

Results of a two year dental health education program to reduce dental caries in young Aboriginal children in New South Wales, Australia

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Objective: To assess the effectiveness of a dental health education program, ‘Smiles not Tears’ in preventing Early Childhood Caries in young Aboriginal children. **Basic research design:** Community trial. **Clinical setting:** Aboriginal Community Controlled Health Services in rural, remote and metropolitan areas in New South Wales, Australia. **Participants:** Aboriginal families who had a child six months of age. **Interventions:** Aboriginal Health Workers from eight Aboriginal Community Controlled Health Services in rural, remote and metropolitan areas in New South Wales recruited Aboriginal families with young children to participate in the Smiles not Tears dental education program. A convenience sample of Aboriginal children from the same communities was recruited to form a historical control group. **Main outcome measures:** The caries prevalence at 30 months of age compared to children of a similar age in the control group. **Results:** More children in the test group were caries free ($n = 104$; 97.2%) when compared to the historical control group ($n = 54$; 65.9%). Only three children in the test group had caries which is less than the control group ($n = 29$). **Conclusion:** These results suggest that the Smiles not Tears dental education program has a positive impact on reducing the caries prevalence in young Aboriginal children.

Keywords: Children, dental caries, health promotion, Indigenous, prevention

Introduction

Aboriginal Australians have poor levels of general well-being and this includes oral health problems. Unfortunately, young Aboriginal children are no exception and experience a higher prevalence of Early Childhood Caries (ECC) when compared with the non-Indigenous population. However, the effect of ECC is not restricted to the teeth; it is associated with many serious health problems that may affect a child’s wellbeing and comfort. A recent study found that forty percent of Aboriginal children had active untreated dental caries and required treatment (Smith *et al.*, 2015). The New South Wales 2007 Child Dental Health survey also reported that significantly more Aboriginal children had dental caries than non-Aboriginal children (Centre for Oral Health Strategy NSW, 2009). Despite these findings, current approaches have been unsuccessful in reducing the burden of disease for young Aboriginal children. A potential barrier is accessing timely and culturally appropriate dental services. Traditionally health promotion interventions are delivered through schools because they reach a large number of participants in the one setting (St Leger, 2004; Waters *et al.*, 2017). However ECC begins before children are of school age. Nearly fifty percent of Australian Aboriginal children who are six months old or younger are bottle fed (Australian Bureau of Statistics, 2012), only five per cent brush their teeth regularly (Jamieson *et al.*, 2007) and they have a high intake of sugar products and snack

foods (Australian Bureau of Statistics, 2015a; b). All of these health behaviours have a direct link with ECC.

Early Childhood Caries can be controlled. However, it is necessary for parents and children to be introduced to preventive information in a timely manner. This includes regular use of fluoride toothpaste, appropriate dietary practices and not using a night time bottle of milk as a comforter.

Due to a lack of dental personnel and dental services in rural and remote areas of Australia it is imperative to investigate an alternative approach to teach Aboriginal parents/caregivers healthy dental behaviours rather than relying on professional oral health care workers. The Australian Government recommends the involvement of health care workers other than dental professionals to deliver preventive advice and to involve Aboriginal people in the oral health workplace (Australian Government, 2015). One solution is to utilise Aboriginal Health Workers (AHW’s) in delivering dental advice to Aboriginal families with young children. A recent study indicated that Aboriginal children are more likely to attend Aboriginal Community Controlled Health Services (ACCHS) than a state funded school dental service (Parker and Jamieson, 2007; Jamieson *et al.*, 2013; Jamieson *et al.*, 2008) and are more likely to access dental services at an ACCHS. There is a need for a simple intervention that utilises general health professionals in delivering oral health education and dental screening to Aboriginal families with young children with the specific aim of reducing the burden of dental disease among this disadvantaged population.

