

The outcomes of mandibular third molar removal and non-removal: a study of patients' preferences using a multi-attribute method

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The aim was to study patients' preferences about outcomes of mandibular third molar removal and non-removal using multi-attribute utility (MAU) methodology. The study comprised three stages. Stage 1: Elicitation of domains, i.e. main areas of patients' lives which could be affected by third molar removal and non-removal. Stage 2a: Interdomain weighting was obtained by relative weighting of the domains elicited in Stage 1. Stage 2b: Intradomain weighting obtained by patients' designation of values for different health states of each domain. Stage 3: Rating of outcomes. The patients were asked to imagine experiencing a variety of outcomes of mandibular third molar removal and non-removal, described in 19 short vignettes. The numbers of patients interviewed for the three stages were 30, 78, and 55, respectively. Five domains were identified. The mean relative weightings were approximately equal for the domains "Home and social life" and "General health and well-being", followed in order of importance by "Job and studies" and "Health and comfort of mouth, teeth and gums". "Your appearance" received the lowest mean relative weighting. The vignette, which described the presence of a fluid-filled sac and suggested that this tooth must be removed, received the highest mean preference (least effect on patients' lives). The lowest mean preference (most effect on patients' lives) was generated by the vignette, which stated that the jaw was broken and that the teeth must be wired together for 6 weeks. We conclude that, from the patient's perspective, outcomes of non-removal were preferable to outcomes of mandibular third molar removal.

□ *Decision analysis; decision-making; dental; third molar surgery; tooth extraction*

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Decision analysis allows the outcomes of different procedures and treatment options relevant to a given condition to be evaluated quantitatively. Such analyses suggest that, under a wide range of conditions taking account of risk of pathology and probability of surgical complications, the strategy of removing only mandibular third molars, which are associated with disease, is the risk-minimizing option compared to prophylactic removal (1). Another study of treatment planning for mandibular third molar removal using patient-derived preferences, indicated that "postoperative complications reduced health to a greater degree than did complications following non-intervention" (2).

It is now accepted that the patient's perception of health should play a significant role in health care and that treatment should result in health gain from the patient's perspective (3). In order to estimate the health gain and maximize the benefit to patients, methods of quantifying patients' preferences concerning various outcomes of surgery and non-surgical management have been developed. Preferences refer to the levels of subjective satisfaction, distress, or desirability that individuals associate with a particular health state (4). One method of quantifying patients' preferences is the multi-attribute

utility (MAU) methodology, described by Torrance et al. (5). The MAU method applies decision analysis to situations in which the decision-maker is faced with multiple competing objectives rather than a single, well-defined objective (4). The aim of this study was to develop values that reflect patients' preferences about possible outcomes of surgical removal and non-removal derived from published evidence using MAU methodology.

Patients and methods

Description of the multi-attribute utility (MAU) method applied to mandibular third molar removal and non-removal

Stage 1. Elicitation of domains (attributes), i.e. main areas of concern that patients considered to be important generally in life and which could be affected by mandibular third molar removal or non-removal.

Stage 2. Both inter- and intradomain weighting were performed. Interdomain weighting was carried out by relative weighting of the domains elicited in Stage 1. In the intradomain weighting, patients designated values for all the different health states, which were described as a decomposed function of each attribute (4).

Table 1. Sex and age (years) distribution of patients participating in the different stages of this multi-attribute utility (MAU) study

	Female			Male			Total		
	Age			Age			Age		
	<i>n</i>	Mean	Range	<i>n</i>	Mean	Range	<i>n</i>	Mean	Range
Stage 1: Elicitation of domains	16	27.2	19–40	14	30.0	19–52	30	28.5	19–52
Stage 2: Inter and intradomain weighting	39	28.9	20–51	39	28.7	17–56	78	28.8	17–56
Stage 3: Rating of outcomes	34	29.3	19–58	21	28.4	18–47	55	29.0	18–58

Stage 3. Rating of outcomes, i.e. the patients were asked to imagine experiencing a series of representative outcomes; these were described in a number of short descriptions (vignettes).

