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ORIGINAL PAPER

Public preferences for establishing nephrology facilities in Greenland: estimating willingness-to-pay using a discrete choice experiment

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Abstract At present there are no nephrology facilities in Greenland. Greenlandic patients with renal failure needing dialysis thus have to travel to Denmark to obtain treatment. For patients in haemodialysis this necessitates a permanent residence in Denmark. Our study was aimed at examining Greenlanders' preferences for establishing nephrology facilities in Greenland at Queen Ingrid's Hospital in Nuuk, and to estimate the associated change in welfare. Preferences were elicited using a discrete choice experiment (DCE). A random sample of 500 individuals of the general population was sent a postal questionnaire in which they were asked to consider the trade-offs of establishing nephrology facilities in Greenland as opposed to the current situation. This involved trading off the benefits of having such facilities in their home country against the costs of the intervention. Besides including a payment attribute described in terms of incremental tax payment, the DCE included two interventions attributes related to (1) the organisation of labour, and (2) the physical settings of the patients. Respondents succeeded in answering the DCE despite cultural and linguistic disparity. We found that all the included attributes had a significant effect on respondents' choices, and that respondents' answers to the DCE were in keeping with their values as stated in the questionnaire. DCE data was analyzed using a random parameter logit model reparametrized in willingness-to-pay space. The results showed that establishing facilities in Greenland were preferred to the current treatment in Denmark. The welfare estimate from the DCE, at DKK 18.74 million, exceeds the estimated annual costs of establishing treatment facilities for patients with chronic renal failure. Given the estimated confidence interval this result seems robust. Establishing facilities in Greenland therefore would appear to be welfare-improving, deriving positive net benefits. Despite the relatively narrow policy focus, we believe that our findings provide some insight into individuals' preferences for decentralization of public services and on citizens' views of 'self-governance' that go beyond the case of Greenland. More generally, this paper illustrates how DCE can be applied successfully to developing countries with culturally, demographically, and geographically distinct features.

Keywords Discrete choice experiment · Willingness-to-pay space · Socital value · Publicly provided health care · Greenland · Nephrology facilities

JEL Classification D61 · I38 · O12

Introduction

Access to health care facilities in Greenland is limited due to the vast geographical scope and a small population. For some patient groups treatment is not available in Greenland. Some patients have to receive treatment outside Greenland—in most cases in Denmark. This includes patients with renal failure in need of dialysis treatment. At present there are no nephrology facilities in Greenland and Greenlandic patients with renal failure needing haemodialysis have to move permanently to Denmark to obtain treatment. This implies that these patients have to move

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away from their local communities and cultural centres, enduring personal isolation and severe loss of quality of life beyond the suffering caused by the disease. Renal patients in peritoneal dialysis can continue living in Greenland but have to travel to Denmark and have to be accommodated for shorter stays for control evaluations, and in cases of complications. Recently, members of the Greenlandic Parliament have requested evaluation of the possibility of establishing nephrology facilities in Greenland with the intention to treat most cases of renal failure in Greenland. The results of the present study are part of this evaluation, providing information to policy makers on societal value of establishing nephrology facilities in Greenland.

The purposes of this study were to examine Greenlanders' preferences for establishing nephrology facilities in Greenland at Queen Ingrid's Hospital in Nuuk, and to estimate the associated change in welfare. A random sample of the general population was asked to consider the benefits of and their willingness-to-pay (WTP) for establishing nephrology facilities in Greenland. Preferences were elicited using a discrete choice experiment (DCE). The contribution of the present study is twofold: firstly, to the authors knowledge, the study is the first of its kind to apply stated preference methodology to elicit preferences in Greenland. Secondly, due to the special conditions in Greenland, this study provides an additional insight into the application of stated preference techniques to developing countries with culturally, demographically and geographically distinct features. The application of DCEs to consider a question of health policy and planning in developing countries is relatively recent but of growing interest [1]. Overall, we find the DCE to be an applicable method for eliciting individual preferences among the Greenland population. The respondents seem to be engaged in the subject, and our results indicate that most Greenlanders value positively the establishment of dialysis facilities in Greenland, albeit a minority of individuals strictly prefers treatment in Denmark to treatment in Greenland. Hence, the results of our study provide valuable information on public preferences that can be used to guide policy making.

The remainder of the paper is organised as follows. A Background section provides a short introduction to the access to health care in Greenland. The Methods section provides a description of the methodology used in the present study, including a description of the design of the DCE. There follows the Results of the study and a discussion of the main findings. Finally, we summarise the Conclusions.

Background

Greenland—an Arctic island in the Atlantic Ocean—is the largest non-continental island in the world. Most of Greenland is covered by ice and some of the most rural and remote residence locations are isolated and hard to access. The population numbers around 57,000 inhabitants, 89 % of whom are Inuit. Around 14,900 inhabitants live in the capital, Nuuk, whereas around 10,000 inhabitants live in small settlements in remote locations [2]. On 21 June 2009, Greenland moved from a status of 'home rule' to 'self-governance' within the Danish Commonwealth.

