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Exploring the relationship between childhood obesity and proximity to the coast: A rural/urban perspective

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ABSTRACT

Childhood obesity is one of the 21st century's most serious global health challenges. Research suggests that better access to 'greenspace' (e.g. parks) may encourage physical activity and reduce the risk of obesity amongst children. We extend earlier work by considering childhood obesity in relation to proximity to the coast, using data from England's National Child Measurement Programme. Results suggest that although the overall prevalence of childhood obesity is slightly lower at the coast (−0.68% points comparing <1 km to >20 km, $p<0.001$), the relationship depends on area type. Specifically, although a coastal proximity gradient (lower obesity rates nearer the coast) was found for rural areas and smaller cities and towns, it was not present among large urban conurbations (interaction p-value <0.001). Coastal environments and access to them are changing in many areas, and research to explore potential impacts on child health is warranted.

1. Introduction

The World Health Organisation (WHO) (2009) considers childhood obesity to be one of the greatest contemporary global challenges. The National Health Service (NHS) (2008) estimates that in the UK there are currently one million children under the age of 16 years who are obese. Without intervention, they warn that 90% of the UK's children could be overweight by 2050 (NHS, 2008). Childhood obesity has been shown to lower children's quality of life, to cause serious health consequences (Waters et al., 2011; Tsiros et al., 2009) and is also a highly influential determinant of adult obesity (Biro and Wein, 2010; Flodmark et al., 2004; Reilly and McDowell, 2003). Reducing childhood obesity has therefore become a key target for the UK government (Department of Health, 2011).

Childhood obesity is influenced by a complex web of factors ranging from genetics to the sociocultural environment (Foresight Programme, 2007). However, when considering the rapid increase in obesity over the last 30 years, an overriding effect of the environment (broadly defined) is suggested, since changes have surpassed the time-scale of genetic evolution (Thigpen, 2004). One of the most influential environmental predictors of childhood obesity is socio-economic status. For instance, the National Obesity Observatory (NOO) (2012) report that children from the most deprived areas in England were almost twice as likely to be obese than children from the least deprived areas.

Regional and urban/rural differences in childhood obesity prevalence have also been reported. For instance, the Marmot (2010) review suggests a North/South divide in England, but found the biggest inequalities in childhood obesity to be within London. Within the debate regarding whether urban or rural environments are most conducive to obesity, research outcomes have remained ambiguous (Thigpen, 2004). In the UK, the National Child Measurement Programme (NCMP) outcomes from 2012/13, found that children from urban areas had higher levels of obesity than their rural counterparts (Health and Social Care Information Centre (HSCIC), 2013). Ridler et al. (2011) however, suggest that the urban/rural divide in obesity is indistinct. They argue that although urban areas are more conducive to childhood obesity, they found that some affluent urban communities had the lowest levels of childhood obesity in England.

In contemporary research and policy, physical environmental influences on childhood obesity have received considerable attention (e.g. Edwards et al., 2010; Dunton et al., 2009; Evans et al.,

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2012), particularly regarding active environments (Wheeler et al., 2010; Park et al., 2011; Kyttä et al., 2012). Research has typically focused on how greenspace (e.g. parks, natural woodland or grassland) may promote physical activity and thus, potentially deter the development of obesity (Bell et al., 2008; Park et al., 2011). For instance, Coombes et al. (2010), Roemmich et al. (2006), and Veitch et al. (2005) conducted studies examining this hypothesised relationship within the UK, US and Australia respectively. They suggested that children living in closer proximity to parks or with access to gardens were more likely to partake in regular physical activity. In contrast, Wheeler et al.'s (2010) study of children's physical activity using GPS tracking and accelerometers in Bristol, UK, reported that most physical activity amongst children is not conducted in greenspace, but rather in non-green urban areas. However, they found that when children, particularly boys, played in greenspace, activity was more intense. This gender difference is consistent with Sanders et al.'s (2015a,b) longitudinal study in Australia, which suggested that increased neighbourhood greenspace is predictive of lower body mass index (BMI) and higher moderate to vigorous physical activity only in boys, but not girls. How access to greenspace in turn affects childhood (or boys') obesity is disputed. For instance, Potestio et al. (2009) found that proximity to community parks in Canada was not associated with reduced levels of childhood obesity. However, Cetateanu et al. (2014) analysed NCMP data and found that childhood obesity prevalence was inversely associated with greater greenspace density in England.

