A cost benefit analysis of management alternatives for first trimester miscarriage: Results from a discrete choice experiment within a randomised controlled trial

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Background

Approximately one in seven confirmed early pregnancies end in miscarriage during the first trimester (Regan, Braude, & Trembath 1989). The traditional management approach for miscarriage is surgical evacuation of the retained products of conception. This approach was developed in the first half of the 20th century as a result of high rates of gynaecological infection from the retained products of conception and the ensuing mortality from septicemia (Ankum, Wieringa-de Waard , & Bindels 2001). Expectant management or 'watchful waiting' does not involve surgical or medical intervention and is another alternative in the management of first trimester miscarriage. Women choosing expectant management do not require ward stay, surgery or medical treatment and are advised to rest at home. Expectant management has recently been acknowledged by many general practitioners as a means of facilitating a well regulated natural process in human reproduction. Finally, medical management of first trimester miscarriage involves the use of drugs (Mifepristone, Misoprostol) to expel the retained products of conception. This management option often involves hospital stay, usually outpatient admittance.

A number of randomized controlled trials (RCTs) comparing expectant management with surgical management (Chipchase & James 1997;Nielsen & Hahlin 1995; Wieringa-de Waard et al. 2002), medical management with surgical management (Chung et al. 1999;Creinin, Moyer, & Guido 1997;De Jonge et al. 1995;Demetroulis et al. 2001;Johnson et al. 1997) and expectant management with medical management (Nielsen, Hahlin, & Platz-Christensen 1999) have been conducted. However, no RCT to date has compared all three management methods. Moreover, the RCTs that have been conducted lack information on resource use, thus preventing assessments of cost-effectiveness from being made. In addition to this, no trials to date have explored, within-trial women's preferences for attributes of all three management options using economic methodology. This paper will focus on the use of the economic methodology of discrete choice experiments (DCEs) to elicit womens preferences for attributes of alternative forms of miscarriage management. One of the uses of DCE data is to estimate willingness to pay values for use in cost-benefit analyses (Kleinman L et al. 2002;Lancsar & Savage 2004;McIntosh, Donaldson, & Ryan 1999;Ratcliffe 2000;Ryan 2004). Prior to reporting

the methods and results of the study, this paper will take a brief look at previous studies in this area in addition to describing the clinical trial alongside which this miscarriage DCE was carried out.

Exploring women's preferences for using discrete choice methodology

A small number of papers have used the economic methodology of DCEs in the area of maternal and perinatal health (Hundley, Ryan, & Graham 2001; Longworth, Ratcliffe, & Boulton 2001;Petrou & Henderson 2003;Ryan M & Hughes J 1997). Ryan and Hughes (1997) used the methodology of DCEs to explore women's preferences for attributes of surgical and medical management of miscarriage: the DCE survey was sent to women following a randomized clinical trial of surgical and medical management of miscarriage. In the study by Ryan and Hughes (1997), the authors estimated willingness to pay as well as utility score estimates for attributes of miscarriage. Attributes included the following: level of pain experienced; time in hospital receiving treatment; time taken to return to normal household activities; cost to women of treatment; and complications following treatment. The design of this DCE was to compare all scenarios with the 'current situation' of surgical management. The results showed that all attributes were significant predictors of choice of management and a negative constant in the probit model implied there was a general preference for surgical over medical management.

The MIST Trial

The DCE reported in this paper represented part of the economic research conducted alongside a randomized controlled trial (RCT) of alternative management methods of first trimester miscarriage (The MIST Trial) (Trinder et al. 2004). The economic evaluation in the MIST trial provides for the first time, both the clinical information on all three alternative miscarriage management options (expectant, medical and surgical) and information on the use of resources thereby allowing the cost-effectiveness of expectant, medical and surgical management of first trimester miscarriage to be assessed (Petrou et al. 2004). Furthermore, the MIST study was also novel in that it was the first RCT of miscarriage management to incorporate information on both resource use and willingness to pay (WTP) estimates (derived via a DCE questionnaire to women in the

trial). The incorporation of this element allows a cost-benefit analysis (CBA) to be reported along with the cost-effectiveness analysis (CEA) results. This paper will concentrate upon the CBA element of the MIST trial. The paper represents work in progress and will concentrate upon a number of issues specific to the use of DCE methodology. These include:

