

BMJ Open Economic burden of managing oral cancer patients in Sri Lanka: a cross-sectional hospital -based costing study

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ABSTRACT

Objective Cancer of the oral cavity is the leading malignancy among males in Sri Lanka, and sixth among women. This study aimed to estimate costs of managing patients with oral cancer (OCA) in Sri Lanka for a 12 month period from diagnosis.

Design Hospital based costing study.

Settings Four selected cancer treatment centres in Sri Lanka.

Participants Sixty-nine OCA patients: 60 were males and 12 had recurrent tumours.

Outcome Societal perspectives (healthcare, household and indirect costs) were itemised. Costs to the healthcare system included surgery, Intensive Care Unit (ICU) care, chemotherapy and radiotherapy. Capital costs including apportioned value of land, buildings, equipment and furniture. Household costs consisted of out of pocket expenditure for healthcare and indirect costs of lost income. Costs were estimated from the stage of presentation for treatment to 1 year of follow-up.

Results Mean cost of managing a single stage II OCA patient for 1 year was Sri Lankan rupees (SLR) 58 979 (US\$394, at the midyear exchange rate in 2016) to the health system. Mean household cost was SLR 77 649 (US\$518). The annual cost of managing a stage III or IV patient was SLR 303 620 (US\$2027), with household costs of SLR 71 932 (US\$480).

Conclusions Owing to the high incidence of OCA in Sri Lanka, the economic costs associated with these diseases are enormous, resulting in negative impacts on both the healthcare system and individual families, seriously impacting the country's economy. Policy-makers should take note of this burden and increase steps for prevention and control of this devastating disease.

INTRODUCTION

Oral cancer poses a huge challenge to the well-being of people worldwide, and more specifically in the Asian region. Here we define oral cancer as malignant neoplasms of lip, tongue and mouth (OCA). Taken together, these cancers were estimated to affect 354864 people worldwide in 2018, with 177384 deaths.¹ Fifty-six per cent of the world's oral and pharyngeal cancer burden

Strengths and limitations of this study

- A unique methodology was developed to collect costing data in low socioeconomic settings.
- This methodology could be replicated in similar countries with high prevalence of oral cancer.
- Arbitrary depreciation and personnel rates were taken due to unavailability of government validated costing algorithms.
- Cost calculations could be incomplete due to missing records.

(excluding nasopharyngeal carcinoma) is from Asia. The incidence of oral cancer for men was estimated at 14.8 per 100 000 population per annum in Globocan 2018. Incidence of oral cancer among men in Sri Lanka was 15.6 per 100 000 population as reported in 2014.² Oral cancer accounts for nearly 10% of reported cancers with the highest mortality rates of all cancers in Sri Lanka.²

Both incidence and prevalence approaches have been used to assess the costs of cancer care across the globe. The incidence-based approach assesses the costs of new cases reported in a year and then adds life-time costs. The prevalence-based approach assesses all new and old cases known in a single or particular year. Life-time costs include all expenditures from diagnosis to death. Several examples of the costs of managing head and neck cancer have been published from developed countries: A cross-sectional study from New Zealand reported that cost as NZ\$22 694 per patient.³ In England, the cost of treating oral and oropharyngeal carcinoma was £213 million for a 5 year period. The cost of treatment for oral and oropharyngeal carcinoma in the USA per patient was reported as US\$13513 for each stage IV case over 3 years.⁴

In Sri Lanka 3.5% of Gross Domestic Product is spent on the health budget. Of that, Sri Lankan rupees (SLR) 5945.5 million

(2.3% of the current health expenditure) were spent in treating neoplasms.⁵ Sri Lanka provides a totally free healthcare service to all citizens. There is no published information on the cost of care for OCA patients in Sri Lanka. This study aims to establish this information by conducting a costing exercise within the Sri Lankan health system.

