

Current Controversies No. 59

FAST FOOD OUTLETS AND OBESITY

What is the evidence?

By Christopher Snowdon
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About the author

Christopher Snowden is Head of Lifestyle Economics at the Institute of Economic Affairs. His research focuses on social freedoms, prohibition and policy-based evidence. He is a regular contributor to the Spectator Health blog and often appears on TV and radio discussing social and economic issues.

Snowdon is the editor of the Nanny State Index and the author of five books: *Killjoys* (2017), *Selfishness, Greed and Capitalism* (2015), *The Art of Suppression* (2011), *The Spirit Level Delusion* (2010) and *Velvet Glove, Iron Fist* (2009). He has also written more than a dozen reports for the Institute of Economic Affairs including 'Drinking, Fast and Slow', 'The Proof of the Pudding: Denmark's Fat Tax Fiasco', 'Cheap as Chips', 'Sock Puppets' and 'Closing Time: Who's killing the British pub?'.

Executive summary

- Several local authorities in Britain have introduced ‘zoning laws’ to restrict fast food outlets within a certain distance of schools. Public Health England, the British Medical Association and the Mayor of London have all endorsed this policy as a way of tackling childhood obesity.
- Standard economic theory suggests that restricting supply by law leads to higher prices, poorer quality and reduced choice for consumers. Fast food zoning bans effectively protect incumbent businesses from competition at the expense of the public. These anti-competitive measures are said to be justified on ‘public health’ grounds to tackle childhood obesity. This report looks at the empirical literature to see whether this is true.
- We identified 74 studies published over a period of fifteen years which look at the relationship between the density and proximity of fast food outlets and the prevalence of obesity.
- Of the studies, only fifteen (20%) found a positive association between the proximity and/or density of fast food outlets and obesity/body mass index. Forty-four (60%) found no positive association, of which eleven (15%) found evidence that living near a fast food outlet reduced the risk of putting on weight. Fifteen (20%) produced a mix of positive, negative and (mostly) null results, which, taken together, point to no particular conclusion.
- The evidence that fast food availability causes obesity among children is even weaker. Of the 39 studies that looked specifically at children, only six (15%) found a positive association while twenty-six (67%) found no effect. Seven (18%) produced mixed results. Of the studies that found no association, five (13%) found an inverse relationship between fast food outlets and childhood obesity. Two-thirds of the studies found no evidence for the hypothesis that living near fast food outlets increases the risk of childhood obesity and there are nearly as many studies suggesting that it reduces childhood obesity as there are suggesting the opposite.

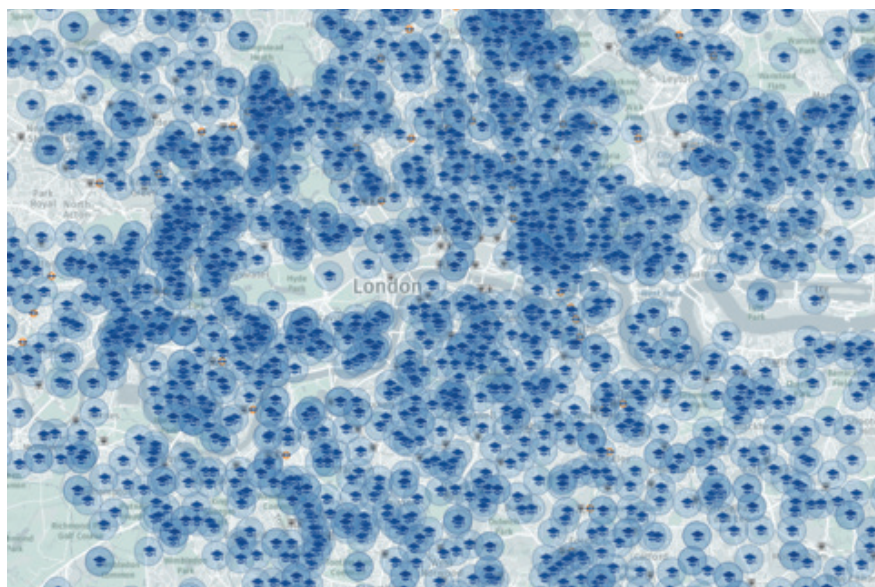
- Studies which suggest that living near a fast food outlet increases the risk of obesity are outnumbered 3 to 1 by those which find no such association. For childhood obesity, this ratio rises to 4 to 1.
- The belief that restricting the availability of fast food will reduce obesity in children or adults is based on assumptions that are not supported by an extensive body of evidence.

Introduction

In November 2017, the Mayor of London, Sadiq Khan, proposed a ‘total ban’ on new fast food establishments opening within 400 metres walking distance of schools in the city (Mayor of London 2017: 257). This is not a new idea. Waltham Forest became the first local authority to ban new takeaway outlets from opening within 400 metres of schools, parks and youth facilities in 2009. Since then, around twenty councils in Britain have imposed rules banning new fast food shops from opening within 400 or 800 metres of a school.

In central London, it would be a de facto ban on new outlets opening almost anywhere. Figure 1, created by the housing specialist Dan Cookson, shows the areas that would be affected if new outlets were banned within 400 metres of schools.¹ Little is left aside from parks and the river.

Figure 1: Exclusion zones of 400 metres radius of London schools



Standard economic theory suggests that restricting supply by law leads to higher prices, poorer quality and reduced choice for consumers. The fast food zoning ban would effectively protect incumbent businesses from competition at the expense of the public. But this anti-competitive measure is said to be justified on 'public health' grounds to tackle childhood obesity. According to the *Guardian* (Duncan and Butler 2017):

'Public health experts have warned that heavy exposure of children to fast food outlets and increased consumption of high-fat nutrient-poor food leads to greater risk of childhood obesity, as well as heart disease and stroke in later life.'

The easy availability of fast food is not only said to cause obesity in children but, according to the BBC (2017), there is also 'quite a lot of evidence that having fast food nearby leads to more obesity in adults'.

But is there? Dozens of studies have looked at the impact of fast food outlets on obesity. This report looks at their conclusions.

Methodology

All published studies on the relationship between the proximity and density of fast food outlets and obesity/overweight/body mass index (BMI) were gathered by searching PubMed and by taking relevant studies from six evidence reviews of the food retail environment (Fraser et al. 2010; Fleischhacker et al. 2011; Black et al. 2014; Mackenbach et al. 2014; Williams et al. 2014; Cobb et al. 2015). This yielded a total of 74 studies published between 2004 and 2017.

The majority of studies were cross-sectional in design, but ten were longitudinal. Studies looking at proximity typically examined the impact on obesity/overweight/BMI of the presence of a fast food outlet within a certain distance from the home, workplace and/or school. Studies looking at density examine the impact of different numbers of outlets within certain distances.

