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Cohort Profile: South Australian Aboriginal Birth Cohort (SAABC); a prospective longitudinal birth cohort

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2 Cohort Profile: South Australian Aboriginal Birth Cohort (SAABC); a prospective
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2 ABSTRACT:
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5 PURPOSE: The South Australian Aboriginal Birth Cohort (SAABC) is a prospective, longitudinal
6 birth cohort established to: (1) provide estimates of Aboriginal child dental disease compared with
7 general population estimates; (2) determine if an intervention aiming to reduce prevalence of early
8 childhood caries was more effective in early versus late infancy; (3) examine if these differences
9 were sustained over time and; (4) to document factors influencing social, behavioural, cognitive,
10 anthropometric, dietary and educational attainment over time.
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17 PARTICIPANTS: The original SAABC comprised 449 women pregnant with an Aboriginal child
18 recruited Feb 2011 to May 2012. The sample represented two-thirds of those eligible, and was
19 representative by age, socio-economic position and tobacco smoking status. At child age 2 years,
20 324 participants were followed up (74% retention), at child age 3 years, 324 participants were
21 followed up (74% retention) and at child age 5 years, 299 participants were followed up (69%
22 retention). Fieldwork for follow-up at child age 7 years is underway (interrupted due to COVID-19
23 restrictions), with funding available for follow-up at child age 9 years.
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31 FINDINGS TO DATE: At baseline, 53% of mothers were aged 14 to 24 years and 72% had
32 achieved high school or less as their highest educational attainment. At child age 3 years, rates of
33 dental disease were less among cohort children exposed to the intervention earlier rather
34 than later in childhood. The effect appeared to be sustained at child age 5 years, rates were still
35 higher than general child population estimates. Experiences of racism were high among mothers,
36 with impacts on tooth brushing behaviours and experience of toothache. Compared with population
37 estimates, levels of self-efficacy and self-rated oral health of mothers at baseline were low. The
38 proportion of total energy from discretionary foods was far higher for study children at age 3 years
39 than for non-Aboriginal Australian children. Breastfeeding >24 months was associated with higher
40 dental caries prevalence at child age 3 years compared with children who were never breastfed.
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50 FUTURE PLANS: The current follow-up, and child age 9 year follow-up, will hopefully be
51 completed without future interruption from COVID-19. We will seek funding for continued follow-
52 up of the cohort at ages 11, 13 and 15 years. The data yielded will contribute to a greater
53 understanding of the environmental, behavioural, dietary, biological and psychosocial factors
54 contributing to Aboriginal child/adolescent oral health, general health and social and emotional
55 wellbeing. This will be beneficial in charting the trajectory of cohort participants' health and
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2 wellbeing overtime, particularly in identifying the antecedents of chronic diseases which are highly
3 prevalent among Aboriginal Australian adults.
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7 REGISTRATION: Australian and New Zealand Clinical Trial Registry, ACTRN12611000111976.
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2 INTRODUCTION: Untreated dental caries (tooth decay) in children may cause substantial pain and
3 have severe consequences on eating, sleeping, playing, learning and general quality of life.¹ It is
4 associated with other chronic childhood conditions such as malnutrition, and is the strongest
5 predictor of poor oral health in adulthood.² Childhood caries is entirely preventable, yet Indigenous
6 Australian children experience high levels of the disease, with Indigenous children in some areas
7 having up to 5 times the prevalence of their non-Indigenous counterparts.³ In the 2012-14 National
8 Child Oral Health Survey, the mean number of decayed, missing or filled tooth surfaces in the
9 primary dentition of Indigenous children aged 5 to 10 years was 6.3 compared with 2.9 among non-
10 Indigenous children.⁴
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19 Provision of dental care to young Indigenous children can pose many challenges because of child
20 stage of emotional and physical development, and consequent capacity for co-operation in the
21 dental chair. The issues are multiplied for Indigenous children in rural and remote locations, where
22 access to dental care is severely limited. Hospital-based treatment under general anaesthetic is an
23 increasingly utilised mode of dental treatment for such children, with Indigenous Australian
24 children having twice the rate of hospital admissions for dental care than non-Indigenous children.⁵
25 However, dental treatment under general anaesthetic does not prevent the occurrence of new dental
26 decay, with children frequently re-admitted for hospital-based dental general anaesthetic after their
27 initial treatment.⁶ Oral rehabilitation under general anaesthetic also does little to alleviate dental fear
28 or to change non-cooperative behaviour and may, in fact, heighten these characteristics. Moreover,
29 comprehensive dental care under general anaesthetic is not without risk, including the potential for
30 long-term adverse neuro-developmental effects.⁷⁻⁹ Dental general anaesthetics are extremely
31 expensive for the tax-payer and community more broadly, and require considerable time and
32 financial investments from carers (to transport child to hospital, stay overnight, ensure fasting prior
33 to operation etc). The estimated mean cost of dental general anaesthetics for Indigenous children is
34 substantially higher than the cost of care for non-Indigenous children.⁷ Preventive approaches that
35 can be undertaken in the homes or Aboriginal Community Controlled Health Organisations of
36 Indigenous children to reduce the number of children undergoing dental general anaesthetics is thus
37 urgently required.
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53 The South Australian Aboriginal Birth Cohort study was established in 2011 to provide direct
54 estimates of Aboriginal child dental disease in South Australia compared with general population
55 estimates, to determine if an intervention aiming to reduce prevalence of early childhood caries was
56 more effective in early versus late infancy, to examine if these differences were sustained over time,
57 and to document social, behavioural, cognitive, anthropometric, dietary and educational attainment
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2 over time. Funding was originally received in 2011 to establish the cohort and to follow-up at child
3 ages 2 and 3 years.¹⁰ Further funding was received to follow-up the children at age 5 years, with
4 current funding received to follow-up the children at age 7 years (currently suspended due to
5 COVID-19 restrictions) and 9 years.
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10 COHORT DESCRIPTION

