



**Scuola Superiore
Sant'Anna**
di Studi Universitari e di Perfezionamento

**Using discrete choice experiments to assess population
preferences for primary care services**

A thesis presented
by
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to
The Class of Social Sciences
for the degree of
Doctor of Philosophy
in the subject of
Management, competitiveness and development

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Scuola Superiore Sant'Anna
A.Y. 2010-2011

In memory of my grandfather, Albino Mengoni

ACKNOWLEDGMENTS

Numerous people have contributed to the thesis described here and I would like to spend a few words to thank them.

First of all, I am deeply grateful to my promotor and supervisor, Prof. Sabina Nuti, for having offered me the opportunity to do my PhD in the stimulating environment of Laboratorio Management e Sanità of Scuola Superiore Sant'Anna. She has supported my interests since joining the lab and has allowed me to evolve naturally in my studies. It would be hard to overstate how much I benefited from her enthusiasm in sharing her vast knowledge, and her capacity to open new areas, new ideas, and new ways of looking at things.

I would like to extend my gratitude to all the researchers and to the dedicated team of interviewers in our lab that made it possible to carry out the work I am presenting. In particular, I am indebted to Chiara Seghieri, who inspired me to work on discrete choice experiments and provided me with statistical advice at times of critical need. Thanks also go to Paolo Tedeschi, for his guidance and support during the early stages of this thesis.

I would also like to express my appreciation to Prof. Andrea Piccaluga, for his kind interest in my work and, most of all, for his flexibility and understanding at critical moments of my life during these years.

I am also grateful to all respondents who gave their time to be interviewed, sharing their perceptions of and preferences for primary care services.

Of course, I owe special gratitude to my parents Ida and Ivano, my grandparents Luigina and Giuseppe and my brothers Emanuele, Mattia and Leonardo, who supported me continuously and unconditionally, giving me the motivation needed to succeed and persist. Thanks also to my friends, for putting up with my anti-social work schedule and my long absences.

Lastly, and most importantly, I would like to thank my girlfriend Angelica for helping me in so many ways and for being really present when it was most required. Without her love, endless patience and constant encouragement, this work may not have been completed.

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1. INTRODUCTION

1.1. THE EFFICIENT ALLOCATION OF SCARCE RESOURCES

The dramatic increase in the demand for health care over the last 40 years coupled with the finite nature of labour and capital resources have led to an increasing interest in efficient allocation of scarce resources through economic evaluation, with a greater focus on health care choices and values (Ryan et al., 2008). In planning effective and efficient health policies and services that accurately reflect the desires of society, information about individuals' preferences for health programs and health outcomes is needed (Viney et al., 2002). As Hall et al. (2004) pointed out, policymakers need to be able to determine whether new programs (such as new drug therapies or changes to the way services are delivered) are feasible by assessing their value in relation to their opportunity costs. Where programs are already in operation their success will be amplified by ensuring that the program is designed to meet consumer preferences and therefore maximise participation. For programs such as screening and immunization, for example, effectiveness depends on achieving high uptake in the target population. Since a considerable amount of health decisions take place daily at the point of the clinical encounter (Morgan and Hurley, 2004), the impact on health care efficiency of economic information could be particularly significant in the primary care sector (Lessard et al, 2010). Already in 1991, the World Organisation of Family Doctors (WONCA), clearly recognized that the advocacy role of the general practitioner (GP) also includes the management of society's scarce health care resources (WONCA, 1991).

1.1.1. Revealed and stated preference data in the healthcare sector

The usual source of information on preferences for goods and services used by economists is revealed preference (RP) data (Lancsar and Louviere, 2008). As the name indicates, RP is a generic term for market analysis and refers to the observation of preferences revealed by real market behaviour (Kjær, 2005). However, there are potentially a number of problems with these data in the healthcare sector. In describing the reasons why health economists should be less interested in RP data, Viney et al. (2002) highlighted that, due to public and private insurance, in most countries consumers rarely face market prices for healthcare goods and services. Then, given the asymmetry of information between provider and consumer, it is not always clear that observed healthcare consumption is based on consumers' preferences alone. Where consumers do make market-based choices, the relationship between healthcare and health is complex and the attributes that consumers value may not be readily discernible from observed healthcare consumption. Lastly, many of the healthcare choices that are of the greatest interest to policy-makers are about new interventions, for which there may be no market data. Other disadvantages of RP data, reported by Rohr (2006), are that attributes may be very highly correlated in market data (e.g. best quality alternatives may always be the most expensive), making it difficult or impossible to predict the effect of independent variation in an attribute. Furthermore, as attributes of choice options and individual characteristics are not controlled and/or precisely specified in advance using a design, which allows straightforward identification of all effects of interest, the model identification cannot be guaranteed (Ryan et al., 2008). As a result, stated preference (SP) data, which is information on preferences provided by hypothetical choice scenarios of goods or services (what individuals

say they would do rather than what they are observed to do), have been commonly used in health economics. SP approaches usually applied in the health sector to examine preferences and to value health outcomes include standard gamble (SG), time trade-off (TTO), person trade-off (PTO) and contingent valuation method (CVM). This thesis is focused on a relatively new SP method, generally identified as discrete choice experiments (DCEs), that has been increasingly used in the recent years.

1.2. DISCRETE CHOICE EXPERIMENTS

A DCE is a preference elicitation technique in which individuals are presented with sets comprising different hypothetical combinations of goods or services (choice sets) and are asked to choose for each choice set their preferred combination (scenario). The choice is discrete in nature and is only possible to choose one alternative per choice set. Rather than examining the entire scenario as a package, the choice experiment allows the researcher to break down the relevant attributes of the situation and to determine preferences for different attributes (Garrod and Willis 1999). Each of the attributes in the experiment is described by a number of levels. By systematically varying the scenarios in the choice sets, assigning different levels to the attributes in accordance with experimental design principles, it becomes possible to examine the degree to which each attribute influences the choice of the decision-maker, i.e. to estimate the marginal rates of substitutions of the attributes (Louviere et al. 2000). DCEs provide a richer set of information for the respondent, allowing the researchers to elicit preferences for new technologies with which no one has yet had any real experience (Hall et al., 2004). With the inclusion of respondents' sociodemographic characteristics in the survey it is also possible to determine how individual characteristics influence choices, accounting for heterogeneity in the population (Louviere et al. 2000).

Once the model of preferences, summarised by an indirect utility function, has been estimated, this can potentially be used in various ways. As explained by Lancsar and Donaldson (2005), the estimated model can be used to investigate the relative overall importance of products or programmes, the relative importance of the attributes that comprise these programmes, as well as the rate at which persons are prepared to trade off such attributes via the MRS. Similarly, the results could be valuable to predict demand for healthcare products and programs under different scenarios to maximize compliance or uptake. Furthermore, DCEs are not concerned merely with benefits but also provide information on negative influences on utility. If appropriately designed, implemented, analysed and interpreted DCEs offer viable alternatives and complements to existing methods of valuation and preference elicitation (Lancsar and Louviere, 2008) and present several advantages in the health sector, the most important of which could be summarized as follows:

- DCEs are not the same as ranking or rating tasks, but are more consistent with economic theory and closer to real market choices. If a study objective is to accurately predict demand or estimate welfare measures, preferences should be elicited using DCEs (Viney et al., 2002);
- Health outcomes are the usual outcome measures in healthcare evaluation. DCEs allow health outcomes and other factors to be included, such as the value of information and process characteristics and also allow one to investigate trade-offs between health and other outcomes (Viney et al., 2002);
- DCEs can be used to elicit willingness to pay (WTP) for individual characteristics of goods/services and theoretically consistent monetary measures of welfare gain (Hicksian compensating variation), which could be used in cost-benefit analysis (CBA) (Lancsar and Louviere, 2008). DCEs also offer some advantages over CVM (Ryan et al., 2008).

1.2.1. Lancaster's theory of value and random utility theory

During the late 1970s and the 1980s conjoint analysis (CA) played an important role in the prediction and understanding of consumers' decision-making and choice behaviour (Wittink and Cattin, 1989). In the health literature such technique has often been confounded with DCEs.

DCEs and conjoint methods have in common the description of goods or services in terms of underlying attributes, the use of experimental design methods to develop instruments for preference elicitation and the use of statistical models to determine the contribution of each attribute to preferences (Bennett and Blamey, 2001). Furthermore, such techniques are rooted in Lancaster's theory of value (Ryan et al., 2001). This theory assumes that goods/services can be described by their attributes, and the total utility of a good/service depends on the nature and level of these attributes; therefore consumers have preferences for and derive utility from underlying attributes, rather than goods/services *per se*. (Lancaster, 1966).

DCEs are distinct from other conjoint methods because preferences are elicited by asking respondents to choose one alternative from those presented, rather than asking respondents to rank alternatives, or give them a rating and because the analysis is based on the random utility theory (RUT) rather than *ad hoc* techniques or axiomatic measurement theory (Viney et al., 2002).

The use of ranking and especially rating techniques suffers from potential theoretical and practical obstacles. Bennett and Blamey (2001) argued that individuals might experience difficulty in ranking/rating all the alternatives. In particular, rating tasks involve difficulty in making interpersonal comparisons and departure from the choice contexts that are faced by consumers in the real world. The DCE is the simplest of the choice techniques and thus its greatest advantage is the low cognitive complexity arising from the experiment (Louviere et al. 2000). Bateman et al. (2002) also pointed out that, compared to DCEs, conjoint methods differ in their ability to produce WTP estimates consistent with the usual measures of welfare change and thus eligible for inclusion in the CBA. Thus, DCEs are consistent with economic theory (Hanley et al., 2001) and can simulate the types of decisions that individuals are accustomed to making in everyday life (Ryan, 1999a). The theoretical foundation of the DCEs is based on RUT (a probabilistic choice theory¹) and is consistent with neoclassical economics and, as previously described, with Lancaster's economic theory of value. The concept of random utility was put forward by Thurstone (1927) in psychology. It was introduced into economics by Marschak (1960), formalized by Manski (1977) and further extended to the modelling framework by McFadden (1974). Considering an individual who has to choose one alternative from a choice set of alternatives, in accordance with neoclassical economic theory RUT assumes that the individual has perfect discriminatory power and unlimited information-processing capacity and chooses the alternative with the highest level of utility. The individual can thus determine his or her best choice and will repeat this choice under identical circumstances (Anderson et al. 1991). The link with probabilistic choice theory arises from the researcher's lack of information about the individual's true utility function. Probabilistic choice theory is thus introduced not to reflect a lack of rationality in the individual, but to reflect a lack of information regarding the characteristics of

¹ As explained by Kjær (2005), the basis of probabilistic choice theory and modelling is that it is not possible to perfectly predict individual choices and so a characteristic of models dealing with uncertainty is that, instead of identifying one alternative as the chosen option, they assign to each alternative a probability to be chosen. Probabilistic choice modelling can be divided into two main families. In the former family of models the decision rule is assumed to be random and the utility to be deterministic while in the latter group the decision rule is assumed to be deterministic and the utility to be random. DCEs belong to the second family of models that view the individual's behaviour as rational and the probability as the inability of the researcher to accurately formulate individual behaviour. As the researcher cannot observe the individual's true utility function, a probabilistic utility function is used in the estimation.

the alternatives and/or the characteristics of the individual on the part of the researcher (Manski 1977).

1.2.2. Limitations of cost-effectiveness analysis and cost-utility analysis

The most prevalent evaluation methods used in health care are cost-effectiveness analysis (CEA) and cost-utility analysis (CUA). As illustrated by Kjær (2005), common to these evaluation methods is that they examine the effect of an intervention and the decision-making rule is to optimize effect per cost. In CEA the effect is a one-dimensional measure such as blood pressure or life year saved, whereas in CUA it is a two-dimensional measure capturing health-related quality of life (HR-QoL) and length of life, measured by QALYs (Torrance, 1986). In CEA there is no elicitation of consumer preferences, assuming that the chosen outcome measure is of value, while in CUA consumer preferences for (HR-QoL) are elicited using a range of techniques and then combined with information about the probability of the outcome and survival to estimate the expected value of the outcome (Viney et al., 2002). During the years, the QALY measure has gained considerable prominence (Neumann et al., 2005) and it is seen by many health care decision makers as a standard tool for priority setting and rationing when used as an input to “cost per QALY” analysis (Ryan et al., 2008).

Nevertheless, an important feature of these approaches is that they only allow for health-related preference-based outcome measures, meaning that only health-related measures of benefits are considered. Hence, the decision rule underlying CEA and CUA is built on a reduced concept of utility compared to the definition of utility known from neoclassic economic theory, in which the third type of evaluation method, CBA, is based on. CBA presents theoretical advantages such as a strong basis in welfare economics and a common unit of measure for costs and benefits (generally, a money metric) as required to determine whether a policy increases social welfare (allocative efficiency) (Ryan et al., 2008). CBA aims to maximize aggregated welfare, where “welfare” constitutes all the elements that provide individuals with utility and therefore is able, compared to CEA and CUA, to take into account whatever preferences individuals have (Kjær, 2005). Yet market data signal that people do value factors other than health related quality of life and survival. For example, people pay for benefits such as extra convenience, additional comfort, and information that has no immediate bearing on health outcome (Hall et al, 2004). Also in the literature there has been recognition that consumers may value other outcomes of healthcare (Mooney, 1998). Other concerns are dealt with by valuing a QALY equally to whoever receives it. If some of the omitted factors are valuable to patients or members of the public, the conclusions reached by policy makers may conflict with those of patients and public (Ryan, 1999b). Moreover, although measures such as QALYs allow comparisons across different health products or programmes, avoiding the need for repeated valuation exercises, monetary measures such as WTP facilitates comparison across a broader range of attributes, products, programmes or even sectors of the economy than does the use of QALYs (Lancsar and Donaldson, 2005).

These concerns with the limitations of CEA and CUA have led to a renewed interest in cost-benefit analysis (CBA) as an evaluation tool (Donaldson and Shackley, 1997). Almost uniquely, DCEs have the potential to provide inputs to both CBA and CUA (Lancsar and Louviere, 2008). DCEs allows the integration of individuals’ values on all aspects of care in one measure (Ryan, 2004), potentially capturing all forms of benefit, including health, non-health (e.g. reassurance or anxiety) and process benefits (e.g. waiting time, location of treatment, type of staff providing care), and allowing investigation of the trade-offs between such types of benefits. Furthermore, as DCEs can measure outcomes in monetary measures as well as utility, the technique could also be used to inform CUA (Lancsar and Louviere, 2008). Attempts have also been made in this direction, and the feasibility

of using DCEs to elicit utility weights for calculation of QALYs is also being explored (Hakim and Pathak, 1999).

1.2.3. Biases in cost-benefit analysis and related improvements

Both DCEs and dichotomous choice CVMs could be used in CBA, allowing for the possibility of measuring benefits beyond health outcomes. The two methods also share the same economic foundation (RUT) and involve consumers making mutually exclusive choices from a set of substitutable goods / services.

As mentioned earlier CBA describes an analysis which seeks to quantify in monetary terms the costs and benefits of a policy intervention or project. WTP is generally considered the standard and most reliable way to measure that benefits (Arrow et al. 1993). Despite the advantages of the approach, there has been a historical lack of popularity of CBA in health economics, maybe partly due to the perceived difficulty associated with placing monetary values on so-called intangible benefits of health care provision and partially to some methodological concerns regarding the application of CVM (Ryan et al., 2008). However, as significant progress has been made in monetary valuation methods within the health care arena over the past decade, the same author highlighted that this view is gradually changing and a greater use of decision-making based on monetised costs and benefits of alternative policy interventions is increasingly advocated. With respect to this, DCEs can offer several advantages over the CVMs.

Starting in the late 1980s, CVM was the first SP method to be used for valuation in health care. CVM attempts to measure the value of a good / service in its entirety, by asking people directly about their WTP, contingent on a particular hypothetical scenario of the commodity being valued. Nothing is revealed about the value of the different attributes that comprise the good / service (O'Brien and Gafni, 1996).

Some biases that can be quite problematic in CVMs do not seem to create big problems in DCEs. Firstly, as already specified, directly asking respondents' WTP for healthcare often results in a number of protest bids (respondents not answering the question because they may be unfamiliar with the health state under valuation or they may have an objection to place a monetary value on human health). In DCEs, WTP is to be inferred indirectly rather than explicitly pricing the good, with individuals trading the cost attribute for improvements in the positively valued attributes, or for a decrease in negatively valued attributes. Furthermore, DCE is not as sensitive to scope effect as CVM, as the good of interest can be "hidden" within the pool of available goods. This may de-emphasise the importance of the cost attribute by focusing respondents' attention directly on the trade-offs faced when making different policy decisions. This indirect approach is considered to be an advantage over CVM as it considerably reduces focus on the price aspect (Blamey et al. 2000), probably resulting in fewer protest answers. Secondly, in dichotomous choice CVM there is evidence that individuals tend to state they would pay amounts above their maximum WTP (saying "yes" to the bid offered), resulting in an overestimation of true WTP (Brown et al., 1996). DCEs may overcome the 'yea-saying' bias (Hanley et al., 2001). Thirdly, the experimental design methods used in DCEs allow a range of attributes and levels to be valued within the one survey, enabling researchers to collect more information. A CVM study usually estimates the overall value of a given health care intervention, with given characteristics while in DCEs monetary values can be estimated for numerous possible healthcare interventions (Hanley et al., 2001). Fourthly, DCEs allow estimation of incremental benefits that consumers derive from the different individual attributes of health care interventions (Ryan et al., 2008) whereas CVM normally provides an overall valuation. Information on the value of individual attributes could be useful, as policy changes are often concerned with changes in certain aspects of care. Finally, as the use in DCEs of generic health attributes facilitates the transfer of WTP estimates of a variety of potential health interventions for CBA, such technique is better suited for benefit transfers (Hanley et al., 1998). Benefit transfers refer to the

use of existing estimates of the benefit of a non-marketed good from one or more sites (study sites) to predict the value for the same or for a similar good in a different site (policy site) (Ryan et al., 2008).

1.3. RESEARCH QUESTIONS

According to the previous assertions, this thesis is principally focused on the investigation of two research questions (RQs) related to the assessment of public preferences for primary care services using DCEs. An additional RQ was then formulated to take maximum advantage of this methodological approach. As its investigation was propaedeutic to the analysis of the other two RQs, it was placed in the first section of the thesis. The three RQs are presented hereafter. Each one was examined through a specific paper.

RQ1. Which are the health and healthcare areas where DCEs have been used?

The number of DCEs in health economics has increased quickly in recent years, with the explosion of the literature applying this technique (Ryan et al., 2008). Although many researchers have reported during the years the state of the practice of the DCE methodology, in order to fully understand the potentialities of this approach a classification of the areas covered by DCEs could be valuable. Hall et al. (2004) and De Bekker-Grob et al. (2010), reported a synthetic taxonomy of the main fields where DCEs have been used. Nevertheless, a more detailed categorization of DCEs areas of application is lacking.

The paper *“The application of discrete choice experiments in health economics: a systematic review of the literature”* provides a comprehensive classification and description of the various areas in which DCEs in health care have been performed. Using a comparative approach between different periods, it also identifies a range of emerging trends.

RQ2. What characteristics of primary care models are important to citizens?

Over the past two decades healthcare reforms in Western Europe have changed primary care systems, reshaping in particular the organizational role of general practitioners (GPs) and their clinical and managerial activities (De Maeseneer et al., 1999; Chaix-Couturier et al., 2000; Rico et al., 2003). Since these changes have been always supply-led rather than demand-led, the idea that the redefinition of primary care models should be first of all consistent with the population needs and preferences is strengthening (Inglese, 2008).

Traditionally, GPs in Italy have worked in solo practices without any auxiliary staff or institutional links to other GPs. Over the past 10 years, many GPs were encouraged to participate in collaborative arrangements such as group practices in which they share practice space and other resources (Fattore et al., 2009). More recently, Italian primary healthcare reform has moved towards a more comprehensive and team-based approach to address population-specific needs and to more proactively treat chronic diseases. In this setting, professionals from various disciplines provide a broad range of medical and community services (Bellentani et al., 2009). Despite the apparent superiority of the team-based community models, the present trials as well as the national and international literature highlighted some important limitations of these solutions (Lamarche et al., 2003; Maio et al., 2009; Agnetti et al., 2011).

In view of the difficulty to determine which organizational approach could be the best, in order to design services that are sensitive to population needs in a context of limited resources it is therefore important to find out which aspects of primary care models people would most like to see improved, with a necessary trade-off between the most important attributes of such models. At present, there is only little evidence in the literature about this topic (Hjelmgren and Anell, 2007).

In the paper “*Applying discrete choice modelling in priority setting: an investigation of public preferences for primary care models*”, the relative importance of the different primary care model attributes, the rate at which individuals trade between attributes and the relative value of different service configurations was examined by means of a DCE, providing significant implications for the demand for new and existing primary care services.

RQ3. Are population preferences for different GP consultations affected by socio-demographic characteristics and past experiences with primary care services?

Due to the numerous criticisms raised to the asymmetry in the physician-patient interaction, the consultation approach has evolved from being a paternalistic one to a patient-centred one (Mead et al., 2002), especially in the primary care sector. Although existing research emphasizes support for increasing patient-centeredness in consultations, empirical evidence for the role of patient-centred care in patient outcomes is mixed (Lewin et al., 2001; Mead and Bower, 2002).

Some authors, thus, pointed out that patient preferences should be a more central element in determining the type of consultation style (Krupat et al., 2000), even though addressing patients expectations could be arduous, as there are various consultation characteristics potentially important for patients that often generate conflicting results in the doctor-patient interaction (Coulter, 2005; Légaré et al., 2008). This implied an increasing interest in the analyses where patients are required to trade off between some relevant attributes.

The literature presents a quite comprehensive evaluation of patients’ priorities for characteristics of primary care consultations (Vick and Scott, 1998; Scott and Vick, 1999; Longo et al., 2006; Cheraghi-Sohi et al., 2008). However, the knowledge of the subject remain partial because the existing work has not accounted enough for the influence that patients’ socio-demographic characteristics and past experiences could have on primary care consultations’ preferences. As these aspects may have a significant impact on patients’ choices, some researchers emphasized the importance of flexibility in the physician-patient consultation approach so that individual differences in patient preferences are respected (Charles and Gafni, 1999).

The paper “*Heterogeneity in preferences for primary care consultations: results from a discrete choice experiment*” tries to deepen the knowledge on this matter, investigating population preferences for different GP consultation approaches and paying particular attention in the analysis of the relative importance assigned by respondents subgroups to the various attributes. The results provided could support the implementation of more appropriate consultation strategies, to better meet the patients’ different desires for information-receiving and involvement in decision-making.

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2. THE APPLICATION OF DISCRETE CHOICE EXPERIMENTS IN HEALTH ECONOMICS: A SYSTEMATIC REVIEW OF THE LITERATURE

ABSTRACT

Objectives. In recent years, there has been a growing interest in the development and application of discrete choice experiments (DCEs) within health economics. Even though the literature include several reviews of the methodology associated with conducting DCEs and analysing the resultant choice data, a detailed classification of the areas covered by DCEs is lacking. The aim of this paper is to provide, after a brief description of the most important phases of a DCE, a comprehensive categorization of the various areas in which DCEs in health care have been performed.

Methods. A systematic literature review was conducted to identify published studies using stated preferences DCEs within a health context between January 1990 and May 2011.

Results. 256 DCEs were included in the review. Compared to the 1990-2000 period, the number of DCEs has increased quickly, with experiments carried out in 30 different countries. A growing number of studies primarily investigated patients' preferences during the years, collecting a greater number of responses in comparison to the baseline period. A significant proportion of publications estimated the benefits of health care services, like specialistic surgical and medical services, generic medical services, services for chronics and elderly people, maternity and childbirth services and diagnostic facilities. Nevertheless, DCEs has also been used to value health outcomes, examine preferences for pharmaceutical products, investigate labour-market choices as well as healthcare systems characteristics and health policies.

Conclusions. This paper adds to the body of literature reviewing the growing stock of published DCEs in health economics, providing a new detailed taxonomy of the various areas in which such experiments have been applied. Together with the methodological refinements, future research should continue to explore new contexts of analysis.

