Risk factors for oral health in young, urban, Aboriginal and Torres Strait Islander children

K Butten,* NW Johnson,†‡ KK Hall,§a J Anderson,§ M Toombs,¶ N King,* *KF O’Grady*

*Queensland University of Technology, Institute of Health & Biomedical Innovation, Centre for Children’s Health Research, South Brisbane, Queensland, Australia.
†Menzies Health Institute Queensland and School of Dentistry and Oral Health, Griffith University, Gold Coast, Queensland, Australia.
‡Dental Institute, King’s College London, London, UK.
§Coomoolture Community Medical, Coomoolture, Queensland, Australia.
*Rural Clinical School, The University of Queensland, South Toowoomba, Queensland, Australia.
**Faculty of Health, Queensland University of Technology, Kelvin Grove, Queensland, Australia.

ABSTRACT

Background: The caries process follows a strong social gradient which can commence in the first years of life. Yet data on young children remain limited. This study reports the potential risk factors and indicators in urban, Aboriginal and Torres Strait Islander children aged less than 5 and estimates the prevalence of caries.

Methods: Demographic and risk factor and risk indicator data were collected at baseline in a cohort study of children attending a health clinic in north Brisbane. Dentulous children received a basic oral examination to explore the presence of decayed, missing and filled teeth (dmft). Descriptive analyses were performed. A backwards stepwise logistic regression model was performed to identify potential associations with dmft status.

Results: In this study, 180 children enrolled: 111 children received the oral examination, of whom 14 (12.6%) (mean age 35 months) were estimated to have dmft >0. There was a high prevalence of socio-economic, dietary and behavioural risk factors/indicators present for children. Due to the small sample size, planned regression was not performed.

Conclusions: Overall, the prevalence of risk factors and risk indicators for caries in the study population is high. More culturally appropriate resources that support preventive care need to be invested before children are school aged.

Keywords: Aboriginal and Torres Strait Islander, children, dental caries, risk factors, urban.

Abbreviations and acronyms: ADG = Australian Dietary Guidelines; QCOHS = Queensland Child Oral Health Survey.

( Accepted for publication 23 October 2018.)

BACKGROUND

Within Australia, dental caries is the most common chronic disease of childhood1 and Aboriginal and Torres Strait Islander (hereafter respectfully referred to as Indigenous) children experience a disproportionate amount of that burden.2 Despite being acknowledged as a priority population by the Australian Government’s National Oral Health Plan1 since 2004, data on the oral health of Indigenous peoples are lacking, particularly for those living in urban areas and young children. Indeed, there is a lack of data nationally on the oral health of children aged less than 5 years.3,4

It is important to address this gap as recent research suggests that a cariogenic environment may be established early on and preventive measures should take place in the first year of life before deciduous dentition commences.3 Caries are associated with a number of different risk factors and risk indicators. In this paper, we define a risk factor as an attribute in the direct causal chain of the disease (such as poor oral hygiene and high sugar diet), and a risk indicator as an attribute which is not of itself causal, but which has an indirect influence on the outcome (e.g., parenting practices) by influencing exposure to real risk.4,5

Individual factors attributed to the increased risk of early childhood caries include: going to sleep with a bottle, regular exposure to sugar through food or drink, not visiting a dentist, and lack of preventive
Risk factors in Indigenous children
care i.e. brushing and fluoride exposure.\textsuperscript{6,7} Socio
demographic factors including low-income, being a
single-parent, and low levels of parent education are
also well-established risk indicators for caries.\textsuperscript{8} Fur
thermore, it is hypothesized that cultural factors such
as the impact of colonization and the transgenera
tional experience of dispossession may also be associ
ated with caries risk within Indigenous populations.\textsuperscript{9} His
torically, the oral health of Indigenous peoples
was considered good, if not superior to non-Indigen
ous peoples.\textsuperscript{2} However, it is well known that colo
nization and transgenerational inequities have nega
tively impacted the overall health of Indigenous
people.\textsuperscript{9} Cultural factors such as family history (e.g.
Stolen Generation), community involvement, connec
tion to country and partaking in traditional cultural
practises have not been studied in relation to oral
health.

National data collections currently do not adequately
capture Indigenous people and research has mostly
taken place in rural and remote communities.\textsuperscript{2} Risk fac
tors and indicators for different populations may vary,
particularly between urban, rural, and remote popul
ations. Thus, we aimed to determine the prevalence of
known risk factors and risk indicators for caries in
Indigenous children aged less than 5 years in an urban
population and identify the characteristics of a child at
risk for caries inclusive of demographic, behavioural,
physiological, and cultural factors.

METHODS

The study was approved by the ethics committees of
the Queensland Children’s Health Services (HREC/12/
QRCH/169), University of Queensland (2012001395)
and Queensland University of Technology
(13000000741). The study was registered with the
Australia New Zealand Clinical Trials Registry
(ACTRN 12614001214628). Cultural oversight was
provided by an Indigenous Research Reference Group.

This paper reports on results from an opportunistic
oral health investigation conducted during a prospect
ve cohort study investigating acute respiratory illness
in children aged less than 5 years. The full study pro
tocol has been published.\textsuperscript{10}

Recruitment and data collection were opportunistic
and was conducted through an Aboriginal owned and
operated primary health care clinic in Caboolture, a
northern suburb of Brisbane, Queensland, between
February 2013 and October 2015. Clients with children
were approached in the waiting room by an Aboriginal
research officer. Children were eligible for the study if
they were aged less than 5 years, registered as a patient
of the clinic, and the parent/carer was willing and able
to consent and complete the study requirements. Chil
dren were excluded if the family was planning to move
in the following 12 months. The study protocol was
explained verbally and a plain language written state
ment was provided to potential participants. Signed
consent was obtained.

A parent/carer questionnaire was used to collect
data at enrolment. Information collected included
demographic, cultural, economic, and clinical factors.
Factors cited in the literature as established or poten
tial risk factors and risk indicators of dental disease
were also collected. These included both dietary and
oral health behaviours of parent and child.

