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Health Economics and Geriatrics: Challenges and Opportunities

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1. Introduction

1.1 The relationship between health economics and geriatrics

The fundamental economic problem of limited resources coupled with unlimited claims upon those resources holds particular resonance for geriatrics given the projected huge future growth in demand for health and aged care services for older people as a consequence of demographic change. Population ageing is a world-wide phenomenon which poses major challenges and opportunities for health economics and geriatrics. Currently approximately 2 million Australians, almost 10% of the total population, are aged 70 years and over and this figure is set to double during the next two decades. It is estimated that by 2045, one in four Australians will be aged 65 years or more and nearly one in ten will be 80 years or over [Productivity Commission, 2005]. This situation is not unique to Australia, population ageing forecasts in many countries and regions throughout the world mirror these statistics. In addition, factors other than an ageing population are creating new pressures and challenges for geriatrics, particularly in relation to how health and aged care services are provided in the future. The so called post-war “baby boomer” generation is generally expected to have much higher expectations for choice and responsiveness in the provision of health and aged care services relative to previous generations. Therefore, techniques for systematically engaging older people to establish their preferences in relation to the provision and configuration of geriatric services are likely to become more important. This chapter discusses the challenges and opportunities for the application of health economics and geriatrics from two main perspectives. Firstly, in relation to economic evaluation and the methods for assessing the cost effectiveness of new health care technologies and models of aged care service delivery. Secondly, in relation to methods adopted by health economists for measuring and valuing patient or consumer preferences in health care.

2. Health economics and economic evaluation

Health economics is a sub-discipline of economics, principally concerned with issues related to scarcity in the allocation of resources for health care expenditures for the promotion of

health [Drummond et al, 2005]. It has long been recognized that the resources available for expenditure in geriatrics, as in all other areas of medicine, are constrained and unfortunately difficult decisions must be made about which services are to be provided, to whom, where and when. Any decision to introduce new geriatric services or expand existing services will inevitably have resource and cost implications and will be associated with lost opportunities (otherwise known as opportunity costs) in terms of foregone health benefits [Brazier et al 2007]. For example, making more resources available for secondary care services e.g. expansion of diagnostic geriatric neurology services for older people means that fewer resources will be available to provide services in the community e.g. incontinence assessment and management. Inevitably, therefore, there will be opportunity costs and such decisions will potentially have major implications for health.

A recent influential policy report by the National Health and Hospital Reform Commission, established by the Australian Federal Government to develop a long-term health reform plan for a modern Australia, highlighted the need for greater evaluation in the provision of geriatric services [National Health and Hospital Reform Commission, 2009]. Health care policy makers within the United Kingdom, Canada and the United States have also called for greater evaluation of health, social and aged care services for older people, suggesting that this will lead to improvements in efficiency by targeting scarce resources towards interventions which promote the health, independence and well-being of older people [Department of Health, 2001; Glendinning, 2003; Kodner, 2006; MacAdam, 2009].

2.1 Economic evaluation and its role in promoting efficiency

Economic evaluation is an evaluation tool that can be used to facilitate resource allocation decision-making. There has been an increasing use of economic evaluation to inform health care policy making over the last decade through the establishment of organisations such as the National Institute for Health and Clinical Excellence in the UK and similar agencies in other countries. The overall aim of health economic evaluation methodology is to aid decision-makers to make efficient and equitable decisions about the allocation of scarce resources via a systematic and transparent comparison of the costs and benefits of competing interventions [Drummond et al, 2005]. In many instances, a new intervention will be more costly but will also result in increased health benefits relative to existing alternatives. Therefore the decision problem concerns whether the increased costs represent good value for money.

2.2 Types of economic evaluation

There are four main types of economic evaluation: cost minimisation, cost-effectiveness, cost-utility and cost-benefit analyses [Brazier et al 2007]. Cost-minimisation analysis seeks to establish which is the least cost alternative, but is only an appropriate technique of economic evaluation if it can be shown that the alternatives under consideration achieve identical outcomes. However, in practice this is very rarely achieved since there is always uncertainty around the measure of outcome. Cost-effectiveness analysis determines what is the best method of achieving a given objective, usually measured in clinical or 'natural' units, and presents results in terms of cost per unit of effect (e.g. cost per positive cancer detected or cost per symptom free day). Cost-utility analysis compares the costs of alternative health

care programmes with their utility, usually measured in terms of quality adjusted life years (QALYs). QALYs combine survival and quality of life into a single measure of value and are discussed in detail in sections 3 and 4 of this chapter. Cost-benefit analysis compares the benefits with costs of a health care programme, where all the benefits are valued in money terms including health improvement. The most widely applied technique of economic evaluation is cost-utility analysis. Many regulatory authorities including the National Institute of Health and Clinical Excellence [NICE, 2008] in England and Wales and the Pharmaceutical Benefits Advisory Committee in Australia [Commonwealth Department of Health and Ageing, 2002] routinely require the presentation of a cost utility analysis alongside information relating to the clinical safety and efficacy of a new health technology as part of their reimbursement decision-making process.

2.3 Economic evaluations in geriatrics

Economic evaluations in geriatrics are rare in comparison with other medical specialties. A recent review of the National Institute for Health Research Centre for Reviews and Dissemination databases (which contain abstracts of published journal articles from around the world relating to the effectiveness and cost-effectiveness of health care interventions) recorded a total of 8428 abstracts relating to economic evaluations from all medical fields of which only 48 (<1%) were classified as relating to the field of geriatrics. Of these 37 (77%) were defined as cost effectiveness analyses and the remaining 11 studies (23%) were defined as cost utility analyses. Examples of recent cost effectiveness studies undertaken in geriatrics include a study by Jowett and colleagues which examined the cost effectiveness of warfarin versus aspirin in patients older than 75 years with atrial fibrillation [Jowett et al 2011] and a study by Holman and colleagues which examined the cost effectiveness of cognitive behavior therapy versus talking and usual care for depressed older people in a primary care setting [Holman et al 2011]. Both of the studies were undertaken in the UK. The study to assess the cost effectiveness of warfarin comprised an economic evaluation alongside a randomized controlled trial in 973 patients aged 75 years and over with atrial fibrillation randomized to receive either warfarin or aspirin. Patients were followed up for a mean of 2.7 years. The costs of thrombotic and hemorrhagic events, anticoagulation clinic visits and primary care utilization were determined. Clinical benefits were expressed in terms of a primary event avoided including fatal or non-fatal disabling stroke, intracranial hemorrhage, or systemic embolism. It was found that total costs over the four year study period were lower in the warfarin group (difference, -£165; 95% CI -£452 to £89). This difference was primarily driven by the difference in primary event costs as the primary event rate over 3 years was lower in the warfarin group (0.049 versus 0.099). With lower costs and a higher clinical benefit (characterized by a lower primary event rate) warfarin is the dominant treatment and the authors therefore concluded that warfarin represents a highly cost effective intervention compared with aspirin in atrial fibrillation patients aged 75 years and over. The aim of the study for older people with depression was to compare the cost effectiveness of cognitive behavior therapy (CBT) a talking control (TC) and treatment as usual (TAU) delivered in a primary care setting. The study presented cost data generated from a single blind randomized controlled trial of 204 people aged 65 years and over who were offered only TAU or TAU plus up to 12 sessions of CBT or a TC. The main outcome measure was the Beck Depression Inventory II. The primary analysis was focused upon the cost-effectiveness of CBT compared with TAU at 10 months follow up. It was found that

total costs per patients were significantly higher in the CBT group compared with the TAU group (difference £427; 95% CI £56 to £787). Reductions in the Beck Depression Inventory II scores were significantly greater in the CBT group (difference 3.6 points, 95% CI: 0.7-6.5 points). It was therefore found that CBT is associated with an incremental cost of £120 per additional point reduction in the Beck Depression Inventory II score. The authors concluded that CBT is likely to be recommended as a cost effective treatment option for this patient group provided that the value placed on a unit reduction in the Beck Depression Inventory II score is greater than £115 since CBT is significantly more costly than TAU alone or TAU plus TC but more clinically effective.

