Are adults willing-to-pay to avoid a sore throat day? A contingent valuation study

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Word count: 2911

Abstract

Background:

Methods:

Results:

Conclusions:

Keywords:

Introduction

The benefit of tonsillectomy in the management of adult sore throats remains uncertain. Current guidance from the Royal College of Surgeons and Scottish Intercollegiate Guidelines Network (SIGN) (1) recommends the use of tonsillectomy depending on the number of sore throat episodes in the preceding year(s). However, there is little evidence supporting this guidance (1, 2). A Cochrane review concluded that evidence was only available for child tonsillectomies and further research was needed to demonstrate the benefit of tonsillectomy in adults (3). Tonsillectomies are not considered routine care for sore throats in adults. General practitioners (GPs) are reluctant to refer individuals for treatments they consider of limited clinical value and "relatively ineffective" (4, 5). Despite this uncertainty, over 14,000 adult tonsillectomies were performed in the UK in 2016/2017, costing the National Health Service (NHS) nearly £23 million (6). Further healthcare costs associated with the management of adult sore throats relate to primary care consultations, prescriptions, hospital admissions, and complications associated with tonsillectomies. As a consequence of all these costs it was estimated, using 2012 hospital episode data, that the management of sore throats cost the NHS over £120 million annually (7).

Individuals with sore throats suffer physical symptoms and, due to reoccurring sore throats, a substantial impact on their quality of life (4, 8). Individuals report purchasing over-the-counter medications and taking time off work and usual activities due to their sore throat. Some feel visiting their GP is futile, as they will not receive their desired treatment (tonsillectomy) (4). Hence avoiding sore throat days would have potentially considerable value to individuals.

Given the desire of individuals to undergo tonsillectomy but the uncertainty in the effectiveness of this treatment, the National Institute of Health Research (NIHR) Health Technology Assessment (HTA) programme funded NATTINA (The NAtional Trial of

Tonsillectomy IN Adults: a clinical and cost-effectiveness study). As part of this commissioned study, participants were randomised to one of two arms: surgical management (tonsillectomy) or medical management to identify the effectiveness and efficiency of tonsillectomy in the management of sore throats in adults (7). The trial is in the follow-up phase at the time of writing.

NATTINA's economic evaluation compares the two management strategies in terms of costs and effects. The economic results can be used by decision-makers to ensure scarce resources are efficiently allocated to improve the health of the population (9). One of the main ways in which efficiency of healthcare interventions is assessed is using cost-utility analysis, which uses quality-adjusted life years (QALYS) as preferred outcome measure (10). Within NATTINA, QALYs will be estimated based on response to the SF-12, a generic QoL questionnaire, which can be mapped onto the SF-6D from which utility values can be estimated (11). While QALYs are an internationally recommended outcome measure for economic evaluation, (9, 12, 13) they have a number of limitations (14, 15). One criticism is that QALYs are not sensitive enough to capture small but clinically important changes in QoL hence other outcome measures may need to be considered in the economic evaluation and presented alongside the QALY (9).

Given the perceived limitations of QALYs, NATTINA study participants at the point of recruitment were asked to complete a contingent valuation (CV) questionnaire. CV methods have traditionally been used in transport safety (16) and environmental economics (17) but have been increasingly used in health economics (18). CV hypothetically values a commodity when no market to determine its value exists (19). Hence, its applicability to healthcare, which seeks to value health and non-health related outcomes. In contrast to QALYs, which focus on health, CV can capture information on both health and non-health related outcomes and values these in monetary terms. CV estimates individuals' strength of preference to avoid

a health state, or to access certain treatments/services ("willingness-to-pay"), or to forgo a service or bear some harm by estimating the minimum compensation required ("willingness-to-accept") (19). Recent CV studies have valued participants' preferences for a wide range of healthcare interventions such as: diagnostic tests (20), dental treatments (21), programmes to support independent living (22), and parents' value on the provision of tonsillectomy (23). The aim of this article is to identify participants' willingness-to-pay (WTP) to avoid one sore throat day, with higher monetary values for WTP, relative to income, indicating greater benefit from avoiding a sore throat day.

Methods

The CV questionnaire was administered at baseline to identify the effect of sore throats prior to treatment.

