

# Patients' willingness to pay for dental services in a population with limited restorative services

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**Objectives:** To determine and compare patients' willingness-to-pay (WTP) for tooth extraction and filling services in Tanzania and to assess the socio-demographic factors that are associated with such valuations. **Methods:** Contingent valuation survey utilizing an open-ended willingness-to-pay format was administered among 1522 outpatients in four regional hospitals in Tanzania. WTP for extraction and tooth filling services for various tooth categories were determined and compared using Mann-Whitney and Kruskal-Wallis tests. The association of WTP values with socio-demographic background factors was assessed using multiple regression analysis. **Results:** The mean WTP amounts for tooth filling were Tanzania shillings (Tshs) 7,398 (3.4 US\$) and Tshs 7,726 (3.5 US\$) for anterior and posterior teeth respectively. The mean WTP for tooth filling services was lower than the average charged fees in dental facilities. The mean WTP amounts for tooth extraction were Tshs 5,448 (2.5 US\$) and Tshs 6,188 (2.8 US\$) for anterior and posterior teeth respectively. WTP amounts were shown to vary by age, income, outpatient status and previous experience with the dental services. Belonging in youngest age group (18-24 years) and having a high-income level was associated with increased odds for high WTP valuations irrespective of tooth and treatment types. **Conclusions:** WTP reveals a preference for tooth filling rather than extraction services in this population. More studies are needed to address the discrepancy between the stated preferences and utilization patterns for dental services.

**Key words:** dental services, utilization, health economics, willingness-to-pay, low-mid income countries, United Republic of Tanzania

## Introduction

Dental caries is one of the most prevalent diseases in the world. It is estimated to affect 60%-90% of populations worldwide (Petersen and Bourgeois, 2005). Significant proportions of populations in low-mid income countries (LMICs) remain afflicted by this disease. Consequently, dental caries remains the major reason for attendance in many oral health facilities in LMICs (Kikwilu *et al.*, 2008; Kandelman *et al.*, 2012). Several factors may determine what kind of treatment patients receive upon attendance at the oral health facility. Provider factors include: availability of materials and equipment, expertise and preferences of the health care provider. On the other hand, patient factors may include perceptions, preferences and financial considerations (Okullo *et al.*, 2004; Brennan and Spencer, 2005). These factors may combine in determining the definitive treatment eventually given to the patient. Nonetheless, the vast majority of treatment offered for dental caries in many LMICs has been shown to be tooth extractions, with tooth fillings contributing negligibly small proportions (Kikwilu *et al.*, 2008; Mashoto *et al.*, 2009).

Like many other outpatient clinical disciplines, patient inputs contribute greatly towards the treatment plan and final decision regarding dental treatment obtained. The economic decision in preference of tooth filling over tooth

extraction services can be explained by utility theory (Torrance, 1987). This theory describes a method of decision making under uncertainty, based on rational behaviour. Therefore, in this instance utility refers to the desirability or preferences that individuals exhibit for either tooth fillings or extractions services. Individuals compare the benefits of purchasing tooth filling and tooth extraction services against the health expenditures required for it. If the relative benefits of one service are perceived to be greater than the incurred costs, the individual may purchase such service.

The primary valuation method for cost-benefit analysis is willingness-to-pay (WTP). WTP is commonly used measure to determine health benefits in monetary terms (Klose, 1999). It can also be used to determine differences in strengths of preferences and utility between related health care alternatives. Its underlying principle is that the maximum amount individuals are willing to pay for a health gain correlates to their value of that specified health gain. When given a choice, it is likely that the option of retaining one's teeth will be favoured compared to that of losing them (Tan *et al.*, 2016). However, tooth extractions have been shown to be the most commonly rendered services in LMICs, even when the facilities and equipment available permit carrying out of tooth filling services (Okullo *et al.*, 2004; Kikwilu *et al.*, 2009; Khalifa and Allen, 2012).

The preferences and associated factors of patient populations in LMICs towards treatment options available for dental caries remain unexplored. Further, the amounts that they would be willing to pay for these services have not been reported in the literature. The aim of this study was to determine and compare patients' WTP for tooth extraction and tooth filling services in Tanzania; and to assess the socio-demographic factors that are associated with their WTP valuations.

