A034: Using discrete choice experiments (DCEs) within a cost-benefit analysis (CBA) framework to estimate benefits of Woods in and Around Town (WIAT) project for mental well-being

Abstract:

Recent years have seen increasing interest in environmental interventions for mental well-being. It has been found that mental health is a serious public health problem and improving it at societal level has been a priority. There is growing evidence that suggests that natural environments sustain or improve mental wellbeing through three possible behavioural mechanisms: they may encourage physical activity; they may promote social interactions; and they may reduce stress through exposure. Experimental and observational studies seem to suggest that these three mechanisms are closely linked and have a synergistic effect on a psycho-biological link that leads to psychological restoration which could potentially benefit the society. The restoration process is believed to be a psycho-evolutionary response to nature known as the biophilia phenomenon that is explained through stress reduction and attention restoration theories.

This paper discusses an economic evaluation of an environmental intervention for mental well-being in Scotland: Woods in and Around Town (WIAT) project which aims to regenerate, improve and promote green spaces to render them safe and to increase contact with nature which would potentially improve mental well-being of the society. The economic analysis begins with cost-consequences analysis (CCA) of observed costs and outcome data between the intervention and control sites. A top-down approach is used to assess costs. A CCA allows flexibility on the use of relevant or complementary economic evaluation technique. A cost utility analysis (CUA) is planned using EQ-5D which would assess whether the project represents good value for money. However, CUA fails to capture non-health outcomes and compares only interventions that produce similar units of outcomes such as QALYs. Given that this kind of environmental intervention is expected have a broad range of benefits beyond health, an economic evaluation technique that is broader in focus would be appropriate.

Literature indicates that discrete choice experiments (DCEs) could be used within a cost-benefit analysis (CBA) framework to indirectly estimate willingness to pay (WTP) values to derive welfare measures. This approach appears to be able to offer a credible conceptual and methodological framework in addition to CBA’s ability to capture broad range of outcomes that accrue to society which earns it its basis in welfare economics. Both costs and outcomes are in monetary terms which permit questions of allocative efficiency to be addressed within and across different sectors of the economy.

This paper aims to develop an optimal DCE that could be used within a CBA framework for WIAT project and is intended as a contribution towards literature of DCEs of forestry-based healthcare economic evaluations.

Key words: Natural environments; cost-consequences analysis; cost-utility analysis; cost-benefit analysis; discrete choice experiments.

1. Introduction

Improving mental health and well-being at societal level is increasingly becoming a priority among public health policy makers (White et al., 2013). Recent years have seen increasing interest in environmental interventions for mental well-being which would potentially affect the quality of life of the larger population (Thompson Coon et al., 2011; Saulle and La Torre, 2012; Dallat et al., 2013). A substantial body of literature illustrates that natural environments such as green spaces have profound effects on the well-being of individuals through exposure and experience with them (Wells and Evans, 2003; Bates and Marquit, 2011). Natural environments have been associated with the provision of feelings of well-being way back in history dating hundreds of years ago and across many cultures of the world with some of the history and beliefs still being upheld to date (Tsunetsugu et al., 2010; Ward Thompson, 2011; Bratman et al., 2012).

Three possible mechanisms have been suggested to be responsible for the natural environments' sustenance or improvement of mental well-being: they may encourage physical activity; they may promote social interactions; and they may reduce stress through exposure (Groenewegen et al., 2012; Richardson et al., 2013). Experimental and observational studies seem to suggest that these three mechanisms are closely linked (Townsend, 2006; David et al., 2008; Lee and Maheswaran, 2011), and have a synergistic effect on a psycho-biological link that leads to psychological restoration (Herzele and Vries, 2011; Vadims, 2011; Di Nardo et al., 2012; Ward Thompson et al., 2012; Xiaolu and Md Masud, 2012). The restoration process is believed to be a psycho-evolutionary response to nature known as the biophilia phenomenon (Wilson, 1984) which claims that people possess an inherent preference for nature and that over the course of millions of years, human beings have adapted to respond positively to natural environments in order to thrive and for survival (Mason, 2009). Theories such as stress reduction theory (SRT) (Ulrich, 1983) and attention restoration theory (ART) (Kaplan and Kaplan, 1989) explain the biophilia phenomenon.

