



Trading off dietary choices, physical exercise and cardiovascular disease risks



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ABSTRACT

Despite several decades of decline, cardiovascular diseases are still the most common causes of death in Western societies. Sedentary living and high fat diets contribute to the prevalence of cardiovascular diseases. This paper analyses the trade-offs between lifestyle choices defined in terms of diet, physical activity, cost, and risk of cardiovascular disease that a representative sample of the population of Northern Ireland aged 40–65 are willing to make. Using computer assisted personal interviews, we survey 493 individuals at their homes using a Discrete Choice Experiment (DCE) questionnaire administered between February and July 2011 in Northern Ireland. Unlike most DCE studies for valuing public health programmes, this questionnaire uses a tailored exercise, based on the individuals' baseline choices. A "fat screener" module in the questionnaire links personal cardiovascular disease risk to each specific choice set in terms of dietary constituents. Individuals are informed about their real status quo risk of a fatal cardiovascular event, based on an initial set of health questions. Thus, actual risks, real diet and exercise choices are the elements that constitute the choice task. Our results show that our respondents are willing to pay for reducing mortality risk and, more importantly, are willing to change physical exercise and dietary behaviours. In particular, we find that to improve their lifestyles, overweight and obese people would be more likely to do more physical activity than to change their diets. Therefore, public policies aimed to target obesity and its related illnesses in Northern Ireland should invest public money in promoting physical activity rather than healthier diets.

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Introduction

Obesity and overweight have become a growing problem affecting most of Western societies. According to the World Health Organization (WHO), in 2008 there were about 1.5 billion overweight adults. This figure is increasing dramatically because of our sedentary lifestyles and worsening eating habits (World Health Organization, 2011). In Northern Ireland almost 60% of adults are either overweight or obese, and, according to the Public Health

Agency, this figure is growing (Department of Health, Social Service and Public Safety, 2011). This epidemic has become an economic burden (Müller-Riemenschneider, Reinhold, Berghöfer, & Willich, 2007), as well as a major health problem, as obesity increases the risk of type 2 diabetes, cancer and cardiovascular diseases (CVDs). As a result, governments and public health agencies are diverting considerable resources to prevent obesity and promote healthy lifestyles (Department of Health, Social Service and Public Safety, 2010; Fit Futures, 2006; Foresight Report, 2007; World Health Organization, 2001). Thus it is important to explore strategies that help people choose healthier lifestyles and to estimate their willingness to pay for improvements in their health and for reductions in their risk of disease.

A discrete choice experiment (DCE) survey is the appropriate framework to analyse individuals' stated behaviour in response to a broad range of hypothetical choices (Ben-Akiva & Lerman, 1985; Carlsson & Martinsson, 2003; Louviere, Hensher, & Swait, 2000;

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Ryan, Gerard, & Amaya, 2008; Train, 2009). DCEs allow researchers to analyse to what extent, and under what conditions, individuals are willing to change their unhealthy lifestyles for healthier ones. This health improvement is presented here in terms of a reduction of the risk of suffering from CVD, which are among the most serious obesity-related health problems, in the context of food choices and physical activity behaviour.

Food choices and risk have been analysed with respect to genetically modified food (Rigby & Burton, 2005, 2006), traceability (Van Rijswijk & Frewer, 2008) and food safety (Lobba, Mazzocchi, & Trail, 2007). Most of these studies are based on one single choice or a set of single choices. Conversely, in our study, we set a more realistic framework for dietary choices, which implies a series of regular choices over many years. In addition, respondents are not asked to choose between artificial scenarios completely unrelated to their own habitual food choices and amounts of physical activity. We tailor our DCE questions using individuals' actual diet, level of physical activity and the CVD risk they face.

Dietary choices are based on habit but are the result of a trade-off between taste (sensory perceptions), health, cost, and among other attributes, attitudes, values, and beliefs (Furst, Connors, Bisogni, Sobal, & Winter Falk, 1996). Cardiovascular diseases are known to be highly correlated with high levels of cholesterol in the blood (Mente, de Koning, Shannon, & Anand, 2009), part of which comes from an excess of saturated fat intake. At the same time, the presence of fat is correlated with taste and palatability in food. On the other hand, a sedentary lifestyle tends to be correlated with high levels of cholesterol in the diet (Auchincloss et al., 2009; Lakdawalla & Philipson, 2009). Despite its well-known benefits, the majority of people in the UK do not engage in regular physical activity. Physical activity levels are declining in Northern Ireland (NI), with 23% of the population classed as sedentary (Northern Ireland Health and Social Wellbeing Survey 2005/06).

