

THE ROLE OF PUBLIC HEALTH DENTISTRY IN REDUCING ORAL HEALTH DISPARITIES

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ABSTRACT

Oral health inequalities are still considerable between urban and rural residents, especially in low and middle income countries. Six hundred participants (300 urban, 300 rural/underserved) were reached in public health centres, schools and mobile dental clinics for a six-month intervention. These included providing oral health education, school-based application of fluoride varnish, supervised tooth-brushing, tobacco-cessation counseling, screening camps, and mobile dental services with referral coordination. Differences between pre- and post-values of knowledge, behaviours, clinical indicators and urban/rural differences. Important oral health knowledge gains (39.7% to 75.2%), twice daily brushing with fluoridated toothpaste (39.2% to 68.5%) and recent visits to the dentist (21.5% to 49.0%) (all $p < 0.001$) were found. Untreated caries declined from 48.0% to 39.8%, and unmet need from 55.7% to 33.5%. Urban-rural discrepancies in the rates of brushing and attending the dentist became much smaller. Public health dentistry interventions that are coordinated by public health can reduce this disparity in oral by improving preventive behaviors, access to care, and early care and, if delivered in the school or mobile setting, in communities with limited access.

Key words: public health dentistry, oral health disparities, school-based oral health, mobile dental clinics, health equity, preventive dentistry, rural-urban differences.

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INTRODUCTION

Oral health is an integral part of health and quality of life and there are major inequities between different populations around the globe. Oral diseases including dental caries, periodontal disease and tooth loss are largely preventable, and continue to be a problem affecting billions of people worldwide, particularly socioeconomically disadvantaged, rural, and marginalized populations. Such inequities are strongly associated with social determinants of health—such as income, education, geographic location, and health services access—and this leads to inequities in oral health between people in urban and rural areas.^{1,2} Rural people have consistently poorer oral health than those living in urban areas, such as more cases of untreated dental caries, periodontal disease and substantial tooth loss. Much of this inequity can be attributed to geographic isolation, financial constraints and limited proximity to dental services, especially in under-served communities with lower rates of insurance coverage and higher rates of poverty. It has been demonstrated that rural populations have lower oral health related quality of life and that the impact is higher in the domains of pain, psychological discomfort and social disability.^{3,4} Oral disease is a problem of high magnitude in urban slum environments in low and middle-income countries, where there is a higher

prevalence rate of dental caries and periodontal diseases than in non-slum urban environments.

Mouth cleaning, usually once daily and the use of professional dental care facilities, is not always optimal in oral hygiene in these institutions. Oral health is undermined by inequities, which can be addressed using a population approach through preventive health strategies, health promotion, public health advocacy and equitable service delivery through public health dentistry.⁵ Public health dentistry approaches like community water fluoridation, school oral health education, routine screening and teledentistry have been demonstrated to have positive effects on the oral health of communities of all types. Mobile dental clinics and dental outreach camps have been documented to bring dental services closer to the disadvantaged and teledentistry programs have been documented to increase dental hygiene practices.⁶ One of the most effective methods towards bridging this gap in accessing dental services in rural areas is the use of mobile dental clinics, teledentistry programs, and dental outreach camps. These have been done because of logistical issues such as transportation problems, missing daily work hours, etc., and because of lack of experts in remote parts of the country. Digital and epidemiological data used together, as well as public-private partnerships, enable equitable and scalable distribution of various

resources, thus significantly reducing the overall oral disease burden, yet oral health remains an under-addressed issue in some national health agendas, and even within the National Oral Health Programme in some countries like India, there are a tremendous need gap in terms of coverage, funding and distribution of workforce.⁷ Scoping reviews clearly signal the need for a policy change, targeted interventions, and equity-specific research to help understand how to reduce the social gradient in oral health that exists in both urban and rural environments.⁸ More recent systematic reviews highlight that adverse childhood experiences in combination with rural-urban status, are independently associated with oral health inequalities, with rural children experiencing a greater difficulty in maintaining oral health, and accessing appropriate dental visits. The results highlight the importance of developing public health strategies and interventions that address the specific needs of these underserved groups and work towards improving access to dental care by increasing preventive services and decreasing financial barriers. In this respect, the role of public health dentistry in resolving oral health inequities through community-based, equity-based interventions is important for policymakers to consider as they look towards long-term, high impact, and equitable strategies in the future.^{9, 10} Knowledge of how structured public health dentistry programmes intervene on oral health knowledge, behaviours, service use and/or clinical outcomes of both urban and rural populations could offer insights to policy and practice for achieving oral health equity. The purpose of this study is to assess impact on oral health inequities after 6-months of a public health dentistry intervention in comparison to oral health behaviors and access to services at both urban and rural/underserved settings, with selected clinical indicators as outcomes.