All 11 studies categorised as cost utility analyses by definition included cost per QALY as the main measure of outcome and reflected a wide range of topics including an assessment of the impacts of aggressive treatment strategies (including mechanical ventilation and intensive care) for older people [Hamel et al 2001], a systematic review to assess the impact of falls prevention strategies in community and residential aged care [Church et al 2011], hip protector use in community [Honkanen et al, 2006] and nursing home settings [Colon-Emeric et al, 2003] and the impact of universal versus selective bone densitometry for osteoporosis [Ito et al 2009; Schousboe et al 2005]. The methods used to estimate QALYs (see section 3 below) varied considerably across these studies as did the reported cost per QALY ratios; ranging from \$106 (AUS) per QALY for Vitamin D supplementation for older people living in residential aged care to \$100,000 per QALY for ventilator support and intensive care for high risk patients (defined as those with a $\leq 50\%$ probability of surviving at least two months) in the 65-74 years age group with acute respiratory failure.

3. The measurement and valuation of health

In order to conduct a cost utility analysis, there is a need to collect and present data relating to the measurement and valuation of health in addition to the presentation of data relating to the measurement and valuation of resource use (costs). Traditionally health related utility measures, principally the quality adjusted life year (QALY), have been utilised to value the benefits of health care services and programs within cost utility analysis [Weinstein et al, 2009]. To calculate QALYs it is necessary to represent health on a scale where death and full health are assigned values of 0 and 1 respectively. Therefore, states rated as better than dead have values between 0 and 1 and states rated as worse than dead have negative scores which, in principle, are bounded by negative infinity. Table 1 provides a simple hypothetical illustration of how the benefits of health care services and programs can be estimated using QALYs. This table compares medical and surgical management for treating coronary artery disease. Health in each year is approximated by the mean health state value for two groups of patients, the first group receiving medical management and the second group receiving surgical management. It can be seen that for those patients receiving medical management life expectancy is 5 years on average whereas for those patients receiving surgical management life expectancy is longer, 9 years on average. The total QALY gain for each group of patients is calculated using area under the curve methods, by summing the mean health state values for each period of time (in this case each year) [Drummond et al, 2005]. Medical management is associated with a total QALY gain of 4.068 QALYs whereas the total QALY gain from surgical management is somewhat higher, 7.614 QALYs.

Year	Medical management	Surgical management
1	0.856	0.850
2	0.856	0.850
3	0.856	0.850
4	0.800	0.850
5	0.700	0.850
6	Dead	0.850
7		0.850
8		0.832
9		0.832
10		Dead
Total	4.068	7.614

Table 1. Calculation of QALY’s gained for treatment of coronary artery disease

There are a number of approaches which can be used to generate health state values for the calculation of QALYs including direct valuation of their own health status by older people using an established utility elicitation technique or indirect valuation through the utilisation of generic preference based measures of health [Brazier et al, 2007].

3.1 Direct valuation of health

An example of the direct valuation of health by older people is a study which was undertaken within the context of a randomised trial of external hip protectors for older women at risk of hip fracture [Salkeld et al 2000A]. The main objective of this study was to use an elicitation technique known as time trade off (TTO) to estimate the utility associated with hip fracture and fear of falling among older women. The TTO derives an estimate of preference for health by finding the point at which respondents show no preference between a longer period of time in impaired health versus a shorter period of time in full health. Respondents were asked to rate three health states; fear of falling, a “good” hip fracture, and a “bad” hip fracture on the 0-1 QALY scale using TTO. A “bad” hip fracture which results in admission to a nursing home was valued at 0.05; a “good” hip fracture resulting in the maintenance of independent living in the community was valued at 0.31, and fear of falling was valued at 0.67. In addition, 80% of the women surveyed indicated that they would rather be dead (utility = 0) than experience the loss of independence and quality of life that results from a bad hip fracture and subsequent admission to a nursing home. Thus the study authors concluded that older women place a very high marginal value on their health and a loss of ability to live independently in the community has a considerable detrimental effect on their quality of life.

3.2 Indirect valuation of health

In practice, examples of the direct valuation of health are less commonly found within economic evaluations, both within geriatrics and in other medical specialities. Indirect valuation through the utilisation of generic preference based measures of physical and mental health such as the AQoL (Assessment of Quality of Life), the EQ-5D (EuroQol) and the SF-6D have become the most popular mechanisms for the estimation of quality adjusted

life years or QALYs for cost utility analyses [Brazier et al 2007]. Generic preference based measures of health comprise two main elements: a descriptive system for completion by patients or members of the general population comprising a set of items with multiple response categories covering the different dimensions reflecting health related quality of life and an off the shelf scoring algorithm which reflects society's strength of preference for the health states defined by the instrument. The scoring algorithms are typically generated from large general population surveys to elicit health state values for a selection of health states described by each descriptive system [Brazier et al, 2007]. Statistical modelling techniques are then employed to infer health state values for all health states described by each descriptive system. The scoring algorithms are anchored on the numerical scale required to construct QALYs, where full health is one and zero is equivalent to death. For some instruments eg. EQ-5D particularly severe health states are associated with negative values, reflecting the average general population view that these states are considered worse than death.

An example of the indirect valuation of health in older people is provided by a cost utility analysis of an outpatient geriatric assessment with an intervention to increase adherence undertaken in the USA by Keeler and colleagues [Keeler et al, 1999]. This study employed the SF-6D scoring algorithm [Brazier et al, 2002] in subjects aged 65 years and over to devise a single preference based measure of health-related quality of life from individual responses to the SF-36 at various time points throughout the five year time horizon of the randomised controlled trial. The algorithm generates an index value where 0 represents death and 1 perfect health, with intermediate values for all remaining health states. The valuations are based upon the preference weights obtained for a series of health states defined by the SF-6D from a sample of 611 members of the UK general population. The area under the curve was calculated in order to measure the QALY gain for each patient. Over the five year period it was found that the incremental QALY gain for the study intervention was 0.07 in comparison with no intervention and when coupled with the associated incremental costs the study authors concluded that the cost effectiveness of an outpatient geriatric assessment with an intervention to increase adherence compared favourably with other interventions.

