KENT PUBLIC HEALTH OBSERVATORY

National Child Measurement Programme: Further Analysis of the Drivers of Excess Weight

February 2017

Produced by

Val Miller: Public Health Specialist (Val.Miller@Kent.gov.uk)
Wendy Jeffreys: Public Health Specialist (Wendy.Jeffreys@Kent.gov.uk)
Rachel Kennard: Senior Intelligence Analyst (Rachel.Kennard@kent.gov.uk)
Zara Cuccu: Public Health Analyst (Zara.Cuccu@Kent.gov.uk)
Correspondence to: Zara Cuccu

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1. Executive Summary

1.1 Key Findings

1.1.1 Excess weight, deprivation & ethnicity

- The prevalence of excess weight (the combined overweight & obesity indicator) was 22.5% for reception year (4-5 years) and 32.8% for year six (10-11 years) pupils across Kent in 2014/15.
- Excess weight prevalence is higher in children resident within areas of deprivation. There has been a widening gap in obesity prevalence between the most and the least deprived groups across Kent during 2008/09 to 2014/15.
- There were higher odds of excess weight in Black reception and year six pupils even after accounting for deprivation, meaning that deprivation does not fully explain these differences.
- The geographical variation in the relationship between excess weight and Black ethnicity has been mapped. Areas with high Black ethnic group concentrations and higher excess weight prevalence have also been highlighted.

1.1.2 The impact of the living environment

- There were independently higher odds of excess weight within both reception and year six pupils resident in areas closer to a food outlet (within 1200m), as well as, those resident within areas with lower access to supermarkets. However, after adjustment the association did not remain significant, suggesting that area deprivation and the urban/ rural environment explain some this association.
- There were independently lower odds of excess weight within both reception and year six pupils resident in areas with lower access to greenspace, as well as, those resident within areas with longer distances to nearest sports facility. However, after adjustment the association did not remain significant.
    - The greenspace findings replicate a National study, mediating influences could include; greenspace acceptability, crime and walkability of local environment.
- Maps have been produced to describe the living environment in areas with high excess weight.

2. Introduction

Childhood obesity is a key public health priority; the Government aims to reduce England's rate of childhood obesity within the next ten years.[1]

The National Child Measurement programme shows that the prevalence of excess weight (the combined overweight & obesity indicator) was 22.5% for reception year (4-5 years) and 32.8% for year six (10-11 years) pupils across Kent in 2014/15. Locally, there is also evidence for a widening gap in obesity prevalence between the most and the least deprived groups across Kent during 2008/09 to 2014/15. Further analysis by ethnicity identifies higher odds of excess weight in some groups even after accounting for deprivation, suggesting that deprivation does not fully explain these differences.

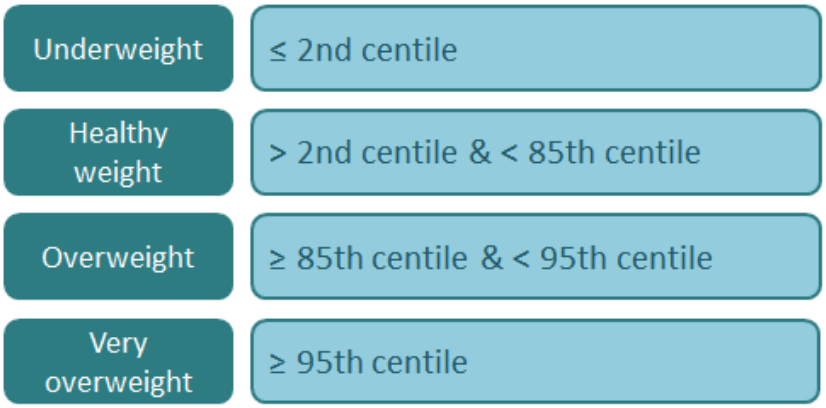
The complex and multifaceted determinants of obesity can be recognised.[2] This report has focused on the determinants of obesity that are measureable and amenable to leverage from public health intervention. Relevant indicators have been selected that are grounded within the evidence base with a possible mode of influence. The findings from these analyses do not prove any causal association due to the observational approach, but may guide understanding of some of the possible determinants of obesity within the local context. The findings from this analysis will enable locality mapping of the main assets and vulnerabilities to describe local areas.

[1] HM Government (2016) Childhood obesity: a plan for action http://bit.ly/2bpeBTp
[2] Government Office for Science (2007) Foresight. Tackling obesities: future choices – project report. http://bit.ly/1RMduJC

3. Excess Weight in Kent

The National Child Measurement Programme annually measures the height and weight of children in reception year (4-5 years) and year six (10-11 years) in state maintained schools. The measurement process is overseen by trained healthcare professionals and used to calculate body mass index (BMI). The following BMI centiles of the British 1990 growth reference are recommended for use to categorise child measurements for population monitoring:

Figure 1: Population BMI centiles.



The following analyses of local childhood weight data have been produced:

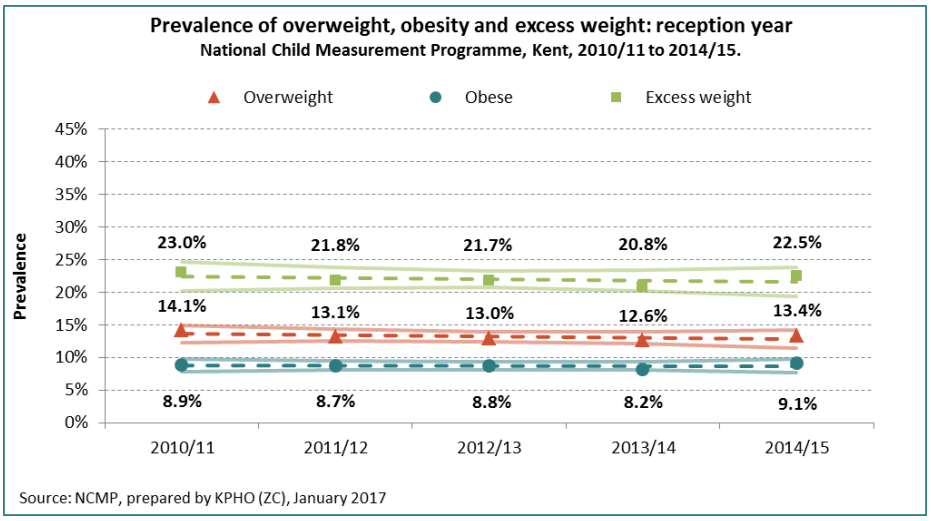
- Local authority level trend analysis of data up to 2015/16, with comparisons to Kent, the South East and England.
- Kent analysis of the inequalities in childhood obesity.