Baseline questions

The baseline questionnaire was administered after participants were randomised but prior to receiving treatment. This questionnaire collected information on participant characteristics such as date of birth, ethnicity, and education level and employment status for both them and their partner, if applicable. As described above, utility values based on the responses to the SF-12 were used to describe QoL (11).

Contingent valuation question

The method of CV used was a payment card which was developed by Mitchell and Carson (1981) (24). This method provides participants with a list of WTP amounts to choose from, which increase by a fixed interval. The payment card has been shown to replicate real life as it gives participants the opportunity to "shop around" and identify their maximum WTP (25). Participants were asked to "*Please tick if you are sure you would be willing to pay to avoid*

one sore throat day". Participants had to tick each amount on the payment card they would be willing-to-pay and stop when they reached their maximum WTP value.

Nine levels of WTP amounts ranging from £0 to £30 where shown on the payment card, as shown in Figure 1. If participants indicated they would pay more than the highest amount (£30 per sore throat day avoided) they were asked to state their maximum WTP value in a free text box. Participants were also asked; 1) the most important factor behind their given WTP value, 2) why they would be unwilling to pay if they have indicated a maximum WTP value of £0, and 3) how easy they found the CV question on a scale from 0 (extremely easy) to 5 (extremely difficult). Information on income was collected as participants' ability to pay can affect their WTP values (26).

Identifying protesters and non-demanders

Participants who reported a WTP value of zero were asked to justify the reason they were not WTP to avoid a sore throat day from a list of options, which included: "I do not place any value on avoiding a sore throat day", "I believe that healthcare should be free" or "lack of budget". Protesters were identified as those who expected others to pay for this service ("I believe that healthcare should be free") as their only reason for not providing a WTP value and were excluded from the analysis. Responses from non-demanders or true zero voters were included in the analysis. Non-demanders were identified as those participants who did not value avoiding a sore throat day ("I do not place any value on avoiding a sore throat day") or those who valued avoiding a sore throat day but were constrained by their ability to pay ("lack of budget").

Data analysis

The data were analysed in STATA (27). Baseline characteristics were presented for the whole sample and split to present those who; 1) completed the WTP question, 2) did not complete

the WTP question, and 3) protest voters. The sample was split to identify potential differences in characteristics between the different types of participants. Age and utility, measured by the SF-6D, were presented as means with standard deviations. For all other characteristics, the total number of respondents for each category was provided with the corresponding percentage of the sample. Participants' only stated their actual WTP value if they were willing-to-pay above £30. For those who only gave responses on the payment card we assumed their WTP value to be the last value indicated on the payment card. To summarise the WTP data we took a conservative estimate for those who were not willing to pay more than £30 to avoid a sore throat day by assuming that their WTP value was the last WTP value indicated on the payment card. These WTP values were presented as the mean and median values with corresponding uncertainty measures. To reduce the effect of extreme upper end WTP responses, responses from the top one percent of WTP values were removed in a sensitivity analysis (28). A two-part model (tobit and generalised linear model [glm]) was fitted to control for baseline characteristics (age, education, employment status, ethnicity, SF-6D utility score, and income). The two-part model allowed us to identify potential characteristics, which may have affected 1) whether or not a participant was likely to be WTP and 2) participants' self-reported WTP to avoid a sore throat day.