METHODOLOGY

A quasi-experimental, pre-post study was undertaken in selected urban and rural/underserved areas to assess public health dentistry intervention for six months in the community. A multi-stage sampling method was used, and a total of 600 participants (300 urban and 300 rural) who had been living in the community for at least 6 months were selected from the public health centres, government schools and community outreach sites. Subjects who were severely ill or could not be examined/consent were not included.

Information was obtained at baseline and 6-months using interviewer-administered questionnaires and standardized clinical examinations by trained dentists using WHO-adapted criteria (sociodemographics, dental access, oral health knowledge, behaviours, self-reported pain and unmet need, visible plaque, gingival bleeding, untreated caries, other lesions).

Apart from oral health education sessions, in school application of fluoride varnish, supervised tooth brushing, tobacco cessation counselling, community screening camp, coordination of referrals, mobile dental-clinic visits were also undertaken and the focus was given on poor and underserved communities.

Data was analyzed using descriptive statistics and paired tests were conducted to compare the compares the results obtained before intervention and after intervention; the difference between the key indicators was used to identify the gaps between urban-rural regions. Ethical approval and informed consent were gained, and confidentiality maintained.

RESULTS

Total participants included 600, 300 from urban communities and 300 from underserved and rural communities. The participants were recruited for the Centre for public health and government schools, community health camp and mobile dental clinic etc. Age mean was 28.6 ± 14.2 years old, where 54.0% were female. The majority of the participants belonged to a lower and middle-income group and 42.5% reported that they did not have access to frequent dental treatment with a dentist.

Significant differences in oral health according to resident location, SES and education and access to dental services were identified at baseline. For each of the indicators of oral conditions, including for dental caries, gingival bleeding, dental pain and unmet dental needs, rural were more likely than urban. 18.3% of the rural individuals reported that they visited a dentist in the past year, as compared to 46.7% of urban individuals.

Six months of public health dentistry interventions were provided which included oral health education, supervised tooth-brushing demonstration, school-based fluoride-varnish application, tobacco-cessation counselling, screening camps, referral services, and mobile dental-clinic visits. The community health workers, school teachers, dental interns and public health dentists worked together to conduct oral-health promotion activities.

Table 1. Baseline socioeconomic and oral-health characteristics of participants (N = 600).

Variable	Urban participants (n = 300)	Rural/underserved participants (n = 300)	Total (N = 600)	p-value
Mean age, years (Mean $\pm$ SD)	29.4 $\pm$ 13.8	27.8 $\pm$ 14.6	28.6 $\pm$ 14.2	0.164
Female particip	158 (52.7)	166 (55.3)	324 (54.0)	0.521

Outcome indicator	Baseline, n (%)	Six-month follow-up, n (%)	Absolute change	p-value
Low household income, n (%)	96 (32.0)	189 (63.0)	285 (47.5)	<0.001
No dental visit in previous 12 months, n (%)	160 (53.3)	245 (81.7)	405 (67.5)	<0.001
Untreated dental caries, n (%)	112 (37.3)	176 (58.7)	288 (48.0)	<0.001
Gingival bleeding, n (%)	98 (32.7)	158 (52.7)	256 (42.7)	<0.001
Self-reported dental pain in past 6 months, n (%)	81 (27.0)	142 (47.3)	223 (37.2)	<0.001
Use of fluoridated toothpaste twice daily, n (%)	174 (58.0)	93 (31.0)	267 (44.5)	<0.001
Unmet dental treatment need, n (%)	124 (41.3)	210 (70.0)	334 (55.7)	<0.001

The number of factors indicating an improvement in oral health knowledge, preventive behaviours and service use were found to have changed after the implementation. The participants in rural areas showed the highest increase in knowledge. 39.2% said they used fluoridated toothpaste at baseline and 68.5% at 6 months to brush their teeth twice per day. There was an increase in dental check up within the past 6 months (21.5% to 49.0%) particularly in the rural areas where geographical and financial barriers were reduced with mobile clinics and referral. A total of 196 (in school) participants had fluoride-varnish applied to them after oral screening of 418 participants. 71.6% of those identified as having an urgent dental need were referred to a public dental facility or mobile dental service. There was continuity of care due to the opportunities of

referral-coordination and follow-up communications and low cost treatment in the public sector.