Keywords. discrete choice experiments, review, areas of application, health economics

2.1. INTRODUCTION

In recent years, there has been a growing interest in the development and application of discrete choice experiments (DCEs) within health economics shown by the explosion of the literature applying this technique (Ryan et al., 2008). DCEs involve generation and analysis of choice data, and creation of hypothetical markets that can be constructed to suit relevant research questions. Thus, DCEs can mimic existing markets or elicit preferences and values for goods/services for which markets do not exist. DCEs offer several advantages in the health sector, the most important of which is that they provide rich data sources for economic evaluation and decision making, allowing investigation of many types of questions, some of which would otherwise be intractable analytically (Lancsar and Louviere, 2008). The health economics literature includes several reviews of the methodology associated with conducting DCEs and analysing the resultant choice data. Starting from the work of Ryan and Gerard in 2003, where the main methodological issues were identified, many researchers have reported during the years the state of the practice of the DCE methodology (Hanley et al., 2003; Fiebig et al., 2005; Viney et al., 2005; Belkar et al., 2006; Lancsar and Louviere, 2006; Ryan et al., 2008; Guttman et al., 2009; Louviere and Lancsar, 2009; De Bekker-Grob et al., 2010). In spite of the valuable contribution of these papers, less attention has been paid to the classification of the areas covered by DCEs. Hall et al. (2004) and De Bekker-Grob et al. (2010), reported a synthetic taxonomy of the main areas where DCEs have been used. Nevertheless, a more detailed categorization of DCEs areas of application is lacking. The aim of this paper is to provide, through a systematic literature review, a comprehensive classification of the various areas in which DCEs in health care have been carried out. In the next session a brief description of the most important phases of a DCE is presented. The methods for identifying and reviewing DCEs are then explained, followed by a description of the specific areas where DCEs have been applied. A comparative approach between the periods is adopted in order to identify any emerging trends.

2.2. BACKGROUND

2.2.1. Discrete choice experiments

Originated in mathematical psychology, DCEs were pioneered in marketing (Louviere and Woodworth, 1983) and have become very popular in transportation economics (Hensher, 1997) and environmental economics (Adamowicz and Boxall, 2001). Since the first application in health economics, (Propper, 1990) the number of studies using DCEs has grown rapidly (De Bekker-Grob et al., 2010).

Discrete choice experiments are based on the assumption that goods/services can be described by their attributes (Lancaster, 1966), and the value of a good/service depends on the nature and level of these attributes. The attributes might describe the impact of the goods/services on health outcomes, but might also describe non-health outcomes or the process by which the services are delivered (Ryan, 1999).

Individuals are presented with alternative hypothetical goods/services consisting of a number of attributes with different levels, and so they are asked to choose between quality/time/price differentiated versions of a good/service in a way that often requires them to make trade-offs between attributes.

Such stated preference techniques are favoured in health economic analyses because they are grounded on the utility theory (responders choose the alternative which gives them the highest utility) and they simulate the types of decisions that individuals are accustomed to making in everyday life (Ryan, 1999).

The DCE approach is able to indicate whether particular attributes are predictors of choice over alternative scenarios, to provide information on the relative importance of the attributes used to describe the alternatives in choice sets and to indicate the relative overall importance of specific scenarios (combinations of attributes and levels) that are regarded as plausible competing scenarios (Louviere et al., 2000).

Moreover, since all attributes (including time or price) are varied simultaneously in the course of the experiment, given the appropriate experimental design, marginal rates of substitution between all attributes (the degree to which respondents are willing to trade one attribute for another) can be derived from responses (Zweifel et al., 2006).

The most important phases of a DCE, as described by Ryan and Gerard (2003), are: selection of attributes and level setting, experimental design and construction of choice sets, preferences measurement, estimation procedure and tests of the validity of responses. Such stages are briefly described below. For a detailed description on how to conduct a DCE see Lancsar and Louviere (2008).

2.2.2. Selection of attributes and level setting

A critical aspect of the DCE design is the identification and the correct specification of the relevant attributes and attribute levels describing the hypothetical scenarios under consideration.

Attributes can be quantitative (e.g. cost / waiting time) or qualitative (e.g. healthcare service characteristics). As the health-related DCEs could be complex, selecting and defining the attributes requires a good understanding of the target population's perspective and experience (Hall et al. 2004). Attributes are generally identified from published literature, grey literature (policy documents and government reports) and qualitative methods such as semi-structured interviews and / or focus groups with samples of relevant respondents and experts (e.g. clinicians / policy makers) (Coast and Horrocks, 2007). While some respondents may consider a different set of attributes to be relevant, it is important that the DCE captures the main attributes for the majority of respondents so that concerns about omitted attributes are avoided (Hoyos, 2010).

Once the attributes are identified, attribute levels need to be specified. The levels should reflect the range of situations that respondents might expect to experience, although DCEs can include currently unavailable but possible alternatives (e.g. 'new treatments') by stretching level ranges (Lancsar and Louviere, 2008). A sufficiently wide range of levels should be used (to avoid respondents ignoring attributes because of little difference in levels) and evenly-spaced attribute levels can be useful for interpreting the estimated effects of numerical attributes.

The greater the number of attributes, the greater the cognitive difficulty of completing a DCE. Therefore, the possibility of omitted variable bias must be weighed against task complexity and cognitive burden. Concerns about too complicated a task and non-compensatory decision rules (Bech et al., 2010), may have led to the use of a lower number of attributes in current DCEs (De Bekker-Grob et al., 2010). In this respect, iterative pilot tests provide an opportunity to review the selection and definition of attributes and of their levels.

Regarding quantitative attributes, although including a monetary attribute (such as cost of a treatment) allows indirect estimation of willingness to pay (WTP), several authors noted the difficulties in defining the appropriate payment vehicle in a collectively funded health care system, where patients pay very little for their health care (Guttman et al., 2009; Ryan and Gerard, 2003). Where a cost variable was not included, a measure of time (e.g. waiting time, travel time) frequently served as an indicator of the relative value of other attribute levels. In cases where WTP could be measured the monetary attribute was preferred, but in some contexts it was more appropriate to value trade-offs in one attribute with respect to changes in waiting time (Guttman et al., 2009). Finally, with respect to risk attributes (e.g. percentage chances of side effects), particular attention should be given to their description, as respondents may have difficulty in interpreting probabilities (Peters et al., 2006).

2.2.3. Experimental design

The experimental design is the combination of the attributes levels used to construct the alternatives included in the choice sets. A full factorial design includes all

possible combinations of the levels of the attributes and allows for estimation of main effects and interaction effects independently of one another. A main effect refers to the direct effect of each independent variable (the difference in attribute levels) on the dependent variable (choice variable). An interaction effect is the effect of the interaction between two or more independent variables (by varying two or more attribute levels together) on the dependent variable. Given that the number of combinations of a full factorial may become too large to be examined by respondents, fractional factorial designs are usually implemented. A fractional factorial design is a sample of the full design, which allows the estimation of all the relevant effects for the researcher (as a minimum main effects only or main effects plus some higher-order interaction effects). To reduce the cognitive complexity, full and fractional factorial designs can also be blocked into different versions to which respondents are randomly assigned. For the construction of the choice combinations, if a binary choice DCE is used (e.g. would you use this service, yes/no) then the scenarios derived from the full factorial or fractional factorial design are the choices. If two or more alternatives are employed the scenarios must be properly placed into choice sets.

Two of the main design objectives identified by Louviere et al. (2000) are identification and efficiency. As recently emphasized by Louviere and Lancsar (2009), identification is a crucial aspect of design implementation because one may be able to improve efficiency by increasing sample size, but identification cannot be changed once a design is constructed.

Identification is related to the effects included in the indirect utility function (IUF) that can be independently estimated, which establishes the possible specification of the IUF. Therefore, the parameters to be estimated should be known before an experimental design is created. Furthermore, the design should allow estimation of the most possible general IUF specification, given the financial and the cognitive constraints. Small fractional factorial designs, that allow only main effects to be estimated under the assumption that all omitted effects are not statistically significant, typically have been used in health (e.g. Van der Pol and Carins, 1998; Ryan, 1999; Scott, 2001). This may be convenient but is rarely likely to be correct, because the main effects are likely to be biased if IUFs are not strictly additive² (Lancsar and Louviere, 2008). In many cases, fractional factorial designs were used even when full factorials were relatively small and could have been used, which unnecessarily limits the effects that can be estimated (Viney et al., 2002).

Efficiency is related to the precision with which the effects are estimated. In this respect, Huber and Zwerina (1996) proposed desirable design criteria that are orthogonality (attribute levels appear with equal frequency with each level of each other attribute in all the included alternatives), level balance (the levels of each attribute appear with equal frequency in all the included alternatives), minimal

² The context for health care decision making is often complex and - as Lancsar and Louviere (2006) pointed out - many decision rules that subjects might use would be inconsistent with additive conditional utilities, such as multiplicative decision rules. The latter can be modelled by including interactions between attributes in the design to produce non-linear indirect utility functions, a step rarely undertaken in health-related DCEs. So, the likelihood of obtaining unbiased estimates from models that assume linear, additive utility specifications without interactions is small. Indeed, Viney et al. (2002) specified that the main effects that can be estimated will be correlated with unobserved and unobservable interaction effects; unless these interaction effects are non-significant, the main effects estimated will be biased. This suggests that one should implement the largest design possible, because this provides more statistical information, minimises bias and also makes it more likely that one can identify non-additive decision rules that lead to 'apparent' violations of rationality (Louviere et al., 2000). If the additivity assumption is true in a data set, one will obtain the same estimates of main effects from large designs that one obtains from small designs; however larger designs also insure against the likelihood that utility is not additive (Lancsar and Louviere, 2006). However, full factorial design is only a real possibility for small experiments that involve a limited number of either attributes or levels, or alternatively a highly blocked design (Kjaer et al., 2005).

overlap (there are as few overlaps of levels as possible for each attribute in each choice set) and utility balance (the options in each choice set should have similar probabilities of being chosen). Satisfying the four principles, however, does not guarantee an optimal design for every particular problem of interest because there may be trade-offs between these desirable design properties. For example utility balance can increase random variability and lead to biased parameter estimates, as the parameters of discrete choice models cannot be estimated independently of the variance of the error term (Viney, 2005). Moreover if all options in each set are approximately equal in utility, there would be no reliable statistical information for model estimation (Louviere et al., 2008). As regards minimal overlap, Huber and Zwerina (1996) pointed out that while it is a desirable feature for main effects designs, it precludes estimation of interactions.

With the development of the knowledge of statistical efficiency, an approach to produce optimally or near optimally efficient designs for conditional logit models with additive IUFs has emerged (Street and Burgess, 2007), although the literature on optimally efficient designs focuses largely on choice experiments in which all alternatives in the choice set are generic (i.e. they have the same attributes and are not labelled).

As in the construction of efficient designs it is normally assumed that all alternatives are equally likely to be selected (that is all the parameters are zero), further efforts to improve statistical efficiency are focused on using prior assumptions about parameters, obtained from the pilot studies, in the design development (Rose and Bliemer, 2008).

2.2.4. Preference Measurement

The created choice sets form the basis for the DCE questionnaire. The number of choice sets presented to each respondent is context specific, depending on the task complexity (number of attributes, attributes levels and alternatives), incentives, mode of elicitation (e.g. mail survey, personal interview) and types of respondents (Louviere et al., 2000). Within health economics, the usual number of choice sets is around eight and seldom above sixteen (Ryan and Gerard, 2003), even though the use of larger numbers of choice sets per respondent has increased (De Bekker-Grob et al., 2010). It may be useful to add further choice questions to the experimental design, to test the validity of the results by incorporating consistency tests, or by providing “warm-up choices” to make respondents understand the task better (Carson et al., 1994). As discussed later, validity refers to the degree to which a DCE succeeds in measuring preferences without significant biases. To minimize any bias caused by the order in which the choice sets occur or the attributes are described, it is good practice to produce several versions of the questionnaire in which choice sets and attributes are presented in different orders (Kjaer et al. 2006). The questionnaire should be clearly presented and should contain a standard introduction to the DCE with choice set examples. Furthermore, to analyse the effect of individual characteristics on the choices made, data on socio-economic indicators should be collected. Finally, iterative pilot tests should be used in order to check for the adequacy of the attributes and levels considered, the respondents' understanding of the choice context and task, and whether the number of choice sets can be managed by the target population (Hall et al. 2004).

After the questionnaire has been developed, the analyst must make decisions about sampling issues and survey administration. Based on the sampling frame (the universe of respondents relevant for the study objectives) a sampling strategy and sample size must be defined. Several sampling strategies can be adopted. In the simple random samples (SRS), each decision maker in the sampling frame has an equal likelihood of being selected for the sample. With an exogenously stratified random samples (ESRS), the sampling frame is divided into mutually exclusive groups, each representing a proportion of the population. Within each group (stratum), individuals have an equal probability of being selected (Ben-Akiva and

Lerman, 1985). SRS is generally a reasonable choice. Yet, ESRS may be appropriate if there exists a relatively small but important subgroup or one wants to increase the precision of the estimates (Ryan et al., 2008). Sample size should be chosen to allow estimation of reliable models, subject to research budget and other constraints. Undertaking significant post hoc analysis to identify and estimate covariate effects invariably requires larger sample sizes (Lancsar and Louviere, 2008).

According to Champ and Welsh (2006), a DCE can be conducted in one of two ways: an interviewer can ask the survey questions and record the respondents' answers (interviewer-administered) or survey respondents can record their own answers (self-administered). Interview-administered surveys can be conducted face-to-face with the survey respondent or over the telephone. Self-administered surveys can be conducted through the mail, phone, internet or on-site. Interviewer-administered DCEs are increasing (De Bekker-Grob et al., 2010), probably because this approach is generally considered the best one, though more costly one (Ryan and Gerard, 2003). On the other hand self-administered DCEs are often cheaper compared to other collection methods, but their response rates tend to be lower (Ryan et al., 2008).

2.2.5. Model estimation

The analysis of responses from choices made in DCEs is based on random utility theory (RUT), developed by McFadden (1974). According to the RUT, individuals hold some construct of (indirect) "utilities" for choice alternatives and they may have a perfect discrimination capability. However, researchers cannot observe all factors affecting individuals' preferences. Therefore, as shown in equation 1, the latent utility of alternative i in a choice set C_n (as perceived by individual n) is considered to be decomposable into two additively separable parts: a systematic (explainable) component V_{in} and a random (unexplainable) component ε_{in} , representing unmeasured variation in preferences.

$$U_{in} = V_{in} + \varepsilon_{in} \quad (\text{Eq.1})$$

The systematic component (as shown in equation 2) is at least a function of attributes of the good/service, where the characteristics (covariates) of individual chooser are typically included.

$$V_{in} = X_{in} \beta + Z_n \gamma \quad (\text{Eq.2})$$

X_{in} represents the vector of attributes, usually including time/price and quality of alternative i as viewed by individual n , and Z_n is a vector of characteristics of individual n , and β and γ are vectors of coefficients to be estimated.

The basic assumption is that individual n will choose alternative i if and only if that alternative maximises his utility amongst all J alternatives included in the choice set C_n . From equation 1, alternative i is chosen if and only if:

$$(V_{in} + \varepsilon_{in}) > (V_{jn} + \varepsilon_{jn}) \quad \forall j \neq i \in C_n \quad (\text{Eq. 3})$$

Rearranging to place the observable and unobservable components together yields:

$$(V_{in} - V_{jn}) > (\varepsilon_{in} - \varepsilon_{jn}) \quad \forall j \neq i \in C_n \quad (\text{Eq. 4})$$

The analyst does not observe $(\varepsilon_{in} - \varepsilon_{jn})$, and consequently cannot determine exactly if $(V_{in} - V_{jn}) > (\varepsilon_{in} - \varepsilon_{jn})$. Therefore, choice outcomes can only be determined up to the analysis of the probability choosing one alternative over another. As the actual distribution of $\varepsilon_{in} - \varepsilon_{jn}$ across the population is not known, for the analysis it is assumed that it relates to a certain distribution. Together with the type of choice

modelled (binary choices or multiple choices), the latter distribution will determine the specific econometric model form for the choice probability.

If the choice faced by respondents is dichotomous (e.g. would you prefer alternative A: yes/no) or includes only two alternatives (e.g. would you prefer alternative A or B), binary probit or logit models are suitable. A probit specification assumes a standard normal distribution of the error terms, while a logit model implies a logistic distribution of the random component of the IUF. In both models, a panel specification (i.e. random effects) may be used in order to consider the multiple observations usually obtained from each respondent.

When three or more alternative choice options are available to the individual, the multinomial logit model (MNL) is the most commonly used specification. The MNL has three assumptions: independence of irrelevant alternatives (IIA) (i.e. choice probabilities would all change in the same proportion with the introduction of a new alternative or the deletion of an existing one); error terms are independent and identically distributed (IID) extreme value type I (Gumbel) across observations; no taste heterogeneity (i.e. homogenous preferences across respondents). Within health economics, the majority of early applications of DCEs have employed the three aforementioned models (Ryan and Gerard, 2003). In particular, the random-effects probit remains a popular choice model (Guttmann et al., 2009).

However, in many cases, the MNL model assumptions could be too restrictive in describing human behaviour. As highlighted by Train (2003), the IIA assumption is difficult to justify in situation where some alternatives compete more closely with each other than they do with other alternatives. For example, it is likely that the two services compete between each other more intensively than they do with opting out. Regarding the second assumption, the MNL model can handle situations where unobserved factors are independent but it cannot be used when unobserved factors are generating some correlation, for example in panel data when the unobserved factors affecting individual choice are dependent over time, implying a non-identical error distribution across individuals. With respect to the third restriction, the MNL can only represent the systematic heterogeneity by allowing for interaction between socio-economic characteristics and attributes of the alternatives, but cannot embody some differences in tastes that will remain random. Consequently, more behaviourally realistic choice models have been and continue to be developed. For example, the class of generalised extreme value (GEV) models (e.g. the nested logit (NL) model) relax the IIA property by using more general substitution pattern. The heteroscedastic models relax the IID assumption by assuming independent but not identically distributed errors across individuals and alternatives. Models such the mixed logit (MXL) and the latent class (LC) relax the assumption of taste homogeneity by allowing for random taste variation, and are also able to overcome the other two previously cited limitations.

Among more flexible models, NL, MXL and LC models are increasingly used by researchers (De Bekker-Grob et al., 2010).

The NL is the most widely used GEV model. It partially relaxes the IIA assumption by nesting (grouping) subsets of alternatives with characteristics that are more similar to each other with respect to other characteristics which are present in the other alternatives. The IIA holds between pairs of alternatives included in the nest, but not across nests (Train, 2003).

McFadden and Train (2000) pointed out that, under some basic conditions, any random utility model can be derived from an MXL. The MXL allows the fixed coefficients of the observed characteristics to vary over respondents according to some pre-specified continuous distribution (generally normal or lognormal), as a representation of individual taste variation. Indeed, this model is particularly appropriate when tastes could vary considerably across members of the population. The analyst must specify which coefficients should be modeled as randomly distributed ones and what distribution should be used for the random coefficients (Hensher and Greene, 2003).

LC would be a feasible model specification if it can be assumed the existence of a finite sets of groups of people in the data with similar tastes. In the LC model the pre-specified distribution of the observed parameters is discrete instead of continuous. The LC approach assumes that there are two or more classes (segments) of respondents with homogeneous utility functions. The segment membership is identified by unobserved (latent) variables that can be related to a set of discrete observed variables such as general attitudes and perceptions or socio-demographic characteristics of the respondents. As this model is semi-parametric, assumptions about parameters distribution are not required. However methodological tests must be used to determine the optimal number of classes (Greene and Hensher, 2003). The capacity of the LC specification to investigate the probability of belonging to a given group, gives this model an advantage compared with the MXL, since it allows easier interpretation of the results (Fiebig et al., 2010).

2.2.6. *Validity issues*

The DCEs format allows researchers to incorporate consistency tests to check the validity of subject's responses. As DCE tasks are cognitively challenging (Phillips et al., 2002), consistency of choice responses with theoretical principles is an indication of whether the results from a survey are valid and accurate (Bowling, 1997). The assumptions of the classical preference-based consumer theory commonly tested are completeness (or stability), transitivity, monotonicity (or non-satiation) and continuity (or compensatory decision making). According to Lancsar and Louviere (2006), the most important axioms to the preference-based view of rationality are transitivity and completeness.

Ozdemir et al. (2010) stated that transitivity requires that if subjects prefer Treatment A to Treatment B at one point in the sequence and Treatment B to Treatment C at another point, then they should also prefer Treatment A to Treatment C at a third point. Within-set monotonicity requires that subjects prefer better levels to worse levels of an attribute. If Treatment A and Treatment B are identical in all attributes but the cost attribute, and if Treatment A has a lower cost, then Treatment A should be preferred to Treatment B. Cross-set monotonicity tests take advantage of treatments that are dominated by a treatment alternative in a different choice set. Subjects who prefer Treatment A to Treatment B also should prefer Treatment A to any Treatment C that is unambiguously dominated by Treatment B; that is all attribute levels in Treatment C are equal to or worse than those in Treatment B. It seems reasonable also to require that preferences be stable, at least for the duration of the survey. Stability requires that if subjects prefer Treatment A to Treatment B at one point in the sequence of choice questions, then they should prefer Treatment A to Treatment B at any subsequent point.

Lexicographic preferences describe cases where individuals rank attributes in order of priority and make decisions based on the highest priority attribute. When the level of the most important attribute is the same in two alternatives, the level of the second most important attribute determines the consumer's preferences and so on until a unique choice is made. Lancsar and Louviere (2006) specified that lexicographic preference orderings are complete, transitive and strongly monotonic. However, such preferences are not continuous because individuals do not trade over all attributes when making decisions, thus violating the compensatory decision-making framework³. This limits the ability to derive marginal rates of substitution between attributes and such preference orderings cannot be represented by a utility function. This theoretical assumption is commonly tested by identifying individuals with dominant preferences: individuals who always chose the scenario with the

³ Compensatory decision-making assumes that the respondents can be compensated for a decrease in one attribute with an increase in the other attribute, involving that the respondent is willing to trade-off the attributes (Bech et al., 2003).

'best' level of a particular attribute and who rank that attribute as the most important (Scott et al., 2002).

Several studies have investigated preference consistency in DCEs. Bryan et al. (2000), Sheill et al. (2000) and Skjoldborg et al. (2005) found evidence of stability of preferences for SC studies in health applications. Ryan and San Miguel (2003) found no evidence of a relationship between the product and being inconsistent, and pointed out that unfamiliar goods conform as well as commonly used goods to the axiom of completeness. Various authors (Maddala et al., 2003; Wordsworth et al., 2006; Peacock et al., 2006; Ubach et al., 2003; Ryan and Farrar, 2000) included a monotonicity test and reported low failure rates (2–8%).

Once respondents 'fail' such axioms, the question is raised of what to do with them. Lancsar and Louviere (2006) argued that deletion of such respondents may be inappropriate since such responses may be valid. Supporting this concern, San Miguel et al. (2005) and Ryan et al. (2009), both using qualitative research techniques, found that individuals who had been defined as failing non-satiation from quantitative tests, had 'rational' reasons for doing so. Lancsar and Louviere (2006) also noted that random utility models are robust to both violations of compensatory decision making and errors made by individual in forming and revealing preferences. Deleting such respondents may therefore result in the removal of valid preferences, which in turn may reduce statistical efficiency and/or result in sample selection bias. Furthermore, even if respondents are not trading, and marginal rates of substitution cannot be estimated, these preferences are still important from a policy perspective (Lancsar and Louviere, 2006).

2.3. METHOD

A systematic literature review was conducted to identify published studies using stated preferences DCEs within a health context between January 1990 and May 2011.

The bibliographic databases used were Medline, Scopus, Social Science Citation Index and EconLIT. The same text terms as Ryan and Gerard (2003) were used in the search strategies for each individual database. Search terms comprised "conjoint", "conjoint analysis", "conjoint measurement", "conjoint studies", "conjoint choice experiments", "part-worth utilities", "functional measurement", "paired comparisons", "pairwise choices" "discrete choice experiments", "discrete choice conjoint experiments" and "stated preference". Bibliographic searching was supplemented by reviewing references from identified key articles and by Internet searching of relevant web sites.