Participants

The participants comprised patients referred to three different oral and maxillofacial surgery clinics of the National Health Service in south Sweden for surgical removal of one or more mandibular third molars. The number, sex, and age of the patients participating in the three stages of the study are presented in Table 1.

Patients were not recruited to the study until after they had consulted the oral surgeon, during which they were scheduled for third molar removal or not, depending on indications for surgery. No patient had any earlier experience of surgical third molar removal. At the consultation the patients scheduled for surgery had been fully informed of the possible complications of surgery, the probability of the complications occurring, and the extent of morbidity to be expected from this type of surgical procedure.

Stage 1. Elicitation of domains

The domains were elicited by means of an interview technique based on recommendations set out by Babbie (6). Four of the authors (RL, KK, LL, MR) interviewed 30 patients in all. The interviews were non-structured, but included questions regarding biomedical, psychological, social, cultural, and economic dimensions. The interviews were tape-recorded, transcribed, and then utilized to categorize the domains. The categorization was performed by consensus of the six authors.

Table 2. Interdomain weighting, mean and standard deviation (*s*) of the relative importance of the elicited domains as judged by 78 patients referred for mandibular third molar removal

Domain	Mean	<i>s</i>
Home and social life	26.56	6.97
General health and well-being	25.90	7.31
Job and studies	20.41	6.61
Health and comfort of mouth, teeth and gums	18.26	5.02
Your appearance	8.82	6.29

Stage 2. Domain weighting

Interdomain weighting. A separate sample of 78 patients was asked to weight the relative importance of the domains using a resource allocation model. They were given a limited resource of 100 points and asked to distribute them among the domains, assigning a greater or lesser number of points (from 0 to 100) depending on how important the domains were to them. They were also allowed to reject any domain which they considered would not be affected by the outcomes achieved.

Intradomain weighting. Four health states (see Table 3), representing a range of descriptions applicable to the selected domains, were constructed as described by Brickley et al. for each of the selected individual domains (7). Values were then assigned to these health states by the same sample of 78 patients who took part in the interdomain weighting exercise. By placing the health states on a 100 cm visual analog scale (VAS) with numerical anchor points of 0 and 100, it was possible to obtain quantitative values for health states. The patients were asked to mark their choices for 0 ("worst") and 100 ("best") on the VAS, then to place the remaining two health states on the scale between 0 and 100. These two points were measured to the nearest 0.5 cm.

Stage 3. Rating of outcomes

Nineteen vignettes describing outcomes of mandibular third molar removal and non-removal were constructed using evidence from the literature (8–16). A further sample of 55 patients was asked to imagine experiencing the outcomes of each vignette. The patients were then asked to select the health state within each of the five domains (see Table 3) that matched how they imagined they would experience the outcomes described in each vignette. This was repeated for all 19 vignettes.

Analysis

The outcomes were recorded as numerical data and were entered in a spreadsheet. The mean and standard deviation of the domain weightings were then calculated using SPSS (Statistical Package for the Social Sciences). In the present study, the expression 'preference' is used as the outcome derived for each vignette. The preference for

Table 3. Intradomain weighting, mean and standard deviation (*s*) expressed in cm VAS (0 represents "worst" health state and 100 "best" health state on the VAS) of 78 patients referred for mandibular third molar removal