- The use of DCEs within RCTs
- The appropriate choice of levels for post-analysis welfare estimation for policy purposes
- The incorporation of choice probabilities into the welfare estimates
- The use of DCE-derived willingness to pay estimates within health care cost-benefit analyses
- The use of cost-benefit analyses more generally for allocating health care resources

Methods

Women with a confirmed pregnancy of less than 13 weeks gestation, who had miscarried, were randomized into the three arms of the MIST trial outlined above: expectant, medical or surgical management. Women allocated to the expectant group were allowed home with no intervention. The management of women allocated to the medical group depended on the type of miscarriage. Those with incomplete miscarriages were admitted to hospital and given a single vaginal dose of 800µg misoprostol, whilst those with missed miscarriages were pre-treated with a single oral dose of 200mg mifepristone and then admitted 24-48 hours later for a single vaginal dose of 800µg misoprostol. Women allocated to surgical management were admitted for surgical evacuation of the retained products of conception in line with the usual policy of six participating clinical centres. Documented gynaecological infection within 14 days of trial entry constituted the primary clinical outcome of the trial. This was defined as two or more of the following: purulent vaginal discharge; pyrexia >38.0 C; tenderness over the uterus on abdominal examination and/or increase in white cell count (WCC) above $15x10^9$/ml. A prospective economic evaluation was conducted alongside the MIST trial, which is discussed in detail

in the paper by Petrou et al. (2004). In brief, the use of health services and other resources by women up to 8 weeks post-miscarriage was collected using a combination of trial data collection forms, observational research and self-completed questionnaires and then combined with unit costs (£, 2001-2 prices) to obtain a net societal cost per woman. The nonparametric bootstrap method was used to present cost-effectiveness acceptability curves and net benefit statistics at alternative willingness to pay thresholds held by decision makers for preventing one gynaecological infection.

A DCE was run in parallel to the MIST economic evaluation. Women participating in the RCT received a DCE postal questionnaire three months following their miscarriage which elicited their preferences for the two management alternatives that they did *not* receive. For example, women in the surgical management arm received a DCE questionnaire which elicited preferences for medical versus expectant management. The aim of such an approach was to control for the effect of women expressing a preference for the actual management option they had received.

Following on from the work carried out by Ryan and Hughes (1997), the attributes and levels for characteristics of miscarriage management included in this DCE are shown in Table 1 below.

Table 1 Attributes and levels for MIST DCE

Attribute	Levels
Time spent at the hospital receiving treatment	Overnight Half a day One day
Level of pain experienced	Low Moderate Severe
Number of days of bleeding following treatment	3 Days 8 Days 14 Days
Time taken to return to normal activities after treatment	1-2 Days 3-4 Days 7 days or more
Cost to women of treatment	£50 £150 £250
Chance of complications requiring more time or readmission to hospital	Very unlikely (about 5 in 100) Quite unlikely (about 10 in 100) Unlikely (about 20 in 100)

The attributes and levels were combined into scenarios using statistical software and set alongside the 'current situation' scenario of surgical, medical or expectant management. Hence, three different questionnaires were designed such that women in each arm of the trial were asked their preferences for the two management alternatives not received. Questionnaires 1, 2 and 3 were therefore administered to women who had undergone expectant, medical and surgical management respectively. Since a constant 'current situation' increases the length of the questionnaire (as that option remains fixed throughout), each questionnaire contained 25 choice sets. Twenty five choices was felt to be too lengthy and hence each questionnaire was blocked into 2 questionnaires (1a, 1b, 2a, 2b, 3a & 3b), with either 12 or 13 choices. For analysis, however, the individual 'a'