'Smiles not Tears' (SnT) is an evidence-based dental education program for young Aboriginal children. The study received funding to support the program within selected Aboriginal Community Controlled Health Services (ACCHS) and Aboriginal Medical Services (AMS) in New South Wales, Australia. The project addressed the issue of ECC by training and supporting AHW's who in turn taught Aboriginal families within their local community simple scientific messages about preventing dental caries and offered screening examinations to detect early carious lesions in the primary dentition.

The aim of the SnT program was to reduce the caries prevalence of preschool-aged Aboriginal children. The aim of this evaluation was to assess the effectiveness of a dental health education program, 'Smiles not Tears' in preventing Early Childhood Caries in young Aboriginal children.

In this paper the term 'Aboriginal' includes those of an Aboriginal and/or Torres Strait Islander Heritage.

Method

Study Context

The development, implementation, delivery and design of the SnT dental education program was directed by a team of researchers and paediatric dental specialists who regularly consulted with staff from the AMS, ACCHS and an Aboriginal Advisory Committee which represented the

Aboriginal communities involved and ensured all aspects of the research were culturally appropriate.

Pilot, background procedures and training program

The study was successfully piloted in the Central Tablelands of NSW, and improvements were made on the advice of the AHW's involved with the initial phase (Blinkhorn *et al.*, 2012; Smith *et al.*, 2016). Leaflets and fridge magnets (Figure 1) were developed in partnership with Aboriginal advisors to support the dental health messages delivered to families (Blinkhorn *et al.*, 2014) and a telephone advice line was organised.

All the participating AHW's completed a one day training course at each ACCHS to learn about ECC so they could deliver the designated oral health messages, screen for dental caries and use the SnT program (Smith *et al.*, 2016). The structure for each training day was identical. Multiple teaching methods were used to teach the AHW's including a two-hour PowerPoint presentation, role-play activities and group discussions. Refreshments were provided at lunch during the staff training day. Due to staff changes retraining was required throughout the duration of the study so that newly employed staff could continue the program.

Participants and settings

AMS and ACCHS with AHW's who had been trained in the use of the SnT program were responsible for delivering it to Aboriginal families with young children.



Figure 1 Example of a fridge magnet from the Smiles not Tears program

Locations included eight AMS/ACCHS in rural, remote and metropolitan areas of NSW, Australia. The program was delivered either in the AMS/ ACCHS premises or family home between 2012 and 2016. Aboriginal families who had a child six months of age were recruited, and the initial collection of data including consent took place at an ACCHS or AMS. All participating parents/ carers signed a consent form and took home participant information leaflets. Some families wanted time to consider whether they would join the program so took the consent and information home.

Objectives and Null Hypotheses

The aim of the SnT program was to reduce the prevalence of dental caries in young Aboriginal children. The primary endpoint for the study was the prevalence of dental caries at 30 months of age. The caries prevalence from children in the SnT group was compared to the control group (Blinkhorn *et al.*, 2012).

The null hypothesis was that dental health parameters (including dmft, dmfs, SiC¹⁰ and SiC³⁰) (Bratthall, 2000) for Aboriginal children in the historical control group would be equivalent to those in the active group at 30 months of age.

Dental examination for the historical control group

After consultation with an Aboriginal Advisory Group and before children were recruited to the active group, the baseline epidemiological data for the historical control group were collected. Examinations were undertaken in rural, remote and metropolitan areas of New South Wales in locations where it was planned to introduce the dental education program. Children from 21 childcare facilities had a dental examination.

Visual dental examinations were undertaken by one experienced epidemiologist using a torch and mouth mirror. Mean dmft and dmfs scores were calculated. In addition the Significant Caries Index was computed to highlight 10 per cent and 30 per cent of children with the largest number of carious lesions (Bratthall, 2000).

