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Working Paper

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FOI Working Paper, No. 2010/2

Provided in Cooperation with:
Department of Food and Resource Economics (IFRO), University of Copenhagen

Suggested Citation: Bonnichsen, Ole (2010) : Elicitation of Preferences for Improvements in Ostomy Pouches – A Discrete Choice Experiment, FOI Working Paper, No. 2010/2, University of Copenhagen, Department of Food and Resource Economics (IFRO), Copenhagen

This Version is available at:
https://hdl.handle.net/10419/204307

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Elicitation of Preferences for Improvements in Ostomy Pouches – A Discrete Choice Experiment

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Abstract

This paper attempts to examine and measure ostomates' preferences for improvements in ostomy pouches. Described are the study design, elicitation procedure and resulting preference structure of the Swedish ostomate sample. The method used to elicit the preferences is a Discrete Choice Experiment (DCE), where respondents are asked to choose between alternatives in choice sets. Each alternative is comprised of a number of attributes relating to the adhesive, filter and flexibility of ostomy pouches. The choice between alternatives made by the respondent implies an implicit trade-off between the attributes and allows for the estimation of individuals' Willingness to Pay (WTP) for the attributes of ostomy pouches when cost is included as an attribute. The data consists of 254 ostomates responding to the survey. The respondents have positive WTP for all improvement attributes presented to them in the survey, with strongest preferences for reducing the number of leakages. The DCE utilised in the survey performs well in terms of reliability and validity of the obtained results. The results suggest that since reducing leakages is the most important attribute for the respondents when making their choices, emphasis should be placed on this attribute when decisions are made as to the allocation of scarce health care resources within research and development aimed at improving ostomy pouches.

1. Introduction

In ostomy surgery a part of the intestine is brought through the abdominal wall creating an opening through which stool is then passed. An ostomy surgery is life saving and the modern stoma management appliances give ostomates[1] the possibility to live close to full lives [1]. One such appliance is an ostomy pouch. Pouches are made of soft plastic, clear or skin-coloured, and they lie flat against the skin. There are many different pouch systems available and it is important for an ostomate to find a pouch that is most suitable for them. Pouches vary according to a number of attributes, the most important of which relate to the adhesive, filter and flexibility of the system.

Because of government intervention in the form of the co-payment system used in Sweden, the price that ostomates pay for their ostomy pouches[2] is not a market price and so ostomy pouches are not purchased in a perfectly functioning market. Public programmes in general, and explicitly in the health sector, often have an impact on non-market goods and services, for which it is typically not possible to derive complementary market good and health good relations. Accordingly, the relationship between people's actual behaviour in a market and the price/qualities of the good in question would not be sufficient for inferring the economic value of the benefits of the non-market goods and policy. This is the case for ostomy pouches in Sweden and therefore the welfare economic value of ostomy pouches must be derived through economic valuation methods [2], which is the aim of this paper. The economic valuation in this study seeks to identify the consumption opportunities individuals would be willing to forgo in return for the opportunity to use alternative ostomy pouches with improved attributes. Different ostomy pouches may represent a change in quality for the consumer – this can be expressed in monetary terms using economic valuation and more specifically for the present case using stated preference techniques, namely the Discrete Choice Experiment (DCE).

The use of economic valuation in health economics has become more popular [3] and DCEs are being increasingly used in health and health care [4], but never specifically to elicit preferences of ostomates for improvements in their ostomy pouches. In the literature, previous studies about ostomates and ostomy pouches commonly address the issues of the surgery, complications, preoperative counselling and quality of life of ostomates [5, 6] as well as psychosocial changes following ostomy surgery [7, 8]. Only a limited number of studies deal with how technical improvements in stoma care would affect ostomates [8] and to the author's knowledge, the present study is the first to elicit ostomates' preferences for improvements in ostomy pouches in the form of monetary values.

With the DCE setup in the present study, it is found that ostomates have strongest preferences for reducing their number of leakages with flexibility of the system weighted second and filter lifetime being the least important. This suggests that emphasis should be placed on the leakages attribute when decisions are made as to the allocation of scarce health care resources within research and development aimed at improving ostomy pouches.

[1] For the remainder of the paper, "ostomate" will be the term used for a patient who has had a stoma put in place.
[2] Swedish Ostomates had a maximum out of pocket expense of 1,800 SEK/year when the survey was conducted.