## Methods

This study was conducted in government regional hospitals in Tanzania. Tanzania mainland is divided into four main zones, each with a referral hospital in one of its regions. Public dental clinics are located within regional and district hospitals, usually in administrative headquarters in municipalities and cities. Restorative services can only be provided in regional or district hospitals, and even then, they are not always available, subject to material and equipment availability (Kikwili *et al.*, 2009). To ensure representativeness, hospitals from each of these four different administrative zones were selected. These hospitals were located in Dar es Salaam, Mbeya, Mwanza and Kilimanjaro regions, representing Coastal, Southern highlands, Lake and Northern zones, respectively.

There was no previous information on patients' WTP for dental services in a society with limited restorative services. Therefore, based on studies conducted elsewhere (Walraven, 1996; Hansen *et al.*, 2013), 400 outpatients from each hospital were considered sufficient for study purposes. All outpatients aged 18 or more attending the selected hospitals during the 4-5 week study period were eligible for participation and included into the study. A maximum of 10 medical and 10 dental outpatients were consecutively enlisted daily until the sample size was reached. These participants were approached in the outpatient waiting rooms.

A contingent valuation survey utilizing an open-ended willingness-to-pay format was used. The survey was conducted in the hospital waiting rooms for both medical and dental outpatients. Also, data on the charged fees for tooth filling and extraction services were collected from the facilities. The interviews were conducted by research assistants who had been especially trained in the WTP technique. They briefly described the purpose and importance of the study, and allowed the patients to read the scenario by themselves. The research assistant provided clarifications when needed and emphasised to the participants that the values provided by participants would have no effect on the charges to be incurred at the hospital.

A questionnaire was developed by the researchers and the scenario tested on a sample of 20 dental and medical outpatients not involved in the study. Comprehensibility of the scenario and ease of responding were assessed. Adjustments to the study tool were made as deemed appropriate. The questionnaire comprised three main sections. The first section described the aim of the study and sought informed, written consent. The second section consisted of the willingness-to-pay elicitation. A hypothetical scenario was described to the respondent. This scenario briefly defined dental caries and its association

with subsequent toothache. It then described the available treatments for a toothache, namely: tooth extraction and tooth filling. Thereafter, the scenario involved them coming to a dental clinic with caries, and being offered treatment. It was explained that a tooth extraction would result in the loss of that tooth, whereas tooth filling will result in continued usage of the restored tooth. Participants were then asked to state their willingness-to-pay independently for: (1) tooth extraction and (2) tooth filling separately for an anterior and posterior tooth in the upper and lower jaws. If the participants were not willing to pay anything for the treatment, they were instructed to fill-in "0". If they were not able to determine any amount, they were instructed to leave that part blank.

The third section asked about demographic factors that may be associated with the willingness-to-pay for tooth filling and tooth extraction. These included: sex, age, education level and type of outpatient (medical/dental). Other questions included were; previous tooth filling experience, previous tooth extraction experience, self-perceived status of teeth and payment modality utilized for purchasing health services (health insurance/out of pocket). Affluence was assessed by inquiring the average monthly household income of the participants.

Preliminary analyses showed no major differences between the stated values for upper and lower jaws in relation to position of the teeth. Therefore, to streamline the results we combined the WTP values for both upper and lower jaws. Participants' mean WTP values for tooth extraction of anterior and posterior teeth were calculated, as were the mean WTP values for filling of anterior and posterior teeth. The exchange rate from FOREX was used, 1US\$ = 2,187 Tanzanian shillings (Tshs), obtained August 2016.

Frequency distributions for age, education and monthly household incomes were transformed for analysis. Age was categorised into four groups (18-24, 25-34, 35-44 and 45+), whilst education and monthly household income were categorized into three (Primary school and below, Secondary school and College/University and 100,000 Tshs and below, 110,000 -500,000 Tshs and  $\geq$ 510,000 Tshs, respectively).

Multivariate analyses were conducted in a two-part modelling procedure, first using logistic regression to determine whether those providing zero WTP responses differed from others. However, because the proportion of zero WTP responses was so low, the logistic regression did not reveal a significant difference. Also, it was determined that the overall coefficient that could be calculated from the two regressions in WTP analyses would not bring any additional information. Therefore, we continued with multivariate linear regression models. Sex, age, education, average monthly household income, patient type, payment modality, status of teeth, previous extraction and previous filling were the independent variables (Table 1). Because this sample contained participants with zero WTP valuations, the original value was first computed as  $1+WTP$  and natural logarithmic transformations were used as  $\ln(1+WTP)$ . Original WTP estimate data was skewed to the right, but they were close to normally distributed after the logarithmic transformation. The transformed WTP values were considered suitable to be used as dependent variables in multivariate linear regression models for respective treatment and tooth types.