Greenland has undergone rapid socio-cultural change in the last 50 years. External influences have resulted in changes in patterns of production, material living conditions, lifestyle, social relations and health status. Life expectancy in Greenland is increasing; however, it is still significantly lower than in e.g. Denmark [3].[1] Most of the health care expenditure is subsidised as part of a block grant from Denmark.[2] The total budget for health care in 2006 was DKK 933 million, of which DKK 832 million was subsidies as part of the block grant from Denmark. Access to health care facilities in Greenland is limited compared to European countries. Before 2007, Greenland's territory was divided into 17 health care districts while nowadays these are reduced to 4 health care districts, each with regional health centres. If necessary, patients are sent to Queen Ingrid's Hospital in Nuuk or alternatively to a hospital in Denmark (citizens on the east coast of Greenland are sent primarily to Iceland). A number of specialised health care services, including dialysis treatment of patients with renal failure [i.e. end stage renal disease (ESRD)], are not provided in Greenland.

When the study was conducted, 14 Greenlanders were in active dialysis therapy due to renal failure, corresponding to approximately 1 in 4,000 individuals. Two patients were in haemodialysis and were treated in Denmark whereas the other patients were in peritoneal dialysis. In Denmark, around 2,500 patients are in active dialysis therapy, corresponding to approximately 1 in 2,100 [4]. Given the lack of dialysis facilities and poor access to health care services it is thus likely that the establishment of nephrology facilities in Greenland will result in an increase in the cases of dialysis treatment. Moreover, it is expected that the prevalence of patients with renal failure will increase among Inuit people in the coming years given ageing and changes in lifestyle, including increases in the burden of diseases such as diabetes and cardiovascular disease. If nephrology facilities are not established in Greenland it is thus expected that the number of patients needing treatment in Denmark will increase in the future. Moreover, as the

[1] Life expectancy in Greenland is 65 years for men and 70 for women.

[2] The block grant from Denmark was 3,100 million DKK in total in 2005. The gross national product (GNP) at market prices was DKK 10,210 million DKK in 2005 whereas the total tax revenue was 4,068 million DKK.

welfare of Greenland's society increases, one could undoubtedly expect stronger public preferences for having better access to health care within Greenland.

Benefits of establishing nephrology facilities in Greenland

The need and preferences for establishing treatment facilities in Greenland is not unique to the treatment of renal failure. Renal replacement therapy, however, is a special case as the therapy involves longer, or permanent, stays in Denmark. Haemodialysis in particular requires that the patient stays permanently or for longer periods in Denmark waiting for kidney transplantation. Primary treatment of patients with renal failure in Nuuk implies that patients in most cases can be treated in their home country without having to travel to Denmark. Patients living outside Nuuk will still have to either move permanently to Nuuk or stay occasionally in Nuuk, leaving their local community. In summary, the consequences of establishing nephrology facilities in Greenland would be

- Provision of haemodialysis therapy in Nuuk
- Management (e.g. control) of patients in peritoneal dialysis in Nuuk
- Facilitating treatment of most acute renal failures in Nuuk
- Patients can stay in Greenland, although those not living in Nuuk have to move away from their community
- Patients will still have to travel to Denmark when starting up renal replacement therapy or in cases of severe complications

Methods

The present study seeks to estimate the WTP for establishing nephrology facilities in Greenland. We applied an ex ante social insurance perspective in which the general population was asked to consider the benefits of establishing dialysis facilities in Greenland, and to value the availability of treatment to those who are in need [5]. Given the framing of the question, the study thus intends to measure the social value of providing access dialysis treatment in Greenland for those in need.

Greenlanders' preferences for establishing nephrology facilities in Greenland were examined using DCE methodology. DCE is a stated preference technique in which respondents—presented with multiple choice sets of hypothetical scenarios—are asked to choose their preferred scenario in a number of consecutive choice sets. Stated preference techniques are based in welfare economics and used to assign monetary values to the outcomes of choices about policies, projects and programs in which one of the most important contexts for these choices is that of cost-benefit analysis [20]. The present study is the first study to apply a stated preference technique to provision of health care services in Greenland, specifically to preferences for dialysis facilities. The main proportion of the respondents can thus be expected to have no past experience with the specific health care service answering stated preference questions.

Identifying attributes and attributes levels

The most important aspect that needed to be covered to be able to measure the associated welfare gain was how much individuals were willing to pay to establish nephrology facilities in Greenland. Rough calculations from the Greenlandic Ministerial Office showed expected increased yearly costs of around 1–5 million DKK. Given the size of the adult population,[3] i.e. tax payers, this corresponds to a yearly payment of approximately 35 DKK per person per year. As health care in Greenland is publicly financed by taxes (and subsidies through block grant from Denmark) the natural choice of payment vehicle was an incremental tax payment, which is the most plausible payment vehicle to finance the establishment of nephrology facilities in Greenland. A well known problem with the use of tax as a payment vehicle is that the plausible added tax per person necessary to finance an incremental increase of a health care program is often small. This causes a problem of insensitivity as most respondents would not decline such a program. However, due to the small population in Greenland, and the significant cost of the proposed health care program, the amount of money is actually of non-negligible size. Besides, the objective of estimating the welfare change associated with introducing home dialysis treatment to Greenland per se, there were two other policy questions hat needed to be examined. Firstly, the question of the organisation of health care personnel, and secondly the type of patient accommodation offered to those patients needing to move permanently or staying occasionally in Nuuk. Both these were considered additional attributes. A DCE design was chosen in which respondents were confronted with three alternatives per choice set; two hypothetical alternatives characterising treatment in Greenland and one alternative characterising the current treatment in Denmark (the status quo option). Table 1 lists the attributes and the attribute levels carefully chosen to describe treatment in Greenland.