In Scotland, Woods In and Around Town (WIAT) project aims to regenerate, improve and promote green spaces in order to render them safe and to increase contact with nature which would potentially lower stress levels and in turn improve mental well-being of the society (Silveirinha de Oliveira et al., 2013). This paper discusses an economic evaluation of this project with the aim to develop an optimal DCE that could be used within a CBA framework in a cost-consequences analysis (CCA) of WIAT project in order to complement the planned cost-utility analysis (CUA). The intention is to contribute towards literature of DCEs of forestry-based healthcare economic evaluations.

The rest of the paper is structured as follows: section two introduces an environmental intervention for mental well-being in Scotland, WIAT project and its planned economic analysis. The DCE theory is explained in section three. Section four discusses DCE methodological approach for WIAT project while section five concludes the paper. References are presented in section six.

2. Woods In and Around Town (WIAT) project

This project is run by the Forestry Commission Scotland (FCS) and works with deprived communities. It involves six woodland sites that have been chosen within the Scottish Lowlands Forest District with their associated communities based on the set inclusion criteria which include being in the worst 30% of the socioeconomic deprivation in Scotland according to the Scottish Index of Multiple Deprivation (SIMD) (Silveirinha de Oliveira et al., 2013). The choice of sites was based on an extensive analysis and consultative process by researchers. Each intervention site has been paired with a control site on the basis of woodland and demographic characteristics including the socioeconomic factors and the type of housing (Silveirinha de Oliveira et al., 2013). This means that three intervention sites will receive the WIAT intervention programme between mid 2013 and early 2015 while three control sites will not, but will receive it after the study (Silveirinha de Oliveira et al., 2013). The intervention is in two stages: physical and social (promotional). The physical intervention involves improving access to and within woods by clearing shrubs, creating paths and adding signage while stage two is aimed at increasing awareness and use of the woods through led-walk programmes, leafleting and event days.

The challenge is to solicit societal values for the environmental enhancements in the intervention sites aimed at improving mental well-being which would be used to estimate welfare measures. It is in this context that an economic analysis is employed which forms part of the process evaluation to assess the implementation of the intervention. The economic analysis would initially take the form of a cost-consequences analysis (CCA), which would present the cost and outcomes data observed between the intervention and control sites in a disaggregated format of a balance sheet. It is a simple, readily understandable presentation although it cannot be used to rank interventions and does not compare costs with outcomes of an intervention, hence cannot be considered to be an economic evaluation technique in the strict sense (Mauskopf et al., 1998; Joanna, 2004; Lorgelly et al., 2010). On the costing side, there are generally two approaches used to costs of health related interventions: top-down and bottom-up approaches (Chapko et al., 2009; Carey and Stefos, 2011). The practical recommendation is to use both approaches in combination for optimal results when estimating resource use of an intervention (Oostenbrink et al., 2002; McIntosh et al., 2010). Top-down approach is used in this project because of resources constraints as it first considers the whole budget and then disaggregates the total costs to the units of services by allocating costs to cost centres then dividing the total costs of the cost centre by the number of units (Oostenbrink et al., 2002; Federowicz et al., 2010).

The main reason for undertaking a CCA in this project is that it would allow flexibility on the use of relevant economic evaluation techniques as different elements of an intervention would be listed under costs and consequences and it would offer a choice of an appropriate or complementary evaluation technique in a diversity of decision context (Mauskopf et al., 1998; Joanna, 2004). A cost utility analysis (CUA) is planned for this project as a formal economic evaluation using EQ-5D to estimate health improvements resulting from the intervention measured by quality-adjusted life years (QALYs). This would assess whether the project represents good value for money to inform future investments in similar interventions (NIHR, 2012). However, CUA is limited in focus in that it fails to capture non-health outcomes which potentially contribute to mental well-being and is unable to compare interventions with units of outcomes other than QALYs (Drummond et al., 2005; Gray et al., 2010). Furthermore, the assessment of the net social benefits of an intervention also becomes problematic, since in order to do so, there is need for costs and benefits (losses) to be expressed in monetary terms which CUA is unable to do (Gray et al., 2010).