Results

Data on 434 participants was used in the analysis. Figure 1 summarises the response rate and reasons for exclusion. Table 1 summarises the baseline characteristics of the whole sample, non-responders, those included in the analysis, and protest voters.
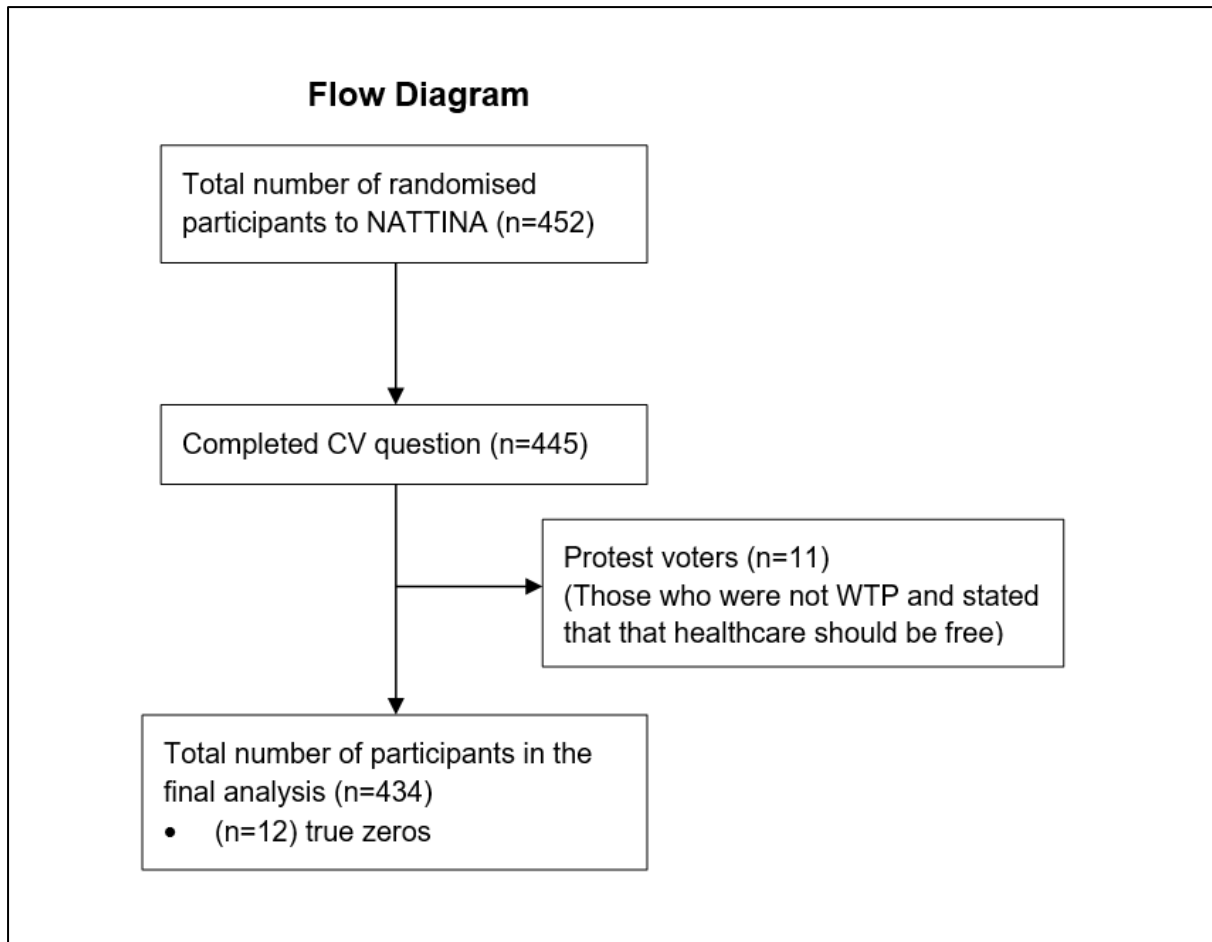
Figure 1 Summary of data used in final analysis

Table 1   Baseline characteristics

Variable	Total Sample	WTP Not completed	WTP Completed	Protest Votes
N	452	7	434	11
	Mean (sd)	**Mean (sd)**	**Mean (sd)**	**Mean (sd)**
SF-6D	0.681 (0.13)	0.549 (0.09)	0.680 (0.13)	0.716 (0.14)
N	445	2	432	11
Age	25.19 (7.4)	25.67 (12.4)	25.15 (7.2)	26.45 (13.1)
N	448	3	434	11
Ethnicity	**n (valid %)**	**n (valid %)**	**n (valid %)**	**n (valid %)**
White	397 (88)	1 (14)	387 (89)	9 (82)
Asian (of Indian, Pakistani, Bangladesh)	20 (4)		19 (4)	1 (9)
Other Asian	4 (1)		4 (1)	
Black or Afro-Caribbean	13 (3)		13 (3)	
Other ethnic origin	13 (3)	1 (14)	11 (3)	1 (9)
Education				
Post-graduate	43 (10)		40 (9)	3 (27)
Degree	118 (26)		116 (27)	2 (18)
Higher level/A level	174 (38)		173 (40)	1 (9)
O level/GCSE	104 (23)	1 (14)	98 (23)	5 (46)
No educational qualification	6 (1)		6 (1)	
Partner's education				
Post-graduate	24 (5)		22 (5)	2 (18)
Degree	43 (10)		43 (10)	
Higher level/A level	29 (6)		29 (7)	
O level/GCSE	32 (7)		30 (7)	2 (18)
No educational qualification	7 (2)		6 (1)	1 (9)
Not applicable	287 (63)	1 (14)	280 (64)	6 (55)
Employment Status				
Self-employed	22 (5)		22 (5)	
Paid employment (full/part time)	283 (62)		276 (64)	7 (64)