and ‘b’ blocks for designs 1, 2 and 3 were combined and analysed as one questionnaire. Each questionnaire contained between 2 - 4 naturally occurring consistency checks. The data were analysed using a random effects probit model to account for the repeated observations nature of the data and a constant term was included to allow for testing for inherent preferences for the labeled options (surgery, medical or expectant) when assuming the attributes and levels are equivalent. Willingness to pay values were obtained by estimating the marginal rate of substitution (MRS) between the attribute coefficients and the cost coefficient. Confidence intervals around the WTP values were obtained using the variance-covariance matrix of the coefficients and the cost coefficient (Propper 1990). Incremental WTP and incremental costs were then placed together within a formal CBA framework using scenarios from the pre-trial questionnaire and again using scenarios obtained from the actual trial data (post-trial scenarios). Net benefit values and cost/benefit ratios were calculated for shifts between the management options.

Results

Questionnaire 1 was administered to 198 patients who underwent expectant management. Once missing ‘prefer’ variables were removed, the analysis was carried out on 189 patients (2,331 observations). Questionnaire 2 was administered to 228 patients who underwent medical management. Once missing ‘prefer’ variables were removed, the analysis was carried out on 223 patients (2,771 observations). Questionnaire 3 was administered to 222 patients who underwent surgical management. Once missing ‘prefer’ variables were removed, the analysis was carried out on 218 patients (2,711 observations). The overall consistency rate for all 6 questionnaires was 83.6%. For details of the individual consistency test results please see Appendix 1. The results from the random effects probit analyses for all three questionnaires are presented in Tables 2 - 4 below.

Table 2 **Values for expectant managed women – surgical versus medical options (surgical treatment fixed comparator)**

Variable	*Attribute Unit*	Coefficients	SE	P	WTP (£) per unit increment/ decrement (95% CI's)
Constant	/	0.2991	0.1692	0.08	/
Time	*Days*	-0.043644	0.0056	<0.001	£13.74 (£13.66, £13.81)
Bleeding	*Days*	-0.05496	0.0103	<0.001	£17.30 (£17.12, £17.48)
Activities	*Days*	-0.16602	0.0210	<0.001	£52.25 (£51.15, £53.35)
Cost	*£*	-0.003177	0.0006	<0.001	/
Complications	*%*	-0.05866	0.0092	<0.001	£18.46 (£18.29, £18.63)
Pain Level *(ref=low)*					
- **Moderate**	*Cat*	-0.5811	0.1215	<0.001	£182.89 (£160.67, £205.11)
- **Severe**	*Cat*	-1.7428	0.1272	<0.001	£548.51 (£478.75, £618.26)
Number of observations: 2,331 Unbalanced panel: 189 individuals Log likelihood function: -703.09 Restricted log-likelihood: -1217.7 Chi squared: 186.7 Significance level: 0.000 Hosmer-Lemeshow chi squared: 6.22 McFadden's R^2: % Correct Predictions: 76% Choice probabilities: Surgery: 75%; Medical: 25%					

Table 3 **Values for medically managed women – surgical versus expectant options (surgical treatment fixed comparator)**

Variable	*Attribute Unit*	Coefficients	SE	P	WTP (£) per unit increment/ decrement (95% CI's)
Constant	/	0.1980	0.154	0.199	/
Time	*Days*	-0.03764	0.0059	<0.001	£14.64 (£14.56, £14.73)
Bleeding	*Days*	-0.07097	0.0094	<0.001	£27.61 (£27.35, £27.87)
Activities	*Days*	-0.1859	0.0214	<0.001	£72.34 (£70.79, £73.89)
Cost	*£*	-0.00257	0.0005	<0.001	/
Complications	*%*	-0.02915	0.0084	<0.001	£11.34 (£11.24, £11.43)
Pain Level*(re f=low)*					
- **Moderate**	*Cat*	-0.486	0.114	<0.001	£189.39 (£167.80, £210.99)
- **Severe**	*Cat*	-1.963	0.106	<0.001	£763.40 (£682.25, £844.55)
Number of observations: 2,771 Unbalanced panel: 223 individuals Log likelihood function: -824.15 Restricted log-likelihood: -1446.6 Chi squared: 256.32 Significance level:0.000 Hosmer-Lemeshow chi squared: 2.97 McFadden's R^2: % Correct Predictions: 75% Choice probabilities: Surgery: 74.4%; Expectant: 25.6%					

