Research on obesity – time to think about the next agendas

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ABSTRACT

Purpose: The purpose of this paper is to highlight a fundamental gap in the economic research on obesity - the demand for unnecessary weight gain preventive goods. Such research is important as it will provide understanding of people's preventive behaviours and for that matter inform policies and practices with regards to influencing people's uptake of obesity preventive goods.
Materials and methods: Using MeSH and PICO approaches, a search strategy was developed to search for relevant articles in a number of academic and scientific journal repositories including PubMed Central, EconLit, Medline, Medscape and relevant (economic) journals' archives. The search strategy combined terms/phrases to look for publications.
Results: A total of 1351 potentially relevant articles (titles and abstracts) were reviewed. No publications could be found that concerned people's preventive behaviours in terms of demand with respect to obesity preventive goods. Only one article which was not specific to obesity looked into people's preventive behaviours using an economic model.
Conclusions: Despite the huge economic and health burden of obesity, participations in activities deemed supportive to weight gain prevention are dismal. It must not therefore be assumed that there will be demand for all effective weight preventive goods/services. As a result of the complex nature of the condition, the demand for obesity preventive goods requires understanding of the complex factors which influence individual decisions. The behavioural economic perspective could help to increase understanding of the preferences of people as it examines how decisions are made by individuals in complex socio-economic and socio-cultural circumstances and financial constraints involving trade-offs.
Key words: Obesity, overweight, demand, economics, prevention, preventive goods.

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INTRODUCTION

Overweight and Obesity, defined by the World Health Organisation as "abnormal or excessive fat accumulation that presents a risk to health [1]," and widely measured as Body Mass Index (BMI) of 25-29.9 for overweight and ≥30 for obese, are among leading causes of preventable morbidity and mortality in the United Kingdom (UK) [2-5] and worldwide [6,7]. Being both a major risk factor for several chronic diseases [3, 8-41], and a condition of its own with severe impact on Health Related Quality of Life (HRQoL) [11, 38, 42-50], the health and economic implications of the pandemic are enormous. Estimates suggest that overweight/obesity and related illnesses cost healthcare systems around the world millions of pounds annually [17,25,28,32].

Since obesity (used from here to collectively refer to overweight and obesity unless otherwise stated) is generated by energy imbalance between calories consumed and expended, that highlights its behavioural nature. In that respect, the risk of obesity related morbidity and mortality can be reduced through preventive behaviours. To date, studies into the understanding of preventive behaviour and its determinants have been examined mainly from psychological and sociological perspectives [10,14,26,31]. Most of these, which were not specifically on obesity, centre on the Health Belief Model (HBM) [14] which has several limitations.

Preventive health behaviours refer to the actions to prevent the development of ill health. These actions involve consumption of goods which reduce risks of future ill health. Such goods have been defined as "preventive goods"[14] and mainly fall under economic disciplinary research. As a behavioural science, economics considers consumer behaviour in the context of utility theory. However, this conventional utility theory cannot fully explain people's behaviours with regards to obesity prevention as there are many other factors at play.

Economists have paid little attention to why the uptake of weight reduction activities is low and there remains a need to gain an understanding of the behaviours of both the obese population and those of normal weight with regard to individuals' demand for preventive goods. The aim of this paper is to search relevant publications which address the issue of why some people demand obesity preventive goods whilst others do not i.e. why people behave the way they do with regard to demanding abnormal weight gain preventive goods. The main objective therefore, is to highlight a fundamental gap in the economic research on obesity - the demand for unnecessary weight gain preventive goods.

This paper begins by putting the pandemic into context in terms of its health and economic impact. In highlighting the gap in economic research and how it should be approached, this work provides a synopsis of research initiatives thus far on the drugs development front. This synopsis has been provided because any eventual successes in developing effective anti-obesity drugs will still be subjected to evaluations not just in terms of their effectiveness and likely impact on scarce healthcare resources but most importantly for purposes of their possible introduction into healthcare and their ultimate uptake by the population.

CONTEXT

The morbidity and mortality impact of obesity has been well documented [8,15,19,24,36, 38,39,41]. It is a risk factor for a range of conditions including vitamin D and B12 deficiencies [9, 11, 18, 40], endometrial, breast and colon cancers, type 2 diabetes, dyslipidemia, coronary heart disease, hypertension, deep vein thrombosis and pulmonary embolism, menstrual abnormalities, polycystic ovarian syndrome, infertility, erectile dysfunction, sleep apnoea, asthma, gastro-oesophageal reflux, mental disorder, arthritis, musculoskeletal disorders, depression and reduced libido [8,13,15,16,20-23, 27,29,33, 35,36,39,42-57]. Obesity has also been established as a condition of its own with severe impact on HRQoL [20,44,58-66].