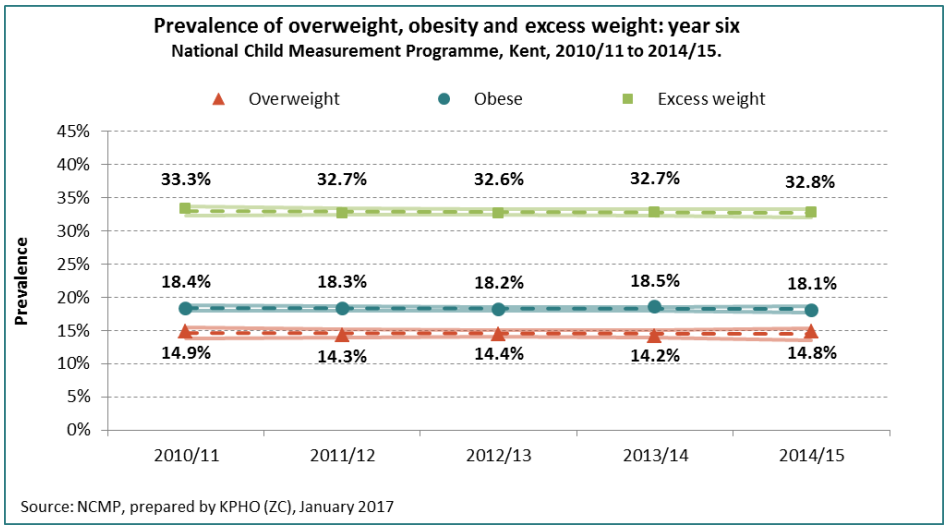
Overall, the prevalence of overweight, obesity and excess weight has remained stable for reception and year six across Kent between 2010/11 and 2014/15. The prevalence of excess weight is higher in children resident within the most deprived areas of Kent. There is also evidence for a widening gap in obesity prevalence between the most and the least deprived groups over time for this period. Further analysis by ethnicity identifies higher odds of excess weight in Black reception and year six pupils even after accounting for deprivation.

3.1 Trend analysis

The following charts show that the prevalence of overweight, obesity and excess weight for reception and year six between 2010/11 and 2014/15 for Kent.

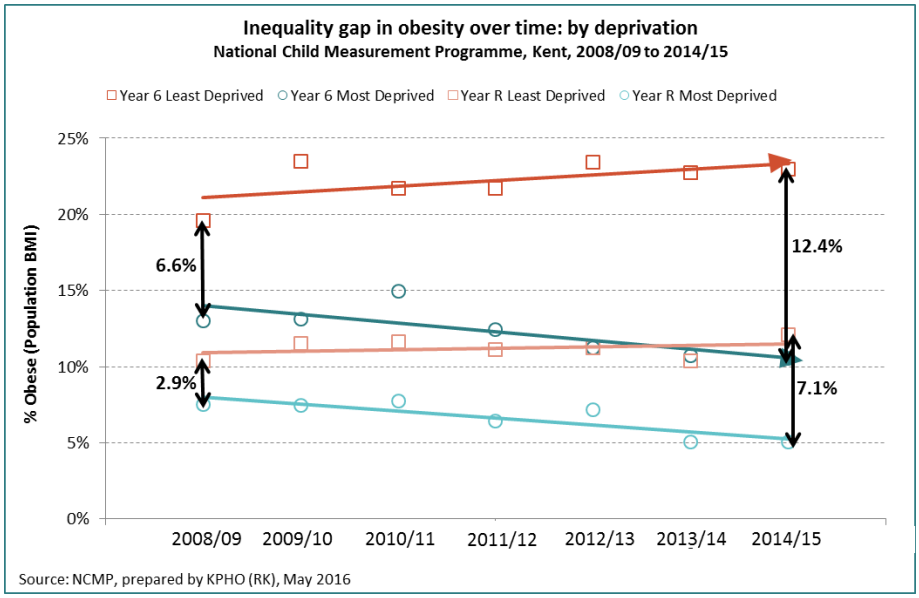
- The trend in overweight, obesity and excess weight has been stable between 2010/11 and 2014/15 for Kent.
- The prevalence of excess weight (combined overweight & obesity indicator) was 22.5% for reception year and 32.8% of year six pupils across Kent in 2014/15.





The prevalence of excess weight is higher in children resident within the most deprived areas of Kent. The chart below details the 'inequality gap' or the difference between obesity prevalence within the most and least deprived between 2008/09 and 2014/15 for Kent.

- For both reception and year six pupils there was evidence for a widening gap in obesity prevalence over time for Kent.
- The year six prevalence of obesity was 23.0% within the most deprived in comparison to 10.5% within the least deprived across Kent in 2014/15.



3.2 Deprivation & Ethnicity

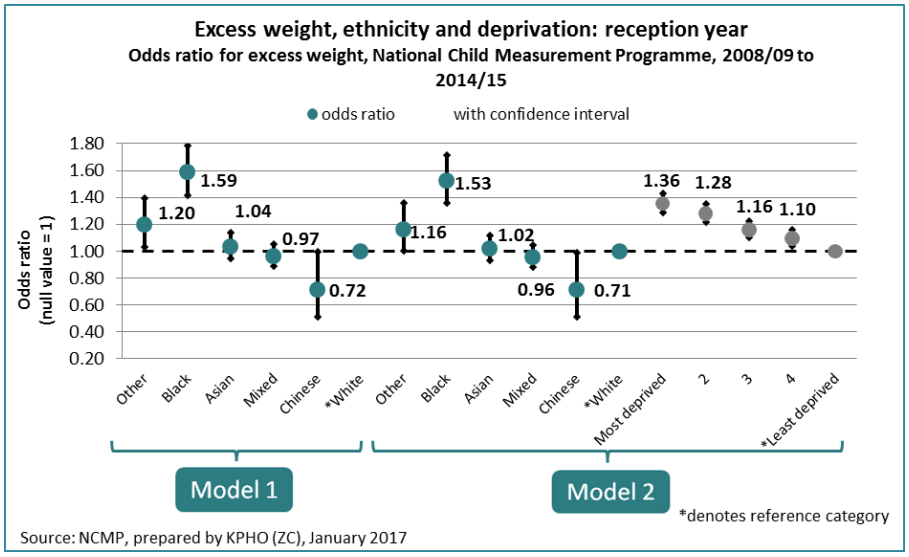
Logistic regression (see Appendix A for notes on methodology) was used to explore the effect ethnicity and deprivation have on the odds for excess weight for Kent as a whole. This was performed for reception and year six separately and used two models:

Model 1	univariate ethnic group
Model 2	ethnic group, adjusted for deprivation

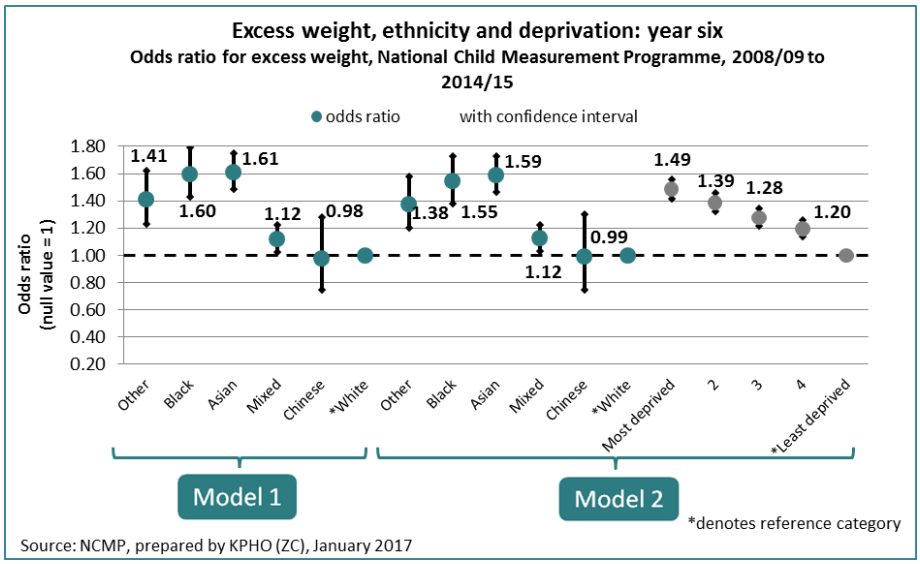
The following charts detail the findings for excess weight, ethnicity and deprivation using a combined data file for 2008/09 to 2014/15[3].

