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Assessing the obesogenic environment of North East England

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ABSTRACT

This study examines the influence of the environment (defined as 'walkability', food availability and deprivation), alongside individual factors, on Body Mass Index (BMI) and fruit and vegetable consumption. The aim of this unique study was to objectively scrutinise the concept of the obesogenic environment in the North East of England.

A set of theoretical obesogenic indices based on the availability of food to consume within and outside of the home, residential density, street connectivity and land use mix were created for North East England. A pooled sample of 893 individuals (aged 16+) over 3 years (2003, 2004, 2005) from the Health Survey for England (HSE) was isolated for further analysis and correlation with the obesogenic indices.

Results suggest that few elements of both walkability and food availability are significantly associated with BMI and fruit and vegetable intake. Some methodological concerns are highlighted, such as the appropriateness of walkability calculations for rural areas. The study concludes by strongly recommending a multi-faceted approach be taken when trying to tackle current levels of obesity.

1. Introduction

Levels of obesity have increased three-fold in the last 20 years and predictions for the future of the obesity problem are becoming ever more pessimistic (Foresight 2008a). A recent report for the Department of Health found that 65% of men and 56% of women are currently overweight in the United Kingdom, with one third of all UK adults recognised as clinically obese (Zaninotto et al. 2006). Foresight models of future trends suggest that by 2050 "60% of adult men, 50% of adult women and about 25% of all children under 16 could be obese" (Foresight 2008b). The consequences of this will have an impact across society. This predicted rise in Body Mass Index (BMI) by 2050 will be associated with increases in diseases attributable to obesity including 30% increase for stroke, 20% for coronary heart disease and greater than 70% increase in type 2 diabetes (McPherson et al. 2007).

BMI as a measure is not without its weaknesses; amongst these criticisms, it is inappropriate for assessing weight status in children, the elderly, the pregnant, and those with a notable amount of muscle tissue, for example. However, the World Health Organisation (WHO) commends the use of BMI as a suitable measure of adiposity (World Health Organisation 2000), and it is one of the most commonly used assessments of weight status implemented in study designs as a result.

Driven by the increased availability of food and ever more sedentary lifestyles, this proliferation in levels of obesity is often referred to as the obesity 'epidemic' (Banwell et al. 2005). Foresight emphasise the need to curtail this epidemic by acting now and being proactive as opposed to taking no action and being reactive (Jeffery & Sherwood 2008; Swinburn & Egger 2002); preventing obesity is much more effective than treating it. The efficacy of 'treating' a rooted obesity problem is not the only issue for the government to remain aware of; in 2002 the estimated total annual cost of overweight and obesity was nearly £7 billion, by 2050 the anticipated wider costs of elevated BMI per annum is £49.9 billion with £6.1 billion of this as predicted extra NHS costs of obesity alone (McPherson et al. 2007). In theory, the cause of obesity is simple: greater energy consumption than expenditure leads to weight gain. This said, the true aetiology of obesity is very much open to debate and although genetics are known to play a part, the possible effect of the environment upon our BMI is regularly suggested (World Health Organisation 2000). It has thus been suggested that a "neighbourhood based approach could add to traditional individual level obesity interventions, which often ignore the environmental context that shapes our behaviours, especially when healthy foods or opportunities for physical activity are unavailable" (Black & Macinko 2008, 2).

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Fundamentally, "obesity results from an energy imbalance that occurs when energy consumption exceeds energy expenditure" so whilst examining the availability of food and its impact upon health, we must also investigate the role of the environment in encouraging or precluding energy expenditure through physical activity (Papas et al. 2007, 129). This is particularly important as "some individuals can avoid obesity in un-supportive [obesogenic] environments by maintaining a pattern of healthy behaviours" (Hill & Peters 1998, 1371). The negative effects of the environment upon individual level health is often referred to as the 'obesogenic environment', a concept led by the notion that our surroundings can drive an "automatic, unconscious influence…[upon] behaviour" (Brug et al. 2006, 528). Moreover, changing geographies mean that the obesogenicity of the environment is unlikely to be uniform and as a result it may be necessary to examine this variation in obesogenic 'exposure' within a framework of 'environmental justice'. It is possible that some populations are actually unfairly predisposed to being obese simply because of the 'obesogenic' environment in which they happen to live (Sexton & Adgate 1999). Despite the apparent poignancy of applying environmental justice to the study of obesogenic environments, no such explicitly focussed work exists in the field thus far (Bowen 2002). Where such a serious health outcome as obesity is concerned, however, we should rightly act to investigate these potential injustices (Bowen 2002; Cutts et al. 2009).