The above impacts have huge implications on healthcare resource use and economies as a whole around the world [25,28, 39, 67-79]. In 2003, the annual extra medical costs of obesity in the United States (US) were estimated to be about $75 billion [80] equivalent to about 4–7% of its healthcare expenditure [81,82]. Some five years later, it was estimated to have added about $147 billion to the country's healthcare costs [83].

In most countries other than the US, obesity accounts for approximately 1 - 3% of total healthcare expenditure [32]. The aggregated costs of obesity in Canada is estimated to be from $1.27 to $11.08 billion [84]. In the UK, the Health Select Committee of the House of Commons suggested that the total annual cost of obesity could be around £6.6–7.4 billion [25].

MATERIALS AND METHODS

PubMed Central, EconLit, Medline, Medscape and relevant (economic) journals were searched together with references cited in identified articles.

Using both Medical Subject Headings and PICO (Participants or Population, Intervention or

Exposure, Comparison and Outcome) [85] methods, a search strategy was developed. This combined the terms obesity, overweight or weight gain, with any of the following terms/phrases: 'economics', 'prevention', 'diet', healthy diet', 'calories', 'preventive goods', 'demand', 'physical activity', 'preventive goods demand', 'cost of illness', 'healthcare costs', 'costs and cost analysis' and 'employer health costs' for example 'obesity – physical activity'. The search was not restricted to any date or any specific country or geographical region.

RESULTS

In total, 1351 potentially relevant articles (titles and abstracts) were reviewed. Only one article looked at demand for physical activity interventions provided by the healthcare sector in Östergötland County of southern Sweden [86]. This population based survey found that only about 25% of the adult population was physically active and that higher activity levels were associated with younger age groups, higher education levels, higher income levels, and lower BMI. Hughes et al's [71] paper looked at physical activities facilities availability and use by older adults (≥65 years old). Four other articles explored motivations for physical activities [87-90] and established that long-term participants in physical activities do it for intrinsic purposes and not necessarily for prevention motives.

Other than Leijon et al. [86] and Hughes et al. [71] which only discuss participation/ involvement in physical activities, no publications could be found that concerned the main area of interest i.e. people's preventive behaviours in terms of demand with respect to obesity preventive goods. Only one article [14], which was not specific to obesity, looked into people's preventive behaviours using an economic model. The rest of the papers dealt with the economic burden of obesity pandemic or the evaluation of the various obesity related interventions including drug treatments and surgery.

The economic burden

Much is known about the economic impact of obesity, its cost of treatment, and the economic evaluations of various intervention programmes. The understanding of economic impact and the economic rationale for interventions have also been well presented [91-95]. While most of the economic studies are model based, others have been conducted along well designed trials and in real life healthcare situations.

Tsai et al. [96], based on their review inclusion criteria, identified 33 studies [36, 39, 47, 56,63, 67,70,72,76,78,79,81,97-117] published between 1992 and 2008 which reported on the cost of overweight, the cost of obesity and on the cost of overweight and obesity combined using BMI as the standard measures. The review estimated cost of overweight and obesity per-person in the US to be about $498 and $1630 respectively. Using the most recent US data, Finkelstein et al. [105] reported that obese patients incur 46% increased inpatient costs, 27% more physician visits and outpatient costs, and 80% increased spending on prescription drugs compared with normal-weight individuals. Tarride et al's [118] recent study in Ontario, Canada also found similar associations between obesity and "negative impact on health and higher health care costs for adults."

Besides medical costs, there are obesity associated indirect costs borne by society as a result of, for example, work absenteeism and reduced productivity, early retirement and pension payments, decreased years of disability-free life, and increased premature mortality before retirement and the resulting inadequate human resources supply problems [119]. If these indirect costs are factored, the estimated costs would be even much higher.

Surgery

Bariatric surgical procedures are relatively effective for long-term weight loss. However, these surgical procedures are invasive, are often associated with complications [120,121] and are mostly restricted to patients with morbid obesity conditions (i.e. with a BMI of 40 kg/m^2 or higher) and those with obesity-related complications [122]. Anti-obesity drugs are also frequent adjuncts as they have limited long-term effects [60] and the weight is often regained when treatment is discontinued in the absence of any sustained behavioural modifications.

