

Costs of dental care and its financial impacts on patients in a population with low availability of services

Nyamuryekung'e Kasusu Klint,^{1,2} Lahti Satu^{2,3} and Tuominen Risto^{4,5}

¹School of Dentistry, Department of Orthodontics, Paedodontics and Community Dentistry, Muhimbili University of Health and Allied Sciences, Tanzania; ²Department of Community Dentistry, University of Turku, Turku, Finland; ³Turku Clinical Research Centre, Turku University Hospital, Finland; ⁴Department of Public Health, University of Turku, Turku, Finland; ⁵Department of Dentistry, University of Namibia, Windhoek, Namibia

Objectives: To determine the direct and indirect costs of accessing and utilizing dental services in Tanzania and the proportion of patients experiencing economic burden due to treatment costs. **Basic research design:** Survey of 489 dental patients utilizing an out-of-pocket payment modality was carried out in four regional hospitals. Direct and indirect costs for service utilization were calculated. Financial expenditures were used to assess significant financial impacts of utilization of dental services on household economies. **Results:** Direct costs comprised 80% of the total treatment costs, whereas indirect costs comprised 20%. About half of the patients experienced significant financial impacts as a result of their utilization of dental services. Proportionately more patients from low-income households (92.2%) experienced significant financial impacts. Most patients attended the clinics due to toothache and the most widely expected treatment was dental extraction. Only 7.1% of the patients received a filling. The costs for dental restorations were three-times those for tooth extraction. **Conclusions:** Dental service utilization leads to significant financial impacts on many of the households in this setting. Increasing the rate of prepayment for health services and reducing income inequality may help to mitigate these impacts.

Keywords: healthcare costs, dental utilization

Introduction

According to the World Health Organization there are three main goals for a healthcare system: good health, responsiveness to the expectations of the population, and fairness of financial contribution (World Health Organization, 2007). The way a health system is financed is key to population health and wellbeing. The mechanisms of financing a health system vary between countries depending, among many other factors, on the economic context (McIntyre, 2001). Problems in financing health services may lead to high patient fees that are unaffordable for many in the served populations.

The health care systems of many low-mid income countries (LMICs) have faced a crisis. Their problems are numerous, ranging from inadequate infrastructure, unresponsiveness to needs, insufficient number and diversity of health personnel, poor governance and underfunding of the health sector generally (Kandelman *et al.*, 2012). The situation may often be worse as far as oral health is concerned. Oral health care is commonly detached from general health policies of LMICs and considered to run in parallel to, and separately from the general health system (Helmchen and Lo Sasso, 2010). In many LMICs, health financing programs give a very low priority to oral health, evidenced by it being allocated only very small proportions of the health budget (Petersen, 2003).

Tanzania is a large East African country with a population of approximately 50,000,000 (2015 census

projections) and is considered to be a low-income country (World Bank, 2018). The most prominent oral health problems in Tanzania are periodontal diseases, dental caries, trauma and oral cancers. However, the primary cause for dental attendance is toothache due to dental caries and the treatment modality most frequently offered is dental extraction, with restorative care and preventive services being negligibly represented. (Moshia and Scheutz, 1993; Mashoto *et al.*, 2009; Kikwilu and Mandari, 2001)

The cost of services has been determined by several studies as one of the most commonly offered reasons for delays, and sometimes indefinite postponements in accessing oral care services in LMICs. Further, it has been reported as an obstacle towards utilization of comprehensive dental care. However, there is no retrievable information on the financial burden and costs that these patients incur while utilizing dental services.

The objectives of this study were to determine the direct and indirect costs of accessing and utilizing dental services in Tanzania and proportions of patients experiencing economic burden due to treatment costs.

Methods

This study was conducted in four public dental clinics in regional hospitals in Tanzania. Public dental clinics are located within regional and district hospitals, usually situated in administrative headquarters in municipalities and cities. These hospitals were located in the Dar es Salaam, Mbeya,

Mwanza and Kilimanjaro regions. Restorative services are not consistently available in public dental facilities, usually due to the unavailability of necessary material and equipment. Only the clinics in Dar es Salaam and Mbeya were offering restorative services at the time of the study.