METHODS

A descriptive cross-sectional study with cost analysis was conducted using activity-based costing with cost apportionment and step-down costing approach. The study was conducted in selected cancer treatment centres in Sri Lanka; the University Dental Hospital Peradeniya (PDH), Apeksha Hospital, Maharagama and Oro-maxillofacial units of General Hospital Kalutara and Kegalle. As both Apeksha Hospital and PDH are centres of excellence for treatment of OCA and treat most of the cases in the nation, it was important to include these two institutions. Two oral and Maxillofacial treatment units were selected randomly from the 25 units across the nation. Sixty nine patients with histopathological confirmation of OCA were selected for study. These patients had squamous cell carcinomas of the oral cavity, arising from the buccal mucosa, retro-molar areas, oral (anterior two-thirds) of the tongue, floor of the mouth, hard palate or lips: these are the common sites, with abuse of areca nut, smokeless and smoked tobacco, and alcohol, often in a background of diets deficient in essential macronutrients and micronutrients as the main risk factors: Human Papilloma Virus-driven cancers are not prominent in these sites in this population.⁶ Malignancies of the nasopharynx, oropharynx, hypopharynx and other pharynx were excluded.

Trained personal were used for data collection. Patients admitted to the oncology or onco-surgery wards for treatment during the year 2016 were recruited. All patients had a minimum of 1 year follow-up with data being collected throughout a 12-month period. Information regarding the type and stage of the disease, treatment procedures and other related details were obtained from patient records. An interviewer-administered questionnaire was used to collect information from the patients regarding their sociodemographic situation and indirect costs incurred.

The study considered two major types of cost: health system costs and household costs. Health system costs included recurrent and capital costs. Recurrent costs consisted of overhead activities (such as utility and supportive services and administrative personnel), intermediate activities (such as salaries of clinicians, medicines and consumables) and costs associated with clinic visits. Capital costs included land value, buildings and equipment. Apportionment of the times of personnel, equipment depreciation, utility services and supportive services to the activity were derived from discussion with experts in the field: medical specialists and personnel involved in

these activities. Cost information of the hospital (salaries, utility and supportive services, equipment purchases and equipment values) were obtained from account ledgers, financial reports, pay sheets and expenditure reports of financial departments of the hospitals. Costs of drugs and consumables were obtained from price lists of the Medical Supplies Division of government. Service-related details were obtained from annual statistical bulletins of the hospitals.

Household costs consisted of direct and indirect costs. Direct costs constituted all the components of out-of-pocket expenditures during the study period for medicines, investigations, travel and food. Indirect costs included opportunity cost for the patient and his/her main carer which were incurred due to clinic visits or hospital days. Opportunity cost per day was calculated by dividing the monthly income of such individuals by days per month (30 days). A standardised data collection form was used to record this information.

Face and content validity were ensured by pilot testing of the checklist and questionnaire in Apeksha Hospital with patients other than OCAs and discussions with experts in the field. Cost data were collected from records in various administrative and financial offices, and from patients when collecting data for household costs. A 10% sample of the questionnaires was rechecked with clinic and BHT records by the first author to enhance the validity and reliability of data.

Data analysis

The opportunity cost of personnel time per minute was derived by dividing their monthly basic salary by minutes per month [30 (days) x 24 (hours) x 60 (min)]. For each intermediate activity, total cost per investigation or procedure was calculated and for each final activity (Clinic, Ward and ICU) cost per patient per day was calculated. Finally, for each patient, a list of final and intermediate activities and number of times that the patient underwent each activity for a period of 12 months were listed using a standard data collection format. The patient cost was the cumulative cost of all these activities. Patients were interviewed to obtain out of pocket expenditure, transport costs, and other indirect costs. Total costs per patient per day, for patients diagnosed with different stages of OCA, were calculated separately. Costs for inward patients and OPD patients who attended review clinics were derived separately.

Patients and public involvement

Patients were not involved in the development of the research questions and design stage of the study. Overall results were returned to patients during the quarterly meetings of the 'Voice of Blue Pea' Patient Group which is an oral cancer victim group established in the main cancer treatment centres in Sri Lanka.