Active group

Our projection was that children in the SnT group would have a 20 per cent reduction in caries from 2 to 1.6 dmft

based on earlier trials. A sample size of 150 participants was required to provide 80 per cent power at the two sided 95 per cent level of significance to distinguish between a caries prevalence of 2 and 1.6 for children aged 30 months, allowing for an attrition rate of 33 per cent (Blinkhorn *et al.*, 2012). Details of the SnT program have been published (Smith *et al.*, 2016). The AHW's met with the parents/ carers over five visits to deliver age appropriate oral health messages when the child was 6, 9, 12, 18, and 24 months of age (Table 1). Each visit took approximately 15 minutes, however this varied according to the parents' needs. Transport for families was arranged through the ACCHS if required or visits could take place at the parents' home. All visits were scripted for consistency between AHW's. Visits consisted of an informal conversation with AHW's and parent using both a didactic and interactive delivery style to educate families. An example of interaction includes showing parents how to brush their child's teeth. The sixth visit included a dental examination by an epidemiologist. The method and materials used for the dental examinations were identical to that of the historical group. The messages discussed by the AHW at the visits included:

1. Appropriate baby bottle use and tooth friendly drinks to put in a bottle;
2. Brushing twice daily with a fluoride toothpaste;
3. Reduce the frequency of intake of sugary foods and drinks.

Culturally appropriate fridge magnets and pamphlets were given at each visit to support the messages. The AHW checked the child's teeth for caries by gently lifting the lip and examining the teeth. Toothpaste and brushes were supplied for all the family (Table 1).

Throughout the program, the SnT Project Manager contacted each AHW to remind them if a child was due for their next visit.

Ethics approval

Ethical approval was granted by the Research and Development Office, Royal Prince Alfred Hospital, Sydney, Protocol Number X14-0101 & HREC-09-RPA 85 and the Aboriginal Health and Medical Research Council Ethics Committee (AH&MRC) Protocol Number 696-09.

Table 1. Age of child and message taught at each 'Smiles not Tears' visit and attendance.

Visit	N (%) of children who attended	Age (months)	Messages
1	107 (100%)	6	Bottle use discussed. Magnets and pamphlets given to support message.
2	95 (88.8%)	9	Brush twice daily with a fluoride toothpaste discussed. Teeth screened by AHW. Magnets and pamphlets given to support message. Fluoride toothpaste and toothbrushes given.
3	88 (82.8%)	12	Safe snacking discussed. Teeth screened by AHW. Magnets and pamphlets given to support message. Fluoride toothpaste and toothbrushes given.
4	77 (72.0%)	18	No new messages given, all previous messages discussed. Teeth screened by AHW. Magnets and pamphlets given to support messages. Fluoride toothpaste and toothbrushes given.
5	64 (59.8%)	24	No new messages given, all previous messages discussed. Teeth screened by AHW. Magnets and pamphlets given to support messages. Fluoride toothpaste and toothbrushes given.
6	107 (100.0%)	30	Teeth examined by a Paediatric Dentist to record dmft/s. Fluoride toothpaste and toothbrushes given.

Results

Control Group Dental Data

There were 82 children in the historical control group of mean age 2.8 years (Table 2) with slightly fewer girls examined ($n = 36$, 43.9%) than boys ($n = 46$, 56.1%).

More than one third of the children had untreated dental caries ($n = 28$; 34.1%) with less than two thirds being caries free ($n = 54$, 65.9%). The dmft scores ranged from 0-14 with a mean of 2.1 (SD = 4.0), the dmfs score ranged from 0-44 with a mean of 4.7 (SD = 10.1), and the SiC¹⁰ and SiC³⁰ scores were 12.5 (SD = 1.3) and 6.9 (SD = 4.4) respectively (Table 2). Three children had previous dental treatment and all had untreated dental caries.

Active Group Dental Data

Aboriginal Health Workers from eight Aboriginal Community Controlled Health Services in New South Wales Australia invited 212 children to join the program. Twelve per cent ($n = 25$) of consents were not returned, thus 187 children were recruited. The recruitment phase ranged from three to six months. Eighty children were lost to program, which was largely associated with the closure of a metropolitan AMS because of financial problems and accounted for nearly half ($n = 38$; 48%) and a further 12 per cent ($n = 10$) due to general population movement. Ultimately, 107 children were examined, giving a response rate of 57.2 per cent. Their mean age was 2.6 years (SD 5.7) with just less than half being girls ($n = 53$; 49.1%).