[3] Note analysis based on data for pupils that are resident in Kent and attending Kent schools. Also, based on data for pupils with complete variable coding for population BMI and ethnic group.

In reception year, there were higher odds for excess weight within Other and Black pupils. This remained after adjustment for deprivation within the Black group.

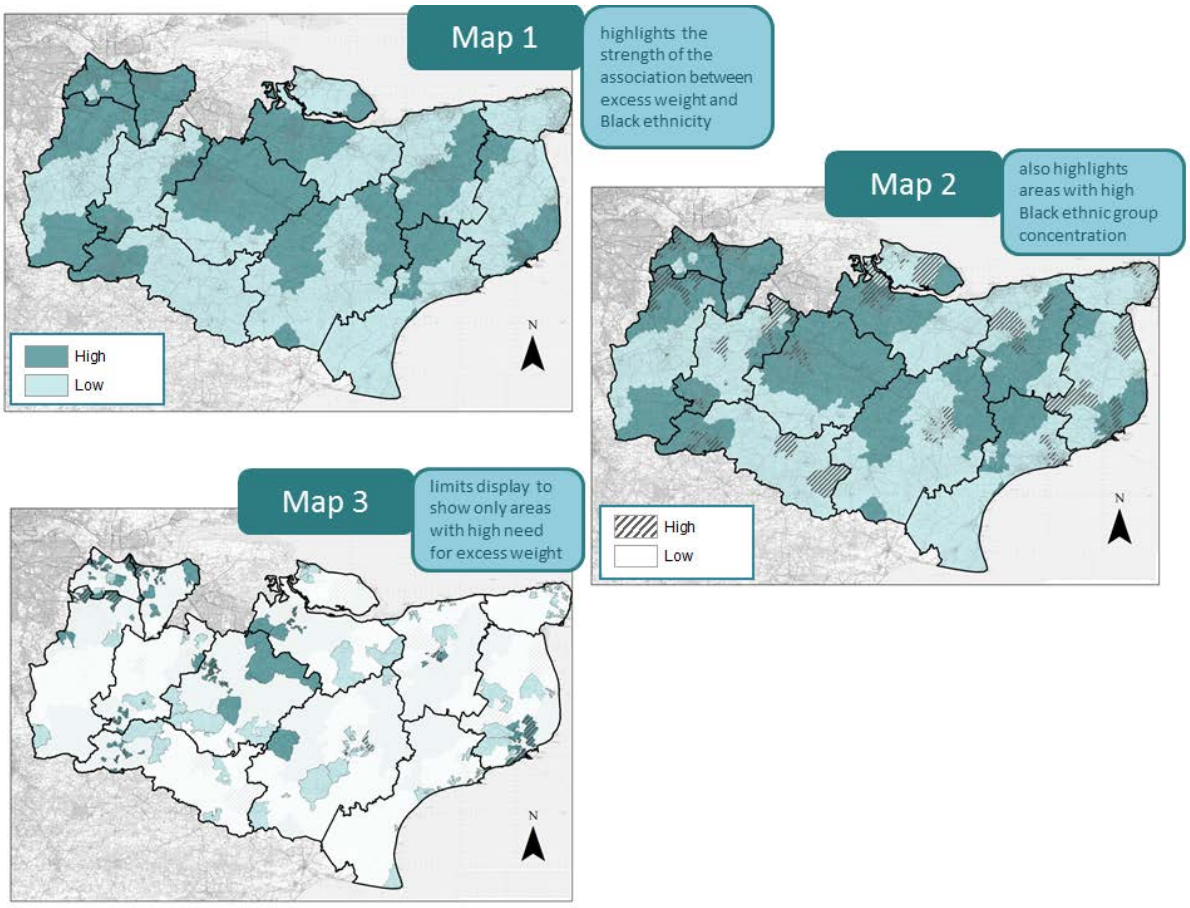


In year six, there were higher odds for excess weight within the Other, Black and Asian and Mixed pupils. This remained after adjustment for deprivation within the Other, Black and Asian groups.



Geographically weighted regression (see Appendix A for notes on methodology) was used to explore the spatial variation in the strength of the relationship between excess weight and Black ethnicity across Kent. This has been mapped, also areas with high Black ethnic group concentration have been highlighted and display limited to show areas with high need for excess weight[4]. This was performed for reception and year six separately.

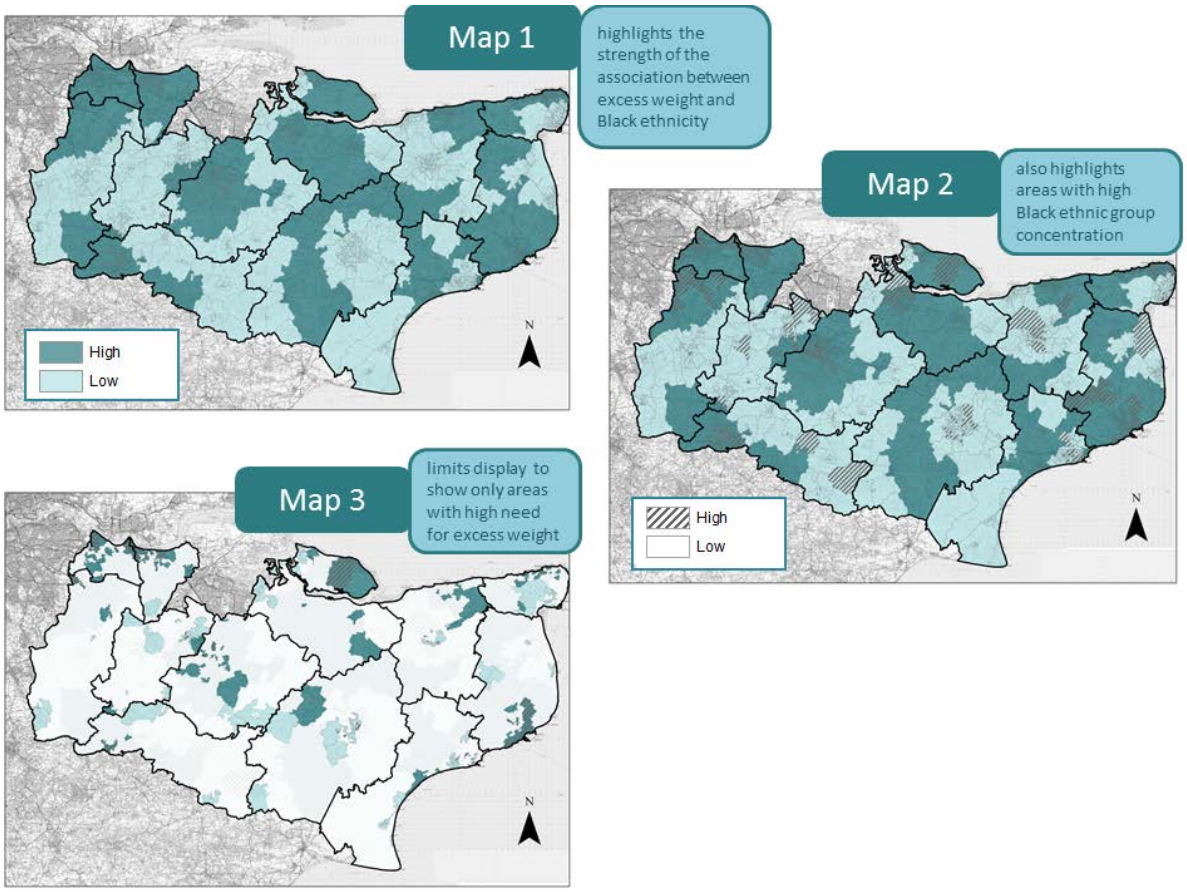
Reception year



Source: NCMP & ONS, produced by KPHO (ZC) January 2017

[4] i.e high levels of excess weight

Year six



Source: NCMP & ONS, produced by KPHO (ZC) January 2017

- The analysis highlights areas with high levels excess weight in North Kent and the South Kent Coast where Black ethnicity is strongly associated with excess weight. Areas can also be identified as having high concentrations of Black ethnic groups.
- The influence of ethnic group concentration on excess weight is unknown. But there is wider research that suggests a protective influence from social inclusion within a majority community.[5]

