

The distribution of dental health specialist locations in Sri Lanka

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Aim: To investigate the distribution of dental health specialist locations staffed by Oral and Maxillo-Facial Surgeons (OMF), Restorative dentists, and Orthodontists in Sri Lanka in relation to population distribution and socio-economic status. **Methods:** Specialist dental locations were mapped using GIS (Geographic Information System) and overlaid with census population data and socio-economic quintiles. **Results:** Overall, there was an uneven geographic distribution of the total 55 specialist dental locations and 74 attributed specialist work force within the country. Access to specialist care is remarkably high in Western and Central provinces, compared to the Northern, Eastern and North Central provinces. When the geographic distribution was compared to population socio-economics, it was found that in Sri Lanka only 22.3%, 44.4%, and 25.4% of the most disadvantaged lived within 20 kms from an Orthodontic, OMF and Restorative clinic respectively, compared to 66.3%, 82.8% and 44.7% of the least disadvantaged. **Conclusion:** The findings of this study can contribute to the decision-making process when determining future locations of dental specialist clinics and identifying subgroups in the population who are geographically and socio-economically isolated from accessing care.

Keywords: Specialist, Sri Lanka, Spatial Distribution, Oral Health

Introduction

Specialist dental care in Sri Lanka is the provision of more complex services by qualified specialist dental practitioners, mostly on referral from general dentists, working in the public or private sector. During the past decade, the number of clinical dental specialists in Sri Lanka has increased substantially, especially in the main three clinical disciplines of dentistry: Oral and Maxillofacial Surgery (OMF); Orthodontics; and Restorative Dentistry. Specialist training includes procedures such as orthodontic treatments, fixed crown and bridges, dental implants, more complex surgery of the mouth and jaws, and complex periodontal and endodontic treatment. Although the government's financial contribution to the training of specialists is substantial, their services are limited to a small sector of the population.

There is a polarization of oral diseases and the socioeconomically disadvantaged, with marginalized groups carrying the highest burden of oral diseases in many parts of the world (Peterson *et al.*, 2005). With a new global partnership to eradicate poverty through Sustainable Development Goals, Universal Health Coverage (UHC) has been recognized as important (United Nations, 2012). Achievement of UHC is an important goal to reduce oral health inequalities within and between countries. Hence, oral healthcare facilities should be universally available, accessible, acceptable, appropriate and of good quality with reference to the needs of children, adults, elderly, low income and socially disadvantaged people.

Sri Lanka is an island located in the centre of the Indian Ocean. It is a lower middle-income country with a total population of 20.3 million, and the population density of the country was 325 persons per square kilometre in 2012. Over half of the population is concentrated in the Western, Central and Southern provinces, which jointly cover less than one fourth of the total land area (Census of Population and Housing, 2012). Sri Lanka's Human Development Index (HDI) value for 2015 is 0.766 and the country was placed in the high human development category, positioning it at 73 out of 188 countries. However, if the value is discounted for inequality, it falls by 11.6%, reflecting pockets of poverty persisting in the North, East, Estate sector and Moneragala district, where equality of opportunity in terms of access to the services are weaker (The World Bank Group, 2017).

In Sri Lanka, specialized oral healthcare is provided freely through Base Hospitals (BH), District General (DGH), Provincial General (PGH) and Teaching Hospitals (TH) and some selected specialized hospitals, and in the Dental Teaching Hospital Peradeniya (DTHP), as a part of the training programme for both general dentists and specialist dentists. The established oral healthcare service delivery system is mainly curative oriented, and both public and private sectors are involved in service provision. However, 60-65% of services are provided by the public sector, with the majority of public dentists, and almost all the public dental specialists also involved in part time private practice (Ministry of Health, 2015).