The majority of children ($n = 104$; 97.2%) were caries free with only three children presenting with untreated dental caries. The mean dmft score ranged from 0-6 with a mean of 0.1 (SD = 0.6) and the dmfs score ranged from 0-6 with a mean of 0.1 (SD = 0.7). SiC¹⁰ and SiC³⁰ scores for the active group were 1.2 (SD = 2.1) and 0.4 (SD = 1.3) (Table 2). Four (3.7%) children were referred for dental treatment. Three children had caries and one was referred for hypoplastic teeth.

All children completed visit one ($n=107$; 100%) and nearly half completed all five visits ($n = 47$, 43.9%). Twenty nine per cent ($n = 31$) attended three visits and 20 per cent ($n = 22$) had four visits. The number of children attending visits reduced over time with the fewest ($n = 64$; 59.8%) attending visit five (Table 1).

Discussion

The SnT dental health education program is unique in that it involved AHW's rather than dental personnel. The study clearly showed reduced levels of caries among this population of young Aboriginal children. It has highlighted the value of expanding the role of AHW's in promoting oral health, by providing parents with advice on how to

prevent dental caries, screening teeth for dental caries, encouraging twice daily brushing with a fluoride toothpaste, not sleeping with a bottle of milk as a night time comforter and reducing the consumption of sugary snacks and drinks. This program is practical because Aboriginal families have regular contact with AHW's, so dental advice can be issued and followed up regularly.

The historical control group data were collected in the same locations as the SnT program and the diagnostic criteria were identical. Using identical locations was important for an accurate comparison between the control and active group. There was no known sociological or demographic differences between the two groups. It was not possible to undertake a randomised double blind controlled study as such a suggestion met strong opposition from the community members. The historical control group highlights the importance of introducing preventive dental care from a young age, as over a third of the children had dental caries. In addition, all children who had previous dental treatment had active dental caries which emphasises that treatment without prevention is of little value.

The mean dmft in the control group was over twenty times higher than that in the SnT group and the dmfs 47 times larger in the active group. The analysis of SiC¹⁰ and SiC³⁰ scores is of value as children suffering the major burden of disease are poorly represented by the overall dmft index. This indicates that not only did the program help reduce the mean dmft and dmfs scores but it had a greater impact on helping those with the poorest levels of oral health.

It is unrealistic in a program to expect all participants to attend all visits. Most children ($n = 105$; 98.1%) received information on all key messages and all received fluoride toothpaste ($n = 107$; 100%). Two (1.9%) children only attended visits one and two, which means they were not taught the messages about reducing the frequency of sugary foods and drinks but continued to receive fluoride toothpaste and brushes delivered to their houses by AHW's.

One of the most important messages delivered was brushing twice daily with a fluoride toothpaste, which is of value in a population with a high caries prevalence. Fluoride is a necessary component of effective dental health promotion programs and has the support of NSW Health Centre for Oral Health Strategy and the World Health Organisation (Australian Dental Association, 2014).

Training local AHW's to use the SnT program meant traveling costs were reduced when compared to programs that require dentists to visit on a regular basis. By training AHW's the program has the potential to be sustainable long term within Aboriginal communities. A Project Manager was a necessity in order to track the participants and remind AHW's if a child was due for a visit.