[5] Pickett K.E. & Wilkinson R.G. (2008) People like us: ethnic group density effects on health. Ethnicity & Health, 13:4, 321-334

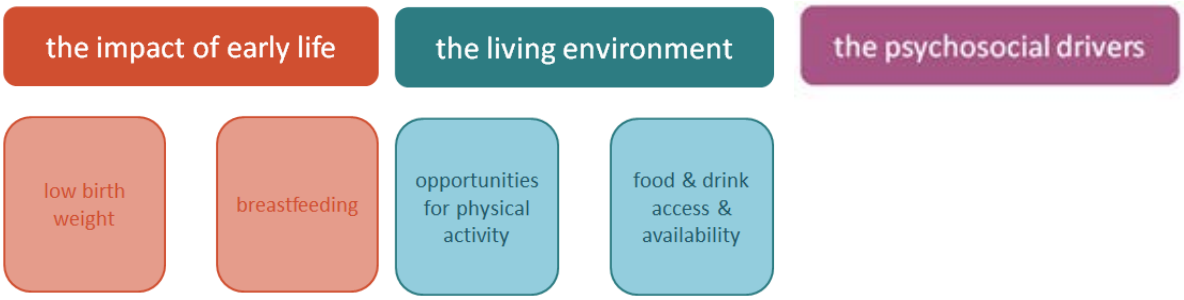
4. The Impact of the Living Environment - Approach

4.1 Framework

An obesity systems map within *'Tackling Obesities: Future Choices'* outlined the complex multifaceted system of determinants of obesity.[6] This included the following themes; physiology, individual activity, physical activity environment, food consumption, food production, individual psychology and social psychology.

Figure 2 shows the key determinants of overweight and obesity, including; the impact of early life, the living environment, as well as, psychosocial drivers.

Figure 2: The determinants of overweight and obesity and sub-domains



This report will focus on the determinants that are measureable and amenable to leverage from public health intervention. Relevant indicators have been selected that are grounded within the evidence base with a possible mode of influence.

[6] Government Office for Science (2007) Foresight. Tackling obesities: future choices – project report. http://bit.ly/1RMduJC

- Early life has a known impact on the risk of overweight and obesity in later life; with increased risk from low birthweight and high infant catch up growth,[7] as well as, the protective effect from breastfeeding. [8]
    - However, it is not possible to link the National Child Measurement Programme data to individual level indicators for birth weight or breastfeeding. Further, a proxy area-level indicator would be limited, as this relies on residence within the same lower super output area at time of birth, during early years and at National Child Measurement Programme measurement.

- Psychosocial influences have been identified within the determinants of obesity,[5] but the relationships between self-perception of weight, stigmatisation and mental health disorders are complex.[9]
    - The Kent Mental Health & Wellbeing Index has been constructed at a ward level using 70 measures of individual, household and area aspects of wellbeing, but is not specific for assessment of child wellbeing. Future, development of a Child & Young Persons Kent Mental Health & Wellbeing Index could be explored in relation to this.

Therefore, this report will focus on indicators that describe the living environment; opportunities for physical activity, as well as, food and drink access and availability. The findings from this analysis will enable locality mapping of the main assets and vulnerabilities to describe local areas.

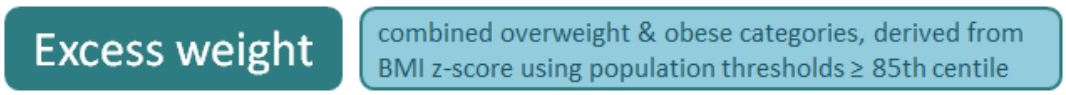
[7] Monsasta L. et al. (2010) Early-life determinants of overweight and obesity: a review of reviews. Obesity Reviews, 11(10)695-708
[8] Jefferis B J et al. (2002) Birth weight, childhood socioeconomic environment, and cognitive development in the 1958 British birth cohort study. BMJ 325:305.
[9] National Obesity Observatory (2011) Obesity and mental health. http://bit.ly/1NbHFrh

4.2 Analytical approach

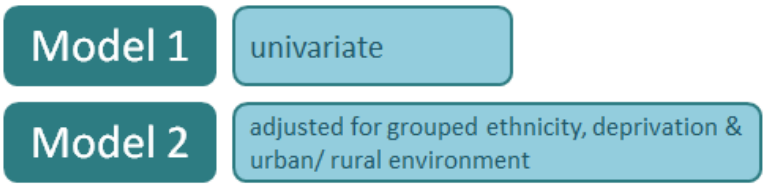
The dataset combined the National Child Measurement Programme annual measurements for the height and weight of children in reception (4-5 years) and year six (10-11 years) for the period 2008/09-2014/15.

The following criteria were applied to restrict the dataset; pupils were included if they were resident in Kent and attending Kent schools. But excluded those attending special schools, as well as, those with incomplete variable coding. It should be noted that within the original data file; 1.4% did not have a population BMI record and 15.2% did not have a stated ethnicity.[10]

The outcome variable of interest was:



Logistic regression was used to explore the effect of each variable on the odds for excess weight for Kent as a whole. This was performed for reception and year six separately and used two models:



The adjusted model can be justified from national research which found significant associations between child obesity and ethnicity, deprivation and urban/ rural environment.[11] Odds ratios with confidence intervals have been presented for excess weight. The reference category was healthy weight & underweight.

*The findings from these analyses **do not prove any causal association** due to the observational approach **but may guide understanding** of some of the possible determinants of obesity within the **local context**.*

[10] This is based on an original data file with 237,858 measurements with 3,327 records without a population BMI record and 31,398 records whereby ethnicity was not stated.
[11] National Obesity Observatory (2007) Health inequalities and childhood obesity: are ethnicity and the urban environment determinants of obesity or is deprivation a confounding factor for both?

5. The Impact of the Living Environment - Findings

5.1 Food outlets

What does the evidence say?