'Fast food' outlets typically included large chains, such as McDonald's, as well as takeaways and, in some cases, pizzerias. Many of the studies also looked at other food outlets, such as supermarkets, groceries, convenience stores, full service restaurants and 'healthy food stores'.

Body mass index (BMI) is a single figure derived from dividing weight by height (kilograms divided by metres-squared). Someone with a BMI of 25 or over is regarded as overweight. Someone with a BMI of 30 or over is regarded as obese. These are the standard definitions.

The results of the 74 eligible studies are listed below. I have divided them into those which find that fast food density/proximity is associated with higher BMI (a positive association), those which have produced mixed results and those which find no positive associations (i.e. the null studies, plus those which report negative associations which imply that fast food

outlets are associated with lower body weight). Studies of children are shown with a cross (†) and studies which report significant negative associations are shown with an asterisk (*).

The evidence

Positive (15)

Maddock (2004)

The Relationship between Obesity and the Prevalence of Fast Food Restaurants: State-Level Analysis.

American Journal of Health Promotion

This rather crude ecological study from the USA used data from 2000-02 to model the association between obesity and fast food outlet density. The author concluded that 'square miles per fast food restaurants and residents per restaurant accounted for six per cent of the variance in state obesity rates after controlling for population density, ethnicity, age, gender, physical inactivity, and fruit and vegetable intake'.

Mehta and Chang (2008)

Weight Status and Restaurant Availability: A Multilevel Analysis.

American Journal of Preventive Medicine

This US study found that obesity rates correlated with the number of fast food outlets and were inversely correlated with the number of full service restaurants. They concluded that a higher density of fast food outlets was associated with a five per cent increase in obesity risk.

Li et al. (2008)

Built Environment, Adiposity, and Physical Activity in Adults Aged 50–75.

American Journal of Preventive Health

This US study found that a one standard deviation increase in the density of fast food outlets was associated with a seven per cent increase in obesity/overweight prevalence.

Davis and Carpenter (2009) †

Proximity of Fast-Food Restaurants to Schools and Adolescent Obesity.

American Journal of Public Health

This study of US adolescents in California found that those who lived within half a mile of a major brand fast food outlet were slightly more likely to be obese, with a seven per cent increased risk.

Inagami et al. (2009)

Body Mass Index, Neighborhood Fast Food and Restaurant Concentration, and Car Ownership.

Journal of Urban Health

This study of adults in Los Angeles County found that BMI was highest among those who did not own cars and who lived in areas with a high concentration of fast food outlets. Among car-owners, BMI was slightly higher for those who lived in areas which had more fast food outlets.

Currie et al. (2010) †

The Effect of Fast Food Restaurants on Obesity and Weight Gain.

American Economic Journal

This US study found that 'a fast food restaurant within a tenth of a mile of a school is associated with at least a 5.2 percent increase in obesity rates' among ninth grade children.

Bodor et al. (2010)

The Association between Obesity and Urban Food Environments.

Journal of Urban Health

This US study failed to find a statistically significant association between fast food outlet proximity and obesity in its unadjusted results. Initial adjustments failed to unearth an association, but further modelling produced the result that living within 2 kilometres of a fast food outlet increased the odds of being obese, albeit by just one per cent. It also found that living within 2 km of a supermarket reduced obesity risk by seven per cent and watching television for more than two hours a day increased obesity risk by 37 per cent.

Mellor et al. (2011) †

Child body mass index, obesity, and proximity to fast food restaurants.

International Journal of Pediatric Obesity

This US study found that close proximity (0.1 miles) to a fast food outlet increased childhood obesity risk but the same proximity to a full service restaurant reduced it. There was a statistically significant association (at 95%) between fast food outlet proximity of 0.5 miles and obesity risk, but not at 0.25 miles or one mile.

Sánchez et al. (2012) †

Differential Associations between the Food Environment Near Schools and Childhood Overweight Across Race/Ethnicity, Gender, and Grade.

American Journal of Epidemiology

This US study found that children who attended a school that was within half a mile of a fast food outlet were two per cent more likely to be overweight than those who did not. The presence of additional outlets made no difference. Among Asian students, however, the availability of a fast food outlet was associated with a six per cent lower chance of being overweight. (As Asians only made up eight per cent of the sample and a positive association was found with whites, Hispanics and blacks, I have counted this as a positive association rather than a mixed result.)

Chen et al. (2012)

Obesity and Fast Food in Urban Markets: A New Approach Using Geo-Referenced Micro Data.

Health Economics

This US study found an association between fast food outlet density and obesity, and its authors created a model which suggests that policies to restrict new fast food outlets could reduce BMI by an average of 0.03 points. This is very modest effect and the authors conclude that 'policies aimed at restricting access to fast food may have limited success in meaningfully affecting BMI'.

Dubowitz et al. (2012)

The Women's Health Initiative: the Food Environment, Neighborhood Socioeconomic Status, Body Mass Index and Blood Pressure.

Obesity

This US study of post-menopausal women found that BMI was positively correlated with the availability of fast food outlets, but negatively correlated with the availability of supermarkets and grocery stores.

Carroll-Scott et al. (2013) †

Disentangling neighborhood contextual associations with child body mass index, diet, and physical activity: The role of built, socioeconomic, and social environments

Social Science and Medicine

This study of fifth and sixth graders in Connecticut found that those who lived within a five minute walk of a fast food outlet had a higher BMI than those who did not.

Grier and Davis (2013) †

Are All Proximity Effects Created Equal? Fast Food Near Schools and Body Weight Among Diverse Adolescents.

Journal of Public Policy and Marketing

This US study found that a school's proximity to a fast food outlet was associated with higher BMIs among 12-19 year old students in California. The effect was strongest among blacks and Hispanics.

Hollands et al. (2014)

Association between neighbourhood fast-food and full-service restaurant density and body mass index: A cross-sectional study of Canadian adults

Canadian Journal of Public Health

This study of adults in Canada found a positive association between fast food density and obesity, and a negative association between full service restaurant density and obesity. Based on their findings, the authors predicted that the average person would weigh an extra kilogram for every ten additional fast-food restaurants (per 10,000 population).

Kruger et al. (2014)

Local Concentration of Fast-Food Outlets Is Associated With Poor Nutrition and Obesity.

American Journal of Health Promotion

This American study found that fast-food outlet density was associated with higher BMIs and lower fruit and vegetable consumption: 'For every standard deviation (SD) increase in fast-food concentration, BMI increased by 9% of a SD.' The authors describe this as 'a statistically small effect'.

Mixed (15)

Morland and Evenson (2009)

Obesity prevalence and the local food environment.

