEP data were unavailable for the geographies smaller than lower-tier LAs. Fifth, there is a potential for ecological fallacy,[38] whereby, some children living in high sugar-promoting areas may have exceptionally good dental health and vice versa. However, the index measured the average socio-environmental conditions affecting majority of the population within a particular area, which is more useful for policy-making. Sixth, the index did not fully capture the impact of commercial determinants including, targeted marketing, on area-level sugar promoton.[39] Seventh, since the study was limited to England, the generalizability of the study findings outside England needs testing. Nevertheless, this study demonstrates how geographical inequalities in child dental health could be associated with sugar promotion in children's immediate environments, and how a multidimensional index could help measure the same for evidence-based public health planning in a particular country.

The role of socioenvironmental sugar promotion, particularly within family and neighbourhood environments, in geographical inequalities in child dental health, is as anticipated as previous research has demonstrated the influence of poor socioeconomic conditions at the family-level, and higher deprivation at the neighbourhood-level on children's sugar consumption and tooth decay,[17–21,23] and could be explained through the pathways of health inequalities.[15] Children belonging to families with higher socioeconomic condition can live in less deprived areas with low population densities and purchase food from their neighbourhoods with more favourable retail conditions. These neighbourhoods and families may also benefit from higher social capital and political support,[15] facilitating increased opportunities to improve their oral health awareness, and maintain sugar consumption related behaviours.[17] Furthermore, the opportunity to access dental care may be greater due to the lower population-to-dentist ratios,[40] in their neighbourhoods, and their higher purchasing powers reducing dependence on limited availability of NHS dentists.[15] In contrast, children living in areas with higher levels of sugar promotion are more exposed to sugar-selling retail outlets, receive less social and political support,[15] as reflected in their awareness, and social and cultural norms related to sugar consumption. Low oral health awareness, reduced purchasing powers of their parents, and higher population-to-dentist ratios in their areas of residence,[40] mean that they are more likely to consume excessive sugars and less likely to regularly access dental care.[15,17] Consequently, they may experience higher levels of dental caries and unmet dental needs.[12]

While initial analyses predicted that sugar-promoting school environment significantly affected dental caries prevalence, this association was not statistically significant in the later analyses when effects of family, school, and neighbourhood environments were considered together. Since this was an ecological investigation, the change in direction of the association between school environment and dental caries, albeit statistically insignificant, could be indicative of the sensitivity of the relationships to the small changes in data. Furthermore, aggregating the index at a higher-geographical level (lower-tier LA-level) could have impacted the findings due to the modifiable area unit problem (MAUP),[41] where the spatial data yields different findings from analyses undertaken at different geographical levels. Another local investigation,[22] undertaken at the MSOA-level, demonstrated that poor school environment significantly increased the likelihood of tooth extractions in 5- to 11-year-olds, of which dental caries is a primary cause.[10] This helps acknowledge a possible impact of the modifiable areal unit problem on the current findings. Even so, the current study employed available data which helped understand the impact of the index on the burden of dental caries.

In summary, this research provides robust quantitative evidence on the significant influence of socioenvironmental sugar promotion in the area of residence of children, as measured by a newly developed multidimensional Index of Sugar-Promoting Environments Affecting Child Dental Health (ISPE-ACDH), on the experience of tooth decay and untreated tooth decay in 5-year-olds living across LAs in England. The generalizability of these findings in children living outside England needs testing. This study highlights that while the public health community and national government strive to promote dental health,[5,42] sugars are being promoted within immediate environments, particularly within neighbourhood and family environments, through multiple socioenvironmental channels, which potentially contribute to the geographical inequalities in children's experience of tooth decay and their unmet dental needs. Policymakers should consider targeted and locally relevant strategies for creating supportive neighbourhood, school, and family environments to tackle sugar promotion across small areas of England and address inequalities in child dental health.

5 | CONCLUSIONS

This study reveals that socioenvironmental sugar promotion, particularly within neighbourhood- and family-environments, may contribute to geographical inequalities in dental caries in children. Further research involving data on individual-level dental outcomes and confounders is required.

AUTHOR CONTRIBUTIONS

Suruchi G. Ganbavale: Contributed to conceptualisation and design of the study, acquired and curated data, performed all statistical analyses and interpreted the results, drafted and critically revised the manuscript. Chris Louca: Contributed to conceptualisation and design of the study, sought the funding, supervised the research and critically revised the manuscript. Liz Twigg: Contributed to conceptualisation and design of the study, statistical analyses and interpretation, supervised the research, and critically revised the manuscript. Kristina Wanyonyi: Contributed to conceptualisation and design of the study, statistical analyses and interpretation, supervised the research and critically revised the manuscript. All authors read and approved the manuscript and agree to the submission of the manuscript to the journal.

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CONFLICT OF INTEREST STATEMENT

We declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Data used for the purposes of this study are open-access datasets and their references are provided in the manuscript.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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