All dental outpatients aged 18 years or more attending the clinics during the 4-5-week study period in the respective regions were eligible for participation and included in the study. Dental outpatients were enlisted daily and consecutively during the study period. In order to calculate their financial expenditures and variation in purchasing behaviour based on their available resources accurately, only patients that utilised out-of-pocket payments (OOP) were included for analysis. Those utilising prepayment schemes or with health insurance were excluded. Patients were approached as they waited for treatment outside the clinic rooms. A research assistant explained the importance and purpose of the study and invited them to participate. Furthermore, they were informed of the voluntary nature of the study, assured of their confidentiality and right to withdraw at any point. The research assistant also clarified and responded to any questions from the patients. Patients who exhibited significant physical discomfort and pain were approached only after they had received treatment. Written, informed consent was obtained from all participants.

This study used a self-administered questionnaire and all costs were reported in Tanzanian shillings (1 Pound Sterling = 2,772 Tanzanian shillings (Tshs), FOREX August 2016). Piloting of the study tool was conducted with a small sample of dental outpatients not involved in the study. Clarity and ease of understanding of the questionnaire contents were assessed. Adjustments in wording, order and contents of the variables were made as necessary. The resultant questionnaire contained questions about patients' demographic characteristics (sex, age, education), monthly household income, number of people in the household, perceived status of teeth, major oral health problem causing attendance at the dental clinic, expected dental treatment and various costs associated with seeking it. Monthly household incomes were recorded as (1) Below 100,000 Tshs, (2) 110,000 – 250,000 Tshs, (3) 260,000 – 500,000 Tshs, (4) 510,000 – 750,000, Tshs (5) 760,000 – 1,000,000 Tshs and (6) Greater than 1,010,000 Tshs. Since the monthly household incomes were recorded as ranges of values, the means of these ranges were calculated and considered as the monthly household income values. Therefore, the mean household incomes were 1) 55,000 Tshs (2) 180,000 Tshs (3) 380,000 Tshs (4) 630,000 Tshs (5) 880,000 Tshs and (6) 1,125,000 Tshs.

Direct costs were determined by inquiring about investigation and treatment fees. All patients underwent routine visual and tactile clinical examinations included in their treatment fees. However, subject to the presenting clinical condition we inquired whether any additional investigations were requested by the dental practitioner. If so, the type of investigation and additional amount paid were recorded. The types of additional investigations included: periapical radiographs, orthopantomograms (OPGs), dental impressions and others. Information about treatment fees and payment for dental treatment provided was collected. The treatment options were (1) Tooth ex-

traction (2) Dental restoration (3) Periodontal treatment (4) Consultation and (5) Others. The total direct costs were calculated as the sum of additional investigations and treatment fees for each patient.

For travel costs, patients were asked of the amount of money spent travelling to the hospital. If the patients did not spend any money on travel (i.e. they walked) to the hospital, a value of "0" was assigned. One-way travel costs were doubled to account for the return trip. Patients were also asked whether they were escorted to the clinic, and if so their escort's travel costs were also included. The travel costs were calculated as the sum of these costs.

Travel time was calculated as the difference between departure to attend and arrival at the hospital, again doubled to account for the corresponding return trip. Treatment time was calculated as the time difference between arriving at the hospital and completion of treatment. In order to transform these times into costs, a variable which corresponded to income per unit time was constructed by dividing the mean monthly household incomes by the total number of members in the household to derive an approximate value of one individual's time per month. The time cost estimates were based on assumptions that there were 21 working days in a month and 8 working hours per day, giving 168 hours per month. Thus, the value of an hour was calculated by dividing the mean monthly household income per household member by 168. This value of unit time was used to calculate the travel, waiting and total treatment time costs. Therefore, indirect costs were calculated based on the travel costs and value of time spent travelling (return trip) and waiting for treatment.

To define whether oral health care service costs caused an economic burden on households, cash expenditures incurred during seeking and obtaining dental treatment were calculated. Travel, treatment and investigation fees were summed to form the cash expenditures related to obtaining dental treatment. The expenditures were converted to a percentage of the calculated mean monthly household income. Overall expenditures that exceeded 10% of the monthly household income were considered cause significant financial impact (SFI). This measure has been used in health research to quantify ability to pay and affordability of health services amongst patients and households dealing with chronic illnesses such as TB, HIV and others (Aspler *et al.*, 2008), but not in dentistry.

