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SMART REVELATIONS?
AN INVESTIGATION OF THE VALIDITY OF STATED
PREFERENCES FOR SELF-MANAGEMENT OF WARFARIN

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Abstract

In health care there exist few opportunities to observe situations that clearly reveal individual preferences. This is largely a result of the presence of information asymmetry leading to decision-making driven by physicians. Thus, the vast majority of preference elicitation work in health care makes use of stated preferences (SP), elicited using hypothetical scenarios, and the issue of their validity remains uncertain.

Patient self-management (PSM) is increasingly being advocated as a means of enhancing patient choice and autonomy. PSM can be employed in the management of patients receiving warfarin, a drug commonly prescribed for conditions such as atrial fibrillation. Regular patient monitoring is required and the development of near patient testing has made PSM feasible. The authors have undertaken a randomised controlled trial involving 617 patients (the SMART trial). Stated preferences for PSM were elicited using a contingent valuation questionnaire. At the end of the trial, patients were given the opportunity to purchase PSM equipment for a fixed price of £100. Information on the final purchase decision represents the revealed preference (RP) data.

A total of 138 (72%) PSM patients completed the contingent valuation questionnaire, of whom 89 (64%) indicated a positive willingness to pay (WTP) for PSM (mean WTP: £13.64 per month). However, only 48 of these patients actually purchased a machine. The exploration of the relationship between the SP and RP data has found some support for the WTP approach in that patients who revealed their preference and chose to purchase the machine gave a WTP response that was significantly higher, compared to the non-purchasers. This paper is one of few in the health economic literature that reports a stated preference contingent valuation exercise along with the revealed preference study.

1. Introduction

In health care there exist few opportunities to observe data that clearly reveal individual preferences or values. This is largely a result of the presence of information asymmetry in the market leading to a situation of decision-making being dominated by clinicians rather than patients. Thus, often, the only course of action open to the health care researcher interested in measuring the value associated with health care interventions is to use data on stated preferences rather than observed actions.

Whilst such limitations tend to be less prevalent in other market settings, there still exist many situations where market data cannot be used to explore preferences.¹ For example, markets frequently exhibit limited ranges of variation in behaviourally or managerially important variables. In addition, new products or services that require evaluation may contain features or enhancements, the preferences for which cannot be identified using market data. Statistical difficulties may also exist in data on observed market choices; such data frequently have explanatory variables that are highly collinear and/or are measured imprecisely (or even incorrectly). Therefore, the health care researcher is not in a unique position in being unable or reluctant to use revealed preference data. Stated preference approaches have also been developed for use in other (non-health care) contexts, such as, transport and environmental research.^{2,3,4}

The stated preference method of interest in this paper is contingent valuation whereby respondents are presented with hypothetical scenarios about the programme or intervention under evaluation. In a contingent valuation exercise respondents “are required to think about the *contingency* of an actual market existing for a programme or health benefit and to reveal the maximum they would be willing to pay for such a programme or benefit”.⁵

In general, two question formats exist for the estimation of willingness-to-pay: open-ended and closed-ended. Open-ended questions simply ask respondents to state the maximum they would be willing to pay for the intervention in question. Such approaches can be criticised on the grounds that they present a task to respondents that is unfamiliar: typically individuals do not think in terms of the *maximum* they would be willing to pay for a good or service, and so this approach has tended to lead

to many non-responses or protest responses.^{6,7,8} Closed-ended questions can be of two sorts: bidding or ‘take-it-or-leave-it’. The former involve bidding a respondent up or down, depending on how they responded to an initial monetary value, and the latter simply involves asking questions like: ‘would you be willing to pay £X for the good in question?’