[3] In January 2006, the adult population (age 18+) was 39,963 (Greenland Statistics [2]).

Table 1 Attributes and attribute levels for treatment in Greenland

Programme attribute	Attribute level	Coding	Variable name
Recruitment of specialists	Permanent position for a nephrologist	Effects coded	Permanent
	Monthly visit from a nephrologist		
Offered accommodation to patients	Hotel	Effects coded	Hotel
	Own apartment	Effects coded	Apartment
	None[a]		
Incremental tax payment	20 DKK, 50 DKK, 100 DKK, 200 DKK, 400 DKK, 700 DKK	Continuous	Tax

[a] The reference level coded (−1) when present [7]

Table 2 Example of discrete choice experiment (DCE) questions

	Current treatment in Denmark	Treatment in Nuuk (A)	Treatment in Nuuk (B)
Recruitment of specialists	Many specialists	Permanent position of one specialist	Monthly visit of a specialist
Accommodation for patients	Patient hotel for Greenlandic people	Patient hotel in Nuuk	Own apartment in Nuuk
Increased tax per person per year	0 DKK	700 DKK	50 DKK
	☐	☐	☐
	Prefer current situation	Prefer alternative A	Prefer alternative B

The DCE design

A simple method to construct efficient DCE designs with minimal overlap and level balance is the 'folding over' technique [6]. In the present study, we had three attributes with 2, 3 and 6 levels leading to a full factorial design plan of 36 alternatives. The full factorial orthogonal design plan was used to construct the subsequent choice sets in which each alternative in the design plan was 'folded over' to construct the pairing alternative in the choice set, resulting in a final design comprising 36 choice sets. The 36 choice sets were split randomly into four blocks each with nine choice sets. Table 2 provides an example of a choice set. We deliberate chose a design with two hypothetical alternatives per choice set, as we expected strong preferences towards the new alternative (i.e. consistently choosing treatment in Greenland). Presenting respondents to multiple hypothetical alternatives per choice set force respondents to make trade-offs between the attributes characterising the hypothetical alternatives. This ensures that information is obtained regarding the relative weighting of the attributes describing the hypothetical alternatives.

The questionnaire

Each respondent received the questionnaire both in Danish and Greenlandic. The questionnaire was translated from Danish into Greenlandic by a professional translator. The translation was proofread by two bilingual translators. Disagreements were solved by dialogue between the translators.

In the introduction, respondents were provided with information on renal failure, therapies and the consequences of taking home dialysis treatment. Prior to the DCE task, respondents received a description of the attributes and a budget reminder. Finally, the questionnaire also included a series of health-related questions, general socio-demographic questions, and debriefing questions related to the DCE task. Before the launch of the survey the questionnaire was pretested on a small sub sample of Greenlanders living in Denmark. Minor changes were made according to their comments.

Survey method

Trading the pros and cons of possible survey formats, geographical barriers, survey costs and time constraints, the questionnaire was distributed as a postal survey. The questionnaire was sent to a random population sample of 500 Greenlanders aged 18 year or older (drawn from the Civil Registration System). To exclude Danish people working periodically in Greenland, Greenlanders were defined as those who have been resident in Greenland for longer than 1 year. Due to an expected low response rate it was decided to carry out follow up telephone interviews for respondents not returning the questionnaire after 14 days. Respondents declining to do the telephone interview were encouraged to fill out the questionnaire independently and return it in the pre-paid addressed envelope. The survey was launched in June 2007 and completed by August.

Econometric specification

The underlying theory of DCE is based on Lancaster's consumer theory [8] and random utility theory (RUT) [9]. According to Lancaster, the (indirect) utility that individual i achieves from good $j = 1,\ldots n$ (V_{ij}) is the sum of the utilities obtained from each of the K characteristics s_{kij} for

$k = 1, \ldots K$. Assuming linearity, the indirect utility of alternative j for individual i is:

$$V_{ij} = \beta_{1j} s_{1ij} + \beta_{2j} s_{2ij} + \ldots + \beta_{Kj} s_{Kij} \quad (1)$$

The parameter β_{kj} represents the weight by which attribute k in alternative j is valued. For simplicity, it is assumed that the weight β_k is independent of alternative j.