As per Anderson et al's study [123,124] and the review by Clegg et al. [125], surgery was found to be cost effective in the long-term at £11 000 per Quality Adjusted Life Year [71,125] compared with nonsurgical management. The results of the comparisons of different types of surgery were however equivocal [125].

Anti-obesity drugs

Anti-obesity drugs can be generally categorised into two broad groups according to their mode of action [126] - those that help to reduce energy consumption and those that stimulate energy expenditure. Research into the development of anti-obesity drugs has been undertaken for decades now. However, because of the complex nature of obesity, the development of anti-obesity drugs has not been a success story as such. Few of the drugs have successfully entered the market or made it through clinical trial stages.

In fact, most that have entered the market have been withdrawn as a result of poor safety records. Life-threatening safety concerns led to the withdrawal of many drugs including Aminorex® in 1968, Fenfluramine® and Dexfenfluramine® in 1997, and Phenylpropanolamine® in 2000 [127, 128]. Table 1 provides information on the various anti-obesity drugs and their status.

Table 1. Anti-obesity drugs and their status.

Drug	Trade Name	Mode of Action	Status (Availability)	
			European Union	United States of America
Orlistat	Xenical	Lipase inhibitor	Available	Available
Orlistat	Alli (OTC)	Lipase inhibitor	Available	Available
Phentermine	Duromine, Ionamin	NA/DA releasing agent	Withdrawn in 2001	Available
Methamphetamine	Desoxyn	NA/DA releasing agent	Withdrawn in 2000	Available
Benzphentamine	Didrex	Sympathomimetic	Withdrawn in 2000	Available
Phendimetrazine	Bontril	Sympathomimetic	Withdrawn in 2000	Available
Diethylpropion (amfepramone)	Apisate, Tenuate	Sympathomimetic	Withdrawn in 2000	Available
Sibutramine	Reductil, Meridia	NA/5-HT re-uptake inhibitor	Withdrawn in 2010	Withdrawn in 2010
Rimonabant	Acomplia	CB_1 antagonist	Withdrawn in 2008	Did not get approved
Phenylpropanolamine	Accutrim, Dexatrim	Sympathomimetic	Withdrawn in 2000	Withdrawn in 2000
Fenfluramine	Pondimin, Ponderax	5-HT releasing agent	Withdrawn in 1997	Withdrawn in 1997
d-Fenfluramine	Redux	5-HT releasing agent	Withdrawn in 1997	Withdrawn in 1997
Aminorex	Aminoxaphen, Aminoxafen, Menocil, Apiquel	Unknown/NA	Withdrawn in 1968	Withdrawn in 1968
Zonisamide	Zonegran	Anti-convulsant agent	Mainly used for epilepsy treatment	At clinical trial phases (phase 3). Use not to exceed 400mg/day
Topiramate* + Phentermine	Qsiva (EU) Qsymia (US)	Unknown/NA + DA releasing agent	Did not get approval	Approved

Sources of data: Vetter ML, Faulconbridge LF, Webb V, Wadden TA [Nat Rev E Endocrinol, 2010 Oct. 6(10):578-588]; Heal DJ, Gosden J, Smith SL [Neuropharmacology, 2012 Jul. 63(1):132-146]; Powell AG, Apovian CM, Aronne LJ [Clin Pharmacol Ther, 2011 Jul. 90(1):40-51]; Ioannides-Demos LL, Proietto J, Tonkin AM, McNeil JJ [Drug Saf, 2006 Apr. 29(4):277-302]; The European Medicines Agency; US Federal Drugs Administration. *Topiramate alone is marketed in the EU under various names for treatment of epilepsy, partial and generalised seizures

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Currently, approval has been obtained for clinical use for only a few drugs mainly Orlistat [128-131]. Nonetheless, anti-obesity drugs development efforts are still continuing. There are currently a number of drugs in development or at trial phases including Zonisamide + Bupropion and Lorcaserin (APD356) [129].

As a result of the limited effectiveness of anti-obesity drugs and the safety and cost concerns

of surgical interventions, we tend to rely on behavioural modification interventions for sustained lifestyle changes and therefore for obesity prevention and management.

Behaviour change interventions

Several weight reduction/maintenance interventions have been subjected to economic evaluations. In the UK, weight problems are usually managed either within the National Health Service primary care sector or in private sector clinics through advice on weight control and management, physical exercise, lifestyle modifications and diet. Specialist services such as very low-calorie-diets (VLCD) are also available. Most of the economic evaluations which assessed these interventions have used different perspectives and analysed effectiveness in terms of changes in the HRQoL gained from a change in BMI for the study participants [54,125,132-142].