The oral examination was basic, limited by the
child’s age and acceptance of the examination to be
conducted, and by the staffing and facilities of the orga
nization. Infants and younger children were held in
their parents arms with their head tilted back. Older
children sat in a chair independently. A dental hygienist
or the researcher who had been trained by the hygienist
visually inspected the mouth and used a gloved hand
and mirror when possible (younger children sometimes
did not accept the use of the mirror) to look and feel for
the number of teeth present and/or erupting and
whether teeth had cavities present, were filled or were
missing as a result of decay. Teeth were considered pre
sent if they had erupted through the gum and could be
exposed to saliva, food, and microflora. Teeth were
marked as having decay if cavitation to the dentine was
visible to the naked eye. Plaque levels and non-cavi
tated lesions were not counted. As there were only two
examiners and the one taught the other, they were not
calibrated. Decayed, missing and filled deciduous teeth
(dmft) were noted on a data collection sheet based on
the ‘dmft index’ criteria proposed by the World Health
Organization.\textsuperscript{11}

Descriptive analyses were performed for all children
with proportions presented by children with and with
out deciduous teeth present. Further analyses were
performed on data from children who had deciduous
teeth present and had undergone a dental screen. Due
to the small sample size, whether children with decid
uous teeth present had any evidence of decayed, miss
ing or filled teeth (dmft) was dichotomized as either
‘yes’ having dmft or ‘no’ not having any dmft; pro
portions were presented by dmft status, ‘dmft-yes’ or
‘dmft-no’. Chi-squared and Fischer’s exact (for vari
ables with cell counts <5) statistics were used to look
for differences in both the teeth present and not yet
present groups and dmft ‘yes’ or ‘no’ groups. In the
dmft status group (i.e. the 111 children who had teeth
present and had a dental screen to determine if they
had any dmft, we planned to enter factors that had a
P value less of <0.2 into a backwards stepwise logistic
regression model to identify potential associations
with dmft status. All analyses were conducted using
Stata 13.1 software (Stata Corp, College Station, TX,
USA).
RESULTS

In this study, 403 children were screened and 200 children enrolled. Of those not enrolled, 72 (35.4%) refused, 43 (21.6%) were ineligible and 88 (43.3%) were not enrolled for other reasons, such as homelessness or because the child was not with a primary carer or legal guardian at the time. Of those enrolled, 180 identified as Indigenous and were eligible for this analysis. The median age was 18.4 months (interquartile range 7.7–34.3); 51% were male. The majority of children 138 (76.6%) had deciduous teeth present and of the 138, 111 received a dental examination. The characteristics of study children by deciduous teeth present or not present are described in Table 1.

Demographic characteristics (Table 1) were similarly distributed between those children with and without deciduous teeth present and a number of demographic-associated risk indicators for caries were present: 76.6% of families had an annual household income of <$52,000, 51.6% of mothers were aged less than 25 at the time of their child’s birth, 37.7% of mothers and 45.0% of fathers had not completed high school (Table 1).

Of the household and cultural factors assessed (Table 1) 45.5% of carers reported having family from the Stolen Generation, 23.3% reported that they did not and 31.1% did not know if their family was from the Stolen Generation. The majority, 76.1% said that they identified with an Indigenous community, 43.3% had a connection with their traditional homeland and 61.1% maintained cultural connections at home (Table 1).

Oral health behaviours for the child and carer are presented in Table 2 and indicate that, of the children that had deciduous teeth present, 81.1% of children brushed their teeth daily, 89.8% of children had their own toothbrush, and 86.6% of children used toothpaste (Table 2). Whether or not, the toothpaste contained fluoride was not recorded, but in the geographical area, the vast majority of toothpaste purchased is fluoridated, as is the council water supply and the study population is considerably economically disadvantaged; 42.7% of fathers and 85.5% of mothers were unemployed and 76.6% of households had an annual income of <$52,000. The Australian National Dental Telephone Interview Survey 201015 reported that 9% of the 552 children aged 36 months had decayed teeth (i.e. cavitated lesions). The mean dmft was 3.0 teeth (standard deviation (SD) 1.7). The mean age for children with dmft experience was 35 months. While there were a number of factors that were identified on univariate analysis for inclusion in regression models, the small sample, the small number of children with dmft, missing data for some variables, and the small values in some cells, meant that a statistically valid model could not be constructed, particularly when accounting for the effect of age. Factors eligible for inclusion are available for viewing in supplementary tables online.

DISCUSSION

Understanding the current oral health environment of young, urban Indigenous children is necessary to inform policy and future programmes. This study is one of few Australian studies4,12–14 to report the characteristics of young children in relation to their oral health and is believed to be the first in over a decade to report on the prevalence of risk indicators and risk factors for caries in Indigenous children aged <5 living in urban Australia.

We found that the prevalence of caries (12.6%), as well as the mean dmft (3.0 teeth, SD 1.7) was higher than has been reported in other studies12–14 for other Australian children of a similar age (mean age 35 months in our study). A longitudinal case–control study (2008)14 of caries development from birth to 36 months conducted in a comparable socio-economic area to our study (Logan, south of Brisbane) reported that 9% of the 552 children aged 36 months had dental caries (i.e. cavitated lesions). The mean dmft was 2.3 teeth (SD 1.5).14 It is speculated that the contact by an oral health therapist every 6 months either by telephone or in a home visit to children during the Logan study may have contributed to the lower prevalence of dmft compared to our study population.

Overall, the prevalence of risk factors and risk indicators for caries in the study population is high. Poverty is one of the greatest influencers of oral health and the study population is considerably economically disadvantaged; 42.7% of fathers and 85.5% of mothers were unemployed and 76.6% of households had an annual income of <$52 000. The Australian National Dental Telephone Interview Survey 201015 reported that 9% of the 552 children aged 36 months had decayed teeth (i.e. cavitated lesions). The mean dmft was 3.0 teeth (standard deviation (SD) 1.7).14 It is speculated that the contact by an oral health therapist every 6 months either by telephone or in a home visit to children during the Logan study may have contributed to the lower prevalence of dmft compared to our study population.
Table 1. Child demographic and cultural characteristics