The public dental service is working towards a clear vision, 'Healthy, smiling Sri Lankan nation with 20 functional teeth at the age of 80 years' (Ministry of Health, 2015). Therefore, comprehensive, free oral healthcare care services are provided through all outpatient dental clinics and specialized units located in government hospitals. However, demand for specialist oral healthcare in Sri Lanka is a growing concern in response to a rapid demographic transition leading to population growth and aging (Samaraweera and Maduwage, 2016). Hence, increased tooth retention into older age, has increased demand for more advanced restorative procedures and new technologies in dental care. Similarly, the long term accumulation of tobacco consumption among older people has increased demand for surgical interventions in oral cancers and related disease.

According to the available statistics on the oral healthcare workforce in Sri Lanka, the ratio of general dentists per 100,000 population was 6.4 in 2012. At the end of 2012, there was a total of 1462 general dentists in the public sector, and approximately 795 in the private sector (Ministry of Health, 2012). In 2015 there were 1536 general dentists, and 58 specialists belonging to the three main clinical dental specialties under the Ministry of Health (Ministry of Health, 2015). Access to dental specialists is limited around the country, especially in rural and remote areas. Irosha and colleagues (2012) concluded that there are obvious limitations in oral healthcare services within rural and poor communities in Sri Lanka.

Despite the recent advances in dental specialties, and freely available dental care, oral diseases such as dental caries, periodontal diseases and oral cancers are widespread. At the last National Oral Health Survey in 2002/2003, over 65% of 5-year olds had early childhood dental decay. There were also high levels of oral disease among young adolescents, adults and older people. The dental caries prevalence among 12-year olds was reported as 40%. According to the same report, periodontal disease (with all levels of severity) for ages 35-44 years and 65-74 years was reported as 89.9% and 98.1% respectively (Ministry of Health, 2009). Oral cancer accounts for 13.3% of total malignancies in the country and it is the most common cancer in Sri Lanka, among males (Cancer Registry, 2013).

In this context of high oral disease burden, it is appropriate to focus on equitable distribution of specialized oral healthcare services in the country. Due to the low dentist to population ratio, as well as the low dental specialist count reported, there is a need to explore the distribution of public dental facilities in order to reduce any major inequalities that exist and promote oral health. Geographic Information Systems (GIS) provide a meaningful spatial analysis tool to understand and identify the prevailing inequality and spatial distribution of dental specialist locations and specialist oral health work force across the country (Maguire, 1991). The aim of this study is to use a geographical model of Sri Lanka to assess, identify and illustrate the distribution of public specialist dental care facilities, and its relation to population demographics, including age and socio-economic status.

Materials and Methods

Ethics: Data used in this study were open access and freely available, and as such, ethical clearance was not needed.

Sources

The information on public dental specialist clinics was obtained from the Ministry of Health, Sri Lanka, and was confirmed by local experts as being a true representation of the current status. Population data were obtained from the most recent population census, retrieved from the Census and Statistics website of Sri Lanka (Census of Population and Housing, 2012).

Income data

Household income data were obtained from the Sri Lankan Household Income and Expenditure Survey (HIES) in 2012 that is compatible with the population census done in the same year (HIES, 2012). Poverty data were categorised into quintiles with the poorest 20% of the population allocated to category 1 and the wealthiest (at GN level) allocated to Category 5.

Population

The population census data were available at high resolution, dividing the country into provinces, districts and 'Grama Niladari' areas (GN), where GN is the smallest level of administration unit in Sri Lanka (Census of Population and Housing, 2012). The household income data were not available at the GN level but only by district and provincial levels (HIES, 2012). The population census data at GN levels were taken and centroids were added to each of the GNs for population location. The age category of 10-18 years old has been used in the analysis of orthodontist locations, as this is one of the most popular age groups visiting orthodontists.

Travel distance

Considering the reasonable estimates given by the local experts on travel distances that people are known to reasonably use to get to specialist dental care in Sri Lanka, a concentric buffer distance of 20 kms was applied to each set (of the three major types) of dental speciality service locations

Geocoding approach

Geocoding of the specialist locations was completed using Google maps, by which geographic coordinates longitudes and latitudes are assigned to the physical addresses of the locations. All the recorded and cleaned database files were transferred into QGIS (version 2.14.1) for analysis. Using the GIS software, population and socio-economic data at the level of GN were extracted based on the centroid locations within (or outside) the various buffers that were constructed around the specialist locations. These extracted datasets were transferred into Excel (Version 2016) and further descriptive analysis was completed.