11 *Who is in the cohort?* This prospective birth cohort study was developed in partnership with local
12 Aboriginal communities and endorsed by the study's Aboriginal Reference Group. Participants
13 were 449 women pregnant with an Aboriginal child who were residing in South Australia during
14 the recruitment period of February 2011 to May 2012. Recruitment was through the antenatal
15 clinics of South Australian Aboriginal Community Controlled Health Organisations and hospitals.
16 The sample represented two-thirds of those who were eligible during the recruitment period, and
17 was representative by age, socio-economic position and tobacco smoking status.¹¹ One child passed
18 away in utero and a further 12 passed away before their 2nd birthday. At child age 2 years, 324
19 participants were followed up (74% retention; Figure 1). At child age 3 years, 324 participants were
20 followed up (74% retention). At child age 5 years, 299 participants were followed up (69%
21 retention). An early childhood caries intervention (that involved dental care to mothers, fluoride
22 application to teeth of children and anticipatory guidance delivered via motivational interviewing)
23 was implemented between pregnancy and child age 18 months (immediate intervention group) and
24 between child age 2 years and 3 years (delayed intervention group).
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38 *How often have they been followed up?* Participants were recruited during pregnancy (baseline) and
39 have been followed up at child mean ages 2 years, 3 years, 5 years and 7 years (currently suspended
40 due to covid-19). Baseline and loss to follow-up sample characteristics are shown for pregnancy
41 and child ages 2, 3 and 5 years in Table 1. At baseline, over half (53%) of mothers were aged 14 to
42 24 years and 72% had achieved high school or less as their highest educational attainment. Around
43 86% received their income from Centrelink (Government agency who provide welfare based on
44 means testing) and 82% owned a health-care card (means-tested, allows access to some health
45 services, for example, dental public health services that otherwise incur out-of-pocket expenses).
46 Around 61% resided in non-metropolitan locations and almost two-thirds (64%) usually visit a
47 dentist because of a problem. Three-quarters (75%) of mothers reported brushing their teeth the
48 previous day and while 55% rated their oral health as fair or poor, only 10% rated their general
49 health as fair or poor. A higher proportion of participants who were not followed-up at child ages
50 two, three and five years had (at baseline) lower educational attainment, received their income from
51 Centrelink, owned a healthcare card, resided in metropolitan locations, usually visited a dentist
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2 because of a problem, did not brush their teeth the previous day, rated their oral health as fair or
3 poor and rated their general health as fair or poor. All missing data for dental caries outcomes used
4 in subsequent analyses was imputed (except outcomes for deceased children) under the assumption
5 that data was missing at random using the Fully Conditional Specification method with logistic
6 regression for binary variables and linear regression for continuous variables. We created 50
7 imputed datasets using 50 iterations, with the results from the imputed datasets combined using
8 Rubin's rules via the 'Proc mianalyse' function.
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16 *What has been measured?* Broad categories of variables collected at baseline and each follow-up
17 phase are provided in Table 2, with more detail of these variables provided in Table 3. Data linkage
18 to government repositories has been approved and is currently underway, with participant consent.
19 Details of the government linkage datasets is provided in Table 4. Self-report questionnaires were
20 completed with the assistance of trained research officers if required. Dental examinations were
21 standardised and conducted by three calibrated dental professionals. Procedures appropriate for
22 young children were used when children were aged 2 years and 3 years, for example, in the 'knee-
23 to-knee' position on their carer's lap. Before examinations, teeth were dried with cotton pads.
24 Standard infection control procedures were followed and a fibre-optic light used as a light source.
25 Diagnosis was based on visual criteria only. Any child diagnosed with carious lesions was referred
26 for dental care through the South Australian Dental Service (provided free of charge). Weight was
27 measured in duplicate to the nearest 0.1 kg using Seca model 803 scales and averaged. If measures
28 differed by >0.2 kg, a third measure was taken and the average of the two closest values used in
29 analyses. Height was measured in duplicate to the nearest 1 mm using a Seca model 213 portable
30 stadiometer, using a standard anthropometric procedure. If measures differed by >5 mm a third
31 measurement was taken and the average of the closest two used in analyses. Blood pressure was
32 measured using a portable oscillometric device (Omron HEM-7211) and a cuff selected to suit the
33 child's mid-upper arm circumference using a standard protocol.
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49 **FINDINGS TO DATE:** Rates of dental disease among Aboriginal children in South Australia were
50 less among those exposed to the intervention earlier rather than later in childhood.^{12,13} The effect
51 appeared to be sustained at child age 5 years, although the rates of dental disease were still far
52 higher than estimates reported in Australia's National Child Oral Health Survey 2012-14.¹⁴ Rates of
53 psychosocial stress among mothers pregnant with Aboriginal children were high compared with
54 general Australian population estimates.¹⁵ Experiences of racism were high among mothers, with
55 impacts on tooth brushing behaviours¹⁶ and experience of toothache.¹⁷ Compared with population
56 estimates, levels of self-efficacy and self-rated oral health of study participants at baseline were
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2 low,¹⁸ with differences in the frame of reference regarding participants' self-rated oral health and
3 self-rated general health described.¹⁹ Smithers and colleagues reported that the proportion of total
4 energy from discretionary foods (including sugars in discretionary foods) was far higher for study
5 children at age 3 years than for non-Aboriginal Australian children.²⁰ Haag and others described
6 how breastfeeding >24 months was associated with higher dental caries prevalence at child age 3
7 years compared with children who were never breastfed.²¹ Santiago and colleagues demonstrated
8 how social support was characterised among study participants,²² and the impact of personal control
9 on self-reported health outcomes.²³ The effectiveness of implementing a motivational interviewing
10 approach to preventing poor oral health among Indigenous children and their families was
11 discussed,²⁴ with comparisons made with other studies involving motivational interviewing and the
12 oral health of vulnerable children.²⁵