Unemployed but actively seeking work	13 (3)	1 (14)	12 (3)	
On maternity leave	2 (<1)		2 (<1)	
Looking after home/family	21 (5)	1 (14)	19 (4)	1 (9)
Full time student/at school	100 (22)		97 (22)	3 (27)
Long term sick/disabled	4 (1)		4 (1)	
On a government training scheme	1 (<1)		1 (<1)	
Partner's employment status				
Self-employed	12 (3)		12 (3)	
Paid employment (full/part time)	101 (22)	1 (14)	97 (22)	3 (27)
Unemployed but actively seeking work	5 (1)		5 (1)	1 (9)
Retired	1 (<1)		1 (<1)	
On maternity leave	3 (1)		3 (1)	
Looking after home/family	6 (1)		5 (1)	1 (9)
Full time student/at school	7 (2)		7 (2)	
Long term sick/disabled	3 (1)		2 (<1)	1 (3)
Not applicable	287 (63)	1 (14)	280 (65)	6 (55)
Income				
Less than £6k	70 (15)		68 (15)	2 (18)
=>£6k <10k	34 (8)		34 (8)	
=>10k <15k	53 (12)		52 (12)	1 (9)
=>15k <20k	43 (10)		42 (10)	1 (9)
=>20k <25k	35 (8)		34 (8)	1 (9)
=>25k <30k	30 (7)		30 (7)	
=>30k <35k	31 (7)		30 (7)	1 (9)
=>30k	130 (29)		127 (29)	3 (27)

On average, those included in the analysis were aged 26, White, and in paid employment. In terms of QoL, those who did complete the CV question had on average a slightly lower QoL score when compared with protest voters but there was no evidence of difference (p=0.377). Table 2 summaries the frequency of the WTP values reported.

Table 2   Frequency of WTP values reported

WTP value (£)	n (valid %)	WTP value (£)	n (valid %)
£0	12 (3)	£45	2 (<1)
£1	5 (1)	£50	49 (11)
£2	18 (4)	£60	1 (<1)
£5	52 (12)	£70	1 (<1)
£10	56 (13)	£80	4 (1)
£15	40 (9)	£90	1 (<1)
£20	64 (15)	£100	33 (8)
£25	11 (3)	£150	1 (<1)
£30	61 (14)	£200	1 (<1)
£30.01	1 (<1)	£250	2 (<1)
£35	2 (<1)	£500	2 (<1)
£40	10 (2)	£999.99	5 (1)

The majority of participants (n=319) reported a WTP value that was on the payment card and 116 participants (27%) stated that they would be willing-to-pay more than £30 to avoid one sore throat day. The WTP values outside of the payment card ranged from £30.01 to £999.99. The mean and median WTP values were estimated for 434 participants and are presented in

Table 3. An additional sensitivity analysis removing the top one percent is also included in

Table 3.

Table 3   Willingness-to-pay values to avoid a sore throat day

WTP value	N	Mean (SD)	Median [IQR]	Min	Max
WTP value (£)	434	42.80 (113)	20 [10 – 40]	0	999.99
WTP value with top 1% removed (£)	429	31.65 (45)	20 [10 – 35]	0	500

SD= standard deviation; IQR = interquartile range

On average, participants were willing-to-pay £43 (SD £113) to avoid a sore throat day and

the median value to avoid a sore throat day was £20. Sensitivity analyses removing the top

one percent of WTP values which, as expected, reduced the average WTP value by £11 but

had no effect on the median WTP values.