Given that this kind of environmental intervention is expected have a broad range of benefits beyond health, a complementary economic evaluation technique that is broader in focus capable of capturing both health and non-health outcomes would be appropriate (Hall et al., 2004).

Literature review indicates that discrete choice experiments (DCEs) could be used within a cost-benefit analysis (CBA) framework to indirectly estimate WTP values for the derivation of welfare measures (McIntosh, 2006). This approach appears to be able to offer a credible conceptual and methodological framework. Besides, CBA has the ability to capture broad range of outcomes that accrue to society which earns it its basis in welfare economics (Brazier, 2007; McIntosh et al., 2010). Both costs and outcomes are in monetary terms which permit comparisons of interventions within and across different sectors of the economy thereby addressing questions of allocative efficiency (Drummond et al., 2005; Belfield and Levin, 2010; Gray et al., 2010). However, CBA has previously not been popular because it is considered to have significant conceptual and practical methodological problems with its willingness to pay (WTP) techniques of directly obtaining monetary values and there is widespread and intrinsic aversion of the concept of placing explicit monetary values on health or life (Drummond et al., 2005; Gray et al., 2010).

Gafni (2006); Schlander (2010); and Reed Johnson (2012) argue that while CBA has its problems, the goal should be to improve its methodology. Hence, recently, the focus has been on this attribute-based measure of outcomes, DCEs. The use of DCEs within a CBA framework of WIAT project's CCA could complement the CUA already planned.

3. Discrete choice experiments (DCE) theory

DCEs are a stated preference technique in which respondents are confronted with hypothetical choice sets described by their relative characteristics or attributes and are requested to choose a single alternative, hence, 'discrete' by mentally trading-off other set of attributes (Ryan and Farrar, 2000; Kjær, 2005; Bullock, 2008). The underlying theoretical basis of DCEs is that respondents are choosers of alternatives that give them the highest utility (Kløjgaard et al., 2012; Mengoni et al., 2013), as a result, it is consistent with economic welfare theory (McIntosh, 2010). DCEs are explained by the Lancaster (1966) economic theory of value (Ryan et al., 2008; Mentzakis et al., 2011; Londoño and Ando, 2013) and the Random Utility Theory (RUT) of McFadden (1973): environmental goods are valued in terms of their characteristics and by applying probabilistic models to choices between different bundles of attributes (Kjær, 2005; Hanley et al., 2006).

When it is assumed that an individual i is faced with two choices J (woodland A) and K (woodland B), the perceived utility of choices j and k is U_{ij} and U_{ik} respectively and are not known with certainty (Viney et al., 2002; Albaladejo-Pina and Díaz-Delfa, 2009; Louviere and Fiebig, 2010).

Therefore, the underlying utility function for individual i takes the following forms:

$$U_{ij} = U(X_j, P_j) \text{ for woodland A} \qquad \text{Equation 1}$$

$$U_{ik} = U(X_k, P_k) \text{ for woodland B}$$

Where X_j and X_k are vectors of attributes describing alternatives j and k and P_j and P_k are the prices or costs associated with each of the alternative.

It follows that individual i will choose alternative j (woodland A) over k (woodland B) if and only if

$$U_{ij} > U_{ik} \qquad \text{Equation 2}$$

The utility U_{ij} associated with the comparison in Equation 2 is assumed to have two components (McFadden, 1973) as shown below where the first term on the right-hand side of each of these expressions is observable (deterministic) also known as systematic or indirect utility function (IUF) and can be denoted as $V_{ij} = V(X_{j,} P_j)$ and $V_{ik} = V(X_{k,} P_k)$ for woodland A and B respectively while the second part is random and unobservable which can be denoted as $\varepsilon_{ij} = \varepsilon(X_{j,} P_j)$ and $\varepsilon_{ik} = \varepsilon(X_{k,} P_k)$ for woodland A and B respectively:.