Studies were included if they were experimental and grounded in RUT (as opposed to solely regarding methodology or theory), if they were based on choice-based response data (as opposed to rating or ranking exercises) and if they were written in English.

The retrieved publications were then reviewed with respect to their background details and classified according to the specific topic areas covered by DCEs. Consideration was also given to the changes occurred between the articles in the baseline period (1990-2000) and those in the current period (2001-2011).

2.4. RESULTS

The search methodology generated 988 possible references. Through a careful reading of the full articles or abstracts, 256 DCEs were included in the review. Appendix 1 shows the complete list of DCEs, grouped by area of application. As the eligible 256 DCEs were related to 251 papers, when a DCE was not the only one in a specific paper it was marked with a double cross in the appendix. Papers that mainly investigated methodological issues and that conducted an original DCE as a demonstration were also included (43), as well as DCEs carried out with already existing stated preference data (18). They were marked in the appendix with an asterisk and with a cross respectively.

2.4.1. Background

Table 1 summarises background information of the DCEs included in the review in the period 1990 to 2000 and from 2001 to May 2011.

Table 1 - Background information of DCEs.

<i>Item</i>	<i>Category</i>	<i>Baseline: 1990 - 2000</i>		<i>Current: 2001 - 2011</i>	
Total		N = 29 (%)		N = 227 (%)	
Year	1990 - 1998	8	(28)		
	1999 - 2000	21	(72)		
	2001 - 2002			26	(11)
	2003 - 2004			29	(13)
	2005 - 2006			49	(22)
	2007 - 2008			65	(29)
	2009 - 2011			58	(26)
Country	UK	21	(72)	79	(35)
	USA	5	(17)	26	(11)
	Netherlands			23	(10)
	Australia	1	(3)	20	(9)
	Canada	1	(3)	16	(7)
	Denmark			16	(7)
	Other European countries			21	(9)
	African countries	1	(3)	7	(3)
	Far-eastern countries			7	(3)
	Middle-eastern countries			4	(2)
	More than one country			8	(4)
Source	Patients	7	(24)	121	(53)
	Population	13	(45)	60	(26)
	Healthcare workers	4	(14)	28	(12)
	Other sources	5	(17)	4	(2)
	More than one source			14	(6)
Average respondents per source	Patients	253		500	
	Population	720		801	
	Healthcare workers	261		426	
	Other sources	630		310	
	More than one source			403	

Markedly, the number of DCEs applied in health care sector has increased considerably, with a production of studies in the current period approximately eight times higher than that in the baseline. After the rapid increase in the DCEs production from 2001 to 2006 - with the highest number of publications reached in the period 2007 to 2008 - a slightly decreasing trend has emerged in the last three years.

The majority of the studies had their origin in the UK, the USA, the Netherlands, Australia, Canada and Denmark, with the UK and the USA being the largest producers of DCEs over both periods. In countries like the Netherlands and Denmark the technique had not been applied in the baseline period. Although to a

lesser extent, DCEs have been also used in other European, Middle-eastern and Far-eastern countries in the recent period.

A large amount of experiments evaluated patients' preferences or community preferences, with a growing utilization over the years of the former preference source: (24% of studies have used patients from 1990 to 2000 compared to 52% of studies from 2001 to 2011). While the proportion of DCEs using healthcare workers' preferences - such as general practitioners (GPs) and nurses - has remained stable in time (around 14% of the total period production), a negative variation between the two periods has occurred for the percentage of studies assessing other preference sources (e.g. policy makers, state and university employees). In the 2001-2011 period, 9 studies and 5 studies used two- and three-preference sources respectively. This was typically a comparison between patients and healthcare workers.

Except for the other preference sources, the average respondents per source increased over the two periods, with the greatest variation related to the responses provided by patients and healthcare workers.

2.4.2. Areas of application

Table 2 shows the specific areas covered by DCEs in the baseline period and in the current one.

Initially, one of the principal driving force behind the application of DCEs in health sector was the desire to value benefits beyond the quality adjusted life year (QALY) paradigm (Ryan, 2004), specifically designed to capture health outcome benefits only. This resulted in a considerable number of studies over both periods assessing the benefits of specific health care services, principally by estimating the value of different attributes in terms of one another, including non-health outcomes (e.g. reassurance, anxiety) and process attributes (e.g. type of care, type of care providers, location of treatment, waiting time, cost).

Among the publications assessing preferences for health care services, the majority of the studies evaluated specialistic medical services and diagnostic services, representing together 27% of the total experiments and 40% of DCEs focused on health care services.

With reference to the former area, in 1990 Propper applied the first health-related DCE (followed by another publication in 1995) in the evaluation of the monetary value of reducing waiting time on NHS waiting lists for specialistic medical services. Following this, Van der Pol et al. (1998) performed a DCE on haematological services. In the current period the previous sub-category - with 8 studies - continued to be the most frequently referred by researchers, even though several DCEs have also emerged in other disciplines. Actually, various studies have been applied in the evaluation of cardiological (5), dermatological (5), rheumatological (5), gastroenterological (4) and mental health (3) services. For example Kjaer et al. (2008) investigated heterogeneity in patients' preferences for cardiac rehabilitation; Coast et al. (2006) analyzed patients' preferences for a dermatology consultation; Ratcliffe et al., (2004) focused on treatments for osteoarthritis; Kleinman et al., (2002) on gastroesophageal reflux disease treatment and Johnson et al. (2007) considered the treatments of bipolar disorder.

Regarding diagnostic services, 4 studies were employed in the baseline period. In 1998 Bryan et al. evaluated university students' preferences for magnetic resonance imaging, and used these data with other preferences obtained in the same area for a methodological study in 2000. Two other methodological DCEs based on cervical cancer and bowel cancer screening preferences followed (Ryan et al., 2000; Salked et al., 2000). The most frequent diagnostic services analyzed in the studies during the current period were colorectal cancer screening (with 6 "standard" and 3 methodological DCEs), cytogenetic test and Down's syndrome test (both with 4 experiments), cervical cancer screening and HIV test (both with 3 studies).

Table 2 - Areas of application of DCEs.

Categories	Sub-categories	Baseline: 1990 - 2000	Current: 2001 - 2011
Total		N=29 (%)*	N=227 (%)*
Specialistic surgical services	Breast cancer management		6 (2.6)
	Colorectal cancer management		2 (0.9)
	Elective surgery in general	1 (3.4)	2 (0.9)
	Knee replacement		1 (0.4)
	Laparoscopic sterilization		1 (0.4)
	Peripheral vascular surgery		1 (0.4)
	Postoperative nausea and vomit		1 (0.4)
	Prostate cancer management		2 (0.9)
	Skin cancer management		3 (1.3)
	Surgical management of menorrhagia	1 (3.4)	
	Transplantation	2 (6.9)	1 (0.4)
	Upper limb surgery in tetraplegia		1 (0.4)
Specialistic medical services	Cardiological services		5 (2.2)
	Cerebral malaria		1 (0.4)
	Chemotherapy		1 (0.4)
	Dermatological services		5 (2.2)
	Gastroenterological services		4 (1.8)
	Haematological services	1 (3.4)	7 (3.1)
	Medical services in general	2 (6.9)	
	Mental health services		3 (1.3)
	Multiple myeloma therapy		1 (0.4)
	Post rape services		1 (0.4)
	Rheumatological services		5 (2.2)
	Maternity and childbirth services	Acute pneumonia in children	
Child analgesia, sedation and anaesthesia			2 (0.9)
In vitro fertilization		2 (6.9)	1 (0.4)
Intrapartum care			12 (5.3)
Maternity-ward care			3 (1.3)
Miscarriage management		1 (3.4)	1 (0.4)
Services for chronics and elderly people	Perinatal care		2 (0.9)
	Alcoholism management		1 (0.4)
	Alzheimer management		1 (0.4)
	Asthma management		11 (4.8)
	Diabetes management		4 (1.8)
	Disease self-management		2 (0.9)
	Hearing loss management		3 (1.3)
	Hip protectors for osteoporotic fractures		2 (0.9)
	Informal care		1 (0.4)
	Long term care		2 (0.9)
	Pain management		1 (0.4)
	Generic medical services	Dental care	3 (10.3)
Family practice			6 (2.6)
Obesity and weight management			1 (0.4)
Out-of-hours services		1 (3.4)	6 (2.6)
Paediatric care			2 (0.9)
Prescribing systems			1 (0.4)
	Smoking cessation		3 (1.3)

* Percentages do not add up to 100% due to rounding error

Table 2 - Areas of application of DCEs (Continued).

Categories	Sub-categories	Baseline: 1990 - 2000	Current: 2001 - 2011
Total		N=29 (%)*	N=227 (%)*
Diagnostic services	Allergic rhinitis test		1 (0.4)
	Bowel cancer screening	1 (3.4)	
	Breast cancer screening		2 (0.9)
	Cervical cancer screening	1 (3.4)	3 (1.3)
	Chlamydia screening		2 (0.9)
	Colorectal cancer screening		9 (4)
	Cytogenetic test		4 (1.8)
	Down's syndrome test		4 (1.8)
	HIV test		3 (1.3)
	Magnetic resonance	2 (6.9)	
	Pap test		1 (0.4)
Health outcomes	Acute illness		1 (0.4)
	Arthritis-related quality of life		1 (0.4)
	Asthma-related symptoms		2 (0.9)
	Cancer-related symptoms		2 (0.9)
	COPD-related symptoms		1 (0.4)
	General quality of life	2 (6.9)	7 (3.1)
	Mortality risks		1 (0.4)
	Pain-related health status		1 (0.4)
	Poor health status		1 (0.4)
	Respiratory and cardiovascular poor health	1 (3.4)	
	Sexual quality of life		1 (0.4)
	Social quality of life		2 (0.9)
	Vision loss-related symptoms		3 (1.3)
Drugs and vaccines	Antibiotics		1 (0.4)
	Antidepressants		1 (0.4)
	Antiepileptic drugs		1 (0.4)
	Benign prostatic hyperplasia drugs		1 (0.4)
	Contraceptives		2 (0.9)
	Generic pharmaceutical products		2 (0.9)
	Intranasal corticosteroids		1 (0.4)
	Meningococcal vaccine		1 (0.4)
	Microbicides for HIV		1 (0.4)
	Osteoporosis drugs		2 (0.9)
	Psoriasis drugs		1 (0.4)
	Rheumatoid arthritis drug		1 (0.4)
	Urinary incontinence drugs		1 (0.4)
	Varicella vaccine		1 (0.4)
Healthcare system	Clinical service developments	1 (3.4)	
	Healthcare providers	2 (6.9)	5 (2.2)
	Healthcare system's characteristics		6 (2.6)
Health policies and health plans	Environmental health policies		1 (0.4)
	General healthcare interventions		7 (3.1)
	Health insurance plans	1 (3.4)	1 (0.4)
	Healthcare programmes for the elderly		1 (0.4)
	Life saving programmes		2 (0.9)
Human resources	Doctor-patient relationship	2 (6.9)	3 (1.3)
	Educational interventions		1 (0.4)
	Job characteristics	2 (6.9)	6 (2.6)

* Percentages do not add up to 100% due to rounding error

The remaining health care service categories where DCEs were employed are the area of services for chronics and elderly people, the area of generic medical services, the group of maternity and childbirth services and of specialistic surgical services.

Differently from the other service groups mentioned before, DCEs investigating services for chronics and elderly people exclusively emerged in the 2001-2011 period. Starting from the work of Ratcliffe et al. (2002), many studies examined preferences for asthma management. For example Ratcliffe et al (2002) elicited preferences for conventional and homeopathic treatment of asthma; Lancsar et al. (2007) considered preventive asthma medication; Hitchcock et al. (2007), Walzer and Zweifel (2007) and Walzer (2007) quantified caregivers' preferences for paediatric asthma treatment. Another often explored category relates to diabetes management with 4 studies in total. With respect to this, for example, patients' (Hauber et al., 2009) and doctors' (Chen et al., 2010) preferences for type 2 diabetes care were obtained. Finally, diverse experiments investigated preferences for hearing loss management (3), disease self-management (2), long term care (2) and hip protectors for osteoporotic fractures (2).

In relation to DCEs directed to the generic medical services area, two studies were initially employed in the dental care sector to determine the relative importance of dental benefit plan attributes (Gaeth et al., 1999; Cunningham et al., 1999); they were followed by another assessing preferences for orthodontic services attributes (Ryan and Farrar, 2000). Even though this sub-category remained attractive for researchers during the years, with two more experiments performed in 2010, most of the studies pertaining to this area tried to establish the importance of characteristics related to out-of-hours services and family practice-related services (both with 6 DCEs). Concerning out-of-hours services, for example, preferences for general (Morgan et al., 1999) and paediatric (Scott et al., 2003) out-of-hours primary care services were quantified, as well as the importance of attributes associated to emergency primary care services available during GP hours (Gerard et al., 2004; Gerard and Lattimer, 2005). The studies focused mainly on family practice, investigating patient predilections for characteristics connected with a GP appointment - mainly access and type of professional consulted - (Rubin et al., 2006; Gerard et al., 2008; Hole 2008) and with continuity of care (Turner et al., 2007). The value given by the population about the provision of nurse-led versus doctor-led primary health care in the treatment of minor illness was also taken into account (Caldow et al., 2006), as well as GPs' preferences for an application to optimize information exchange with hospital emergency units in acute stroke care (Huis in't Veld et al., 2005).

DCEs analyzing opinions for attributes of maternity and childbirth services started in the baseline period with the experiment of Ryan et al. (1997) on miscarriage management and two other studies on in vitro fertilization performed by the same author in 1999. In the current period, the greater part of the studies (12) evaluated the importance of intrapartum care characteristics and, to a lesser extent, of maternity-ward attributes (3).

Regarding the last category of specialistic surgical services, the DCEs production started with two studies on transplantation employed by Ratcliffe and Ratcliffe et al. in 1999 and 2000. Two more studies have been carried out in the same period, assessing preferences for elective surgery in general (Ryan et al., 2000) and for surgical management of menorrhagia (San Miguel et al., 2000). In the 2001-2011 period a total of 21 DCEs evaluated a broad range of surgical services, from peripheral vascular surgery (Shackley et al., 2001) to knee replacement (Byrne et al., 2006). Nevertheless, the majority of experiments have been directed to cancer management services, in particular to breast cancer (6), skin cancer (3), colorectal cancer (2) and prostate cancer management (2).

As one of the main strengths of the DCE approach is the ability to consider a broad range of benefits (Bryan and Dolan, 2004), the technique was also used to value health outcomes in the provision of care. In this field, the greatest portion of studies

were focused on the evaluation of general quality of life, often within the Quality Adjusted Life Year (QALY) paradigm (for example Hakim et al. (1999), Bryan et al. (2002), Gyrd-Hansen (2003) and Stolk et al. (2010)). In addition, other similar DCEs were carried out to investigate principally preferences for vision loss-related symptoms (3), asthma-related (2) and cancer-related symptoms (2).

Since 2002, DCEs have been constantly used in the pharmaceutical sector as well, in an attempt to determine the importance of various drugs and vaccines. For example, Seston et al. (2007) and Fiebig et al. (2010) evaluated preferences for contraceptive products, De Bekker-Grob in 2008 and 2009 concentrated on osteoporosis drugs, Hall et al. (2002) and Bishai et al. (2007) directed the research respectively on the varicella and meningococcal vaccines.

Lastly, the DCEs literature embraces experiments also performed in three minor but still significant areas of the health care sector: healthcare systems, health policies and plans, and human resources.

Studies included in the first category were mainly addressed to the analysis of healthcare provider choice, with 2 experiments in the baseline period and 5 in the current one. Another important area of interest within the same group was connected to preference assessment for healthcare systems characteristics, with 6 DCEs in current period.

For what concerns the publications investigating health policies and health plans, most of them (7) evaluated preferences for general healthcare interventions. Besides, other studies quantified the importance for alternative health insurance plans (2) for life saving programmes (2), for programmes in favour of elderly people (1) and for environmental health policies (1).

Within the area of human resources, various researchers elicited provider preferences for different job characteristics. For example, Thornton (2000) quantified the influence of economic incentives in the physicians' specialty choice process, Wordsworth et al. (2004) elicited principal and sessional GPs' preferences for alternative jobs in general practice, Scott et al. (2007) examined the strength of preference of community pharmacists for existing and potential new roles in primary care.

Other studies inside the category (2 in the baseline period and 3 in the current one) evaluated the importance of different aspects of doctor-patient relationship in general practice, with the assessment of patients' preferred degree of information exchange and involvement in decision making.

2.5. DISCUSSION

This paper adds to the body of literature reviewing the growing stock of over 250 published DCEs in health economics, providing a new detailed taxonomy of the various areas in which such experiments have been applied.

The review showed that, compared to the 1990-2000 period, the number of DCEs has increased quickly, with experiments carried out in 30 different countries. In line with the increasing importance of patient experiences acknowledged in the literature (Coulter, 2005), a growing number of studies primarily investigated patients' preferences during the years, collecting a greater number of responses in comparison to the baseline period.

A significant proportion of publications estimated the benefits of health care services, like specialistic surgical and medical services, generic medical services, services for chronics and elderly people, maternity and childbirth services and diagnostic facilities. Nevertheless, DCEs has also been used to value health outcomes, examine preferences for pharmaceutical products, investigate labour-market choices as well as healthcare systems characteristics and health policies.

Future research should also continue to explore new contexts of analysis, together with methodological refinements.

In spite of its interesting results, this paper has some limitations. First, having excluded non-English language literature, it is possible that some eligible studies

were not included in the review. Second, it is possible that the use of another taxonomy to classify DCEs might have modified the results reported. However, the taxonomy allowed the categorization of the entire material collected, giving no reason to invalidate its use.

Appendix 1a - DCEs list: specialistic surgical services.

<i>Categories</i>	<i>Sub-categories</i>	<i>DCEs</i>
Specialistic surgical services	Breast cancer management	<i>Caldon et al., 2007</i> <i>Van Helvoort-Postulart et al., 2008</i> * <i>Neuman, 2009</i> <i>Van Helvoort-Postulart et al., 2009</i> <i>Kimman et al., 2010</i> <i>Damen et al., 2011</i>
	Colorectal cancer management	<i>Salkeld et al., 2005</i> <i>Langenhoff et al., 2007</i>
	Elective surgery in general	<i>Ryan et al., 2000</i> <i>McIntosh et al., 2002</i> * † <i>Schwappach et al., 2007</i>
	Knee replacement	<i>Byrne et al., 2006</i>
	Laparoscopic sterilization	<i>McKessok et al., 2001</i>
	Peripheral vascular surgery	<i>Shackley et al., 2001</i>
	Postoperative nausea and vomit	<i>Lee et al., 2005</i>
	Prostate cancer management	<i>Sculpher et al., 2004</i> <i>Lloyd et al., 2008</i>
	Skin cancer management	<i>Weston et al., 2004</i> <i>Essers et al., 2010</i> <i>Essers et al., 2010</i> *
	Surgical management of menorrhagia	<i>San Miguel et al., 2000</i>
	Transplantation	<i>Ratcliffe et al., 1999</i> <i>Ratcliffe, 2000</i> <i>Ratcliffe et al., 2005</i>
	Upper limb surgery in tetraplegia	<i>Shnoek et al., 2008</i>

* Methodological DCEs, † DCEs with already existing data, ‡ Several DCEs in the same study

Appendix 1b - DCEs list: specialistic medical services.

<i>Categories</i>	<i>Sub-categories</i>	<i>DCEs</i>	
Specialistic medical services	Cardiological services	<i>Kjaer et al., 2006</i>	
		<i>Lancsar et al., 2007 *</i>	
	Cerebral malaria	<i>Kjaer et al., 2008</i>	
		<i>Clark et al., 2009</i>	
		<i>Torbica et al., 2010</i>	
		<i>Hanson et al., 2005 ‡</i>	
		<i>Aristides et al., 2002</i>	
	Chemotherapy	<i>Coast et al., 2006</i>	
		<i>Coast et al., 2006 *</i>	
	Dermatological services	<i>Kjaer et al., 2006 *</i>	
		<i>Seston et al., 2007</i>	
		<i>Flynn et al., 2008 †</i>	
		Gastroenterological services	<i>Kleinman et al., 2002</i>
			<i>Moayyedi et al., 2002</i>
			<i>Papanikolau et al., 2007</i>
		Haematological services	<i>Johnson et al., 2010</i>
	<i>Van der Pol et al., 1998</i>		
<i>Mantovani et al., 2005</i>			
<i>Ossa et al., 2007</i>			
<i>Lee et al., 2008</i>			
<i>Scalone et al., 2009</i>			
<i>Youngkong et al., 2010</i>			
<i>Brown et al., 2011</i>			
Medical services in general	<i>Johnson et al., 2011 * ‡</i>		
	<i>Propper, 1990 †</i>		
	<i>Propper, 1995</i>		
Mental health services	<i>Dwight-Johnson et al., 2004</i>		
	<i>Johnson et al., 2007</i>		
	<i>Cunningham et al., 2006</i>		
Multiple myeloma therapy	<i>Muhlbacher et al., 2008</i>		
Post rape services	<i>Christofides et al., 2006</i>		
Rheumatological services	<i>Ryan et al., 2001</i>		
	<i>Ryan et al., 2001 *</i>		
	<i>Ratcliffe et al., 2004</i>		
	<i>Fraenkel et al., 2005</i>		
	<i>Ryan et al., 2005</i>		

** Methodological DCEs, † DCEs with already existing data, ‡ Several DCEs in the same study*

Appendix 1c - DCEs list: maternity and childbirth services and services for chronics and elderly people.

<i>Categories</i>	<i>Sub-categories</i>	<i>DCEs</i>			
Maternity and childbirth services	Acute pneumonia in children	<i>Hanson et al., 2005 ‡</i>			
	Child analgesia, sedation and anaesthesia	<i>Gidman et al., 2007</i> <i>Bhatt et al., 2010</i>			
	In vitro fertilization	<i>Ryan, 1999 [2]</i> <i>Bruynesteyn et al., 2005</i>			
	Intrapartum care		<i>Hundley et al., 2001</i> <i>Longworth et al., 2001</i> <i>Ratcliffe et al., 2002 * †</i> <i>Taylor et al., 2003</i> <i>Hundley et al., 2004</i> <i>Bijlenga et al., 2007</i> <i>Pitchforth et al., 2007</i> <i>Danishevski et al., 2008</i> <i>Bijlenga et al., 2009 * †</i> <i>Pavlova et al., 2009</i> <i>Bijlenga et al., 2010 * †</i> <i>Van Mello et al., 2010</i>		
		Maternity-ward care	<i>Neuman et al., 2008 *</i> <i>Neuman et al., 2009 †</i> <i>Neuman et al., 2010 * †</i>		
		Miscarriage management	<i>Ryan et al., 1997</i> <i>Petrou et al., 2009</i>		
		Perinatal care	<i>Van der Pol et al., 2008 * †</i> <i>Van der Pol et al., 2010</i>		
		Services for chronics and elderly people	Alcoholism management	<i>Mark et al., 2004</i>	
			Alzheimer management	<i>Negrin et al., 2008</i>	
			Asthma management		<i>Ratcliffe et al., 2002</i> <i>Lancsar et al., 2004 *</i> <i>Haughney et al., 2007</i> <i>Hitchcock et al., 2007</i> <i>King et al., 2007 †</i> <i>Lancsar et al., 2007</i> <i>Lloyd et al., 2007</i> <i>Walzer et al., 2007 †</i> <i>Walzer, 2007</i> <i>Lloyd et al., 2008</i> <i>McTaggart-Cowan et al., 2008</i>
				Diabetes management	<i>Aristides et al., 2004</i> <i>Hauber et al., 2009</i> <i>Chen et al., 2010</i> <i>Johnson et al., 2011 * ‡</i>
Disease self-management				<i>Porteous et al., 2006</i> <i>Richardson et al., 2009</i>	
Hearing loss management	<i>Fitzpatrick et al., 2007</i> <i>Grutters et al., 2008</i> <i>Grutters et al., 2008 *</i>				
Hip protectors for osteoporotic fractures	<i>Telser et al., 2002</i> <i>Fraenkel et al., 2006</i>				
Informal care	<i>Mentzakis et al., 2011</i>				
Long term care	<i>Brau et al., 2008</i> <i>Nieboer et al., 2010</i>				
	Pain management			<i>Bech et al., 2007 *</i>	

** Methodological DCEs, † DCEs with already existing data, ‡ Several DCEs in the same study*

Appendix 1d - DCEs list: generic medical services.