Therefore, in principle, contingent valuation methods provide a means by which the value attached to non-marketed social goods, such as health care interventions, can be elicited. One of the central advantages of these methods is their basis in welfare economics theory. Contingent valuation is part of a cost-benefit analysis framework and as such is consistent with the Pareto principles, and provides part of the information required to estimate Potential Pareto Improvements.⁹

The number of health care contingent valuation studies has grown rapidly over recent years, as reported by Diener *et al.*¹⁰ They suggest that there is currently wide variation among such studies in terms of the types of questions being posed and the elicitation formats being used. One helpful development was the drawing up of guidelines by the National Oceanic and Atmospheric Administration (NOAA) panel on the use of these approaches in environmental economics.¹¹

However, there remains a key uncertainty relating to the use of contingent valuation methods in health care: how valid are the responses to contingent valuation questions – i.e. are the responses to contingent valuation questions broadly in line with those that would have resulted from a revealed preference exercise, using data from a real market situation? This is the issue that is explored in this paper, using the clinical context of patient self-management of warfarin therapy.

Patient self-management (PSM) is increasingly being advocated as a means of increasing patient choice and autonomy. One of the objectives of self-management is to empower patients with the knowledge and skills they need to treat their own illness. The NHS Plan states that, in the future, patients will have far greater information about how they can look after their own health. In addition, the “Expert Patient” Programme will be extended and professional training will have much more emphasis on supporting self-care, particularly to help people manage chronic conditions.¹²

PSM is currently being considered as a model of care for patients receiving anticoagulation therapy (predominantly warfarin), commonly prescribed for atrial fibrillation and mechanical heart valves, where there is an increased risk of blood clot development and subsequent ischaemic stroke.¹³ Anticoagulation works by reducing the blood's clotting ability, and is shown to be effective in reducing the risk of stroke events. For example, in atrial fibrillation patients, stroke risk is reduced by 68%.¹⁴ However, very serious (i.e. life threatening) adverse events can be associated with warfarin therapy and so regular patient monitoring is required in the form of a blood test, to measure the International Normalised Ratio (INR), to ensure adverse events of a thrombotic or haemorrhagic nature are minimised.

Currently the majority of patients attend primary or secondary care clinics. However, the development of reliable near patient testing (NPT) devices for INR estimation has made PSM feasible. The cost-effectiveness of PSM in this setting is an important consideration, particularly with current technology (e.g. Coaguchek, Roche Diagnostics) costing approximately £450 per machine and test strips priced at about £2.50 each. Given the serious nature of the self-management responsibility being offered to patients taking warfarin, it was considered essential that their preferences for PSM are explored and understood.

This paper initially gives an overview of the clinical and cost-effectiveness studies of PSM of warfarin therapy undertaken by the authors. The stated preference contingent valuation exercise is then reported, along with the revealed preference data collection (whereby patients were offered the opportunity to purchase the PSM machines). Finally, the paper explores the relationship between the SP and RP data.

2. The SMART Trial: an overview

The SMART (Self-Management of Anticoagulation, a Randomised Trial) study aimed to determine the clinical and cost-effectiveness of PSM, in comparison with standard care. It was the first such UK trial powered to detect a significant clinical end point. Patients were randomised to PSM or standard care, only after eligibility for PSM was determined, thus enabling PSM to be evaluated against standard care in terms of clinical and cost-effectiveness. Within the trial, in order to elicit patient attitudes and

preferences in relation to PSM, three methodologies were employed (focus groups, contingent valuation and discrete choice experiments).

Patients aged 18 years and over with a long-term indication for warfarin were recruited from 49 general practices in the West Midlands. After giving consent, patients were randomised either to 'self-management' (PSM arm) or to 'usual care'. Patients in the PSM arm attended at least two training sessions to ensure they had a theoretical understanding of anticoagulation and INR monitoring, could measure their INR reliably and were able to adjust their warfarin dose. All PSM patients judged as being 'capable' of undertaking self-management were given equipment to carry out home testing for 12 months; those patients allocated to the PSM arm but who were judged unable to undertake self-management continued to receive routine care. PSM patients were asked routinely to perform a test every two weeks unless their test result indicated that a dosage change was required, in which case an additional test the following week was required. Assessments by study researchers were carried out at 3 monthly intervals to ensure PSM was being undertaken correctly. As part of the trial, data were collected on INR results, adverse events and resource use, including relevant primary and secondary care contacts, anticoagulation clinic visits and resources required to undertake PSM. The measure of clinical effectiveness was therapeutic control (i.e. percentage of time within therapeutic range). The planned economic evaluation approach was for both a cost-effectiveness analysis (i.e. cost per additional % of time in range) and a cost-utility analysis (i.e. cost per QALY gained) to be conducted. Data on EQ-5D were collected at baseline (i.e. patient entry into the study), 6 months and 12 months, and QALY scores for individual study patients were calculated. All main trial analyses were conducted using an intention-to-treat approach.