|                                      | All children (N = 180) (%) | Deciduous teeth not present (N = 42) (%) | Deciduous teeth present (N = 138) (%) | P value* |
|--------------------------------------|-----------------------------|------------------------------------------|--------------------------------------|----------|
| Gender                               |                             |                                          |                                      |          |
| Female                               | 88 (48.9)                   | 21 (50.0)                                | 67 (48.5)                            | 0.86     |
| Male                                 | 92 (51.1)                   | 21 (50.0)                                | 71 (51.4)                            |          |
| Age group                            |                             |                                          |                                      |          |
| <12 months                           | 39 (21.7)                   | 42 (100.0)                               | 17 (12.3)                            | <0.01    |
| 12 to <24 months                     | 48 (26.6)                   | 0 (0.0)                                  | 48 (34.7)                            |          |
| 24 to <36 months                     | 29 (16.1)                   | 0 (0.0)                                  | 29 (21.0)                            |          |
| 36 to <48 months                     | 22 (12.2)                   | 0 (0.0)                                  | 22 (15.9)                            |          |
| ≥48 months                           | 22 (12.2)                   | 0 (0.0)                                  | 22 (15.9)                            |          |
| Birth age                            |                             |                                          |                                      |          |
| <37 weeks                            | 34 (18.8)                   | 9 (21.4)                                 | 25 (18.3)                            | 0.66     |
| >37 weeks                            | 144 (80.0)                  | 33 (78.5)                                | 111 (81.6)                           |          |
| Birth weight                         |                             |                                          |                                      |          |
| ≤2500 g                              | 31 (17.2)                   | 8 (19.0)                                 | 23 (16.6)                            | 0.72     |
| >2500 g                              | 149 (82.7)                  | 34 (80.9)                                | 115 (83.3)                           |          |
| Child has a chronic illness          |                             |                                          |                                      |          |
| No                                   | 162 (90.0)                  | 39 (92.8)                                | 123 (91.1)                           | 0.57     |
| Yes                                  | 18 (10.0)                   | 3 (7.2)                                  | 15 (10.8)                            |          |
| Diagnosed respiratory illness in past 12 months |           |                                          |                                      |          |
| No                                   | 118 (65.5)                  | 38 (90.4)                                | 80 (57.9)                            | 0.00     |
| Yes                                  | 61 (33.8)                   | 4 (9.5)                                  | 57 (41.3)                            |          |
| Toothache in past 7 days             |                             |                                          |                                      |          |
| No                                   | 177 (98.3)                  | 42 (100.0)                               | 135 (97.8)                           | 1.00     |
| Yes                                  | 3 (1.6)                     | 0 (0.0)                                  | 3 (2.1)                              |          |
| Mother smoked during pregnancy       |                             |                                          |                                      |          |
| No                                   | 90 (50.0)                   | 23 (54.7)                                | 67 (48.5)                            | 0.50     |
| Yes                                  | 89 (49.4)                   | 19 (45.2)                                | 70 (50.7)                            |          |
| Mother consumed alcohol during pregnancy |                           |                                          |                                      | 0.49     |
| No                                   | 147 (81.6)                  | 33 (78.5)                                | 114 (82.6)                           |          |
| Yes                                  | 32 (17.7)                   | 9 (21.4)                                 | 23 (16.6)                            |          |
| Child was breastfed ever             |                             |                                          |                                      | 0.84     |
| No                                   | 49 (27.3)                   | 11 (26.1)                                | 38 (27.7)                            |          |
| Yes                                  | 130 (72.1)                  | 31 (73.8)                                | 99 (72.2)                            |          |
| Maternal age at birth                |                             |                                          |                                      | 0.15     |
| <25 years                            | 93 (51.6)                   | 19 (45.2)                                | 74 (53.6)                            |          |
| 25–30 years                          | 37 (20.5)                   | 7 (16.6)                                 | 30 (21.7)                            |          |
| 30+ years                            | 50 (27.7)                   | 16 (38.1)                                | 34 (24.6)                            |          |
| Paternal age at birth                |                             |                                          |                                      | 0.01     |
| <25 years                            | 65 (36.1)                   | 11 (26.1)                                | 54 (39.1)                            |          |
| 25–30 years                          | 47 (26.1)                   | 7 (16.6)                                 | 40 (28.9)                            |          |
| 30+ years                            | 68 (37.7)                   | 24 (57.1)                                | 44 (31.8)                            |          |
| Mother highest education             |                             |                                          |                                      | 0.03     |
| Tertiary                             | 22 (12.2)                   | 4 (9.5)                                  | 18 (13.0)                            |          |
| High school                          | 85 (47.2)                   | 26 (61.9)                                | 59 (42.7)                            |          |
| Did not complete high school         | 68 (37.7)                   | 10 (23.8)                                | 58 (42.0)                            |          |
| Unknown/missing                      | 2 (1.1)                     | 0 (0.0)                                  | 2 (1.4)                              |          |
| Father highest education             |                             |                                          |                                      | 0.10     |
| Tertiary                             | 22 (12.2)                   | 5 (11.9)                                 | 17 (12.3)                            |          |
| Certificate/diploma                 | 52 (28.3)                   | 18 (42.8)                                | 34 (24.6)                            |          |
| High school                          | 81 (45.0)                   | 15 (35.7)                                | 66 (47.8)                            |          |
| Did not complete high school         | 25 (13.8)                   | 4 (9.5)                                  | 21 (15.2)                            |          |
| Declined/unknown/missing             |                             |                                          |                                      |          |
| Mother’s employment                 |                             |                                          |                                      | 0.66     |
| Employed                             | 25 (85.5)                   | 5 (11.9)                                 | 20 (14.4)                            |          |
| Unemployed                           | 154 (85.5)                  | 37 (88.1)                                | 117 (87.7)                           |          |
| Missed                               | 1 (0.5)                     | 0 (0.0)                                  | 0 (0.0)                              |          |
| Father’s employment                 |                             |                                          |                                      | 0.57     |
| Employed                             | 77 (42.7)                   | 21 (50.0)                                | 56 (40.5)                            |          |
| Unemployed                           | 77 (42.7)                   | 18 (42.8)                                | 59 (42.7)                            |          |
| Annual household income             |                             |                                          |                                      | 0.54     |
| $101 000 to $156 000                 | 5 (2.7)                     | 1 (2.3)                                  | 4 (2.9)                              |          |
| $78 000 to $104 000                  | 12 (6.6)                    | 4 (9.5)                                  | 8 (5.8)                              |          |
| $52 000 to $78 000                   | 25 (13.8)                   | 7 (16.6)                                 | 18 (13.0)                            |          |
| $26 000 to $52 000                   | 69 (38.3)                   | 18 (42.8)                                | 51 (36.9)                            |          |
| <$26 000                             | 69 (38.3)                   | 12 (28.5)                                | 51 (36.3)                            |          |
| Primary carer on welfare            |                             |                                          |                                      | 0.63     |
| No                                   | 18 (10.0)                   | 5 (11.9)                                 | 13 (9.4)                             |          |
| Yes                                  | 162 (90.0)                  | 37 (88.1)                                | 125 (90.5)                           |          |
| Private health insurance             |                             |                                          |                                      | 0.46     |
| No                                   | 171 (95.0)                  | 39 (92.8)                                | 132 (95.6)                           |          |
| Yes                                  | 9 (5.0)                     | 3 (7.1)                                  | 6 (4.3)                              |          |
| Care type at home                    |                             |                                          |                                      | 0.35     |
| Both parents                         | 100 (55.5)                  | 27 (64.2)                                | 73 (52.9)                            |          |
| Single parent                        | 69 (38.3)                   | 14 (33.3)                                | 55 (39.8)                            |          |
| Other                                | 11 (6.1)                    | 1 (2.3)                                  | 10 (7.2)                             |          |