To determine changes in proportions incurring significant financial impacts (SFIs) in poor households, a set of sensitivity analyses were conducted amongst patients in the lowest income category. The household monthly income was varied in 10,000 Tshs increments from the median value within the category while holding all other values constant. Therefore, the household monthly incomes were varied from the median value (50,000 Tshs) to the upper limit of the category (100,000 Tshs) and the proportions expected to experience SFIs calculated for each income level.

Differences in proportions were compared using chi-square tests. All analyses were conducted using SPSS for Windows, Version 20; statistical significance was set at $p < 0.05$. Approval for this study was obtained from Ethical Committee of the Muhimbili University of Health and

Allied Sciences (2015-06-12/AEC/Vol. IX/108). Ethical permission was obtained from the regional administrative secretaries of the respective regions.

Results

A total 643 patients were approached, of whom 636 agreed to participate, giving a response rate of 99%. Of those agreeing, 489 (70.0%) made out of pocket payments and were included for analysis. The excluded patients were those with health insurance or whose treatment was exempt from hospital fees, subject to hospital policies. However, 66 questionnaires were either completed incorrectly or had several missing values and were omitted from further analyses. Therefore, responses from a total of 423 patients were analyzed. The mean age of the patients was 29.8 years (SD 10.4, range 18 to 73 years). Slightly more than half were female (54.3%) and 43.6% had a primary level of education. About one-third (30%) were escorted to the clinic by another adult.

Age, sex, education and monthly household incomes were not associated with utilization of either dental extraction or restorative services. Most attended the clinics with toothache and the most widely expected treatment was an extraction. Nevertheless, in clinics offering restorative care, the proportion of patients expecting to receive such treatment was higher. Similarly, attendees in clinics that

offered restorative care were more likely to have had dental restorations previously and to assess their dental status more favorably than those attending clinics not offering restorative services (Table 1).

Overall treatment fees had an interquartile range from 5,000 Tshs to 10,000 Tshs. Only 7.1% of the patients received a dental restoration. However, treatment fees differed between those that received restorations and those that had extractions. The median extraction fee was 5,000 Tshs compared to 15,000 Tshs for a restoration. A small proportion (2.6%) of the patients were prescribed any investigations; the median fees were also some of the highest, at 15,000 Tshs (Table 2).

About half (51.7%) of the total treatment time costs were attributed to waiting times in the clinics, which ranged from 15 minutes to 6 hours 45 minutes, with the median being 2 hours and 30 minutes. Indirect costs contributed about 20% of the total costs incurred by patients (Table 2).

