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Service Delivery of a Preventive Oral Health Care Model to High Caries Risk Urban Children in Sri Lanka: A Retrospective, Descriptive Study

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Authors' contributions

This work was carried out in collaboration between all authors. Authors IRP and MLP conceptualized the study, planned it and contributed in acquisition of data, interpretation, analysis, drafting the manuscript and all aspects of the work. Author CKH contributed in conceptualizing, revising the manuscript critically and important intellectual contents of it. Authors SSD and JMWJB contributed in important intellectual content of the manuscript and preparation of the final version of the manuscript to be published. All authors contributed to preparing the final version of the manuscript to be published and agreed to be accountable for all aspects of work.

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ABSTRACT

Background: Caries in primary teeth poses a global public health challenge as the most common chronic childhood disease in young children. It is compounded by marked social and geographical inequalities demonstrating high risk groups of children who carry the highest burden of the disease. Present study aims to describe an oral health care delivery model catering to both demands and

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needs for high caries risk, urban children in Sri Lanka with futuristic strategizing for improving its performance.

Methods: Local data were extracted from data sources of the Department of Census and Statistics and Sri Lanka National Dental Hospital (Teaching) Colombo. Accordingly, the Preventive Dental Clinic Performance Data and Preschool Oral Health Programme data were accessed. Moreover, an extensive literature search was conducted. The data entry and analysis were performed using SPSS 16. Descriptive Statistics were used for presentation of data.

Results: Present oral health care model has catered to a total of 5034 high-risk, urban children aged 20 months to 12-years from low socio economic backgrounds during the year 2015 with a coverage approximately of 10% of 1-9 year-old-age group in the target area. The oral health care delivery comprised of 8165 total visits to the Preventive Dental Clinic for 22915 of treatment procedures. 100% of children received behavioural management, dietary counseling and brushing advice and 63.4% received clinical preventive dental treatment comprising of fluoride varnish application, fluoride gel application and pit & fissure sealants. The screening coverage for preschool children was 82% comprising of high risk children, with an unmet need of 69.4% predominantly presented as untreated dental caries and met need of 59.2%.

Conclusions: Present study demonstrated that a range of preventive dental treatment options could be offered to high caries risk, urban children to address their unmet needs and demands in oral health care.

Keywords: Preventive Oral Health Unit; high caries risk urban children; unmet need; met demand; Sri Lanka.

1. INTRODUCTION

Caries in the primary dentition constitutes aglobal public health challenge as one of the most common chronic childhood diseases affecting toddlers, preschool children and primary school children in many parts of the world including Sri Lanka [1-3]. Moreover, the highest burden of dental caries is carried by high risk, socially disadvantaged children [4]. The early onset and rapid progress of caries in primary teeth is a serious cause of concern thus indicating a failure in its prevention and control. For example, as revealed by recent research findings from a US study, 82.8% of children having a cavitated lesion in their primary teeth before the age of 24-months have reached advanced stages at the age of 36-months [5]. As a consequence, moderate to severe forms of caries in primary teeth is debilitating giving rise to an array of negative consequences such as pain, sepsis, space loss, speech problems, failure to thrive, effects on intellectual development, greater risk for caries of permanent teeth, repeated infections, higher incidence of emergency visits and hospitalization with increased treatment costs and impaired quality of life of children and their general health status [6-9].

There is a plethora of determinants and biological, socio-cultural-behavioural and life-style related risk factors associated with this preventable and controllable public health problem which are commonly shared by many Non Communicable Diseases in adulthood [10,11]. While providing treatment for untreated dental caries it is important to address above determinants and risk factors at individual and population levels as children constitute a key target group for oral health care [12]. In developed industrialized countries with overwhelmingly dominant private oral health care delivery models there are safety net/subsidized schemes for school children [13]. School Dental Services in Sri Lanka is closely integrated into the existing provincial public health care infrastructure. It provides need based oral health care to school children upto the age of 13 years [14].

Nevertheless, existing school dental services has a limited service provision on need based preventive oral health care for toddlers and preschool children. Hence, POHU, Sri Lanka National Dental Hospital (Teaching), provides services to address this gap by predominantly catering to underserved children. Accordingly, the POHU has introduced a model of preventive and promotive oral health care since 2011. This model comprised of providing geographically targeted preschool oral health programmes in selected preschools combined with providing clinic based preventive oral health care to high caries risk children including toddlers, preschool and school children. Services are provided by a team comprised of 5 Dental surgeons a Nursing Officer and 2 Health Assistants.