Table 4 Values for surgically managed women – medical versus expectant options (medical treatment fixed comparator)

Variable	*Attribute Unit*	Coefficients	SE	P	WTP (£) per unit increment/ decrement (95% CI's)
Constant	/	0.002086	0.1228	0.98	/
Time	*Days*	-0.033023	0.0047	<0.001	£14.02 (£13.95, £14.08)
Bleeding	*Days*	-0.095703	0.0089	<0.001	£40.62 (£40.26, £40.99)
Activities	*Days*	-0.211407	0.0179	<0.001	£89.74 (£88.13, £91.34)
Cost	*£*	-0.0023558	0.0004	<0.001	/
Complications	*%*	-0.062472	0.0073	<0.001	£26.52 (£26.32, £26.71)
Pain Level*(re f=low)*					
- **Moderate**	*Cat*	-0.4638	0.0975	<0.001	£196.89 (£177.69, £216.09)
- **Severe**	*Cat*	-1.8693	0.107	<0.001	£793.50 (£707.94, £879.06)
Number of observations: 2,711 Unbalanced panel: 218 individuals Log likelihood function: -967.03 Restricted log-likelihood: -1247.86 Chi squared: 524.9 Significance level: 0.000 Hosmer-Lemeshow chi squared: 9.44 McFadden's R^2: % Correct Predictions: 79% Choice probabilities: Medical: 75.5%; Expectant: 24.5%					

Tables 2 – 4 above show that, for all three questionnaires, the attributes were significant predictors of preferences for alternative management options for miscarriage. In none of the models was the constant term a significant predictor of choice, implying that preferences were a function of the attributes and levels provided and not driven by underlying inherence preferences for attributes not included in the design. All the attributes included in the model were, however, significant predictors of women's preferences for management of miscarriage. All the algebraic signs on the coefficients were also in the theoretically expected direction, implying that women prefer less time in hospital following miscarriage, fewer days bleeding, a speedier return to normal activities, less cost, less chance of complications and less pain. The WTP values reported in Tables 2-4 are summarised in Table 5 below to provide a direct comparison of values.

Table 5 Comparison of WTP values across the three arms of the trial

	WTP (£) per unit increment/ decrement (95% CI's)		
Attribute	**Expectant arm**	**Medical arm**	**Surgical arm**
Time	£13.74 (£13.66, £13.81)	£14.64 (£14.56, £14.73)	£14.02 (£13.95, £14.08)
Bleeding	£17.30 (£17.12, £17.48)	£27.61 (£27.35, £27.87)	£40.62 (£40.26, £40.99)
Activities	£52.25 (£51.15, £53.35)	£72.34 (£70.79, £73.89)	£89.74 (£88.13, £91.34)
Complications	£18.46 (£18.29, £18.63)	£11.34 (£11.24, £11.43)	£26.52 (£26.32, £26.71)
Pain – Mod	£182.89 (£160.67, £205.11)	£189.39 (£167.80, £210.99)	£196.89 (£177.69, £216.09)
Pain - Severe	£548.51 (£478.75, £618.26)	£763.40 (£682.25, £844.55)	£793.50 (£707.94, £879.06)

Table 5 above reveals that the women in different arms of the RCT valued the attributes significantly differently for a number of the attributes. For example, women in the expectant arm valued an extra days reduction in bleeding at £17.30 whist women in the surgical arm valued this more highly, at £40.62. Likewise, women in the expectant management arm valued a reduction from severe pain to low pain at £548.51 whilst women in the surgical arm valued this at £793.50.