Health and Place

This US study produced some very mixed results. On the one hand, the authors found that the prevalence of obesity was 45 per cent higher in areas with one or more independently owned grocery store, 31 per cent higher in areas with one or more gas stations, and 36 per cent higher in areas with one or more fast food restaurant. But it also found an inverse relationship between fast food outlet proximity and obesity, with the authors reporting that 'each mile closer to a fast food restaurant was associated with a lower prevalence of obesity'.

Oreskovic et al. (2009) †

Obesity and the Built Environment Among Massachusetts Children.

Clinical Pediatrics

This study of Massachusetts residents found that children from low income households were 13 per cent more likely to be obese if they lived near a large number of fast food outlets, but were 17 per cent less likely to be obese if they lived within one kilometre of a fast food outlet. Among children from high income households, there were no significant associations in either direction.

Chiang et al. (2011) †

Fast-food outlets and walkability in school neighbourhoods predict fatness in boys and height in girls: a Taiwanese population study.

Public Health Nutrition

This study of schoolchildren in Taiwan found that the density of fast food outlets was associated with higher BMIs among boys, but not girls. Conversely, and rather oddly, it found that density of fast food outlets was associated with greater height in girls, but not boys.

Jilcott et al. (2011) †

The association between the food environment and weight status among eastern North Carolina youth.

Public Health Nutrition

This study of 8 to 18 year olds in North Carolina found a positive association between BMI and the density of fast food outlets near the home, but the authors 'did not find hypothesised negative associations between proximity to the closest fast-food restaurant and BMI percentile.'

Harrison et al. (2011) †

Environmental correlates of adiposity in 9-10 year old children: Considering home and school neighbourhoods and routes to school.

Social Science and Medicine

This British study of 9-10 year olds found that girls tended to have a higher 'fat mass index' if they had greater access to 'unhealthy food outlets' at home and at school. There was no such association with fast food outlets on the way to school and there were no associations at all for boys.

Dunn et al. (2012)

The effect of fast-food availability on fast-food consumption and obesity among rural residents: An analysis by race/ethnicity.

Economics of Human Biology

This study of residents of a predominantly rural part of Texas found that 'increased availability of fast-food near the residence of white respondents does not increase fast-food consumption or obesity risk', but '[g]reater availability of fast-food is positively associated with both the number of meals consumed among non-whites residents and their obesity risk.'

Prince et al. (2012)

Relationships Between Neighborhoods, Physical Activity, and Obesity: A Multilevel Analysis of a Large Canadian City.

Obesity

This Canadian study found that overweight/obesity risk among females was 38 per cent higher in areas of high fast food outlet density. Convenience store density was also associated with an increased overweight/obesity risk among females. Neither of these associations were observed among men, however. The authors did not distinguish between overweight and obesity in their analysis.

Gilliland et al. (2012) †

Linking Childhood Obesity to the Built Environment: A Multi-level Analysis of Home and School Neighbourhood Factors Associated With Body Mass Index

Canadian Journal of Public Health

This Canadian study of 10 to 14 year old schoolchildren found no association between BMI and the number of fast food outlets within 500 metres and 1,000 metres of homes or schools. Nor did it find an association between the proximity of convenience stores and BMI. However, when the analysis was extended to the school 'walkshed' (the catchment area for children who walk to school), an association with BMI was found. No other study has used this methodology.

Hattori et al. (2013)

Neighborhood Food Outlets, Diet, and Obesity Among California Adults, 2007 and 2009

Preventing Chronic Disease

The authors of this study of Californian adults 'found no strong evidence that food outlets near homes are associated with dietary intake or BMI' but they did find an association between fast food outlets within 1.5 to 3 miles of the home and being overweight. They did not find any association between obesity and fast food outlet density at any distance from the home.

Reitzel et al. (2014)

Density and Proximity of Fast Food Restaurants and Body Mass Index Among African Americans

American Journal of Public Health

This study of African-American church attendees found no association between obesity and fast food outlet density but did find an association with fast food proximity. Each mile between home and a fast food outlet was associated with a 2.4 per cent reduction in BMI.

Du et al. (2014)

Is density of neighbourhood restaurants associated with BMI in rural Chinese adults? A longitudinal study from the China Health and Nutrition Survey.

BMJ Open

This study of consumers in rural China found an association between fast food outlets and body weight for women but not for men.

Tseng et al. (2014)

Is neighbourhood obesogenicity associated with body mass index in women? Application of an obesogenicity index in socioeconomically disadvantaged neighbourhoods.

Health and Place

This study of US women living in socially disadvantaged areas was based on an 'obesogenicity index' consisting of such factors as recreation accessibility and out-of-home food availability. While the authors found no relationship between this index and BMI, they found a positive association between fast food outlet availability and BMI in urban areas and a negative association between fast food availability and BMI in rural areas.

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

This British study of primary school children found no association between BMI and food retailers near schools, but it did find an association between BMI and the presence of a fast food outlet near the home. This association only existed for girls, however, not boys. The density of outlets had a positive (i.e. weight-increasing) effect on the girls and a negative (i.e. weight-decreasing) effect on boys. The authors said that their results 'did not support an independent effect of food stores or fast food outlets around schools on body weight in a sample of UK Reception or Year 6 students. However, there was evidence of a weak positive association between fast food outlet exposure around the home and body weight for older girls'.

Chen and Wang (2016) †

Changes in the Neighborhood Food Store Environment and Children's Body Mass Index at Peripuberty in the United States.

Journal of Adolescent Health

This longitudinal study from the US followed children from age 11 to age 14 and found that density of supermarkets predicted lower BMI for girls but density of limited-service (e.g. fast food) restaurants predicted higher BMI for girls. For boys, there were no associations at all.

Burgoine et al. (2016)

Does neighborhood fast-food outlet exposure amplify inequalities in diet and obesity? A cross-sectional study.

American Journal of Clinical Nutrition

This study of 29-62 year olds in Cambridgeshire did not find any association between the proximity of fast food outlets and obesity except among the least educated group.

Null/negative (44)

Burdette and Whitaker (2004) †

Neighborhood playgrounds, fast food restaurants, and crime: relationships to overweight in low-income preschool children.

Preventive Medicine

This US study looked at preschool children in Cincinnati, Ohio and found no relationship between obesity and proximity to fast food restaurants.

Simmons et al. (2005)

Choice and availability of takeaway and restaurant food is not related to the prevalence of adult obesity in rural communities in Australia.

International Journal of Obesity

This Australian study concluded: 'Availability of takeaway outlets and restaurants was unrelated to obesity... In a setting of easy availability of food, the obesity epidemic relates strongly to reduced physical activity, but not to consumption of takeaway food.'

