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A comprehensive approach to health promotion for the reduction of dental caries in remote Indigenous Australian children: a clustered randomised controlled trial.

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Aim: To evaluate the effect of a community-oriented primary health care (CPHC) intervention on oral health behaviours of Indigenous preschool children living in remote communities of Australia's Northern Territory. **Methods:** The study was a community-clustered randomised controlled trial over two years, set in 30 remote Indigenous communities in the Northern Territory of Australia. Children aged 18-47 months at baseline were enrolled in the study. The intervention included fluoride varnish applications, training of primary care workers, and health promotion for oral health at an individual, family and community level. Intervention communities received six-monthly visits over two years and control communities were visited at baseline and two years later with no contact in the intervening period. The outcome measures reported in this paper are the impact of the intervention on two secondary endpoints: oral health promotion activities in the community and personal oral health practices of children. **Results:** The intervention did not produce any significant change in oral health behaviours, clinical measures of oral hygiene, or community programmes promoting oral health. Dental caries can be reduced but will continue to be a problem among young remote Indigenous children while they experience major social disadvantage.

Key words: Oral health programmes, remote Indigenous children, Australia

Indigenous children aged 0–4 years represent 4.4% of the Australian child population in that age group[1]. Nearly one quarter of young Indigenous children live in 'remote' or 'very remote' areas compared with 3% of non-Indigenous Australian children[1]. Compared to their non-Indigenous counterparts, Indigenous children have greater mortality rates, lower birth weights and higher rates of infection and injury[2,3].

Higher levels of dental caries have been reported in Indigenous children of all ages compared to non-Indigenous children. At the age of 6 years, 72% of Indigenous children had some tooth decay compared with 38% of other Australian children[4]. This high level of disease has been attributed to both low levels of protective factors and high levels of risk factors. Jamieson *et al.*[5] reported low levels of individual preventive care and

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frequent consumption of sugar-rich drinks and snacks among remote Indigenous children.

Dental caries is less likely to be treated among Indigenous children than non-Indigenous children[4]. Abscesses and other sequelae of advanced decay occur commonly, which translates into higher numbers of young Indigenous children in remote areas undergoing hospitalisation for treatment under general anaesthesia[6]. The oral disease pattern is further complicated by the paucity of dental services to preschool children in remote communities. Dental services are provided by state and territory health departments for school-aged children. However, care for preschool children is typically limited to those who have significant pain or infection.

In remote areas, health care for preschool children is provided in health clinics that are staffed by nurses and Aboriginal Health Workers. The clinics in the larger communities may also have one or more general medical practitioners. Dental care offered by those primary health care workers is limited to symptomatic treatment of dental infections or pain. In remote communities, achieving sustainability of effective oral health services is a major challenge. One option would be to provide sufficient funds for additional local staff and regular visiting by oral health care personnel. Alternatively, primary health care staff could receive additional training and support to include oral health in their package of services. The likely impact of these types of activities is currently unclear.

The aim of this study was to evaluate the effect of a community-oriented primary health care (CPHC) intervention on the oral health of Indigenous preschool children living in remote communities of Australia's Northern Territory. The effect of the intervention on the primary endpoint, dental caries, has been described elsewhere. This paper reports on the impact of the intervention on two secondary endpoints: oral health promotion activities in the community and personal oral health practices of children.

Methods

Study design

The study was a community-clustered randomised controlled trial. Communities were randomly assigned to intervention and control groups and all the children from a particular community were in the same group. Because health promotion programmes are openly promoted, it was not possible to blind the study participants or researchers. During the first six months of the study, 60 remote Indigenous communities were contacted and visited to inform them of the study and seek their agreement to participate. Following this consultation process, 30 communities that met inclusion criteria agreed to participate and be allocated at random into intervention and control groups. Children were included if they were between 18 and 47 months of age inclusive, had no history of asthma and their parents/carers consented to participation. The 15 intervention communities received the comprehensive primary health care intervention while the 15 control communities did not.

Intervention

For two years after the baseline visit each intervention community was visited each six months by the study team (a total of five visits, including baseline). At the visits to the intervention communities, fluoride varnish was applied to the teeth of each enrolled child, clinic staff were trained in dental screening and varnish application, and health promotion activities undertaken. The control communities were visited at baseline and two years later with no contact with the research team in between these visits. The CPHC intervention consisted of:

- Six-monthly applications of fluoride varnish
- Oral health advice/education for individuals/families
- Community based health promotion for oral health
- Training of primary health care staff in oral assessment, risk factors and fluoride varnish application.