A total of 617 patients were recruited to the study, 337 randomised to PSM and 280 control patients (uneven allocation to trial arms was due to patients being randomised 3:2 in favour of the intervention in the third recruitment phase). The flow of patients throughout the study is shown in the CONSORT trial diagram in Figure 1. Of those patients allocated to the PSM arm, 193 completed 12 months of self-management. The study result on effectiveness was that there was no important or significant difference between PSM and routine care; for PSM the time in range result was 70%

and for the control arm the figure was 68% during the study period. There was no difference in the number of serious adverse events between groups. In addition, the mean QALY scores were not significantly different between groups (0.748 QALYs in the PSM arm and 0.725 QALYs in the control arm). On the cost side, unsurprisingly PSM was considerably more expensive than routine care (mean NHS plus private cost per patient: £462.73 vs. £179.80). The results strongly suggest that, using traditional criteria to judge cost-effectiveness, PSM is not a cost-effective alternative.

3. Investigation of preferences

3.1 Methods

A postal questionnaire was sent to all study participants, excluding those who died, moved house, discontinued using warfarin or suffered a serious adverse event. The questionnaire also contained a question that simply asked the patient to state their preferred model of anticoagulant care from the choice of hospital, general practice or PSM. Space was also given for any other comments.

The questionnaire gave an explanation of what PSM entailed and the purpose of asking the WTP question. For the contingent valuation question, a payment scale approach was used with monthly payments including £0, £0.50, thereafter to £10 in units of £1, to £80 in units of £5, and to £100 in units of £10. Subjects wishing to express a valuation in excess of £100 were requested to state the exact amount. Respondents were asked to tick the maximum monthly amount they were willing to pay, and were also asked to give reasons for their responses. (The full wording of the WTP question can be found in Appendix A.) A coding framework for the written comments was developed in order to identify protest responses. A protest response was defined as one where the respondent did not agree in principle with private payments for the health technology offered or health care services generally. Prior focus group work established that a monthly payment was strongly preferred to an annual cost. Information on gender, age, education level and ethnicity was available for all study patients. Information on patient's income or wealth was not collected.

At the end of the trial, patients who had completed 12 months of PSM had the opportunity to buy the Coaguchek point of care system used within the trial, for a one off payment of £100. For some patients the on-going cost of purchasing test strips

would have to be borne if they wished to continue with PSM but for many, this cost would not be incurred as the test strips are now available on prescription. Before a patient was allowed to buy the equipment, proof of supervision by a clinician was required. The final decision on purchase of the equipment, and for those who declined the reason for declining, was recorded where possible. The data represent the patient's revealed preference as an actual purchase decision was made.

3.2 Results

A total of 512 questionnaires were mailed, 230 to control patients and 282 were sent to patients allocated to PSM. A total of 421 questionnaires were returned (82.2% overall response) and 395 were returned completed (77.1% completed response). For completed questionnaires, data were not available for 28 respondents as questionnaires were returned with the patient identifier removed. Excluding the anonymised questionnaires, 198 (70.2%) PSM patients and 169 (73.5%) control patients returned completed questionnaires. Where results are presented by trial arm, an intention-to-treat analysis has been undertaken. Therefore, the PSM arm includes some patients who did not continue with PSM and returned to routine care.

Table 1 shows the characteristics of all respondents. The mean age of respondents was 68.2 years (sd = 11.2), with ages ranging from 29 to 89. The vast majority (94.8%) of respondents were 'white British'. Table 2 reports the model of care preferred by respondents overall, and by the trial arm the patients were originally allocated to. In no group did a majority of patients indicate a preference for PSM.