(continued)
reported that cost was a major barrier to people accessing oral health services and those in the lowest income level were the least likely to receive preventive oral health care.\(^{15}\) In this study, 48.0% of carers had reportedly not visited a dentist in ‘years’ and 26.0% answered ‘unknown’ when asked when they last saw a dentist. A qualitative study found that apprehension towards dentists by Indigenous Australians was attributed to feeling judged by the dentist and having their health behaviours questioned.\(^{16}\) In our study, 75.5% of parents/carers reported that at the time of the study, they had decayed, missing or filled teeth themselves, and 37.7% indicated that they did not like going to the dentist. Fifty-nine of the 75 respondents suggested that they were frightened; others indicated it was a mixture of fear, shame and/or embarrassment. The need for culturally safe care within the Australian health care system is well established.\(^{16}\) Programmes that are culturally safe and support parents to attend the dentist can potentially influence children’s attendance; with the relationship between a carer’s oral health behaviours and a child’s caries risk having been demonstrated previously.\(^{17}\)

In our study, children’s attendance to the dentist was higher (18.1%) than has been found for other Indigenous children of a similar age; 8% of children aged 30 months in Sydney, Australia (between 2005 and 2007) and 13.3% of children <36 months in the Queensland Child Oral Health Survey 2010–2011 (QCOHS).\(^{18}\) It was slightly lower compared with non-Indigenous children (20.5%) as reported in the QCOHS.\(^{18}\) Like other studies,\(^{15,19}\) the QCOHS indicated that children with the lowest family income were the least likely to attend the dentist.\(^{18}\) It is possible that the change to the Child Dental Benefits Schedule in Queensland, which extended the eligibility to children aged 2–4, when previously it provided for school-aged children only, could have improved attendance in our study population.\(^{20}\) However, as this change in policy came half-way through our data collection timeline, we can only speculate the influence. Other studies have reported that cultural connections and a strong Indigenous identity is protective for Indigenous people’s health, particularly for Indigenous children.\(^{21,22}\) Despite over half of parents and carers, suggesting they had received no education on caring for their child’s oral health, 90.5% of children with deciduous teeth present had their teeth brushed, 74.6% of those children brushing 1–2 times per day. Three quarters of participants in our study indicated they had a connection to an Indigenous community and 61.1% maintained cultural practices at home. The prevalence of reported cultural connection within our study community could be a protective factor

| Table 1 continued |
|-------------------|

| Total number of people in | ≤2 | 3–4 | 5–6 | 7+ | Missing | P value* |
|---------------------------|----|----|----|----|---------|---------|
| N = 180 (%) | 10 (5.5) | 81 (45.2) | 69 (38.5) | 19 (10.6) | 1 (0.5) | 0.41 |
| Deciduous teeth | 1 (2.3) | 16 (38.1) | 19 (45.2) | 6 (14.2) | 0 (0.0) | 0.01 |
| not present | N = 42 (%) | | | | | |
| Deciduous teeth | 9 (6.5) | 65 (47.4) | 50 (36.5) | 13 (9.4) | 1 (0.7) | |
| present | N = 138 (%) | | | | | |

| Total number of people | 0 | 1 | 2 | 3+ |
|------------------------|---|---|---|---|
| in bedroom with child | 20 (11.1) | 80 (44.4) | 43 (23.8) | 36 (20.0) |
| Indigenous | 1 (0.5) | 80 (44.4) | 43 (23.8) | 36 (20.0) |
| Non-Indigenous | 19 (10.6) | 14 (33.3) | 11 (26.1) | 16 (38.1) |
| Unknown/missing | 1 (0.5) | 0 (0.0) | 1 (0.7) | |
| Indigenous status of father | 118 (65.5) | 59 (32.7) | 59 (32.7) | 3 (1.6) |
| Indigenous | 24 (57.1) | 17 (40.4) | 17 (40.4) | 1 (2.3) |
| Non-Indigenous | 94 (68.1) | 42 (30.4) | 42 (30.4) | 2 (1.4) |
| Connection to homeland | 121 (67.2) | 59 (32.7) | 59 (32.7) | 3 (1.6) |
| Indigenous | 28 (66.6) | 14 (33.3) | 14 (33.3) | 1 (2.3) |
| Non-Indigenous | 93 (67.3) | 45 (32.6) | 45 (32.6) | 2 (1.4) |
| Maintain cultural connections at home | 68 (37.7) | 78 (43.3) | 9 (5.0) | 110 (61.1) |
| No | 14 (33.3) | 19 (45.2) | 2 (4.7) | 28 (66.6) |
| Yes | 54 (39.1) | 59 (42.7) | 7 (5.0) | 82 (59.4) |
| Unknown | 43 (23.3) | 19 (45.2) | 14 (33.3) | 33 (78.5) |
| Connection to community | 39 (21.6) | 78 (43.3) | 9 (5.0) | |
| No | 8 (19.0) | 19 (45.2) | 1 (2.3) | 2 (1.4) |
| Yes | 31 (22.4) | 72 (52.1) | 6 (14.2) | 59 (42.7) |
| Unknown | 137 (76.1) | 121 (67.2) | 62 (48.3) | 137 (76.1) |
| Family from stolen generation | 42 (23.3) | 82 (45.5) | 56 (31.1) | 33 (23.9) | 2 (1.1) | | 0.72 |
| No | 9 (21.4) | 19 (45.2) | 14 (33.3) | 33 (23.9) |
| Yes | 33 (23.9) | 63 (45.6) | 42 (30.4) | |
| Unknown | 42 (23.3) | 63 (45.6) | 42 (30.4) | |

*Chi-squared test for trend, Fischer’s exact if cell size <5.
although this would need to be explored further in larger studies.

Dietary habits have considerable influence on the oral health of young children, particularly night-time feeding with bottles and the regular consumption of cariogenic food and beverages. In our study, it was encouraging to see that nearly half of children never had a bottle at bedtime and very few