<i>Categories</i>	<i>Sub-categories</i>	<i>DCEs</i>
Generic medical services	Dental care	Cunningham et al., 1999 Gaeth et al., 1999 Ryan et al., 2000 Bech et al., 2010 * Kiiskinen et al., 2010
	Family practice	Huis in't Veld et al., 2005 Rubin et al., 2006 Caldow et al., 2007 Turner et al., 2007 Gerard et al., 2008 Hole, 2008
	Obesity and weight management	Roux et al., 2004
	Out-of-hours services	Morgan et al., 2000 San Miguel et al., 2002 * Scott, 2002 * † Scott et al., 2003 Gerard et al., 2004 Gerard et al., 2005 † Gerard et al., 2006
	Paediatric care	Banfi et al., 2009 Kruk et al., 2009
	Prescribing systems	Ryan et al., 2003 *
	Smoking cessation	Goto et al., 2007 Paterson et al., 2008 Goto et al., 2009

* Methodological DCEs, † DCEs with already existing data, ‡ Several DCEs in the same study

Appendix 1e - DCEs list: diagnostic services and drugs and vaccines.

<i>Categories</i>	<i>Sub-categories</i>	<i>DCEs</i>	
Diagnostic services	Allergic rhinitis test	<i>Szeinbach et al., 2008</i>	
	Bowel cancer screening	<i>Salkeld et al., 2000 *</i>	
	Breast cancer screening	<i>Gyrd-Hansen et al., 2001 ‡</i> <i>Gerard et al., 2003</i>	
	Cervical cancer screening	<i>Ryan et al., 2000 * †</i> <i>Ryan et al., 2004 * †</i> <i>Arana et al., 2006</i> <i>Wordsworth et al., 2006</i>	
	Chlamydia screening	<i>Ryan et al., 2009 *</i> <i>Watson et al., 2009</i>	
	Colorectal cancer screening	<i>Gyrd-Hansen et al., 2001 ‡</i> <i>Salkeld et al., 2003</i> <i>Barchi et al., 2006</i> <i>Marshall et al., 2007</i> <i>Howard et al., 2009 *</i> <i>Marshall et al., 2009</i> <i>De Bekker-Grob et al., 2010 *</i> <i>Van Dam et al., 2010</i> <i>Johnson et al., 2011 * ‡</i>	
	Cytogenetic test	<i>Hall et al., 2006</i> <i>Peacock et al., 2006</i> <i>Reiger et al., 2009</i> <i>Reiger et al., 2009 *</i>	
	Down's syndrome test	<i>Bishop et al., 2004</i> <i>Ryan et al., 2005</i> <i>Lewis et al., 2006 [2]</i>	
	HIV test	<i>Phillips et al., 2002</i> <i>Phillips et al., 2002 * †</i> <i>Maddala et al., 2003</i>	
	Magnetic resonance	<i>Bryan et al., 1998</i> <i>Bryan et al. 2000 * †</i>	
	Pap test	<i>Fiebig et al., 2009</i>	
	Drugs and vaccines	Antibiotics	<i>McGregor et al., 2007</i>
		Antidepressants	<i>Herbild et al., 2009</i>
		Antiepileptic drugs	<i>Lloyd et al., 2005</i>
		Benign prostatic hyperplasia drugs	<i>Watson et al., 2004</i>
		Contraceptives	<i>Seston et al., 2007</i> <i>Fiebig et al., 2010</i>
		Generic pharmaceutical products	<i>Fincham, 2005</i> <i>Johnson et al., 2006</i>
		Intranasal corticosteroids	<i>Mahadevia et al., 2006</i>
		Meningococcal vaccine	<i>Bishai et al., 2007</i>
		Microbicides for HIV	<i>Holt et al., 2006</i>
Osteoporosis drugs		<i>De Bekker-Grob et al., 2008</i> <i>De Bekker-Grob et al., 2009</i>	
Psoriasis drugs		<i>Ashcroft et al., 2006</i>	
Rheumatoid arthritis drug		<i>Skjoldborg et al., 2009 *</i>	
Urinary incontinence drugs		<i>Swiburn et al., 2010</i>	
Varicella vaccine		<i>Hall et al., 2002</i>	

** Methodological DCEs, † DCEs with already existing data, ‡ Several DCEs in the same study*

Appendix 1f - DCEs list: healthcare system and health policies and plans.

<i>Categories</i>	<i>Sub-categories</i>	<i>DCEs</i>	
Healthcare system	Clinical service developments	<i>Farrar et al., 2000</i>	
		<i>Bolduc et al., 1996</i>	
	Healthcare providers	<i>Jan et al., 2000</i>	
		<i>Skjoldborg et al., 2003 * ‡</i>	
		<i>Burge et al., 2004</i>	
		<i>Hjelmgren et al., 2007</i>	
		<i>Albada et al., 2009</i>	
		<i>Boonen et al., 2011 *</i>	
		Healthcare system characteristics	<i>Gyrd-Hansen et al., 2002</i>
			<i>Bech, 2003</i>
Health policies and health plans	General healthcare interventions	<i>Skjoldborg et al., 2003 * ‡</i>	
		<i>Akkazieva et al., 2006</i>	
		<i>Telser et al., 2006 †</i>	
		<i>Zweifel et al., 2006</i>	
		<i>Bosworth et al., 2009</i>	
		<i>Baltussen et al., 2006</i>	
		<i>Schwappach et al., 2006 *</i>	
		<i>Baltussen et al., 2007</i>	
		<i>Tappenden et al., 2007</i>	
		<i>Green et al., 2008</i>	
<i>Mortimer et al., 2008</i>			
<i>Ratcliffe et al., 2009</i>			
Health insurance plans	<i>Chakraborty et al., 1994</i>		
	<i>Wellman et al., 2008</i>		
Healthcare programmes for the elderly	<i>Arana et al., 2008</i>		
Life saving programmes	<i>Schwappach, 2003</i>		
	<i>Gyrd-Hansen et al., 2008</i>		

** Methodological DCEs, † DCEs with already existing data, ‡ Several DCEs in the same study*

Appendix 1g - DCEs list: health outcomes and human resources.

<i>Categories</i>	<i>Sub-categories</i>	<i>DCEs</i>	
Health outcomes	Acute illness	<i>Dickie et al., 2004</i>	
	Arthritis-related quality of life	<i>Witt et al., 2008 *</i>	
	Asthma-related symptoms	<i>McKenzie et al., 2001</i> <i>Osman et al., 2001 †</i>	
	Cancer-related symptoms	<i>Johnson et al., 2006</i> <i>Osoba et al., 2006</i>	
	COPD-related symptoms	<i>Haughney et al., 2005</i>	
	General quality of life	<i>Hakim et al., 1999 *</i> <i>Cairns et al., 2000</i> <i>Bryan et al., 2002</i> <i>Gyrd-Hansen, 2003</i> <i>Gyrd-Hansen, 2004</i> <i>Viney et al., 2005 *</i> <i>Flynn et al., 2007 *</i> <i>Flynn et al., 2010 *</i> <i>Stolk et al., 2010</i>	
	Mortality risks	<i>Tsuge et al., 2005</i>	
	Pain-related health status	<i>Chuck et al., 2009</i>	
	Poor health status	<i>Van der Pol et al., 2001</i>	
	Respiratory and cardiovascular poor health	<i>Johnson et al., 2000</i>	
	Sexual quality of life	<i>Ratcliffe et al., 2009</i>	
	Social quality of life	<i>Ryan et al., 2006</i> <i>Burge et al., 2010</i>	
	Vision loss-related symptoms	<i>Aspinall et al., 2007 *</i> <i>Burr et al., 2007</i> <i>Aspinall et al., 2008</i>	
	Human resources	Doctor-patient relationship	<i>Vick et al., 1998</i> <i>Scott et al., 1999</i> <i>Haas, 2005</i> <i>Longo et al., 2006</i> <i>Cheraghi-Sohi et al., 2008</i>
		Educational interventions	<i>Thompson et al., 2005</i>
		Job characteristics	<i>Gosden et al., 2000</i> <i>Thornton, 2000</i> <i>Scott, 2001</i> <i>Ubach et al., 2003</i> <i>Wordsworth et al., 2004</i> <i>Scott et al., 2007</i> <i>Mangham et al., 2008</i> <i>Kolstad, 2011</i>

** Methodological DCEs, † DCEs with already existing data, ‡ Several DCEs in the same study*

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3. APPLYING DISCRETE CHOICE MODELLING IN PRIORITY SETTING: AN INVESTIGATION OF PUBLIC PREFERENCES FOR PRIMARY CARE MODELS

ABSTRACT

Objectives. The shift toward more innovative and sustainable primary care models in Italy imposed policy makers and clinicians to face difficult decisions between options which are all regarded as potentially beneficial. Given their relevant social impact, such options should also be subjected to community preferences. In this study population preferences for different primary care models were elicited. The relative importance of the different attributes for the entire sample and for respondents subgroups was then examined, as well as the rate at which individuals trade between attributes. The relative value of different service configurations was also investigated.

Methods. A discrete choice experiment (DCE) survey explored the following attributes in a stratified random sample of 6970 adults living in the Tuscany Region: primary care provider (one's own general practitioner (GP), a primary care team, another GP in the same practice), diagnostic facilities (a lot, some and a few diagnostic services) and waiting time for the visit.

Results. The response rate was 47% (n=3263). Respondents would be willing to wait up to 96 minutes for a consultation with their own GP, up to 84 minutes to be visited in a setting with many diagnostic facilities and up to 28 minutes to be visited by a primary care team. Even though a primary care team was less preferred than one's own GP, the predicted utilities of different service configurations have shown that the setting in which the former provider could operate (primary care centre), with many diagnostic services, would be preferable to the "solo GP" model, assuming a waiting time no longer than 3 hours. Preferences differed also by respondents' characteristics and past experiences.

Conclusions. These results have important implications for the demand for new primary care models and could be used, together with other relevant information (such as the costs of different combinations of attributes), to better meet the needs of population subgroups. To the authors' knowledge, this is the first large-scale study in this context that takes into account the impact of the diagnostic facilities. Considering that the Primary Care Centre would perform better than the "solo GP" even with some diagnostic services, for a more rapid diffusion of this model policymakers and managers, at least in the first phase, may direct the care provided by the Primary Care Centres towards a younger population with low healthcare needs. This group, indeed, has demonstrated a strong preference for this specific service configuration. Future policies to improve primary care organizations should be based on a broader framework, that takes into account the different needs of population sub-groups, balancing responsiveness with care continuity, equity, and appropriateness.

Keywords. primary care organisation, priority setting, Italy, discrete choice experiment

3.1. INTRODUCTION AND BACKGROUND

The necessity to invest in innovative and sustainable primary care models is increasingly becoming a central issue in the international health policy debate. An aging population with the consequent increase of chronic and degenerative illnesses, continuous scientific and technological innovations and the difficulty in sustaining the systems financially impose to public health policies different scenarios and solutions as compared to the past.

Over the past two decades healthcare reforms in Western Europe have changed primary care systems, reshaping in particular the organizational role of general practitioners (GPs) and their clinical and managerial activities (De Maeseneer et al., 1999; Chaix-Couturier et al., 2000; Rico et al., 2003). A major thesis shared by many countries is the promotion of cooperation among GPs as well as the improvement of interprofessional collaborative team works as a means to spread knowledge, facilitate accountability and, ultimately, improve patients care with limited resources (De Jong et al., 2003; Saltman et al., 2006; Longo, 2007).

For some years now, also in Italy primary care organizational models have been frequently reconsidered in order to enhance accessibility and improve coordination, continuity, and comprehensiveness of care in the primary care setting, to increase the capacity for an efficient, effective and appropriate care, and to provide opportunities for nursing and other healthcare providers to engage in collaborative practice with GPs in a clinical role that optimizes the professional potentials and the full scope of the primary care provider. Nevertheless, these changes have been constantly supply-led rather than demand-led and the idea that the redefinition of primary care models should be first of all consistent with the population needs and preferences is strengthening (Inglese, 2008).

Various types of primary care models are currently active in Italy. In the Italian National Health Service (NHS), Local Health Authorities (LHAs) are responsible for providing comprehensive healthcare to the population residing in their area and are divided into subunits called districts where initiatives to coordinate GPs' work and other community care activities are generally managed. GPs are family doctors working for LHAs as independent contractors and acting as gatekeepers to higher levels of care. Traditionally, GPs in Italy have worked in solo practices without any auxiliary staff or institutional links to other GPs.

Over the past 10 years, many LHAs tried to reshape the traditional model of primary care by encouraging GPs to participate in collaborative arrangements such as group practices in which GPs share practice space and other resources (Fattore et al., 2009). The main idea behind this initiatives was the improvement of care continuity by reinforcing the service coordination and information sharing among the GPs in the practice. However, apart from these expedients and the patients' loyalty to their physician, there were no formal mechanisms to guarantee longitudinal and vertical continuity of care (Lamarche et al., 2003). Moreover, unlike research in other settings (Sparrowe et al., 2001; Tsai, 2001; Cross and Cummings, 2004), associated GPs did not appear to perform better in terms of meeting the LHA's pharmaceutical budget because of the connections formed as a consequence of GP networks (Fattore et al., 2009).

More recently, Italian primary healthcare reform has moved towards a more comprehensive and team-based approach to address population-specific needs and to more proactively treat chronic diseases, by using a patient-centered rather than disease-focused model of care. In this setting, currently in the experimental phase, professionals from various disciplines (GPs, specialists, out of hours doctors, nurses, physiotherapists, psychologists, social workers) provide a broad range of medical and community services like diagnostic, curative and palliative care, disease prevention, rehabilitation, home care and patient education and self management interventions (Bellentani et al., 2009). To guarantee longitudinal continuity, chronic patient outcomes are systematically measured through structured health tracking instruments and recorded in the patient's medical record,

in order to prevent a relapse into a bad health condition after the improvement. The caregiving team promotes also the creation of networks for vertical continuity, sharing the clinical information with other providers serving the same population (e.g. hospitals or private practices). As the members of collaborative teams share the same centralized building in the most recent community models (called “houses of health” or primary care centres), this setting can also benefit from diagnostic and treatment technologies for disease early detection and rehabilitation, that could avoid non-urgent access to Accident & Emergency Department (A&ED) and considerably reduce the number of unnecessary referrals to a specialist. Some common examples are the electrocardiogram (Houghton et al., 1997; Rutten et al., 2000), the ultrasound scanner (Bono and Campanini, 2007), the X-ray (Mali, 2000) and blood sampling (Wens et al., 2007).

Despite the apparent superiority of the team-based community models, these solutions have shown some important limitations highlighted in the present trials as well as in national and international literature. According to Lamarche et al. (2003), even though on the whole these models (integrated community models in the author taxonomy) achieve the best empirical results in terms of effectiveness, costs reduction, care continuity, quality and equity, they encounter difficulties in preserving the individual relationship between the patient and the mostly responsible professional (relational continuity). This situation generates poorer responsiveness and limits access. Besides, although team-based community models seem to shorten the time waited for the visit if compared to the traditional ones (Ahgren, 2010), for some groups of patients a short distance to a local solo GP practice will probably be more important than a short waiting time in a primary care centre. Indeed, elderly patients - one of main targets groups of the primary care centres - that have in general decreased their mobility over the years, could meet with difficulties in service fruition due to the migration of the single GPs distributed over the territory toward a more centralized organization (Agnetti et al., 2011). Finally, the findings of an empirical study that used administrative data showed a considerable variation in medical patterns among some Italian primary care providers organized on a team-based model (Maio et al., 2009).

Thus, while is possible to recognise the strong and the weak points of the various primary care models, it is still difficult to determine which solution could be the best. To design services that are sensitive to population needs in a context of limited resources it is therefore important to find out which aspects of primary care models users/patients would most like to see improved, given that they cannot have the best level of every characteristic. This implies a necessary trade-off between the most important attributes of the aforementioned models from the population perspective.

At present, there is only little evidence in the literature about preferences for different primary care models. Recently a Swedish study (Hjelmgren and Anell, 2007) have reported population preferences for alternative primary care settings. Nevertheless, for our purposes, the value of the authors’ findings could be quite limited due to the following reasons. Firstly, the study considered a specific primary care system, different from the Italian one, and it may omit some organizational attributes that could be important in other contexts. Secondly, the limited attributes levels used could not be sufficient to explain a complex and fast evolving environment like the primary care in Italy. Moreover, the variables used to analyze the effects of respondents’ characteristics on their preferences didn’t take into account factors related to respondents’ experience, potentially limiting the detection of other relevant population segments.

In this study a Discrete Choice Experiment (DCE) was used to elicit population preferences for different primary care models. Through regression techniques the relative importance of the different attributes for the entire sample and for respondents subgroups was examined, as well as the rate at which individuals trade between attributes. The relative value of different service configurations was also investigated.

3.2. METHODS

DCEs are a popular stated preference technique in health economics (De Bekker-Grob et al., 2010) that elicit people’s preferences on the base of their stated preferences in hypothetical choices (Louviere et al., 2000). They are based on the assumption that the value of goods/services depends on the nature and level of their attributes (Lancaster, 1966). Such attributes might describe the impact of the goods/services on health outcomes, but might also represent non-health outcomes or the process by which the services are delivered (Ryan, 1999). The DCE approach is able to indicate whether particular attributes are predictors of choice over alternative scenarios, to provide information on the relative importance of the attributes used to describe the alternatives in choice sets as well as to indicate the relative overall importance of specific scenarios (combinations of attributes and levels) that are regarded as plausible competing scenarios (Louviere et al., 2000).

As reported by Ryan and Gerard (2003), the key stages of a DCE are: (1) selection of attributes, levels, and scenarios, (2) experimental design and construction of choice sets, (3) measurement of preferences, (4) estimation procedure, and (5) tests of the validity of responses. Each stage is described below.

3.2.1. Selection of attributes, levels, and scenarios

As a first step, through a review of the existing literature and semi-structured interviews to primary care managers and District managers of Local Health Authorities (LHAs), attributes and levels describing the scenarios in the choice experiment were identified. They were then validated in a focus group. The number of selected attributes was limited to the three most important factors emerged (Salked et al., 2003; Torbica & Fattore, 2010), in order to avoid placing a significant cognitive burden on respondents that could alter the trade off between the characteristics (Ryan & Gerard, 2003). Plausible levels to each of the attributes were assigned (Table 1), taking into account also the results of previous choice experiments (Gerard et al., 2006; Hjelmgren and Anell, 2007). Attention was also paid to the waiting time attribute balance, presenting a level beyond the time currently being waited for the service as well as avoiding showing a waiting time so high that the individual refused to make a discrete choice.

Table 1 - DCE attributes, levels and names.

<i>Attributes</i>	<i>Levels</i>	<i>Names</i>
Waiting time for the visit (WAIT)	0 Minutes	Waiting time
	90 Minutes	
	180 Minutes	
Primary care provider (GP)	One’s own GP	Own GP
	A primary care team (GP + other professionals)	Primary Care Team
	Another GP in the same practice *	Another GP
Diagnostic facilities (DIAG)	A lot of diagnostic facilities	A lot of Diag. Facilities
	Some diagnostic facilities	Some Diag. Facilities
	A few diagnostic facilities *	A few Diag. Facilities

** Denotes the base category*

3.2.2. Experimental design and construction of choice sets

A full factorial design with 3³ (27) combinations has been used, in order to retain all possible information (Viney et al., 2002). To obtain a more statistically efficient design the 27 alternatives were paired into choice sets using systematic level

changes⁴ (De Bekker-Grob et al., 2010). Such process involves the application of a design generator⁵ to the initial profiles to construct interim levels for the new alternatives and then the use of modular arithmetic to the interim levels to obtain the attribute levels of the new alternatives (Street et al., 2005). This approach preserves orthogonality (there was no correlation between any pairs of attributes), level balance (all levels of each attribute were represented in the same frequency) and minimal overlap (similar levels of an attribute did not occur within the same choice set) (Huber and Zwerina, 1996). The minimal overlap method (attribute levels are able to vary between each set of scenarios) was preferred to the increased overlap method (some attribute levels were the same between each set of scenarios) because the former can increase efficiency and presents no differences in consistency and perceived difficulty compared to the latter (Maddala et al., 2003).

3.2.3. Measurement of preferences

The DCE was embedded in the patient satisfaction and experience survey on primary care services (SEPC) employed in the Tuscany Region (Italy) in 2009. A detailed description of the survey is reported in Murante (2010). In brief, the SEPC was a biennial survey developed by the Tuscan Regional Health System (TRHS)⁶ to improve the primary service delivery organization through the investigation of patients' experience and perceptions about the healthcare pathways they actually face. The SEPC results are also used to calculate some indicators scores of the TRHS multidimensional Performance Evaluation System (PES)⁷, implemented to assess the processes, the outputs and the outcomes of the LHAs and the THs of the region. In the 2008-2010 regional health plan (Tuscany Region, 2008), TRHS has introduced the strategic priority of developing a proactive approach to population-based medicine. This strategic objective has also led to experiment inter-professional team-based arrangements specifically focused on chronic patients ("primary care units") where almost all Tuscan LHAs and their primary care and districts manager are engaged. Therefore, the result of this DCE seemed of great interest for the TRHS.

The questionnaire consisted of four sections. The first one presented questions taken from the SEPC survey, about respondents' experience with primary care

⁴ The relative D-efficiency obtained with such method (75%) was the same of the design generated by Cock and Nachtstein's modified Fedorov algorithm with the coefficient set to zero, available within SAS software (Kuhfeld, 2005).

⁵ If we wish to construct two alternatives, then the design generator will consist of a sequence of three values, one for each attribute in the new second alternative. The values used in the design generator corresponding to each attribute can be either zero or any integer up to one minus the number of levels in the attribute (in our case the possible generators values could be 0,1,2). To generate the interim attribute levels of each new alternative, we simply add the values in the chosen design generator to the attribute levels of the first alternative. Modular arithmetic is a form of arithmetic dealing with the remainders after whole numbers are divided by a "modulus". The remainder represents the value of interest (e.g.: $\text{mod}_2(5) = 5 \div 2 = 2 \text{ remainder } 1 = 1$; $\text{mod}_3(6) = 6 \div 3 = 2 \text{ remainder } 0 = 0$). The mod value to apply to each attribute is the number of levels that attribute has.

⁶ TRHS serves a population of roughly 4.5 millions. It is organized with 12 LHAs and 5 independent Teaching Hospitals (THs). LHAs are accountable for serving the population residents in a provincial geographical area, and are sub-organized in 34 health districts run by managers accountable for planning and governing the delivery network of primary care and continuity of care services.

⁷ The PES, developed in 2004 by "Laboratorio Management e Sanità" of "Scuola Superiore Sant'Anna in Pisa", includes more than 130 indicators, organized into six dimensions: (a) population health, (b) regional policy targets, (c) quality of care, (d) patient satisfaction, (e) staff satisfaction and (f) efficiency and financial performance (Nutti, 2008). Dimension (d) includes about fifteen indicators on patient satisfaction with health services (e.g. primary care, emergency department, home care, hospital service) that are created using data collected by telephone surveys.

services (the frequency to the GP in the last year, the reason to see the GP, the working organization of the GP - in association or not with other GPs, the time waited in the clinic before the visit, whether the visit to the GP had had to be put off, whether the patient had or had not been listened carefully by the GP, whether there had been enough time to discuss one's health problems with the GP, whether the GP had or not involved the patient in the decisions, whether the GP had or not given clear explanations about the treatment, offered or not advice on eating or physical activity, and whether the patient did or did not trust the GP). In the second section, the attributes selected for the experiment were presented, after a short introduction on why the DCE was performed. To identify participants that appear unwilling to trade-off the attributes, each respondent was invited to rank the attributes in order of importance. The core element of the interview was included in the third section, with choices between alternative primary care models with different attribute levels. Participants were asked to make their choices in the context of a consultation for a non-urgent problem, and to express their preference for each choice set presented by selecting one of the unlabelled options A or B (i.e., it was a "forced choice"). This section started with an exhaustive description of each attribute and of its level to clarify their meanings and implications. The last section consisted of questions on current health status as well as socio-demographic questions, taken from the SEPC survey (age, gender, education, employment status, income, family status, health status and chronic condition).