RUT states that individuals make choices according to a deterministic part along with some degree of randomness (a random component). Allowing U_{ij} to represent the random utility function, V_{ij} is the deterministic component and ε_{ij} is the random component of the individual i's choice [10]. Then, individual i's utility of alternative j can be written as

$$U_{ij} = V_{ij} + \varepsilon_{ij} \quad (2)$$

Assuming that the error terms are independent and identically distributed (iid) will result in the standard logit model. In order to allow for taste heterogeneity, a generalisation of the logit model is necessary. The model used in this paper is a random parameter logit (RPL) model, accounting for individual taste variation. The utility of the RPL model is specified as

$$U_{ij} = \beta_i' S_{ij} + \varepsilon_{ij} \quad (3)$$

The researcher cannot observe the β_i for each individual so it is not possible to condition on β_i. However, it is assumed that the β_i coefficients vary over decision makers in the population with the density $f(\beta)$. Given this specification, it is possible to obtain the unconditional probability that individual i chooses alternative j as the integral of the conditional probability on β_i over all possible values of β_i:

$$P_{ij} = \int \left(\frac{e^{\beta' S_{ij}}}{\sum_n e^{\beta' S_{in}}} \right) f(\beta) \mathrm{d}\beta \quad (4)$$

The distributions of the coefficients are often specified as either being normally or log-normally distributed. The log-normal distribution is often used when the coefficient is known to have the same sign for every individual, such as the price coefficient, which is expected to be negative for all individuals [10]. We assign normal distributions to all non-price attributes and use a log-normal distributed price coefficient (see below).

Well known problems prevail with RPL models in the estimation of WTP measures when allowing for taste heterogeneity in the price as this often leads to an untenable distribution of the WTP estimates [11]. As welfare measurement is one of the key objectives of the paper, we decided to re-parameterize the model in WTP space, estimating the distribution of WTP directly [11, 12]. This approach has recently gained terrain within the modelling of stated preferences as it overcomes some of the short comings with estimation of WTP using traditional modelling of taste variability in preference space. If we re-write Eq. (4), so that the price p is isolated from the vector of non-price attributes Q, we obtain (6):

$$U_{ij} = \beta_{i\$} p_{ij} + \beta_i' Q_{ij} + \varepsilon_{ij} \quad (5)$$

Recall that, in preference space, WTP is the ratio of attribute coefficient and the price coefficient, hence $w_i \equiv \mathrm{WTP}_i = \beta_i / \beta_{i\$}$. This can be re-written as $\beta_i = \beta_{i\$} w_i$ and placed into (6) to obtain the model in WTP space:

$$U_{ij} = \beta_{i\$} p_{ij} + (\beta_{i\$} w_i)' Q_{ij} + \varepsilon_{ij} \quad (6)$$

or as non-vector notation with the price coefficient moved outside the parenthesis:

$$U_{ij} = \beta_{i\$} p_{ij} + \beta_{i\$} \left(w_{1i} q_{1ij} + w_{2i} q_{2ij} + \ldots + w_{(K-1)i} q_{(K-1)ij} \right) + \varepsilon_{ij} \quad (7)$$

In WTP space, we then estimate the coefficient for the price parameter ($\beta_{i\$}$) and the coefficients for the non-price attributes (w_i). The latter coefficients can be interpreted directly as marginal WTP estimates. The utility function in (7) is distinctive from that in (6), as it is non-linear in parameters due to the multiplication of $\beta_{i\$}$ and w_i. This allows us to estimate the marginal utility of price as well as marginal WTP directly along with their standard deviations, thereby accounting for taste heterogeneity in the price attribute as well as in WTP. In the present case this is done by assuming the price parameter to be log-normally distributed and the parameters of the non-price attributes to be distributed normally. The two utility functions in (6) and (7) are behaviourally equal, and by specifying any distribution of the price coefficient ($\beta_{i\$}$) and the non-price coefficients (β_i) in (6) entails a distribution on the price coefficient ($\beta_{i\$}$) and the WTP ($w_i$) coefficients in (7) and vice versa [11].

Non-linear models, such as WTP space models, can be generated using the software package Biogeme [13], which also allows for the estimation of non-linear mixed logit models with panel specifications. 300 Halton draws were used in the simulation process. Confidence intervals of mean WTP are estimated using the Krinsky-Robb approach with 200 Halton draws [14].

According to welfare economics, the welfare gain for establishing the nephrology facilities in Greenland can be measured as the adjustment in income necessary to give the individual the same level of utility after the event as was enjoyed before the event. For an improvement in a program, the welfare measure (CV) represents the amount of money that can be taken from the individual in the new state in order to make him as well off as he was in the

initial state. In this study, the welfare measure represents the individual's WTP for establishing nephrology facilities in Greenland. This can be written as

$$U^{\text{DENMARK}}(m, X^0) = U^{\text{GREENLAND}}(m - CV, X^1) \quad (8)$$

where m denotes income and X denotes the consumption bundle in two alternatives. If nephrology facilities are established in Greenland, the program will replace the existing treatment program in Denmark. Thus, in any given period, only one of the programs is implemented. In such a case, the welfare measure can be estimated as if a new program is utilized with certainty. In the DCE literature, such welfare measure is often referred to as a *state of the world approach* in comparison to the *multiple alternative approach*, see e.g. [15–17] for a discussion. Given the model specified in Eqs. (7) and (8), mean individual CV for an improvement is calculated as the difference between the sum of WTP for the improved policy and the WTP for the initial state policy. Total welfare is then derived by summing individuals WTPs over the population—in the present case the surveyed population is the general adult population in Greenland, which approximates 40,000 individuals (year 2006)

Results

Of the 500 posted questionnaires, 17 were returned by the postal service as having an unknown recipient. We received 206 questionnaires leading to a response rate at 42.7 %[4, 5]. Table 5 in the "Appendix" lists respondents' characteristics. Examining respondents' representativeness with respect to gender, age, income and habitats, we observed minor differences in respondent characteristics compared with the general adult population. With respect to mean income and mean age, we find respondents to be a representative sample of the population. Most noticeably, we observe that the proportion of individuals living in the capital Nuuk is significantly lower in the sample and among respondents compared to the general population.