3.3 Application of generic preference based measures with older people

Although the indirect valuation of health through the utilisation of generic preference based measures has become the most commonly applied method to generate QALYs, specific application in older people remain scant in comparison to applications within the younger adult population. The majority of the studies that have been undertaken to date with older people have been based in community samples and have employed the AQoL [Osbourne et al 2003], the SF-36 [Walters et al, 2001] and the EQ-5D [Holland et al 2004] to assess health status at a population level. Similarly, a variety of instruments have been employed in groups of people living with particular health conditions [Dugan et al 1998; Logsdon et al 2002; Naumann et al 2004]. Comparative evidence relating to the application of two or more generic preference based instruments simultaneously in older people suggests that the EQ-5D is easier to administer and has higher completion rates relative to the AQoL and SF-6D [Brazier et al 1996; Holland et al 2004]. However, it is also important to note that in comparison with the EQ-5D, the SF-6D has been found to be more sensitive particularly for particularly for older adults with milder health problems [Brazier et al 1996]. The

instruments were all designed for self-completion but there are strong arguments in favour of interviewer administration to reduce cognitive burden and help in promoting understanding, particularly in frail older people. Coast et al found that the expected probability of requiring interviewer administration of the EQ-5D increased with age and reductions in cognitive functioning [Coast et al, 1998]. Similarly Brazier et al reported that many older women experienced difficulties completing the SF-36 (from which the SF-6D is derived) and recommended interviewer administration as a potential solution [Brazier et al, 1996]. In older people with severe cognitive impairment previous research has indicated that proxy responses may be the only mechanism for obtaining information relating to health status, although there is debate in the literature as to who represents the most appropriate proxy e.g. family carer, other family member or health care professional [Coucil et al, 2001; Sitoh et al, 2003].

4. Advantages and disadvantages of QALYs

The purported advantages of QALYs for the measurement and valuation of health are mainly based upon three important characteristics [Prieto and Sacristan, 2003]. Firstly, QALYs combine changes in the quality of life and changes in the length of life (survival) into a single indicator. Secondly, QALYs are relatively easy to calculate via simple multiplication. However, it is also important to note that the prior step of eliciting utilities for a wide variety of health states is a complicated task, hence the proliferation of indirect methods for valuing health through the utilisation of generic preference based measures with “off the shelf” scoring algorithms. Thirdly, and potentially most importantly for economic evaluation: QALYs provide a common metric for comparing the benefits of disparate health care treatments and programmes relating to very different disease areas and conditions thereby informing resource allocation decision-making across the health care sector.

However, QALYs are not without their critics. Within geriatrics QALYs have been criticised for their focus upon survival. This inevitably means that the life of a younger person with the capacity to survive for a longer duration is more highly valued than that of an older person with a reduced capacity for survival duration [Crotty and Ratcliffe, 2011]. Some commentators have referred to this possibility as reflecting the principle of utilitarian ageism and have argued that QALYs should be weighted in favour of older people to negate this possibility, noting that even small improvements in health related quality of life tends to be highly valued by frail older people and their families when nearing the end of life [Giles et al, 2009]. Others have noted the possibility of the principle of egalitarian ageism encapsulated by the so called “fair- innings” argument. This notion was first proposed in the health economics discipline by Alan Williams [Williams, 1997] and suggests that everyone in society is entitled to some 'normal' span of health and anyone failing to achieve this has been cheated, whilst anyone getting more than this is effectively 'living on borrowed time'. The dilemma for geriatrics is that when questioned in surveys older people themselves have been found to express this view, often more vigorously and with greater frequency than their younger counterparts [Johri et al, 2005]. As the population ages this debate is likely to become even more prominent and it is important that further research is conducted to assess community preferences for priorities in health care expenditures. In particular further research is needed to assess the extent of community support for expenditures which may promote small but highly valued improvements in health related quality of life for frail older people nearing the end of life.

5. Beyond health? The measurement and valuation of quality of life

In addition to being criticised for a focus upon survival, QALYs have also been criticised for their focus upon health alone as many health and aged care services impact upon quality of life more broadly [Higginson and Carr, 2001]. For example, rehabilitation interventions may include education, problem solving and the provision of aids, e.g. electric wheelchairs and walking aids, in order to promote independent living. Whilst the provision of these interventions may have little or no impact upon an individual's health, they may still lead to significant improvements in their quality of life [Hopman and Verner, 2003]. These improvements will not be reflected by the incorporation of QALY's as the main measure of outcome within a cost utility analysis of these types of interventions. A recent innovation in this regard is the newly developed ICECAP index of capability for older people (ICECAP-O) [Coast et al 2008A].

5.1 The ICECAP-O: A capabilities approach to the measurement and valuation of quality of life for older people

The ICECAP-O represents a recent innovation in the measurement and valuation of quality of life for older people [Coast et al 2008A]. It focuses upon quality of life more broadly rather than health alone and therefore has the potential to be utilised in the economic evaluation of health and aged care services in Australia and internationally.

The developers of the ICECAP-O aimed to identify the attributes that were most important to older people in determining their quality of life through a review of the literature and interviews with older people [Grewal et al, 2006]. A set of functioning's that were most important to people were developed, namely; attachment (feelings of love, friendship and companionship), role (having a purpose that is valued), enjoyment (having a sense of pleasure and joy from personal and communal activities), security (feeling safe and secure and not having to worry) and control (being independent and able to make one's own decisions). Coast et al. discovered it was the person's capability to achieve these functioning's, rather than their level of functioning *per se*, which determined their quality of life. Thus, while an individual's state of health impacts on capability, it is not the sole determining factor. The ICECAP-O has the potential for application across the health and aged care sectors in comparing the value of different interventions to older people; including services that may improve quality of life without necessarily improving health (e.g. electric wheelchairs, meals on wheels and carer respite services), and interventions that improve both quality of life and health (e.g. joint arthroplasty and antidepressant medication). The developers of the ICECAP-O have provided early evidence for the construct validity of the ICECAP-O measure [Coast et al., 2008B] based upon the findings from a community based survey of older people in the UK.

5.2 Case study: Application of the ICECAP-O in transition care and rehabilitation programmes for older people

We have recently conducted a study which demonstrates the strong empirical relationships between the concepts of health, disability, hope and capability (as measured by the ICECAP-O) and provides support for the construct validity of the ICECAP-O in a clinical in-patient rehabilitation setting in Australia. The ICECAP-O consists of five attributes

(attachment, role, enjoyment, security and control), each with four levels. The respondent is asked to rate themselves for each attribute on the four level scale from 1 (for example, 'I can think about the future without any concern') to 4 (for example, 'I can only think about the future with a lot of concern'). Scores can be summarised as quality of life states, (for example, quality of life state 12112). The combined attributes and levels describe 1024 possible quality of life states. An off the shelf scoring algorithm has been developed for the ICECAP-O which assigns a numerical score to each possible combination of responses ranging from 0 (no capability) to 1 (full capability) [Coast et al 2008A]. In our study a questionnaire containing the ICECAP-O was administered using a face to face interview mode of administration with patients participating in in-patient medical rehabilitation (n=100). The relationships between the ICECAP and other instruments including the EQ-5D [Brooks et al, 2003], Modified Rankin Scale (a measure of disability completed by the health care professional) [Banks and Moratta, 2007] the Herth Hope Index [Herth, 1992], and socio-demographic characteristics were examined.