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23 **STRENGTHS AND LIMITATIONS:** The main strength of the study is the Aboriginal community
24 engagement, involvement and partnership, orchestrated through the study's Aboriginal Reference
25 Group, through the Aboriginal Community Controlled Health Organisation stakeholder groups and
26 by the Senior Aboriginal research officer (JH). This has, without doubt, contributed to the excellent
27 follow-up rates, which need to be taken into context. For example, this cohort study has been
28 undertaken over vast distances (e.g. travelling 700 km to the west of South Australia, 400 km east,
29 800 km north), involving highly disadvantaged participants who have not always enjoyed positive
30 research interactions. The fact that participants represented two-thirds of those eligible to be
31 recruited during the recruitment period demonstrates the widespread community support and
32 generalisability of the results. The main limitation is the small sample size, which was essentially
33 limited by the small population size of Aboriginal people in South Australia (around 2% of the total
34 population). That we were able to recruit two thirds of those who were eligible at baseline (and have
35 had strong retention of participants since) suggests that had the target population size been larger at
36 baseline, the sample size of our study would consequently also be larger. Participants reported that
37 the dietary recalls (collected at child age 2 years) were burdensome and this may have increased
38 non-response or socially desirable responses. At the time of writing, follow-up at child age 7 years
39 was suspended due to social distancing restrictions necessitated by the COVID-19 pandemic. This
40 may impact our child age 9 years follow-up also.