Simple DCE statistics reveal that the hypothetical alternatives (i.e. treatment in Greenland) were chosen in nearly two-third of the cases. This implies—ceteris paribus—that there is a slight tendency among the surveyed population to favour dialysis treatment in Greenland even though this involves increased tax payment. Table 3 displays the DCE results from the RPL model in WTP-space. All four attribute parameters describing treatment in Greenland have the expected signs, influencing the individuals' choice significantly.

Notably, patient hotel accommodation is valued higher in terms of WTP than apartment accommodation and the presence of a permanent specialist. The relative weighting of the attributes with e.g. higher WTP for the accommodation attribute level than on accessibility to medical specialists was unexpected, and may be caused by cultural differences and differences in norms between Denmark and Greenland. It is likely that the respondents regard hotel accommodation as a luxury with a corresponding larger WTP than the accessibility to a specialist. The relative high valuation of hotel accommodation might thus demonstrate a desire among respondents to offer patients the best possible treatment 'package'—and not just the best possible treatment.

The welfare measure for establishing nephrology facilities in Greenland also appears in Table 3. The alternative specific constant (ASC), denoting the WTP associated with treatment in Greenland per see, is significant and positive, indicating a tendency to favour treatment in Greenland. The mean individual WTP for establishing treatment facilities in Greenland all else equal is estimated to DKK 469 annually with lower (0.025) and upper (0.975) values estimated at DKK 68 and DKK 870, respectively. Given the size of the adult Greenland population, in 2006 there was 39,963 persons aged 18 years or older in Greenland, this leads to a total welfare estimate of DKK 18.74 million with a lower and an upper value of DKK 2.7 million and DKK 34.8 million, respectively.

Underlying the question of whether or not to establish nephrology facilities in Greenland is a more fundamental question regarding Greenlanders' perception of self-dependence and their attitude to health services provided in Denmark. We therefore expected respondents to show strong preferences for the choice of treatment location (i.e. Denmark vs Greenland), which is also shown by the relatively large ASC. Another way to explore this issue is by examining respondents' behavioural pattern for the location of treatment (i.e. hypothetical alternative vs status quo) in particular respondents (we name them "strong supporters") who, for all nine choices, consistently choose to take home nephrology facilities to Greenland. Notably we observe that approximately 42 % of the respondents can be classified as strong supporters, indicating that these respondents have strong preferences and views about the organisation of the Greenlandic health care system. Irrespective of the cost they are presented with, they want to take home treatment to Greenland, implying that they have not been forced to trade off money against location. These respondents are expected to have strong patriotic feelings

[4] 12 respondents did not answer any of the DCE questions. Less than 20 of the questionnaires were answered using telephone interviews.

[5] The need and preferences for better access to treatment stand against problem of recruiting health care personnel. Recruitment and retention of authorized health care personnel is becoming increasingly difficult (Nordic Social-Statistical Committee 2004: http://nososco-eng.nom-nos.dk/default.asp?side=220).

Table 3 Random parameter logit (RPL) model in willingness-to-pay (WTP)-space and marginal WTPs and total WTP in DKK/Euros

	Coefficient	(SE)	*P*i	WTP DKK/Euros[a]	95 % CI[b]
Apartment	128	25.4	<0.001	520/70	353; 687
Hotel	264	31.2	<0.001	656/88	475; 837
Permanent	112	19.6	<0.001	224/30	72; 376
Tax	1.45	0.139	<0.001	–	
ASC (Greenland)	469	82.9	<0.001	469/63	68; 870
Total WTP				18,742,647/2,515,792	
Standard deviation					
Apartment	270	32.2	<0.001	816/110	
Hotel	276	28.4	<0.001	822/110	
Permanent	341	38.0	<0.001	682/92	
Tax	0.811	0.159	<0.001	–	
ASC (Greenland)	1,980	−273.0	<0.001	1,980/266	
n	1,591				
N	194				
LL	−1,010				
Pseudo-R^2	0.417				

[a] 1 Euro = 7.45 DKK

[b] Confidence intervals are estimated using Krinsky-Robb with 200 Halton draws [14]

Table 4 Analysis of respondents consistently choosing alternative treatment in Greenland

	Coefficient	(SE)	Pr
Female	0.498	(0.0755)	0.000
Age > 55 (25 percentiles)	0.410	(0.0892)	0.000
High income	0.580	(0.0772)	0.000
Low income	−0.394	(0.1156)	0.001
Living in Nuuk	0.876	(0.0973)	0.000
Treated at Dr. Ingrid Hospital	0.353	(0.0741)	0.000
Knowing someone with renal failure	0.095	(0.0824)	0.248
Self-dependence[a]	1.29	(0.0731)	0.000
Easiness of DCE task	0.524	(0.0765)	0.000
Constant	−1.896	(0.0973)	0.000
N	4,266		
n	158		
LL_0	−2,907.56		
LL_R	−2,488.76		
Pseudo-R^2	0.1440		