The paper is structured as follows: The next section presents the method used to elicit preferences, which is followed by the results and conclusion.

2. Method

The DCE is carried out by use of a questionnaire in which respondents are presented with a hypothetical market where they are asked to choose an alternative from a set of three alternatives. In the present study respondents are presented with hypothetical alternative ostomy pouches. In accordance with Lancaster's *attribute theory of value*[3] [9], the scenario introduces potential improvements to the current ostomy pouch with regard to three different attributes relating to the adhesive, filter and flexibility of an ostomy pouch. Each of the attributes is varied over the alternatives according to the attribute levels shown in Table 1.

TABLE 1
Attributes and attribute levels

Attribute	Attribute Level
Flexibility of the system as a whole	Same as current
	Small improvement
	Large improvement
Number of small starting leakages under the base plate per month	3 leakages
	1 leakage
	No leakages
Filter lifetime	7 hours
	12 hours
	24 hours
Additional expense per month	(0 SEK)
	125 SEK
	200 SEK
	375 SEK
	500 SEK
	750 SEK
	1000 SEK

The specific parameters that are investigated are "Flexibility of the system as a whole", "Number of small starting leakages under the adhesive base plate per month" and "Filter lifetime". There is also a monetary value known as a payment vehicle attached to each alternative, which the respondent must consider. This payment vehicle is described to the respondents as an "Additional expense per month" in excess of their present co-payment. The attributes and their levels were chosen on the basis of interviews with experts working within the field of medical devices as well as a focus group and a pilot study. The number of attributes was limited to four since the cognitive burden for respondents may be too high when asked to evaluate many attributes [10].

The employed choice set design consists of four attributes where three of them contain three levels and one contains six levels. This gives a total of 162 (3×3×3×6) possible alternatives

[3] Ref. [9] describes a good as consisting of a bundle of characteristics at certain levels where utility is not derived from the good as such, but rather from the specific attributes – total utility of the good is the sum of the attribute utilities.

and experimental design techniques were used to reduce these to an efficient D-optimal fractional factorial design of 18 alternatives[4] from which preferences can be elicited [12]. The alternatives were then arranged in 9 choice sets. Using two blocks, the respondents evaluated five and four choice sets respectively. This method was used since it was considered to be too large a cognitive burden for each respondent to evaluate 9 choice sets. A manually constructed choice set, where one alternative had superior levels for all attributes, was also included to test for internal consistency[5].

Respondents are given the opportunity to choose a status quo option. In situations where respondents are accustomed to purchasing the particular good, the respondents' own status quo values should be used [13]. Consequently respondents are asked in the questionnaire to state what levels of the attributes that their current system has and this self-reported status quo is included in the estimation procedure as the respondents' own status quo values.

The alternatives are presented to the respondent in a choice set where the respondent is asked to choose between two hypothetical alternatives and their current system (the status quo). Figure 1 shows an example of a choice set used in the questionnaire.

	Alternative 1	**Alternative 2**	**My current system (i.e. no change)**
Flexibility of the system as a whole (base plate and coupling)	Large improvement	Same as current	-
Number of small starting leakages under the base plate per month	3 leakages	No leakages	-
Filter lifetime	24 hours	12 hours	-
Additional expense per month	750 SEK	200 SEK	0 SEK
I prefer	❑	❑	❑
	(mark one box only)		

FIGURE 1 Choice set example

When the respondent chooses an alternative from the choice set, they are making a trade-off between the different attribute levels and thus the respondent's preferences are implicitly revealed. The aim of the DCE in the present study is to estimate the marginal rate of

[4] To minimise the number of dominating and non causal alternatives, the initially identified efficient design was subjected to the manual swapping procedure suggested by [11].
[5] Only three respondents were excluded from the sample after failing the test by preferring the inferior alternative.

substitution[6] between the different attributes and their levels. By including a monetary attribute it is possible to estimate Willingness to Pay (WTP) for the non-monetary attributes. For more information on the underlying economic theory behind the DCE, please refer to [15].

The questionnaire used in the present study works as a data-generating tool for the analysis and therefore the quality of the final results is, to a large part, determined by the quality of the applied questionnaire [16, 17]. With this in mind the questionnaire used for the present study underwent multiple revisions following on from pre-tests where the questionnaire was tested in a focus group of six ostomates as well as a pilot study on a sample of 100 respondents.

The full-scale study was conducted by sending out questionnaires to 1,200 randomly drawn Swedish ostomates from a nationwide sample of 20,000 and the responses comprised the data set used for analysis.