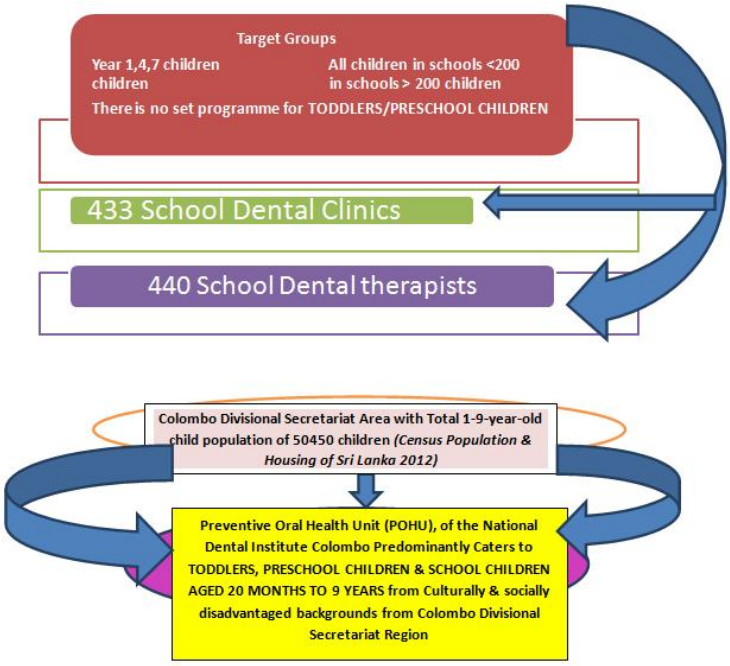

Fig. 1. Flow chart: School Dental Services in Sri Lanka and Preventive Oral Health Unit (POHU), Sri Lanka National Dental Hospital (Teaching), Colombo

Moving from Millennium Development Goals (MDG) to Sustainable Development Goals (SDG) resulted in increased attention for social determinants, universal health coverage and narrowing down health inequalities and oral health inequalities [15]. Geographically targeted high risk health care provision becomes important in such a context to address underserved groups. Despite published research on geographically targeted models on providing preventive oral health care services to high caries risk children in developed countries, there is limited research on similar models in developing countries. Against this backdrop, present study aims to describe the service provision of a preventive oral health care model to high caries risk, urban children in Sri Lanka.

2. METHODS

A retrospective, cross-sectional study was conducted to assess the performance of existing geographically-targeted service model for providing preventive oral health care to urban children at high risk of dental caries by POHU.

2.1 Study Setting

POHU has selected regions of the Colombo Divisional Secretariat (DS) Division for the geographically targeted model of providing need and demand based preventive oral health care to underserved toddlers, preschool and primary school children. The total 1-9 year-old child population of the Colombo DS division was recorded as 50150 by Census of Population and Housing 2012 [16]. Hence, the coverage of provision oral health care to 1-9-year-old children as a proportion of target group was approximately 10%.

As demonstrated in Table 1, based on a sub-sample of children attended the POHU according to socio-demographic profile, 60% of children were girls, and the children were from multi-racial origin. Furthermore, as revealed by Father's occupation, the overwhelming majority (98%) of children belonged to low socio-economic status. Hence, the children receiving oral health care from POHU represents children belonging to multi-racial and low socio-economic backgrounds.

2.2 Data Sources

Performance statistics data of the preventive dental clinic conducted by the POHU for the year 2015 from 1st January to 31st December was accessed from the data base. The preventive dental clinic was conducted for children

predominantly aged 1-9-years from Monday to Saturday. Children were referred by the out-patient department clinic of the Dental Institute on problem-based as well as demand-based visits. In addition, children were referred from preschool oral health programme conducted among selected preschools. Moreover, the performance data of preschool oral health programme covering 21 preschools conducted over the given period and clinic attendance from referrals were accessed.