[a] Respondents supporting self-dependence willing to pay for taking home dialysis treatment

towards the option of receiving medical treatment in their own country and feel obliged to support such an initiative. Principled beliefs of what is the 'right' thing to do thus may serve as an explanation for this behavioural pattern. Table 4 provides an analysis of these "strong supporters". The result seems to confirm our expectations; respondents supporting self-dependence and who are willing to pay for the new service (when asked directly) are more likely to consistently choose one of the Greenland scenarios. Interestingly, the variable describing whether respondents know someone in dialysis comes out as insignificant, suggesting that these respondents actually have taken a social perspective in their choices. As expected, respondents living in Nuuk—and to whom the personal benefits/costs of facilities established in Nuuk thus are higher/lower—are more likely to support the Greenlandic scenarios. The same pattern is observed for high income respondents, signalling an income effect and hence sensitivity to price. Finally we observe that "strong supporters" find the DCE task easy.

A priori we were concerned about the response rate, and that some social groups might be under-represented in the final sample. On these grounds we decided to have both postal reminders as well as telephone reminders on the mailed questionnaire. In the telephone reminders, the interviewers were permitted to fill out the questionnaire together with the respondent during the call if this was considered the only real option (note that this method was used in less than 20 cases). The authors are aware of the problem of different survey methods applied (mailed questionnaire and telephone interviews); however, due to the unique survey conditions, we found the mixed approach the best possible way to deal with the expected low response rate. We accomplished a response rate above 40 %, which is higher than expected taking the barriers (culture, language and geography) into consideration. We acknowledge that a response rate of 40 % may still be subject to problems of the external validity such as sample selection bias. Clearly, this calls for caution in the generalisation of our results. For instance, it might be argued that people with strong views on the policy question have a participation incentive. Comparing our sample with the general population, we observe no differences in habitat (percentage living in towns versus remote areas) and income level. Although not comprehensive, this is a

promising result and serves as a validation of our results. As noted earlier, we do however observe an under-representation of people living in the capital Nuuk caused by the random sampling procedure. To examine the consequences of this sampling bias, we re-estimated the choice model, adding weights for people living in Nuuk. This leads to a mean WTP of DKK 730 (with 95 % confidence interval ranging from DKK 492 to DKK 968). Our results thus reveal a significant (at the 0.05 level) increase in welfare gain when accounting for this under-representation. The use of weights is debatable and has been discussed previously in the literature [18]; however, our results do indicate that the non-weighted mean WTP is likely to be an underestimate of the true WTP.

Whether the use of DCE was the appropriate choice of preference elicitation method can be questioned. It is highly likely that there are obstacles concerning the use of valuation tasks due to ethical, cultural and socio-demographic characteristics of the Greenland population. Mangham et al. [1] note that there are some particular challenges in conducting a DCE in a developing country context, including working in different cultural or language settings and surveying populations that have a lower level of literacy or are less accustomed to market research techniques. In addition, the DCE task might be cognitively demanding for respondents, and issues regarding complexity and understanding of the DCE task are thus important considerations. Overall, our results seem to suggest that participants found the policy question of high relevance and importance. Despite the fact that nearly two-thirds of respondents perceived the choice task difficult or very difficult, our DCE results are consistent with the respondents' answers to the attitudinal questions, suggesting that respondents had a good understanding of the DCE task. Our results are in keeping with those of Mangham et al. [1]. Based on a literature review on applications of DCEs in developing countries, they argue that respondents are able to state their preferences over health service provision and areas for policy reforms and that elicited preferences are reasoned and deliberate [1].

We decided not to include attributes describing clinical outcomes on the basis of clinical experts stating that clinical outcomes of the location was not expected to differ for the individuals treated. Clinical outcome in the population may differ to the extent that persons not currently being treated (but in need) would get treatment if facilities were established in Greenland. This information was stated explicitly in the introduction to the DCE task and hence not included as an argument in the welfare economic valuation. The potential effect of better access may be important since we observed the current prevalence of patients in dialysis to be smaller than expected.

As previously described, this study takes a social perspective. In the introductory leaflet, respondents were told that the results of the study are intended to aid the decision-making process regarding establishing dialysis treatment in Greenland. This statement is likely to increase the consequentialism and incentive compatibility of the valuation question [19, 20]. In addition, in order to reduce the likelihood of hypothetical bias, respondents were given a budget reminder prior to the DCE task. We decided to describe the cost attribute as an incremental annual tax payment. Certainly, the payment vehicle chosen is the most plausible and realistic in comparison to, e.g., donation or other out-of-pocket payments. Dixon and Shackley [21] note that the use of taxation as a payment vehicle may introduce bias because of the fact that not everyone in reality will have to pay the same amount of taxation. Those with low incomes and a low tax burden may bid more in recognition that the valuation exercise is hypothetical and they will not actually have to pay. In addition, Morrison et al. [22] and Johnston et al. [23] note that the use of tax may cause payment vehicle bias due to (1) the incentive to answer strategically in order to avoid any increase in taxes, and (2) protest bids (i.e. some may react provocatively to tax increments). Lusk et al. [24] argue that respondents are conceptualized as thinking along two strategic dimensions when asked hypothetical WTP questions depending upon whether their response will influence the future price or whether their response will influence whether a product will actually be offered. Depending on the strategy adopted, the welfare estimate will either be under- or over-estimated [24]. While recognizing the potential for such biases, this should be set against the biases that may have occurred had respondents felt the WTP questions were not plausible or realistic. Another problem commonly reported when using tax as a payment mechanism relates to the size of the payment bid that individuals are asked to consider. When aggregating individual mean WTP to the societal level, this very often results in seemingly high welfare estimates. Hildebrand and Cannon [25] exemplify this in a study on recreational conservation; "If all persons 18 years and older in the USA were to pay the sum indicated for average WTP in each of the three scenarios, the total amounts would approximate 21.9, 22.5 and $23.8 billion, respectively. Which is 14 times the money budgeted by the federal government to upkeep of national parks" [25]. In contrast to these findings, our welfare estimate is within a reasonable range compared to the actual cost (of which the respondents were not informed).