Results

The total number of specialist dental locations that were geocoded in Sri Lanka was 55 representing 19, 26, and 10 Orthodontic, OMF and Restorative clinics with 21, 35 and 18 clinicians attached respectively. The OMF facilities were remarkably prevalent in the Western (94.7%) and Central (74.4%) Provinces, but completely lacking in the Northern (0%) and low in the North Central Province (41.8%). Access to Orthodontic care was identified as highest in the Western (87.6%) and Sabaragamuwa (55%) Provinces, and lowest in the Eastern (0%) and North Central Provinces (21.8%) (Figure 1). Restorative care was best provided in the Western (60.2%) and Central (52.1%) Provinces, while it was completely absent in the Northern and Eastern (0%) Provinces (Figure 1).

Proportionately more people from low socioeconomic quintiles lived further away from the 20 km buffer zone for all three specialities (Figure 2). The results produced positive trend lines in all three specialities, asserting that the percentage of people living within 20 km of each buffer increased as poverty decreased. The trend lines showed strong correlations within the constituents of the graphs, with correlation coefficients ranging between 0.462 to 0.698 (Figure 2).

There were higher concentrations of specialist locations and specialist counts in the Western and the Central Province, but a lack of specialist clinics in the Northern and the Eastern Provinces of the country. The buffer overlaps were clear in the Western and Central Provinces where accessibility to specialist care was highest (Figure 3).

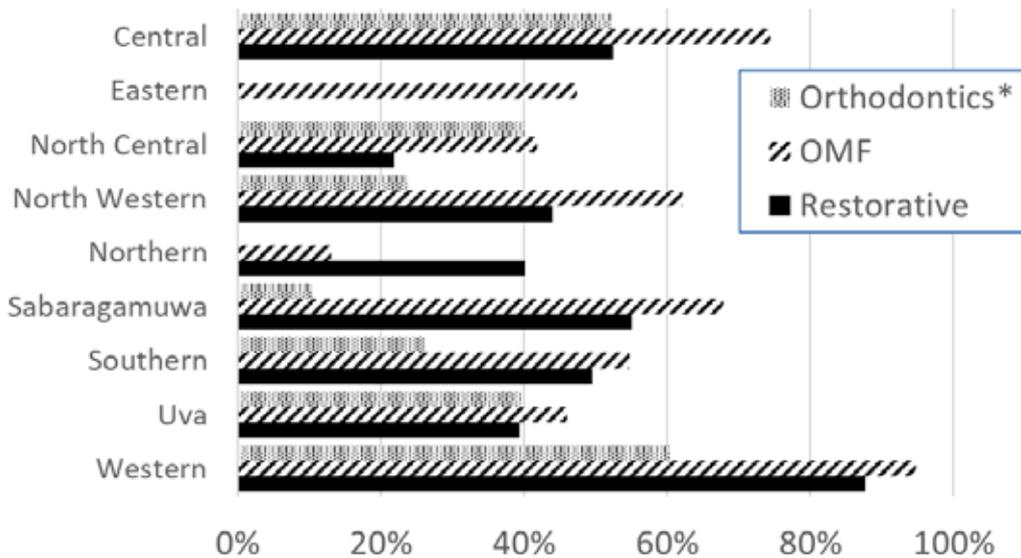
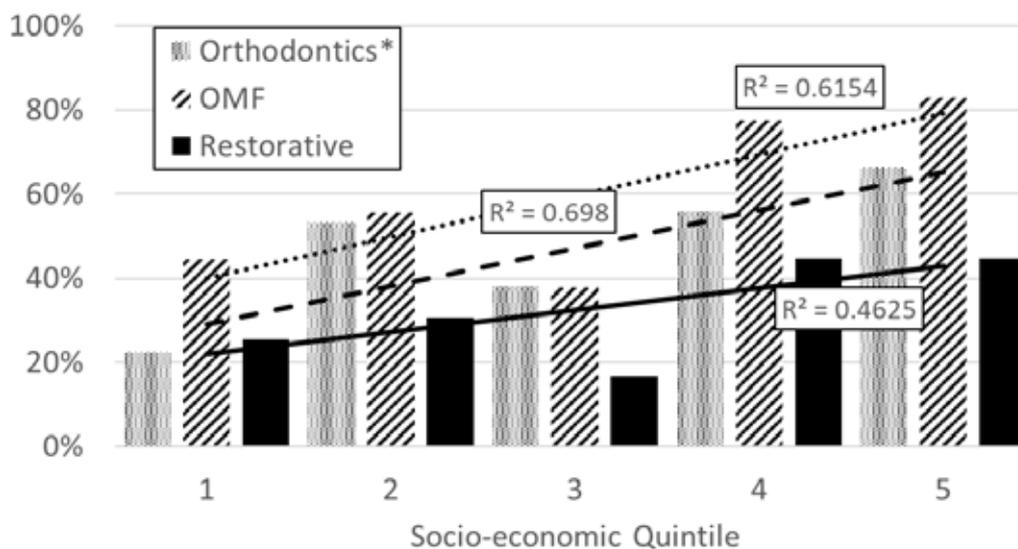