The environment is defined here as "all that is external to the individual", with the term 'built environment' referring to "aspects of a person's surroundings which are human-made or modified" (Papas et al. 2007, 129–130). This definition of the built environment often includes the availability of unhealthy food (such as fast food, which is frequently of a higher calorific value than food produced in the home), the socio-economic status of the neighbourhood (which may affect the quality of retail food outlets), and the extent to which an individual's surroundings may encourage physical activity through walking—the 'walkability' of the environment (Lopez-Zetina et al. 2006). Individually, these factors have been significantly associated and dissociated with outcomes such as BMI and food consumption in recent years, both in the UK and the global context (see Maddock 2004; Mehta & Chang 2008; Smith et al. 2005; Pearce et al. 2008; Cummins et al. 2005; Frank et al. 2004; Ewing et al. 2003; Leslie et al. 2005; Ellaway et al. 1997; Matheson et al. 2008; Burgoine et al. 2009). However, research has delivered little consensus as to what features of the built environment are having the greatest effects upon our health; despite convincing hypotheses, no factors have been *proven* to *consistently* affect our behaviours in a specific way. Furthermore, very few studies (if any) have attempted to address aspects of our environment that both influence consumption and physical activity (Townshend & Lake 2009). Additionally, there are few studies in this field situated in the UK context, a setting that is believed to be radically different to that found in the US and Australia, thus necessitating further research (Townshend & Lake 2009; Lake & Townshend 2006).

This study builds upon existing work by understanding the multitude of factors that constitute our 'environment' and examining how these factors act collectively upon BMI (overweight and obese), and fruit and vegetable intake. Both overweight and obesity are considered within this research as those that are overweight are more 'at risk' of obesity. A case study based approach was employed here, which utilised both primary and secondary data to create a set of theoretical maps of varying obesogenic environment elements. These indices allowed us to link the physical environment of the North East of England with the individuals (and their recorded behaviours) who resided there and to subsequently scrutinise this relationship. The hypotheses are four-fold: increased walkability will be negatively associated with overweight/obesity; increased food availability will be positively associated with overweight/obesity; increased food available to purchase out of the home will be positively associated with increased levels of fruit and vegetable intake; and increased levels of food available to consume out of the home will be negatively associated with levels of fruit and vegetable intake.

2. Methods

Obesogenic indices were created for the study area, which was delimited to the North East of England. The indices were as follows:

- availability of food that is generally consumed outside of the home;
- availability of food that is generally consumed (or at least prepared) within the home;
- residential density;
- street connectivity;
- land use mix.

The latter three are common components in deducing theoretical 'walkability', the extent to which our surroundings may encourage physical activity through walking. These measures have been chosen primarily because there has been limited research linking them to obesity in the UK context, although they have been shown on numerous occasions to relate to obesity in other countries and settings. Socio-economic status was assessed at the area level by means of the 2004 Index of Multiple Deprivation (IMD), provided with the Health Survey for England (HSE) data. IMD is a composite measure of deprivation that summarises information on employment, living environment, crime, health, education, income and housing at the small area level throughout the England (Noble et al. 2004; Cummins et al. 2005). The above indicators were calculated at the Lower Super Output Area (LSOA) level – a statistical area below that of the electoral ward level, containing approximately 1500 individuals – using boundary data available from the EDINA Digimap collections (edina.ac.uk/digimap). Overall, LSOAs were deemed the most appropriate for this study as they allowed a sufficient level of detail to be achieved whilst still allowing for the analysis of larger patterns and trends. The steps involved in calculating these measures are detailed as follows.

2.1. Assessing the foodscape

Data on the foodscape were sourced from the 2007 Yellow Pages using methods described in detail in Burgoine et al. (2009) and Lake et al. (2010). The street addresses for all food retail outlets were noted systematically for the entire North East England region and full postcodes were subsequently obtained using Yell.com (all addresses were matched to a full postcode). Food outlets were classified as either 'food to be consumed out of the home' ('pizza delivery and takeaway', 'takeaway' and 'restaurant' Yellow Pages categories combined) or 'food bought out of the home' ('supermarkets' and 'greengrocers and convenience stores' Yellow Pages classifications combined) based on the likely site of preparation/consumption of the food.

The locations of the food vendors were geocoded and mapped using ArcGIS 9.2 (ESRC Inc., Redlands, CA). Only 3 of 1463 postcodes (0.2%) were unable to be matched to a geographical location. Due to many LSOAs containing no food outlets, the number of food outlets was subsequently aggregated at the larger Middle Super Output Area (MSOA) level. Population data for MSOAs was sourced from the 2001