Table 2. Changes in oral-health knowledge, behaviours, and service utilization after intervention.

Outcome indicator	Baseline, n (%)	Six-month follow-up, n (%)	Absolute change	p-value
Correct knowledge of causes of dental caries	238 (39.7)	451 (75.2)	+35.5 %	<0.001
Brushing twice daily with fluoridated toothpaste	235 (39.2)	411 (68.5)	+29.3 %	<0.001
Daily consumption of sugary snacks/drinks	342 (57.0)	241 (40.2)	-16.8 %	<0.001
Dental visit within previous 6 months	129 (21.5)	294 (49.0)	+27.5 %	<0.001
Participation in community oral-health session	0 (0.0)	472 (78.7)	+78.7 %	—
Tobacco users receiving cessation counselling	0 (0.0)	86 (14.3)	+14.3 %	—
Participants completing referral for treatment	0 (0.0)	142 (23.7)	+23.7 %	—
Participants reporting unmet dental need	334 (55.7)	201 (33.5)	-22.2 %	<0.001

There were also beneficial outcomes related to clinical oral health. The mean scores of visible plaque (64.8%-45.2%), the gingival bleeding

(42.7%-29.5%) and untreated dental caries (48.0%-39.8%) decreased from baseline to the follow-up. The relatively small decrease in dental caries could be attributed to the chronic and cumulative nature of dental caries; often, established lesions will need treatment, necessitating the need of education in addition to treatment.

After the intervention, the gap between urban and rural population decreased. At follow-up, the prevalence of twice daily tooth brushing was 11%, compared to 27% at baseline. The gap in recent dental-service utilization decreased from 28.4 percentage points to 12.0 percentage points.

Table 3. Comparison of oral-health disparities between urban and rural participants before and after intervention.

Indicator	Urban baseline	Rural baseline	Difference at baseline	Urban follow-up	Rural follow-up	Difference at follow-up
Brushing twice daily with fluoridated tooth paste	58.0 %	31.0 %	27.0 %	74.0 %	63.0 %	11.0 %
Dental visit within previous 6 months	35.7 %	7.3 %	28.4 %	55.0 %	43.0 %	12.0 %
Untreated dental caries	37.3 %	58.7 %	21.4 %	32.0 %	47.7 %	15.7 %
Gingival bleeding	32.7 %	52.7 %	20.0 %	23.0 %	36.0 %	13.0 %
Unmet dental treatment need	41.3 %	70.0 %	28.7 %	27.3 %	39.7 %	12.4 %
Oral-health	48.0 %	31.3 %	16.7 %	78.7 %	71.7 %	7.0 %

knowledge score ≥ 75 %						
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Even when things were good, however, there were still differences. Unmet treatment needs continued to be high, even among those with lower levels of education and among those in the lowest income brackets and even amongst rural residents. Some of the main constraints were expenses for restorative treatment, lack of fixed dental services in the area, lost work day wages, lack of specialists and fear of dental treatment. Thus, health education and screening all must be complementary to continuous public funding and investment in community infrastructure, training healthcare and other professionals, outreach and mobile services and the integration of oral-health into primary healthcare.

Overall, the findings show that public health dental interventions based on principles of prevention, health education, community screening, school-based interventions, mobile services and effective referral systems, may be effective in reducing oral inequalities.