Figure 1. Proportion of people in all nine provinces who lived within 20 km of an Orthodontic, OMF and Restorative specialist dental practice.



Note: *The target group for the orthodontic clinics was children aged 10 to 18 years, while for OMF and Restorative clinics it is the total population

Figure 2. Proportion of people living within 20km of the Orthodontic, OMF and Restorative specialist locations in poorest (Quintile 1) to wealthiest (Quintile 5) socio-economic quintiles

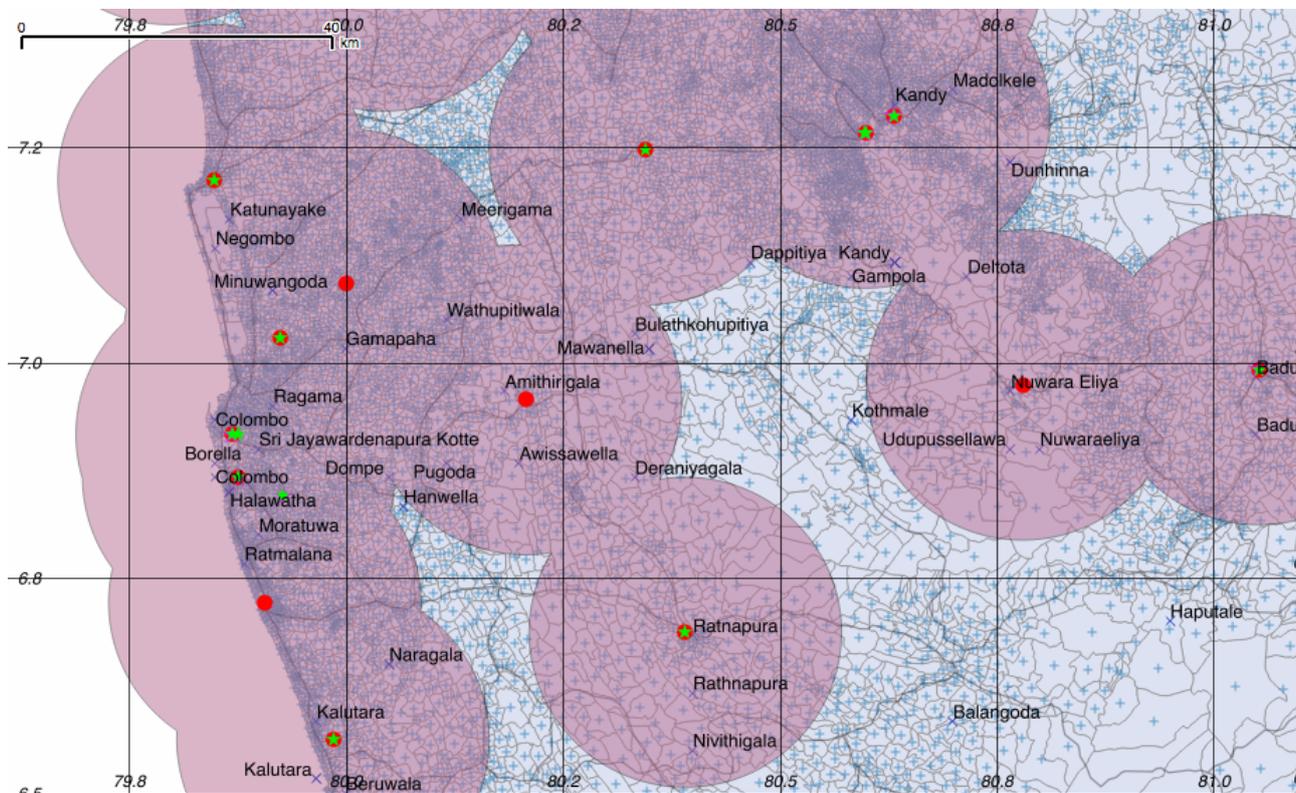


Figure 3: Distribution of specialist Orthodontic, OMFS and Restorative specialist dental facilities in western and central Sri Lanka.

Discussion

This policy-oriented health service investigation describes the current status of specialist dental care provision in Sri Lanka. It was necessary to study the dental specialist locations and workforce to explain socio-economic inequalities in specialist oral healthcare provision and address the disparities between districts and provinces and the related future specialist workforce issues.

The study found a substantial geographic maldistribution of dental health specialist locations in the country (Figure 1). Although there is a need for more specialist dental surgeons, there are already plenty of specialist dentists unevenly distributed across the country. The country contains 55 specialist dental locations with 74 specialist dentists. Even though the concentration of specialist locations in the Western Province is high the results should be viewed with caution since the Western province (WP) stands out as the most developed region with the highest population density in the country. WP accounts for 28.7% of the country's total population and is indexed as the least disadvantaged area according to the poverty head count index (Census of Population and Housing, 2012; HIES, 2012). The uneven distribution of specialist locations, with obvious population and socio-economic disparities, were clearly identified by the spatial analysis (Figure 1, 2, 3).