Table 1. Socio-demographic Profile of children attending POHU

Variable	%
Gender	
Male	40
Female	60
Ethnicity	
Sinhala	50
Tamil	12
Muslim	38
Fathers' occupation	
Unskilled Labourer	22
Skilled Labour	24
Driver	22
Small scale business	14
Professional	2

The data were entered and analysed using SPSS 16 statistical package. Descriptive statistics as percentages were used to demonstrate the key findings according to the objective and design of the study.

3. RESULTS

3.1 Performance of Preventive Dental Clinic

The Preventive Dental Clinic Performance Statistics revealed that a total number of 5034 children received preventive dental care from POHU, with a total of 8165 visits of which the overwhelming majority (73%) was subsequent visits. A cumulative total of 22915 treatment procedures were performed for the year 2015 among children who visited the Preventive Dental Clinic for the year 2015. Of which the proportion of children who received clinical preventive dental care comprising of fluoride varnish and gel application and pit &fissure sealant application was 63.1%. Moreover, 100% of children received behavioural management to gain their cooperation for dental care, dietary counseling and oral hygiene& tooth brushing advice. Dietary counseling &advice were based on risk assessment on unhealthy dietary patterns dominated by frequent cariogenic snacking comprising of toffees, chocolates, biscuits, buns, pastries, sweetened milk packets, fizzy drinks etc. Healthy and less costly choices on diet taking social determinants of the family of the child into consideration was imparted to parental and other care-givers as well as to the child himself and herself based on the age of the child. Moreover, the toddlers and young children on night feeding patterns such as on demand nocturnal breastfeeding with multiple dental caries in their primary teeth were given special advice to minimize the damage.

Oral hygiene advice given to parental and other caregivers of young children was based on level of plaque control and brushing habits of the child such as use of fluoride toothpaste, brushing teeth at night etc. The importance of assisted brushing was highlighted and flash cards were used for these counseling sessions, Almost half of the visits (46.8%) received restorative care with GIC for their cavitated primary teeth. Furthermore, 12.1% of visits comprised of referral for pulp therapy as they have presented with pulp exposed, symptomatic teeth demonstrating advanced form of dental caries in primary teeth. This notion is further supported by the fact that 16.6%of visits comprising of prescribing antibiotics and analgesics for painful symptomatic teeth. Furthermore, 13.4% of total visits to the preventive dental clinic was follow up/ review visits after treatment completion. Development of new caries, arrest of existing caries following professional fluoride applications, risk reduction by adherence to healthy dietary patterns by cutting down cariogenic snacks such as sweets, buns, biscuits and pastries as well as fizzy sugary drinks and improved plaque control and tooth brushing morning and night before going to bed with a fluoride toothpaste and retention of restorations and pit & fissure sealants were the indicators that were assessed during review visits(Table 2).

3.2 Geographically Targeted Preschool Oral Health Programme

Table 3 demonstrates the performance statistics of preschool oral health programme conducted by the unit for the year 2015. It is a geographically-targeted programme conducted over the year covering 21 selected preschools out of 76 preschools in Colombo 4-12 and Colombo 15 regions. The highest percentage

(45.7%) of screened children was from preschools with more than 100 children. Proportions of screened children detected with unmet need for preventive dental were ranged from 17.7% to 44.1% by number of children in a given preschool with an overall rate of 69.4%. Similarly, the met need (% of referred children who received preventive dental care from POHU) was ranging from 18.6% to 43.9% with an overall 59.2% (Table 2).

4. DISCUSSION

The majority of children both in developed and developing countries get caries early in their lives with increased burden and sepsis as they grow up demonstrating failures in timely prevention [9]. Nevertheless, providing preventive oral health care to children at an early age based on their individual needs is challenging requiring behavioural interventions for children as well as for their parental care givers. Children often do not corporate well with oral health care, hence, a child friendly environment is a pre-requisite [17,18]. Against this backdrop, the preventive dental clinic conducted by the POHU coupled with geographically targeted preschool oral health programmes provides a service model to cater to high caries risk urban children from socially disadvantaged and culturally diverse backgrounds. POHU has provided a range of preventive dental care services for high risk urban children for non-cavitated, cavitated and pulp-exposed primary teeth (Table 2).