In this paper, our DCE asks a representative sample of the adult population of Northern Ireland to choose between their current lifestyle, described in terms of their own dietary habits, levels of physical activity and actual risk of suffering a fatal CVD in the next ten years, and other hypothetical lifestyles described by different combinations of diet, exercise, risk of a fatal CVD event in the next ten years, and cost. Cost is shown as increases from respondents' current expenditures. Diets are presented as reductions in the consumption frequency of the most unhealthy (in terms of fat intake) food items consumed by respondents, whilst levels of physical activity are described in terms of increments from respondents' current levels measured in minutes.

The remainder of the paper is structured as follows. Section 2 briefly describes the DCE method; Section 3 gives an overview of the questionnaire used and reports the descriptive statistics of the sample of the Northern Ireland population we surveyed; Section 3 reports the results of the econometric models and discussion; Section 4 concludes the paper with policy implications.

Methodology, questionnaire and data collection

Methodology

Choice models are based on the idea that individuals make choices among alternatives by considering the characteristics of the alternatives (Lancaster, 1966). When facing a set of J alternatives, individuals will pick the one providing the highest utility. DCEs are grounded in random utility theory, which states that individual's choices produce certain utility, U , which contains a modelled part, V , that can be measured in terms of the attributes of each alternative, and another part, ε , that cannot be observed by researchers and therefore it is considered a random term and named the

unmodelled part of the utility (see Ryan & Gerard, 2012; Ryan et al., 2008).

By observing peoples' choices, the modeller can estimate the weights attached to each attribute; these, in turn, allow for the calculation of the marginal willingness to pay (WTP) for improving each of these characteristics. Assumptions made about the distribution of the random error component lead to different types of model. The simplest one is the multinomial logit (MNL) model which assumes that errors are independent and identically distributed (i.i.d.) according to a Type 1 extreme value distribution. Unlike the MNL, a Random Parameter Logit (RPL) model allows heterogeneity in tastes by assuming that the parameters β_s are not fixed, but vary across respondents. The common formulation is that the β_s differ in terms of taste intensity (Train, 1998), leading to the following utility specification obtained by individual q from choosing alternative j :

$$U_{qj} = \widetilde{\beta}_q X_{qj} + \varepsilon_{qj} \quad (1)$$

where X is a vector of attributes describing alternative j and the random taste parameters $\widetilde{\beta}_q$ depend on the values of the parameters θ of an underlying "mixing distribution" $f(\beta|\theta)$. Researchers have to make assumptions about the distributions of the random component.

For the MNL, the WTP for an attribute is calculated as the negative of the ratio between that attribute coefficient and the cost attribute, and welfare estimates can be calculated as described in Lancsar and Savage (2004). Whenever random parameters are used, this formula is not so straightforward (Armstrong, Garrido, & Ortúzar, 2001). In such a case, the calculation of means and confidence intervals would be difficult, although the distribution itself may still exist. For this reason a different parameterisation of the utility function – namely WTP-space – has been recently developed (Train & Weeks, 2005). In further applications, WTP-space has been shown to provide more realistic and informative welfare estimates obtained from DCE data (e.g., Balcome, Chalak, & Fraser, 2009; Scarpa, Thiene, & Train, 2008; Train & Weeks, 2005). Moreover, as documented in Train and Weeks (2005) and in Scarpa et al. (2008), a random cost coefficient in a WTP-space model allows for individual scale heterogeneity – even if it is confounded with the cost coefficient (Scarpa, Thiene, & Hensher, 2012; Thiene & Scarpa, 2010). WTP-space is a transformation of the utility function that involves expressing all non-cost parameters estimates as ratios with the cost coefficient. As discussed by Louviere (2006), if errors are i.i.d. type-one extreme value, there is no difference in the fits of the two models, except for rounding errors. This re-parameterisation of the utility function allows the direct estimation of population moments. The utility function is re-written by substituting for each attribute k the parameter β_k with a new parameter which is a direct estimate of the WTP by noting that

$$\beta_k = \beta_{\text{cost}} \text{WTP}_k$$

In order to obtain more accurate WTP values from the observed sample for policy recommendations, we compute the WTP for each attribute for each individual ($\text{WTP}_{k,q}$) conditional to the pattern of choices observed, y_q . The coefficients for the model at an individual level can be computed using the estimator proposed by Scarpa, Campbell, and Hutchinson (2007):

$$\widehat{E}[\text{WTP}_{k,q}] = \frac{\frac{1}{R} \sum_{r=1}^R \widehat{\text{WTP}}_{k,q}^r L(\widehat{\text{WTP}}_{k,q}^r | y_q, X_q)}{\frac{1}{R} \sum_{r=1}^R L(\widehat{\text{WTP}}_{k,q}^r | y_q, X_q)} \quad (2)$$

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