Obesity and HRQoL

Obesity's effect on mobility (a key factor in the assessment of HRQoL) is overtly observable. Its impact on HRQoL is independent of any related medical conditions or risks. The effect of obesity on HRQoL has been evaluated using generic instruments as well as those specific to weight [20,58, 61,65,66,143-145] such as EQ-5D and Impact of Weight on Quality Of Life Questionnaire (IWQOL). Studies [20,65,66,143-145] have demonstrated that obesity significantly impairs HRQoL.

While the studies have been consistent on its impact on the physical HRQoL component, there have been mixed findings with regards to the psychological HRQoL component. Mhuchu et al. [64], Wiczinski et al. [144], van Nunen et al. [66], and Swallen et al. [65] found significant effect of overweight and obesity on physical functioning related HRQoL but no links with the psychological component. These papers advanced no reason for the lack of relationships between BMI and the psychological HRQoL. While some attribute this to the non-obesity-specific instruments used in the research [61], others suggest that it is likely to be related to the acceptance of the condition by the society[65]. Jia et al. [20] did not report on the psychological component but found significant correlation between BMI and physical HRQoL. In addition to its impact on the physical HRQoL, Kolotkin et al. [61], Fontaine et al. [58], Wille et al. [145], Blissmer et al. [143] and Hassan et al. [59] found significant relationship between obesity and mental/psychological HRQoL. Confounding variables such as age, sex and socioeconomic factors were included in the assessments of most of the studies and were found to have effects on obesity HRQoL outcomes.

Clinicians, health service managers and policymakers have recognised the importance of HRQoL measurements to inform patient management, programme and policy decisions. A number of instruments have been developed for the purpose of HRQoL research. However, not all the instruments are preference-based which is a requirement for their use in healthcare economic evaluations. The relationship between (time) preference and obesity is crucial because an individual's intertemporal choice could be the ultimate cause of most behaviours that lead to weight related problems. Intertemporal choice is a decision people make between two or more goods which have their payoffs at different times. For instance, most weight reduction interventions require individuals to stop consuming unhealthy foods now and/or adopt an active lifestyle now in order to gain future health gains. A strong preference for immediate enjoyment gained from unhealthy foods and/or sedentary lifestyle over future health benefits could influence people's susceptibility to abnormal weight gain.

DISCUSSIONS

There have been many studies into the understanding of the nature of obesity in terms of its causes, psychological effects, health impact and risk factors, economic impact and the evaluation (both economic and clinical) of its various interventions. Significant advancements have also been made in the fight against the condition. Among the significant strides are the surgical treatments [122,125,132,134,146] and the knowledge that adipose tissues are endocrine organs [147-149] i.e. they produce hormones. It is hence hoped that these biomedical advancements will sooner or later lead to a discovery of drugs that can permanently manipulate our genes or hormones to prevent the development of unnecessary weight.

Despite important advances in the medical, public health, and drugs developments and the efforts to develop lasting and more effective solutions, an important question remains unexplored in economic research. Considering the economic, cultural, environmental, psychological and the health complexities of the condition, even when an effective solution has been found the fundamental question will be whether there will be demand for it. There are many intervention programmes being undertaken around the world [34] at private and public sector levels as well as efforts through international collaborations [34, 150-152] geared towards ameliorating the epidemic. However, uptake of these programmes remains low and they do not have lasting effects – a testimony to the challenges faced by public

health practitioners in securing adherence to obesity prevention guidelines.

In most cases, pharmaceutical firms use modelling to assess the possible demand and affordability in the pricing mechanisms of their products and its eventual introduction into the healthcare [153]. Such models primarily consider the effectiveness of the product, the incidence/ prevalence of the concerned disease, the target population (including their socio-economic characteristics) and the alternative options available [153]. However, obesity is incredibly complex and many additional variables will have to come to play in considering matters of demand for its preventive goods.

There is much focus by healthcare policy makers on the provision of supportive environments for individuals to help them make healthier choices. In the UK, the government seems to concentrate on providing public health messages promoting the consumption of recommended daily fruits/vegetables and food labelling[5, 12, 30, 37, 51]. Even though these public health approaches are important in any policy approach in controlling the pandemic, another fundamental area that the UK's regional/devolved governments need to give priority to, is an understanding of the drivers that make some people have higher demand for preventive goods than others. To what extent is their demand affected by budget constraints, to what extent are they utility maximisers and what other variables are also at play? These issues are underexplored in economic research.