In looking at the responses to the contingent valuation question, for 28 (7.1%) respondents, no WTP value was selected. Of those who gave a response, 185 (50.4%) chose the £0 option indicating that they were not willing to pay any amount for PSM. Amounts above zero covered the full range from £0.50 to £100. One respondent chose £100+ option but did not give an exact value, and so a value of £100 was imputed for the analysis. The distribution of WTP values is shown in Figure 2.

For patients who were not willing to pay anything, the respondents were categorised as protesters or non-protesters. There were 74 (40%) protest responses. The themes within these responses were:

- Having “paid into” the NHS for all of their lives, treatment should be freely available.
- Self-management meant that resources in clinics were freed up and so actually NHS money was being saved.
- As warfarin is required to treat chronic and life-threatening conditions, the service should be freely available.
- The precedent of freely available self-management has been set by the NHS – as diabetics do not have to pay to self-test, why should warfarin patients?

Non-protesters who gave a zero WTP tended to have the following explanations:

- A lack of finances to pay for self-management, often due to the patient being on a pension.
- The patient not wanting to continue with, or begin, self-management.

The general personal characteristics of respondents who gave a zero WTP value, and of protesters, can be found in Table 1.

The overall mean WTP value, including protest responses, was £5.28 per month and excluding protest responses was £6.62 per month. Table 3 shows mean WTP values for a number of patient characteristics, both with and without protest responses.

Patients in the PSM arm were, on average, willing to pay more than control patients, and patients below the age of 65 were also willing to pay more. There was no difference in WTP between men and women. As expected, patients who stated PSM was their favoured model of anticoagulant care were willing to pay more per month than those preferring routine care or not having a preference. Mean WTP values for PSM rose with increasing educational level.

The revealed preference data show that of the 193 patients who completed PSM, whilst all were offered the opportunity to purchase the PSM machine, only 63 (32.6%) patients actually took up the offer and completed the purchase. A further 22 (11.4%) patients expressed a wish to buy the machine but were unable to make the purchase. For the majority of these patients (n=20), they were unable to due to refusal of supervision by their general practitioner or consultant. In addition, one patient wanted to buy the machine but warfarin was discontinued, and one patient could not reach agreement on the specifics of the supervision arrangements. The remaining 108 (56.0%) did not want to buy a machine – 64 of these patients did not state a reason for

refusal. Some 22 simply indicated a preference for routine care, and a further 17 thought the machine was too expensive.

Comparing purchasers to non-purchasers, they were more likely to be under 65 (40.2%), and have higher levels of educational qualifications (the proportion of purchasers ranging from 10.5% for those with no qualifications to 51.6% of those educated to a degree level or equivalent). There were no differences between males and females or between patients usually attending a hospital or general practice anticoagulation clinic.

4. Comparison of stated and revealed preference data

Revealed preference data for the 193 patients who completed PSM were analysed in conjunction with stated preference data from the contingent valuation questionnaire. In order to investigate the variables independently associated with the choice of buying a machine, logistic regression analysis was used. The discrete dependant variable was the decision whether or not to purchase a machine. Independent variables entered into the model were age (<65 versus 65 and over), gender, WTP value (from the contingent valuation survey), WTP protest response (protesters versus non-protesters), and educational level (no qualifications, GCSE/O Level, A Level, degree), using no qualifications as the reference group. A full model was estimated with all independent variables included and a backward stepwise logistic regression was also undertaken with a significance level of 10% used for variable removal.