There is a known association between density of fast food outlets and area deprivation.[12] The evidence is unclear whether there is a link between food outlets, food choice and excess weight. A systematic review has explored the influence from food outlets around schools and does acknowledge the importance of the home residential environment.[13]

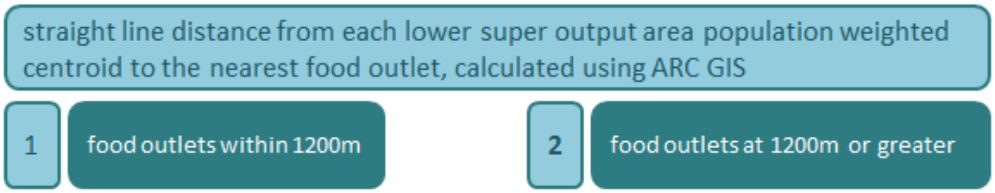
But there is variation in the body of research in terms of the:

- Data sources used to identify food outlets; local authority, business directories and commercial datasets.
- Types of indicator construction, include; count within middle super output area,[14] straight line distance from postcode of residence to nearest outlet[15] and density within varying sized buffers.[16]

Data source

The Ordnance Survey AddressBase dataset was used to extract commercial units classified as 'fast food outlet' or 'restaurant'. For validation, the number extracted was compared with the Yellow Pages online reported figure for Kent.

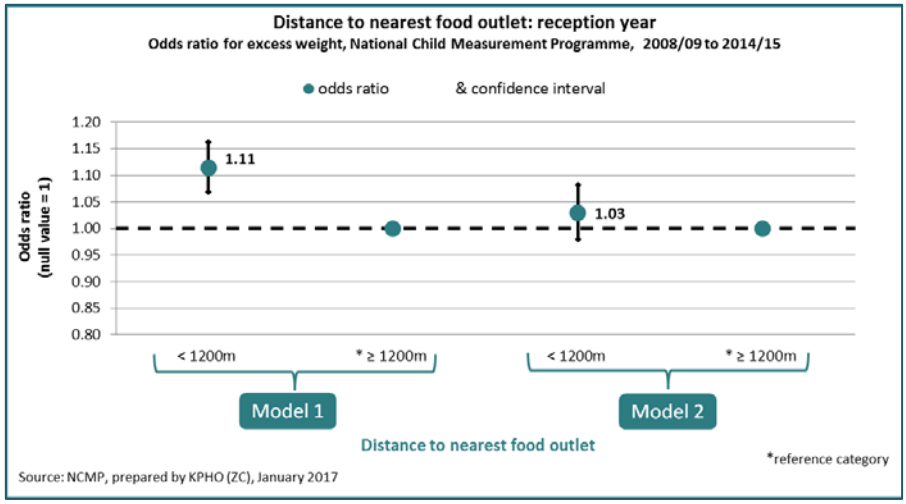
Indicator

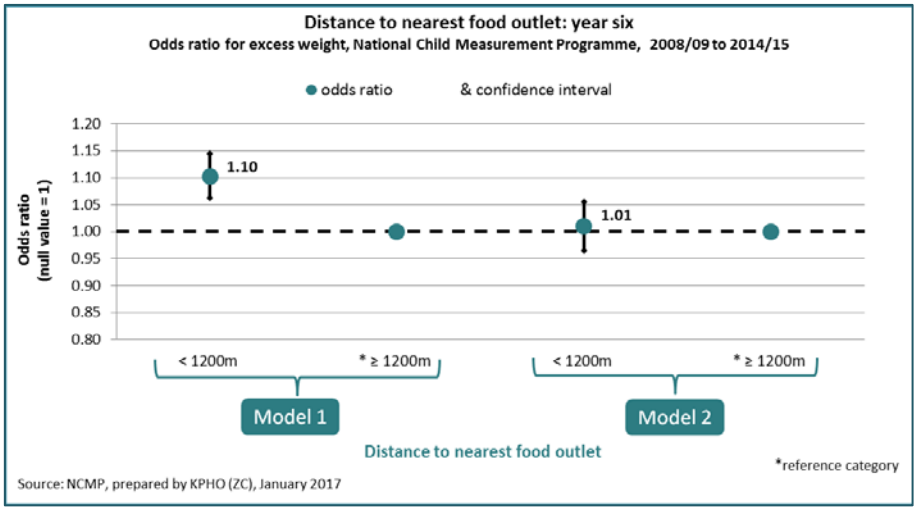


[12] National Obesity Observatory (2016) Obesity and the environment: density of fast food outlets. http://bit.ly/2k8JZsJ
[13] Williams, J., et al. (2014) A systematic review of the influence of the retail food environment around schools on obesity-related outcomes. *Obesity reviews,* 15, 359-374
[14] Cetateanu, A. & Jones, A. (2014) Understanding the relationship between food environments, deprivation and childhood overweight and obesity: evidence from a cross sectional England-wide study. *Health & Place,* 27, 68–76
[15] Fraser, L.K. et al. (2010) The association between the geography of fast food outlets and childhood obesity rates in Leeds, UK. *Health & Place,* 16, 1124 –1128 **and**
Griffiths et al. (2014) A cross sectional study investigating the association between exposure to food outlets and childhood obesity in Leeds, UK. *International Journal of Behavioral Nutrition and Physical Activity,* 11:138
[16] Williams et al. (2015) Associations between food outlets around schools and BMI among primary students in England: a cross-classified multi-level analysis. *PLoS ONE* 10(7): e0132930.

Findings

Overall, there were higher odds of excess weight within both reception and year six pupils resident in areas with a nearest food outlet within 1200m in Model 1. However, in Model 2 after adjustment for ethnicity[17], deprivation and urban/ rural environment the association did not remain significant.





[17] Grouped into categories known to have higher/ lower odds of excess weight.

5.2 Access to supermarkets

What does the evidence say?

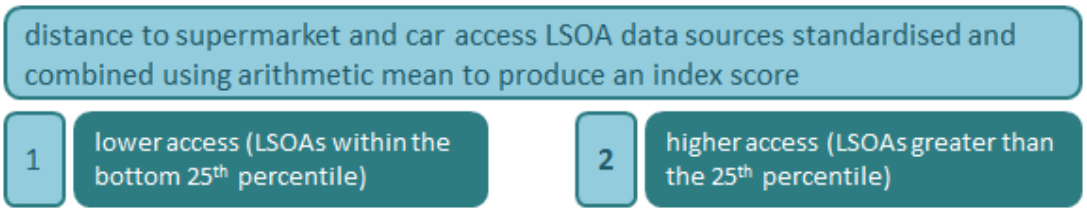
The relationship between access to supermarkets, food choice and excess weight is unclear. There has been a commonly accepted belief that residents within poor urban areas cannot buy affordable healthy food.[18] However, research has been unable to evidence this across the UK, due to few studies that are often small and localised.[19] The factors that guide food choice are likely to be complex, but there may be some influence of from; distance to good quality food retailing, alongside, car availability or use of public transport.

Data source

The Ordnance Survey AddressBase dataset was used to extract commercial units classified as 'shop'. The extract was restricted by name to key chains of large scale and smaller convenience scores,[20] not including corner shops. The number extracted was compared with the Yellow Pages online reported figure for Kent.

- The straight line distance from each lower super output area population weighted centroid to the nearest supermarket was calculated using ARC GIS.
- Also, the percentage of LSOA households with no car access for families with dependent children or lone parents was extracted from the 2011 Census.