$$U_{ij} = V(X_{j,} P_j) + \varepsilon(X_{j,} P_j) \text{ for A } and \ U_{ik} = V(X_{k,} P_k) + \varepsilon(X_{k,} P_k) \text{ for B} \qquad \text{Equation 3}$$

The presence of the random component in utility results in stochastic behaviour of individuals and leads to the formulation for probability of choice (Louviere et al., 2010; Vojáček and Pecáková, 2010). Therefore, the probability of individual i selecting the option j (woodland A) in choice 1 to the alternative k (woodland B) in choice set 2 is expressed as the random utility model showing that the probability of the utility associated with j is higher than that associated with k under a resource constraint represented as follows:

$$P_{ij}|C = \Pr(V_{ij} + \varepsilon_{ij} > V_{ik} + \varepsilon_{ik}) \qquad \text{Equation 4}$$

Where C is a set of choices j and k, ij is a random variable denoting the choice outcome and V_{ij} is the systematic component that can be observed and explained by the alternative's attributes, and ε_{ij} is the random component that indicates unobservable component.

Different probabilistic discrete choice models can be derived from Equation 4 by making different assumptions about probability distributions for the unobservable component (Mazzanti, 2003; Lancsar and Louviere, 2008; Louviere et al., 2010). The most common model is the McFadden (1973) conditional logit (CL) model sometimes also referred to as multinomial logit (MNL) model. This model could calculate three estimates (Ryan, 2004; Lancsar and Louviere, 2008): first is the measure of welfare in a form of WTP for the environmental improvement which is derived by the use of the cost or price proxy attribute using the formula below:

$$\mathrm{WTP} = \frac{1}{-\beta\mathrm{priceproxy}}\left[\mathrm{In}\sum_{j=j}^{J} e^{V_j^j} - \mathrm{In}\sum_{j=j}^{J} e^{V_j^k}\right] \qquad \text{Equation 5}$$

Where $-\beta\mathrm{priceproxy}$ is the marginal utility of income, V_j^j and V_j^k are values of the IUF for each choice j before and after environmental change in J number of options in the choice set.

The second measure is the uptake prediction for the intervention which could be calculated by:

$$P_{ij} = \frac{e^{V_{ij}}}{\sum_{j=j}^{J} e^{V_{ik}}} \qquad \text{Equation 6}$$

The third measure could be the marginal rates of substitution (MRS) as in Equation 7 , thus the trade-offs that respondents make between attributes which is calculated by partially differentiating the IUF with respect to the first attribute and with respect to the second attribute and calculating their ratio and if the price is the numeraire, the denominator denotes the marginal disutility of price known as implicit price of each attribute

$$\mathrm{MRS}_{x1,x2} = \frac{\partial V/\partial x1}{\partial V/\partial x2} \qquad \text{Equation 7}$$

Where V is an IUF and $x1, x2$ are attributes of the good and ∂ is the partial derivative. The numerator (denominator) is interpreted as the marginal utility of attribute 1 (2).

4. DCE methodological approach for WIAT

The actual undertaking of DCEs follow five stages generally categorized as: identification of attributes; assignment of levels to attributes; experimental design to define the choice sets that would be presented to respondents; questionnaire administration to collect data; and data input, analysis and interpretation of responses (Lancsar and Louviere, 2008; Mentzakis et al., 2011). The use of DCEs in WIAT project would follow these stages. It is worth noting that this would happen after the social intervention and alongside a qualitative study which assesses the effectiveness of the whole WIAT project.