In total 138 (72.5%) of the 193 patients who completed twelve months of self-management returned the contingent valuation questionnaire. Of those who completed PSM and returned their questionnaire, 89 (64.5%) indicated a positive WTP, with an overall mean WTP of £13.64 per month (sd £15.54). Of this sub-sample (of 138 patients) only 48 (34.8%) bought a machine. Figure 3 and Table 4 gives results broken down by the purchase decision. In support of the contingent valuation approach, the mean WTP is significantly higher for the group that completed their purchase compared to those that chose not to purchase. This is matched by the much larger proportion of patients with a zero WTP response or protesting in the 'did not purchase' group. The results of the logistic regression models are reported in Table 5. The main predictors of the purchase decision appear to be the WTP value given in the

contingent valuation questionnaire and educational qualifications. The odds ratios indicate, as one would expect, that respondents who gave a higher WTP value were more likely to purchase the machine, and respondents with qualifications at or above GCSE/O Level (compared to those without that attainment) were more likely to purchase.

Discussion

This paper is one of few in the health economic literature that reports a stated preference contingent valuation exercise along with the revealed preference study. The exploration of the relationship between the SP and RP data has found some support for the WTP estimates in that patients who revealed their preference and chose to purchase the machine gave a WTP response that was significantly higher, compared to the non-purchasers.

The limitations of this work need to be considered, some of which are listed below.

- The data from the contingent valuation survey represents a monthly amount and considers the whole package of PSM, whereas the purchase decision was for a one off payment with further costs likely in the future.
- The amount requested for the purchase of a machine was set and so we do not know the maximum amount the patient would have paid for the machine.
- The range of values used in the contingent valuation questionnaire was loaded to the lower end of the scale and this may have affected questionnaire responses.
- We did not collect income and/or wealth data.

We view this paper as ‘work in progress’ and, at this stage, we would like to use this paper to generate further discussion to help inform a subsequent process of data analysis and interpretation.

Finally, as we have said on previous occasions, we are conscious that the analysis reported in this paper makes a number of important value judgements concerning *whose* values about *what* are important and relevant. “... the relevance of the data generated must be placed in its appropriate normative context – largely that of a tax-financed health care system with a high degree of cross subsidisation.”¹⁵ The study

has investigated the values that *patients* place on *non-health* aspects of service outcomes. “Whilst patients *ex post* might place a relatively high value on ‘non-health’ attributes ... tax-payers *ex ante* might value a more limited (and possibly more health-focused) set of attributes.”¹⁵

Table 1 Characteristics of respondents (broken down by WTP response)

Respondent characteristics	n(%)	WTP zero respondents n (%)	WTP protest respondents n (%)
Trial Arm	(n=395)		
Control	169 (42.8)	88 (43.8)	42 (55.3)
PSM	198 (50.1)	81 (47.6)	25 (32.9)
Unknown	28 (7.1)	16 (8.6)	9 (11.8)
PSM patients	(n=198)		
Completed PSM	148 (74.7)	49 (60.5)	17 (68.0)
Withdrew from PSM	50 (25.3)	32 (39.5)	8 (32.0)
Gender	(n=367)		
Male	240 (65.4)	113 (66.9)	44 (65.7)
Female	127 (34.6)	56 (33.1)	23 (34.3)
Age	(n=367)		
<65	115 (31.3)	40 (23.7)	26 (38.8)
65+	252 (68.7)	129 (76.3)	41 (61.2)
Preferred model of care	(n=389)		
Routine care	197 (50.6)	121 (67.2)	36 (48.0)
PSM	169 (43.4)	46 (25.6)	32 (42.7)
No preference	23 (5.9)	13 (7.2)	7 (9.3)
Equivalent education level	(n=395)		
No qualifications	94 (23.8)	47 (25.4)	16 (21.1)
GCSE/O level	119 (30.1)	61 (33.0)	22 (26.3)
A level	75 (19.0)	31 (16.8)	19 (25.0)
Degree level	52 (13.2)	13 (7.0)	3 (3.9)
Missing	55 (13.9)	33 (17.8)	16 (21.1)

Table 2 Preferred model of care by trial arm

Model of care for which a preference was indicated	All patients n (%)	Control n (%)	PSM n (%)	Trial arm unknown n (%)
PSM	169 (42.8)	64 (37.9)	95 (48.0)	10 (35.7)
Hospital	45 (11.4)	23 (13.6)	17 (8.6)	5 (17.9)
General Practice	150 (38.0)	67 (39.6)	73 (36.9)	10 (35.7)
No preference	25 (6.3)	14 (8.3)	9 (4.5)	2 (7.1)
No response	6 (1.5)	1 (0.6)	4 (2.0)	1 (3.6)
Total	395 (100)	169 (100)	198 (100)	28 (100)