Domains and health states	Mean	<i>s</i>
Home and social life		
My home and social life is unaffected. I can enjoy life as much as usual.	100	
My home and social life is affected a little. I can enjoy life almost as much as usual.	69.10	15.16
My home and social life is seriously affected. I cannot enjoy life as much as usual.	24.36	12.77
My home and social life is completely disrupted. I do not enjoy life as much at all.	0	
General health and well-being		
I feel really good, well and relaxed. I am not worried about my health.	100	
I feel fairly well in myself. I am not worried or anxious about my health.	72.26	12.70
I do not feel especially well. I feel a bit anxious about my health.	30.62	13.65
I do not feel well at all. I feel very anxious about my health.	0	
Job and studies		
My job and studies are unaffected.	100	
My job and studies are slightly affected.	72.31	15.66
My job and studies are affected to a moderate extent.	39.57	19.60
My job and studies are seriously affected.	0	
Health and comfort of mouth, teeth and gums		
My mouth feels really healthy and my teeth and gums are comfortable. I can eat and talk normally.	100	
My mouth feels fairly healthy and my teeth and gums are comfortable. I can eat and talk almost normally.	67.11	16.15
My mouth, teeth and gums do not feel very healthy. It is affecting my eating to a moderate extent.	24.62	15.41
My mouth does not feel healthy at all. Speaking and eating are difficult.	0	
Your appearance		
My face looks normal.	100	
My face looks quite normal.	74.56	16.68
My face looks quite abnormal.	34.37	20.90
My face looks completely abnormal.	0	

each vignette and each patient was calculated using the following formula:

$$P_{\text{total}} = (\sum P_d W_d) / 100$$

Where P_{total} = the overall preference, P_d = the value given to the intradomain health state that has been derived from the intradomain weightings, and W_d = the interdomain weighting of a specific domain. A worked example is shown in the Appendix. The mean preference was then calculated for each of the 19 vignettes.

Patients' understanding of the method for domain weighting

The patients' understanding of the method for interdomain weighting was tested with the aid of 8 patients participating in Stage 2. Prior to the intradomain exercise, they were asked to rank the domains without distributing the 100 points. The two methods, the distribution of points and the ranking, respectively, were compared using Spearman's rank correlation. The level of significance was set at $P = 0.05$. The rank correlation coefficient (r^s) varied between 0.36 and 1.00. Three patients rankings were significantly different (r^s between 0.36 and 0.79). The differences were due to the fact that these 3 patients distributed about an equal number of points to each of the 5 domains.

The patients' understanding of the method for intradomain weighting was tested by asking 7 patients to rank health states within 2 randomly selected domains prior to the actual exercise. The patients' ranking was in accordance with the sequence when performing the standard intradomain exercise.

Reliability

Reliability of the interdomain weighting was tested by asking the 8 patients to repeat the interdomain exercise (the distribution of 100 points to the domains) after the intradomain exercise. The repeated exercise was performed the same day. The median was calculated on the absolute deviation between the two exercises and varied for the domains between 0 and 2 points. Reliability of the intradomain weighting was tested by asking the 8 patients to repeat this exercise for one randomly selected domain. The repeated exercise was performed the same day. The median was calculated on the absolute deviation between the two exercises. The median of the two health states which were placed between the anchors was 3.0 cm and 9.0 cm, respectively, i.e. between 3% and 9%.

Results

Elicitation of domains

From the information collected, five domains were identified: (i) Home and social life, (ii) general health and well-being, (iii) job and studies, (iv) health and comfort of mouth, teeth, and gums, and (v) your appearance.

Domain weighting

The interdomain weightings are presented in Table 2. The mean weighting of relative importance was almost highest and almost equal for "Home and social life" and "General health and well-being", followed in decreasing

Table 4. Preference, mean and standard deviation (*s*), and relative ranking of 19 vignettes. The preferences were based on 55 patients' answers when asked to imagine experiencing the outcomes of the vignettes. Ranking 1 represents the least annoying and ranking 19 the most annoying outcome