Table 2. Performance statistics of preventive dental clinic of POHU, Dental Institute, Colombo from January to December 2015

Type of treatment	Number of visits	% of Total number of visits
Behaviour Management of the child	5034	100.0
Dietary Counseling to the parental care giver & child	5034	100.0
Oral hygiene Instructions given to parental care giver & child	5034	100.0
Fluoride Varnish Application/Fluoride Gel Application & Pit & Fissure Sealant Application	3192 (2091*+750+351)	63.4
Temporary Fillings	145	2.9
Glass Ionomer Fillings	2357	46.8
Other type of treatment ie.prescribing antibiotics and analgesics	836	16.6
Referral for pulp therapy	608	12.1
Review Visits	675	13.4
Total Number of children treated	5034	100.0
Total Number of Procedures	22915	
First Visits	2206	27.0
Subsequent Visits	5959	73.0
Total Visits	8165	100.0

** 65.5% of clinical preventive dental procedures*

Table 3. Performance statistics of geographically targeted outreach preschool oral health programme conducted by POHU, Sri Lanka National Dental Hospital (Teaching), Colombo

Preschool type by number of children	N (%)	Total number (%) of children	Total number (%)screened	Number (%) referred	Number (%) attended the preventive clinic
< 50 Children	10 (47.6)	247 (19.3)	170 (16.1)	130 (17.7)	84 (18.6)
50-100 Children	7 (33.3)	502 (39.2)	405 (38.2)	281 (38.2)	150 (34.5)
>100 Children	4 (19.1)	532 (41.5)	484 (45.7)	324 (44.1)	191 (43.9)
Total	21 (100.0)	1281(100.0)	1059 (100.0)	735 (100.0)*	435 (100.0)**

** 69.4% of screened children were referred for preventive dental care*
***59.2% of referred children received preventive dental care*

As revealed by previous research the mean number of decayed teeth for these children was 6.1 ± 3.5 indicating a high burden of caries in primary teeth presented as untreated caries [19,20]. This burden was reflected by types of preventive dental care provided to children such as behavioural management, dietary and brushing advice (100%), preventive dental care with professional fluoride application, pit and fissure sealant application (63.4%), GIC fillings for cavitated lesions (46.8%) and referral for pulp therapy for pulp exposed, symptomatic teeth (12.1%) (Table 2).

Professional fluoride application and Fissure Sealant Applications constituted commonly used preventive regimes provided at the Preventive Dental Clinic. These accounted for 63.4% of total number of children treated. These findings were comparable with similar studies conducted in USA and Australia. For example, Riley at al., 2010 reported 69% of Fissure Sealants and 82% in-office fluorides as most commonly used preventive treatment strategies practiced among children aged 6-18-years by dental practices in New York [21]. However, the present study reported a lower percentages fissure sealants and in- office fluorides which could be plausibly attributed to endogenous factors as differences in age groups, disease severity at the time of presentation, inclination to problem based dental visits among Sri Lankan children compared to US children. Furthermore, a study conducted in New South Wales Australia reported that preventive dental care provided to adolescents by Dental Therapists were ranging from 32.0% to 55.8% in local districts [22]. Such differences in findings could be attributed to seemingly different purviews of preventive dental care provision by POHU, Sri Lanka National Dental Hospital (Teaching) compared to Adolescent oral health care provided in New South Wales.

Despite various attempts to provide services, oral health represents the largest unmet health care need of children with reported geographic variations in met need for preventive oral health care [23]. Many developed and few developing countries have adopted different mechanisms to provide preventive oral health care to young children. These comprise of screening and risk assessment, oral health counseling, fluoride varnish to children below 3.5 years of age, For example, dental professionals as well as non-dental personnel were involved in providing oral health care to young children in USA. For example, North Carolina Medicaid Programs re-imburse non dental professionals such as Primary Care Providers (PCP): Physicians, Physician Assistants and Nurse Practitioners funded by North Carolina Medicaid, and young children before the age of 3 years are being referred to a Dentist [24]. As a consequence, recent reports revealed that preventive dental visits have increased from 71.5% in 2003 to 77.0% in 2011/2012 in USA [25-27].