| Table 2. Oral health behaviours of child and carer | All children N = 180 (%) | Deciduous teeth not present N = 42 (%) | Deciduous teeth present N = 138 (%) | P value* |
|-----------------------------------------------|-----------------------------|----------------------------------------|-----------------------------------|----------|
| Exclusively breastfed | No | 154 (86.0) | 22 (52.3) | 132 (96.3) | 0.86 |
| | Yes | 24 (13.4) | 20 (47.6) | 4 (2.9) | |
| Child had bottle at bedtime ever | No | 89 (49.4) | 32 (76.1) | 57 (41.3) | <0.01 |
| | Yes | 82 (45.5) | 7 (16.6) | 75 (54.3) | |
| Child sucked thumb ever | No | 154 (85.5) | 35 (83.3) | 119 (86.2) | 1.00 |
| | Yes | 18 (10.0) | 4 (9.5) | 14 (10.1) | |
| Child used pacifier ever | No | 93 (54.6) | 23 (54.7) | 70 (50.7) | 0.46 |
| | Yes | 78 (43.3) | 15 (35.7) | 63 (45.6) | |
| Pacifier cleaned in carer mouth ever | No | 141 (78.3) | 30 (71.4) | 111 (80.4) | 0.46 |
| | Yes | 29 (16.1) | 8 (19.0) | 21 (15.2) | |
| Pacifier dipped in sweet ever | No | 155 (86.1) | 36 (85.7) | 119 (96.2) | 0.73 |
| | Yes | 14 (7.7) | 2 (4.7) | 12 (8.7) | |
| Are child’s teeth brushed | No | 7 (3.8) | 1 (2.3) | 6 (4.3) | <0.01 |
| | Yes | 127 (70.5) | 2 (4.7) | 125 (90.5) | |
| Child uses toothpaste | No | 6 (3.3) | 3 (7.1) | 3 (2.1) | <0.01 |
| | Yes | 120 (66.6) | 0 (0.0) | 120 (86.6) | |
| Child has own toothbrush | No | 2 (1.1) | 1 (2.3) | 1 (0.7) | 0.04 |
| | Yes | 126 (70.0) | 2 (4.7) | 124 (89.8) | |
| Frequency of brushing | >2 per day | 9 (5.0) | 0 (0.0) | 9 (6.5) | <0.01 |
| | 1–2 per day | 104 (57.7) | 1 (2.3) | 103 (74.6) | |
| | <1 per day | 7 (3.8) | 1 (2.3) | 6 (4.3) | |
| | None | 5 (2.7) | 3 (7.1) | 2 (1.4) | |
| Child has been to dentist | No | 157 (87.2) | 39 (92.8) | 118 (85.5) | 0.07 |
| | Yes | 11 (6.1) | 0 (0.0) | 11 (7.9) | |
| Child likes dentist | No | 14 (7.7) | 0 (0.0) | 14 (10.1) | N/A |
| | Yes | 12 (6.6) | 0 (0.0) | 12 (8.7) | |
| Last dental visit for carer | Months ago | 23 (12.8) | 5 (11.9) | 18 (13.1) | 0.57 |
| | Years ago | 86 (48.0) | 18 (42.8) | 68 (49.6) | |
| | Unknown | 47 (26.6) | 12 (28.5) | 35 (25.5) | |
| | Never | 3 (1.6) | 2 (4.7) | 1 (0.7) | |
| | Missing | 21 (11.6) | 5 (11.9) | 16 (11.5) | |
| Carer likes dentist | No | 68 (37.7) | 16 (38.1) | 52 (37.6) | 0.71 |
| | Yes | 97 (53.8) | 22 (52.3) | 75 (54.3) | |
| Carer has DMFT | No | 36 (20.0) | 4 (9.5) | 32 (23.1) | 0.09 |
| | Yes | 136 (75.5) | 35 (83.3) | 101 (73.1) | |
| Carer perception of fluoride | Good | 59 (32.7) | 14 (33.3) | 45 (32.6) | 0.37 |
| | Neither good nor bad | 63 (35.0) | 16 (38.1) | 47 (34.0) | |
| | Bad | 17 (9.4) | 2 (4.7) | 15 (10.8) | |
| | Don’t know what fluoride is/unknown | 33 (18.3) | 6 (14.2) | 27 (19.5) | |
| Carer has received education on dental health for child | No | 95 (52.7) | 25 (59.5) | 70 (50.7) | 0.94 |
| | Yes | 68 (37.7) | 13 (30.9) | 55 (39.8) | |
| | Unknown/missing | 17 (9.4) | 4 (9.5) | 13 (9.3) | |

*Chi squared test for trend excluding unknown/missing, Fischer’s exact if cell size <5.
†Not applicable.
### Table 3. Dietary variables