Cost-benefit analysis

Using the results above within a CBA framework raises a number of important issues for consideration. The following section will explore the use of the DCE results within CBA. Using the marginal WTP values derived in Tables 2 – 4 above along with the descriptions of the management options used in the pre-trial designed questionnaires basic estimates of the welfare shift from medical to surgical, surgical to expectant and medical to expectant can be estimated. These values can then be combined with the MIST incremental cost data to obtain incremental CBA results. Tables 6-8 below show the marginal WTP values for the shifts discussed using the pre-trial scenario estimates. Tables 9-11 show the same values using post-trial scenario data.

Table 6 Welfare shift from medical to surgical management (pre-trial scenarios)

	Medical	Surgical	WTP for surgical over medical		
			Exp w's prefs	Med w's prefs	Surg w's prefs
time	0.5	1	-£6.87	-£7.32	-£7.01
pain	Mod	Low	£182.89	£189.39	£196.89
bleed	8	3	£86.49	£138.04	£203.12
activ	3.5	3.5	/	0	0
compl	10	5	£92.31	£56.69	£132.59
Incremental benefit			**£354.82**	£376.80	£525.58
Incremental cost			**£234.17**	**£234.17**	**£234.17**
Net benefit			**+ £120.65**	**+ £142.63**	**+ £291.41**
Incremental cost/benefit ratio			**0.66**	**0.62**	**0.45**

Exp w's prefs = WTP values elicited from women who underwent expectant management
Med w's prefs = WTP values elicited from women who underwent medical management
Surg w's prefs = WTP values elicited from women who underwent surgical management

Table 7 Welfare shift from surgical to expectant management (pre-trial scenarios)

	Surgical	Expectant	WTP for surgical over expectant		
			Med w's prefs	Exp w's prefs	Surg w's prefs
time	1	0.5	-£7.32	-£6.87	-£7.01
pain	Low	mod	£189.39	£182.89	£196.89
bleed	3	14	£303.69	£190.27	£446.86
activ	3.5	3.5	/	/	/
compl	5	5	/	/	/
Incremental benefit			**£485.76**	**£366.29**	**£636.74**
Incremental cost			**£539.33**	**£539.33**	**£539.33**
Net benefit			**- £53.57**	**- £173.04**	**+ £97.41**
Incremental cost/benefit ratio			**1.11**	**1.47**	**0.85**

Table 8 Welfare shift from medical to expectant management (pre-trial scenarios)

	Medical	Expectant	WTP for medical over expectant		
			Surg w's prefs	Exp w's prefs	Med w's prefs
time	0.5	0.5	/	/	/
pain	Moderate	Moderate	/	/	/
bleed	8	14	£243.74	£165.65	£103.78
activ	3.5	3.5	/	/	/
compl	10	5	-£132.59	-£56.69	-£92.31
Incremental benefit			**£111.15**	**£108.96**	**£11.47**
Incremental cost			**£305.16**	**£305.16**	**£305.16**
Net benefit			**- £194.01**	**£192.20**	**£293.69**
Incremental cost/benefit ratio			**2.7**	**2.8**	**26.6**

Table 9 Welfare shift from medical to surgical management (post-trial scenarios)

	Medical	Surgical	WTP for surgical over medical		
			Exp w's prefs	Med w's prefs	Surg w's prefs
Time	1.2	0.99	£2.88	£3.08	£2.94
Pain	Low	Low	/	/	/
bleed	11	8	£51.89	£82.82	£121.87
activ	6.7	6.7	/	/	/
compl	2	3	-£18.46	-£11.34	-£26.52
Incremental benefit			**£36.31**	**£74.56**	**£98.30**
Incremental cost			**£234.17**	**£234.17**	**£234.17**
Net benefit			**- £197.86**	**- £159.61**	**- £135.87**
Incremental cost-benefit ratio			**6.4**	**3.1**	**2.4**

Table 10 Welfare shift from surgical to expectant management (post-trial scenarios)