Sturm and Datar (2005) †

Body mass index in elementary school children, metropolitan area food prices and food outlet density.

Public Health

This study of children in the USA found no impact on obesity from fast food prices or fast food outlet density. The authors said that they 'initially expected food outlets to play an important role, but no association was found.'

Jeffery et al. (2006) *

Are fast food restaurants an environmental risk factor for obesity?

International Journal of Behavioral Nutrition and Physical Activity

This study of more than a thousand residents of Minnesota found no relationship between the proximity of fast food restaurants and body weight, nor did it find an association between proximity and frequency of purchase. Men who lived or worked near fast food restaurants tended to weigh less than those who did not.

Wang et al. (2007)

Socioeconomic and food-related physical characteristics of the neighbourhood environment are associated with body mass index.

Journal of Epidemiology and Community Health

The authors of this US study hypothesised that the density of fast food outlets increases obesity risk and that the proximity of supermarkets reduces obesity risk. Their findings supported neither of these beliefs, however. Women (but not men) who lived near supermarkets were more likely to be obese and only the density of grocery shops was associated with increased obesity risk - again, only for women. Obesity was not related to either the proximity or density of fast food outlets.

Lopez (2007)

Neighborhood Risk Factors for Obesity.

Obesity

This study of Massachusetts residents found that obesity was associated with income, education and population density, but '[n]either the supermarket or fast food density variables were associated with obesity risk.'

Crawford et al. (2008) * †

Neighbourhood fast food outlets and obesity in children and adults: the CLAN Study.

International Journal of Pediatric Obesity

This study of children and adults in Australia found that living near fast food outlets reduced obesity risk in most cases. Older children and their fathers were significantly less likely to be overweight or obese if they lived within 2 km of a fast food outlet. The further the father lived from a fast food outlet, the more likely he was to be obese. The authors' rather understated conclusion was that 'this study provides little support for the concept that exposure to fast food outlets in the local neighbourhood increases risk of obesity.'

Seliske et al. (2008) †

Association between the food retail environment surrounding schools and overweight in Canadian youth.

Public Health Nutrition

This study of the food environment around Canadian schools concluded: 'None of the individual food retailers was associated with an increased likelihood of overweight.' Children who attended schools which had a fast food outlet within 1km were significantly less likely to be overweight, as were children attending schools which had a high density of fast food outlets within 5 km.

Pearce et al. (2009) *

A national study of the association between neighbourhood access to fast-food outlets and the diet and weight of local residents.

Health and Place

This study from New Zealand found an inverse association between the availability of fast food and body weight, with those who had less access to 'multi-national fast-food outlets' being 17 per cent more likely to be overweight. There was no association between living near a 'locally operated fast-food outlet' and being overweight.

Oreskovic et al. (2009b) †

Obesity and the Built Environment Among Massachusetts Children.

Clinical Practice

After controlling for sociodemographic factors, this study of children in Massachusetts found that neither fast food outlet proximity nor fast food outlet density was associated with obesity. Its main finding was that children were less likely to be overweight if they lived near a greater number of subway stations.

Zick et al. (2009)*

Running to the Store? The Relationship between Neighborhood Environments and the Risk of Obesity.

Social Science and Medicine

This study of Salt Lake County residents found no association between living near a fast food outlet and being obese. Its most notable finding was that people in 'non-low income neighbourhoods' were more likely to be obese if there were no fast food outlets, convenience stores or restaurants within walking distance.

Rundle et al. (2009)

Neighborhood Food Environment and Walkability Predict Obesity in New York City.

Environmental Health Perspectives

This study of adults in New York City found that a high density of healthy food shops was associated with lower BMI but found no association with 'unhealthy food density' (ie. fast food and takeaways). 'Consistent with other studies in this area,' the authors write, 'we found no association between density of unhealthy food and BMI or obesity.'

Powell and Bao (2009) †

Food prices, access to food outlets and child weight.

Economics and Human Biology

This US study of children found some association between food prices and rates of obesity but no statistically significant association with fast food outlet density.

Powell et al. (2010) †

Economic Contextual Factors, Food Consumption, and Obesity among U.S. Adolescents.

Journal of Nutrition

This study of American adolescents found that the 'availability of fast food restaurants was not associated with youth BMI'. The authors note that this is 'consistent with other recent studies'.

Hickson et al. (2010) *

Associations of Fast Food Restaurant Availability With Dietary Intake and Weight Among African Americans in the Jackson Heart Study, 2000–2004.

American Journal of Public Health

This study for African-Americans in the south-east of the USA found no evidence of positive associations between fast food availability and BMI or waist circumference within 0.5-mile, 1-mile, 2-mile or 5-mile zones. 'In fact, we observed unexpected statistically significant inverse associations when comparing the highest FFR [fast food restaurant] category to the lowest in men aged 55 years or older'. The study also found that fast food proximity was 'unexpectedly positively associated with total fibre intake'.

Galvez et al. (2010) †

Childhood Obesity and Neighborhood Food Store Availability in an Inner City Community. *Academic Pediatrics*

This US study found that children who lived on a block 'with one or more convenience stores were more likely to have a BMI-percentile in the top tertile' than those who did not. However, the authors found 'no statistically significant associations between a child's BMI and the number of fast food restaurants' on the block.

Laska et al. (2010) * †

Neighbourhood food environments: are they associated with adolescent dietary intake, food purchases and weight status?

Public Health Nutrition

This study of adolescents in Minnesota found no association between obesity and the proximity of fast food outlets to schools. Moreover, the authors say: 'Paradoxically, the few findings that were significant in our analyses of school neighbourhood environments were in the opposite directions to those that had been hypothesised'. The children who went to school within 800 metres of fast food outlets tended to weigh less than those who did not.

Gibson (2011)

The Neighborhood Food Environment and Adult Weight Status: Estimates From Longitudinal Data. *American Journal of Public Health*

This longitudinal study from the USA found that the density of small grocery stores was positively associated with obesity prevalence. The density of fast food outlets was not.

Harris et al. (2011) †

Location of Food Stores Near Schools Does Not Predict the Weight Status of Maine High School Students

Journal of Nutrition Education and Behavior

This study of high school students in Maine, USA found 'no correlation between students' overweight risk and the presence of stores with unhealthful food choices near their schools.'

Howard et al. (2011) †

Proximity of food retailers to schools and rates of overweight ninth grade students: an ecological study in California.

BMC Public Health

This study of ninth grade students in California found a positive association between BMI and the presence of convenience stores within a ten minute walk, but found no such association with fast food outlets.

Block et al. (2011)

Proximity to Food Establishments and Body Mass Index in the Framingham Heart Study Offspring Cohort Over 30 Years.