RESULTS

Of 69 OCA patients, 60 were male. Age ranged from 40 to 81 years and 78% of the patients were less than 60 years of

Table 1 Sociodemographic characteristics OCA patients

Characteristics	OCA patients	Percentage
Sex		
Male	60	87.0
Female	9	13.0
Age		
Years 40–50	17	24.6
50 – 60	30	43.5
60 – 70	12	17.4
Above 70 years	10	14.5
Education		
No formal education	7	10.1
Up to general certificate of education (GCE) ordinary/ level exam	55	79.7
GCE advanced level and postgraduate	7	10.1
Stage of diagnosis		
Stage II	6	8.7
Stage III	37	53.7
Stage IV	26	37.7
Recurrences		
Total	69	100

OCA, oral cancer.

age. Most (66%) patients were from disadvantaged backgrounds. Twelve patients had presented with recurrence. Only six OCA patients were in stage II, the remainder being stage III and IV (table 1). Eighty per cent of the OCA patients reporting to these cancer treatment centres were chewers of betel quid, 48% were smokers and 67% were consuming alcohol regularly. Among the areca nut/betel-chewing patients, the mean number of quids chewed was 6.9 quids per day (range 0–25); mean number of cigarettes and/or Bidi smoked was four per day (range 0–25).

The present study also assessed the average monthly income and average expenditure on presumptively deleterious lifestyle habits. Average monthly income of the OCA patients was SLR 20 669 (US\$138) and SLR 3003 (US\$20) was spent on betel quid chewing monthly (table 2). On average, a total of SLR 10 299 (US\$69) was spent monthly by each of the 40% of patients who practiced these habits. This amounts to approximately half of each patient's average monthly income.

The mean cost of managing a stage II oral cancer patient was SLR 136 628 (table 3). The highest portion of this was the health system cost. Direct and indirect household cost was higher than the health system cost. A patient had to bear about 28% of the total cost paying as out of pocket expenditure and 41% total cost as direct treatment-related expenses.

Cost of managing stage I and IV patient with oral cancer was higher than a stage II patient. The total cost

Table 2 Average monthly income and money spent on habits by OCA patients

Monthly income and expenditure for lifestyle habits	Amount in SLR (range in SLR)
Monthly income	
Average patient monthly income	20 669 (800–150 000) (US\$138)
Patients household average monthly income	24 728 (4000–150 000) (US\$165)
Average expenditure for habits	
Monthly expenditure for areca nut/betel quid chewing	3003 (300–10 740) (US\$20)
Monthly expenditure for tobacco smoking	3214 (0–10 500) (US\$21)
Monthly expenditure for consumption of alcohol	4082 (0–22 400) (US\$27)

OCA, oral cancer; SLR, Sri Lankan rupees.

per patient was SLR 375 551 (table 4). The highest cost portion was borne by the health system. The out-of-pocket cost for the patient was 8.7% of the total cost.

DISCUSSION

This is the first study in calculating cost of OCA in the South Asian region where oral cancer is highly prevalent. We found very high out-of-pocket costs for all patients, most of whom are from low socioeconomic backgrounds. The methodology developed in this study can be of relevance to similar economies in calculating cost of any diseases.

Compared with the other cancers, OCA is a preventable cancer because of its strong association with habits of areca nut/betel quid chewing, tobacco use and alcohol misuse. The majority of OCAs which present in low and Middle Income countries arise from a potentially malignant disorder. Unfortunately, most patients with OCA present with advanced disease.⁷ Every year around 1500–2000 new cases of OCA are diagnosed in Sri Lanka,² where almost all patients then receive treatment from State hospitals. As the country has universal free health services, costs are borne by government. In addition, the patient and his/her immediate family have to bear many indirect costs which can be catastrophic for them. To date, no proper cost analysis has been done in the country to identify the actual direct and indirect cost for the management of OCA and to compare it with preventive measures to identify the cost effectiveness.