**Table 1.** Distribution of characteristics among 1511 participants

	%
<i>Sex</i>	
Male	42.7
Female	57.3
<i>Age</i>	
18-24 years	25.0
25-34 years	35.0
35-44 years	24.7
45+ years	15.3
<i>Education</i>	
Primary school and below	36.4
Secondary school	42.6
College/University	21.0
<i>Patient type</i>	
Dental outpatient	48.4
Medical outpatient	51.6
<i>Income</i>	
≤100,000 Tshs	40.3
110 – 500,000 Tshs	44.4
510,000 + Tshs	15.3
<i>Payment modality</i>	
Out of pocket	74.2
Health insurance	25.8
<i>Status of teeth</i>	
Poor	47.4
Good	52.6
<i>Ever had a tooth filling?</i>	
Yes	11.4
No	88.6
<i>Ever had a tooth extraction?</i>	
Yes	52.6
No	47.4

Differences in proportions were compared using chi-square tests; Kruskal-Wallis and Mann-Whitney tests were used to test differences between the numeric variables. Multiple regression was used to explore the associations of background socio-demographic factors with WTP valuations for tooth filling and extractions. All analyses were conducted using SPSS for Windows, Version 20; statistical significance was set at  $p < 0.05$ .

Approval for the study was obtained from Ethical Committee of the Muhimbili University of Health and Allied Sciences (2015-06-12/AEC/Vol. IX/108). Permission to conduct this study in regional hospitals was obtained from the regional administrative secretaries of the respective regions (Dar es Salaam, Mwanza, Kilimanjaro and Mbeya). Permission was also obtained from the medical officers in charge of the hospitals. Participants were given verbal and written information about the study and confidentiality was assured. Signed, informed consent was obtained from all participants.

## Results

The response rate was high. Only 19 patients declined to participate, giving a response rate of 99%. The obtained sample comprised 1522 participants. Most were female and aged below 34 years (Table 1). The prevailing fees for tooth filling services ranged from 10,000 - 20,000

Tshs, and for tooth extraction ranged from 2,000 - 10,000 Tshs, depending on the facility.

The proportion of missing WTP values ranged from 8.5% - 9.3%, whereas 2.0% - 5.0% were valued at zero, depending on treatment and tooth types. The mean WTP value for a filling was consistently higher than for an extraction, irrespective of tooth type. The WTP value for a filling did not differ by tooth type. However, the mean WTP for an extraction was higher for posterior than anterior teeth. (Table 2).

**Table 2.** Willingness to pay for tooth extractions and fillings by tooth types

	<i>Anterior teeth</i>		<i>Posterior teeth</i>	
	<i>WTP Extraction</i>	<i>WTP Filling</i>	<i>WTP Extraction</i>	<i>WTP Filling</i>
Mean	5447.60 Tshs (2.5 US\$)	7397.50 Tshs (3.4 US\$)	6187.94 Tshs (2.8 US\$)	7726.37 Tshs (3.5 US\$)
95 % CI	5182.68, 5712.51	7073.96, 7721.04	5916.77, 6459.11	7397.71, 8055.03
Valid responses	1393	1380	1393	1386

Participants with perceptions of having poor dental status, with previous tooth filling experience and with previous tooth extraction experience had higher WTPs values tooth fillings than their counterparts. Dental outpatients and those belonging in the highest income category reported higher WTP values for both tooth filling and extraction services. Being aged 45+ years was associated with reporting lower WTP values for either a filling or an extraction of anterior teeth (Table 3).

Multiple regression models revealed that participants aged 45+ years were more likely to offer lower WTP values than other age groups. Those with higher income were more likely to offer high WTP values for fillings and extractions than other income groups, irrespective of tooth type. Nevertheless, these models only predicted a small proportion of total WTP variance (Table 4).

## Discussion

The finding that outpatients were willing to pay higher amounts for fillings than extractions indicates a preference towards the former option. This may be due to an appreciation of better oral health conferred by this service, as compared to tooth extractions (Tan, 2016). However, numerous studies conducted in LMICs have shown that tooth extraction is utilized much more frequently than fillings (Okunseri *et al.*, 2004; Mashoto *et al.*, 2009; Kandelman *et al.*, 2012). In all these previous studies, WTP was not used to determine preferences. Instead, preference was determined from treatment profiles of the facilities and clinical examinations of participants. Establishing the WTP values for fillings and extractions was important due to lack of available data in this population and the value of such information in provision of oral health services and planning oral health promotion.