According to (Lancsar and Louviere, 2008), the exclusion of an opt-out option could be a violation of the underlying welfare measures of the economic experiment, since it makes it impossible to estimate the value of doing nothing, which may be chosen in practice. Nevertheless, Ryan and Skatun (2004) suggested that this may raise the number of neutral responses, increasing the number of individuals that may choose the opt-out scenario to prevent making difficult choices, even though this would not provide the highest utility. As the pilot study revealed that neutral responses were likely to be obtained in this DCE, a forced choice was chosen as appropriate. Adding a status-quo alternative would have been another option, but it was rejected for two reasons. First of all, the "status-quo bias", i.e. the tendency to choose what respondents know best (Salkeld et al., 2000), since respondents were already experienced with primary care services. Secondly, the possible econometric and interpretation difficulties, due to the fact that the status-quo alternative differed among respondents.

Although DCEs in health care have mainly been carried out using self-complete postal questionnaires (Ryan and Gerard, 2003; De Bekker-Grob et al., 2010), a computer aided telephone interview (CATI) approach was selected as it allowed a wide geographic coverage with higher response rates than postal or internet approaches (Burge et al., 2006) and it was considered a viable method if used with a small number of choice sets per respondent (Perkins, 1993).

The reference population of the study consisted of Tuscan residents over 18 years of age. A sample of 6970 individuals was generated from the telephone directory of the Tuscany Region using a random sampling approach stratified by health districts. This sampling strategy was selected to obtain statistically significant results at health district level in SPC survey, on the basis of previous experience and the expected response rates⁸. Telephone interviews were conducted in the spring of 2009 by a team of experienced interviewers.

A pre-pilot test was performed to a sample of 34 individuals of different age and geographical location with the intention of verifying whether the sample understood

⁸ There is limited guidance on sample size calculations for DCEs, and there are no practical well-designed rules to guide the analyst (Hensher et al., 2005). Pearmain et al., (1991) have suggested that for DCE designs sample sizes over 100 are able to provide a basis for modelling preference data, and Hensher et al. (2005) have suggested a rule of thumb of 50 respondents per question to provide adequate variation in the variables of interest.

the questionnaire, whether the experiment didn't take into account other relevant attributes and whether the responses were internally consistent.

Considering that there is little evidence in the literature about the manageable number of choice sets per respondent with telephone surveys and that, above all, the appropriate number of choice sets is context specific (De Bekker-Grob et al., 2010), a blocked design was used to pre-pilot two different sets of questionnaires, including 10 and 4 choice tasks respectively. The 27 choice sets were therefore distributed across three blocks of nine and nine blocks of three respectively, creating an extra column with a number of levels equal to the number of blocks which is uncorrelated with every attribute of every alternative⁹. Hence, each respondent faced only a subset of choice situations from the full factorial design¹⁰. Level balance was satisfied within each block, so that subjects do not just face only low or high attribute levels for a certain attribute. To avoid possible ordering effects, in each version the sequence of questions was randomized. The first choice set in each version was then repeated as the last choice set, to provide a check of response consistency (discussed further below) and to allow for a "warm-up" question at the beginning of the sequence ensuring respondents' correct understanding of the task (Carson et al., 1994). As it adds no statistical information, the repeated question was not included in the main data analyses. This resulted in a total of 4 choice tasks in the 9-versions design and 10 choice task in the 3-versions design. At the end of the choice experiment, respondents were asked if they were taking into consideration other attributes not included in the task when making choices, and to outline them in the affirmative case.

On the basis of respondents' direct feedbacks, response rates, item response rates, and rationality tests, the pre-piloting indicated that respondents were able to handle a maximum of 4 choices¹¹. Apart from the "consultation length" mentioned by one respondent, no other attributes different from those included in the DCE were considered as relevant by the participants during their decision making process. Some changes were made to the wording of the questions and the instructions, integrating in particular the attributes description with examples in order to place the hypothetical scenarios in a more recognisable and realistic setting.

To determine the adequacy of the new format, a further pilot study was undertaken with a new sample of 34 subjects of different age and geographical locations. On the whole, respondents understood the choice tasks, finding the questionnaire acceptable.

Thus, in the final questionnaire each respondent was randomly assigned to one of the nine blocks and was presented with four discrete choices. To preserve the data set orthogonality (Lancsar et al., 2007), the nine subgroups related to each questionnaire version included an equal number of respondents. The groups were then tested to be homogenous with regard to geographical location (health district), age and sex. An example of a choice task is shown in Figure 1.

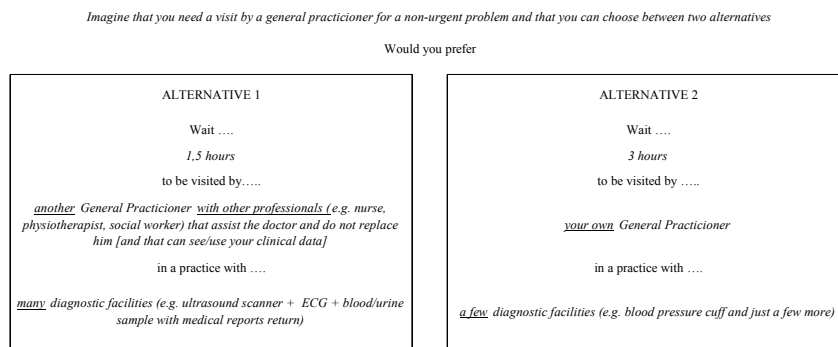
⁹ This approach was preferred to random blocking because the latter leads to poorer model performance, overestimates the implied willingness to pay indicators and increases the risk of non-trading behaviour (Hess et al., 2008; Bliemer and Rose, 2011).

¹⁰ Providing that each sub-sample is large enough and that there is no significant difference in the preferences shown by the sub-samples, this is acceptable as a valid way of identifying overall preferences (Pearmain et al., 1991).

¹¹ Within health economics, the number of choice sets commonly presented to each respondent is 2–16 (Ryan and Gerard, 2003). It is not trivial to remember that the use of larger numbers of choice sets per respondent may increase the cognitive burden or task complexity for respondents (De Shazo and Fermo, 2002; Louviere et al., 2008; Bech et al., 2011).

The preliminary detection of “dominant options¹²” (where all attributes of the first alternative are preferred to all attributes of the second alternative, or vice versa (Viney et al., 2005)) was not feasible in this DCE for two reasons. First, the experiment includes a qualitative attribute (“primary care provider”) with levels that do not have a clear ordering and that vary systematically across the alternatives. Second the sample size of the pilot study was inadequate to make reliable assumptions on parameters priors. Nevertheless, potential imprecision in the estimates should predictably be filtered out, since design techniques that also accounts for a statistical efficiency, excluding most of the choice situations with clearly dominant options (Bliemer and Rose, 2011), were used, and also because of the large sample size of the study. Furthermore, addressing dominance by maximizing utility balance (in which the options in each choice set should have similar probabilities of being chosen) would decrease choice consistency¹³ (Louviere et al., 2008) with potential biases in parameter estimates (Viney et al., 2005).

Figure 1 - Example of a choice set.



¹² A clearly dominant option in a choice situation reduces the amount of information gained from that choice situation, because the dominant options will always be chosen. In contrast, if in a choice set there isn't a clear dominant option, the respondent has to make a clear trade-off between the attributes, hence this will provide information. When a design would consist of many dominant options, the parameters are likely to be larger (in an absolute sense), as the error variance will be smaller for such choice situations. Hence, in a stated choice experiment the parameters may become biased when many dominant options are included in the experimental design (Bliemer and Rose, 2011). In Bliemer and Rose (2010) evidence is found that bad priors may lead to dominant options in the design, biasing the parameter estimates, at least in small sample sizes. In order to assess dominancy, utilities need to be computed for each alternative, and this is only possible if one has (prior) knowledge about the parameter values.

¹³ The decrease of choice consistency is attributable to the increase of the variance of the unobserved component or variation in choice outcomes not explained by the systematic component (and not explained by unobserved heterogeneity in preference if one takes that into account). Thus, inconsistency includes the case where a preference ordering over a set is incomplete and/or not transitive, as well as cases where respondents make mistakes, use heuristic rules, or are simply indifferent among alternatives and choose randomly (Louviere et al., 2008). Because the parameters of discrete choice models cannot be estimated independently of the variance of the error term, factors that increase random variability will lead to biased parameter estimates (Louviere et al., 2002; Louviere et al., 2003). So there may be a trade-offs between statistical efficiency and respondent efficiency, and experimental design requires consideration not only of the extent to which the combination of attributes and levels can yield information for estimation, but also of the impact of the combination of attributes and levels on responses (Viney et al., 2005).

3.2.4. Estimation procedure

Choice data were modeled using a random utility maximization framework (McFadden, 1974). Each participants' choice between pairs, treated as a single observation, was included in the model as the binary dependent variable ("1" represents the option being chosen, with "0" when not chosen). The independent variables were the differences between the levels of each attribute in each pair of scenarios. Binary choice models were appropriate since binary choice data were collected. A random effect probit model was used for the estimation (Propper, 1995), to represent the distribution of the error term that was assumed normal, and also to account for multiple observations from a single respondent (that made questionable the assumption of independence of the error terms¹⁴). Having also assumed a linear additive utility function (where a change in the level of one attribute does not affect the marginal utility of another attribute), the follow baseline empirical model was specified:

$$\Delta U_{nc} = \beta_0 + \beta_1 * \Delta WAIT_c + \beta_2 * \Delta GP_c + \beta_3 * \Delta DIAG_c + \pi_n + \lambda_{nc} \quad (\text{Eq. 1})$$

ΔU indicates the difference in utility between alternatives of a choice set which is observed indirectly through the choice of the respondent. The subscripts n and c refer to the individual and the number of choice set respectively. $\Delta WAIT$, ΔGP , $\Delta DIAG$ represent the differences in attribute levels within each choice set. In view of the fact that a shorter waiting time and more diagnostic facilities are intuitively preferable, it was expected that the former attribute would be associated with a negative coefficient and the latter with a positive one. For the remaining qualitative attribute, no a priori assumption was made (Roux, 2004). Effects-coding¹⁵ was used for the attributes "primary care provider" and "diagnostic facilities", as this technique allows parameters of the omitted base attribute level to be computed (Bech et al., 2005). β_0 is the constant term that captures the overall preference for alternative B over A when all attributes in the model are fixed. The inclusion of constant terms is a violation of the theoretical basis of the model because the respondents should not have an a priori preference for one alternative over another regardless of the level of attributes presented in each alternative. However, it was included¹⁶ to test and control model misspecifications due to unobserved dimensions or unobserved interactions between respondents' socio-economic characteristics and dimensions (Scott, 2001). β_1 , β_2 , β_3 denote the part-worths estimated from the regression analysis. π_n is the individual specific error term due to differences amongst respondents (resulting from measurement error) whereas λ_{nc} is the random error term because of the differences among observations (the common error term that may also vary across scenarios) (Manski, 1977)¹⁷. To quantify the correlation between choices, the serial correlation was estimated, or $\text{Corr} [\pi_n, \lambda_{nc}] = \rho$, where $\rho = \delta_{\pi}^2 / (1 + \delta_{\pi}^2)$ and δ_{π} is the variance of π_n .

Besides analysing the three main effects in equation 1, it was hypothesised that respondents' socio-demographic condition and their past experience with the GP,

¹⁴ Where the errors terms are independent and identically distributed across observations (IID).

¹⁵ Using effects coding, parameters estimates sum to zero whereas the parameter value for the base category is equal to the negative sum of the parameter values for all other categories of that variable (Phillips et al., 2002).

¹⁶ There is little guidance in the health economics literature on the procedures for dealing with a significant constant; indeed DCEs in the health economics literature appear to suppress the constant and assume it to be insignificant or use individual-specific (choice invariant) constant terms via random effects to "account" for the clustered nature of multiple responses from each individual (McIntosh and Ryan, 2002; Ryan et al, 2006).

¹⁷ The λ_{nc} is the traditional error term unique to each observation, and the π_n is an error term representing the extent to which the intercept of the n th unit differs from the overall intercept (Petrou et al., 2009).

would also influence preferences for a primary care service. Since these characteristics do not differ between each choice, simply dropping out of the equation, they were entered into the model analysis through interactions with the main effects. Including these interactions in the analysis allows the identification of subgroups within the sample, indicating where these subgroups have any additional strengths or weaknesses of preferences for particular attributes. Moreover, these effects minimise the consequences of any biases that would otherwise be present in the regression result estimates. The segmented model included all main and interaction effects. Following a “general to specific” method of model building (Maddala, 1992), this model was reduced stepwise to a more parsimonious one, by excluding insignificant interaction effects one at a time on the basis of the likelihood ratio test with a p -value > 0.05 .

The sign and the statistical significance of the estimated coefficients were used to quantify the relative importance of the attributes and the marginal rate of substitution (MRS). A positive sign on a coefficient indicates that as the level of the attribute increases the utility derived increases (and conversely for a negative sign). The higher the size of the coefficient, the greater the importance of the attribute level in absolute value in affecting overall benefit. The MRS, anchored in Lancaster’s theory of demand (Lancaster, 1966), provides an indication of the extent to which respondents are, on average, prepared to trade an improvement in one attribute for a detriment in another one. MRS values were calculated by dividing the coefficient values of the estimated attributes with the “waiting time” attribute, so that respondents’ preferences and the trade-offs could be compared on a common value scale in terms of “willingness to wait”.

Furthermore, as previously done in other health care related DCEs (Ryan et al., 2000; Longworth et al., 2001; Phillips et al., 2002; Gerard et al., 2006; Schwappach and Strasmann, 2007; Chen et al., 2010), the part-worth utilities (β s) and the constant estimated in the equation 1 were summed to predict the overall utility (or benefit scores) for all the combinations of attribute levels in the full factorial design. In addition to the 27 hypothetical scenarios included in the design, three forms of care delivery, that are the most representative of the Italian primary care service alternatives previously described (“solo general practice”, “group general practice” and “primary care centre”), were identified. For a visit in a “solo general practice”, on average, patients have to wait more than one hour (70 minutes) to be seen by their own GP exclusively, in a practice with a few diagnostic facilities. In a “group general practice”, often a setting with some diagnostic services, if patients accept to be seen by an associated GP different from their own physician, they usually have to wait less (40 minutes). A consultation in a “primary care centre” normally implies a short waiting time (10 minutes), for a visit provided by a primary care team in a practice with many diagnostic services. All the resulting scores were then ranked in order of preference. This technique shows the relative value of the service configurations as perceived by the population, and is useful to assess the impact of changes in single attribute levels and in combinations of attribute levels on the hypothetical scenarios described and on the three reference cases previously specified.

The 95% confidence intervals (95% CIs) for the “willingness to wait” estimates and predicted utilities were calculated using non-parametric bootstrapping (Efron, 1979)¹⁸ with 2000 iterations. The advantage of the bootstrap is that, unlike the other methods, such as Fieller’s method and the delta method (Herson, 1975), it makes fewer distributional assumptions (Briggs et al., 1997) and is thus robust to challenges about the sampling distribution. All statistical analyses were performed using Stata 10 (StataCorp, College Station, Texas).

¹⁸ Confidence intervals are constructed on a so-called bootstrap distribution, which is obtained by estimating the desired statistic on a series of random samples (in our case 2000) from the original data set, samples that are made with replacement. Observed bias in the mean of the bootstrap distribution is adjusted for by the so-called bias correction method.

3.2.5. Tests of the validity of responses

Internal validity was tested with three approaches: (a) consistency of preferences, (b) willingness to trade, and (c) consistency with theoretical predictions.

(a) To measure internal consistency a test of stability (or completeness) was carried out, by which subjects are asked to consider the same discrete-choice comparison both at the beginning and at the end of the questionnaire. We expected subjects to make the same choice both times the question was offered. According to the pilot results, the transitivity test (that implies the inclusion of additional choice sets in each block) was not included, as it would have increased the cognitive burden of respondents. Similar concerns about the feasibility of transitivity test were also mentioned by other authors (Ozdemir et al., 2010).

(b) The willingness of respondents to trade-off the attributes, as expected in the compensatory decision making framework, was tested through the approach used in Scott et al. (2002), identifying respondents with dominant preferences (individuals that always choose according to the best level of a given attribute). In relation to the attributes “waiting time” and “diagnostic capabilities”, where the “best” could be identified, for each attribute was tested whether an individual always chose the option with the best level and ranked the attribute as the most important in a simple ranking of the attributes. Dominant preferences for “primary care provider” were not calculated since the “best” level of this qualitative attribute was not known a priori. The influence of dominant preferences was then assessed by running a regression analysis twice, including and excluding respondents with dominant preferences.

(c) Theoretical validity was investigated by examining the sign and significance of parameter estimates.

3.3. RESULTS

Of the 6970 persons contacted, 3372 participated to the SPEC survey. Out of these participants, 3263 completed the choice tasks, with a response rate of 47% - in line with other surveys in similar settings. After the removal of missing values (entire respondents were deleted only where all variables were missing), 19340 observations were available for the analysis.

The respondents were equally distributed and without any significant differences in socio-demographic characteristics and past experience with the GP across the nine versions of the questionnaire used (V1 respondents = 364, V2 respondents = 366, V3 respondents = 354, V4 respondents = 362, V5 respondents = 354, V6 respondents = 366, V7 respondents = 363, V8 respondents = 367, V9 respondents = 367). However, the sample included a slightly larger proportion of older persons and women than in the population at large. This result may be expected in an “in-home” interview survey of this type (Greene, 2009). On average, the time needed to complete the questionnaire was 8.37 minutes (standard deviation: 3.20 minutes; range: 3 - 29 minutes). Details on responders’ characteristics are given in Table 2.

3.3.1. Sample characteristics

The age of respondents ranged from 18 to 96 years old with the mean age of 58 years; 76.8% were female and 57.1% had a secondary level of education. 43.9% were working in medium and low skilled jobs or engaged in a full time education; 41.1% had a medium income. 13.1% were in a fair or poor health status and 38.9% of them declared to have a chronic disease. 68.9% of the respondents went more than 3 times to the GP clinic in the last year and 77.1% of them waited less than 1 hour for a consultation. The GP was mainly seen in order to get some prescriptions or certificates (59.9%) and for a check on already existing illness (22.8%). During the consultation, the GP carefully listened to the 98.6% of the participants, gave to 98.5% of them enough time to discuss about their problems, involved 97.7% of them in the decisions, gave clear explanations to 98.7% of them and advice on

eating or physical activity to 67.4% of them. 98.6% of the respondents trusted their GP.

Table 2 - Characteristics of respondents.

<i>Attributes</i>	<i>Levels</i>	<i>Names</i>	<i>Freq.</i>	<i>%</i>
Age group	18-49 years	Age 18-49	955	29.6
	50-69 years	Age 50-69	1388	43.0
	> 69 years *	Age > 69	886	27.4
Gender	Female	Female	2502	76.8
	Male *	Male	756	23.2
Education	None / Primary level	Educ No	1047	32.6
	Secondary level	Educ Sec	1833	57.1
	University degree or higher *	Educ Uni	328	10.2
Employment status	Not working / Retired	Empl No	1490	46.5
	Working (High-skilled jobs)	Empl High	308	9.6
	Working (Medium / low-skilled jobs) + Students *	Empl Low	1406	43.9
Income	High	Inc High	1313	42.2
	Medium	Inc Med	1279	41.1
	Low *	Inc Low	520	16.7
Living alone	Yes	Alone	402	12.5
	No *	Alone No	2802	87.5
Health status	Fair / Poor	Health Low	420	13.1
	Excellent / Very good / Good *	Health High	2775	86.9
Chronic disease	Yes	Chron	1254	38.9
	No *	Chron No	1971	61.1
Frequency to the GP clinic in the last year	Never / From 1 to 3 times	Freq Low	921	31.1
	More than 3 times *	Freq High	2043	68.9
Reason to see the GP	General health check / Minor illness treatment	Reas Min	504	17.3
	Already existing illness check	Reas Exist	666	22.8
	Prescriptions / Certificates / Other *	Reas Other	1748	59.9
The GP works with other GPs	Yes	Assoc	839	28.8
	No *	Assoc No	2079	71.2
Time you waited in the clinic	Less than 1 hour	Wait Less	2180	77.1
	More than 1 hour *	Wait More	648	22.9
You have had to put off seeing the GP	Yes (Waited too much, GP unavailable, Clinic closed)	Putoff	285	9.8
	No *	Putoff No	2633	90.2
The GP listened to you carefully	Yes	Listen	2870	98.6
	No *	Listen No	42	1.4
The GP gave you enough time to discuss	Yes	Entime	2870	98.5
	No *	Entime No	43	1.5
The GP involved you in the decisions	Yes	Involv	2839	97.7
	No *	Involv No	68	2.3
The GP gave you clear explanations	Yes	Clear	2871	98.7
	No *	Clear No	38	1.3
The GP gave you advices	Yes	Advice	1965	67.4
	No *	Advice No	949	32.6
You trust in your GP	Yes	Trust	2878	98.6
	No *	Trust No	40	1.4

* Denotes the base category

3.3.2. Internal validity

On the whole, 11% of respondents failed the stability test, which was considered to be acceptable as the percentage of inconsistent responses usually vary from 1% (Howard et al., 2009) to 25% (Phillips et al., 2002; Maddala et al., 2003). Since the first question was repeated at the end of the task sequence, failing a stability test could be interpreted as the net effect of learning minus fatigue between the beginning and end of the question sequence (Johnson and Desvousges, 1997; Maddala et al., 2003; Schwappach and Strasmann, 2007). In this case learning effect seemed to be the principal source for the stability test failure, considering the relatively small number of choice tasks presented, and thus responses to the first question - treated as a warm-up question - could be noisy.

For what concerns the identification of apparent non-traders, 11% of respondents chose always the scenario with the best level of a given attribute that they ranked as the most important attribute in the simple ranking. Even though a consistent dominant attribute pattern is more likely to be found among respondents receiving few choice sets (Bech et al., 2011), the level of dominant preferences was similar to other studies (Scott et al., 2002). The results of the regression analyses indicated that the impact on the coefficient size and direction for each attribute was the same regardless of whether dominant preferences were excluded or included within the data analysis. Considering also that random utility models are robust to violations of compensatory decision making (Lancsar and Louviere, 2006), all respondents were thus included in the final analysis.

3.3.3. Main effects model

To fit equation 1 to the survey data, the random effects probit model was used. However, the non statistically significant value of Rho (an estimate of ρ , that was 3.25×10^{-11}), indicated that respondents treated the decision made in each pair-wise comparison as a separate hypothetical situation, and not in association with the choice made in each of the remaining pair-wise comparisons. Hence, all models were re-fitted to the data using the standard probit model, where each choice is treated as a separate observation and the error term is assumed to be independent across observations.

To verify whether the linear representation of the continuous variable “waiting time” was admissible, as a linear utility function was assumed, a univariate smoothed scatter plot (Cleveland and Devlin, 1988) was first performed to show potential non-linearities. In addition, the probit model was re-estimated using dummy variables replacing the continuous variable. If the dummy variable coefficients were increased by approximately equal intervals, and the confidence intervals from one dummy variable to the next were overlapped, the explanatory variable would increase monotonically and could be considered linear (Witt et al., 2009). Lastly, a likelihood ratio test was used to assess whether the inclusion of a quadratic term would have improved the explanatory power of the model. The results confirmed that a linear representation of “waiting time” was congruent with the data.