The EQ-5D is a measure of health related quality of life consisting of five attributes (mobility, self care, usual activities, pain/discomfort and anxiety/depression). Each attribute has three levels and respondents are asked to indicate which level best describes their current health state [Brooks et al, 2003]. The combined attributes and levels describe 243 possible EQ-5D health states. Application of the existing UK general population based scoring algorithm to individual responses to the instrument generates EQ-5D values ranging from a minimum of -0.594 (for health state 33333) to a maximum of 1.0 (health state 11111 full health). It was anticipated that there would be a strong positive relationship between capability as measured and valued by the ICECAP-O and health related quality of life as measured and valued by the EQ-5D, supporting the previous findings from studies conducted by the developers of the ICECAP-O [Coast et al, 2008B; Grewal et al, 2006].

In addition to the EQ-5D self-report instrument, we included an instrument which was designed to be completed by a health care professional directly involved in the provision of the participant's care. The Modified Rankin Scale (MRS) was completed by the study occupational therapist following discussion with the participant about their previous and current ability to manage everyday activities. The MRS describes global disability, which includes basic activities of daily living (for example walking, dressing) and instrumental activities of daily living (for example shopping, meal preparation). The MRS is commonly used in rehabilitation settings and clinical trials. The participant is assigned a score ranging from 0 (no symptoms at all) to 5 (severe disability). The MRS has demonstrated construct and convergent validity, and good test-retest reliability [Banks and Moratta, 2007]. Similarly to the EQ-5D, it was predicted that capability would be inversely related to disability as measured by the Modified Rankin Scale implying that as the level of disability increased, overall capability would decrease.

The Herth Hope Index is designed to measure the concept of hope. The tool consists of 12 statements (for example: 'I believe that each day has potential'), each with a 4 point Likert scale (1=strongly disagree, 2=disagree, 3=agree or 4=strongly agree). The tool is scored using a simple summative scoring system ranging from 12 (lowest hope) to 48 (highest hope). The tool has demonstrated good construct validity and internal consistency [Davis 2005; Snyder et al 1991] and has been applied previously in a variety of clinical settings

including palliative care and organ transplantation [Benzein and Berg, 2005; Evangelista et al 2003]. Hope can be defined as ‘a positive motivational state that is based on an interactively derived sense of successful goal directed energy and planning to meet goals’ [Snyder et al, 1991]. Several studies have found a positive correlation between hope and quality of life in a variety of patient populations [Davis, 2005; Evangelista et al, 2003; Sigstad et al, 2005; Yadav, 2010]. It has been found that individuals recovering from major health events including heart failure and stroke report higher levels of hope than healthy individuals from the general population [Laver, 2009; Rustoen et al, 2005]. The concept of hope is thought to play a central role in rehabilitation as individuals with higher levels of hope have been found to perform better in terms of setting and achieving their rehabilitation goals [Snyder et al, 2006]. The relationship between hope and capability has not previously been well documented. However, it is plausible to expect that hope may also impact positively upon capability.

A significant proportion, 50% (n=50), of the study participants had a diagnosis of stroke as their main reason for admission. The second most common reason for admission was a fall (15%, n=15). All of the remaining participants had a variety of diagnoses that could broadly be described as ‘de-conditioning’ or the effects of decreased physical activity following medical illness or non-surgical fracture. The majority of participants were females (68%, n=68) and the mean age of participants was 75 years (range 27-92) with the vast majority [78%, n=78] being 65 years or older. The distribution of responses to the EQ-5D (Table 1) indicates that the majority of participants reported at least some problems in one or more dimensions of the instrument. Participants generally reported more problems with the physical dimensions (mobility, self- care and usual activities) of the EQ-5D which is

Mobility	
I have no problems in walking about	14 (14%)
I have some problems in walking about	83 (83%)
I am confined to bed	3 (3%)
Self Care	
I have no problems with self care	39 (39%)
I have some problems washing or dressing myself	59 (59%)
I am unable to wash or dress myself	2 (2%)
Usual activities	
I have no problems with performing my usual activities	12 (12%)
I have some problems with performing my usual activities	70 (70%)
I am unable to perform my usual activities	18 (18%)
Pain/Discomfort	
I have no pain or discomfort	46 (46%)
I have moderate pain or discomfort	43 (43%)
I have extreme pain or discomfort	11 (11%)
Anxiety/Depression	
I am not anxious or depressed	49 (49%)
I am moderately anxious or depressed	43 (43%)
I am extremely anxious or depressed	8 (8%)

Table 1. Distribution of individual responses to EQ-5D (n=100)

consistent with what would have been predicted for this population. The mean score for the EQ-5D was found to be 0.53 (SD 0.32) for the total sample and 0.55 (SD 0.28) for the proportion of the sample aged 65 years or over (n=78). The mean scores are well below previously reported norm values from the general population in the UK of 0.78 for adults in the 65-74 years age group and 0.73 in the 75 + years age group [Kind et al, 1999]. The mean scores reflect the significant levels of health impairment in this clinical population relative to community based samples.

The distribution of responses for each dimensions of the ICECAP-O are presented in Table 2. It can be seen that while the majority of participants reported high levels of love and friendship (attachment), many participants expressed some concern about their future (security) and reported limitations in their independence (control) and ability to do things that made them feel valued (role). The mean ICECAP-O score was 0.76 (SD 0.15) for the total sample and 0.77 (SD 0.14) for the proportion of the sample aged 65 years or over (n=78). These mean scores are lower than reported by Coast et al [2008A] who found a mean ICECAP score of 0.814 in a community based general population sample of older people. However the difference in mean values between this clinical population and the community based population is not as pronounced for the ICECAP as was evident for the EQ-5D.

Attachment	
I can have all of the love and friendship that I want	58 (58%)
I can have a lot of the love and friendship that I want	30 (30%)
I can have a little of the love and friendship that I want	9 (9%)
I cannot have any of the love and friendship that I want	0
Security	
I can think about the future without any concern	20 (20%)
I can think about the future with only a little concern	31 (31%)
I can only think about the future with some concern	28 (28%)
I can only think about the future with a lot of concern	20 (20%)
Role	
I am able to do all of the things that make me feel valued	14 (14%)
I am able to do many of the things that make me feel valued	32 (32%)
I am able to do a few of the things that make me feel valued	46 (46%)
I am unable to do any of the things that make me feel valued	6 (6%)
Enjoyment	
I can have all of the enjoyment and pleasure that I want	24 (24%)
I can have a lot of the enjoyment and pleasure that I want	36 (36%)
I can have a little of the enjoyment and pleasure that I want	33 (33%)
I cannot have any of the enjoyment and pleasure that I want	6 (6%)
Control	
I am able to be completely independent	9 (9%)
I am able to be independent in many things	45 (45%)
I am able to be independent in a few things	36 (36%)
I am unable to be at all independent	9 (9%)

Table 2. Distribution of responses to the ICECAP-O (n=100)