American Journal of Epidemiology

This longitudinal study of 3,113 residents of Massachusetts spanning a 30 year period 'did not find a consistent relation between access to fast-food restaurants and individual BMI'. It found a 'small association' between body weight and the distance required to drive to a fast food outlet, but this relationship only existed for women. The authors conclude that 'the food environment's contribution to reducing or controlling the obesity epidemic may be limited.'

An and Sturm et al. (2012) †

School and Residential Neighborhood Food Environment and Diet Among California Youth.

American Journal of Preventive Medicine

This study of children aged 5 to 11 years in California found no evidence that the proximity of fast food outlets was associated with greater fast food consumption or higher BMI.

Langellier (2012) †

The Food Environment and Student Weight Status, Los Angeles County, 2008-2009.

Preventing Chronic Disease

This study of children attending schools in Los Angeles County concluded that the 'presence of fast food restaurants within a half-mile of schools was not associated with overweight prevalence among students.'

Lee (2012) †

The role of local food availability in explaining obesity risk among young school-aged children.

Social Science and Medicine

This longitudinal study of childhood obesity in the US found that 'food outlet exposure holds no independent relationship to child weight gain, even in the simplest model... children who experience greater exposure to fast-food or convenience food establishments in their home neighborhoods are no more likely to gain excess weight than their counterparts who experience less exposure. In fact, the association with proximity to fast-food outlets goes in the opposite direction to that which was expected, but this is not statistically significant.'

Richardson et al. (2012)

Neighborhood fast food restaurants and fast food consumption: A national study.

BMC Public Health

This study of 18 to 28 year olds in the USA starts out by saying that it is 'intuitive that fast food restaurants contribute to obesity' but then finds no relationship between fast food availability and fast food consumption. The authors conclude: 'Our findings suggest that targeting neighborhood fast food availability may not reduce consumption or obesity among young U.S. adults.'

Wall et al. (2012) †

Patterns of Obesogenic Neighborhood Features and Adolescent Weight: A comparison of statistical approaches.

American Journal of Preventive Medicine

This study of adolescents in Minnesota found that proximity of convenience stores was associated with higher BMI among girls but not boys. Neither the proximity nor density of fast food outlets was associated with BMI for either gender.

Shier et al. (2012) †

Is there a robust relationship between neighbourhood food environment and childhood obesity in the USA?

Public Health

This longitudinal study from the US found some evidence that BMI is influenced by the availability of a variety of food outlets, but found no association between BMI and fast food outlet availability.

Héroux et al. (2012) †

The food retail environment in school neighborhoods and its relation to lunchtime eating behaviors in youth from three countries.

Health and Place

This study of schoolchildren in Canada, Scotland and the USA found no association between fast food outlets, cafés and convenience stores near schools and childhood obesity. 'Irrespective of country', write the authors, 'no statistically significant relationships were observed between the food retailers and weight status.'

Lamichhane et al. (2012) * †

Associations of built food environment with body mass index and waist circumference among youth with diabetes.

International Journal of Behavioral Nutrition and Physical Activity

This study of diabetic youths in North Carolina failed to find an association between fast food outlet density and BMI/waist circumference. Nor did it find any association between BMI and the proximity of fast food outlets. Indeed, as the authors write, 'contrary to our hypothesis, we found significantly higher BMI z-score the farther the youth resided from the nearest fast food outlet.'

Buck et al. (2013) †

Clustering of unhealthy food around German schools and its influence on dietary behavior in school children: a pilot study.

International Journal of Behavioral Nutrition and Physical Activity

This study of children in Germany looked at supermarkets, fast food restaurants and convenience stores and found that 'the food retail environment showed no effect on BMI'. It also found that 'the consumption of junk food in young children is not influenced by spatial availability of unhealthy food'.

Rossen et al. (2013) †

Food Availability en Route to School and Anthropometric Change in Urban Children.

Journal of Urban Health

This longitudinal study followed predominantly black children in a low income, urban area of the USA for a year and found that access to healthy food outlets led to a smaller rise in BMI than expected, but found no associations with the availability of fast food outlets.

Park et al. (2013) * †

School and Neighborhood Nutrition Environment and Their Association With Students' Nutrition Behaviors and Weight Status in Seoul, South Korea.

Journal of Adolescent Health

This study from South Korea found that supermarket density near schools was associated with a 37 per cent higher chance of children being obese, but found no such relationship with fast food outlets. Indeed, fast food outlet density near schools was associated with a 17 per cent lower chance of children being overweight.

Stark et al. (2013) *

Neighbourhood food environments and body mass index among New York City adults.

Journal of Epidemiology and Community Health

This study of adult consumers in New York City found an inverse relationship between fast food outlet density and BMI, with those living in areas of high concentration weighing less than those who lived in low concentration neighbourhoods. The authors found an association between a higher proportion of food outlets serving 'BMI-unhealthy food' and obesity, but only in higher income areas. They concluded that their findings 'support a more nuanced assessment of the impact of the food environment and its association with obesity.'

Bader et al. (2013) * †

More neighborhood retail associated with lower obesity among New York City public high school students.

Health and Place

This study found that high school students in New York City were less likely to be obese if they went to schools in areas with high density of fast food outlets. 'We find lower odds of obesity prevalence in neighbourhoods with more fast food' (*italics in original*). The authors conclude that 'our results suggest that policy makers should approach policies designed to limit fast food, as for example zoning laws do, with caution.'

Boone-Heinonen et al. (2013)

The Neighborhood Energy Balance Equation: Does Neighborhood Food Retail Environment + Physical Activity Environment = Obesity? The CARDIA Study.

PLoS One

The authors of this longitudinal study from the US 'hypothesised that the food retail and physical activity environments interact in their relationships with BMI'. However, they found that 'our study findings do not support this hypothesis... fast food restaurant density was unrelated to BMI'.

Fiechtner et al. (2013) †

Proximity to Supermarkets Associated with Higher Body Mass Index among Overweight and Obese Preschool-Age Children.

Preventive Medicine

This US study found that preschool children living within a mile of a large supermarket had a higher BMI than those who did not. No association with fast food outlets or any other food establishments was found. As the authors explain, 'we did not find an association between proximity to fast-food restaurants, convenience stores, smaller supermarkets, or bakeries, coffee shops, and candy stores with child BMI.'

Ohri-Vachaspati et al. (2013) †

A closer examination of the relationship between children's weight status and the food and physical activity environment.

Preventive Medicine

This US study of children aged 3 to 18 years found that BMI tended to be higher if the child lived within a quarter of a mile of a convenience store but found no association with any other food outlet, including fast food. Children living within half a mile of a park were half as likely to be overweight or obese as those who did not.