As Table 3 shows, the main effects probit model has a good fit (McFadden Pseudo $R^2 = 0.25$ ¹⁹), an improved explanatory power over a model where only constant term is included (significant χ^2 statistic of 6636.99 distributed with five degrees of freedom) and predicts correctly 76% of the responses. All the attributes had a significant impact on respondents’ decisions, because their coefficients are significantly different from 0.

¹⁹ The pseudo R^2 is given by $1 - LL(\beta)/LL(0)$, where $LL(\beta)$ is the log-likelihood of the reported model and $LL(0)$ is the log-likelihood of a constant-only model.

Table 3 - Regression results from DCE: main effects model.

Attribute	Coefficient	Std. Err.	MRS (Min.)	95% CI (Lower)	95% CI (Upper)
Constant	0.546 ***	0.016	-	-	-
Waiting time (min)	-0.006 ***	0.000	-	-	-
Own GP	0.611 ***	0.015	95.7	90.4	102.1
Primary Care Team	0.100 ***	0.014	15.7	11.4	20.3
A lot of Diag. Facilities	0.534 ***	0.015	83.6	77.9	89.1
Some Diag. Facilities	0.176 ***	0.014	27.6	23.4	32.3
N	19340				
Log Likelihood	-10086.97				
Likelihood ratio test (c ² , d.f.) ^a	6636.99 (5) ***				
Pseudo R ² McFadden ^a	0.248				

*** $p < 0.001$

^a Compared to a only constant model

Such coefficients can be interpreted as the change in utility in moving from alternative A to alternative B. For example, the negative coefficient for the “waiting time” attribute indicates that the higher the level of this attribute in alternative B relative to alternative A, the less like the individual is to prefer alternative B over alternative A. Respondents, thus, other things being equal, were more likely to chose a primary care consultation that implied a lower waiting time. The positive coefficient for “primary care team” and “own GP” indicates that respondents preferred a consultation provided by a GP-led team of professionals or by their own GP exclusively, instead of seeing another single GP that works in the same practice of their own physician. Furthermore, given that the coefficient on “own GP” is larger than that on “primary care team”, there results that, everything else equal, respondents preferred a visit by their own GP to a primary care team consultation. The same applies to “diagnostic capabilities” attribute. Ceteris paribus, a visit in a practice with some diagnostic facilities or a lot of diagnostic facilities were more likely to be chosen than a consultation in a setting with a few diagnostic facilities, although each to a different extent. The increase in marginal utility for a practice with many diagnostic facilities is larger than it is for a practice with some diagnostic services. These results are in line with expectations and provide support for the theoretical validity of the model.

The relative importance of the different attributes was inferred from the magnitude of attribute coefficients. However, coefficients were not directly comparable across attributes because the unit of measurement for each coefficient varied across these attributes. For example, although “waiting time” has the smallest coefficient, it must be noted that this attribute is measured in minutes. While a change in waiting time of 1 minute may not be as important as a marginal change in any of the other two attributes, assuming a linear utility function and all else equal, the change in benefit resulting from a 120 minutes change is equal to 0.72 (0.006×120), which outweighs the benefit of a marginal change in both “primary care provider” and “diagnostic capabilities”. Estimating the value of single attributes in terms of the time respondents are willing to give up for that attribute, “waiting time” becomes more important than “own GP” if the difference in waiting time was longer than 96 minutes. This indicates that respondents would be willing to wait up to 96 minutes for a consultation with their own GP. Similarly, “waiting time” is more important

than “a lot of diagnostic facilities” if the difference in waiting time was longer than 84 minutes, suggesting that respondents would be willing to wait 84 minutes longer to be visited in a setting with many diagnostic services. Therefore, being seen by one’s own GP is more important than a practice with many diagnostic facilities. The other study dimensions were much less important. Participants would only be willing to wait up to 28 and to 16 minutes respectively to be visited by a primary care team and to have some diagnostic facilities in the practice.

The positive and significant constant term suggest either that there was ‘right’ bias, where respondents were more likely to favour alternative B, or that respondents were considering attributes not in the model.

3.3.4. Segmented model

Compared with the main effects model, the reduced model has a better fit (Pseudo $R^2 = 0.28$), with the main effects of a similar sign and significant. The coefficients of the statistically significant interaction terms show how preferences differ depending on respondents’ socio-demographic characteristics and past experiences. Since some of the respondents did not report such characteristics, the sample size in this model is smaller. The relevant socio-demographic factors that had a substantial impact on preferences pertain to the respondents’ age, gender, employment status, health status and chronic condition; while the most relevant variables related to the respondents’ past experience with the GP are the frequency of visits to the GP in the last year, the reason to see the GP, the time waited in the clinic before the visit, having had to put off seeing the GP and having or not received advice on eating or physical activity from the GP. The results of the model are given in Table 4.

The sign of the coefficients and the regression coding used indicate that younger respondents (under 45 years) and people that waited in the GP practice less than 1 hour for the last visit preferred to wait shorter for a primary care consultation, while participants with fair or poor health conditions showed a weak inclination to wait longer for a visit. The last finding could depend on the fact that for people with fair or poor health conditions - with more healthcare needs than the average - a longer waiting time could be associated with a more thorough examination by their physician and with a more accurate diagnosis, with an increase in the likelihood of receiving better treatment.

Participants with chronic illnesses and those who are retired or are not working preferred to be visited by their own GP. This provider had also a higher marginal utility for respondents who, in their last consultation, received advice from the GP on eating or physical activity. People who went to the GP clinic with a low frequency (from one to three times) or that never used this service in the last year, did not prefer to be seen by their own GP. On the other hand, a primary care team was not considered the preferred provider by middle-aged respondents (from 50 to 69 years), by respondents with chronic diseases and by those who received advice from the GP on eating or physical activity in their last consultation. This type of provider was instead the favourite option for respondents who went less frequently to the GP clinic in the last year, and for younger participants.

For what concerns the impact of respondents’ characteristics on preferences for the diagnostic setting, a visit in a practice with many diagnostic facilities was the preferred option for female respondents and for those that reported a chronic condition. A setting with some diagnostic services was more likely to be preferred by younger respondents and by people who are retired or are not working. Conversely, middle-aged respondents and those who are employed in high-skilled jobs did not prefer this diagnostic setting. Those who saw a GP in the last year for a minor illness treatment or for a general health checking and those who have had to put off seeing the GP in the last year also preferred to be visited in a practice with some diagnostic facilities.

Table 4 - Regression results from DCE: segmented model.

<i>Attribute</i>	<i>Coefficient</i>	<i>Std. Err.</i>
Constant	0.5993 ***	0.018
Waiting time	-0.0065 ***	0.000
Own GP	0.6165 ***	0.020
Primary Care Team	0.1636 ***	0.019
A lot of Diag. Facilities	0.5507 ***	0.019
Some Diag. Facilities	0.2563 ***	0.028
Waiting time * Age 18-49	-0.0006 ***	0.000
Waiting time * Health Low	0.0003 *	0.000
Waiting time * Wait Less	-0.0004 **	0.000
Own GP * Empl No	0.0740 ***	0.016
Own GP * Chron	0.3579 ***	0.018
Own GP * Freq Low	-0.0676 ***	0.018
Own GP * Advice	0.1159 ***	0.017
Primary Care Team * Age 18-49	0.0927 ***	0.023
Primary Care Team * Age 50-69	-0.0591 **	0.019
Primary Care Team * Chron	-0.2379 ***	0.017
Primary Care Team * Freq Low	0.0606 **	0.018
Primary Care Team * Advice	-0.0919 ***	0.017
A lot of Diag. Facilities * Female	0.0360 *	0.017
A lot of Diag. Facilities * Chron	0.1065 ***	0.015
Some Diag. Facilities * Age 18-49	0.1166 ***	0.026
Some Diag. Facilities * Age 50-69	-0.0407 *	0.019
Some Diag. Facilities * Empl No	0.1091 ***	0.027
Some Diag. Facilities * Empl High	-0.1024 **	0.033
Some Diag. Facilities * Reas Min	0.0481 **	0.018
Some Diag. Facilities * Putoff	0.0829 ***	0.024
N	16120	
Log Likelihood	-8055.42	
Likelihood ratio test (c ² , d.f.) ^a	6236.23 (25) ***	
Pseudo R ² McFadden ^a	0.279	

*** $p < 0.001$, ** $0.01 > p \geq 0.001$, * $0.05 \geq p \geq 0.01$.

^a Compared to a only constant model

3.3.5. Predicted utilities

In Table 5, a utility-based ranking for all the service configuration hypothesized is reported. Scenarios with positive scores lead to greater satisfaction than that enjoyed from the current service organization, while those with negative values show that a change from the current system to the alternative would produce a fall

in utility. Those with a score of zero would leave overall benefit unchanged. Assuming that the intention is to improve the service, regardless the amount of resources required, the only scenarios that would be taken into consideration are those that result in a positive change in utility. These would be, in order of preference: scenario 22, scenario 25, scenario 18, scenario 13, scenario 6, scenario 7, scenario 26, scenario 2, scenario 20, scenario 10, scenario 12, scenario 16, scenario 9 and scenario 14.

Table 5 - Predicted utilities for alternative scenarios of care delivery.

<i>Scenario</i>	<i>Waiting time</i>	<i>Caregiver</i>	<i>Diagn. facilities</i>	<i>Indirect Utility</i>	<i>95% CI (Lower)</i>	<i>95% CI (Upper)</i>
22	0 Min	Own GP	A lot	1.69	1.63	1.75
25	0 Min	Own GP	Some	1.33	1.28	1.39
18	0 Min	Primary care team	A lot	1.18	1.13	1.24
<i>P. Care Centre</i>	<i>10 Min</i>	<i>Primary care team</i>	<i>A lot</i>	<i>1.12</i>	<i>1.07</i>	<i>1.17</i>
13	90 Min	Own GP	A lot	1.12	1.07	1.16
6	0 Min	Primary care team	Some	0.82	0.77	0.88
7	90 Min	Own GP	Some	0.76	0.71	0.81
26	90 Min	Primary care team	A lot	0.61	0.56	0.65
2	180 Min	Own GP	A lot	0.54	0.49	0.59
20	0 Min	Own GP	A few	0.45	0.40	0.50
10	0 Min	Another GP	A lot	0.37	0.32	0.42
12	90 Min	Primary care team	Some	0.25	0.21	0.29
16	180 Min	Own GP	Some	0.18	0.14	0.23
9	180 Min	Primary care team	A lot	0.03	-0.02	0.08
14	0 Min	Another GP	Some	0.01	-0.04	0.06
<i>Solo GP</i>	<i>70 Min</i>	<i>Own GP</i>	<i>A few</i>	<i>0.00</i>	<i>-0.04</i>	<i>0.05</i>
1	0 Min	Primary care team	A few	-0.06	-0.11	-0.01
5	90 Min	Own GP	A few	-0.13	-0.17	-0.08
19	90 Min	Another GP	A lot	-0.21	-0.25	-0.16
<i>Group GP</i>	<i>40 Min</i>	<i>Another GP</i>	<i>Some</i>	<i>-0.24</i>	<i>-0.29</i>	<i>-0.20</i>
21	180 Min	Primary care team	Some	-0.33	-0.38	-0.28
3	90 Min	Another GP	Some	-0.56	-0.60	-0.52
23	90 Min	Primary care team	A few	-0.64	-0.68	-0.59
11	180 Min	Own GP	A few	-0.70	-0.76	-0.65
4	180 Min	Another GP	A lot	-0.78	-0.83	-0.73
8	0 Min	Another GP	A few	-0.87	-0.92	-0.82
24	180 Min	Another GP	Some	-1.14	-1.19	-1.09
15	180 Min	Primary care team	A few	-1.21	-1.26	-1.16
17	90 Min	Another GP	A few	-1.45	-1.50	-1.40
27	180 Min	Another GP	A few	-2.02	-2.08	-1.96

Scenario 22, in which individuals are immediately visited by their own GP in a practice with many diagnostic facilities, would be the most preferred. Such

scenario, of course, is quite unrealistic, especially because the NHS can't provide many diagnostic technologies to every single GP due to an unaffordable investment. With reference to the current forms of primary care delivery previously described, the "primary care centre" would be the most preferred scenario, followed by the "solo general practice" and the "group general practice".

Despite "own GP" being the most preferred respondents' caregiver, the actual context in which such physicians have to operate - with few diagnostic facilities and long waiting times for the visits ("solo general practice") - would not be considered the best service alternative. Not surprisingly, the utility score for this scenario was not far from zero, indicating an indifference in overall benefit for respondents, due to the fact that this service combination is currently the most typical and widespread way to provide primary care in Italy.

Among the existing care models, "primary care centre" would be the service with the highest benefit score, with an increase of 1.12 in utility compared with the "solo general practice". Most of all, its superiority over the "solo general practice" derived from a greater diagnostic potential, rather than a shorter waiting time. Indeed, assuming that the former service would not maintain a certain diagnostic power, even with no waiting time for the visit (scenario 1) it would present a lower benefit score compared with the utility of the "solo general practice" configuration. The current service configuration to be ranked last by participants would be the "group general practice". The predicted utility for this type of service was negative, indicating that in a "group general practice" respondents would probably prefer to be visited in any case by their own GP in that practice, instead of another associated GP (in the same practice). To have a positive benefit score with such service configuration, respondents need to be compensated with a 40 minutes reduction of waiting time (scenario 14) or, assuming no changes in waiting time, with more diagnostic services.

3.4. DISCUSSION AND CONCLUSION

The shift toward more innovative and sustainable primary care models in Italy imposed policy makers and clinicians to face difficult decisions between options which are all regarded as potentially beneficial. Given their relevant social impact, such options should also be subjected to population preferences. The results presented in this paper provide useful insights regarding community preferences for different primary care models. To the authors' knowledge, this is the first large-scale study in this context that takes into account the impact of the diagnostic facilities.

While all attributes identified were significant, the "willingness to wait" values have shown that a consultation with one's own GP (relational continuity) is more important than being seen by a primary care team and than a practice with many diagnostic services. This highlights an important finding, given the tendency to limit the relational continuity in current health policies (Starfield and Horder, 2007). The respondents' predilection for their own GP was also highlighted in similar studies. In Hole (2008) and Cheraghi-Sohi et al. (2008) patients preferred a GP that has access to their medical notes and knows them well instead of a GP that has access to their medical notes but does not know them. Furthermore, seeing a physician who knows the patient well was the most important attribute in the latter study. Also in Rubin et al. (2006) respondents, in the context of telephoning for an appointment to discuss a routine non-urgent problem, preferred their own choice of GP instead of any available GP.

Preferences differed also by respondents' characteristics and past experiences, and some of the interaction effects emerged were similar to those described in similar analyses. In particular, the higher utility of the chronics for their own GP is in accordance with the results of Rubin et al. (2006), where respondents with long-standing physical illness preferred their own choice of GP instead of any available GP for a hypothetical routine appointment. In addition, the reported influence of

age on preferences for the primary care provider is consistent with the findings of Hole (2008), in which middle-aged patients (aged 40–65) valued seeing a GP that knows them well more highly than other patients; of Cheraghi-Sohi et al. (2008), where among middle-aged patients (40-65) and older patients (over 65) seeing a physician who knows them well was more highly valued; of Hjelmgren and Anell, (2007), where the older the respondents, the more likely they were to prefer a GP instead of a primary care team comprising both physicians and nurses; and of Rubin et al.(2006), where older patients preferred their own choice of GP instead of any available GP.

Consistently with the interactions found we can suppose that people who preferred to be visited by their own GP and who didn't chose to be visited by a primary care team could be those with high and continuous healthcare needs, probably living in a certain isolation that makes them difficult to seek for new or alternative care providers. Such group could see their own GP as a stable reference point. Specularly, respondents who preferred a consultation with a primary care team and didn't like to be visited by their own GP are young people, with low healthcare needs, that haven't probably matured yet a sort of dependency from their own GP, and could therefore be more sensitive to service innovations. Regarding the subgroups preferences for diagnostic technologies, we can presume that people who preferred to have many diagnostic facilities in the practice and who didn't choose to have some diagnostic services are probably those with a superior willingness to pay and with high healthcare needs. On the other hand, individuals who had a preference for some diagnostic technologies and who didn't choose a practice with many diagnostic facilities seem to be those with a lower willingness to pay, with minor healthcare needs and without a propensity to wait too long for a diagnostic test. This preference data could be used (together with other relevant information) to better meet the needs of population subgroups, designing tailored policies on the basis of their preferred attributes.

The results obtained from the predicted utilities of different service configurations would need to be combined with costs of different combinations of attributes to establish the most cost-effective model of care. Nevertheless, these results have important implications for the demand for new primary care models. Even though a primary care team was less preferred than the own GP, the setting in which the former provider could operate (primary care centre), with many diagnostic services, would be preferable to the "solo GP" model, assuming a waiting time no longer than 3 hours. Considering that the Primary Care Centre would perform better than the "solo GP" even with some diagnostic services (for example scenario 6), for a more rapid diffusion of this model policymakers and managers, at least in the first phase, may direct the care provided by the Primary Care Centres towards a younger population with low healthcare needs. This group, indeed, has demonstrated a strong preference for this specific service configuration. This strategy, of course, would only consolidate partially the team-based community models, because such organizations were particularly designed to tackle the needs of chronic and elderly people.

Future policies to improve primary care organizations should be based on a broader framework, that takes into account the different needs of population sub-groups, balancing responsiveness with care continuity, equity, and appropriateness.

As this study is essentially explorative, it presents some limitation that should be considered. First of all, a relatively small number of attributes was used in the study, in order to create a manageable questionnaire without placing a considerable cognitive burden on respondents. Although all the attributes included were considered important and statistically significant, this strategy may have led to the omission of other characteristics probably captured within the constant term. With respect to this topic there is little discussion in the literature, and where a significant constant is identified, the problem tends to be ignored (Richardson et al, 2009). While attempts were made to select the attributes in an unbiased way, it is not possible to establish whether other qualitative approaches would generate the same

attributes and levels. For a better evaluation of the significance of the attributes found, comparative qualitative approaches identifying attributes and levels for the same study would be necessary (Gunther et al., 2010).

Secondly, even though the response rate achieved (47%) was acceptable in relation to the response rates of previous discrete choice experiments in the primary care setting (between 18% and 76%) (Vick and Scott, 1998; Scott and Vick 1999; Morgan et al., 2000; Scott et al., 2003), the comparison with the Tuscan population data revealed that older respondents and women were overrepresented. A more ample evaluation of sample selection bias (for example, considering variables reflecting respondents' attitudes and other socio-demographic characteristic) was not feasible because age and sex were the only available data on the Tuscan population. Furthermore, the generalization of these results across countries should be done cautiously, for the reason that every healthcare system has specific organizational, economic, and cultural characteristics. The potential for such biases needs to be addressed in future studies, by the allocation of more resources on the recruitment phase.

Thirdly, in discrete choice tasks individuals are asked to evaluate hypothetical circumstances. Such questions are intended to simulate realistic decisions, but do not have the same clinical, financial, and emotional consequences as actual decisions. Thus, it is not given that respondents will behave in real settings as they state they would and there is only little evidence available on this (Mark and Swait, 2004; Telser and Zweifel, 2007). Furthermore, given the lack of a market for health care, tests for external validity are difficult to conduct (de Bekker-Grob et al., 2010). Future DCEs should attempt to follow up model estimation with focus groups to address the validity of the results achieved by asking respondents if their preferences are consistent with the findings of the estimated model.

Fourthly, the rich set of respondents' characteristics allowed us to show several aspects of preference heterogeneity, that were incorporated into the model by allowing for interactions between participants' characteristics (socio-demographic ones and past experience with primary care services) and attributes of the alternatives. This could be important for the implementations of more accurate policy interventions. However, some differences in tastes will probably remain random to the extent that it cannot be related to observed characteristics. As the probit model cannot represent unobserved heterogeneity, future analyses should explore the added value of discrete choice models that relax the assumption of taste homogeneity (e.g. mixed logit and latent class model) by allowing for random taste variation.

3.5. REFERENCES

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4. HETEROGENEITY IN PREFERENCES FOR PRIMARY CARE CONSULTATIONS: RESULTS FROM A DISCRETE CHOICE EXPERIMENT

ABSTRACT

Objectives. The increasing importance of flexibility in the physician-patient consultation approach in primary care, in order that differences in patient preferences are respected, required healthcare managers and physicians to fix a balance between various potentially important general practitioner (GP) consultation characteristics for diverse groups of patients. Trying to deepen the knowledge on this matter, in this study population preferences for different GP consultation approaches were obtained, paying particular attention in the analysis of the relative importance assigned by respondents subgroups to the various attributes. The rate at which individuals traded between attributes and the relative value of different GP consultations was also examined.

Methods. A discrete choice experiment (DCE) was conducted on a sample of the Tuscan general population (n=6970). Participants were asked to select their preferred option in a series of pairwise choices, defined by the following attributes: involvement in decision making (complete, partial and no involvement), amount of information (a lot, some and a little information) and waiting time for the visit.

Results. Analyses were based on responses from 3225 adults (a 46% response rate). The “willingness to wait” assessment revealed that receiving information from the GP was more important than being involved in the decisions and that, approximately, a complete involvement had the same importance as a partial involvement. Apart from the important impact of some socio-demographic variables, such as a chronic condition, gender and family status, the characteristics connected to the participants' past experiences appeared to have the greatest influence on the involvement level. The amount of information required by the respondents was also influenced by a complex interplay of personal and contextual factors, as well as by the physician.

Conclusions. This large-scale study extends the body of literature on DCE applications for different GP consultation approaches, providing new information about the influence that patients' socio-demographic characteristics and past experiences could have on consultation preferences. Given this diversity of preferences, a good strategy would be that of matching the physician's actual behaviour to the patients' desired levels of information and involvement. While there are several ways to achieve successful preference-match interventions, it is also important to note that patients' preferences could change as the patient-provider relationship proceeds. Further research therefore is needed to reveal principally how patients' preferences and needs change over time.

Keywords. physician-patient relations, primary care, public preference elicitation, discrete choice experiment

4.1. INTRODUCTION AND BACKGROUND

In Western countries, the physician-patient interaction has evolved from being a paternalistic one to a patient-centred one. This trend is particularly advocated in the primary care, considering the lack of complex diagnostic and therapeutic technologies and the long term nature of the doctor-patient relationship in this setting.

Such interaction has been traditionally described as subjected to a systematic pattern of asymmetry, interpreted as indicative of the physician's exercise of power and authority over the patient. In a review of recordings of physician-patient interactions, Maynard (1991) outlined examples of asymmetry in that doctors ask more questions than patients, interrupt patients more than the reverse, decide which topics are relevant to the consultation and so on. The numerous criticisms raised to the asymmetry have strengthened the patient-centred style in consultations, that could be described as paying attention to patients' psychosocial as well as physical needs, enabling the disclosure of patients' concerns, conveying a sense of partnership, and actively facilitating patient involvement in decision making (Mead et al., 2002).

Although existing research emphasizes support for increasing patient-centeredness in consultations, empirical evidence for the role of patient-centred care in patient outcomes is mixed (Mead and Bower, 2002). While such interventions are generally successful in modifying styles of communication and increasing rates of patient satisfaction, it is much less clear as to whether they result in positive health outcomes (Lewin et al., 2001). Some studies, for example, point out that patient-centred care is related with health status (Arora et al., 2009), treatment adherence (Kahn, et al., 2007), and patient satisfaction (Mallinger et al., 2005). In contrast, there are analyses that report a negative relationship or no relationship between patient-centeredness and health outcomes (Kinmonth et al., 1998) and patient satisfaction (Mead et al., 2002).

Also in health economics, where the doctor-patient relationship has been modelled within the economic theory of "agency" (Ryan, 1994), some of the theoretical arguments implicitly assume a patient-centred approach, while others imply a more paternalistic consultation style. Summarizing the various theoretical contributions on this subject, Scott and Vick (1999) illustrated that, together with the absence of an explicit contract between the doctor (agent) and the patient (principal) and the lack of extensive competition among physicians for patients, information asymmetry is considered the main source of imperfect agency. The same authors noted that, as proposed by Williams (1988), imbalance of information - where the doctor has more knowledge about the effect of healthcare on the health status of the patient but an incorrect perception of the patient utility function - could be rectified by the doctor giving the patient information so that the patient can choose, but it has been suggested that, as with standard agency theory, it should be the agent who chooses the action and not the principal (Evans, 1984).