Table 3 presents the mean EQ-5D, Herth Hope Index and Modified Rankin Scores according to individual responses to the ICECAP-O. Increases in mean EQ-5D scores were evident with increases in capability levels particularly pertaining to participants’ ability to do valued activities (role), and improved levels of enjoyment and attachment. There is a clear pattern of association between disability as classified by the Modified Rankin Scale and levels of

Attribute	Mean EQ-5D (n=100)	Mean HHI (n=100)	Mean MRS (n=100)
Attachment			
I can have all of the love and friendship that I want	0.53	36.25	3.09
I can have a lot of the love and friendship that I want	0.54	36.00	2.90
I can have a little of the love and friendship that I want	0.44	35.13	3.22
I cannot have any of the love and friendship that I want	N/A	N/A	N/A
Security			
I can think about the future without any concern	0.57	37.95	2.95
I can think about the future with only a little concern	0.60	36.97	3.00
I can only think about the future with some concern	0.55	34.96	3.00
I can only think about the future with a lot of concern	0.36	34.28	3.25
Role			
I am able to do all of the things that make me feel valued	0.63	37.64	2.79
I am able to do many of the things that make me feel valued	0.58	36.67	3.00
I am able to do a few of the things that make me feel valued	0.47	35.48	3.20
I am unable to do any of the things that make me feel valued	0.35	34.00	2.83
Enjoyment			
I can have all of the enjoyment and pleasure that I want	0.68	36.68	2.88
I can have a lot of the enjoyment and pleasure that I want	0.54	37.00	2.97
I can have a little of the enjoyment and pleasure that I want	0.46	35.52	3.15
I cannot have any of the enjoyment and pleasure that I want	0.33	32.33	3.50
Control			
I am able to be completely independent	0.69	37.22	2.44
I am able to be independent in many things	0.63	36.64	2.91
I am able to be independent in a few things	0.49	35.45	3.22
I am unable to be at all independent	0.69	33.86	3.56

Table 3. Distribution of mean EQ-5D, Herth Hope Index and Modified Rankin Scale values across levels of capabilities

enjoyment and control with increases in disability being associated with lower levels of enjoyment and control on average. Table 3 also illustrates that there was a clear pattern of increased mean Herth Hope Index scores with higher levels of the ICECAP-O indicating that, in general, individuals with higher levels of hope as measured by the Herth Hope Index, also reported higher levels of capability. However, it is important to note that the range of responses to the Herth Hope Index was relatively small (Inter Quartile Range: 34.5-37) indicating relatively small levels of differentiation in levels of hope across this population.

Table 4 illustrates that the ICECAP-O was found to be inversely correlated with the Modified Rankin Scale (Spearman’s $r = -0.286$; $P < 0.01$) indicating that as the level of disability increased, capability decreased. The ICECAP was also found to be positively correlated with the EQ5D (Spearman’s $r = 0.418$; $P < 0.01$) indicating that as the level of self-reported health status increased, capability increased. The ICECAP-O scores were also found to be positively correlated with the Herth Hope Index (Spearman’s $r = 0.402$; $P < 0.01$) suggesting higher levels of hope was accompanied by higher levels of capability.

	ICECAP-O
EQ-5D	0.418**
Herth Hope Index	0.402**
Modified Rankin Scale	-0.286**

** correlation is significant at the 0.01 level

* correlation is significant at the 0.05 level

Table 4. Relationship between the ICECAP-O and other measurement tools calculated using Spearman’s rho

Overall, the results indicate that whilst health related quality of life and hope were positively associated with capability, the level of disability impacts negatively upon capability.

This is the first study, to our knowledge, which has examined the construct validity of the ICECAP-O in a clinical setting. There are similarities between our findings and the findings of Coast et al. [2008B] who examined the construct validity of the ICECAP-O in a general population sample in the UK. Coast et al. also found strong correlations between capability, disability and health status. Although the sample size for our study was relatively small, our total consent rate for participation of 92% was very high and therefore suggests good representation of older people from the South Australian clinical rehabilitation population. We applied existing general population scoring algorithms for the EQ-5D and ICECAP-O which were generated from values of the UK general population. However, it is important to note that Australian general population specific scoring algorithms are currently being developed for both the EQ-5D [Cronin et al, 2009] and ICECAP-O [Flynn et al, 2010] instruments and future studies applying these instruments in an Australian context should attempt to apply these new country specific scoring algorithms once these become publicly available.

It is also important to highlight that whilst self-report measures of health related quality of life are commonly used in clinical and economic evaluation, there may potentially be compromised validity of these measures in a proportion of this population of older people. Several studies have found that older patients with cognitive impairment may have

difficulty understanding the concept of quality of life, and may lack insight into their functional ability [Bryan et al, 2005; Hulme et al, 2004; Novella et al., 2006]. In this study, a total of 19 participants were defined by the occupational therapist [applying the Modified Rankin Scale] as grade 4 – having a moderately severe disability [defined as being unable to walk and attend to own bodily needs without assistance] on the scale of 1 to 5 where 1=no symptoms at all and 5=severe disability. Despite this, one participant [n=1] within this group reported that they had no problems with self care, and, three participants [n=3] reported that they were able to be independent in many things. Further research is required to investigate the relationship between patient's own self report of health status and capability and the assessment of proxy assessors including family carers and/or health care professionals involved in the delivery of care.

Finally, this study was essentially opportunistic, the instruments being presented as part of a wider study to assess patient preferences for alternative rehabilitation programs. Therefore this study was designed to elicit responses at one time point only. Further studies should be conducted in a clinical setting to apply the ICECAP-O with older people at more than one point in time in order to determine it's sensitivity to change over time and to assess the test re-test reliability of the instrument.

In summary, the findings from our study demonstrate the potential for the wider application of the ICECAP-O in clinical populations of older people. By focusing upon quality of life more broadly, the ICECAP-O offers new insights into the benefits of interventions which may be more appropriate than traditional measures of health for the economic evaluation of new innovations in aged care service delivery. The ICECAP-O instrument may be more widely applicable than traditional health focussed instruments in facilitating decision making regarding the allocation of scarce resources across health, social and aged care sectors. Whilst the findings from this study provide support for the construct validity of the ICECAP-O in this particular patient population, further research is required to explore the construct validity of the ICECAP-O in other settings and with older people exhibiting different clinical characteristics.

6. Consumer engagement in the measurement of preferences for geriatric services

Health economists have increasingly recognised that consumers in geriatrics and other areas of medicine typically obtain 'utility' or value from more than just the outcome of the services they are exposed to (regardless of whether outcome is defined in terms of improvements in health or quality of life more broadly). Typically the 'process' by which geriatric services are provided is also highly important, both for older people themselves and for their families. Consumer satisfaction surveys offer one method for consumer engagement which has been and continues to be widely used. However a review of the patient satisfaction literature found that consumer satisfaction surveys in health care are often developed on an adhoc basis with little theoretical development and with insufficient evidence of their psychometric properties [Hawthorne, 2006]. In addition, a well-known problem with consumer satisfaction surveys in health care, particularly where these are conducted in populations of older people is that they tend to suffer from 'gratitude bias'. An extensive review of responses to consumer satisfaction surveys concluded that high levels of satisfaction are typically reported by at least 80% of respondents [Fitzpatrick, 1991].