| Serving                        | All children N = 180 (%) | Deciduous teeth not present N = 42 (%) | Deciduous teeth present N = 138 (%) | P value* |
|--------------------------------|--------------------------|---------------------------------------|-------------------------------------|----------|
| **Beverages in bottle per day**|                          |                                       |                                     |          |
| Cordial ‘fruit drink concentrate’ | None                     | 166 (92.2)                            | 19 (45.2)                           | 37 (26.8) | 0.17 |
| <1 per day                     | 3 (1.6)                  | 0 (0.0)                               | 3 (2.1)                             |          |
| 1–3 per day                    | 2 (1.1)                  | 0 (0.0)                               | 2 (1.4)                             |          |
| >3 per day                     | 2 (1.1)                  | 0 (0.0)                               | 2 (1.4)                             |          |
| Unknown/missing                | 7 (3.8)                  | 2 (4.7)                               | 5 (3.6)                             |          |
| Carbonated drink               | None                     | 171 (95.0)                            | 40 (95.2)                           | 131 (94.9)| 0.46 |
| <1 per day                     | 1 (0.5)                  | 0 (0.0)                               | 1 (0.7)                             |          |
| 1–3 per day                    | 1 (0.5)                  | 0 (0.0)                               | 1 (0.7)                             |          |
| >3 per day                     | 0 (0.0)                  | 0 (0.0)                               | 0 (0.0)                             |          |
| Unknown/missing                | 7 (3.8)                  | 2 (4.7)                               | 5 (3.6)                             |          |
| Flavoured milk                 | None                     | 168 (93.3)                            | 40 (95.2)                           | 128 (92.7)| 0.04 |
| <1 per day                     | 1 (0.5)                  | 0 (0.0)                               | 1 (0.7)                             |          |
| 1–3 per day                    | 2 (1.1)                  | 0 (0.0)                               | 2 (1.4)                             |          |
| >3 per day                     | 1 (0.5)                  | 0 (0.0)                               | 1 (0.7)                             |          |
| Unknown/missing                | 8 (4.4)                  | 2 (4.7)                               | 6 (4.3)                             |          |
| Fruit juice                    | None                     | 156 (86.6)                            | 36 (85.7)                           | 120 (86.9)| 0.99 |
| <1 per day                     | 8 (4.4)                  | 2 (4.7)                               | 6 (4.3)                             |          |
| 1–3 per day                    | 9 (5.0)                  | 2 (4.7)                               | 7 (5.0)                             |          |
| >3 per day                     | 0 (0.0)                  | 0 (0.0)                               | 0 (0.0)                             |          |
| Unknown/missing                | 7 (3.8)                  | 2 (4.7)                               | 5 (3.6)                             |          |
| Plain milk                     | None                     | 111 (61.6)                            | 21 (50.0)                           | 90 (65.2) | 0.04 |
| <1 per day                     | 0 (0.0)                  | 0 (0.0)                               | 0 (0.0)                             |          |
| 1–3 per day                    | 8 (4.4)                  | 0 (0.0)                               | 8 (5.8)                             |          |
| >3 per day                     | 54 (30.0)                | 19 (45.2)                             | 35 (25.3)                           |          |
| Unknown/missing                | 7 (3.8)                  | 2 (4.7)                               | 5 (3.6)                             |          |
| Water                          | None                     | 128 (71.1)                            | 25 (39.5)                           | 103 (74.6)| 0.02 |
| <1 per day                     | 0 (0.0)                  | 0 (0.0)                               | 0 (0.0)                             |          |
| 1–3 per day                    | 5 (2.7)                  | 0 (0.0)                               | 5 (3.6)                             |          |
| >3 per day                     | 39 (21.6)                | 15 (35.7)                             | 24 (17.3)                           |          |
| Unknown/missing                | 8 (4.4)                  | 2 (4.7)                               | 6 (4.3)                             |          |
| **Beverages in cup per day**   |                          |                                       |                                     |          |
| Cordial ‘fruit drink concentrate’ | None                     | 118 (65.9)                            | 40 (95.2)                           | 78 (56.9) | <0.01 |
| <1 per day                     | 36 (20.1)                | 0 (0.0)                               | 36 (26.2)                           |          |
| 1–3 per day                    | 10 (5.5)                 | 0 (0.0)                               | 10 (7.3)                            |          |
| >3 per day                     | 7 (3.9)                  | 0 (0.0)                               | 7 (5.1)                             |          |
| Unknown/missing                | 8 (4.4)                  | 2 (4.7)                               | 6 (4.3)                             |          |
| Carbonated drink               | None                     | 120 (66.6)                            | 39 (92.8)                           | 81 (58.7) <0.01 |
| <1 per day                     | 40 (22.2)                | 1 (2.3)                               | 39 (28.2)                           |          |
| 1–3 per day                    | 10 (5.5)                 | 0 (0.0)                               | 10 (7.3)                            |          |
| >3 per day                     | 2 (1.1)                  | 0 (0.0)                               | 2 (1.4)                             |          |
| Unknown/missing                | 8 (4.4)                  | 2 (4.7)                               | 6 (4.3)                             |          |
| Flavoured milk                 | None                     | 128 (71.1)                            | 40 (95.2)                           | 88 (63.7) <0.01 |
| <1 per day                     | 33 (18.3)                | 0 (0.0)                               | 33 (21.9)                           |          |
| 1–3 per day                    | 9 (5.0)                  | 0 (0.0)                               | 9 (6.5)                             |          |
| >3 per day                     | 2 (1.1)                  | 0 (0.0)                               | 2 (1.4)                             |          |
| Unknown/missing                | 8 (4.4)                  | 2 (4.7)                               | 6 (4.3)                             |          |
| Fruit juice                    | None                     | 84(46.6)                              | 37(88.1)                            | 47(34.0) <0.01 |
| <1 per day                     | 44(24.4)                 | 2(4.7)                                | 42(30.4)                            |          |
| 1–3 per day                    | 38(21.1)                 | 1(2.3)                                | 37(26.8)                            |          |
| >3 per day                     | 6(3.3)                   | 0(0.0)                                | 6(4.3)                              |          |
| Unknown/missing                | 8(4.4)                   | 2(4.7)                                | 6(4.3)                              |          |
| Plain milk                     | None                     | 43(23.8)                              | 27(64.2)                            | 16(11.5) <0.01 |
| <1 per day                     | 6(3.3)                   | 0(0.0)                                | 6(4.3)                              |          |
| 1–3 per day                    | 35(19.4)                 | 1(2.3)                                | 34(24.6)                            |          |
| >3 per day                     | 87(48.3)                 | 12(28.5)                              | 7(5.0)                              |          |
| Unknown                       | 9(5.0)                   | 2(4.7)                                | 7(5.0)                              |          |
| Water                         | None                     | 35(19.4)                              | 27(64.2)                            | 8(5.8) <0.01 |
| <1 per day                     | 1(0.5)                   | 1(2.3)                                | 0(0.0)                              |          |
| 1–3 per day                    | 23(12.7)                 | 1(2.3)                                | 22(15.9)                            |          |
| >3 per day                     | 113(62.7)                | 11(26.1)                              | 102(73.9)                           |          |
| Unknown/missing                | 8(4.4)                   | 2(4.7)                                | 6(4.3)                              |          |

(continued)
having sugar-sweetened beverages in their bottles on a daily basis. However, there was a marked increase in the consumption of both cariogenic food and beverages once children had one or more deciduous teeth present and were drinking from a cup. This likely reflects the increased age of the child. Yet the consumption of ‘discretionary foods’ as described by the Australian Dietary Guidelines (ADG)\(^\text{23}\) is not recommended for young children. The ADG advises that discretionary foods are “not an essential or necessary part of healthy dietary patterns” and children <12 months should not be consuming them at all and older children should have them “only sometimes and in small amounts”.\(^\text{23}\) In univariate analyses, a number of foods/drinks were associated with dmft, as reported in other studies.\(^\text{3,4,23}\) However, we could not examine them in regression analyses; larger studies are required to investigate these associations further. A qualitative study of parents of young children found that parents were more likely to give sugary beverages to children as they aged to appease children’s preference and temperament.\(^\text{24}\) Programmes that support parent’s self-efficacy to continue with the healthy habits of Indigenous children would be an important focus for future research.