The results from the DCE are part of a broader project aimed at analysing the total welfare effects of establishing facilities for patients with chronic renal failure in need of dialysis in Greenland. Besides estimation of the benefits, this included an incremental cost analysis [26]. From this latter paper, it appears that the intervention was estimated to cost Greenlandic society about DKK 1.4 million per year

over a 10-year period. This cost estimate was sensitive to the demand for dialysis treatment among people in need of treatment. However, only under extreme assumptions would the additional costs compared to the situation today exceed the estimated benefits of DKK 18 million per year reported in this paper. Using the obtained confidence interval as a mean of sensitivity analysis, we observe that the lower mean WTP value exceeds the costs. Hence, our result of positive net-benefits seems very robust. From a welfare theoretical perspective, our results thus indicate that an implementation of the policy intervention could in fact be welfare improving. It is worth noting, however, that our study serves only as one of several inputs to the decision-making process. At time of writing, the political decision of whether or not to establish dialysis treatment in Greenland is yet to be taken (although it has been debated in Parliament).

Conclusion

Because of the geography of Greenland and the fact that the size of the population is relatively small, the organisation of the country's health care system offers a number of challenges for health care authorities and the country's administration. One of the many challenges is to organise the treatment of illnesses with low incidence and prevalence that nevertheless require substantial investment in medical equipment and the presence of specialists. For a number of such illnesses, patients are treated in hospitals outside Greenland, requiring that patients travel to another country or sometimes even leave Greenland permanently for the treatment of certain chronic conditions. Treatment of renal failure is one such condition. The purpose of the present study was to provide input to policy makers on Greenlanders' preferences for, and the societal value of, establishing nephrology facilities in Greenland at Queen Ingrid's Hospital in Nuuk. This was done using stated preference methodology known as discrete choice experiment (DCE). We found that (1) respondents succeed in answering the DCE despite cultural and linguistic disparity; (2) all the included attributes had a significant effect on respondents' choice; and (3) respondents' answers to the DCE were in line with their previous answers to other questions in the questionnaire. Our results thus seem to demonstrate that the DCE is an appropriate method for eliciting individual preferences among the Greenland population. Importantly, our results show that establishing facilities in Greenland is preferred to the current treatment in Denmark. The welfare estimate from the DCE of DKK 18.74 million exceeds the estimated annual costs of establishing treatment facilities for patients with chronic renal failure. Thus, establishing facilities in Greenland therefore appears to be welfare improving. The present study provides valuable input to the decision-making process regarding public preferences for the organisation of the health care sector, and for priority settings within the public sector in Greenland. Despite the relatively narrow policy focus, we believe that our findings provide some insight into individuals' preferences for decentralisation of public services and on citizens' views of 'self-governance' that go beyond the case of Greenland. More generally, this paper illustrates how DCE can be applied successfully to developing countries with culturally, demographically and geographically distinct features.

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Appendix

See Table 5.

Table 5 Respondents' characteristics

	Respondents	Sample	Population[a]
Male	49.0 %	54.6 %*	51.4 %*
Mean age in years	44 (15)	42 (16)	42
Habitat			
Town	82.0 %	82.3 %	83.9 %
Local community	18.0 %	17.7 %	16.1 %
Living in Nuuk	16.5 %	14.49 %	27.9 %*
Mean household income* in 1,000 DKK	350	–	354
Diabetic	4.43 %	–	–
On medication	32.04 %	–	–
Self perceived health			
Excellent	11.59 %	–	–
Very good	19.32 %	–	–
Good	50.24 %	–	–
Less good	16.91 %	–	–
Poor	1.93 %	–	–
Occupation			
Employed	59.80 %	–	–
Unemployed	11.76 %	–	8.6 %[b]
Student	6.37 %	–	–
Pensioner	17.16 %	–	–
Other	4.9 %		–
Treated at hospital in Denmark	44.87 %	–	–
Know someone in dialysis	23.38 %	–	–
Want to take home treatment	88.89 %	–	–