An alternative approach for systematically engaging older people and their families to elicit their preferences in relation to the process of geriatric service delivery is to employ discrete choice experiment (DCE) methodology. DCE has strong theoretical foundations originating in Lancaster's characteristics approach to micro-economic consumer theory [Lancaster, 1966]. Lancaster hypothesized that rather than deriving utility directly from goods and services themselves, consumers derive utility from the characteristics or attributes of the good or service. Application of Lancaster's theory to health care highlights the potential importance of the characteristics of health care 'process' in addition to health outcomes in determining the overall utility or value to patients of health care. It is possible that there are other characteristics of the commodity health care (in addition to good health) which the patient finds utility or dis-utility bearing. Such characteristics may include factors relating to the provision of information (including reassurance and patient choice), in addition to other process factors such as continuity of staff, waiting time, location of care etc. For example, a change in the provision of out-patient rehabilitation services for older people such that greater continuity of staff is achieved may be highly valued by patients' and their families. However, measuring utility or value from out-patient rehabilitation services purely in terms of the health outcomes achieved by patients receiving this service would overlook this positive influence.

DCE is an economic technique based upon stated preference which is designed to establish the relative importance and impact of individual attributes, or characteristics, upon the overall utility of a good or service [Ryan, 2004]. DCEs are typically administered through a questionnaire in which the respondent is presented with a series of choices between alternative health or rehabilitation programs and asked to choose the program that they would prefer. The alternative programs are described in terms of their attributes and associated levels (for example waiting time, location of treatment, type of treatment and staff providing the treatment). The attributes and levels for inclusion in the DCE can be derived using qualitative methods (e.g. through interviews or focus groups), from a literature review, by consultation with clinical experts or health policy-makers or a combination of these approaches [Ryan et al 2008]. DCEs provide information about the acceptability of different characteristics of programs, the trade-offs that patients are willing to make between these characteristics, and the relative importance of each of these characteristics in determining overall utility or value [Ratcliffe and Buxton, 1999; Ryan, 2004]. Within health care there has been an exponential increase in the number of DCE studies undertaken to assess patient preferences within a wide variety of health care programmes and services within the last decade [9]. However, DCE studies specifically designed for and conducted with older people (aged 65 years and over) remain rare in comparison with those conducted with general adult samples. The authors have recently undertaken several DCE studies to obtain the views of older people as to how services should be provided to best meet their needs in transition care and in rehabilitation following stroke and hip fracture [Laver et al 2011; Ratcliffe et al 2010]. These studies have demonstrated the potential for the wider application of DCE methodology as a valuable tool for engaging with, and eliciting the views and preferences of older people and their families in relation to the provision of health and aged care services.

6.1 Case study: Application of a DCE in measuring patient preferences for liver transplantation

An example of a DCE question from a study conducted to elicit patient preferences for liver transplantation [Ratcliffe and Buxton, 1999] is presented in Figure 1.

Choice 1	Programme A	Programme B
Time spent on waiting list	4 months	2 months
Continuity of care	Low	High
Chance of successful liver transplant	85%	80%
Amount of information received	Some	Lots
Amount of follow up support received	Some	Some
Distance from home	200 miles	50 miles

Fig. 1. Example DCE question liver transplantation

The relevant attributes to present within the DCE and their associated levels were determined following a literature review and qualitative interviews with a small group of patients (n=12) who had recently undergone liver transplantation. The questionnaire contained 9 discrete choice questions in total with differing levels of the attributes presented in each choice. Two of the discrete choice questions represented a situation where one alternative was clearly dominant over another and hence should rationally be the chosen alternative. These questions were included as a test of internal consistency and assumed that, all other things being equal, patients would prefer a shorter waiting time, more continuity of contact with the same medical staff, a greater chance of a successful liver transplant, more information about the transplant, more follow up support and a shorter distance between the transplantation centre and the patient’s home. The questionnaire was designed for self-completion and was administered by post to all patients with primary biliary cirrhosis who had undergone liver transplantation at one regional liver transplantation centre during the period January 1987-December 1996 and who were, in the opinion of a clinical research nurse based at the centre, considered well enough to complete the questionnaire (n=213). The reasons for choosing patients who have received a transplant rather than those awaiting transplant were two fold. Firstly, there is evidence to suggest that prospective patients may have difficulty in determining the relative importance of attributes relating to a service they had not yet experienced [Salkeld et al, 2000B]. Secondly, ethical concerns relating to the possibility of patient sensitivity with regard to the questions asked, particularly in relation to the length of the waiting period and chance of success attributes, could lead to increased anxiety amongst some patients awaiting transplantation. The questionnaire was sent by post to the patient’s home address and included a covering letter by a physician from the centre involved in administering their care.

The data from the DCE can be analysed within the framework of random utility theory [Hannemann 1984]. Within the random utility framework therefore, an individual will choose Centre B over Centre A (the base alternative) if the measurable component of utility (V_b) plus the unobservable component of utility associated with Centre B (E_b) is greater than the measurable component of utility (V_a) plus the unobservable component of utility associated with Centre A (E_a).

$$\text{Choose B if } (V_b + E_b) > (V_a + E_a) \tag{1}$$

The measurable components of utility for each centre (V_b and V_a) can be estimated empirically. Assuming a linear additive utility function, the utility to be estimated in moving from Centre A to Centre B is:

$$\Delta V = \Delta_1 \text{WAITDIFF} + \Delta_2 \text{CONTDIFF} + \Delta_3 \text{SUCCDIFF} + \Delta_4 \text{INFODIFF} + \Delta_5 \text{FOLLDIFF} + \Delta_6 \text{DISTDIFF} + E \quad (2)$$

where ΔV is the change in utility in moving from Centre A to Centre B and Δ_1 - Δ_6 are the parameters of the model to be estimated. 'WAITDIFF' is the difference in waiting time, 'CONTDIFF' is the difference in continuity of care experienced, 'SUCCDIFF' is the difference in the chance of success, 'INFODIFF' is the difference in the amount of information received about the transplantation process, 'FOLLDIFF' is the difference in follow up care received, 'DISTDIFF' is the difference in the distance between the hospital centre and the patient's home and E is the error term representing the unobservable component of utility. The marginal rate of substitution (MRS) between any pair of continuously defined attributes can be estimated by the ratio of the relevant parameters e.g. the MRS between the level of waiting time experienced and continuity of care is equal to Δ_1/Δ_2 . The model is estimated without a constant term since the treatment option being considered in the model does not differ across choices. Given that the dependant variable is binary with discrete choice data and also given the repeated measurement aspect of the data (whereby multiple observations are obtained from the same individual), an appropriate model for data analysis is the random effects probit model [Propper, 1995; Ryan 1996]. Hence the random effects probit model was used to analyse the data generated within this study.