Indicator



See note [21]

[18] Cummins S. & Macintyre S. (2002) Food deserts – evidence and assumption in health policy making. *British Medical Journal*, 325, 436-8

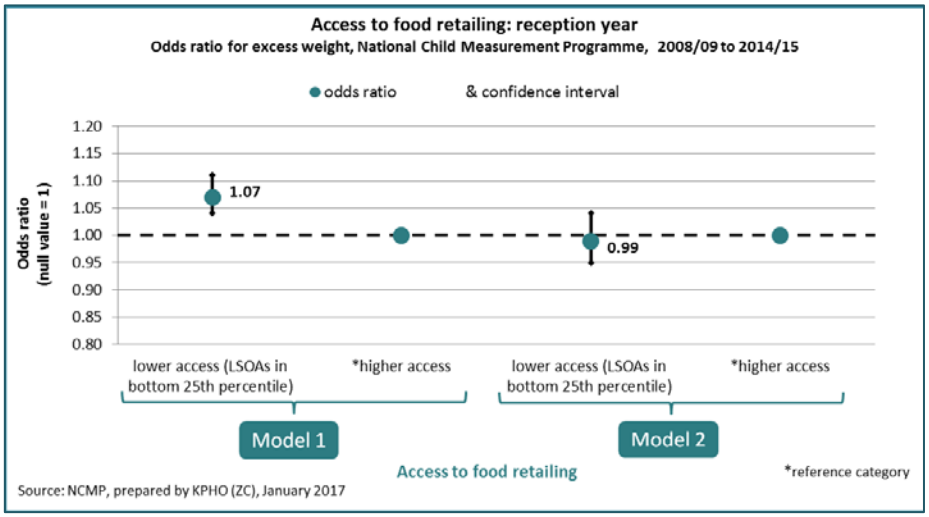
[19] Cummins S. & Macintyre S. (2006) Food environments and obesity – neighbourhood or nation? *International Journal of Epidemiology*, 35, 100-104 **and**
Mills S. & Wright T. (2015) Access to food retail outlets in County Durham, UK: a pragmatic cross-sectional study. *The Lancet*, Poster 42 **and**
Hackett A. et al. (2008) Mapping dietary habits may provide clues about the factors that determine food choice. *Journal of Human Nutrition & Dietetics*, 21, 428-437

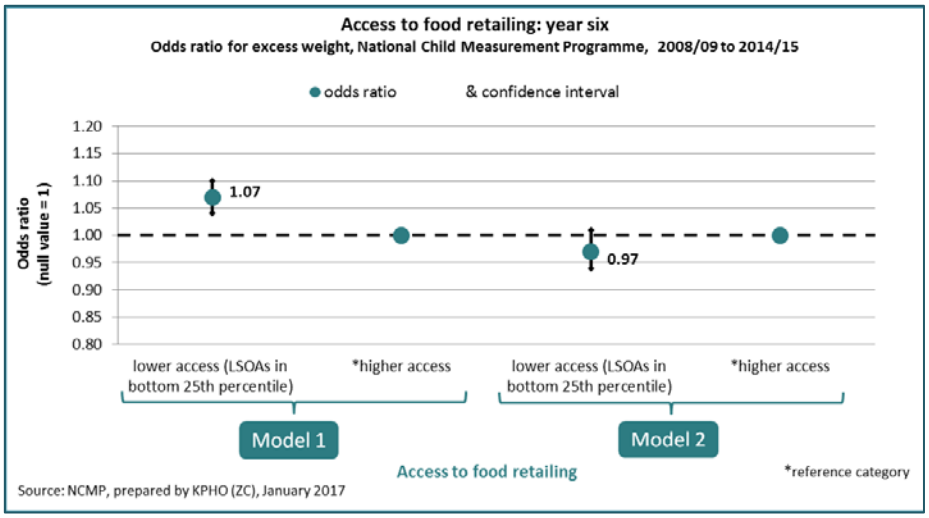
[20] Aldi, Lidl, Tesco, Asda, Iceland, Sainsbury, Farmfoods, Co-op, Waitrose, Marks & Spencer, Morrisons

[21] In the absence of an established meaningful definition for categorisation, an optimal threshold for statistical significance was used.

Findings

Overall, there were higher odds of excess weight within both reception and year six pupils resident in areas with lower access to supermarkets index scores in Model 1. However, in Model 2 after adjustment for ethnicity[22], deprivation and urban/ rural environment the association did not remain significant.





[22] Grouped into categories known to have higher/ lower odds of excess weight.

5.3 Greenspace

What does the evidence say?

The relationship between access to greenspace, physical activity and excess weight is unclear. Whilst there is a clear theoretical basis for greenspace within improving health, the evidence in association to physical activity and weight status has been unclear.[23] The largest nationally representative study to date found a counterintuitive relationship between greenspace, overweight and obesity.[24] Possible mediating influences could include; perception of greenspace acceptability, fear of crime, as well as, the walkability of the local environment with influences from road connectivity, land use, residential density and traffic exposure.

Data source

A needs assessment relating to the provision of natural greenspace produced by the Health & Nature Subgroup of the Kent Nature Partnership was identified,[25] this stratified LSOAs by provision of greenspace. They used the following categories for feeling of naturalness:

Level 1 – nature conservation areas, local nature reserves, national nature reserves, woodland and remnant countryside

- Level 2 – open space, unimproved farmland, rivers and canals, unimproved grassland, disused land, country parks and open access land
- Level 3 – allotments, church yards and cemeteries and formal recreation space

The defined greenspace entry points as the points where access routes intersect with greenspace boundaries. Using the defined travel distances (for each indicator below) they then identified postcodes assessed to have greenspace access.

[23] Lachowycz K. & Jones A.P. (2011) Greenspace and obesity: a systematic review of the evidence. Obesity Reviews, 12, e183-189

[24] Cummins S. & Fagg J. (2012) Does greener mean thinner? Associations between neighbourhood greenspace and weight status among adults in England. International Journal of Obesity, 36, 1108-1113

[25] Kent Nature Partnership (2016) A needs assessment relating to the provision of natural greenspace in areas with low levels of physical activity. http://bit.ly/2mswUNo

Indicators

percentage of population with access (using the service area method) to at least 1 site greater than 2ha (using ANGSt naturalness 1, 2 & 3) within 300m of where people live

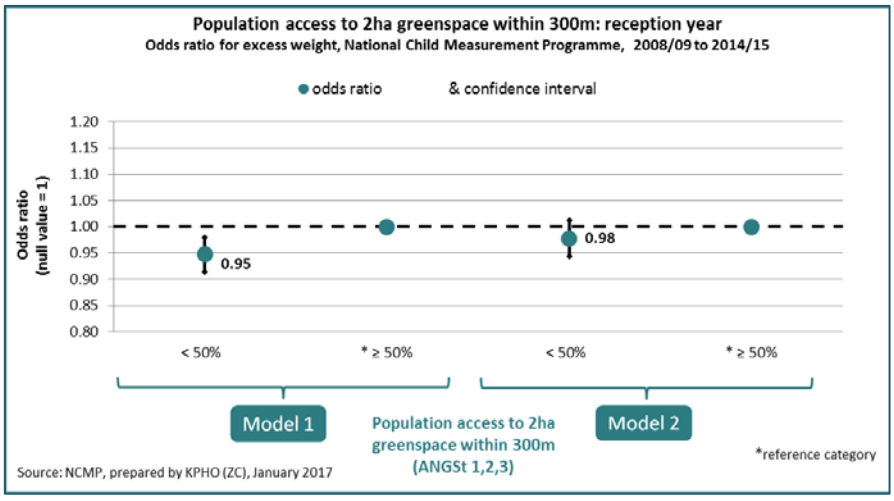
1	lower access (less than 50% of population)
2	higher access (50% or more of the population)

percentage of population with access (using the service area method) to at least 1 site greater than 0.4ha within 300m of where people live in urban locations **or** greater than 2ha within 1km in rural locations (using naturalness 1, 2 & 3)

1	lower access (less than 50% of population)
2	higher access (50% or more of the population)