Table 5 continued

	Respondents	Sample	Population[a]
Willing to pay more in tax to take home treatment	49.72 %	–	–
Self perceived risk of renal failure			
Above average	22.00 %	–	–
Average	46.67 %	–	–
Below average	31.33 %	–	–
Self perceived difficulty of DCE questions			
Very difficult	19.12 %	–	–
Difficult	51.47 %	–	–
Easy	23.53 %	–	–
Very easy	5.88 %	–	–
Ranking exercise (median rank on scale 1–4)			
Location	1	–	–
Specialist	2	–	–
Accommodation	3	–	–
Increased taxes	4	–	–

* Significant different from respondents at a 5 % significance level

[a] Comparative statistics of the Greenland adult population (Greenland Statistics [2])

[b] Unemployment rate in town only

References

1. Mangham, L.J., Hanson, K., McPake, B.: How to do (or not to do) designing a discrete choice experiment for application in a low-income country. Health Policy Plann. **24**(2), 151–158 (2009)
2. Greenland Statistics; http://www.statgreen.gl
3. Iburg, K.M., Bronnum-Hansen, H., Bjerregaard, P.: Health expectancy in Greenland. Scand. J. Publ. Health **29**(1), 5–12 (2001)
4. Sundhedsstyrelsen. Dialyse ved kronisk nyresvigt—kan antallet af patienter i udgående dialyse øges? En medicinsk teknologivurdering. Sundhedsstyrelsen, Center for Evaluering og Medicinsk Teknologivurdering, København, 2006 (8)
5. Dolan, P., Olsen, J.A., Menzel, P., Richardson, J.: An inquiry into the different perspecitves that can be used when elicting preferences in health. Health Econ. **12**(7), 545–551 (2003)
6. Street, D., Burgess, L.: The construction of optimal stated choice experiments: theory and methods. Wiley-Interscience, New Jersey (2007)
7. Bech, M., Gyrd-Hansen, D.: Effects coding in discrete choice experiments. Health Econ. **14**(10), 1079–1083 (2005)
8. Lancaster, K.J.: A new approach to consumer theory. J Polit Econ **74**(2), 132–157 (1966)
9. McFadden, D.: Conditional logit analysis of qualitative choice behaviour. In: Zarembka, P. (ed.) Frontiers of econometrics, pp. 105–142. Academic, London (1974)
10. Train, K.: Discrete choice methods with simulation. Cambridge University Press, Cambridge (2003)
11. Scarpa, R., Thiene, M., Train, K.: Utility in willingness to pay space: a tool to address confounding random scale effects in destination choice to the Alps. Am. J. Agric. Econ. **90**(4), 994–1010 (2008)
12. Train, K., Weeks, M.: Discrete choice models in preference space and willingness-to-pay space. In: Scarpa, R., Alberini, A. (eds.) Applications of simulation methods in environmental and resource economics, pp. 1–17. Springer, Dordrecht (2005)
13. Bierlaire M. BIOGEME: A free package for the estimation of discrete choice models. Proceedings of the 3rd Swiss Transportation Research Conference, Ascona, Switzerland, 2003
14. Krinsky, I., Robb, A.L.: Three methods for calculating the statistical properties of elasticities: a comparison. Empir. Econ. **16**(2), 199–209 (1991). doi:10.1007/BF01193491
15. Lancsar, E., Savage, E.: Deriving welfare measures from discrete choice experiments: inconsistency between current methods and random utility and welfare theory. Health Econ. **13**(9), 901–907 (2004)
16. Ryan, M.: Deriving welfare measures in discrete choice experiments: a comment to Lancsar and Savage. Health Econ. **13**(9), 909–912 (2004)
17. Silva, J.M.C.S.: Deriving welfare measures in discrete choice experiments: a comment to Lancsar and Sagage (2). Health Econ. **13**(9), 913–918 (2004)
18. Boardman, A., Greenberg, D., Vining, A., Weimer, D.: Cost-benefit analysis, concepts and practice, 4th edn. Prentice Hall, New York (2010)
19. Carson, R.T., Groves, T.: Incentive and informational properties of preference questions. Environ. Resour. Econ. **37**(1), 181–210 (2007)
20. Bateman, I.J., Carson, R.T., Day, B., et al.: Economic evaluation with stated preference techniques, a manual, 1st edn. Elgar, Cheltenham (2002)
21. Dixon, S., Shackley, P.: The use of willingness to pay to assess public preferences toward the fortification of foodstuffs with folic acid: results of a pilot study. Health Expect. **6**(2), 140–148 (2003)
22. Morrison, M.D., Blamey, R.K., Bennett, J.W.: Minimising payment vehicle bias in contingent valuation studies. Environ. Resour. Econ. **16**(4), 407–422 (2000)
23. Johnston, R.J., Swallow, S.K., Weaver, T.F.: Estimating willingness to pay and resource tradeoffs with different payment mechanisms: an evaluation of a funding guarantee for watershed management. J. Environ. Economics Manage **38**(1), 97–120 (1999)
24. Lusk, J.L., McLaughlin, L., Jaeger, S.: Strategy and response to purchase intention questions. Mark. Lett. **18**, 31–44 (2007)
25. Hildebrand, S., Cannon, J.: Environmental analysis. The Nepa Experience. Lewis, London (1993)
26. Kronborg C, Kjaer T, Bech M. Hjemtagning af dialysebehandling til grønlandske patienter med kronisk nyresvigt, Odense University Press. Odense