Burgoine et al. (2014)

Associations between exposure to takeaway food outlets, takeaway food consumption, and body weight in Cambridgeshire, UK: population based, cross sectional study.

British Medical Journal

On its face, this British study appears to have found a positive association between fast food outlet proximity and obesity, with adults who were more exposed to the most 'takeaway food' outlets at home, work and while

commuting being 80 per cent more likely to be obese than the least exposed group. This is how the study was reported by the media (e.g. Cooper 2014). Upon closer inspection, however, it can be seen that the authors included supermarkets as takeaway food outlets. The authors admit that when supermarkets are excluded from the analysis, ‘the associations between combined take-away food outlet exposure, consumption of take-away food and body mass index were attenuated towards the null’. As Franklin (2014) notes, ‘[t]he expression “attenuated towards the null” is an understatement: no association remains at all’.

Wasserman et al. (2014) †

A multi-level analysis showing associations between school neighborhood and child body mass index.

International Journal of Obesity

This study of children in Kansas City found that proximity to convenience stores, fitness facilities and parks was associated with less obesity while proximity to grocery stores was associated with more obesity. There was no association in either direction for proximity to fast food outlets.

Griffiths et al. (2015) †

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

After looking at the density of food outlets around children’s homes, schools and commute, the authors of this British study found ‘no evidence of an association between the number of food outlets and childhood obesity in any of these environments’. When takeaway and fast food outlets were examined in isolation, there was also no association with childhood obesity. When the proximity to food outlets was studied, the only statistically significant finding was an inverse correlation between childhood obesity and food outlets near the home.

Mejia et al. (2015)

Neighborhood Food Environment, Diet, and Obesity Among Los Angeles County Adults, 2011.

Preventing Chronic Disease

This study of adults in Los Angeles County found few positive associations. The authors concluded that ‘no strong evidence emerged that local food environments affect diet or BMI of adults ... there was no association between BMI and fast-food outlets, small food stores, midsize grocery stores, or supermarkets’.

Rummo et al. (2017)

Does unmeasured confounding influence associations between the retail food environment and body mass index over time? The Coronary Artery Risk Development in Young Adults (CARDIA) study.

International Journal of Epidemiology

This longitudinal study from the USA found some association between obesity and the number of small grocery stores in the local area, but found no relationship with fast food outlets. As the authors concluded, 'Neighbourhood convenience stores and fast-food restaurants were not associated with BMI in any model.'

Mazidi and Speakman (2017) *

Higher densities of fast-food and full-service restaurants are not associated with obesity prevalence.

American Journal of Clinical Nutrition

The title of this US study is somewhat misleading. Associations were found, but not in the expected direction. The authors found that obesity was 'highly significantly negatively related to density of both FFRs [fast food restaurants] and FSRs [full service restaurants]'. Americans who lived in areas where there were many fast food outlets tended to weigh less than those who did not.

Lamb et al. (2017)

Associations between major chain fast-food outlet availability and change in body mass index: a longitudinal observational study of women from Victoria, Australia.

BMJ Open

This Australian study monitored obesity rates among women in poor neighbourhoods between 2007 and 2013. It found no relationship between body weight and fast food outlets.

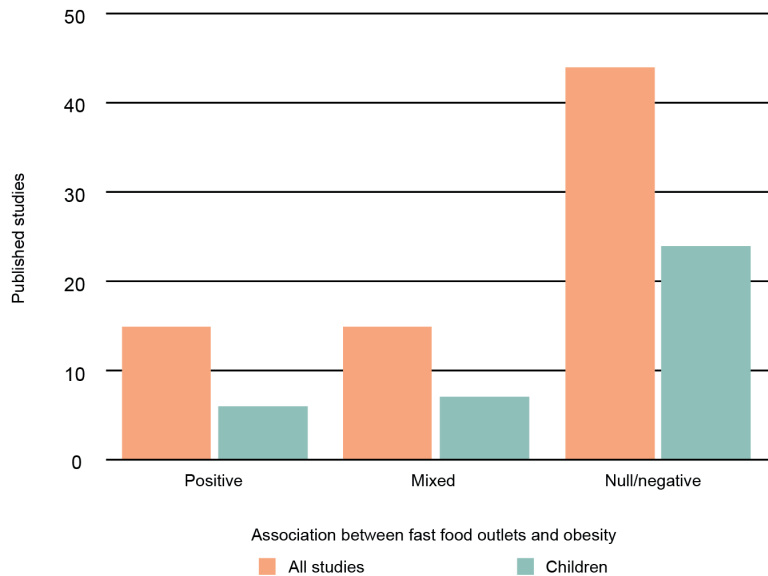
Results

Of the 74 studies identified, only fifteen (20%) found a positive association between the proximity and/or density of fast food outlets and obesity/BMI. Forty-four (60%) found no positive association, of which eleven (15%) found a negative (inverse) association. Fifteen (20%) produced a mix of positive, negative and (mostly) null results, which, taken together, point to no particular conclusion.

Of the 39 studies that looked specifically at children, only six (15%) found a positive association while twenty-six (67%) found no association and seven (18%) produced mixed results. Of the studies that found no association, five (13%) found an inverse relationship between fast food outlet density/proximity and childhood obesity/overweight. The evidence that fast food availability causes obesity among children is therefore even weaker than it is for adults.

Figure 2 shows the number of studies that came to each of the three conclusions. Overall, the weight of evidence suggests that there is no association between obesity and either the proximity or density of fast food outlets to schools, homes and workplaces. The majority of studies failed to find any positive association between these variables and there are almost as many studies suggesting that the availability of fast food leads to lower rates of obesity than there are suggesting a link with higher rates of obesity.

Figure 2: Number of studies finding positive, mixed and null/negative results



Science is not decided by sheer weight of numbers, but the fact that most studies in the literature have found no association between obesity/BMI and fast food outlet density/proximity strongly suggests that no such relationship exists. This conclusion is not based on an absence of evidence. There is plenty of evidence. Dozens of studies have been conducted and most of them support the null hypothesis. The existence of a smaller body of evidence reporting diametrically opposed positive and negative findings is not unusual in epidemiology and can readily be explained by chance, bias and coincidence.

Even among the studies which report a positive relationship the associations are typically small, as several of the authors acknowledge in the text. David and Carpenter (2009) find an increase in obesity risk of seven per cent while Mehta and Chang (2009) and Currie et al. (2009) report a figure of five per cent. Sánchez et al. (2012) found that the presence of a fast food outlet was associated with a mere two per cent increase in overweight (and even this only applied to non-Asians). Bodor et al. (2010) reported a one per cent increased risk of obesity for those living near a fast food outlet. Based

on their positive association, Chen et al. (2012) suggest that restricting fast food outlets would reduce average BMI by a barely measurable 0.03 points. These results are statistically significant but it is doubtful whether they would be clinically significant even if they were supported by the rest of the evidence.