Table 3 Mean WTP values by patient characteristics

	Mean (sd) WTP (£) (including protests)	Mean (sd) WTP (£) (without protests)
All respondents	5.28 (9.92), n=367	6.62 (10.70), n=293
Trial Arm		
Control	3.63 (5.63), n=160	4.89 (6.05), n=119
PSM	7.02 (12.81), n=179	8.10 (13.45), n=155
Unknown	3.64 (5.12), n=28	5.37 (5.44), n=19
Completed PSM	8.80 (14.07), n=138	9.55 (14.58), n=122
Withdrew from PSM	1.02 (2.25), n=41	1.27 (2.45), n=33
Gender		
Male	5.42 (10.99), n=220	6.70 (11.86), n=178
Female	5.42 (8.64), n=119	6.71 (9.16), n=96
Age group		
<65	8.86 (14.84), n=112	11.53 (16.01), n=86
65+	3.72 (6.25), n=227	4.50 (6.62), n=188
Preferred model of care		
Routine care	1.79 (3.51), n=175	2.25 (3.80), n=139
PSM	9.32 (13.09), n=164	11.41 (13.64), n=134
No preference	4.26 (6.73), n=23	6.13 (7.37), n=16
Equivalent education level		
No qualifications	3.20 (4.95), n=86	3.94 (5.22), n=70
GCSE/O level	4.43 (6.80), n=110	5.53 (7.19), n=88
A level	7.48 (14.53), n=73	9.75 (15.94), n=56
Degree level	10.28 (15.15), n=46	11.00 (15.42), n=43
Missing	3.04 (4.79), n=52	4.39 (5.23), n=36

Table 4 WTP values and protests by purchase decision

	All respondents	Purchased	Wished to purchase	Did not purchase
Number	138	48	18	72
Mean (sd) WTP	8.79 (14.07)	13.90 (18.21)	11.50 (13.50)	4.72 (9.09)
Number (%) protestors	16 (11.6)	3 (6.3)	2 (11.1)	11 (15.3)
Number (%) with zero WTP	49 (35.5)	4 (8.3)	4 (22.2)	41 (56.9)

Table 5 Logistic regression models

Variable	Full model			Partial model		
	β	Odds ratio (95% CI)	p	β	Odds ratio (95% CI)	p
Constant	-2.796	0.061	<0.001	-2.543	0.079	0.001
WTP value	0.029	1.029 (0.995-1.065)	0.091	0.039	1.039 (1.006-1.074)	0.022
Protest response	-0.830	0.436 (0.121-2.000)	0.254			
Female	0.161	1.175 (0.493-2.797)	0.716			
Age <65	0.659	1.932 (0.842-4.433)	0.120			
GCSE/O Level	1.941	6.967 (1.429-33.965)	0.016	1.856	6.398 (1.333-30.706)	0.020
A Level	1.701	5.482 (1.065-28.216)	0.042	1.602	4.963 (0.992-24.821)	0.051
Degree	1.730	5.641 (0.994-32.010)	0.051	1.771	5.877 (1.069-32.315)	0.042