The results of the regression analysis, presented as Supplementary Material Table 1, found no

evidence to suggest that ethnicity, age, education status, or QoL influenced whether or not a

participant was WTP to avoid a sore throat day or the their WTP value. However, our results

provide good evidence (p=0.036) that those on lower incomes offered a lower WTP amount

than those earning medium incomes (£15k-£25k).

All participants provided information on the factors they considered most important when

deciding their maximum WTP value. The most frequently reported factors considered were

personal income/savings (39%) and impact of sore throat on family life (37%); 73

participants (17%) provided other factors not listed as their main consideration. The other

reason most reported was pain (n=26) followed by missing work/education (n=16). On

average participants' (n=433) found the payment card somewhat easy to neither easy nor

difficult to complete (mean [SD]: 2.86 [1.3]).

Discussion

The aim of this study was to identify individuals' preferences to avoid a sore throat day by identifying their WTP value. The overall response rate to the CV question was high (98%, n=445) with few of these being identified as protest voters (n=11, 2%). One reason for this is that the payment card, compared to other CV methods, provides more structure and guidance to make it easier for respondents to engage with the task (29). Participants were, on average, WTP £43 to avoid one sore throat day and the median WTP value was £20 per sore throat day avoided which suggests sore throats affect adults' daily lives.

In the regression analysis, we found that ability to pay, measured by income, affected the WTP values reported, in that those on lower incomes were more likely to report lower WTP values than those on medium incomes (p=0.036), which provides evidence of theoretical validity. No other characteristics were considered statistically significant in the logit or glm models.

As we know the desired treatment of those who experience sore throats is tonsillectomy (4) however we don't know if the cost of tonsillectomy is greater than the benefit that could be gained from patients in avoiding sore throat episodes. We estimated the monetary benefit associated with avoiding sore throat episodes by assuming a five day duration for each sore throat episode and that the WTP to avoid a sore throat does not diminish if sore throat days are continuous and compared this to the current cost of tonsillectomy in the UK. The number of episodes of sore throats each patient was expected to experience prior to referral was based on SIGN guidance (1). The net benefit was positive for two out of the three referral criteria. The net benefit was negative for those who had to report seven sore throat episodes in one year but the difference between the benefits and costs was £100. However, Douglas et al (2017) found that patients in West Scotland were more likely to experience nearly 28 sore throat episodes over a period of 7 years (30). Hence, the benefit associated with avoiding sore

throat episodes far exceeds the costs associated with tonsillectomy, even if we assumed a shorter duration for each episode and diminishing marginal returns for our mean WTP to avoid a sore throat day.

There are some limitations associated with this study. Firstly, we used conservative estimate of the maximum WTP for those who indicated that their WTP value was on the payment card. If we assumed the upper limit of the payment card range as their maximum WTP it would have slightly increased the mean WTP reported to £45 and the median WTP to £25.

Secondly, the payment card method is vulnerable to range bias hence reported WTP values may be lower than the individual's maximum WTP value (29). This study overcame this by providing an open text box for those who would be willing-to-pay more than £30 to avoid one sore throat day. These higher WTP values demonstrated participants' strong preference to avoid a sore throat day however, they did not always consider their ability to pay based on their reported annual household income. One participant's, who valued avoiding a sore throat day as £999.99, main consideration was "*take the pain away*" however their reported household income was less than £6000. Additionally the design of this question was vulnerable to a framing effect as the format of the open text box resulted in five participants reporting a WTP value of £999.99, the maximum possible value that could be included in the space provided. The top one percent of WTP values were removed from the data which removed these five participants and hence any potential bias from the question design (28). The average WTP value was reduced by £11 but the median WTP value remained unchanged. This suggests that although the mean WTP value is vulnerable to extreme responses the value is still positive highlighting the need to avoid sore throat days in this population.