The study attempted to calculate total costs of management of different stages of OCA for the first time in Sri Lanka. The hospital records of many of these patients were incomplete, and no billing system was in place in the hospitals. Use of advanced investigations, types of surgeries performed, use of radiotherapy and chemotherapy, vary from centre to centre, and operator to operator. Facilities in State sector hospitals are severely

Table 3 The health system cost and household cost of managing single stage II oral cancer patient for 1 year

Cost category	Item	Cost in SLR
System		
Recurrent cost	Clinic visit	273
	Biopsy	1399
	Dental extraction	337
	X-ray	532
	Scan	255
	Lab	636
	Ward management	7983
	Surgery	41 946
	Surgery consumables	202
	Follow-up clinic visit	3000
	Staff overhead cost	527
		Total
Capital cost	Land	145
	Building	158
	Furniture	1585
	Total	1888 (US\$13)
Household cost		
Direct cost (Out Of Pocket Expenditure)	Medicines/investigations	18 200
	Travel	11 249
	Food	8 839
	Total	38 287 (US\$256)
Indirect costs	Patient_stay home	8 858
	Patient_ward days	8 176
	Patient clinic	8 176
	Carer cost ward	7 840
	Companion clinic visit	6 311
	Total	39 362 (US\$263)
Total cost		136 629 (US\$912)

SLR, Sri Lankan rupees.

limited, leading to suboptimal use of diagnostic and staging investigations, and many of the treatment modalities used may have been far from international standard. Costs derived may not represent ideal outcomes from the patient perspective, but reflect the actual situation in the nation. Many costs may have been underestimated due to the difficulties in collecting accurate information from hospital records. Similar difficulties have been reported by others in collecting accurate cost data.⁸

For a patient with stage II OCA, system cost of management was approximately SLR 58 979 (US\$93.72) and household cost around SLR 77 649 (US\$518). For a patient with stage III or IV disease, system cost was around SLR 303 620 (US\$2027) and household cost around SLR 71 932 (US\$480). We did not encounter cases with stage I OCA for cost analysis but can reasonably assume that it is less than stage II cases. This finding is consistent with the

findings of other similar studies.^{8,9} Our results highlight the importance of early diagnosis of oral cancer, not only to improve survival and the patient's quality of life, but also to minimise costs to the health system.

In Greece in 2002, the average cost of treatment for a patient with OCA was estimated to be US\$7450 (~SLR 1 200 000)⁸ whereas in the Netherlands in 2001, it was US\$ 22 080 (SLR 3 315 000)¹⁰ and in the USA in 1998, it was reported as US\$32 500 (around SLR 4 875 000).¹¹ In the present study, the average cost for management of OCA was much lower, ~SLR 350 000 (~US\$2300). In India,¹² average treatment cost for OCA was calculated at ~146 000 Indian rupees (~SLR 375 000 or US\$2400), similar to our values, although the majority of patients in the Indian study were stages I and II. Advanced rehabilitation of surgically treated patients, such as dental and facial prostheses were not provided to this cohort of

Table 4 The health system cost and household cost of managing a single stage III and IV oral cancer patient for 1 year

Cost category	Item	Cost in SLR
System cost		
Recurrent cost	Clinic visit	273
	Biopsy	1399
	Dental extractions	337
	Dental restorations	415
	X-ray	532
	Scan	255
	CT scan	1094
	Lab	1062
	Ward management	7983
	Surgery	50383
	Surgery consumables	190
	ICU ward management	113782
	ICU investigation	998
	Radiotherapy	55818
	Chemotherapy	63683
	Follow-up clinic visit	3000
Staff overhead cost	527	
	Total	301 731 (US\$2011)
Capital cost	Land	145
	Building	158
	Furniture	1585
	Total	1888 (US\$13)
Household cost		
Direct cost (Out Of Pocket Expenditure)	Medicines/investigations	12059
	Travel	10126
	Food	10385
	Total	32570 (US\$217)
Indirect costs	Patient stay home	8858
	Patient_ward days	8176
	Patient clinic	8176
	Carer cost ward	7840
	Companion clinic visit	6311
	Total	39362 (US\$263)
Total cost		375551 (US\$2507)

SLR, Sri Lankan rupees.

patients. If the nation can move to provide such services, much higher costs will be incurred.