**Table 3.** Mean willingness to pay (WTP) for dental extractions and fillings by background factors

	Anterior teeth		Posterior teeth	
	WTP Extraction	WTP Filling	WTP Extraction	WTP Filling
<i>Sex</i>				
Male	5709.8	7576.5	6568.5	7860.7
Female	5259.5	7226.3	5917.3*	7598.3
<i>Age</i>				
18-24 years	5953.5	8139.6	6644.8	8511.7
25-34 years	5157.2	7185.8	6099.9	7559.9
35-44 years	5660.3	7351.8	6228.5	7571.4
45+ years	4872.5***	6678.5**	5526.8***	7026.8*
<i>Education</i>				
Primary school and below	5554.1	7037.35	6143.6	7041.55
Secondary school	5379.5	7448.75	6099.7	7887.6
College/University	5425.1*	7888.3	6442.7*	8561.0***
<i>Patient type</i>				
Dental outpatient	5795.4	8796.7	6739.3	8983.4
Medical outpatient	5159.9***	6193.2***	5726.4***	6639.7***
<i>Income</i>				
≤100,000 Tshs	5594.1	7257.1	6215.6	7576.4
110 – 500,000 Tshs	5115.8	6911.8	5892.8	7214.6
510,000 + Tshs	6126.9***	9001.3***	6983.5***	9536.0***
<i>Payment modality</i>				
Out of pocket	5378.3	7302.0	6058.0	7595.7
Health insurance	5635.4*	7770.8*	6672.4**	8195.5*
<i>Perceived status of teeth</i>				
Poor	5498.1	8058.8	6326.8	8243.9
Good	5396.9***	6850.1**	6044.3***	7275.5**
<i>Ever had a tooth filling?</i>				
Yes	5821.5	8585.6	6331.7	9018.2
No	5413.1	7251.5	6186.4	7559.3*
<i>Ever had a tooth extraction?</i>				
Yes	5462.9	8003.6	6328.5	8353.2
No	5295.2	6729.3**	5832.5***	7091.5**

\* p < 0.05

\*\* p < 0.01

\*\*\* p < 0.001 p (MW & Kruskal Wallis tests)

The contingent valuation method aims to determine preferences among groups of individuals for services either not available in the market, or whose current prices do not reflect their value to individuals (Luchini, Protière and Moatti, 2003). Thus, one possible explanation for the discrepancy between stated preferences and utilized services might be the price of fillings at health facilities. A previous Tanzanian study showed the price for a single filling to be several times more than the daily wages for most of the population (Nyamuryekung'e *et al.*, 2015). Further, the price of fillings has been mentioned as a major barrier towards their take up (Kikwilu *et al.*, 2009). Therefore, considering the economic investment required for a filling, extractions may be more attractive by virtue of their affordability. This becomes especially relevant if the overriding concern of the patient is pain alleviation (Ntabaye *et al.*, 1998).

The proportions of both missing and zero WTP values can be considered low. Particularly in an LMIC with many people with limited experience of oral health care services, it might be expected that some participants are not able to estimate their WTP. Also, the very few zero values indicate that the services were valued. In many contingent valuation studies, 'protest votes' have been of concern. Some participants may give zero values because they do not appreciate the research, with their zero values not indicating their true willingness to pay. However, the relatively few zero values in this study suggest that protest votes did not undermine the mean WTP estimates and that the obtained values represent those of the studied population.

The WTP values for fillings were consistently lower than the fees charged by the health facilities. This supports an argument that price may be a factor explaining the high extraction rates in this setting, despite preferences for fillings. Nevertheless, due to the hypothetical nature of WTP, predicting real life decisions and behaviour may be problematic because the considerations and assumptions made in a survey may differ from the reality. Further, it is not clear to what extent the demand for dental services may be influenced by manipulating out of pocket costs and what role the other characteristics of service providers play in individual decision making. However, as demonstrated in Nigeria (Onwujekwe *et al.*, 2001), WTP valuations in a health market may correlate with and thus predict real-life decision making.

**Table 4.** Multiple regression analysis predictors of WTP for extractions and fillings of anterior and posterior teeth.