Figure 1 Study CONSORT diagram

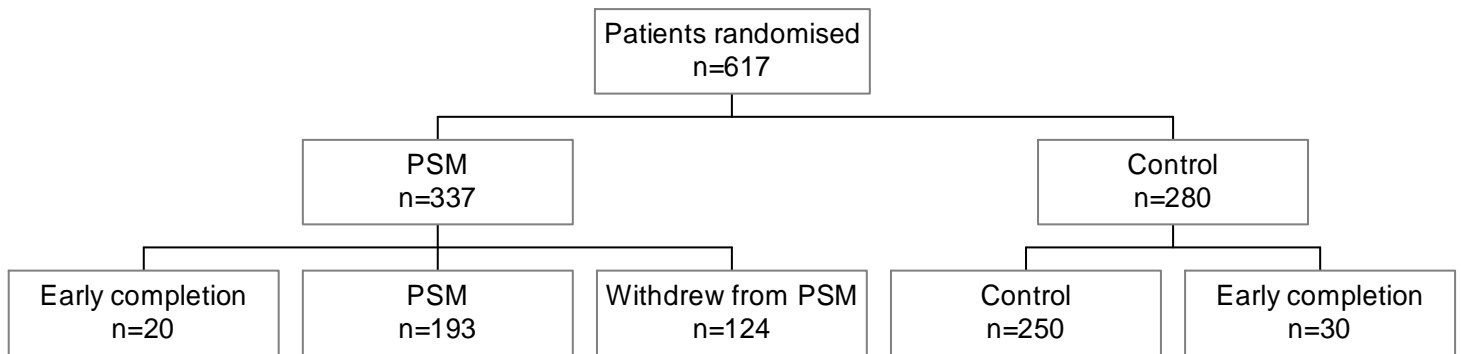


Figure 2 Frequency distribution of WTP values.

