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## Economic growth and obesity: An interesting relationship with world-wide implications

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## ABSTRACT

The prosperity of a country, commonly measured in terms of its annual per capita Gross Domestic Product (GDP), has different relationships with population levels of body weight and happiness, as well as environmental impacts such as carbon emissions. The aim of this study was to examine these relationships and to try to find a level of GDP, which provides for sustainable economic activity, optimal happiness and healthy levels of mean body mass index (BMI). Spline regression analyses were conducted using national indices from 175 countries: GDP, adult BMI, mean happiness scores, and carbon footprint per capita for the year 2007. Results showed that GDP was positively related to BMI and happiness up to ~\$US3000 and ~\$5000 per capita respectively, with no significant relationships beyond these levels. GDP was also positively related to CO<sub>2</sub> emissions with a recognised sustainable carbon footprint of less than 5 tonnes per capita occurring at a GDP of <\$US15,000. These findings show that a GDP between \$US5 and \$15,000 is associated with greater population happiness and environmental stability. A mean BMI of 21–23 kg/m<sup>2</sup>, which minimises the prevalence of underweight and overweight in the population then helps to define an ideal position in relation to growth, which few countries appear to have obtained. Within a group of wealthy countries (GDP > \$US30,000), those with lower income inequalities and more regulated (less liberal) market systems had lower mean BMIs.

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### 1. Introduction

We have previously proposed an ecological model for understanding obesity, which suggests that changes towards a more ‘obesogenic’ environment explain the rise of the obesity epidemic over the past three decades (Egger and Swinburn, 1997). While this concept is now widely accepted (Katan et al., 2009; Sassi, 2009), there are clearly layers of environmental influence, which Rose

(1992) referred to as the ‘causes of the cause’. The immediate or proximal environments,<sup>1</sup> which influence changes in energy intake and physical activity levels,

<sup>1</sup> **‘Drivers’** are the key linear forces behind disease causality. They range from **proximal** (i.e. more immediate to the disease), to **distal**. Obesity, for example, has proximal drivers of energy over-consumption, medial drivers of obesogenic food environments and distal drivers of economic policies. **‘Mediators’** are influences on the causal pathway (e.g. agricultural subsidies for fat/sugar, lower cost for manufacturing, lower retail prices, increased consumption of high fat/sugar foods); **‘moderators’** accentuate or attenuate factors on the causal pathway (e.g. the built environment or cultural impacts on health behaviours), and **‘enablers’** are conditions allowing causal factors to be exhibited (e.g. sufficient disposable income to permit over-consumption of food).

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include the food environment, the built environment, and the entertainment environment – especially small screen technology. These food and activity environments can operate close to people in settings (such as homes, schools, supermarkets, neighbourhoods) or at more of a distance in sectors (such as food production, food marketing, transportation systems) (Swinburn et al., 1999). The next layers of environments, the medial drivers, are generally societal in nature.

### 1.1. Obesity and inequality

Several researchers have studied the effects of socio-economic position as a key determinant of chronic disease, including obesity. Marmot and colleagues, for example (Marmot et al., 1991; Elovainio et al., 2009; Stringhini et al., 2010, 2011), have shown the impact of income inequality on a range of health and social problems. More specifically, Pickett et al. (2005) and Wilkinson and Pickett (2010) have shown a relationship between income inequality, as measured by the ratio of the difference between the richest and poorest 20% of income earners (RP20) and obesity in OECD countries, but no relationship between obesity and average income.

### 1.2. Obesity and economic insecurity

More recently, Offer et al. (2010) used 96 data sets from 11 high-income countries over the ten years from 1994 to 2004 to test the effects of inequality and other factors relating to the connection between affluence, welfare regimes and obesity. They showed that while income inequality, and the relative price of ‘junk food’ (food ‘shock’), were related to population obesity prevalence, the relationship was much stronger using a measure of economic insecurity based on a weighted composite of four sub-indices: insecurity from unemployment, illness, single parent poverty, and poverty in old age. Offer et al. also showed that economic insecurity and obesity prevalence were greater in a group of wealthy (mainly English speaking) countries they classify as ‘market-liberal’ (US, Australia, Canada, NZ, UK, Ireland) compared to a group they rate as ‘non-market liberal’ (Norway, Sweden, Finland, Denmark, France, Germany). Market liberalisation here refers to the level of regulatory constraint on commerce and level of social spending and market governance, which predominate within a country.

Offer et al. (2010) suggest that market-liberal reforms stimulate greater competition in both labour and consumption markets, and that this undermines personal stability and security, affecting body weight, particularly amongst those lower down the social scale. A mediator hypothesised for this is stress, stemming from class inequalities and lack of trust. Offer et al. propose that inequality, which is a social attribute, and economic insecurity, which is a personal one, could be different, but inter-relating mediators predisposing to obesity within a country, driven by the form of market governance (‘liberal’, or minimally regulated vs ‘non-liberal’ or more regulated) of that country.

### 1.3. Obesity and economic growth

This type of evidence points to an even deeper layer of distal environmental driver of obesity. Modern, market-based economies have at their core a drive for economic growth, so much so that increasing the annual per capita Gross Domestic Product (GDP), the most commonly used indicator of national improvements in prosperity, has become a dominant political objective. A common way of achieving this is through increasing consumption (including eating more, and buying more entertainment and energy saving devices). But the more effective companies become at selling products and services (and thus contributing to GDP), the higher the likelihood that beneficial consumption could tip over into over-consumption. The links from here to obesity, through an over-consumption of food energy (Hall et al., 2009; Swinburn et al., 2009), and to climate change, through over-consumption of fossil fuel energy (Delpeuch et al., 2009; Egger, 2008; Egger and Swinburn, 2010), appear obvious, but have barely been explored. Socio-economic inequalities and economic insecurity for substantial proportions of the population also so appear to be an outcome of less regulated or more ‘liberal’ market-based economies (James, 2008).

Clearly, economic growth is currently a primary means by which low-income countries can lift themselves out of poverty. It has also undoubtedly been one of the single biggest influences on health improvements throughout human history (Riley, 2001). However, by the law of diminishing returns, beyond a point, the benefits from continued economic growth start diminishing and ‘costs’ start rising (Egger, 2009). We have thus postulated that there may be a theoretical GDP which is high enough to produce good health, sufficient prosperity and happiness, but not so high that it produces the overconsumption problems of obesity and an unsustainable carbon footprint (Egger and Swinburn, 2010). The primary aim of this paper is thus to examine the possible relationship between GDP and obesity, using cross-sectional data from 175 countries. A secondary aim is to identify an ideal level of per capita GDP within a country for optimal levels of body weight, human happiness and sustainability. A third aim is to assess the effects of different forms of market governance on obesity. Because of the available data, this latter analysis is confined to upper income countries.

## 2. Materials and methods

### 2.1. Data sources

GDP and social inequality data were obtained from the Human Development Report (UNDP, 2010) and mean national body mass index (BMI) data from the Global Burden of Metabolic Risk Factors of Chronic Diseases Collaborating Group (Imperial College, 2011). Social inequality values were calculated as the ratio between the richest and poorest quintiles (RP20) of average income as reported in the Human Development Index (UNDP, 2010). The analysis year was 2007 unless otherwise indicated. Countries used in the analysis ( $n = 175$ ) were

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