An emerging body of research, much of it from Australia, has found similar health benefits linking proximity to bluespace (i.e. aquatic environments such as rivers, lakes and the coast) and physical activity (e.g. McCormack et al., 2008; Ball et al., 2007). One of the most influential studies was conducted by Bauman et al. (1999). They found that individuals residing within coastal postcodes in Australia were 38% more likely to undertake vigorous exercise, 27% more likely to partake in levels of physical activity adequate for health and 23% less likely to behave sedentarily, than individuals residing outside coastal postcodes. They named this phenomenon the 'coastal effect' (Bauman et al., 1999, 322). However, these findings are based on self-reported survey data, therefore they could be influenced by self-reporting bias. Furthermore, a study in China found that children residing in Northern coastal regions had the highest obesity prevalence. However they attribute this association to affluence in the coastal areas, linking with the fast development of China and the increased nutrition available for children (Ji and Cheng, 2009).

The relationship between physical activity, health and coastal proximity is of particular importance in England since it is bounded by approximately 4000 km of coastline (Department for Environment, Food and Rural Affairs, 2007). Studies regarding the 'coastal effect' for the UK are limited, but are suggestive of a similar outcome. In a qualitative study, Ashbullby et al. (2013) found that in the UK beaches provided an opportunity for families to engage collectively in physical activity. Furthermore, a cross-sectional study based on interviews with over 180,000 residents of England, indicated that those living closer to the coast were more likely to self-report achieving recommended physical activity levels, and that this was mediated by visits to the coast (White et al., 2014). Furthermore Elliott et al. (2015) report that overall adult energy expenditure is greater when visiting coastal environments, in comparison to the countryside or urban greenspace, due to the relatively longer duration of the visit. These are set in the context of a study by Wheeler et al. (2012) indicating that self-reported good general health was higher with proximity to the coast and that this effect was stronger for urban and more deprived communities, hypothesising that this could be attributed to greater opportunities for physical activity and stress reduction.

However, both physical and socio-economic access have been shown to influence the degree to which a community benefits from the resources of natural environments, and Natural England (2011) suggest that perceived access to natural environments is often more pervasive than physical proximity. For instance, Babey et al. (2007) and Taylor and Lou (2011) in the US found that for children living in deprived neighbourhoods, perceptions of whether greenspace was considered safe determined the likelihood of the associated physical activity within these areas. Furthermore Ashbullby et al. (2013) found that car availability and the cost of parking was a key barrier to visiting the seaside. In addition, public transport and opportunities for active travel may be limited within rural settings (Pateman, 2011).

Using secondary data from the NCMP, this paper builds upon Cetateanu et al. (2014) childhood obesity and greenspace study and the emerging bluespace and health literature to examine the relationship between childhood obesity and proximity to the coast. Additionally, since the NCMP outcomes from 2012/13 found that children from urban areas, in general, experienced higher levels of obesity than their rural counterparts (HSCIC, 2013) and Wheeler et al. (2012) found a stronger effect of coastal proximity on health and wellbeing in urban areas, the relationship is tested for modification by urban/rural location.

2. Methods

The availability of a relevant, small-area dataset (from the NCMP) provided the opportunity for a cross-sectional ecological approach based on a very large sample, with which to examine the association between childhood obesity and coastal proximity.

2.1. Study population and geographical scale

The NCMP is run annually by the HSCIC and measures the weight and height of children between the ages of 4–5 and 10–11 years in England. The NCMP dataset is the most representative nation-wide dataset regarding childhood obesity prevalence, with 93% of children per eligible state school taking part in 2012/13 (HSCIC, 2014). The study population (n=1,475,617) were children aged between 10 and 11 years, with childhood obesity prevalence (BMI $\geq$ 95th percentile) as the outcome. The NOO (2014) combined the latest three years of NCMP data – 2010/11 (n=495,353), 2011/12 (n=491,118) and 2012/13 (n=489,146) – thereby increasing the number of child measurements per area, which has been shown to produce more statistically significant variances in obesity prevalence (Dinsdale and Ridler, 2011).

NCMP data were available in aggregate form for 2001 Census Middle-Layer Super Output Areas (MSOA), and these were therefore used as the geographical unit of analysis. MSOAs have been argued to represent the most appropriate scale for robust small-area estimates for the NCMP dataset (Dinsdale and Ridler, 2011). In England there are a total of 6781 MSOAs (at 2001), with a mean population of 7200, a minimum population of 5000 and a maximum population of 15,000 (Office for National Statistics (ONS), 2011a). MSOAs, unlike electoral wards/divisions, are designed to have approximately consistent population size, and are generally not subject to temporal boundary changes. Furthermore, they group socially similar households and consider local infrastructure. Their comparability and stability are therefore beneficial for this type of analysis (ONS, 2013).

2.2. Primary exposure variable

The primary exposure variable for this study was coastal proximity. For the purpose of this paper, coastal proximity was