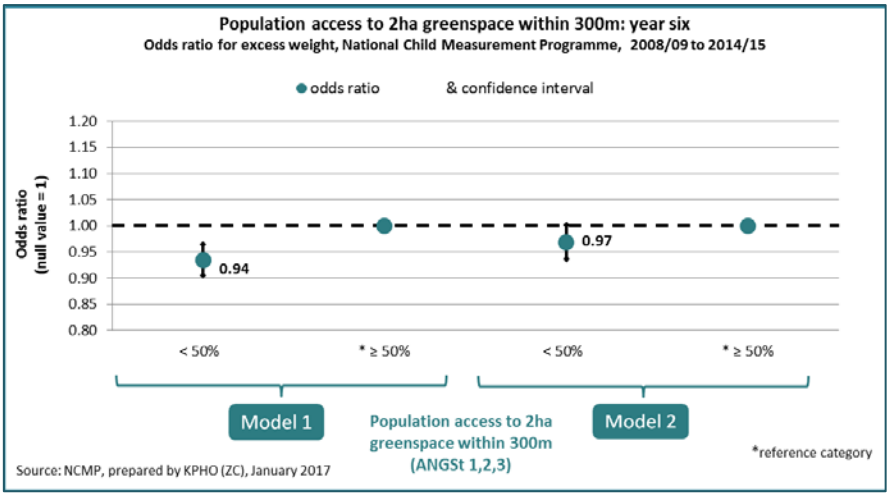
Findings

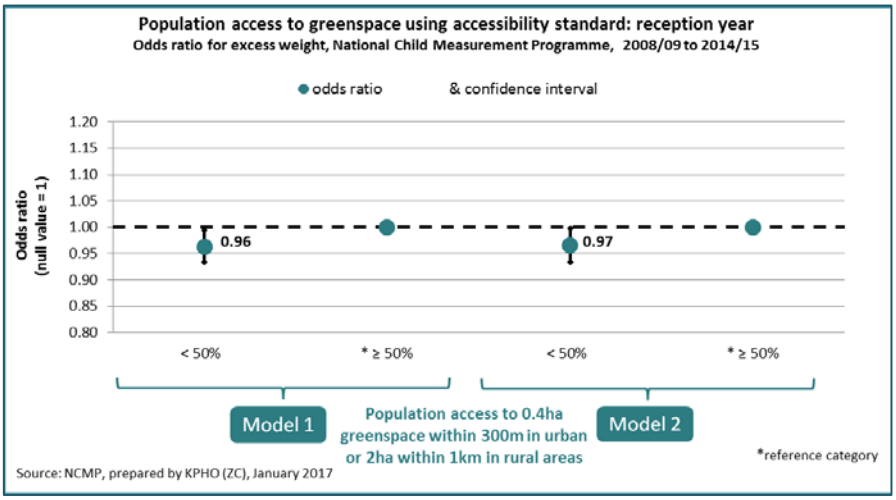
Overall, there were lower odds of excess weight within both reception and year six pupils resident in areas with lower access to greenspace using both indicators in Model 1. This finding is similar to the following study.[26] Within Model 2 after adjustment for ethnicity[27], deprivation and urban/ rural environment the majority of associations did not remain significant. With some borderline significance from the first indicator within year six, as well as, the second indicator within reception year.

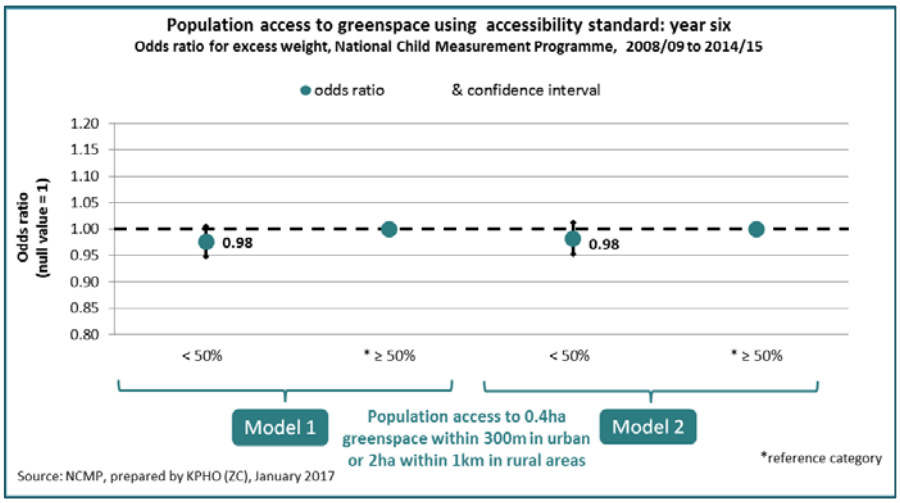


[26] Cummins S. & Fagg J. (2012) Does greener mean thinner? Associations between neighbourhood greenspace and weight status among adults in England. International Journal of Obesity, 36, 1108-1113

[27] Grouped into categories known to have higher/ lower odds of excess weight.


Population access to 2ha greenspace within 300m: year six
Odds ratio for excess weight, National Child Measurement Programme, 2008/09 to 2014/15
odds ratio
& confidence interval
Odds ratio (null value = 1)
1.20
1.15
1.10
1.05
1.00
0.95
0.90
0.85
0.80
0.94
0.97
< 50%
* ≥ 50%
< 50%
* ≥ 50%
Model 1
Population access to 2ha greenspace within 300m (ANGSt 1,2,3)
Model 2
*reference category
Source: NCMP, prepared by KPHO (ZC), January 2017


Population access to greenspace using accessibility standard: reception year
Odds ratio for excess weight, National Child Measurement Programme, 2008/09 to 2014/15
odds ratio
& confidence interval
Odds ratio (null value = 1)
1.20
1.15
1.10
1.05
1.00
0.95
0.90
0.85
0.80
0.96
0.97
< 50%
* ≥ 50%
< 50%
* ≥ 50%
Model 1
Population access to 0.4ha greenspace within 300m in urban or 2ha within 1km in rural areas
Model 2
*reference category
Source: NCMP, prepared by KPHO (ZC), January 2017


Population access to greenspace using accessibility standard: year six
Odds ratio for excess weight, National Child Measurement Programme, 2008/09 to 2014/15
odds ratio
& confidence interval
Odds ratio (null value = 1)
1.20
1.15
1.10
1.05
1.00
0.95
0.90
0.85
0.80
0.98
0.98
< 50%
* ≥ 50%
< 50%
* ≥ 50%
Model 1
Population access to 0.4ha greenspace within 300m in urban or 2ha within 1km in rural areas
Model 2
*reference category
Source: NCMP, prepared by KPHO (ZC), January 2017

5.4 Public & Private Sports Facilities

What does the evidence say?

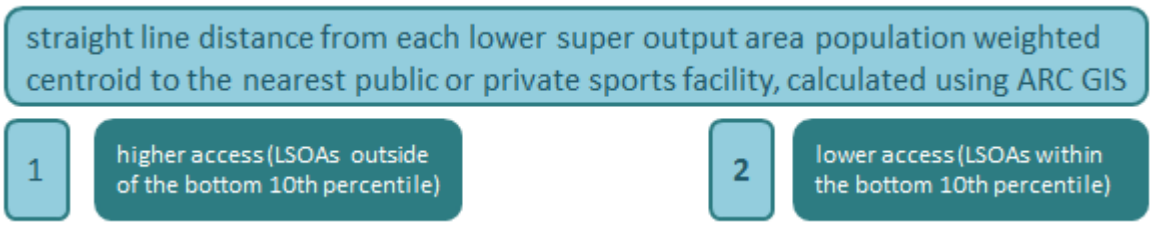
There is little UK based research exploring the relationship between access to sports facilities, activity and excess weight. The largest nationally representative study to date found lower numbers of outdoor physical activity facilities within the most deprived areas in comparison to the least deprived.[28] However, the findings for indoor physical activity facilities were non-significantly lower within the most deprived areas.[19] It should be noted that sports facilities and structured activity do not exclusively provide opportunity for physical activity, the importance of play from unstructured activity has been recognised.[29] Further, the factors that guide use of sports facilities are likely to be complex.