A response rate of 89% was achieved based upon 189 usable questionnaires which were returned (6 additional questionnaires were returned but the DCE choice questions were not completed and hence these individuals were excluded from the main data analysis). This response rate is higher than is typically achieved in postal DCE surveys to elicit patient preferences in health care [De Bekker-Grob et al, 2010] and may have been facilitated by the covering letter sent with the questionnaire which was sent from the consultant who was involved in the care of a large number of the patients in the sample. In addition, there is evidence to suggest that patients who have received a transplant are generally very grateful for the care they have received, many of them believing that they have been given a new chance [Tymstra, 1989]. Hence such individuals are potentially more likely than other groups to respond to questionnaires about the care they have received. Respondents were mostly female (90%), and the age range of respondents was 50-79 years. A total of 29 respondents (15%) exhibited a dominant preference for the chance of success attribute. Hence they consistently chose the centre with the higher chance of success regardless of the levels of the other attributes for all 9 discrete choice questions. The tests of internal consistency revealed that a small number of respondents [17 (9%)] answered inconsistently. The responses to the discrete choice questions were analysed using the random effects model in the statistical package STATA. The results from the random effects probit model excluding subjects revealing dominant preferences and inconsistent responders are given in Table 7. For comparison, the results from the random effects probit model including subjects revealing dominant preferences and excluding inconsistent responders only are given in Table 8. It can be seen that although the size of the coefficients differs slightly in Tables 7 and 8, the results are broadly similar. The results indicate that all of the attributes are highly significant in determining the choice of centre. The results also provide some support for the model's theoretical validity since the signs of the coefficients for each of the attributes are all in the expected direction.

Attributes	Coefficient	P	95% CI
WAITDIFF	-0.1537	<0.001	-0.2048 to -0.1026
CONTDIFF	0.6026	<0.001	0.4491 to 0.7561
SUCCDIFF	0.1184	<0.001	0.1010 to 0.1358
INFODIFF	0.4883	<0.001	0.3960 to 0.5805
FOLLDIFF	0.5436	<0.001	0.4521 to 0.6351
DISTDIFF	-0.0049	<0.001	-0.0060 to -0.0037

Number of observations = 1266
Number of groups = 145
Observations per group (min / avg / max) =1 / 8.73 / 9
Chi² =418.13 (p=0.000).

Table 7. Random effects probit model excluding subjects revealing dominant preferences and inconsistent responders

Attributes	Coefficient	P	95% CI
WAITDIFF	-0.1663	<0.001	-0.2203 to -0.1139
CONTDIFF	0.7152	<0.001	0.6472 to 0.8516
SUCCDIFF	0.1297	<0.001	0.1135 to 0.1391
INFODIFF	0.4929	<0.001	0.4016 to 0.5722
FOLLDIFF	0.5376	<0.001	0.4436 to 0.6058
DISTDIFF	-0.0052	<0.001	-0.0064 to -0.0040

Number of observations = 1544
Number of groups = 175
Observations per group (min / avg / max) =1 / 8.82 / 9
Chi² =538.81 (p=0.000)

Table 8. Random effects probit model including subjects revealing dominant preferences and excluding inconsistent responders

The negative sign on the waiting time and distance attributes suggests that respondents prefer lower levels of these attributes i.e. a shorter waiting time and a shorter distance between the transplantation centre and the patient’ home. The positive signs on the chance of success, continuity, information and follow up support attributes suggest that respondents prefer higher levels of these attributes. The marginal rates of substitution between attributes are calculated by dividing the coefficients of the attributes of interest. For example the marginal rate of substitution between chance of success and waiting time for non-dominant respondents (0.77) is estimated by dividing the coefficient of chance of success (0.1184) by the coefficient of waiting time (-0.1537). The estimate indicates that respondents were prepared to exchange an increase in waiting time of 0.77 months for an increase in the probability of a chance of a successful transplant of 1%.

These models can be used to estimate the preference scores for different combinations of levels of the attributes included in the DCE exercise, by inserting the values for the relevant levels into the equation (Table 9). Such preference scores have also been defined in the literature as utility scores [Ryan, 1996]. However, when defined in this way, it is important to note that the scores generated are specific to the study being considered and it is not possible to compare the utility scores across studies in a manner akin to the comparison of the results of cost utility studies. One might move towards comparable utilities by examining more clearly the trade-offs that respondents are prepared to make between the health outcome attribute and the other attributes included in the DCE exercise. For example, if the health outcome attribute were presented in a format whereby an interval scaled utility value lying between 0 (death) and 1 (perfect health) could be assigned to each level presented then it is possible that the overall impact in terms of a reduction or improvement in the utility value of the other attributes included in the exercise could be examined.

Attributes and levels	Codings
Waiting time	2, 4, 6 (months)
Continuity	High =1, Low=0
Success	0.80, 0.85, 0.90 (percentage)
Information	Lots=2, some=1, little=0
Follow up support	Lots=2, some=1, little=0
Distance	50, 100, 200 (miles)

Table 9. Coding for levels of attributes included in the DCE

The preference score for Scenario 1 in Table 10 is:

$$V = -0.1537*4 +0.6026*1+0.1184*0.85+0.4883*1+0.5436*1 -0.0049*100$$

(3)

Solving this equation gives a total score of 0.63. The combination of attributes can then be ranked in order of preference with a higher score indicating a higher preference. In Table 10, Equation (1) has been used to estimate the preference scores for each of the nineteen scenarios (S) presented in the questionnaire. It is possible, however, to generate such scores for all possible combinations of the levels of the six identified attributes. It can be seen that, of the restricted set of options presented to respondents, the most favoured mode of delivery using the DCE approach i.e. the one that was ranked first, would not be a liver transplantation programme with the highest chance of success.

S	Wait in months	Cont	Success %	Inform	Follow	Distance in miles	CA score	Rank Health Outcome	Rank CA
3	2	0	0.85	2	2	50	1.61	7 =	1
12	6	1	0.9	2	2	100	1.36	1=	2
15	4	1	0.85	2	1	50	1.36	7 =	2
17	4	1	0.8	1	2	100	1.17	14=	4
14	2	1	0.85	1	2	200	0.99	7 =	5
19	2	1	0.9	2	0	100	0.89	1 =	6
1	4	1	0.85	1	1	100	0.63	7 =	7
10	6	1	0.8	0	2	50	0.62	14 =	8
5	6	1	0.9	1	1	50	0.57	1 =	9
9	2	1	0.8	2	0	200	0.39	14 =	10
11	2	0	0.8	1	1	100	0.33	14 =	11
16	2	1	0.8	0	0	50	0.14	14 =	12
18	4	1	0.85	0	1	100	0.14	7 =	13
13	2	1	0.9	0	1	200	-0.03	1 =	14
8	4	0	0.9	1	0	50	-0.26	1 =	15
6	6	0	0.8	2	1	200	-0.29	14 =	16
4	4	0	0.9	0	2	200	-0.40	1 =	17
2	6	1	0.85	1	0	200	-0.71	7 =	18
7	6	0	0.85	0	0	100	-1.31	7 =	19

Table 10. Comparison of health outcome and DCE rankings for alternative service configurations