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55 **COLLABORATION:** Study data are not freely available because of ethical and data protection
56 constraints. The de-identified data are stored at the University of Adelaide and cannot be sent
57 outside the institution. Proposals for possible collaborations in further analyses of the data should be
58 addressed to Lisa Jamieson (lisa.jamieson@adelaide.edu.au)

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2 and will be reviewed by the SAABC research team and Aboriginal Reference Group.
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16 Movement, Wodlitanattoai Program, Ninko Kutangga Patpangga, Kanggawodli Step Down Service,
17 Kaurna Plains, Fleurieu Families, Gilles Plains Community Health, MADEC Community Support
18 Services, Naporendi Aboriginal Forum, Nunga MiMinar, Aboriginal Strategy Unit of Families
19 South Australia, Inbarendi College, Para West Adult Campus, Pangula Mannanurna Aboriginal
20 Health Corporation and the Muno Parra Medical Centre, Second Story, Inner Southern Health
21 Service, The Corner House, Louise Place, PARKS, Talking Realities Program, Child Youth
22 Women's Health Services, Southern Junction Community Services, TAFE campuses, GP Plus
23 centres, employment programs, childcare centres, women's centres, domestic violence shelters, and
24 primary and high schools.
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Table 1. Baseline and follow-up/loss to follow-up characteristics at child age 2 years, 3 years and 5 years