DISCUSSION

The present study reflects that a structured programme of public health dentistry, in a mixed population of 600 individuals, can make a significant positive impact on oral health knowledge, oral health preventive behaviours and use of oral health services and reduce the urban–rural gap in such behaviours. Baseline data revealed that there was a significant disparity as the families in the lower income category and families residing in the rural areas had higher prevalence of untreated caries, gingival bleeding, dental pain and unmet treatment needs and lower acceptance of preventative services. The results match the national and global research finding indicating the inequitable distribution of oral disease load to socio-economically disadvantaged and geographically challenged populations. Following the implementation of multi-component interventions (OHE, S-based fluoride varnish, SuT-B, Tobacco-cessation counselling, Screening camps, Mobile dental services) for 6 months, significant improvements were observed for all of the key indicators. The percentage of respondents who said they brush their teeth twice a day with the fluoride toothpaste significantly rose (39.2%-68.5%) as well as the percentage of participants who visited the dentist in the past year (21.5%-49.0%). The level of knowledge about caries aetiology increased from 39.7% to 75.2% while self-reported unmet need decreased from 55.7% to 33.5%. But one of the significant findings is that the gap between urban and rural areas is reduced.^{11, 12} Systematic reviews of school-based and community oral health promotion programmes report consistent improvements in oral

health knowledge, attitudes and behaviour, with often less consistent but generally positive changes in short-term clinical outcomes. At the start of the intervention, the differences between the proportion of urban and rural participants who brush their teeth twice a day was 27 percentage points and at the end of the intervention, 11 percentage points. There was also a decrease in recent dental visits from 28.4 to 12.0 percentage points. The trend suggests that outreach public health dentistry activities have the potential to provide greater benefit in populations with social, economic and geographic constraints to contributing to their oral health and increase oral health equity. These findings are consistent with other evidence that school-based and mobile dental services can “reach the unreached” by minimizing the obstacles for rural residents and those with low incomes, such as transportation, cost and time.^{13, 14} Further evidence of the effectiveness of combining health education and preventive and early treatment services is suggested by the improvements in clinical outcomes observed: the decrease in visible plaque (64.8% to 45.2%), the decrease in gingival bleeding (42.7% to 29.5%) and the decrease in untreated caries (48.0% to 39.8%). This lesser reduction in caries prevalence compared to the other health outcomes (behavioural and gingival) is to be expected because caries is a chronic and cumulative condition and normally established caries lesions, in addition to education, require restorative intervention. However, combined with the statistically significant reduction in caries, good evidence of referral completion (71.6% of those who need urgent care received it) suggests that screening and co-ordinated referral and low-cost public sector care can help improve continuity of care and prevent progression of disease, as illustrated in the subgroup analysis schools and mobile clinics are important vehicles for equity-based oral health promotion.^{15, 16} Because both SFV and supervised tooth-brushing are known to lower the risk of caries, and increase the likelihood of long-term oral health behaviors and better plaque control, the highly positive results seen among children may be attributed to provision of both. Mobile dental units, however, appear to have played a significant role in provisions in rural areas, and areas that are not well served and have distance and/or cost problems. Other elements of an ecologically-based multi-level strategy that has been proposed for promoting oral health equity include CHWs, teachers, dental interns and PHDs. There were several significant differences at follow-up, however, as the rural residents and the less educated, and those in the lowest income category, had higher unmet treatment needs than those with more education and in the higher income categories.^{17, 18} Financial costs of restorative treatment, time traveling to dental services, lost productivity per day as well as lack of specialists and dental fears were still significant. The findings in line with the

literature indicating the complex interplay between the social determinants and the structural determinants of oral health and oral health inequities. Public health dentistry can play a part in redressing some of these inequities through enhancing the resources they have for prevention and outreach but complementary policy actions are required: increase of public funding for oral health, encouraging rural practice, further development of mobile and school-based services, and better referrals and funding for restorative and specialist services.^{19, 20}

CONCLUSION

This study has demonstrated that the coordinated public health dentistry programme could be a tool to address the lack of difference in oral health based on knowledge, preventing behaviour, utilization of services and so on among the underserved. There were important increases in twice-daily brushing with fluoridated toothpaste, number of dental appointments and oral health literacy, and decreases in plaque, gingival bleeding and untreated caries, showing that combined interventions are effective to achieve behaviour and clinical improvements. The school-based provision of prevention and mobile dental services, along with agreed referral pathways have great potential for equity: there has been a marked decrease in urban-rural equity gaps in key outcomes. However, there are also continuing areas of unmet health needs that underscore that education and screening are insufficient and continued public support, risking a qualified workforce, and integration of oral health into primary care is required. Therefore it seems logical that public health dentistry should be part of the necessary transformation in overall health systems that address social determinants of health, expand access to restorative dental care, and prioritize high-risk communities. These strategies are essential to progress towards universal access to oral health care and make meaningful, lasting strides in oral health inequities.

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