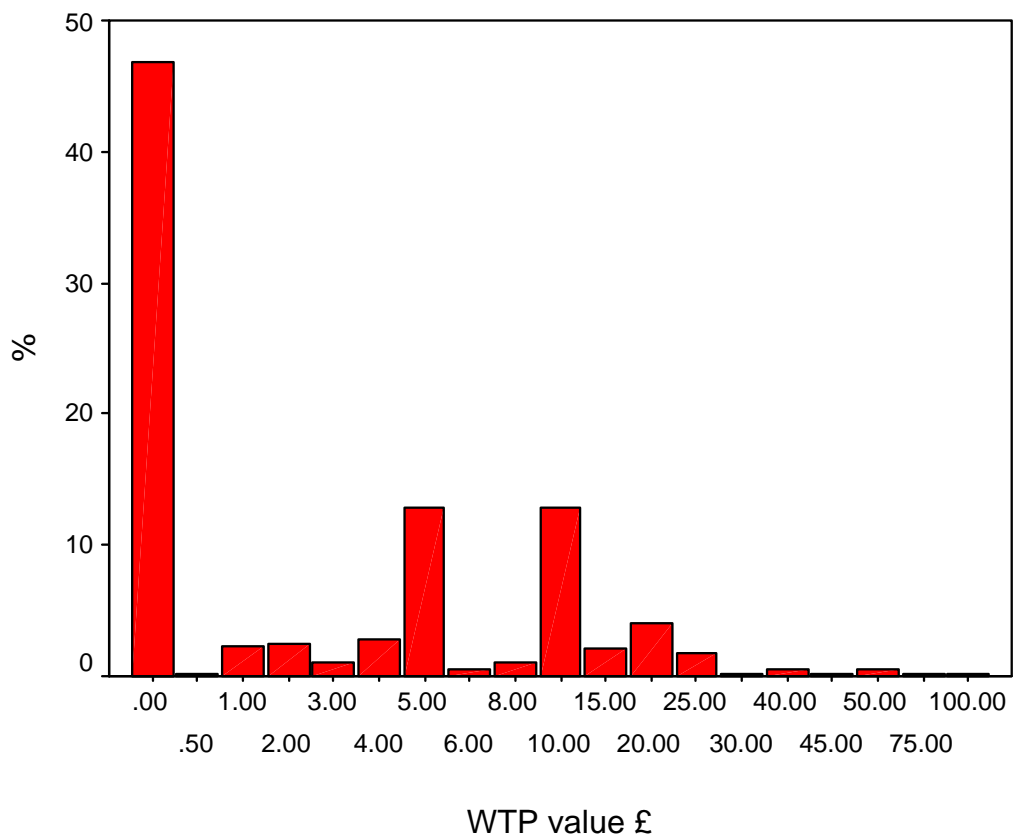
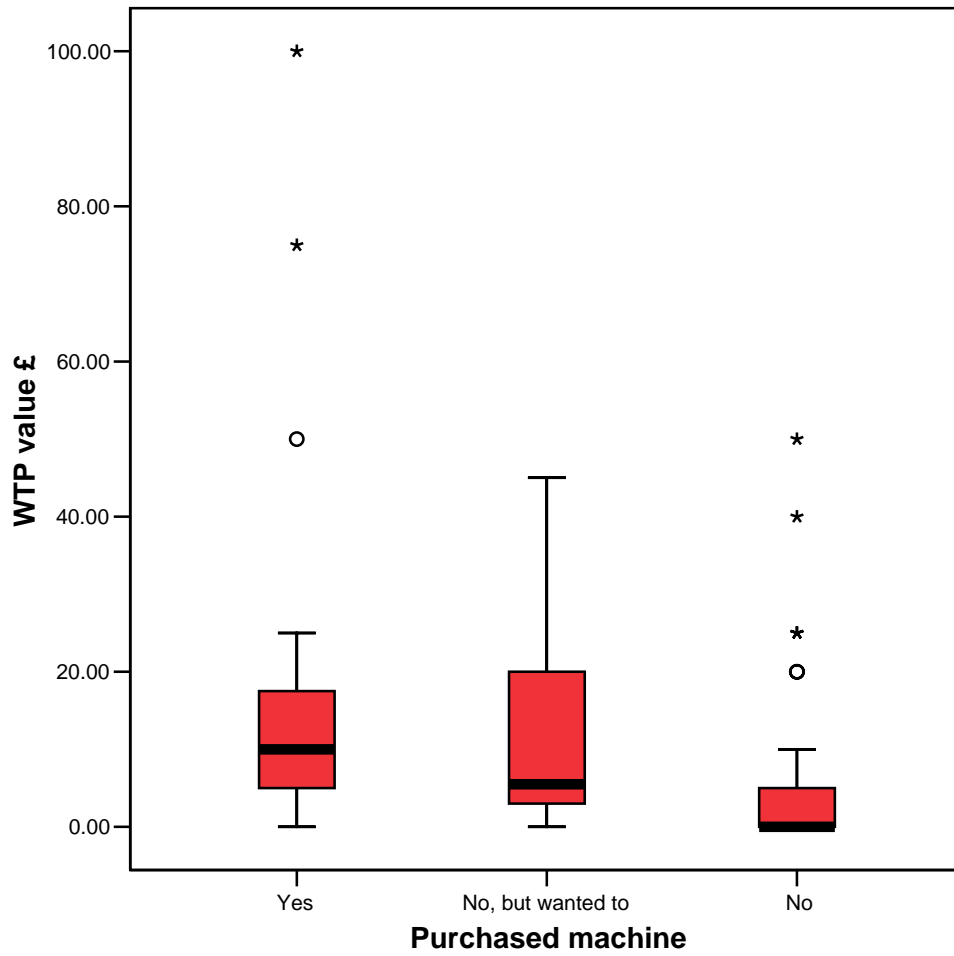


Figure 3 Box and whisker plot of WTP values by final purchase decision



Appendix A Willingness to pay question

One way of measuring how valuable patient self-management is to you, is to ask what you would be prepared to give up in order to receive this type of care. That is, how much you would be willing to pay for it. This is simply a way of measuring how strongly you feel about patient self-management of warfarin and how much you would value this type of service. **This exercise is not being carried out to set a charge for this type of care.**

There are no right or wrong answers. The amount you say could be large or small or you may not wish to pay at all. We are interested in your view.

*What is the maximum amount of money you would be willing to pay **per month** to be able to carry out warfarin patient self-management? Assume that the cost includes the machine and all other items e.g. test strips, lancets and quality control.*

Put a tick (✓) next to the **maximum monthly amount** you would pay

£0
50p
£1
£2
£3
£4
£5
£6
£7
£8
£9
£10
£15
£20
£25
£30
£35
£40
£45
£50
£55
£60
£65
£70
£75
£80
£90
£100+

(If £100+ state the exact amount in the space provided below)

£ _____

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