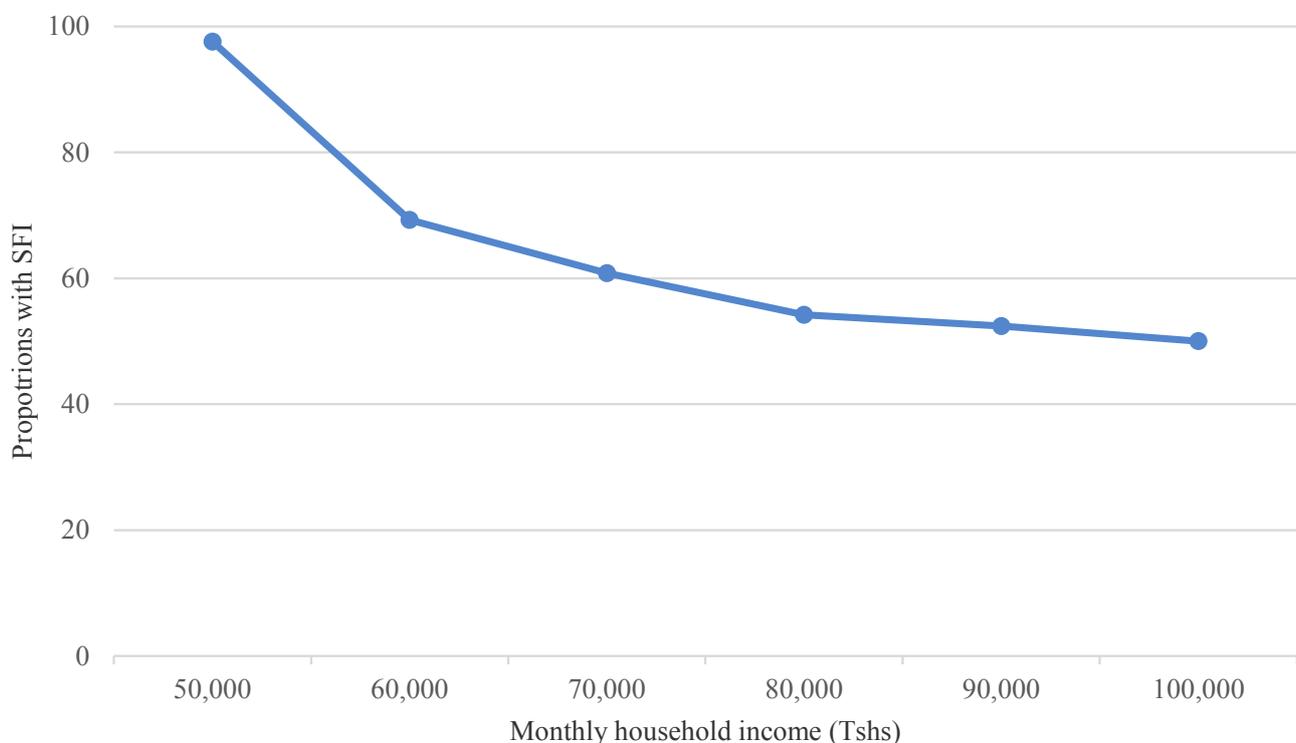
About half (54.7%) of the patients experienced significant financial impacts as a result of their utilization of dental services. Proportionately more patients from low-income households (92.2%) experienced SFI. Sensitivity analyses revealed that even if the income level of the lowest income group was doubled up to 100,000 Tshs, the proportion of patients experiencing SFI would be 50.0% (Figure 1).

Table 1. Characteristics of the study population (n = 423) by dental provider service profile

Variable		Restorative services absent n (%)	Restorative services present n (%)	P (Chi sq.)
Age	18-24 years	101 (39.5)	53 (33.5)	0.541
	25-34 years	88 (34.4)	65 (41.1)	
	35-44 years	40 (15.6)	24 (15.2)	
	45+ years	27 (10.5)	16 (10.1)	
Sex	Male	123 (47.7)	69 (42.6)	0.359
	Female	135 (52.3)	93 (57.4)	
Education	Primary	117 (45.2)	66 (41.0)	0.647
	Secondary	105 (40.5)	68 (42.2)	
	Tertiary	37 (14.3)	27 (16.8)	
Household income	<100,000 Tshs	140 (54.9)	78 (50.3)	0.318
	110,000 – 250,000 Tshs	68 (26.7)	35 (22.6)	
	260,000 – 500,000 Tshs	26 (10.2)	21 (13.5)	
	510,000 – 750,000 Tshs	10 (3.9)	12 (7.7)	
	760,000 – 1,000,000 Tshs	8 (3.7)	8 (5.2)	
	>1,000,000 Tshs	3 (1.2)	1 (0.6)	
Presenting complaint	Toothache	245 (94.6)	146 (89.6)	0.151
	Gum disease	3 (1.2)	3 (1.8)	
	Others	11 (4.2)	14 (8.6)	
Expected treatment	Tooth extraction	232 (89.6)	115 (71.9)	0.000
	Dental restoration	10 (3.9)	25 (15.6)	
	Periodontal treatment	0 (0.0)	1 (0.6)	
	Consultation	12 (4.6)	12 (7.5)	
	Others	5 (1.9)	7 (4.4)	
Restored tooth	None	243 (94.6)	129 (81.6)	0.000
	At least one	14 (5.4)	29 (18.4)	
Perceived status of teeth	Poor	211 (81.5)	113 (70.6)	0.014
	Good	48 (18.5)	47 (29.4)	

Table 2. Median and interquartile ranges (IQR) for direct, indirect and total costs among 423 dental patients.