All the aforementioned indications suggest that patient preferences should be a more central element in determining the type of consultation approach. Krupat et al. (2000), indeed, highlighted that it is reasonable to expect that the success of different physician styles also depends on the preferences of the patient, irrespective of how pleasing the patient-centeredness of the physician is in the consultation.

It is also important to note that addressing patients expectations could be arduous, as there are various consultation characteristics potentially important for patients that often generate conflicting results in the doctor-patient interaction. It has been shown, for example, that patients want fast access to good care, as well as to have a say in their care and be helped to help themselves (Coulter, 2005). On the other hand, time constraints was the most often reported barrier to implementing shared decision making in clinical practice (a specific aspect of patient-centred care), according to the perceptions of health professionals (Légaré et al., 2008). This implied an increasing interest in priority setting analyses, where patients are

required to trade off between some important attributes. Discrete choice experiments (DCEs) in primary care have presented a quite comprehensive evaluation of patients' priorities for characteristics of primary care consultations (Vick and Scott, 1998; Scott and Vick, 1999; Longo et al., 2006; Cheraghi-Sohi et al., 2008).

However, our understanding of the subject remain partial. The existing work has not accounted enough for the influence that patients' socio-demographic characteristics and past experiences could have on primary care consultations' preferences. Previous studies on primary care demonstrated that such characteristics had an impact on patients' preference for information exchange and involvement in decision making (Edwards et al., 2009) and that the fit between physicians' style and patients' orientation influenced patient satisfaction and trust (Krupat et al., 2001). In addition, Charles and Gafni (1999), rather than advocating a particular approach to patient care, emphasized the importance of flexibility in the decision making process so that individual differences in patient preferences are respected. Trying to deepen the knowledge on this matter, in this study a DCE was used to elicit population preferences for different GP consultation approaches, paying particular attention in the analysis of the relative importance assigned by respondents subgroups to the various attributes. The rate at which individuals trade between attributes and the relative value of different GP consultations was also examined.

4.2. METHODS

4.2.1. Discrete choice study

DCEs are a commonly used technique in health economics (De Bekker-Grob et al., 2010) in which individuals are presented with alternative hypothetical goods/services consisting of a number of attributes with different levels, and then they are asked to choose between quality/time/price differentiated versions of a good/service in a way that often requires them to make trade-offs between attributes. Thus, DCEs can mimic existing markets or elicit preferences and values for goods/services for which markets do not exist (Lancsar and Louviere, 2008). DCEs are favoured in health economic analyses because they are grounded on the utility theory (respondents choose the alternative offering them the highest utility) and they simulate the types of decisions that individuals are accustomed to make in everyday life (Ryan, 1999).

4.2.2. Questionnaire design

The attributes and levels describing the scenarios in the choice tasks were initially identified through a review of the existing literature and semi-structured interviews to primary care managers and District managers of Local Health Authorities (LHAs) and they were subsequently validated in a focus group. In order to avoid placing a significant cognitive burden on respondents that could alter the trade off between the attributes (Ryan & Gerard, 2003), the number of attributes selected was limited to the three most important factors emerged (Salked et al., 2003; Torbica & Fattore, 2010). Considering also the results of previous choice experiments (Vick & Scott, 1998; Scott & Vick, 1999; Gerard et al., 2006; Longo et al., 2006; Cheraghi-Sohi et al., 2008), plausible levels to each of the attributes were assigned (Table 1). Regarding the waiting time attribute balance, attention was given to present a level beyond the time currently being waited for the service and, on the other hand, to avoid showing a waiting time so high that the individual refused to respond.

To retain all possible information, a full factorial design has been adopted (Viney et al., 2002). The full factorial design produced 3^3 (27) combinations. The 27 alternatives were paired into choice sets using systematic level changes, applying a design generator to the initial profiles to construct interim levels for the new alternatives and then using modular arithmetic to the interim levels to obtain the

attribute levels of the new alternatives (Street et al., 2005). This approach, which was developed to obtain more statistically efficient designs (De Bekker-Grob et al., 2010) was used to maintain orthogonality, level balance and minimal overlap (Huber and Zwerina, 1996). The minimal overlap method was preferred to the increased overlap method because the two methods have no differences in consistency and perceived difficulty, but the minimal overlap method can increase efficiency (Maddala et al., 2003).

Table 1 – Attributes and levels selected.

<i>Attributes</i>	<i>Levels</i>	<i>Names</i>
Waiting time for the visit (WAIT)	0 Minutes	Waiting time
	90 Minutes	
	180 Minutes	
Involvement in decision making (INVOLV)	Complete (you choose considering the doctor's opinion)	Completely involv
	Partial (you and the doctor make a joint decision)	Partially involv
	No (the doctor chooses for you) *	No involv
Amount of information (INFO)	A lot of information	A lot of info
	Some information	Some info
	A little information *	No info

* Denotes the base category

This experiment was embedded in the patient satisfaction and experience survey on primary care services (SEPC) performed in the Tuscany Region (Italy) in 2009. Full details of the design, methodology and analysis of the survey are reported elsewhere (Murante, 2010). The SEPC was a biennial survey developed by the Tuscan Regional Health System (TRHS) to improve the primary service delivery organization through a “patient centeredness” logic, taking into account the patients’ actual healthcare pathways. The SEPC results are also used to calculate some indicators scores of the TRHS multidimensional Performance Evaluation System (PES), implemented to assess the processes, the outputs and the outcomes of the LHAs and the THs of the region (Nutri, 2008). In the 2008-2010 regional health plan (Tuscany Region, 2008), TRHS has planned the development of a more comprehensive and proactive approach to primary care, to better address population-specific needs. This have also implied a greater attention to the physician-patient interaction during the consultation. Hence, the findings of this study appeared of great interest for the TRHS.

The questionnaire comprised four sections. The first section included questions about respondents’ experience with primary care services, taken from the SEPC survey (the frequency to the GP in the last year, the reason to see the GP, the working organization of the GP - in association or not with other GPs, the time waited in the clinic before the visit, whether the visit to the GP had had to be put off, whether the patient had or had not been listened carefully by the GP, whether there had been enough time to discuss one’s health problems with the GP, whether the GP had or not involved the patient in the decisions, whether the GP had or not given clear explanations about the treatment, offered or not advice on eating or physical activity, and whether the patient did or did not trust the GP). After a short introduction on why the DCE was performed, the second section presented the attributes selected for the experiment and required each respondent to rank them in order of importance. This information was used to identify respondents that appear unwilling to trade-off the attributes. The third section comprised the choices between alternative GP consultations with different attribute levels. After an ample description of each attribute and of its level to clarify their meanings and

implications, participants were asked to make their choices in the context of a consultation for a non-urgent problem, and to express their preference for each choice set presented selecting one of the unlabelled options A or B. The fourth section comprised questions on current health status and socio-demographic questions, taken from the SEPC survey (age, gender, education, employment status, income, family status, health status and chronic condition).

The DCE was carried out using a computer aided telephone interview (CATI) approach, as it allowed a wide geographic coverage with higher response rates than postal or internet approaches (Burge et al., 2006) and it was considered a viable method if used with a small number of choice sets per respondent (Perkins, 1993).

Considering that the appropriate number of choice sets is context specific (De Bekker-Grob et al., 2010) and that there is little evidence in the literature about the manageable number of choice sets per respondent with telephone surveys, two different sets of questionnaires were tested, including 10 and 4 choice tasks respectively, using a blocked design. This means that each respondent faced only a subset of choice situations from the full factorial design. The 27 choice sets were therefore distributed across three blocks of nine and nine blocks of three respectively, creating an extra column with a number of levels equal to the number of blocks which is uncorrelated with every attribute of every alternative. Level balance was satisfied within each block, so that respondents do not just face only low or high attribute levels for a certain attribute. In each version the sequence of questions was randomized (as to avoid possible ordering effects) with the first choice set repeated as the last choice set, for a total of 4 choice tasks in the 9-versions design and 10 choice task in the 3-versions design. The repeated question - not included in the main data analyses - provided a check of response consistency (discussed further below) and allowed for a “warm-up” question at the beginning of the sequence to ensure respondents' correct understanding of the task (Carson et al., 1994).

4.2.3. Recruitment and data collection

The reference population of the study consisted of Tuscan residents over 18 years of age. Taking into account the number interviews required to return statistically significant results at health district level in SPEC survey, on the basis of previous experience and the expected response rates, a sample of 6970 individuals was generated from the telephone directory of the Tuscany Region using a random sampling approach stratified by health districts, so that the data offered results representing the population in these territories. Telephone interviews were conducted by a team of experienced interviewers in the spring of 2009.

The questionnaires were pre-piloted to a sample of 34 individuals of different age and geographical location in order to assess which type of questionnaire was more likely to be accepted, whether the sample understood the questionnaire, whether the responses were internally consistent and whether the experiment didn't take into account other relevant attributes. In relation to the last point, respondents were asked at the end of the DCE section if they were taking into consideration other attributes not included in the task when making choices, and to outline them in the affirmative case. The pre-piloting indicated that respondents were able to handle no more than 4 choices, based on respondents' direct feedbacks, response rates, item response rates, and rationality tests. Some changes were made, integrating the attributes description with examples in order to place the hypothetical scenarios in a more recognisable and realistic setting. Two respondents identified other attributes which they felt may be important such as the “type of contact with the GP (by telephone or in the practice)” and the consultation length. Apart these last two, no other attributes different from those included in the DCE were considered as relevant. A further pilot study was then undertaken with a new sample of 34 individuals of different age and geographical locations, to determine the

acceptability of the modified format. In this case, nearly all respondents understood the exercise, finding the questionnaire adequate.

Regarding the exclusion of the opt-out option, some authors have suggested it could be a violation of the underlying welfare measures of the economic experiment, since it makes it impossible to estimate the value of doing nothing, which may be chosen in practice (Lancsar and Louviere, 2008). Some others have claimed that this may increase the number of subjects that may be prone to choose the opt-out scenario to prevent making difficult choices (neutral responses), even though this would not provide the highest utility (Ryan and Skatun, 2004). The pilot study indicated that neutral responses were likely in this DCE and a forced choice was chosen as appropriate. Adding a status-quo alternative would have been another possibility, but also raised two concerns. First, since respondents were already experienced with primary care services, great care has been given to the “status-quo bias”, i.e. the tendency to choose what respondents know best (Salkeld et al., 2000). Second, as the status-quo alternative differed among respondents, it might have caused econometric and interpretation difficulties.

In view of the fact that the experiment includes a qualitative attribute (“involvement in decision making”) with levels that do not have a clear ordering and that systematically vary across the alternatives, and since the sample size of the pilot study was considered inadequate to make reliable assumptions on parameters priors, it was not possible to detect “dominant options” a priori - where all attributes of the first alternative are preferred to all attributes of the second alternative, or vice versa (Viney et al., 2005). Nevertheless, potential imprecision in the estimates would be filtered out, since design techniques that accounts also for a certain statistical efficiency were used - that mostly rule out choice situations with clearly dominant options (Bliemer and Rose, 2011), and given also the large sample size of the study. Further, addressing dominance through maximizing utility balance would decrease choice consistency (Louviere et al., 2008) with potential biases in parameter estimates (Viney et al., 2005).

In the final questionnaire configuration each respondent was randomly assigned to one of the nine blocks and was presented with four discrete choices. Figure 1 shows an example of a choice task. To favour the orthogonality of the data set (Lancsar et al., 2007), the nine subgroups assigned to each questionnaire version comprised an equal number of respondents. The groups were then tested to be homogenous with respect to geographical location (health district), age and sex.

Figure 1 - Illustration of a choice task.

Imagine that you need a visit by a general practitioner for a non-urgent problem and that you can choose between two alternatives

Would you prefer

ALTERNATIVE 1	ALTERNATIVE 2
Wait	Wait
<i>Nothing</i>	<i>1,5 Hours</i>
to be visited by a GP that	to be visited by a GP that
<i>does not involve</i> you in the decisions (the doctor chooses the treatment for you)	<i>partially involves</i> you in the decisions (you and the doctor make a joint decision about your treatment)
and that	and that
<i>gives you <u>some information</u> on your problem / treatment (e.g. the most important information about drugs utilization)</i>	<i>gives you a <u>lot of information</u> on your problem / treatment (e.g. how to benefit from specific healthcare services that could offer a better treatment or how to improve the quality of you life)</i>

4.2.4. Data analysis

Each choice of the participants between pairs, considered as a single observation, was included in the model as the binary dependent variable, where “1” represents the option being chosen and “0” the non-chosen one. The independent variables

were the differences between the levels of each attribute in each pair of scenarios. Choice data were modeled using a random utility maximization framework (McFadden, 1974). As the data were binary choice data, binary choice models were appropriate. Assuming a normal distribution of the error term, and in order to account for multiple observations from a single respondent, a random effect probit model was used for modelling (Propper, 1995). Assuming also a linear additive utility function (i.e. that a change in the level of one attribute does not affect the marginal utility of another attribute), the baseline empirical model was specified as follows:

$$\Delta U_{nc} = \beta_0 + \beta_1 * \Delta WAIT_c + \beta_2 * \Delta INVOLV_c + \beta_3 * \Delta INFO_c + \pi_n + \lambda_{nc} \quad (\text{Eq. 1})$$

ΔU denotes the difference in utility between alternatives of a choice set which is observed indirectly via the choice of the respondent. The subscripts n and c refer to the individual and the number of choice set respectively. $\Delta WAIT$, $\Delta INVOLV$, $\Delta INFO$ are the differences in attribute levels within each choice set. Given that a shorter waiting time and more information are intuitively preferable, it was expected that the former attribute would be associated with a negative coefficient and the latter with a positive one. No a priori assumption for the qualitative attribute “involvement in decision making” was made (Roux, 2004). The attributes “involvement in decision making” and “amount of information” were effects-coded. The major advantage of effects-coding over dummy-coding is that with the former, parameters of the omitted base attribute level can be computed (Bech et al., 2005). β_0 is the constant term that captures the overall preference for alternative B over A when all attributes in the model are fixed, included to test and control model misspecifications due to unobserved dimensions or unobserved interactions between respondents’ socio-economic characteristics and dimensions (Scott, 2001). β_1 , β_2 , β_3 refer to the part-worths estimated from the regression analysis. π_n is the individual specific error term due to differences amongst respondents whereas λ_{nc} is the random error term because of the differences among observations (Manski, 1977)²⁰. The correlation between choices was taken into account by estimating the serial correlation, or $\text{Corr} [\pi_n, \lambda_{nc}] = \rho$, where $\rho = \delta_{\pi}^2 / (1 + \delta_{\pi}^2)$ and δ_{π} is the variance of π_n .

In addition to analysing the three main attributes specified in equation 1, it was hypothesised that respondents’ characteristics, such as socio-demographic condition and their past experience with the GP, would also influence preferences for a GP consultation. Including these effects in the analysis minimises the outputs of any biases that would otherwise be present in the regression result estimates. Given that these characteristics do not differ between each choice and they simply drop out of the equation, they were entered into the model analysis through interactions with the main effects. The segmented model included all main and interaction effects. To create a more parsimonious model, this was reduced stepwise by excluding insignificant interaction effects one at a time on the basis of the likelihood ratio test with a p-value > 0.10. A less stringent p-value was used so as not to arbitrarily exclude variables that may be relevant with respect to the hypotheses being tested (Scott, 2002). This follows a “general to specific” method of model building, commonly used in econometrics (Maddala, 1992). These interactions can identify subgroups within the sample and can indicate where these subgroups have any additional strengths or weaknesses of preferences for particular attributes.

The regression coefficients (their sign and statistical significance) were used to estimate the relative importance of attributes and the trade-offs respondents would be willing to make between them (the marginal rate of substitution (MRS)),

²⁰ The λ_{nc} is the traditional error term unique to each observation, and the π_n is an error term representing the extent to which the intercept of the n th unit differs from the overall intercept (Petrou et al., 2009).

calculated by dividing the respective coefficient values of the attributes in question). A positive sign on a coefficient indicates that as the level of the attribute increases the utility derived increases (and conversely for a negative sign). The higher the size of the coefficient, the greater the importance of the attribute level in absolute value in affecting overall benefit. Respondents' preferences and the trade-offs were compared on a common value scale in terms of "willingness to wait", calculating the MRS values using the "waiting time" attribute as the denominator.

The estimated utility equation was also used to calculate the predicted benefit or utility scores for all combinations of attribute levels in the full factorial design (27 scenarios), that were then ranked in order of preference. The part-worth utilities (β s) and the constant were summed to give an overall utility for each combination of attribute levels. This technique, also carried out in other health care related DCEs (Ryan et al., 2000; Longworth et al., 2001; Phillips et al., 2002; Gerard et al., 2006; Schwappach and Strasmann, 2007; Chen et al., 2010), shows the relative value of the service configurations as perceived by the population, and is useful to assess the impact of changes in single attribute levels and in combinations of attribute levels on the scenarios described.

The 95% confidence intervals (95% CIs) for the "willingness to wait" estimates and predicted utilities were calculated using non-parametric bootstrapping (Efron, 1979)²¹ with 2000 iterations. To estimate confidence intervals a number of methods have been used including Fieller's method and the delta method (Herson, 1975). The advantage of the bootstrap is that, unlike the other methods, it makes fewer distributional assumptions (Briggs et al., 1997) and is thus robust to challenges about the sampling distribution. All statistical analyses were performed using Stata 10 (StataCorp, College Station, Texas).

4.2.5. Internal validity investigation

To measure internal validity three approaches were used: (a) consistency of preferences, (b) willingness to trade, and (c) consistency with theoretical predictions.

(a) Internal consistency was measured with a test of stability (or completeness) by which subjects are asked to consider the same discrete-choice comparison twice (early and late in the survey instrument). We expected subjects to make the same choice both times the question was offered. We haven't used other internal consistency tests - such as transitivity test - by including additional choice sets in each block because, as the pilot demonstrated, it would have increased the cognitive burden of respondents. The same concern about the feasibility of transitivity test is also present in the literature (Ozdemir et al., 2010).

(b) The willingness of respondents to trade-off the attributes, as expected in the compensatory decision making framework, was tested by identifying respondents with dominant preferences (individuals that always choose according to the best level of a given attribute) following the approach in Scott et al. (2002). For the attributes "waiting time" and "amount of information", where the "best" could be identified, we tested for each attribute whether an individual always chose the option with the best level and ranked the attribute as the most important in a simple ranking of the attributes. Dominant preferences for "involvement in decision making" were not calculated since the "best" level of this qualitative attribute was not known a priori. We then assessed the influence of dominant preferences by running a regression analysis twice, including and excluding respondents with dominant preferences.

(c) Theoretical validity was explored by examining the sign and significance of parameter estimates.

²¹ Confidence intervals are constructed on a so-called bootstrap distribution, which is obtained by estimating the desired statistic on a series of random samples (in our case 2000) from the original data set, samples that are made with replacement. Observed bias in the mean of the bootstrap distribution is adjusted for by the so-called bias correction method.

4.3. RESULTS

4.3.1. Response patterns and characteristics of respondents

Of the 6970 persons contacted, 3367 participated to the SPEC survey. Of these 3367 participants, 3225 completed the DCE, with a response rate of 46% - comparable to other surveys in this healthcare setting. After the deletion of missing values (entire respondents were removed only where all variables were missing), analyzable responses were available for 19212 observations. Details on responders' characteristics are presented in Table 2. On average, the time needed to complete the questionnaire was 7.47 minutes (standard deviation: 2.89 minutes; range: 3 - 27 minutes). The respondents were equally distributed and without any significant differences in socio-demographic characteristics and past experience with the GP across the nine versions of the questionnaire used (V1 respondents = 345, V2 respondents = 368, V3 respondents = 351, V4 respondents = 365, V5 respondents = 348, V6 respondents = 370, V7 respondents = 347, V8 respondents = 364, V9 respondents = 367). However, the sample contained a slightly larger proportion of older persons and women than in the population at large. This result may be expected in an "in-home" interview survey of this type (Greene, 2009).

Respondents were aged 18 - 96 (mean 58); 75.0% were female and 56.1% had a secondary level of education. 44.5% were working in medium and low skilled jobs or engaged in a full time education; 41.6% had a medium income. 13.3% were in a fair or poor health status and 36.1% of them declared to have a chronic disease. In the last year 68.3% of the respondents went more than 3 times to the GP clinic and 78.0% of them waited less than 1 hour for a consultation. Mainly, the GP was seen to have some prescriptions or certificates (62.6%) and for an already existing illness checking (21.4%). During the consultation, the GP carefully listened to the 98.2% of the participants, gave to 98.1% of them enough time to discuss about their problems, involved 97.3% of them in the decisions, gave to 98.1% of them clear explanations and communicated to 69.9% of them an advice on eating or physical activity. 98.4% of the respondents trusted their GP.

4.3.2. Validity issues

The stability test showed that overall, 10% of respondents were inconsistent, which was considered to be acceptable. These levels are similar to those found in other studies, which range from 1% (Howard et al., 2009) to 25% (Phillips et al., 2002; Maddala et al., 2003). Since the first question was repeated at the end of the task sequence, failing the stability test may be caused by learning or fatigue effects that, according to previous studies (Johnson and Desvousges, 1997; Maddala et al., 2003; Schwappach and Strasmann, 2007), work in opposite directions to affect subjects' stated preferences. Considering the relatively small number of choice tasks presented to each respondent, learning effect seemed to be the principal source for the stability test failure, as subjects tried to understand the choice task (Johnson and Desvousges, 1997). Therefore, responses to the first question - treated as a warm-up question - could be noisy. For what concerns the identification of apparent non-traders, the detection of dominant preferences as suggested by Scott et al (2002) is a common way to assess the willingness to trade. However, all other things being equal, a consistent dominant attribute pattern is more likely to be found among respondents receiving few choice sets than respondents receiving several choice sets (Bech et al., 2011). In this case, the level of dominant preferences was similar to other studies (Scott et al., 2002), as 17% of respondents chose always the scenario with the best level of a given attribute that they ranked as the most important attribute in the simple ranking. The results of the regression analyses including and excluding respondents with dominant preferences indicated that removing such respondents had no statistically significant impact on the coefficient size and direction for each attribute. In any case, random utility models are robust to

violations of compensatory decision making (Lancsar and Louviere, 2006). Therefore we included all respondents in the final analysis.

Table 2 – Respondents' description.