Despite the limitations of the payment card, it is arguably the best method to estimate "true" WTP values that are representative of individuals' actual WTP values based on their ability to pay (31). This was evident in this study as the majority of respondents had a WTP value of £100 or less to avoid a sore throat day; values that would be considered plausible based on the income levels reported. One participant who had a WTP value of £50 to avoid a sore throat day wrote, "*if I earn £110 per day then it is worth it*" suggesting they would be willing to sacrifice nearly 50% of their income to avoid a sore throat day.

The CV results will be incorporated into the economic evaluation of the NATTINA study. As previously mentioned the primary economic analysis will focus on the cost per QALY gained however the results of the CV study can be incorporated into a cost-benefit analysis (CBA) (10). The CBA will determine whether the benefits of tonsillectomy or medical management, valued in monetary units, outweigh the costs associated with managing sore throats in adults. While CUA is arguably more pertinent to decision-makers as it facilitates decisions across different healthcare interventions CBA is useful as it can capture benefits beyond the QALY that are important to individuals (10). However, decision makers need to be cautious using the results of the CBA in isolation as they can actually be a measure of demand rather than need, hence they may not align with the objectives of the decision maker whose decisions on resource allocation also have equitable considerations (9). Using the results of both analyses, however, decision-makers can develop better-informed policies on the most appropriate management of sore throats in adults.

Conclusion

The results of the NATTINA study are necessary to provide evidence to inform and support guidance on the management of sore throats in adults, which is currently lacking. Our results show there is a demand for a treatment as individuals' preferences are to avoid a sore throat. On average, individuals are WTP £43 (median £20) to avoid a sore throat day hence there

needs to be consensus on an effective management strategy to reduce the occurrence of sore throats in adults.

<u>Disclaimer</u>

Supplementary materials

Table 1

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Part 1: logit
─────────────────────────────────────────────────────────────────────────────
                                        Number of obs   =        414
                                        LR chi2(9)      =      10.62
                                        Prob > chi2     =     0.3026
Log likelihood = -49.005576             Pseudo R2       =     0.0978

Part 2: glm
─────────────────────────────────────────────────────────────────────────────
                                        Number of obs   =        402
Deviance       =   28.6650093           (1/df) Deviance =    .073125
Pearson        =   33.22558485          (1/df) Pearson  =   .0847591

Variance function: V(u) = u^3           [Inverse Gaussian]
Link function    : g(u) = ln(u)         [Log]

                                        AIC             =      10.96
Log likelihood   = -2192.960217         BIC             =  -2321.944
```

minwtp	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf. Interval]	
logit						
income_dummy						
low pay	.8862145	.7064974	-0.15	0.880	.1857608	4.22789
high pay	1.561148	1.431093	0.49	0.627	.258913	9.413134
education_dummy						
school education	5.137616	7.50121	1.12	0.262	.2937375	89.8595
higher education	13.28868	21.46096	1.60	0.109	.5607987	314.8882
employment_dummy						
not employed	1.656252	2.316576	0.36	0.718	.1067981	25.68559
student	.2062858	.1679168	-1.94	0.052	.0418399	1.017064
SF12_bl	4.613974	11.6563	0.61	0.545	.0326348	652.3329
white_dummy	1.665168	1.405887	0.60	0.546	.3182701	8.712047
age	.935049	.0487588	-1.29	0.198	.8442049	1.035669
_cons	10.27033	28.49376	0.84	0.401	.0446716	2361.225
glm						
income_dummy						
low pay	-.7390581	.3531365	-2.09	0.036	-1.431193	-.0469232
high pay	-.4508273	.3590301	-1.26	0.209	-1.154513	.2528588
education_dummy						
school education	.7919785	.9226136	0.86	0.391	-1.016311	2.600268
higher education	.4595565	.936118	0.49	0.623	-1.375201	2.294314
employment_dummy						
not employed	.719018	.4757073	1.51	0.131	-.2133512	1.651387
student	.3044566	.3081614	0.99	0.323	-.2995285	.9084418
SF12_bl	-.2539016	.6786662	-0.37	0.708	-1.584063	1.07626
white_dummy	-.1451775	.3206429	-0.45	0.651	-.773626	.483271
age	-.0008292	.0199129	-0.04	0.967	-.0398577	.0381994
_cons	3.758057	1.164946	3.23	0.001	1.474806	6.041309

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