Variables	Patients reporting cost			
	n (%)		Median (IQR)	
DIRECT COSTS				
Investigation fees	11	(2.6)	15,000	(10,000 – 20,000)
Overall treatment fees	423	(100)	10,000	(5,000 – 10,000)
Tooth extraction fees	336	(79.4)	5,000	(5,000 – 10,000)
Dental restorations fees	30	(7.1)	15,000	(10,000 – 22,000)
Total direct costs			10,000	(5,000 – 10,000)
INDIRECT COSTS				
Transportation costs	409	(96.7)	1,200	(800 – 2,200)
Value of overall treatment time	366	(86.5)	589.4	(265.9 – 1437.8)
Value of return travel time	387	(91.5)	218.3	(98.2 – 603.2)
Value of waiting time	366	(86.5)	304.7	(138.7 – 727.1)
Total indirect costs			2,202.3	(1,184.3 – 1,437.8)
TOTAL COSTS			11,081.2	(6,921.3 – 13,537.7)

*Figure 1. Variation in significant financial impacts (SFIs) and household monthly income amongst participants in the lowest income category*

Discussion

The costs for these patients to utilize dental services can be considered high, with half of them expected to experience significant financial impacts as a result of their utilization. Direct and indirect costs contributed four-fifths and one-fifth of total treatment costs, respectively. Services were not uniformly available across the dental facilities.

The SFI measure using the reported incomes of participants has been considered a useful proxy of the burden of cost and ability to pay for health services. Nevertheless, most studies use the catastrophic health expenditure (CHE) measure (Su *et al.*, 2006; Xu *et al.*, 2007; Van Minh *et al.*, 2013; Bernabé *et al.*, 2017;

Wagstaff *et al.*, 2017). By its definition, CHE employs a much more stringent criterion than the SFI, requiring households to spend more than 40% of their annual non-food expenditures (Xu *et al.*, 2007). Although it has not been used in dentistry before, the SFI was considered as an appropriate measure to quantify the magnitude of out-of-pocket payments; especially due to the high impoverishment levels and relatively high costs for dental services in this setting.

The finding that about half of all participants would incur SFI from utilizing dental services is disconcerting. It implies either high fees for dental services, low household income levels, high transportation costs or a combination of these factors. Additionally, waiting and travel times contributed to the experienced costs. Previous research by

Brinda *et al.*, (2014) in Tanzania revealed that 18% of the households experienced catastrophic health expenditures, primarily because of out-of-pocket payments for health services. Low income levels have been independently associated with greater likelihood of utilizing out-of-pocket payments for healthcare (McIntyre, 2001). Conforming to findings from the Tanzanian household survey (2013), proportionately more participants in this study originated from households with low monthly incomes. Accordingly, SFIs were mostly clustered around these households, with the wealthier households remaining largely unaffected. The financial expenditures associated with dental service utilization were collected at the point of, and during service provision, eliminating possible recall bias. Thus, the calculated impacts may reflect the actual situation within the studied population.

Possible limitations of the SFI measure are that a large proportion of the Tanzanian population is informally employed and thus have unstable incomes with frequent fluctuations. Further, many of its population are subsistence farmers, consuming the food that they grow (United Republic of Tanzania, 2014). Nevertheless, there are significant difficulties associated with measuring household consumptions, especially in low and middle income settings. Piloting of the study tool revealed that making the response option to the question: "What is your average monthly household income" a categorical response with ranges of incomes rather than an open ended one yielded much higher response rates. The ranges in the response categories possibly allowed participants to consider their fluctuating incomes and were thus used to deduce average household incomes. This is corroborated by the distribution of reported incomes being similar to those reported in Tanzanian household budget surveys; suggesting that participants could estimate their monthly household incomes fairly accurately (United Republic of Tanzania, 2013).

Average household monthly incomes were used as a proxy for overall consumption in this study. This measure of household income may under-estimate the overall household consumption because household income measures only monetary resources, whereas household consumption also includes non-monetary resources. Furthermore, the household financial impacts experienced will vary depending on the household member seeking treatment. The impacts on main earners will be greater than for household members who don't contribute financially to the household. Nevertheless, in the absence of better, readily available measures of consumption, household incomes were considered appropriate for the purposes of quantifying the financial implications of dental service charges on the household economies.