3. Results

The questionnaires were sent to Swedish ostomates with either a colostomy or an ileostomy[7] in place and who use a 2-piece coupling system[8]. Of the 1,200 questionnaires sent, 647 responses were received. This is equivalent to a response rate of 54%, which is considered acceptable [19]. Of these 647, there were 145 respondents excluded who stated that they use pouches without a filter. These respondents were excluded since they would not be able to relate to all of the attributes presented to them in the choice sets. Respondents were also excluded if they were identified as protest bidders[9]. These protest bidders were identified through two screening questions presented to respondents in the questionnaire after the choice sets. For more information on these protest bidders, please refer to [20]. After excluding respondents from the initial sample, an effective sample of 254 usable responses was established.

3.1 Demographics – non-parametric analysis

An analysis of a range of demographic background characteristics of the sample was conducted and the results are shown in Table 2.

[6] Marginal rate of substitution (MRS) is the relationship where an individual chooses to make a trade-off between two goods [14]. MRS is calculated as $MRS_{ij} = X_i / X_j$, where *i* and *j* are two different goods. If MRS_{ij} is equal to 2, then the individual is indifferent between having either 1 unit of good *i* or 2 units of good *j*. Similarly, if MRS is 200 and good *j* is money (SEK), then the individual is indifferent between either having 200 SEK or 1 unit of good *i*.

[7] There are three types of stoma: Colostomy, ileostomy and urostomy. Ostomates with a urostomy were excluded from the sample.

[8] A 2-piece coupling system means that ostomates use a base plate attached to the skin and a pouch attached to the base plate, rather than the 1-piece coupling system where the pouch is attached directly to the skin [18].

[9] A protest bidder is a respondent who has not really made the required trade-offs when making their choice and their expressed bid does not genuinely reflect the respondent's true preferences and values [16]. For this reason protesters must be identified and excluded from the analysis.

TABLE 2
Respondent demographics

	%		%
Gender		Type of stoma	
Male	46	Colostomy	32
Female	54	Ileostomy	68
Household gross income (SEK)		Type of coupling	
<150,000	9	Adhesive	83
150,000-299,999	26	Mechanical	17
300,000-499,999	28	Length of time of stoma in place	
500,000-799,999	22	<1 yr	1
>800,000	5	1-5 yrs	33
Age		5-10 yrs	25
18-34	8	>10 yrs	41
35-54	32	Physical activity	
55-74	57	Yes	91
Education		No	9
Primary and vocational	69	Perceived skin problems around stoma	
Short-middle academic (college)	18	Yes	53
Long-term academic (university)	12	No	47
Occupation		"I am satisfied with my current system"	
Self employed	6	Completely disagree	1
Employed in public sector	25	Disagree	5
Employed in private sector	20	Neither agree nor disagree	4
In education	1	Agree	45
Retired	39	Completely agree	44
Unemployed	3	Use of accessories	
Other	6	Yes	68
		No	32

As can be seen from Table 2, respondents generally belong to the older age group, are retired and have had their stoma in place for many years. This is the expected result, as the most typical ostomate falls within these groups. The respondents are physically active to a certain extent and it would appear that respondents are happy with their current system. The distribution of income is normal with a possibility that the lowest and highest income groups are underrepresented[10] in the sample. The distribution of gender is almost even. The majority of respondents report that they use accessories, have an ileostomy in place and use the mechanical coupling system. More than half of the respondents state that they have skin problems around their stoma.

This would suggest that respondents will have preferences for minimising their skin problems (i.e. reducing their number of leakages), while at the same time having a preference for staying with their current system. This expectation is in line with previous quality of life studies conducted on ostomates, where it is stated that ostomates undergo physical and psychological distress due to stoma-related complications such as leakage and rashes [5, 21]. Ref. [5] finds that of the problems that ostomates experience with their pouches, leakages is the most major and odours are less important. The paper concludes that further development and improvement to equipment is required to help reduce skin irritation, leakage and

[10]An investigation of the sample's representativeness of Swedish ostomates could not be carried out, since no data on the socio-economic characteristics of Swedish ostomates was available.

ballooning. With the majority of respondents in the present study having an ileostomy, it is also expected that the filter lifetime attribute will not be given as much emphasis as would have been the case with a sample with mostly ostomates with a colostomy, since odours of ileostomy effluent are less potent compared with faecal matter from a colostomy [22].