The fifteen studies that found mixed results provide little illumination and give as much support to the null hypothesis as they do to the theory that living near fast food outlets makes people fat. Four of them report both positive and negative associations (Morland and Evenson 2009; Oreskovic et al. 2009; Tseng et al. 2014; Williams et al. 2015). Two studies find an association with density but not proximity (Oreskovic et al. 2009; Jilcott et al. 2011) while another finds the reverse (Reitzel et al. 2014). Five studies find an association for females but not for males (Harrison et al. 2011; Chen et al. 2012; Prince et al. 2012; Du et al. 2014; Williams et al. 2015) while another finds an association for males but not females (Chiang et al. 2011). One finds an association for blacks but not whites (Dunn et al. 2012). One finds an association in urban areas but not rural areas (Tseng et al. 2014) and another finds no association except among the worst educated (Burgoine et al. 2016). Two studies find associations with proximity within certain distances but not within other, apparently similar, distances (Hattori et al. 2013; Gilliland et al. 2012).²

There are no obvious explanations for these ambiguous and conflicting findings. There may be local peculiarities that have led to negative and positive associations being found in certain areas, but it is not obvious what these could be. Looking at the methodologies used by the various researchers, no clear patterns emerge. No particular methodology predicts positive, negative or null findings. Older studies are slightly more likely to produce positive associations and all the studies published since 2015 have been null, negative or mixed. All but one of the fifteen studies that reported significant positive associations came from the USA, but American studies dominate this literature, with 56 of the studies (76%) looking at US residents. Canada and Australia contributed four studies each, and the UK contributed five. New Zealand, China, Germany, South Korea and Taiwan contributed one each. One study looked at three countries: Canada, Scotland and the USA (Héroux et al. 2012).

² As does Mellor et al. (2011) whose study is classed as an overall positive association in this report.

Most of the studies are cross-sectional in design, and while Gordon-Larsen (2014) has called for more longitudinal research in this area it should be noted that none of the ten longitudinal studies published to date have found a strong positive association between fast food outlets and obesity/overweight, whereas eight of them have produced null or negative findings. No attempt has been made in the present paper to assess the methodological quality of each study, but Mackenbach et al. (2014: 12) took this into account when conducting their review and found that roughly the same proportion of 'weak', 'moderate' and 'strong' studies reported null findings (around two-thirds).

Discussion

Research of this kind is fundamentally based on correlations between variables which have many confounding factors. Most of the studies listed above are cross-sectional and rely on aggregate data. An extreme example is Maddock (2004), who reported a positive association by comparing the obesity rate of each US state to the number of McDonald's and Burger King branches listed in each state's Yellow Pages. Most studies employed more sophisticated methods, using surveys to establish BMI and using geographical information systems to count the fast food outlets in the local area, but the raw data remain fairly crude.

Crude though it might be, such methods answer the basic question of whether people who live near fast food outlets are fatter than those who do not. Regression analysis is then used to isolate the impact of the outlets by accounting for other factors, but this is not easy as there are many variables to control for. People who live near fast food outlets are often different in income, social class, age, car ownership and ethnicity to those who do not. They are often different in body weight too, but that does not mean that the availability of fast food outlets is the cause of this. The number of fast food outlets in a neighbourhood may simply be a marker for other characteristics of the local residents and their environment that make them more or less likely to be obese. To illustrate this, Bader et al. (2013) found that a greater number of banks in a neighbourhood was associated with lower rates of obesity, although it is difficult to see how this relationship could be causal. Prince et al. (2012) reported that higher crime rates are associated with lower odds of obesity but, again, the mechanism for a direct relationship is far from clear.

Untangling the many variables requires researchers to adjust the data and this can have a dramatic effect on the results. A notable example is the study by Burgoine et al. (2014) which reported a remarkably strong positive

association between takeaway outlets and obesity in Cambridgeshire, UK. While most of the studies that reported positive associations with fast food outlets found an increased obesity risk of between one and seven per cent, Burgoine et al. found that those who were most 'exposed' to takeaway outlets were 80 per cent more likely to be obese than those who were unexposed.

However, as the statistician Jeremy Franklin (2014) noticed when he looked at the raw data, rates of obesity in the areas where takeaway outlets were most common were actually no higher than in the other areas. Moreover, as he noted, 'mean take-away consumption was slightly inversely correlated with combined take-away availability'. The findings presented by the authors were entirely the result of adjustments made to the data. The people living in the neighbourhoods where takeaway outlets were most highly concentrated ate less takeaway food and had the same average BMI as those who did not live near any takeaway outlets. The unadjusted figures are shown in Table 1. No doubt some adjustments to the data were necessary, but we are required to put a lot of faith in researchers when data is transformed so dramatically. In practice, the study's conclusion was not that obesity rates were higher in areas where takeaway shops were common but that they would have been higher if it were not for various weight-decreasing factors.

Table 1: Unadjusted data from Burgoine et al. (2014)

Takeaway Availability	BMI	Takeaway consumption (g/day)	Energy intake (kJ/day)
1 (least)	26.7	36.3	8218
2	26.7	34.6	8138
3	26.6	35.2	8167
4	26.6	34.2	8084

For a causal link to exist between fast food outlet availability and obesity, two conditions would have to be met. First, people who live near fast food shops would have to eat more fast food than those who do not. Second, eating fast food would have to cause obesity by encouraging excess

calorie consumption. Neither of these hypotheses is implausible and yet the evidence for both is far from conclusive.

Two Australian studies found that proximity to fast food/takeaway shops had no effect on how often people consumed these foods. Thornton et al. (2009) concluded that 'density and proximity were not found to be significant predictors of fast food purchasing', and Turrell and Giskes (2008) concluded that the 'number of takeaway shops in the local food environment, and road distance to the closest takeaway shop, were largely unrelated to the purchase of takeaway food.' Several other studies, including An and Sturm et al. (2012), Gebremariam et al. (2012) and Richmond et al. (2013), found no association between the retail food environment and children's dietary habits. Timperio et al. (2009) found that children who lived near fast food outlets were less likely to consume fast food than those who did not.

On the other hand, a study of adolescents in East London by Smith et al. (2013) found 'small significant relationships between proximity to takeaways and unhealthy diets' and He et al. (2012) found that both the proximity and density of fast food outlets were positively associated with fast food purchasing (neither study looked at body weight or obesity). Simmons et al. (2005) found that takeaway availability was related to takeaway consumption but that neither the availability nor consumption of takeaway food had any effect on BMI. Jeffery et al. (2006) found that those who ate fast food more frequently tended to be fatter, but he also found that people who lived near fast food outlets ate less of it.