Dental therapists hired for the project cleaned and dried children's teeth before applying 0.25ml of Duraphat (5% sodium fluoride (2.26 % fluoride ion). They demonstrated tooth cleaning to parents or family members who accompanied the child. Face painting of the children was done prior to the varnish application as a fun activity to encourage participation. Photographs of the face painted children were taken with consent and displayed in the community at each subsequent visit to encourage continued involvement.

The health promotion component at both an individual and community level focussed on water as the beverage of choice and tooth brushing using toothpaste with fluoride. At each visit to the community staff demonstrated tooth brushing to the parent or caregiver, gave each child a toothbrush, toothpaste and encouraged drinking water rather than sugar-rich drinks. At one visit the children were given a small reusable water bottle. Staff also visited child care centres and preschools to promote the adoption of tooth brushing programmes, advise how to obtain cheap toothbrushes and toothpaste, and promote the use of water as the preferred beverage. Similar discussions were held with community leaders and members of the community councils. Discussions were also held with store managers on suitable toothbrushes and toothpaste for the very young children, sources of low cost brushes and paste and the relative placement of bottled water and sugar-rich drinks and the possibility of cross subsidising their prices. The same health promotion messages were emphasised in presentations to interested and available primary care workers in the health clinics where possible.

Data collection

Oral epidemiological examinations were conducted by trained and calibrated dental therapists assisted by project staff at baseline and at the two year follow-up. The oral examinations included visual assessment to rate each of six dental sextants using the Oral Hygiene Index[7] and a single, visual assessment of gingival health. Interviews covered demographics and risk factors for dental caries, dietary factors, dental health behaviours, dental symptoms and dental visiting.

Community characteristics and any relevant health promoting policies and programmes were recorded at baseline and follow-up. Research staff spoke to community members and recorded observations in relation to tooth brushing programmes in preschools and schools, water drinking and presence of water fountains in the community. They also recorded store practices for sales of toothbrushes and toothpaste, high sugar drinks, bottled water and cross-subsidisation from less healthy to more healthy foods and drinks.

Data were analysed to compute percentages of communities and children reporting 13 health behaviours. Statistical significance between intervention and control groups was determined using Fisher's exact test for health behaviours and t-test for the Oral Hygiene Index and the Gingival Index. P values were adjusted for clustering by community.

Ethics approval was obtained from the Human Research Ethics Committees of the Menzies School of Health Research and NT Department of Health and Families, Central Australia, and the University of Adelaide. An Indigenous Reference Group was established to provide advice and feedback to the investigators.

Results

At the 30 participating communities 666 eligible children were examined at baseline. Of these, 543 (281 in intervention group, 82% and 262 in control group, 81%) were examined again two years later. As noted in a separate paper reporting on the primary endpoint, almost all children (89%) developed new dental caries over the two year period.

At baseline, there was no statistically significant difference in the health behaviours of children in the intervention and control communities in terms of drinking sugary beverages and oral hygiene the previous day (*Table 1*). Parents/carers of over 60% of children reported that the child had a sugary drink the previous day and that less than 20% of children had brushed their teeth. At follow-up a similar proportion of children in the intervention community reported having a sugary drink in a similar ratio to that at baseline. The percentage reporting tooth cleaning increased over the two year period to 40% in both groups. At follow-up, half the children in both intervention and control communities reported eating lollies the previous day.

The self-reported finding in relation to oral hygiene was supported by the oral hygiene and gingivitis findings from the clinical examination (*Table 2*). No significant difference in these clinical measures was found between the children in the intervention and control groups at baseline nor was any significant difference in the change in these scores at follow-up. *Table 3* indicates that there were no statistically significant differences in the uptake of community level oral health promotion activities between the intervention and control communities at the two year follow-up. However, three of the 15 intervention communities offered low-cost toothbrushes and toothpaste in stores, compared to none of the control communities (P=0.22).

Discussion

This study found no difference in either self reported or clinical measures of oral health behaviours between remote Indigenous communities who received a CPHC intervention and those that did not. This study's six month consultation process was successful in recruiting remote communities to agree to be randomised into intervention and control groups. Most families with preschool children within those communities agreed to participate. This was a major achievement in part due to having two Indigenous staff members (one of whom was well known to many of the communities) who were committed to a thorough consultation process. The recruitment and retention of 82% of children over the two year period was helped by assigning staff to communities so that the same staff made each six-monthly visit. Photographs taken of the children and displayed on return visits encouraged follow up. Face painting children prior to applying the fluoride varnish built relationships and made the visits a fun event.