The differing availability of dental restorative services across healthcare facilities exemplifies structural inequalities in health as suggested by Watt (2007). Inequalities in oral health are considered to be differences that are both avoidable and unfair within the society. In this case, entire groups of people are selectively and regionally excluded from benefitting from restorative dental services, despite them being available in similar health facilities within the same society. The effects of this disparity are likely to disproportionately affect the poorest members of society. Unlike their better-off counterparts, they have fewer

options and means to obtain these services elsewhere. (Watt *et al.*, 2015)

Patients that received dental restorations paid approximately three times more than those that had dental extractions. Consequently, the proportion of patients that received restorations was very low. Previous studies support the perceived high cost of restorative services in Tanzania as a barrier to their receipt (Kikwilu *et al.*, 2009; Nyamuryekung'e *et al.*, 2015). A previous population survey in this setting revealed that close to three-quarters of all that reported oral symptoms did not seek dental services, with cost being the most frequently cited reason for non-attendance (Kikwilu *et al.*, 2008). Indeed, paying for dental services increases the likelihood of low-income households experiencing significant health expenditures (Bernabé *et al.*, 2017). Nevertheless, our data were from low-income patients that had already made the decision to incur out of pocket costs for dental services. Therefore, they either considered themselves able to sustain the cost, or could not postpone treatment.

Another limitation of this study was the non-inclusion of medication fees in the calculation of costs. Typically, treatment fees include the costs of prescribed medications; subject to their availability. However, health facilities in this setting experience recurrent medication stock-outs and only a fraction of all prescribed medications are regularly stocked in the hospital pharmacies. Hence, outpatients frequently have to purchase their medications in private pharmacies (Brinda *et al.*, 2014). Due to the wide variability in prescribing patterns, purchasing behaviors and prices of medication, they were not included in our cost calculations. Furthermore, use of over-the counter medication is widely prevalent in Tanzania and is the preliminary course of action more many people experiencing illness. However, we also did not inquire about costs due to self-medication of the presenting complaint before attending the hospital. A multi-country study by Bernabé *et al.* (2017) showed that buying over the counter medication had a similar financial effect on households as that of hospital admission. This further highlights medications as a significant source of health expenditures. Therefore, our calculated direct costs and financial impacts might be conservative estimates of the actual costs.

Indirect costs contributed to the overall costs of accessing dental services. Although calculations for individual time-costs were based on overall household incomes; they were considered a valid proxy to determine indirect costs of seeking and utilizing care. This is due to the difficulty in obtaining participants' individual income levels, because so many either worked at home, worked outside their home only occasionally or received part of their compensation not as money but as in-kind compensation, such as in groceries, other food items or other goods. Thus, the time-cost estimate calculated in such a setting is in any case an imprecise measure.

Travel costs constituted slightly more than half of the total indirect costs. A previous population-based survey elucidated that travel costs were the reason for non-attendance to dental clinics for up to 15% of participants, despite them having oral pain (Kikwilu *et al.*, 2008). Indirect costs can be substantial barriers to obtaining dental treatment, and particularly affect people living in rural areas; where accessing of services might involve extensive travel and

social arrangements (Curtis *et al.*, 2007). Thus, it is very likely that participants from rural areas within this study incurred greater indirect costs than their town dwellers, compounded by them being less wealthy than their urban counterparts. Therefore, not only will they incur greater indirect costs, but the consequences of such expenditure will also have a greater impact on their economies. Due to the difficulties and ambiguities of rural/urban categorization within this setting, we did not inquire about participants' area of residency. Therefore, the findings of this study can be considered to be generalizable to urban dental outpatients attending regional hospitals in Tanzania.

About one third of participants were escorted to the hospital by at least one adult. Therefore, the overall productivity loss and indirect costs extend to other family members. Waiting times were also long; in some instances, exceeding six hours. Accordingly, waiting time was the source of the second highest indirect cost. Currently, Tanzania does not use an appointment system for public dental services; all treatment is considered as "emergency" and is provided on a first come- first serve basis. The introduction of appointment systems might reduce indirect costs experienced from waiting times.

Dental service utilization leads to significant financial impacts to many of the households in this setting. Increasing the rate of prepayment for health services and reducing income inequality may help to mitigate these negative effects. Interventions aiming at ensuring the availability of affordable fluoridated toothpaste and policies that reduce sugar consumption in vulnerable population groups may reduce need in the long term. Health policy targeted at the poorest segment of the population, with the aim of decreasing health inequality, is needed.

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