Table 2. Dental status of the Active and Control groups

	Mean age (years)	Caries free n, %	Untreated caries n (%)	dmft range	Mean dmft (SD)	dmfs range	Mean dmfs	SiC 10	SiC 30
Control group	2.8	54 (65.9%)	28 (34.1%)	0-14	2.1 (4.0)	0-44	4.7 (10.1)	12.5 (1.3)	6.9 (4.4)
Active group	2.6	104 (96.3%)	3 (2.8%)	0-6	0.1 (0.6)	0-6	0.5 (0.1)	1.2 (2.1)	0.4 (1.3)

Control group $n = 82$

Active group $n = 107$

Although the program successfully controlled the onset of caries in young Aboriginal children Health Service Managers will have to consider the costs of implementing the scheme when determining future budget planning.

Assessing the potential costs of the program was not part of the research, but the provision of health promotion on a part time basis by Aboriginal Health Workers delivered a cohort of young children largely free from dental caries. Clinical care of carious teeth is expensive in young children and often requires the provision of a general anaesthetic which is difficult to access in many parts of NSW. Therefore it seems appropriate to support the SnT program which is endorsed by the Aboriginal Communities and is certainly cheaper than the standard provision of public dental services (Gwynne *et al.*, 2017).

Challenges and limitations

The pilot work in the Central Tablelands of NSW provided positive results in terms of recruiting mothers with young children. The AHW's thought the preventive program would be useful as dental services were intermittent. On the basis of this pilot work the research team had a view that recruiting mothers with young children to the study would not be problematic. Indeed the training program on how to recruit and offer dental advice was well received by the AHW's who attended the induction meetings. Never the less a number of difficulties emerged during the course of the study, namely;

Consent - the consent paperwork was a source of concern to many of the mothers/carers. The legalistic nature of the documents and their length tended to discourage mothers from signing up to the study. The format of the consent papers was decided by the Ethics Committees and was not open to any changes. The research team met the AHW's to highlight the problem and suggested ways of explaining the study to worried parents.

Staff changes - there was a high turnover of staff in all but one of the AMS's, which impacted on the recruitment and education process, as re-training was required for new individuals. If the program is to be adopted as a mainstream service it will be important to appoint a well-established employee as an 'Oral Health Champion' to ensure new staff members understand the SnT program.

Population movement - Aboriginal societies have 'moving around' an area as part of their cultural heritage. Mothers moved to visit relatives and were no longer in contact with the recruiting AMS. If the program was State-wide the relocation to new areas would not be a problem as all Aboriginal Health Services would be offering the same advice (Davies *et al.*, 2008).

Organisational difficulties - although the participating AMS management teams agreed to support the SnT project there were administrative changes. One rural AMS had major staff losses and closed a number of projects in order to maintain statutory medical screening requirements. Although SnT was resource neutral as each AMS received a fee, the recruitment and education process was halted.

The largest Metropolitan Aboriginal Health Service was closed because of financial difficulties and staff were made redundant. Although the new organisation charged with reconfiguring the service supported the scheme, up

to 25 per cent of the participants were lost to follow up.

Mobile Telephones- are essential for contacting participants to ensure the visit schedule is maintained. The recruitment paperwork collected telephone numbers, but there was a high turnover of those numbers. This problem is difficult to solve. We relied on the AMS staff who would see the mothers/carers on a regular basis to maintain interest in the program and ask individuals who had not returned consent paperwork or missed an advice session to come into the clinic to make an appointment.

It is important to note that these challenges were not unique to the SnT program. Another study that assessed caries prevalence among a Cree population in Canada reported time constraints, personal resources, a lack of interest and a high staff turnover as barriers to implementing their program. In addition, they had difficulty with recruitment as interest in the program waned overtime (Harrison, Veronneau and Leroux, 2012). It is more challenging to implement a health promotion program that requires parental and community involvement than school based programs (Waters *et al.*, 2017). We worked hard to maintain contact with Community members, AHWs and Health Service Managers, via face to face meetings, email, telephone calls and regular program updates.

Conclusion

Children who participated in The SnT education program had much less dental caries experience than an historical control group. Utilising AHW's rather than dental professionals is a sustainable approach to help reduce the burden of ECC in young Australian Aboriginal children.

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All Authors contributed equally to the manuscript.

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