Studies by Smith et al. (2009) and Frank et al. (2009) did not look at outlet density or proximity, but did find associations between higher rates of fast food/takeaway consumption and obesity. However, a study of 11-14 year olds in a poor area of inner London found that 'BMI has a significantly inverse relationship to fast food consumption' (i.e. those who ate it the most weighed the least). This relationship disappeared, but was not reversed, after adjustments were made to account for age and gender (Patterson et al. 2012). Looking at the food environment more generally, a study of consumers in eleven European countries found that those who spent more money on out-of-home food tended to weigh less (Drichoutis et al. 2009). And while Allcott et al. (2017) did not look at fast food outlets specifically, their work on supermarkets concluded that 'the causal impact of unhealthful food supply is small, relative to either the overall obesity rate or the nutrition-income relationship.'

Taken together, then, it is far from clear that people who live near fast food outlets consume fast food more regularly - or consume more calories overall - than those who do not. Fraser et al. (2010: 2301) rightly describe the evidence linking fast food availability to fast food consumption as 'conflicting'. Given how uncertain this relationship is, it is not surprising that most studies have found no relationship between living near fast food outlets and being obese.

Finally, none of the studies take account of the simple fact that many takeaway outlets do deliveries. If people are eating food that has been delivered to them, the number of outlets available and their distance from the front door is of little consequence and restrictive policies based on assumptions about walkability have no chance of succeeding.

Intuition is not enough

An intimate knowledge of the evidence base is not needed to understand that restricting fast food outlets is unlikely to have an impact on obesity. Several evidence reviews, of which the present study is the latest and largest, have shown that it is not an evidence-based policy. The earliest of these (Fraser et al. 2010: 2304) noted 'there have been conflicting results', not only with regard to the relationship between fast food outlets and obesity but between fast food outlets and fast food consumption. The second found more null results than positive associations (Fleischhacker et al. 2011).

Four subsequent evidence reviews concluded that the evidence linking fast food availability to obesity is, at best, weak. Williams et al. (2014: 372) 'did not find strong evidence at this time to justify policies related to regulating the food environments around schools'. Gordon-Larsen (2014) found that: 'Studies of access to fast food and body weight generally showed null results'. Cobb et al. (2015) found that two-thirds of the associations between fast food availability and obesity in the literature were null, as did Mackenbach et al. (2014: 12) who took the methodological quality of the studies into account when conducting their review before concluding that 'the overall evidence for an association between environmental factors and weight status is weak'.

Moreover, there is real world evidence showing that such policies do not work. In July 2008, a temporary ban on new fast food outlets was imposed on South Los Angeles and its 700,000 residents after the city council became concerned with high levels of obesity in the area. The ban became permanent in 2010, but when the policy was evaluated in 2015 it was found that there had been a greater rise in obesity rates in the part of the city that had the 'zoning ban' than in the rest of Los Angeles (Sturm and Hattori 2015).

With all this evidence in the public domain, why is it still widely assumed that the prevalence of fast food outlets has a direct and causal impact on obesity rates - and on childhood obesity in particular? Perhaps it is because food eaten out of the home is seen to be more amenable to regulation, and fast food outlets are the most visible part of the out-of-home food environment. Since much of the food sold in takeaways is relatively high in sugar, salt and fat, it may seem intuitive that its availability leads to obesity, despite the fact that the vast majority of food is eaten in the home.

That certainly seems to have been the assumption of some of the researchers when they embarked on their work. Reading the studies, one gets the firm impression that many of their authors both expected and wanted to find positive associations. When Pearce et al. (2009) found that those who lived near a multi-national fast food outlet were less likely to be overweight than those who did not, they remarked that their finding was 'contrary to expectations'. Drichoutis et al. (2009) said that their findings showing that out-of-home food expenditure was inversely associated with body weight were 'surprising' and 'contrary to normative views'. Similarly, when Mazidi and Speakman (2017) found that obesity was inversely related to fast food outlet density, they described it as 'contrary to our a priori predictions'. Morland and Evenson (2009) said that their results 'were not in the direction hypothesised'. Rundle et al. (2009: 445-6) acknowledged that their failure to find a relationship between the density of 'unhealthy food' outlets and obesity was 'consistent with other studies in this area' but nevertheless said that they had 'hypothesised that increasing density of BMI-unhealthy food options would be positively associated with BMI'.

Social scientists rarely conduct research in the hope of finding nothing, so we should not be surprised by these hints of disappointment. The knowledge that some researchers may have been biased towards finding positive associations does, however, strengthen the case for there being no relationship between fast food outlet density/proximity and obesity. The majority of studies found no association despite the expectations - and, perhaps, the hopes - of their authors.

Conclusion

Public Health England (PHE) has actively encouraged 'public health professionals' to use 'regulatory and planning measures to address the proliferation of hot food takeaways'. In November 2013 it published a briefing paper (Cavill and Rutter 2013: 4) in which it said:

'Research into the link between food availability and obesity is still relatively undeveloped although a US study has found evidence of elevated levels of obesity in communities with high concentrations of fast food outlets.'

It is unclear which study the authors had in mind because the sole citation for this claim is an article in a nursing journal which provides no such evidence. Elsewhere in the briefing, PHE claims that there is an 'unavoidable lack of evidence' but cites one of the studies that found a link between fast food outlet density and BMI (Kruger et al. 2014, listed above). Despite the authors' claim that academic research was 'undeveloped', more than fifty studies looking specifically at the link between fast food outlets and obesity had been conducted by the time their briefing was published. The majority of them had found no association. PHE's decision to cite one study supporting its position while ignoring the weight of evidence - evidence that had already been summarised in two published reviews by 2013 - could only mislead the reader.

At least Public Health England paid lip service to the empirical literature. The British Medical Association did not cite any evidence when it called for a ban on new takeaway shops near schools in a 2015 report (BMA 2015). Nor was any evidence cited by the Mayor of London (2017: 260) when he launched his public consultation in December 2017. Instead, he simply asserted that: 'A wide range of health experts recommend restricting the proliferation of hot food takeaways, particularly around schools, in order to help create a healthier food environment'.

In their study of childhood obesity in Leeds, Griffiths et al. (2014: 3) remarked that it 'seems that current UK recommendations in relation to the influence of the "food environment" are driven largely on assumptions or speculations'. As this report shows, the belief that obesity rates can be lowered by restricting the number of fast food outlets is not evidence-based. It is a form of 'public health' folklore, easy to believe and superficially plausible, but ultimately disproved by a large body of research.

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