4.1 Identifying attributes

The first stage would be to identify attributes of the green spaces under the project. Attributes can either be qualitative or quantitative (Lancsar and Louviere, 2008). There is 'no gold standard' way for undertaking this process and there is generally very little guidance in literature (Kjær, 2005; Coast et al., 2012). There has also been poor reporting on how attributes and their associated levels have been developed in various studies (Coast et al., 2012). Some studies have reported focus groups; expert interviews; policy documents; scientific literature; pilot studies; working with scientists or ecologists; literature reviews and their theoretical arguments; existing outcome measures; professional recommendations; patient surveys and expert reviews as their sources of attributes (Guttmann et al., 2009; Coast et al., 2012; Kragt, 2013). Qualitative processes in the generation of attributes are, however, the most recommended because of the 'richer' results of meaningful and important attributes to respondents (Coast et al., 2012). Additional or other qualitative work could be a rating and/or ranking exercise in order to determine the attributes for inclusion (Bridges et al., 2011).

The starting point for identifying relevant attributes for WIAT project could potentially be: an assessment of documents including the WIAT project conceptual model in Figure 1; and the questionnaire for the qualitative study taking place alongside this economic analysis (see Figure 2); and followed by the qualitative process of focus groups and interviews. Three focus groups associated with intervention sites comprising of six members of the community and six FCS staff members would be recruited with special consideration on gender balance and with people from a wide range of age groups and life stages (Silveirinha de Oliveira et al., 2013).

Since the aim of the evaluation is to obtain welfare values, the inclusion of the price/cost attribute also referred to as a payment or bid vehicle is key to an elicitation procedure for WTP (Hanley et al., 1998; Morrison et al., 2000; Kjær, 2005; Hoyos, 2010; McIntosh, 2010). The most common payment vehicles applied in healthcare are taxes, water or land rates, out-of-pocket payments at the point of consumption, increased entrance fees, or private health insurance premiums (Morrison et al., 2000; Gyrd-Hansen, 2013) or cost of travel to the environmental good (Christie et al., 2007) . Of all these, taxes appear to the preferred one because of their ability to include both use and non use values such as option values (Gyrd-Hansen, 2013). One study in the UK used council tax as the cost/price attribute because its revenues contribute to publicly funded services including environmental quality as such it provides a credible payment vehicle (Gyrd-Hansen, 2013; Lanz and Provins, 2013).

The choice of payment vehicle depends on the context of the choice task and choice condition (Kjær, 2005). It has been found that other forms of user charge are associated with negative utilities (Kjær, 2005). It would appear, therefore, that care has to be exercised when deciding on the appropriate payment vehicle in order to minimise protest responses from respondents. Tentatively, entrance fee appears to be a realistic payment mechanism for green spaces. Again, a qualitative process would determine the appropriate payment vehicle for WIAT project.

The decision would have to be made on the number of attributes for inclusion in this project's DCE. There is no specific suitable number of attributes stipulated for inclusion. Previous studies of DCEs in health have reported varied numbers to as many as 12 attributes (Lancsar and Louviere, 2008). The general consensus though is to have a maximum of eight attributes (Kjær, 2005) although what could be considered as plausible number is the one within realism. The most important issues to consider when identifying attributes for inclusion in the DCE are that they should be relevant to policy makers; meaningful; important to respondents; easy to comprehend; and concise (Kjær, 2005; Coast et al., 2012; Kløjgaard et al., 2012).

4.2 Assignment of levels

Once attributes have been generated, qualitative work would be undertaken to determine the levels for the attributes and how many they should be. The number of levels vary but there is an upper limit that would allow respondents to evaluate the choices before fatigue effects occur (Alriksson and Öberg, 2008). The rule of thumb is that the number of levels should be realistic. Good research practice limits the levels to three or four per attribute (Bridges et al., 2011). It is also important to note that levels determine the type of effects to consider such that a two-way level attribute only allows for the estimation of linear effects while more than two levels can make an estimation of non-linear effects (Kløjgaard et al., 2012).

The decision on the choice of levels and on the choice format (whether to have unlabelled or labelled choice) for WIAT project's DCE would also have to be determined through the qualitative process. It is important that the levels have the scope or range that captures and ensures trade-offs between attributes while still being acceptable to the respondents (Kløjgaard et al., 2012).

The setting of level ranges as well as level numbers is particularly important for the cost/price attribute if it is to be used to calculate implicit values of other attributes using MRS or when estimating the WTP values (Lancsar and Louviere, 2008; Hoyos, 2010). Inappropriate cost interval may result in over or underestimated WTP values which could be misleading (Kjær, 2005).