Fluoridated toothpaste and fluoride varnish containing 5% sodium fluoride (22,600 ppm fluoride) have been gained recognition as one of the most effective strategies for prevention and control of early child hood dental caries combine with an overall preventive package. After application fluoride is being slowly released to oral biofilm over a period of several weeks. For example, a recent meta-analysis and systematic review reported 37% (95% CI 24% to 51%; $P < 0.0001$), caries reduction in primary teeth [28]. Nevertheless, there are knowledge gaps in optimal regimes and protocols of aforementioned preventive oral health care for significant outcomes. For example, two recent stratified cluster randomized controlled trials conducted in semi-annual professional application of fluoride varnish as a supplement to standard oral health programme for young children attending primary dental care services of Northern Ireland as well as toddlers living in multi-cultural areas in greater Stockholm Sweden could not demonstrate statistically significant differences between intervention and control groups of children aged 3-years in conversion from caries-free to caries active state despite significant difference in the mean number of carious surfaces among both groups with lower number for the intervention group [29,30]. Hence, there is an important need to select appropriate risk groups of young children with continuum of care for fluoride varnish application as a component of a comprehensive package of prevention and control of caries in primary teeth at primary and secondary levels of prevention.

As shown in results (Table 2), of the total of 5034 children visited POHU, 2091 fluoride varnish applications were performed comprising of 41.5% of children and 65.5% of clinical preventive dentistry procedures. Moreover, only 2.26% fluoride varnish was recommended for children younger than 6-years of age among topical fluoride preparations [31]. A preliminary analysis of data on fluoride varnish application at POHU revealed that 73% of children belonged to 3-4 year-old age group thus complying with this

recommendation. These findings were in agreement with a Taiwanese study based on data base of the Ministry of Interior for the year 2008 and 2006-2008 data on preventive healthcare and health insurance from the Bureau of Health Promotion and the National Health Research Institute respectively. This study reported that 34.85% of children below 5-years-of age received fluoride varnish services [32]. According to the authors of this study, children younger than 5-years-of age are eligible for biannual dental examination with fluoride. However, compared to Taiwan there is no such a system in place as at present in Sri Lanka. Nevertheless, there is concerted effort on establishing fluoride varnish application programme for high risk children below 5 years of age as a national programme.

One of the unique attributes of the present model is it almost exclusively caters to high caries risk children from low-socioeconomic backgrounds. In general, there are disparities in the usage of preventive dental care among children as children from low-income families having the lower probability of using such services. For example, a Brazilian study reported that preschool children of poor parental care givers who perceived their child's oral health status to be poor were less likely to have visited the Dentist for preventive care [33]. This could be a prominent plausible explanation for relatively lower levels of met demand in present model which was 59.2%compared to higher levels of met oral health needs with regard to preventive oral health care reported from western countries [25,26]. These differences in findings could also be attributed to methodological differences in assessing preventive dental visits by various studies could have influenced the respective findings.

Untreated dental caries among young children is a globally common finding demonstrating lapses in providing oralhealth care to children.For example, untreated caries in deciduous teeth was the 10th most prevalent condition affecting 621 children worldwide [34]. As revealed by the findings of present study, 69.4% of preschool children screened for oral diseases presented with an unmet need in the form of untreated dental caries. These findings were in agreement with similar studies conducted elsewhere, for example, more than half of all carious teeth in primary teeth among 8-10-year-old children remained untreated [35]. Similarly, according to National Oral Health Survey 2002-2003, among 5-year-old Sri Lankan children with caries in primary teeth, 63.51% of had untreated dental caries in their deciduous dentition [2].

Moreover, 59.2% of met need of present study reported a lower value.

5. CONCLUSIONS

The present study described a model of providing oral health care services tohigh caries risk, urban children from socially disadvantaged and culturally diverse backgrounds in selected geographic setting with a range of preventionoriented dental treatment options.

6. RECOMMENDATIONS

Present study provides some important directions for health policy makers. For example, mechanisms and strategies should be developed to capture high risk children with a view to increasing coverage at a low-cost. In addition a forward and backward referral mechanisms by integrating with School Dental Services should be developed to enhance the potential of the present model. Furthermore, geographic and socio-economic modeling could be used as a service planning tool for better targeting and estimation of future needs for preventive dental care for the present service model.

Moreover, this model could be better evaluated by performance indicators such as coverage (% of high caries risk young children aged 1-9-years catered by this model) and its quality eg. % caries risk children practicing healthy dietary patterns and maintaining good oral hygiene and % of children developing new caries after 1-2 years. Furthermore, the met demand coverage should be periodically monitored with a view to improving. Evaluating cost-effectiveness of present model will provide more evidence for its appropriateness for policy makers.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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