### Table 3 continued

| Serving          | All children N = 180 (%) | Deciduous teeth not present N = 42 (%) | Deciduous teeth present N = 138 (%) | P value* |
|------------------|-------------------------|---------------------------------------|-----------------------------------|----------|
| **Food items per week** |                         |                                       |                                   |          |
| Cereal           |                         |                                       |                                   |          |
| None             | 123 (68.3)              | 39 (92.8)                             | 84 (60.8)                         | <0.01    |
| <1 per week      | 34 (18.8)               | 1 (2.3)                               | 33 (23.9)                         |          |
| 1–3 per week     | 6 (3.3)                 | 0 (0.0)                               | 6 (4.3)                           |          |
| >3 per week      | 7 (3.8)                 | 0 (0.0)                               | 7 (5.0)                           |          |
| Unknown/missing  | 10 (5.5)                | 2 (4.7)                               | 8 (5.8)                           |          |
| Chocolate        |                         |                                       |                                   |          |
| None             | 81 (45.0)               | 38 (90.4)                             | 43 (31.1)                         | <0.01    |
| <1 per week      | 60 (33.3)               | 2 (4.7)                               | 58 (42.0)                         |          |
| 1–3 per week     | 18 (10.0)               | 0 (0.0)                               | 18 (13.0)                         |          |
| >3 per week      | 12 (6.6)                | 0 (0.0)                               | 12 (8.7)                          |          |
| Unknown/missing  | 9 (5.0)                 | 2 (4.7)                               | 7 (5.0)                           |          |
| Fresh fruit      |                         |                                       |                                   |          |
| None             | 48 (26.6)               | 35 (83.3)                             | 13 (9.4)                          | <0.01    |
| <1 per week      | 5 (2.7)                 | 1 (2.3)                               | 4 (2.9)                           |          |
| 1–3 per week     | 38 (21.1)               | 4 (9.5)                               | 34 (24.6)                         |          |
| >3 per week      | 80 (44.4)               | 0 (0.0)                               | 80 (57.9)                         |          |
| Unknown/missing  | 11 (6.1)                | 2 (5.0)                               | 1 (1.5)                           |          |
| Honey            |                         |                                       |                                   |          |
| None             | 118 (65.5)              | 40 (95.2)                             | 78 (56.5)                         | <0.01    |
| <1 per week      | 39 (21.6)               | 0 (0.0)                               | 39 (28.2)                         |          |
| 1–3 per week     | 6 (3.3)                 | 0 (0.0)                               | 6 (4.3)                           |          |
| >3 per week      | 7 (3.8)                 | 0 (0.0)                               | 7 (5.0)                           |          |
| Unknown/missing  | 10 (5.5)                | 2 (4.7)                               | 8 (5.8)                           |          |
| Hot chips ‘french fries’ |                   |                                       |                                   |          |
| None             | 69 (38.3)               | 38 (90.4)                             | 31 (22.4)                         | <0.01    |
| <1 per week      | 46 (25.5)               | 1 (2.3)                               | 45 (32.6)                         |          |
| 1–3 per week     | 46 (25.5)               | 1 (2.3)                               | 45 (32.6)                         |          |
| >3 per week      | 9 (5.0)                 | 0 (0.0)                               | 9 (6.5)                           |          |
| Unknown/missing  | 10 (5.5)                | 2 (4.7)                               | 8 (5.8)                           |          |
| Jam/fruit conserve |                       |                                       |                                   |          |
| None             | 125 (69.4)              | 40 (95.2)                             | 85 (61.5)                         | <0.01    |
| <1 per week      | 34 (18.8)               | 0 (0.0)                               | 34 (24.6)                         |          |
| 1–3 per week     | 6 (3.3)                 | 0 (0.0)                               | 6 (4.3)                           |          |
| >3 per week      | 5 (2.7)                 | 0 (0.0)                               | 5 (3.6)                           |          |
| Unknown/missing  | 10 (5.5)                | 2 (4.7)                               | 8 (5.8)                           |          |
| Confectionary    |                         |                                       |                                   |          |
| None             | 79 (43.8)               | 38 (90.4)                             | 41 (29.7)                         | <0.01    |
| <1 per week      | 55 (30.5)               | 2 (4.7)                               | 53 (38.4)                         |          |
| 1–3 per week     | 22 (12.2)               | 0 (0.0)                               | 22 (15.9)                         |          |
| >3 per week      | 13 (7.2)                | 0 (0.0)                               | 13 (9.4)                          |          |
| Unknown/missing  | 11 (6.1)                | 2 (4.7)                               | 9 (6.5)                           |          |
| Potato chips ‘crisps’ |                  |                                       |                                   |          |
| None             | 93 (51.6)               | 39 (92.8)                             | 54 (39.1)                         | <0.01    |
| <1 per week      | 49 (27.2)               | 1 (2.3)                               | 48 (34.7)                         |          |
| 1–3 per week     | 15 (8.3)                | 0 (0.0)                               | 15 (10.8)                         |          |
| >3 per week      | 13 (7.2)                | 0 (0.0)                               | 13 (9.4)                          |          |
| Unknown/missing  | 10 (5.5)                | 2 (4.7)                               | 8 (5.8)                           |          |
| Tinned fruit     |                         |                                       |                                   |          |
| None             | 118 (65.5)              | 38 (90.4)                             | 80 (57.9)                         | <0.01    |
| <1 per week      | 33 (18.3)               | 1 (2.3)                               | 32 (23.1)                         |          |
| 1–3 per week     | 14 (7.7)                | 1 (2.3)                               | 13 (9.4)                          |          |
| >3 per week      | 4 (2.2)                 | 0 (0.0)                               | 4 (2.9)                           |          |
| Unknown/missing  | 11 (6.1)                | 2 (4.7)                               | 9 (6.5)                           |          |

*Chi-squared test for trend excluding unknown/missing, Fischer’s exact if cell size <5.
choices they are making for their infant could potentially be beneficial. As has been shown in our study, parents appear to be supporting positive oral health behaviours, but there is room for improvement, especially as children age.

There are limitations to our study, including the method of oral screening. Due to the age of children and facility resources, only basic visual examinations were conducted and obvious decay recorded. Some argue that cavitated lesions, as documented for the dmft index, should not be the only marker for disease and pre-cavitated lesions should also be recorded as they contribute to disease trajectory. Given the insensitivity of the dmft measurement index, researchers should consider that the burden of disease is likely higher in a study population. In this study, due to small numbers, we dichotomized the dmft status. The Australian Research Centre for Population Oral Health posits that by looking at mean dmft scores, and in our case, a yes or no status, we are potentially overlooking the number of children that are carrying a disproportionate amount of the disease. Also, impacted by the sample size was our ability to achieve a stable regression model. Despite a number of factors approaching or reaching significance in univariate analysis, a sound model could not be completed because of the small sample size, the small proportion with dmft, and some missing data. Other limitations for the study include its cross-sectional nature, the self-reporting of dietary data, and that all data were from a single centre.

Our study indicates that parents and carers of young, urban Indigenous children are engaged in supporting their child’s oral health at home. However, there is also a high prevalence of several known risk factors and risk indicators for dental disease. Currently, many research studies and preventive programmes take place in school-aged children. This study, and the few others investigating oral health of young children, indicate that more resources need to be invested before children are school-aged, particularly culturally appropriate services that will increase healthy life styles amongst families, and the uptake of dental care in this population. Such dental care would need to be both affordable and appropriate, and to support parenting as argued recently by Kumar et al. and the authors of the La Cascada Declaration.