There are underlying reasons and emerging issues pertaining to the unevenness in the distribution of specialist locations and attributed work force. The provincial concentration of specialists in the Central Province is due to the location of the country's only Dental University, which represents the higher number of specialists (university academics) involved in teaching at the Dental

Teaching Hospital of Peradeniya (DTHP).

The country has a shortage of dental specialist clinics for restorative care, with only 10 compared to 26 OMF and 19 orthodontic clinics, with attributed workforces of 18, 35 and 21 respectively. The low number of specialist locations for restorative care is explained by the high concentration of restorative dentists in the DTHP. A restorative specialist combines the multiple skills and responsibilities of four additional clinical disciplines, namely paediatric dentistry, endodontics, prosthodontics and periodontics, hence the Dental University has recruited seven restorative specialists out of the total of 18 to provide specialist care in the relevant departments of these sub-disciplines in the DTHP.

One of the major reasons accounting for the unevenness of the distribution of dental specialists, is the 30 years of terrorist activities and civil war that affected the country. The ethnic conflict affected the eastern and the northern regions of Sri Lanka since 1983, which may account for the lack of dental institutes and specialists in those regions. There has been a reported build-up of new specialist locations in the eastern and the northern regions, and newly appointed OMF surgeons working in the District General Hospital in Vavuniya, the Teaching Hospital in Batticaloa, District General Hospital in Trincomalee and District General Hospital in Ampara. There is also an Orthodontist working in the Teaching Hospital in Jaffna.