<i>Attributes</i>	<i>Levels</i>	<i>Names</i>	<i>Freq.</i>	<i>%</i>
Age group	18-49 years	Age 18-49	938	29.5
	50-69 years	Age 50-69	1377	43.3
	> 69 years *	Age > 69	868	27.3
Gender	Female	Female	2419	75.0
	Male *	Male	805	25.0
Education	None / Primary level	Educ No	1066	34.0
	Secondary level	Educ Sec	1759	56.1
	University degree or higher *	Educ Uni	308	9.8
Employment status	Not working / Retired	Empl No	1444	46.2
	Working (High-skilled jobs)	Empl High	293	9.4
	Working (Medium / low-skilled jobs) + Students *	Empl Low	1391	44.5
Income	High	Inc High	1214	42.1
	Medium	Inc Med	1199	41.6
	Low *	Inc Low	472	16.4
Living alone	Yes	Alone	364	11.8
	No *	Alone No	2733	88.2
Health status	Fair / Poor	Health Low	414	13.3
	Excellent / Very good / Good *	Health High	2697	86.7
Chronic disease	Yes	Chron	1132	36.1
	No *	Chron No	2008	63.9
Frequency to the GP clinic in the last year	Never / From 1 to 3 times	Freq Low	903	31.7
	More than 3 times *	Freq High	1950	68.3
Reason to see the GP	General health check / Minor illness treatment	Reas Min	434	16.0
	Already existing illness check	Reas Exist	579	21.4
	Prescriptions / Certificates / Other *	Reas Other	1692	62.6
The GP works with other GPs	Yes	Assoc	757	28.0
	No *	Assoc No	1948	72.0
Time you waited in the clinic	Less than 1 hour	Wait Less	1992	78.0
	More than 1 hour *	Wait More	563	22.0
You have had to put off seeing the GP	Yes (Waited too much, GP unavailable, Clinic closed)	Putoff	243	9.0
	No *	Putoff No	2462	91.0
The GP listened to you carefully	Yes	Listen	2651	98.2
	No *	Listen No	49	1.8
The GP gave you enough time to discuss	Yes	Entime	2649	98.1
	No *	Entime No	52	1.9
The GP involved you in the decisions	Yes	Involv	2627	97.3
	No *	Involv No	73	2.7
The GP gave you clear explanations	Yes	Clear	2649	98.1
	No *	Clear No	52	1.9
The GP gave you advices	Yes	Advice	1881	69.9
	No *	Advice No	810	30.1
You trust in your GP	Yes	Trust	2661	98.4
	No *	Trust No	44	1.6

* Denotes the base category

4.3.3. Basic model

The random effects probit estimator was used to fit equation 1 to the survey data. The value of Rho, an estimate of ρ , was 3.10×10^{-11} and not statistically significant. This suggested that respondents treated the decision made in each pair-wise comparison as a separate hypothetical situation, and not in association with the decision made in each of the remaining pair-wise comparisons. Thus, all models were re-fitted to the data using the standard probit estimator. With the standard probit model, each choice is treated as a separate observation and the error term is assumed to be independent across observations.

As it was assumed that the utility function is linear in the covariates, it was verified whether the linear representation of the continuous variable “waiting time” was admissible. For this purpose a univariate smoothed scatter plot (Cleveland and Devlin, 1988) was first performed to show potential non-linearities. Second, the probit model was re-estimated using dummy variables replacing the continuous variable. If the dummy variable coefficients were increased by approximately equal intervals, and the confidence intervals from one dummy variable to the next were overlapped, the explanatory variable would increase monotonically and could be considered linear (Witt et al., 2009). The evidence confirmed that a linear representation of “waiting time” was compatible with the data. Furthermore, a likelihood ratio test indicated that including a quadratic term would not result in an improved explanatory power.

Table 3 reports the results of the main effects probit model. The model has good fit, as explained by McFadden Pseudo R^2 (0.24)²², and predicts correctly 75% of the responses. The significant χ^2 statistic of 6490.03, distributed with five degrees of freedom, indicates that the estimated model has improved explanatory power over a model where only constant term is included. All attributes have coefficients that are significantly different from 0, indicating that the attributes had a significant impact on respondents’ decisions. The positive and significant constant term suggest either that respondents were more likely to favour alternative B, or that they were considering attributes not in the model.

The attributes coefficients can be interpreted as the change in utility in moving from alternative A to alternative B. The negative coefficient for the “waiting time” attribute indicates that the higher the level of this attribute in alternative B relative to alternative A, the less like the individual is to prefer alternative B over alternative A. In other words, other things being equal, respondents were more likely to chose a GP consultation that implied a lower waiting time.

The positive coefficient for “completely involv” and “partially involv” indicates that the respondents preferred a consultation with a GP that totally involves them in the decisions about their treatment (in which the respondents choose their treatment considering the GP’s opinion), or that partially involves them (the GP and the respondents make a joint decision about their treatment), instead of a visit where the GP does not involve them (the GP being the only one to choose their treatment). Although with a slight discrepancy, the coefficient on “completely involv” is larger than that on “partially involv”, indicating that, everything else equal, participants preferred a complete to a partial involvement in the decision making process. The findings on this dimension are coherent with other similar analyses. In Scott (1999) respondents, for an hypothetical GP visit, preferred to be involved in decision making rather than not be involved in decision making. Longo et al. (2006), reported that patients preferred respectively a complete and a partial involvement in the decisions about their treatment, in place of a consultation where only the doctor chooses the treatment. In the study of Cheraghi-Sohi et al. (2008) patients, for a minor physical problem, preferred to see a GP who involves them in the decisions about treatment instead of a doctor that does not.

²²The pseudo R^2 is given by $1 - LL(\beta)/LL(0)$, where $LL(\beta)$ is the log-likelihood of the reported model and $LL(0)$ is the log-likelihood of a constant-only model.

As regards “the amount of information”, *ceteris paribus*, a consultation with a GP that gives to the respondents a lot of information and some information on their problem and treatment was more likely to be chosen than a consultation with a GP providing little information, although each to a different extent. The increase in marginal utility for a large amount of information given is larger than it is for a moderate amount of information. Also in this case, the higher utility for an increase in amount of information received is in accordance with the results of Scott (1999) and Longo et al. (2006). In the former study patients, for a GP visit, preferred a lot of information to a little, while in the latter one patients chose a moderate and a large amount of information, instead of a small amount. These results are in line with expectations and provide support for the theoretical validity of the model.

While a change in waiting time of 1 minute may not be as important as a marginal change in any of the other two attributes, the change in benefit resulting from a 300 minutes (5 hours) change is equal to 0.90 (0.003×300), which outweighs the benefit of a marginal change in both “involvement level in decision making process” and “amount of information”. This shows that coefficients are not directly comparable across attributes and a common unit of measurement is required. Estimating the value of single attributes on a common scale, in terms of the time respondents are willing to give up for that attribute, “waiting time” becomes more important than “completely involv” if the difference in waiting time was longer than 93 minutes. This indicates that respondents would be willing to wait up to 93 minutes for a consultation with a GP that completely involves them in the decisions. Similarly, “waiting time” is more important than “some info” and “a lot of info” if the difference in waiting time was longer than 115 minutes and 292 minutes respectively, suggesting that respondents would be willing to wait 1 hours and 55 minutes longer to be visited in a practice where the GP gives them some information, and 4 hours and 52 minutes longer to have a lot of information from the physician. This implies that a large and a moderate amount of information from the GP is more important than being completely involved in the decisions. With reference to the remaining attribute level, participants would be willing to wait up to 92 minutes to be partially involved in the decisions.

Table 3 - Results from DCE: basic model.

<i>Attribute</i>	<i>Coefficient</i>	<i>Std. Err.</i>	<i>MRS (Min.)</i>	<i>95% CI (Lower)</i>	<i>95% CI (Upper)</i>
Constant	0.193 ***	0.016	-	-	-
Waiting time	-0.003 ***	0.000	-	-	-
Completely involv	0.235 ***	0.014	93.4	79.4	109.6
Partially involv	0.233 ***	0.015	92.5	78.8	108.5
A lot of info	0.735 ***	0.015	292.3	263.9	328.5
Some info	0.289 ***	0.014	114.7	99.7	133.0
N	19212				
Log Likelihood	-10071.73				
Likelihood ratio test (c^2 , d.f.) ^a	6490.03 (5) ***				
Pseudo R ² McFadden ^a	0.244				

*** $p < 0.001$

^a Compared to a only constant model

4.3.4. *Reduced model with interaction terms*

The results from the reduced model are presented in Table 4. The Pseudo R^2 (0.27) shows that this model has a better fit than the main effects model. In the segmented model the main effects are of a similar sign and significant. Some of the interaction terms have a substantial impact on the results and their coefficients show how preferences differ depending on respondents' characteristics and past experiences.

The set of relevant socio-demographic characteristics that influenced preferences for the GP consultation are limited to the respondents' gender, income, family status and chronic condition; while the most relevant variables related to the respondents' past experience with the GP are the working organization of the GP (in association or not with other GPs), having had to put off seeing the GP, having been carefully listened to or not by the GP, having been involved or not in the decisions by the GP, having or not received advice on eating or physical activity from the GP and trusting the GP or not. Interaction terms that dropped out of the estimated model during the backward stepwise elimination of variables were not statistically significant, thus they did not influence the relative importance of primary care setting characteristics. In this model, the sample size is smaller due to some of the respondents not reporting their socio-demographic characteristics and the data on their past experience with the GP.

The regression coding used and the sign of the coefficients indicate that respondents who received in their last consultation advice from the GP on eating or physical activity showed a weak inclination to wait more for a visit.

Individuals who have been listened to carefully by the GP in their last consultation, those who received in the last visit advice from the GP on eating or physical activity and those who trust their own GP did not prefer a consultation with a GP that totally involves them in the decisions about their treatment. Respondents who have been involved in the decisions in their last consultation with the GP were instead more likely to value being totally involved in the decisions about their treatment. Further, a complete involvement in the decision making process had a lower marginal utility for participants with chronic diseases.

The last two interactions described are in line with the findings of a similar study (Scott, 1999), where patients who were more involved in the decision making and those in good health preferred being involved in decision making, although the significant interaction between age and involvement in decision making reported in the aforementioned study was not found in the present analysis.

Conversely, participants who have been involved in decision making during their last visit did not prefer to be partially involved in a GP consultation, while those who trust their GP had a stronger preference for being partially involved. Moreover, a GP consultation with a partial involvement was more likely to be preferred by respondents living alone, whereas females showed a weaker preference for this type of involvement. This last interaction was also consistent with the results reported by Scott (1999), in which females had a stronger preference than males for being involved in decision making.

With reference to the impact of respondents' characteristics on preferences for the amount of information received, a consultation with a GP who gives a lot of information on the problem and treatment was the option preferred by the chronics, by respondents whose GP works in association with other GPs, by respondents who have had to put off seeing the GP, by those who received in their last consultation advice from the GP on eating or physical activity and by those who trust their GP.

A moderate amount of information given in a GP consultation was more likely to be preferred by respondents with a medium income, even though it wasn't the option preferred by those who received advice in their last GP consultation. Significant interactions between the amount of information and education level, and between information and frequency of visits to the GP clinic in the last year, reported in a similar analysis (Scott, 1999) - where patients with a lower level of education

preferred less information and those whose last visit to a GP was more than one year before preferred a lot of information - were not found in this study.

Table 4 - Results from DCE: reduced model with interaction terms.

<i>Attribute</i>	<i>Coefficient</i>	<i>Std. Err.</i>
Constant	0.1766 ***	0.019
Waiting time	-0.0024 ***	0.000
Completely involv	0.2726 ***	0.076
Partially involv	0.2614 ***	0.075
A lot of info	0.7297 ***	0.061
Some info	0.2878 ***	0.019
Waiting time * Advice	0.0003 **	0.000
Completely involv * Chron	-0.0409 **	0.015
Completely involv * Listen	-0.1384 †	0.076
Completely involv * Involv	0.2140 **	0.069
Completely involv * Advice	-0.0357 *	0.016
Completely involv * Trust	-0.1212 †	0.073
Partially involv * Female	-0.0297 †	0.017
Partially involv * Alone	0.0921 ***	0.024
Partially involv * Involv	-0.1540 **	0.059
Partially involv *Trust	0.2024 **	0.071
A lot of info * Chron	0.0565 ***	0.016
A lot of info * Assoc	0.0924 ***	0.017
A lot of info * Putoff	0.1225 ***	0.028
A lot of info * Advice	0.1941 ***	0.019
A lot of info * Trust	0.1441 *	0.058
Some info * Inc Med	0.0635 **	0.020
Some info * Advice	-0.1708 ***	0.018
N	14344	
Log Likelihood	-7396.96	
Likelihood ratio test (χ^2 , d.f.) ^a	5091.08 (22) ***	
Pseudo R ² McFadden ^a	0.256	

*** $p < 0.001$, ** $0.01 > p \geq 0.001$, * $0.05 > p \geq 0.01$, † $0.1 > p \geq 0.05$

^a Compared to a only constant model

4.3.5. Comparison of scenarios

Table 5 shows a utility-based ranking for all the scenarios in the design. A high utility implies a strong preference for a particular scenario. Assuming that the costs of different service configurations do not vary, policy makers should attempt to attain the scenario with the highest benefit possible. The most preferred service configuration would be scenario 18, where respondents are immediately visited by a GP who completely involves them in the decisions about their treatment and gives

them a lot of information. As the marginal utilities for both a complete involvement and a partial involvement are very similar, consequently every service configuration that included the former involvement level would produce an overall benefit very similar to that generated by a scenario including the latter type of involvement, assuming all other things equal. Other scenarios that would lead to greater satisfaction than that enjoyed from the current service organization are, in order of preference: scenario 10, scenario 26, scenario 19, scenario 6, scenario 14, scenario 9, scenario 4, scenario 3, scenario 12, scenario 22, scenario 21, scenario 24, scenario 13, scenario 25 and scenario 2.

Table 5 – Evaluation of alternative scenarios.

<i>Scenario</i>	<i>Waiting time</i>	<i>Involvement level</i>	<i>Info.</i>	<i>Indirect Utility</i>	<i>95% CI (Lower)</i>	<i>95% CI (Upper)</i>
18	0 Min	Completely involv	A lot	1.16	1.11	1.22
10	0 Min	Partially involv	A lot	1.16	1.11	1.21
26	90 Min	Completely involv	A lot	0.94	0.89	0.98
19	90 Min	Partially involv	A lot	0.93	0.89	0.98
6	0 Min	Completely involv	Some	0.72	0.67	0.77
14	0 Min	Partially involv	Some	0.71	0.67	0.76
9	180 Min	Completely involv	A lot	0.71	0.66	0.76
4	180 Min	Partially involv	A lot	0.71	0.66	0.76
3	90 Min	Partially involv	Some	0.49	0.45	0.53
12	90 Min	Completely involv	Some	0.49	0.45	0.53
22	0 Min	No involv	A lot	0.46	0.41	0.51
21	180 Min	Completely involv	Some	0.26	0.21	0.31
24	180 Min	Partially involv	Some	0.26	0.21	0.31
13	90 Min	No involv	A lot	0.23	0.19	0.28
25	0 Min	No involv	Some	0.01	-0.03	0.06
2	180 Min	No involv	A lot	0.01	-0.04	0.06
7	90 Min	No involv	Some	-0.21	-0.26	-0.17
16	180 Min	No involv	Some	-0.44	-0.49	-0.39
1	0 Min	Completely involv	A little	-0.60	-0.65	-0.55
8	0 Min	Partially involv	A little	-0.60	-0.65	-0.55
23	90 Min	Completely involv	A little	-0.82	-0.87	-0.78
17	90 Min	Partially involv	A little	-0.82	-0.87	-0.78
15	180 Min	Completely involv	A little	-1.05	-1.10	-1.00
27	180 Min	Partially involv	A little	-1.05	-1.10	-1.00
20	0 Min	No involv	A little	-1.30	-1.36	-1.24
5	90 Min	No involv	A little	-1.53	-1.58	-1.47
11	180 Min	No involv	A little	-1.75	-1.81	-1.69

4.4. DISCUSSION

The increasing importance of flexibility in the physician-patient consultation approach in primary care, in order that differences in patient preferences are respected, required healthcare managers and physicians to fix a balance between various potentially important GP consultation characteristics for diverse groups of patients. This large-scale study extends the body of literature on DCE applications for different GP consultation approaches, providing new information about the influence that patients' socio-demographic characteristics and past experiences could have on consultation preferences.

While the results obtained confirmed the value of all the attributes that were identified, the "willingness to wait" assessment revealed that receiving information from the GP was more important than being involved in the decisions and that, approximately, a complete involvement had the same importance as a partial involvement. Apart from the analysis of Longo et al. (2006), where a partial involvement was judged slightly more important than receiving a lot of information, these results support the findings from other DCEs (Vick and Scott, 1998; Scott and Vick, 1999) and from the non-DCE literature (Benbassat et al., 1998; Guadagnoli and Ward, 1998; Robinson and Thomson, 2001; Levinson et al., 2005).

Thus, patient participation encompasses several aspects that are not necessarily interrelated: patients can be quite active when it comes to asking questions to their physician, but at the same time do not really participate in the decision-making process (Schouten et al., 2007). This complex preference pattern could be better understood through the results of the segmented model.

Apart from the important impact of some socio-demographic variables, such as a chronic condition, gender and family status, the characteristics connected to the participants' past experiences seem to have the greatest influence on the involvement level. If the GP has paid attention to what the patients had to say and has given advice on eating or physical activity - both probable determinants of trust in the caregiver - then the patient would not prefer to be completely involved, sharing the decision-making authority with the GP. This is true, unless the GP has accustomed the patient to be systematically involved in the decisions; in this case the patient would prefer to be highly involved.

Several studies could explain these interactions. In a review of the empirical literature on patient decision role preferences regarding treatment and screening, Chewning et al. (2011) found that, compared to the 63% of the 119 analyses included, only 46% of the 26 analyses from patients with chronic conditions found the majority of their respondents wanted to participate in decisions rather than delegate decisions to the physician. For people with chronic conditions, which is often the case in older patients, common problems related to getting old including forgetfulness, poor hearing or vision and being less mobile were viewed as complicating active involvement (Bastiaens et al., 2007). Regarding the role of trust, Thom and Campbell (1997) stated that it is likely to be enhanced among patients who reported that their physicians made an effort to communicate clearly and completely, because the process of interactive exchange of information and ideas between the individuals and the health system caregivers generates trust in the first place (Thiede, 2005). In addition, empirical research showed that patients who prefer to make their own decisions trust their physicians significantly less than other patients (Kraetschmer et al., 2004; Lee and Lin, 2010) and that autonomy support may also mitigate the negative relationship between decisional preference and patient trust, because the greater the patients' perception of their own physicians' propensity to involve them in decision making, the more active a role the patient preferred (Say et al., 2006).

Thus, our data suggest that preferences for a different involvement level could be relatively controllable by the caregivers, considering that, to a large extent, they seem to depend on the attitude of the GP in the previous visits.

Heterogeneity was also found with reference to information preferences. People who preferred to have a lot of information from the GP and who didn't choose to have some information are those with chronic illnesses, those whose GP works in association with other GPs, those who have had to put off seeing the GP, those who received advice from the GP and those who trust the GP. Respondents who preferred a moderate amount of information are individuals with a medium income. Therefore, the amount of information required by the respondents is also influenced by a complex interplay of personal and contextual factors, as well as by the physician.

Regarding the personal influence, in their literature review Willems et al. (2005) revealed a vicious circle between patients from lower social classes - as probably those with a medium income - and doctors in their communication. These patients' communication and actions (less question asking, less opinion giving, less affective expressiveness) elicit a less involving behaviour from the doctor, with less partnership-building utterances, which discourages the patient from adopting a more active communication style. On the contrary, chronic illnesses and trust in the physician seem to have a different impact. Older patients, frequently with chronic conditions, valued receiving information about their health condition, treatment options and preventive measures (Bastiaens et al., 2007). Furthermore trust was considered as a factor improving communicative interaction (Thiede, 2005).

Another important factor for patients' information preferences is the physician's communicative approach, since the physicians' use of supportive communication influenced patients' question-asking and opinion-giving (Street, 1991; Street, 1992; Wissow et al., 1994; Schouten et al., 2007).

However, the information required also varies according to other situational influences, such as the organisation of the practice. As in a long consultation doctors pay greater attention to the relation with the patient, listen more extensively and give more information (Deveugele et al., 2004), patients who did not have sufficient time to talk with the physician - which could often be the case for those who have had to put off seeing the GP - reported to be particularly irritated by the belief that it was unrealistic to prolong a consultation by asking too many questions and would have liked more information (Pooley et al., 2001). Patients whose GP works in association with other GPs may not be visited by the same physician each time they attend a clinic, and they could suffer from the lack of relational continuity, where the health professional they see knows little of their case and just go through normal routine of questions (Pooley et al., 2001). The relationships between patient and multiple health care professionals (clinician-patient alliance) is actually enhanced when clinicians are optimally informative and show empathy with the patient's circumstances, when patients have an opportunity to express their concerns, and when the patient receives consistent messages and coordinated care from the clinical team (Epstein and Street, 2007).

The study does have a number of limitations, reflecting the explorative nature of the research. First, although all the characteristics in the experiment were considered important and statistically significant, the relatively small number of attributes used in the design to ensure that the task was manageable for respondents, may have led to the omission of other features probably captured within the constant term. There is little discussion on this in the health economics literature, and where a significant constant is identified, the problem tends to be ignored (Richardson et al, 2009). In the qualitative part of the study we tried to select attributes in an unbiased way, but we cannot know whether other qualitative approaches would produce the same attributes and levels. Comparative qualitative approaches identifying attributes and levels for the same study would be important for determining the significance of the attributes found (Gunther et al., 2010).

Second, in comparison with response rates of previous discrete choice experiments in the primary care setting (between 18% and 76%) (Vick and Scott, 1998; Scott and Vick 1999; Morgan et al., 2000; Scott et al., 2003), our response rate of 46% was acceptable. Nevertheless, the comparison with the Tuscan population data

revealed some bias in that older respondents and women were more likely to respond. As age and sex were the only available data on the Tuscan population, a more comprehensive evaluation of sample selection bias in terms of variables such as participants' attitudes and other socio-demographic characteristic was not possible. Given also the specific social, economic, and cultural characteristics of healthcare systems, readers should be cautious when attempting to generalize these results across countries. In future studies, the potential for such biases needs to be addressed through more resources spent on recruitment of subjects.

Third, as respondents evaluated hypothetical choices intended to simulate realistic decisions but without the same consequences as actual ones, it is not given that they will behave in real settings as they state they would. The available evidence on this issue is scarce (Mark and Swait, 2004; Telser and Zweifel, 2007), and due to the lack of a market for health care, tests for external validity are difficult to conduct (de Bekker-Grob et al., 2010). Carrying out focus groups at the end of future DCEs could help in verifying the validity of the results achieved by asking respondents if their preferences are consistent with the findings of the estimated model.

Fourth, the incorporation into the model of several aspects of respondents' characteristics, interacted with the attributes, consented the investigation of important features of preference heterogeneity. However, some variations in tastes will probably remain unknown to the extent that it cannot be related to observed characteristics. Estimation models such as mixed logit and latent class model, that relax the assumption of taste homogeneity by allowing for random taste variation, should be explored in the future.

4.5. CONCLUSION

Given this diversity of patient preferences, a good strategy would be that of matching the physician's actual behaviour to the patients' desired levels of information and involvement. Some authors have proposed that physician attempts to interact in ways that fit the patients' preferred level of information and participation in treatment decisions could be beneficial to patients (Cecil and Killeen, 1997; Guadagnoli and Ward, 1998; Auerbach 2000). Better congruence, however, should be achieved because - as previous studies found - even though preference-matching may enhance patient outcomes, 52% of patients didn't experience a match regarding their information preferences and 40% of subjects reported mismatches with their preferred level of participation in decision-making (Kiesler and Auerbach, 2006).

Ideally, physicians should adapt their participatory style to match exactly any patient's particular needs and preferences, impersonating easily the entire range of egalitarian to paternalistic role behaviours (Makoul, 1998). However, this solution is not easily viable, because physicians sometimes have difficulties in judging accurately patient expectations (Coulter et al., 1994; Hall et al., 1999) and attempting to change provider consultation behaviours is hard to sustain (Hulsman et al, 1999).

Thus, further strategies should be used, such as pre-consultation approaches (routine pre-visit assessments of patients preferences and behaviours (Krantz et al., 1980; Degner et al., 1997; Krupat et al., 2000), patient activation programs that train patients to disclose their preferences and to be actively involved in their consultations (Post et al., 2002; Harrington et al., 2004)) or tailored interventions with interactive computer based presentations providing detailed descriptions about the disease, the treatment alternatives and the potential outcomes (Lauver et al., 2002).

While there are several ways to achieve successful preference-match interventions, it is also important to note that patients' preferences could change as the patient-provider relationship proceeds (Robinson et al., 2001; Say et al., 2006). In any case, the physicians could assess patient preferences during the visit by directly asking patients (Swenson et al., 2004), although patients are often unable or

unwilling to express their desired roles and needs, and time restrictions may hamper the ability of the physician to elicit valid preferences (Keating et al., 2002). Further research therefore is needed to reveal principally how patients' preferences and needs change over time. Clarifying these issues could facilitate the implementation of potentially more appropriate preference match strategies, enabling physicians to deliver a more flexible care with respect to the patient's varying requests for information-receiving and involvement and to consequently improve patient outcomes.

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