	Surgical	Expectant	WTP for surgical over expectant		
			Med w's prefs	Exp w's prefs	Surg w's prefs
Time	0.99	0	-£14.50	-£13.60	-£13.88
Pain	Low	low	/	/	/
bleed	8	12	£110.43	£69.19	£162.49
activ	6.7	7.6	£65.11	£47.03	£80.76
compl	3	3	/	/	/
Incremental benefit			**£161.04**	**£102.62**	**£229.38**
Incremental cost			**£539.33**	**£539.33**	**£539.33**
Net benefit			**- £378.29**	**- £436.71**	**- £309.95**
Incremental cost/benefit ratio			**3.35**	**5.3**	**2.4**

Table 11 Welfare shift from medical to expectant management (post-trial scenarios)

	Medical	Expectant	WTP for medical over expectant		
			Surg w's prefs	Exp w's prefs	Med w's prefs
Time	1.2	0	£16.82	£17.57	£16.48
Pain	low	low	/	/	/
bleed	11	12	£40.62	£27.61	£17.30
activ	6.7	7.6	£80.76	£65.11	£47.03
compl	2	3	£26.52	£11.34	£18.46
Incremental benefit			**£164.72**	**£121.63**	**£99.27**
Incremental cost			**£305.16**	**£305.16**	**£305.16**
Net benefit			**- £140.44**	**- £183.53**	**- £205.89**
Incremental cost/benefit ratio			**1.85**	**2.5**	**3.1**

Excluding the choice probabilities reported in Tables 2-4 above, and using scenario preferences from women whose preferences were elicited for those comparisons the results from the basic welfare analysis using various different baselines, reveal that

expectant management is cost-beneficial compared to medical and surgical management options. However, another cost-beneficial shift would be from medical management to surgical management, with an incremental net benefit of £120.65 and a cost/benefit ratio of 0.66. Using post-trial scenarios identified from actual trial data however reveals that none of the shifts from expectant management are cost-beneficial, thus implying that expectant management is again the most cost-beneficial strategy. It should be noted at this stage that these results accord with the cost-effectiveness analysis carried out in the MIST trial which reported that expectant management had a 97.8% probability of being the most cost-effective management method at a decision making value of £10,000 for preventing one gynaecological infection (Petrou, Trinder, Brocklehurst, & Smith 2004).

Exploring the cost-benefit ratios of all women for all shifts (i.e. using the WTP values to evaluate all shifts irrespective of which arm of the trial women were in) then it is possible to see from the Tables above that the cost-benefit ratios are sensitive to the different values. Table 7 shows that when using preferences of women randomized to the surgical arm the cost-benefit ratio changes from 1.11 and 1.47 to 0.85 implying that for these women surgery is more cost-beneficial than expectant management. Also, Table 8 reveals that, whilst the direction of the cost-benefit ratio doesn't change, for women in the medical arm of the trial, a shift from expectant to medical would be much less valued that other women, with the cost-benefit ratio changing significantly from 2.7 and 2.8 to 26.6 for these women.

Discussion

A number of further complexities beyond these basic results however should be explored. Firstly, when considering the choice probabilities from the women's preferences reported in Tables 2 to 4 above, these reveal that, contrary to the trial results of effectiveness, women preferred the surgical scenario to the medical scenario (75% to 25%), the surgical scenario compared to the expectant management scenario (74.4% to 25.6%) and the medical scenario to the expectant management scenario (75.5% to 24.5%). Recent work by Lancsar and Savage (2004) have recommended that welfare estimates must also take into account the *probability* of choosing a good, suggesting that the welfare values must

be implicitly weighted by the probability of choosing each alternative in the choice set. However Ryan (2004) has shown that when using state of the world models (as in this study where the choice is binary), the formula advocated by Lancsar and Savage, reduces to the method traditionally used by economists (and used in this analysis). However care should be taken when analyzing welfare shifts in multiple alternative models. Hence, whilst the welfare estimates reported in this paper appear to be valid, when considering the choice probabilities alone it would appear that the preferences of women are in direct conflict to the results of the cost-effectiveness analysis and it may be that further consideration of these choice probabilities alongside the welfare estimates would be appropriate.