	Anterior teeth		Posterior teeth	
	Extraction β (95% CI)	Filling β (95% CI)	Extraction β (95% CI)	Filling β (95% CI)
Sex	-0.023 (-0.25, 0.10)	0.005(-0.20, 0.23)	-0.021 (-0.20, 0.23)	-0.005 (-0.25, 0.20)
Age	-0.044 (-0.16, 0.02)	-0.070 (-0.24, -0.02)	-0.067 (-0.17, -0.01)	-0.078 (-0.27, -0.04)
Education	-0.005 (-0.15, 0.13)	0.003 (-0.16, 0.18)	-0.019 (-0.16, -0.09)	0.028 (-0.10, 0.26)
Patient type	-0.010 (-0.28, 0.78)	-0.005 (-0.27, 0.24)	0.057 (-0.03, 0.34)	-0.030 (-0.39, 0.14)
Monthly household income	0.101 (0.09, 0.37)	0.075 (0.03, 0.38)	0.074 (0.02, 0.27)	0.075 (0.04, 0.40)
Payment modality	-0.041 (-0.37, 0.07)	0.015 (-0.20, 0.33)	0.002 (-0.18, 0.20)	0.013 (-0.22, 0.34)
Perceived status of teeth	-0.023 (-0.28, 0.14)	0.003 (-0.24, 0.27)	-0.013 (-0.22, 0.15)	0.019 (-0.19, 0.34)
Ever had a tooth filling?	-0.023 (-0.40, 0.18)	0.030 (-0.17, 0.53)	-0.027 (-0.37, 0.13)	0.051 (-0.04, 0.69)
Ever had a tooth extraction?	-0.017 (-0.24, 0.14)	0.010 (-0.27, 0.19)	0.000 (-0.165, 0.165)	0.003 (-0.23, 0.25)
F	10.606	10.703	10.831	20.817
R <sup>2</sup>	0.011	0.012	0.013	0.019
n	1393	1380	1393	1386

The observation that dental outpatients had consistently higher valuations for dental services may be due to the presence of existing dental problems, which may affect their perceptions and amplify the value of treatment. Medical patients on the other hand have other health problems, so dental issues may be less salient to them at that moment. Nonetheless, the WTP values are from hospital patients seeking care and thus may not be representative of the general population. Furthermore, these individuals were mostly from urban areas. Area of residence affected WTP in Thailand (Tianviwat *et al.*, 2008). Perhaps if the study sample comprised participants not in need of any health services and from rural areas, the reported WTP values may have differed. Although generalization of the WTP amounts from other settings in LMICs is not feasible, the comparative differences in stated WTP amounts for extractions and fillings remain important. Use of purchasing parity rates in future WTP studies may be valuable in enabling such comparisons.

The finding that patients with previous fillings reported high WTP values may indicate high satisfaction with treatment and its outcomes, and consequent high value placed upon it. However, it could also be that these patients' WTP was influenced by their knowledge of the market price for this service, leading to values aligned to their experiences. This 'anchoring' may bias WTP estimates (Grewal *et al.*, 1998). Alternatively, those with previous extractions also reported high WTP for fillings, which may highlight shortcomings of previous utilization patterns to indicate preference. Other factors, such as personal economic considerations, availability of equipment, material and expertise at the dental clinic or lack of knowledge regarding tooth filling may have influenced their decision making (Brennan and Spencer, 2005; Kikwilu *et al.*, 2009; Nyamuryekung'e *et al.*, 2015). The hypothetical nature of the survey (assuming that materials, equipment and services are available) and elimination of economic constraints by allowing self-determination of the payment value, might have allowed individuals' true preferences to emerge.

Techniques used to elicit WTP include open-ended, closed-ended, iterative bidding, and payment scales. However, there remains no consensus on the best approach (Hanley *et al.*, 2003). An open-ended format was used here. The validity of this format has been questioned, due to its apparent inability to discriminate between alternatives and a potentially large number of missing values. The format was considered appropriate in this setting because most patients already utilize "out-of-pocket" payments for their healthcare, which made it much easier to understand than other methods. The relatively small proportion of missing values may indicate the motivation of the participants, understanding of the described scenarios and their familiarity with "paying for a health service" with more than three-quarters of the participants utilising an out-of-pocket method for payment. The positive correlation between monthly income and WTP values may also indicate the suitability of the method. It has been suggested that variation of WTP values by income level serves as a marker for reliability of contingency surveys (Olsen and Smith, 2001). This implies that the participants probably took into consideration their level of income and individual ability to pay before making their WTP choices.

Understanding the different values ascribed to fillings and extractions allows for health promotion programs and payment policies to take population preferences into account in planning. Our findings reveal a need to ensure that public dental clinics are stocked with sufficient materials and equipment to enable filling services. Similar studies are needed in general populations and in other LMICs to establish the relative values of services and to understand the contradiction between stated preferences and utilization patterns of oral health services.

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