When both attributes and levels have been identified, the most important aspect becomes the decision on the choice format especially on deciding whether to use generic versus labelled choice or whether to include an 'opt-out' 'status quo' or 'neither' option (Lancsar and Louviere, 2008; Hoyos, 2010; Doherty et al., 2013). Labels include sites, locations, policy names and other descriptors which may convey additional information beyond the attributes and their levels (Blamey et al., 2000). It has been found that responses from labelled choices may better reflect the emotional context in which preferences are ultimately revealed (Blamey et al., 2000). However, the potential issue with labels in DCEs is that they may influence respondents and affect their choice outcomes (Doherty et al., 2013).

It is advisable to include an opt-out option when the aim is to estimate welfare values as it allows respondents to choose freely among options without being forced which would ideally reflect reality (Lancsar and Louviere, 2008; Hoyos, 2010).

An exploratory review of documents related to WIAT project have resulted in the attributes and levels in Table 1 which could be used to open up the discussion on attribute and level identification but without influencing it. It is also expected that HESG conference would provide some insight on: (1) attribute and level identification; and (2) the best way to reduce the number of attributes and levels when they are so many and from a variety of sources. This process would be followed by an iterative qualitative work for refinement.

Possible attributes	Possible levels
1. Accessibility	Not accessible, slightly accessible, accessible
2. Safety	Not safe, somehow safe, safe
3. Cleanliness	Some litter, mostly clean of litter, very clean of litter
4. Visibility of views and wildlife	Poor, good, better, best
5. General appearance and aesthetics	Poor, good, better, best
6. Conducive to health activities	Low, medium, high
7. Facilities	No facilities, some facilities, more facilities
8. Cost to you	£0, £5, £10,