When exploring the cost/benefit results in Tables 6-8 as compared with the post-trial models in Tables 9-11 using scenario preferences from women whose preferences were elicited for those comparisons, it can be seen that the cost/benefit ratios are sensitive to the levels imputed for the attributes with the most striking change being the cost/benefit ratio for surgery over medical changing from 0.66 using the pre-trial levels to 6.4 using the post-trial levels. However it should be pointed out that, for these scenarios, the *direction* of preference never changes, with surgery always being preferred to medical, surgery to expectant and medical to expectant. However, when using the values for women other than those randomized to elicit preferences for a particular shift, Table 7 reveals one scenario where surgery is more cost-beneficial to expectant management.

Table 5 also revealed that women's values for the attributes differed depending upon which *arm of the trial* the women were allocated to. Whilst this might be explained by differences in the *actual* levels of attributes as obtained from the trial data such as number of days bleeding and pain levels experienced by the women, this was not however the case as there were no statistically significant differences in any of these outcomes in the trial. Such a result requires further consideration.

Conclusion

The study reported in this paper has shown that whilst no significant differences in health related quality of life nor gynaecological infection (the key trial outcome) were reported by the RCT data, the trial-based DCE however, provided statistically significant values for other attributes identified and measured in the trial, including 'time spent in hospital receiving treatment', 'number of days bleeding following treatment', 'time taken to return to normal activities' and 'chance of complications'. Valuing these attributes using DCE methodology and using actual trial levels has revealed that women value the attributes of surgical management over medical management over expectant management. Such preference results are in direct contrast to the cost-effectiveness analysis of the MIST trial. However, when combining these preference data with cost data within a CBA framework, the cost/benefit results do in fact concord, in the majority, with the cost-effectiveness analysis results reported in the MIST Trial economic analysis (Petrou, Trinder, Brocklehurst, & Smith 2004).

Given the sensitivity of the cost-benefit results to the DCE values in this study, this paper has shown the importance of identifying appropriate levels for attributes when carrying out post-analysis welfare estimation using DCE derived values. The study has also shown that the cost/benefit ratios change significantly when using actual post-trial data as compared to pre-trial level estimates. And, one again, within an economic evaluation, this study has shown that 'whose values' elicited matter.

Whilst the use of DCE's in health care evaluation is becoming more common (Ryan M & Gerard K 2001) the reporting of actual CBA studies where monetary benefits and costs have been combined adequately and where the welfare values have been provided by DCEs is less common. The DCE methodology provides a flexible alternative to holistic willingness to pay values and the ability to estimate numerous configurations of attributes and levels provides the applied welfare economist with a useful tool for policy analyses. However, whilst the use of this methodology is to be encouraged for decision making in the health service, a number of methodological issues regarding the use of DCEs in CBA must be clarified before economists can expect decision making bodies such as the

National Institute for Clinical Excellence to incorporate such results into their recommendations.

Appendix 1 Consistency test results

Questionnaire/ choice no	Consistency Rate	Questionnaire/ choice no	Consistency rate
Q1a n=1079	**%**	**Q1b n=1252**	**%**
5 ApB	78.3	3 ApB	59.6
6 ApB	84.3	5 ApB	83.5
7 ApB	88.0	6 ApB	85.4
		7 ApB	80.0
Combined consistency	83.5	*Combined consistency*	77.1
2a n=1339		**2b n=1432**	
3 ApB	60.7	5 ApB	76.6
5 ApB	79.5	6 ApB	90.8
6 ApB	79.5	7 ApB	86.4
7 ApB	77.5		
Combined consistency	74.3	*Combined consistency*	84.5
3a n=1387		3b n=1324	
2 ApB	94.8	6 ApB	96.1
5 ApB	93.0	7 ApB	90.2
7 ApB	78.4		
Combined consistency	88.8	*Combined consistency*	93.1

Average consistency across all questionnaires = **83.6%**

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