The study also found that most specialist clinics were located in the most advantaged regions, with high socio-economic statuses and lower predicted needs. The inverse care law states that the provision of good medical care is inversely proportional with the need for it in the population

(Hart, 1971). The reasons for the poor and disadvantaged communities having less care available than the well-off is complex, but supply-side factors playing a part in the decision-making contribute to the situation (Stirling *et al.*, 2001; Fiscella and Shin, 2005). As people of lower socio-economic status have higher needs for medical care, it is important to identify the reasons for reluctance of dental specialists to work in these areas. Previous studies have identified multiple factors that influence practice location including the challenges faced by physicians in working with disadvantaged and marginalised people, reluctance to working in remote regions, increased workload due to lower staff, economic viability of practice location and limited resources (Stevenson *et al.*, 2015; Shiikha *et al.*, 2015). The fee-for-service model in the private sector encourages health practitioners to work in specific areas based on the economic viability of the practice locations. In Sri Lanka, public dentists are remunerated on a salary basis competitive compared with the fee-for-service model, and hence public dental specialists in Sri Lanka are reluctant to open full time private practices. Instead they work after hours in part time private practices. However, the high cost for dental treatment in private dental facilities, mostly concentrated around major cities, are both physically and economically inaccessible to the poor.

The results of this study should be interpreted in the light of some limitations. First, the study only considered public dental locations, but there is a relatively small, but growing specialist work force in the private sector. The Ministry of Health, Sri Lanka, did not possess open access data on specialist private practice locations, and thus made it impossible to gain specialist locations for geocoding. However, private specialist services are not widely available in Sri Lanka and full-time private specialist care is rarely seen in the country. The part time private specialist clinics are staffed by full-time public sector specialists, mostly located near the government specialist practices and operated only for limited hours. Almost all the specialist dentists work for the public sector with a number working after hours in privately-owned specialist clinics, therefore imposing a very low impact on these results. A previous study on private sector dental care in Sri Lanka reported only 0.6% of total 876 private dental practices in the country were limited to a specialist service provision and majority were functioned as general dental practices (De Silva, 2012). However, the private dental facilities create opportunities for the well-off categories to seek private dental treatments, especially where long waiting lists exist and where resources for providing care, in the public sector are limited (especially for orthodontic treatment). Orthodontic care is not available in public dental clinics for patients above 18 years, and for these patients private dental care is the only option. The patients who seek private orthodontic care are occasionally treated by general dentists in the private sector, and there is an issue of not receiving gold standard treatment by a qualified orthodontist.

Despite these limitations, the findings from the current study provide valuable information to the Sri Lankan Department of Health in developing its dental specialist workforce policy, and for the authorities of postgraduate dental education in deciding the annual intake of

trainee dental specialists. The ratio of Specialist to non-specialist Dental Surgeons in the Department of Health, Sri Lanka is 1:25 and remains very low compared to the other developing countries (De Silva, 2012). Policies that could be implemented include the establishment of clinics in the war affected regions, developing clinics in the socio-economically disadvantaged regions, providing incentives for dentists working in distant locations and allocating more positions for dental students coming from disadvantaged and war affected regions in the dental university. A district quota system is already in place and a maximum three attempts in the General Certificate of Education in Advanced Level examination (G.C.E A/L) are allowed for university admission in Sri Lanka. It should be noted that nearly one third of the students qualifying for dentistry come from the district of Colombo (De Silva, 2012). Moreover, students from distant districts are reluctant to serve in their respective under-privileged districts after graduation.

This study has highlighted the need to further enhance specialist dental provision in Sri Lanka according to population socioeconomic status, rurality and population density. Sri Lanka possesses the ability to continually develop optimal methods to distribute health care resources according to the predicted need of its population. Hence, the information provided by this study may inform policy planning in the health sector and the government of Sri Lanka to make educated decisions on the allocation of specialist dental health services.

Conclusion

This study demonstrated substantial disparities in the distribution of dental specialists in Sri Lanka. One of the significant findings was higher proportion of people from high socioeconomic status residing closer to the specialist locations, compared to the people at the lower end of the socioeconomic spectrum. These results may be considered in decision making on the allocation of dental specialist services by the Sri Lankan government and other decision-making bodies.

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Competing interest

None to declare

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