3.2 Estimating WTP – Parametric Analysis

Based on the data set, a Mixed Logit Model [23] is used to estimate the marginal utility (satisfaction or worth) that respondents derive from each attribute and accordingly their preferences for the attributes of the alternative ostomy pouches. The coefficient values shown in Table 3 represent this marginal utility. It is expected that the coefficients will be positive and increasing in size when moving to the higher levels of ostomy pouch improvements. WTP is estimated by dividing the coefficient of interest with the negative price coefficient [15]. The WTP estimates presented in the final column of Table 3 are based on a change from the average respondents' current system (i.e. no change). This means that the WTP estimates represent the monetary value that the average respondents express to go from the attribute levels that their average current system has, to the improvements presented to them in the choice sets. The average of the respondents' stated values for the attributes of their current system is 3.5 leakages per month and 9 hours filter lifetime.

TABLE 3
Mixed Logit Model

Variable	Coefficient	P-value	Significance	WTP in SEK per month
Alternative specific constant	–1.8665	<0.001	***	–316
1 leakage per month	1.2697	<0.001	***	215
0 leakages per month	2.4869	<0.001	***	421
12 hours filter lifetime	0.5164	0.028	*	87
24 hours filter lifetime	0.8212	0.002	**	139
Small improvement in flexibility	0.8017	0.004	**	136
Large improvement in flexibility	0.8447	0.003	***	143
Price	–0.00591	<0.001	***	-

NS indicates no significance, * indicates significance at 95%, ** at 99% level and *** at 99.9% level.

All parameters are shown to be significant at the 95% level and above. The expected positive signs of the attribute coefficients, indicates that the improvements to the ostomy pouches presented to the respondents contribute positively to their utility. The variables representing the higher levels of improvement all have larger coefficients than the variables representing lower levels of improvement. The negative sign on "price" indicates that an increasing price contributes negatively to respondents' utility. This all supports the theoretical validity of the survey [24].

An alternative specific constant (ASC) is also specified. The coefficient for the ASC represents the marginal utility associated with either one of the two hypothetical alternatives

opposed to the status quo alternative[11]. The significance of the ASC indicates that respondents are not indifferent between staying with their current system and changing to one of the two hypothetical alternatives. The coefficient has a negative sign, which indicates that respondents have a preference for staying with their current system regardless of potential improvements.

Table 3 shows that respondents express WTP in excess of their present co-payment of 215 SEK and 421 SEK per month to reduce their number of leakages per month to one and zero respectively. The respondents are also willing to pay 87 SEK and 139 SEK per month to have a pouch with filter lifetime of 12 hours and 24 hours respectively. Finally the WTP for small and large improvements in flexibility are 136 SEK and 143 SEK per month respectively. This implies that reducing leakages is the most important attribute for the respondents when making their choices (also indicated by the relative size of the coefficients).

4. Conclusion

The focus of this study has been to investigate the preferences that ostomates have for improvements to various attributes of their ostomy pouch systems. This has been carried out by undertaking an economic valuation, specifically a Discrete Choice Experiment, aimed at estimating monetary values for attribute improvements. The Willingness to Pay values were estimated by use of a questionnaire sent out to 1,200 Swedish ostomates, the responses to which comprised the data set used for analysis.

The specific attributes that were investigated were “Flexibility of the system as a whole”, “Number of small starting leakages under the adhesive base plate per month” and “Filter lifetime”. The results indicate that the respondents have the highest Willingness to Pay for reducing their number of leakages, followed by flexibility improvements and finally by filter lifetime. This suggests that since reducing leakages is of the greatest importance for the respondents, emphasis should be placed on this attribute when decisions are made as to the allocation of scarce health care resources within research and development aimed at improving ostomy pouches.

5. Acknowledgements

I gratefully acknowledge the helpful and valuable comments of Jacob Ladenburg at the Danish Institute of Governmental Research, Søren Bøye Olsen at the University of Copenhagen and Rasmus Skovgaard at Coloplast A/S. I also thank Coloplast A/S for providing financial support.

[11] Care should be taken with this interpretation of the ASC as it only holds under the assumption that the respondent has made the required trade-offs when making their choice between the status quo and the two hypothetical alternatives. That is to say that the respondent has to have considered all of the attributes and attribute levels of the two hypothetical alternatives before deciding to choose the status quo and not some rule of thumb.

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