Table 1: Proposed attributes and levels

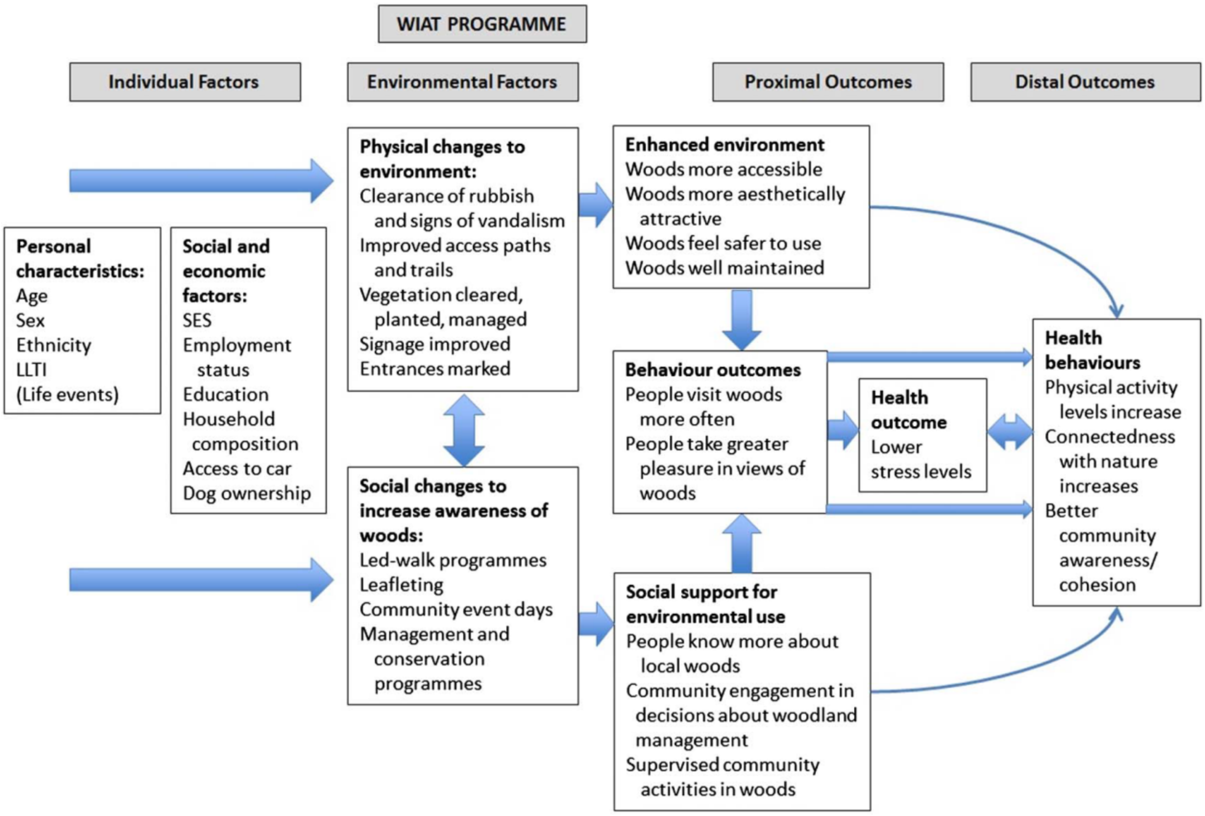

Figure 1: conceptual model of mental health impacts of WIAT project on deprived communities. Source: Silveirinha de Oliveira et al. (2013).

	TICK START, ROTATE, READ OUT	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
B12	**The woodlands are free from litter**	1	2	3	4	5
B13	**Poor entrances make it difficult to get into the woodlands**	1	2	3	4	5
B14	**I feel safe in the woodlands**	1	2	3	4	5
B15	**Poorly maintained paths make it difficult to visit the woodlands**	1	2	3	4	5
B16	**I feel at peace in the woodlands**	1	2	3	4	5
B17	**I can pursue healthy activities in the woodlands**	1	2	3	4	5
B18	**The woodlands provide a place to visit with family and friends**	1	2	3	4	5
B19	**I can see and enjoy wildlife in the woodlands**	1	2	3	4	5
B20	**I like the natural appearance of the woodlands**	1	2	3	4	5
B21	**There is a lack of good facilities in the woodlands**	1	2	3	4	5

Figure 2: Section of WIAT main study questionnaire. Source: WIAT project (2013).

After this, the next stage would be to assign the attributes with their associated levels into choice sets through an experimental design

4.3 Experimental design

This stage would involve the organisation of the identified attributes and their associated levels into choice sets and deciding on the number of attributes, their levels and the number of choice sets that should be presented to respondents for evaluation (Adamowicz et al., 2001; Viney et al., 2002; Breffle, 2008; Reed Johnson et al., 2013). This phase is critical as it determines the success and quality of outcome of DCEs (Hoyos, 2010; de Bekker-Grob et al., 2012; Graßhoff et al., 2013).

While it is recommended to avoid small fractional designs when possible and implement the largest possible design (Lancsar and Louviere, 2008), full factorial design that includes all the combinations of all attributes and levels in the project may be impractical for WIAT study due to task complexity and budgetary constraints. For this reason, OMEP design would be developed either manually using Hahn and Shapiro (1966) catalogue or if feasible, it would be created through use of some experimental design software. The Hahn and Shapiro (1966) catalogue is readily available and considered to be efficient. The advantage of OMEP design is its small size which makes it more practical though it has the disadvantage of assuming that the IUF is additive for all respondents which is difficult to test and reject when this assumption is false (Lancsar and Louviere, 2008; Carson and Louviere, 2010).

It is important to note that an optimal DCE design might not be an efficient design statistically despite the fact that much literature discusses more about efficiency than other design concerns (Breffle, 2008). What is important during experimental design is to consider carefully issues of identification which refers to the ability to obtain unbiased parameter estimates from the data for every parameter in the model and efficiency which relate to both statistical methods and response from respondents (Lancsar and Louviere, 2008; Reed Johnson et al., 2013), Special attention would be paid to the former because it cannot be changed once a design has been constructed while the latter can be improved later (Reed Johnson et al., 2013).