CONCLUSION

The cost of management of OCA patients in Sri Lanka is extremely high, in relation to mean per capita income and national Gross Domestic Product. This has negative impacts on both the healthcare system and on individual families and impacts the national economy. Most

patients affected by this devastating disease are in low socioeconomic category, burdening their families with catastrophic financial consequences. Early identification can reduce the cost of management of OCA significantly. Policy-makers should take note of this burden and take immediate and effective steps to improve primary prevention and early detection of OCA.

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Contributors All authors designed the study, generated hypotheses, interpreted the data and critically reviewed the manuscript. HA analysed the data and wrote the first draft, RDJ contributed in data collecting and writing and editing the manuscript, DD and SK developed the data collection tools and developed the methodology. MA participated in data collection and in editing the manuscript, NJ and PAS advised on study design and edited the manuscript. All authors approved the final version.

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REFERENCES

1. Ferlay JEM, Lam F, Colombet M, *et al*. Global cancer observatory: cancer today. Lyon, France: International Agency for Research on Cancer. 2018 <https://gco.iarc.fr/today> (Accessed 24 Jan 2019).
2. National Cancer Control Programme. Cancer incidence data Sri Lanka. 2014 www.nccp.health.gov.lk/index.php/publications/cancer-registries (Accessed on 30 Jan 2019).
3. Jayakar R, Choi J, MacKinnon C, *et al*. The cost of major head and neck cancer surgery. *N Z Med J* 2017;130:111–9.
4. Keeping ST, Tempest MJ, Stephens SJ, *et al*. The cost of oropharyngeal cancer in England: a retrospective hospital data analysis. *Clin Otolaryngol* 2018;43.
5. Health Economics Cell MoH, Nutrition & Indigenous Medicine Sri Lanka (2016). *Sri Lanka national health accounts 2013*. Sri Lanka, Colombo: The Ministry of Health, 2016. ISBN: 978-955-0505-76-0.
6. Johnson NW GB, Speicher DJ, Ray C, *et al*. Etiology and Risk Factors, Chapter 2 in Shah JP and Johnson NW. Oral and Oropharyngeal Cancer, Second Edition, CRC Press. 2018 <https://www.crcpress.com/Oral-and-Oropharyngeal-Cancer/FACS-MDSc/p/book/9781498700085>.
7. Alahapperuma LS, Fernando EA. Patient-linked factors associated with delayed reporting of oral and pharyngeal carcinoma among patients attending national cancer institute, Maharagama, Sri Lanka. *Asian Pac J Cancer Prev* 2017;18:321–5.
8. Zavras A, Andreopoulos N, Katsikeris N, *et al*. Oral cancer treatment costs in Greece and the effect of advanced disease. *BMC Public Health* 2002;2:12.
9. Han S, Chen Y, Ge X, *et al*. Epidemiology and cost analysis for patients with oral cancer in a university hospital in China. *BMC Public Health* 2010;10:196.
10. van Agthoven M, van Ineveld BM, de Boer MF, *et al*. The costs of head and neck oncology: primary tumours, recurrent tumours and long-term follow-up. *Eur J Cancer* 2001;37:2204–11.
11. Funk GF, Hoffman HT, Karnell LH, *et al*. Cost-identification analysis in oral cavity cancer management. *Otolaryngology–Head and Neck Surgery* 1998;118:211–20.
12. Goyal S, Tiwari VK, Nair KS, *et al*. Risk factors and costs of oral cancer in a tertiary care hospital in Delhi. *Asian Pac J Cancer Prev* 2014;15:1659–65.