The scenario ranked first from the restricted DCE subset of possibilities is a centre with the following characteristics: an 85% chance of success, lots of information provided about the transplant process, lots of follow up support received, a short distance from the patient’s home to the transplant centre and an average 2 month waiting period for the transplant operation (Scenario 15). The same scenario would be ranked 7th using a “health outcome maximisation” approach (whereby scenarios are ranked according to their chance of success with those scenarios with a 90% chance of success being ranked highest in this particular context). Alternatively, Scenario 17, which is ranked 4th using the DCE approach would be ranked only 14th using the health outcome maximisation approach. A comparison of the scenarios ranked 1st and 2nd using the DCE approach (scenarios 3 and 12 respectively) reveals that a reduction in 5% in the probability of survival at five years post-transplantation is more than compensated for by a reduction in transplant waiting time and a shorter distance between the patient’s home and the transplant centre. This result implies that patient’s would prefer to attend a centre closer to their home, even if the chance of a successful outcome were reduced, providing that the average waiting time would be no longer than 2 months. Similarly, a comparison of the scenarios ranked equal 2nd using the DCE approach (scenarios 12 and 15 respectively) reveals that a reduction in average waiting time of 2 months coupled with a reduction of 50 miles in the distance between the patient’s home and the transplant centre would equally compensate for a reduction of 5% in the probability of survival at five years post-transplantation.

The existence of a 'centre' effect, whereby larger transplantation centres with a relatively high throughput of patients tend to have higher success rates than smaller transplant centres, has been proposed as an argument for retaining a small number of geographically dispersed transplantation centres throughout the UK [Taylor et al, 1985]. A review of evidence from the NHS Centre for Reviews and Dissemination indicated that there is no general relationship between volume of activity and clinical outcome, although this review did not focus upon transplantation specifically [NHS CRD, 1996]. The evidence presented from the findings of the DCE study suggests that patients may prefer the provision of smaller transplant centres in many geographical locations, even if the chance of success would be reduced.

However, these results must be interpreted with caution due to the nature of the sample upon which the survey was conducted. In addition, as previously highlighted all of the patients in the sample had successfully survived the transplantation process and hence it is possible that respondents did not place as much emphasis on the chance of success attribute as they would have done if they had been awaiting transplantation. Despite these limitations, the results of this comparative exercise illustrate the extent to which factors associated with the 'process' of health care service delivery may influence patient's preferences for the service provided. A utility function, which is defined only in terms of health outcome e.g. QALYs, would overlook these influences. The potential importance of such characteristics is such that many respondents indicated that they would be prepared to sacrifice a reduction in the health outcome expected for an increase in the process characteristics of the service. These findings raise important issues for the organisation and delivery of the liver transplantation service. Whilst the QALY may remain an adequate model for addressing the broader allocative efficiency question 'should we provide a liver transplantation programme in the first instance', the potential for trade-offs between process characteristics and health outcome raises important issues concerning how a liver transplantation service should be provided to best meets the needs and preferences of patients.

6.2 Issues raised in the application of DCE's with older people

Application of DCEs with populations of older people raises a number of important issues. The research we have conducted to date with older patient populations receiving liver transplantation and geriatric rehabilitation services indicates that, although DCEs are often challenging for older people, they are often well received. The majority of older people with good levels of cognitive functioning (defined as a mini-mental score of 24 or above) are able to fully engage with and complete a DCE task [Folstein et al, 2001]. Our previous research also indicates that an interview mode of administration is often preferable to self-completion postal or on-line surveys as this helps to aid respondent understanding and promotes completion rates. The maximum number of attributes and levels respondents can adequately process and the maximum number of discrete choice questions which respondents can be expected to complete reliably are issues of controversy in the DCE literature. In a review of the conduct of DCEs in the health care literature Lancsar and Louviere [2008] indicated that the specification of the number of attributes and levels to be included is context specific. However, DCE applications in health care have included as many as 12 attributes in one scenario and up to 16 choice questions per experiment. For older people our previous research indicates that simpler experiments with a maximum of 6

attributes and 5-6 choice questions are preferable [Laver et al 2011; Ratcliffe et al 2010]. Within this context, our preliminary findings point towards high acceptance levels and good reliability and validity of the technique in older populations. However, further work should be undertaken to more formally investigate the reliability and validity of the DCE approach in older people including: the acceptability of the approach in different elderly populations, the threshold level of cognitive ability required to reliably complete a DCE task and where cognitive impairment precludes completion, who is the most appropriate proxy respondent.

7. Summary and conclusions

This chapter has outlined how health economics methods can be usefully applied in geriatrics and has described some recent innovations in health economics methodology and applications in relation to older people. An ageing population coupled with a desire for greater autonomy and choice are creating new pressures and demands for the aged care sector and health economic techniques can be helpful in facilitating difficult decisions about how scarce resources should best be allocated to ensure benefits are maximised. Firstly, economic evaluation and the methods for assessing the cost effectiveness of new interventions and modes of service delivery have been outlined and practical examples from the literature have been highlighted. The disadvantages of the QALY for the measurement and valuation of the benefits of health care for older people have been highlighted, in particular in terms of the focus upon expected length of survival and in terms of the focus upon health alone as the main indicator of benefit. A case study of the application of a newly developed instrument the ICECAP-O index of capability for older people has demonstrated its potential for application in measuring and valuing the quality of life of older people in the community and clinical based patient populations. Secondly, this chapter has outlined the potential for the wider application of DCEs methods, as a valuable tool for engaging with, and eliciting the views and preferences of older people and their families in relation to the provision of health and aged care services. In summary, it is our belief that the discipline of health economics has much to offer geriatrics. Although many challenges lie ahead, the future potential for health economists and health professionals engaged in geriatrics to work productively together to facilitate decision-making with the aims of promoting both efficiency and responsiveness within health and aged care systems is immense. For many countries, given the current era of an ageing population and demographic change the application of health economics to geriatrics represent an opportunity which should not be missed.

8. References

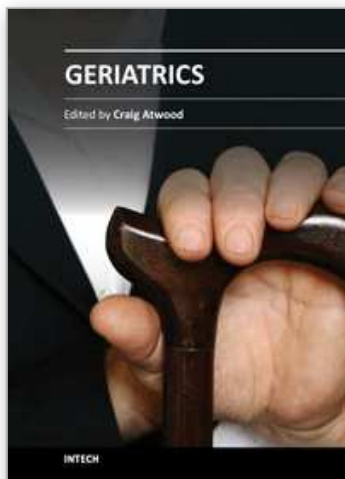
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With the baby boomer generation reaching 65 years of age, attention in the medical field is turning to how best to meet the needs of this rapidly approaching, large population of geriatric individuals. Geriatric healthcare by nature is multi-dimensional, involving medical, educational, social, cultural, religious and economic factors. The chapters in this book illustrate the complex interplay of these factors in the development, management and treatment of geriatric patients, and begin by examining sarcopenia, cognitive decline and dysphagia as important factors involved in frailty syndrome. This is followed by strategies to increase healthspan and lifespan, such as exercise, nutrition and immunization, as well as how physical, psychological and socio-cultural changes impact learning in the elderly. The final chapters of the book examine end of life issues for geriatric patients, including effective advocacy by patients and families for responsive care, attitudes toward autonomy and legal instruments, and the cost effectiveness of new health care technologies and services.

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