OMEP designs are considered to be optimal designs simply because they appear to have some required characteristics such as orthogonality and level balance and could be checked for minimal overlap and utility balance assuming the model is unbiased and consistent. These four qualities aim to maximise statistical efficiency of the designs, thus, the level of precision of model parameter estimates of the DCE model and were proposed by Huber and Zwerina (1996). Orthogonality means that the attributes are purposefully uncorrelated in the design which makes it easier to assess the effect of independent variables on dependent variables. Level balance means that there are the same numbers of levels for every attribute. Minimal overlap means that the attribute levels do not repeat. Utility balance means that the alternatives in choice sets are close in utility space for respondents in order for them to have equal chances of being chosen (Kanninen, 2002; Breffle, 2008). The experimental design stage would be followed by data.

4.4 Data collection

There is need to determine sample size before data collection. The appropriate sample size for a DCE is context dependent (Bridges et al., 2011). For this project, a total sample size of 2100 which include 1050 participants from the intervention site and the remaining 1050 participants from the control site with an equal split of male and female has been calculated to detect gender differences, thus 5% level of significance and 80% power based on Stigsdotter et al. (2010) with a further 25% increase to account for clustering effects (Silveirinha de Oliveira et al., 2013). This is well above the recommended sample sizes of at least 300 with a minimum of 200 respondents per group for subgroup analysis (Bridges et al., 2011). Eligible participants would be aged 16 and above, residing in the intervention or control site and live within 1.5 km of the green spaces under study (Silveirinha de Oliveira et al., 2013). WIAT project would employ a distance stratified random sampling of household addresses within 1.5 km of the woodland site using the address point. Stratification by distance has been necessitated by the notion that green space use declines with distance (O'Brien et al.). For more on other sampling techniques see Hoyos (2010).

Data collection for this DCE would be done through questionnaire administration which would follow principles of good practice of research (Dillman, 2000). The DCE questions would be incorporated in the overall qualitative study questionnaire which would be administered by a 25 minute face-to-face, computer-assisted interview (CAPI) by an experienced survey company (Silveirinha de Oliveira et al., 2013). Consent prior to questionnaire completion would be sought and it is envisaged that piloting would be important in this study to check the accuracy of parameters and the understanding of the survey questionnaire by the respondents as well as length and timing (Hoyos, 2010; Kløjgaard et al., 2012). Respondents would be introduced to DCE task through an introductory letter or a preface with clear study aims and an introduction that captures issues related to approximate time required for questionnaire completion; confidentiality; and a description of the choice options (Kjær, 2005).

4.5 Data input, analysis and interpretation of responses

STATA software would be used in this project for managing the response data. A typical data management framework for a DCE would require response variable about respondents' choice or preference; the experimental design variables; number of alternatives; and others variables relating to individuals and context. Important consideration would be given to issues related to data manipulation in a form of coding (Bech and Gyrd-Hansen, 2005).

The analysis would again be through use of STATA. This software is command-based, relatively easy to use, cheap and readily available as opposed to other applications matrix-based and difficult to use or outright expensive. The analysis would start with the simple MNL to ensure that there are no problems in the data that could hinder the estimation parameters (Ryan et al., 2008). The estimation of more general models would follow to test the restricted assumptions embodied in MNL models.

DCE responses for WIAT project could, in addition to being used for calculating measures of welfare in a form of WTP for the environmental improvement through the use of the cost or price proxy attribute, also be used to calculate: the intervention uptake prediction; and the trade-offs that respondents make between attributes (Ryan, 2004; Lancsar and Louviere, 2008).

5 Conclusion

This paper has attempted to show the methodological approach that could be taken to use DCEs within a CBA framework in the WIAT project's CCA to complement the CUA. DCEs appear to be able to offer a credible conceptual and practical methodological framework which would result in wide acceptance and use of CBA especially in capturing the broader aspects of the benefits of environmental interventions for health. They could additionally offer a prediction of the intervention uptake and an implicit measure of the trade-offs made between attributes. The development of an optimal DCE is dependent on the proper conduct of each of the five stages of undertaking DCEs.

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