Vignette	Preference		Ranking
	Mean	<i>s</i>	
1 After the extraction you experience mild discomfort for a few days	74.86	12.39	5
2 After the extraction you experience moderate pain and your face and mouth are very swollen	51.65	15.24	12
3 After the extraction you experience severe pain, which keeps you awake for a few nights	37.32	14.55	18
4 After the extraction your jaw is stiff and painful. You have difficulty opening your mouth as wide as normal	55.89	20.43	10
5 After the extraction you experience minor discomfort and abnormal bleeding from the socket for a few hours	60.83	22.64	8
6 After the extraction you experience minor discomfort and also tingling and prickling sensations in your lower lip or tongue for up to 2 weeks	56.29	23.76	9
7 After the extraction you have minor discomfort. Your tongue is completely numb on one side for up to 6 weeks	50.53	19.61	13
8 After the extraction you have minor discomfort. Your tongue is completely numb on one side permanently	44.07	21.96	15
9 After the extraction you have minor discomfort. Your lower lip (but not your tongue) is completely numb on one side for up to 6 weeks	54.98	19.81	11
10 After the extraction you have minor discomfort. Your lower lip (but not your tongue) is completely numb on one side permanently	48.17	24.22	14
11 After the extraction you have minor discomfort. Your lower lip and your tongue are completely numb on one side up to 6 weeks	42.79	17.27	16
12 After the extraction you have minor discomfort. Your lower lip and your tongue are completely numb on one side permanently	40.47	19.93	17
13 After the extraction the surgeon tells you that your jaw is broken and that you need your teeth wired together for up to 4 weeks	35.89	15.13	19
14 A tooth comes up at the back of your mouth. On one occasion this gives you a few days of aching pain and around the tooth the gum is swollen	84.95	14.59	2
15 A tooth comes up at the back of your mouth. Every six weeks or so you experience a few days of aching pain and around the tooth the gum feels swollen	73.73	20.05	6
16 The position of the wisdom tooth causes "gum disease" in the tooth in front which will make losing it more likely	71.75	17.08	7
17 You have a new tooth which comes up behind your last lower tooth. This results in the tooth in front becoming decayed and needing extraction	82.70	15.51	4
18 You notice that the appearance of your lower front teeth has changed slightly. The teeth appear to be more "squashed" together	83.69	19.37	3
19 After having an X-ray to find out if your wisdom tooth is present, the dentist tells you that there is a fluid-filled sac around your wisdom tooth and that this tooth must be removed	85.08	13.88	1

order of importance by "Job and studies" and "Health and comfort of mouth, teeth and gums". "Your appearance" received the lowest mean weighting. The intradomain weightings are presented in Table 3. The weights of the two health states which were influenced by the patients' preferences, i.e. the second "best" health state and the second "worst" health state, varied substantially.

Rating of outcomes

Table 4 presents the mean preferences and the relative ranking of the outcomes described in the 19 vignettes. Generally, the outcomes of non-removal of mandibular third molars attracted higher preference than outcomes of surgical removal. Vignette 19, which described the presence of a fluid-filled sac and suggested that this tooth must be removed, received the highest mean preference. Thus, the patients imagined experiencing this outcome as having least effect on their lives. Vignette 14, which described mild transient pericoronitis, attracted the second highest preference. The lowest mean preference was generated by vignette 13, which stated that "After the extraction, the surgeon tells you that your jaw is broken and . . .", this outcome was considered to have the most

impact on patients' lives. The experience of severe pain, which keeps the patient awake for a few nights after the removal (vignette 3), attracted the second lowest preference.

Discussion

Methodological issues

To achieve values for different health states, different scaling methods have been applied, including the standard gamble method, time trade-off, rating scales, magnitude estimation, equivalence, and willingness to pay (17, 18). The MAU method may be accomplished using any of these methods (19) and most scaling methods are considered credible (18). The rating scale method (VAS) is widespread in studies of preferences in health care. In the present study, the reliability of the rating scale was fairly high for intradomain weighting and high for interdomain weighting. We therefore concluded that the patients understood the method used.

For health care purposes, utilities are usually defined on a scale with 0 as death and 1.0 as perfect health, although the way these expressions are used varies in the literature

(4). Since the required anchoring 0 and 1.0 was not defined in the present study and thus the values were not cardinal utilities (19), we use the expression preference instead of utility.

When the patients were interviewed to elicit domains, they mentioned several areas of concern. Evidence indicates, however, that individuals can process simultaneously only about 5–9 items of information (20). As a consequence, some areas of concern rarely mentioned were not included as a domain. When making a treatment decision, it is important to take into account both outcomes of medical and dental decisions and the extent to which they occur (probabilities) and human values (preferences). The vignettes were constructed to illustrate a wide variety of outcomes of both removal and non-removal of third molars and thus different time perspectives, reflecting both temporary and chronic outcomes.