Conventional economics uses utility and intertemporal choice theories in the analyses of consumer behaviours particularly when it involves choices between goods whose payoffs arise at different points in time. Discounted Utility Model is the most widely used tool for the analysis which has several limitations including issues of rationality and hyperbolic discounting. Besides these limitations, utility theories cannot fully explain people's behaviours with regards to obesity preventive goods. Utility is generally described as the satisfaction (enjoyment) gained from the consumption of a good/service, but the utility gained from the consumption of obesity preventive goods may not necessarily be instantaneous. In some situations people get no immediate enjoyment from consuming obesity preventive goods with all benefits occurring in the future. In these cases demand can be said to be wholly based on utility-in-anticipation [14] rather than conventional utility-in-us [14].

Psychological approaches which mostly use HBM to understand people's health behaviours also have several limitations that can limit its use in understanding individual's preventive behaviours in the context of obesity. For example HBM does not account for other factors that influence people's acceptance or otherwise of a health behaviour such as the person's attitudes, habitual behaviours (e.g. addictions), issues of social acceptability (hence stigma), cultural factors and beliefs, environmental and socio-economic factors which may promote or otherwise the required action.

This review has identified only one study [14] which provides some understanding of people's preventive behaviours using a utility model. Although the paper is not specific to obesity, it can be useful for further empirical research into the understanding of people's demand for obesity preventive goods. The paper identified 15 variables as the determinants for people's preventive behaviours. It argued that "the primary motivating factor in preventive behaviour is the anxiety associated with the threat, rather than the threat itself." However, while anxiety can result from the awareness of being at risk, there can still be many other factors that influence one's anxiety levels in the perspective of weight related conditions. For example one's level of education is fundamental to the understanding of the risk. Such education is also the impetus for one's acceptance or otherwise of cultural perceptions/beliefs of the threat and risks in general. Cultural influences on food habits have also been well established [154]. In addition, there may also be significant addiction elements at play.

The behavioural economic perspective which examines how decisions, under complex socio-economic and socio-cultural circumstances as well as financial constraints involving trade-offs, are made by individuals could help to provide understanding of people's preventive behaviours in the context of obesity. Since the condition is largely behavioural with complex interactions between genetic, behavioural, socio-economic, cultural and environmental factors, therefore behavioural economic, psychological and health economic theories will have to be considered together to better understand people's preventive behaviours. Any such research into the understanding of people's uptake or otherwise of obesity preventive goods should be comprehensive. It must be an empirical research that captures all or most of the complex variables that are at play across the socio-economic and socio-cultural divide.

CONCLUSIONS

Even though the morbidity and mortality impacts of obesity are enormous, participations in activities considered to be supportive to abnormal weight gain preventions are considerably low. It

cannot therefore be assumed that there will be a demand for all effective preventive goods and services. Efforts to increase the demand for obesity preventive goods require an understanding of the factors which influence individual decisions and the personal and practical reasons for resisting behaviour change. It is hence imperative for there to be further studies into alternative approaches to preventive behaviour.

The behavioural economic perspective could help to increase understanding of the preferences of individuals as it examines how decisions, under the various often complex socio-economic and socio-cultural variables as well as financial constraints involving trade-offs, are made by individuals. Understanding determinants of demand for obesity preventive goods can be vital in furthering knowledge of how changes in health policies will impact on individuals and their demand for preventive goods and as well provide a platform for effective treatments of weight related conditions.

Considering the evidences that suggest obesity is largely a behavioural issue, and the economic restraints on individuals and their families, it is surprising that there remains a paucity of studies to understand the behaviours of individuals from an economic perspective regarding demand for obesity preventive goods. It will be difficult for one to advance any specific reason for this. It is however obvious that economic research has instead concentrated on studies on the impact of the pandemic on healthcare resources and the economy and the evaluations of interventions.

Conflicts of interest

The author declares that has no competing interests in the publication of the manuscript.

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Mr. Alexander M. French passed away on 9th September 2012 at Southern General Hospital in his home city of Glasgow, Scotland. Mr French was obese and developed cardiovascular problems in the latter parts of his life. In this connection he had a number of bypasses and a major operation to unblock the main arteries/veins to his heart. When he was attacked by colitis sometime in November 2011 he was unfortunately not able to overcome that as he subsequently developed multiple organ failures.

Mr. French was a parent to Mr. Touray in all aspects. He was a kind and benevolent individual who opened his hands and heart to people particularly the needy. He supported and helped many people directly regardless of their backgrounds and race and many more through charities working with the poor around the world. I would like to dedicate this paper to Mr. French.

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