ACKNOWLEDGEMENTS

The authors thank the following for their support with study implementation and recruitment: Melissa Dunbar and Dan Arnold from QUT; Jacob Anderson, Ryan Anderson, Kim Bullivant, Gavan Bullivant, Megan Anderson, Lauren Doheny, Loretta Anderson and Melissa Bond from the Murri Health Group. Funding was provided through a Queensland Children’s Medical Research Institute Project Grant, UQ Foundation Research Excellence Award, a Queensland University of Technology Indigenous Health Start-up Research Grant. KB is supported by a Supervisor Scholarship at Queensland University of Technology. KO was supported by a NHMRC Career Development Fellowship (1045157) and Queensland Smart Futures Fellowship and is currently supported by the NHMRC Centre for Research Excellence in Lung Health for Indigenous Children (1040830). KH was supported by an Australian Postgraduate Award and the NHMRC Centre for Research Excellence in Lung Health for Indigenous children (1040830). The views expressed in this publication are those of the authors and do not reflect the views of the NHMRC.

DISCLOSURE

None declared.

SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article:

Table S1. Demographic and behavioural factors eligible for inclusion into a regression model.

Table S2. Dietary factors eligible for inclusion into a regression model.

REFERENCES

1. Oral Health Monitoring Group. Australia’s national oral health plan 2015–2024. COAG Health Council, Adelaide: Australian Government, 2015. Available at: https://www.mah.se/PageFiles/1541119092/Australias-National-Oral-Health-Plan-2015-2024_uploaded-170216.pdf. Accessed 15 July 2017.

2. De Silva AM, Martin-Kerry J, Geale A, Cole D. Flying blind: trying to find solutions to Indigenous oral health. Aust Health Rev 2016;40:570–583.

3. Leong PM, Gussy MG, Barrow S-YL, de Silva-Sanigorski A, Waters E. A systematic review of risk factors during first year of life for early childhood caries. Int J Paediatr Dent 2013;23:235–250.

4. Kumar S, Tatidakamadla J, Zimmer-Gembeck M, Kroon J, Laloo R, Johnson NW. Parenting practices and children’s dental caries experience: a structural equation modelling approach. Community Dent Oral Epidemiol 2017;45:1–7.

5. Johnson NW. Introduction: the nature of the caries process and the need for markers of risk. In: Johnson NW, ed. Risk markers for oral diseases. New York, NY: Cambridge University Press, 1991:1–11.

6. Harris R, Nicoll AD, Adair PM, Pine CM. Risk factors for dental caries in young children: a systematic review of the literature. Community Dent Health 2004;21:71–85.
7. Corrêa-Faria P, Martins-Júnior PA, Vieira-Andrade RG, Marques LS, Ramos-Jorge ML. Factors associated with the development of early childhood caries among Brazilian preschoolers. Pesqui Odontol Bras 2013;27:356–362.

8. Abreu LG, Elyasi M, Badri P, Paiva SM, Flores-Mir C, Amin M. Factors associated with the development of dental caries in children and adolescents in studies employing the life course approach: a systematic review. Eur J Oral Sci 2015;123:305–311.

9. Durey A, Bessarab D, Slack-Smith L. The mouth as a site of structural inequalities; the experience of Aboriginal Australians. Community Dent Health 2016;33:161–163.

10. Hall KK, Chang AB, Sloots TP, et al. The respiratory health of urban Indigenous children aged less than 5 years: study protocol for a prospective cohort study. BMC Pediatr 2015;15:56.

11. World Health Organization. Oral health surveys: basic methods, 5th edn. Geneva: WHO, 2013.

12. Kilpatrick NM, Neumann A, Lucas N, Chapman J, Nicholson JM. Oral health inequalities in a national sample of Australian children aged 2–3 and 6–7 years: early life oral health inequalities. Aus Dent J 2012;57(1):38–44.

13. Gussy M, Ashbolt R, Carpenter L, et al. Natural history of dental caries in very young Australian children. Int J Paediatr Dent 2016;26(3):173–183.

14. Platt KA, Pukallus ML, Barnett AG, Holcombe TF, Walsh LJ, Seow WK. A Longitudinal Case-Control Study of Caries Development from Birth to 36 Months. Caries Res 2013;47(2):117–127.

15. Harford J, Luzzi L. Child and teenager oral health and dental visiting: results from the national dental telephone interview survey 2010. Dental statistics and research series 64. Canberra, Australian Institute of Health and Welfare. Cat. no. DEN 226; 2013.

16. Durey A, McAullay D, Gibson B, Slack-Smith L. Aboriginal health worker perceptions of oral health: a qualitative study in Perth, Western Australia. Int J Equity Health 2016;15:4.

17. De Castilho AR, Mialhe FL, De Souza BT, Puppin-Rontani RM. Influence of family environment on children’s oral health: a systematic review. Jornal de Pediatria 2013;89:116–123.

18. Mejia GE, Ellershaw A, Ha D, Koster C. Study sample characteristics. In: Do LG, Spencer AJ, ed. The Beginning of Change: Queensland Child Oral Health Survey 2010–2012. Brisbane, Qld: Queensland Health, 2014:24–27.

19. Schwarz E. Access to oral health care – an Australian perspective. Community Dent Oral Epidemiol 2006;34:225–231.

20. Australian Government Department of Human Services. Child dental benefits schedule services, 2017. Available at: https://www.humanservices.gov.au/individuals/enablers/child-dental-benefits-schedule-services. Accessed 1 April 2018.

21. Young C, Tong A, Nixon J, et al. Perspectives on childhood resilience among the Aboriginal community: an interview study. Aust NZ J Public Health 2017;41:403–410.

22. Priest N, Mackean T, Davis E, Waters E, Briggs L. Strengths and challenges for Koori kids: harder for Koori kids, Koori kids doing well - exploring Aboriginal perspectives on social determinants of Aboriginal child health and wellbeing. Health Sociol Rev 2012;21:165–179.

23. National Health and Medical Research Council. Australian dietary guidelines. Canberra: National Health and Medical Research Council, 2013. Cat. No.: N55.URL: Avalaible at: https://www.nhmr.gov.au/guidelines-publications/n55. Accessed 15 July 2017.

24. Hoare A, Virgo-Milton M, Boak R, et al. A qualitative study of the factors that influence mothers when choosing drinks for their young children. BMC Res Notes 2014;7:430.

25. Armfield JM; Australian Research Centre for Population Oral Health. High caries children in Australia: a ‘tail’ of caries distribution. Aust Dent J 2005;50:204–206.

26. Kumar S, Zimmer-Gembeck MJ, Kroon J, Laloo R, Johnson NW. The role of parental rearing practices and family demographics on oral health-related quality of life in children. Qual Life Res 2017;26:2229–2236.

27. Cohen LK, Escobar A, Fejerskov O, Johnson NW, Manji F. La Cascada declaration. Daraja Press, 2017. Available at: https://lacascada.pressbooks.com/. Accessed 1 September 2017.

Address for correspondence:
Kaley Butten
Institute of Health & Biomedical Innovation
Centre for Children’s Health Research
Queensland University of Technology
South Brisbane
Queensland
Australia
Email: kaley.butten@hdr.qut.edu.au