This was to cover outcomes affecting patients' quality of life in a lifetime perspective. The temporary outcome is a once in a lifetime event and no further complications are expected to develop in a lifetime perspective. The chronic outcomes are complications that affect the patient every day in a lifetime perspective.

Content issues

The results of the present study indicate that the patients overall believed that the impact of third molar removal had a greater negative effect on their lives than the impact of non-removal. The vignette describing a wisdom tooth with a fluid-filled sac (vignette 19) received the highest preference value. This indicates that patients interpreted this as an innocuous condition whilst some professionals would have interpreted it as a follicular cyst. Alternatively, it could be explained by patients' preferences for symptomless health states. The vignette that received the second highest preference described mild pericoronitis (vignette 14) as a "once-in-a lifetime" event. The patients probably considered it as a minor self-limiting condition not influencing areas of life.

The health state which attracted the lowest preference was a broken jaw (vignette 13), a serious, though rare, complication of removal. In contrast to persisting numbness (vignettes 8 and 10), which was rated higher, a broken jaw is not a permanent condition. It might be easy for the patients to understand how a broken jaw can interfere with daily activities such as eating and talking. Studies on quality of life following third-molar removal show that patients felt that surgery exerted its impact primarily by reducing ability to eat (21) and by adversely affecting nutritional intake (22). Surprisingly, the outcome of the vignette "After the extraction you experience severe pain which keeps you awake for a few nights" was less desirable than those of the vignettes that included different degrees of numbness. In explanation, most of the patients were young and in good oral health and had therefore never received local anesthesia or experienced numbness and the effects of numbness. Most patients, on the other hand, are

familiar with pain and the effects of pain, and therefore might have more insight of this experience, even though it might not be related to the mouth and teeth. This emphasizes the importance patients attach to postoperative pain and reinforces the need for good analgesic prescription after surgery (21).

The vignette in which the lower front teeth were described as becoming more "squashed together" presented a high preference value, suggesting that the patients were not that concerned about lower arch crowding. Prophylactic removal to prevent crowding of the lower incisors is considered controversial among dentists (23–29). So far, there is no scientific evidence that removal of mandibular third molars prevents crowding (23–30).

In conclusion, advice to patients about whether or not to have their third molars removed must be based on evidence of the likely effects and possible risks of removal and non-removal and, as Savin and Ogden (31) emphasize, the effects on a patient's quality of life. The results of our study exploring the patients' perspective will be further evidence worth attention when dentists make decisions whether to intervene or not on mandibular third molars in partnership with their patients. This model can also serve as a foundation for further research into decision-making about effects on patients' quality of life, and may help decision-makers understand the underlying basis for treatment decisions in dentistry.

Appendix

Example of the calculations for one patient and vignette 2: "After the extraction you experience moderate pain and your face and mouth are very swollen." The patient selected the following health states within each domain that matched how she imagined experiencing the outcomes described in vignette 2.

Domain	Health states selected by the patient	Intradomain weighting	Interdomain weighting
Home and social life	Seriously affected	30.5	31
General health and well-being	Do not feel especially well	27.0	27
Job and studies	Slightly affected	68.5	24
Health and comfort of mouth, teeth and gums	Do not feel very healthy	19.5	14
Your appearance	Quite normal	75.0	4

The preference (P) for this patient and vignette 2 would be:
 $P = (\text{intradomain weighting for home and social life} \times \text{interdomain weighting for home and social life}) + \text{etc.}/100$

$P = (30.5 \times 31) + (27.0 \times 27) + (68.5 \times 24) + (19.5 \times 14) + (75.0 \times 4)/100$

$P = 945.5 + 729 + 1644 + 273 + 300/100$

$P = 3891.5/100$

$P = 38.9$

On a scale of 0 (worst health state) to 100 (best health state), this patient would have a preference of 38.9.

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