The inability to affect reported behaviour change at an individual level was disappointing. This may be related to the overwhelming disadvantage (in terms of health and social circumstances) that these communities and children experience. There is also a high degree of child autonomy. The behaviour of young children (particularly the drinking of sweetened drinks) is influenced by parents, siblings, extended family and other community members. We attempted to address all three levels by targeting individuals, their families and communities, including community stores. On the other hand, we did not attempt to counteract television advertising or other mass media influences that are as pervasive in these remote Aboriginal communities as they are in other parts of Australia.

At a community level, a statistical effect of the intervention on these secondary endpoints was all the more difficult to demonstrate as there were small numbers of communities. When assessing statistical significance between groups of children, a more sophisticated analytic approach would adjust for clustering of children

Table 1 Health behaviours of children at baseline and follow-up

	All		Intervention group children		Control group children		Fishers exact test P value
	N	%	N	%	N	%	
Baseline							
Drank sugary drink yesterday	580	64.7	342	65.8	238	63.0	0.54
Cleaned teeth yesterday	558	15.9	313	16.6	245	15.1	0.64
At 2 year follow-up							
Drank sugary drink yesterday	523	57.2	278	61.5	245	52.5	0.03
Cleaned teeth yesterday	434	40.3	220	40.5	214	40.2	1.00
Ate lollies yesterday	522	44.4	280	43.6	242	45.5	0.72

Table 2 Baseline data on health behaviours of children who participated at baseline and follow-up

	Intervention group			Control group			t-test P value
	N	mean	SD	N	mean	SD	
Baseline							
Worst oral hygiene score	297	0.89	0.81	315	0.87	0.84	0.81
Mean oral hygiene score	297	0.56	0.68	315	0.60	0.75	0.58
Gingival index	313	1.61	0.97	334	1.53	0.96	0.29
At 2 year follow-up							
Change in worst oral hygiene score#	237	0.90	0.88	254	0.93	0.89	0.74
Change in mean oral hygiene score#	237	0.75	0.75	254	0.74	0.77	0.89
Change in gingival index#	249	0.48	1.15	271	0.54	1.22	0.56

Change measured by score at follow-up minus baseline score

Table 3 Uptake of community level health promotion activities

	Intervention % (n=15)	Control % (n=15)	Fishers exact test p value
Water drinking policy#	73.3	73.3	1.00
Use of water bottle policy#	13.3	26.7	0.65
Teeth cleaning programme#	60.0	46.7	0.72
Fluoride toothpaste available in store	93.3	93.3	1.00
Oral assessments by clinic staff	33.3	26.7	0.72
Cheap toothbrushes/toothpaste available in store	20.0	0.0	0.22
Cheap toothbrushes/toothpaste available elsewhere	46.7	26.7	0.45
Cross subsidy towards healthy foods	46.7	40.0	1.00

Activities in child care centre or preschool or school.

within communities. However, our findings regarding the primary endpoint, dental caries, showed very small intra-class correlations of 2% or less, so effectively, there is little, if any, inflation of type I error in the results reported here, which makes no adjustment for clustering.

The study team had difficulty in engaging primary health care staff to be involved in the delivery of the intervention. As the study progressed a small number of staff expressed interest and were trained to a varying degree. However, only 17 of the 1,190 varnish applications in intervention communities were performed by health centre staff. Some of those who expressed interest in providing preventive dental care explained that it was difficult to accommodate with their very heavy workload of providing basic medical care, and others cited barriers due to staff shortages and staff turnover. The possibility of having a dedicated staff person for oral health or regional resource persons for groups of smaller communities should be explored. To be sustainable, it will be essential to integrate these oral primary care activities within the broader primary care priorities. More substantial training and continuing education programmes need to be provided and staffing issues addressed.

The near ubiquitous nature of caries among these very young children despite a major effort to implement a comprehensive preventive programme is a major concern. However, the intervention was effective in reducing dental caries, the study's primary endpoint. The current findings of little, if any, impact of the intervention on health behaviours, imply that caries-preventive benefits of the intervention were largely due to the clinical application of varnish. However, varnish alone is not sufficient: 90% of children developed caries over the two year period, both in intervention and control groups. Like other diseases, dental caries will continue to be a problem among young remote Indigenous children while communities and families experience such substantial social disadvantage. Prioritising the integration of oral health and primary oral care in routine health promotion activities is advocated. Further work to understand the most effective way to increase oral health improvement in young Indigenous children is needed.

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