Data source

The Sport England Active Places Power website was used to extract public and private sports facilities. The extract was restricted to facilities that were either operational or temporarily closed. This includes indoor (health fitness centres, ice rinks, indoor bowls, indoor tennis, sports halls and swimming pools) or outdoor (athletics tracks, golf courses, ski slopes, synthetic turf pitches and grass pitches) facilities

- The straight line distance from each lower super output area population weighted centroid to the nearest public or private sports facility was calculated using ARC GIS.

Indicator

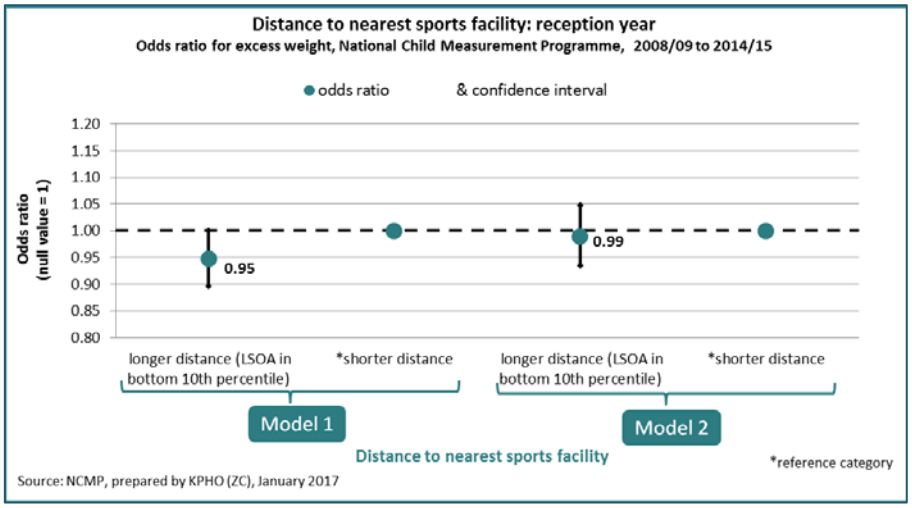


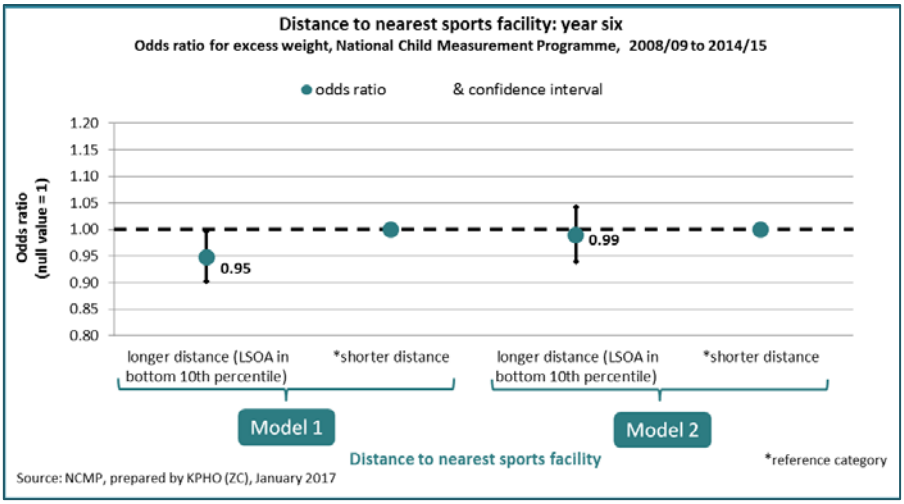
See note [30]

[28] Molaodi O.R. et al. (2012) Neighbourhood food and physical activity environments in England, UK: does ethnic density matter? *International Journal of Behavioral Nutrition and Physical Activity*, 9, 75
[29] (2008) *Child: Care, Health and Development*, 34(4), 470-474
[30] In the absence of an established meaningful definition for categorisation, an optimal threshold for statistical significance was used.

Findings

Overall, there was borderline significance for lower odds of excess weight within both reception and year six pupils resident in areas with longer distances to nearest sports facility in Model 1. Within Model 2 after adjustment for ethnicity[31], deprivation and urban/ rural environment the associations were non-significant.





[31] Grouped into categories known to have higher/ lower odds of excess weight.

6. Conclusions

This report has focused on the determinants of obesity within the living environment, which are grounded within the evidence base with a possible mode of influence, measureable and amenable to leverage from public health intervention.

Overall, there was evidence to suggest independently higher odds of excess weight within both reception and year six pupils resident in areas closer to a food outlet (within 1200m), as well as, those resident within areas with lower access to food retailing. However, after adjustment for ethnicity, deprivation and urban/ rural environment the association did not remain significant. In contrast, for the opportunity for physical activity indicators; there was a counterintuitive association with independently lower odds of excess weight within both reception and year six pupils resident in areas with lower access to greenspace, as well as, those resident within areas with longer distances to nearest sports facility. This also did not remain significant after adjustment for ethnicity, deprivation and urban/ rural environment. Possible mediating influences could include; perception of greenspace acceptability, fear of crime, as well as, the walkability of the local environment with influences from road connectivity, land use, residential density and traffic exposure.

The findings from these analyses do not prove any causal association due to the observational approach, but may guide understanding of some of the possible determinants of obesity within the local context. A series of maps have been produced to present the key variables analysed within this report for Districts. This describes local area assets and vulnerabilities in terms of opportunities for physical activity, as well as, food and drink access / availability (see District reports).

Appendix A: Notes on Statistical Methodology

A.1.1 Logistic regression

Logistic regression enables exploration of the effects of several variables on excess weight. The model predicts the probability of an event occurring based on the sum of probabilities associated with observed and predicted outcomes.

Odds of an event occurring describes the probability of an event occurring divided by the probability of an event not occurring. Odds ratios are used to compare the relative odds of excess weight given exposure to the variables of interest (i.e. ethnic group or deprivation) after adjusting for other variables in the model.

- Interpretation of odds ratios:
  - odds ratio = 1 exposure does not affect odds of outcome,
  - odds ratio > 1 exposure associated with higher odds of outcome,
  - odds ratio < 1 exposure associated with lower odds of outcome,
  - confidence intervals should not overlap the null, odds ratio = 1.

A.1.2 Geographically weighted regression

The geographically weighted regression maps display the parameter estimates for each independent variable. This helps understanding of a complex relationship that may vary geographically.

- The maps show that across Kent there was spatial variation in relationship between obesity and the independent variables; ethnic minority populations.
- The darker shading highlights areas where ethnic minority populations appear to be more important in its association with excess weight.

Areas with high Black ethnic group concentration have been defined as the upper quintile of local authority Black ethnic group population residing within a particular LSOA. Also, areas with higher excess weight have been defined as the upper quartile of excess weight across Kent.