	Baseline (pregnancy) (n=448)	Child age 2 years follow-up (n=324)	Child age 2 years loss to follow-up (n=112)	Child age 3 years follow-up (n=324)	Child age 3 years loss to follow-up (n=112)	Child age 5 years follow-up (n=299)	Child age 5 years loss to follow-up (n=137)
Maternal age							
14-24	238 (53.1)	172 (53.1)	66 (53.2)	173 (53.2)	59 (52.7)	156 (52.2)	76 (55.5)
25+	210 (46.9)	152 (46.9)	58 (46.8)	152 (46.8)	53 (47.3)	143 (47.8)	61 (44.5)
Education							
High school or less	322 (72.4)	226 (70.0)	88 (79.3)	232 (72.1)	82 (73.2)	203 (68.4)	111 (81.0)
Trade or University	123 (27.6)	97 (30.0)	23 (20.7)	90 (28.0)	30 (26.8)	94 (31.7)	26 (19.0)
Income							
Job	62 (14.0)	56 (17.34)	4 (3.7)	55 (17.1)	5 (4.5)	47 (15.9)	13 (9.6)
Centrelink	381 (86.0)	267 (82.7)	105 (96.3)	267 (82.9)	106 (95.5)	249 (84.1)	123 (90.4)
HCC status							
Yes	358 (82.2)	254 (79.9)	95 (89.6)	252 (79.3)	97 (91.5)	236 (80.8)	113 (85.6)
No	77 (17.8)	64 (20.1)	11 (10.4)	66 (20.8)	9 (8.5)	56 (19.2)	19 (14.4)
Residential location							
Metropolitan	171 (38.7)	116 (36.3)	55 (45.1)	116 (36.1)	51 (46.0)	132 (44.8)	35 (25.7)
Non- metropolitan	271 (61.3)	204 (63.8)	67 (54.9)	205 (63.9)	60 (54.1)	163 (55.2)	101 (74.3)
Usual reason visit dentist							
Problem	275 (64.0)	195 (61.9)	72 (69.2)	194 (62.4)	74 (67.9)	184 (63.7)	83 (63.8)
Check-up	155 (36.1)	120 (38.1)	32 (30.8)	117 (37.6)	35 (32.1)	105 (36.3)	47 (36.2)
Brush yesterday							
Yes	321 (75.0)	239 (76.0)	74 (69.8)	240 (77.4)	74 (67.9)	217 (75.9)	96 (72.7)
No	107 (25.0)	73 (23.4)	32 (30.2)	70 (22.6)	35 (32.1)	69 (24.1)	36 (27.3)
Self-rated oral health							
Excellent, very good or good	203 (45.3)	153 (47.2)	43 (38.4)	151 (46.5)	46 (41.1)	130 (43.5)	66 (48.2)
Fair or poor	245 (54.7)	171 (52.8)	69 (61.6)	174 (53.5)	66 (58.9)	169 (56.5)	71 (51.8)
Self-rated general health							
Excellent, very good or good	402 (89.9)	294 (91.0)	97 (86.6)	298 (92.0)	94 (83.9)	272 (91.0)	119 (87.5)
Fair or poor	45 (10.1)	29 (9.0)	15 (13.4)	26 (8.0)	18 (16.1)	27 (9.0)	17 (12.5)

Table 2. Broad categories of variables collected at baseline and each follow-up phase

Phase	Measurements
Baseline	Mother self-reported questionnaire <ul style="list-style-type: none"> • Dental treatment needs, oral health-related behaviours, maternal oral self-efficacy, self-rated oral health and oral health related quality of life. • General health conditions, health-related behaviours and self-rated general health. • Socioeconomic and psychosocial factors, including income, education, employment, experience of racism and cultural identity.
Child mean age 2 years	Carer self-reported questionnaire <ul style="list-style-type: none"> • Dental treatment needs, oral health-related behaviours, maternal oral health literacy, self-efficacy, dental perceptions, self-rated oral health and oral health related quality of life. • General health conditions (mother and child), health-related behaviours, physical activity, self-rated general health, 24-hour dietary recalls (child), breastfeeding habits. • Socioeconomic and psychosocial factors, including income, education, employment, experience of racism and cultural identity. • Family functioning and home environment Child height, weight, blood pressure, upper arm circumference Child dental examination
Child mean age 3 years	Carer self-reported questionnaire <ul style="list-style-type: none"> • Dental treatment needs, oral health-related behaviours, maternal oral health literacy, self-efficacy, dental perceptions, self-rated oral health and oral health related quality of life. • General health conditions (mother and child), health-related behaviours, physical activity, self-rated general health and dietary habits • Socioeconomic factors. Child height, weight, blood pressure, upper arm circumference Child dental examination
Child mean age 5 years	Carer self-reported questionnaire <ul style="list-style-type: none"> • Dental treatment needs, oral health-related behaviours, maternal oral health literacy, self-efficacy, dental perceptions, self-rated oral health and oral health related quality of life. • General health conditions (mother and child), health-related behaviours, physical activity, self-rated general health and dietary habits. • Socioeconomic factors. • Family functioning and home environment. • Child socioemotional well-being and cognitive outcomes. Child height, weight, blood pressure, upper arm circumference Child dental examination

<p>Child mean age 7 years</p>	<p>Carer self-reported questionnaire</p> <ul style="list-style-type: none"> • Dental treatment needs, oral health-related behaviours, maternal oral health literacy, self-efficacy, dental perceptions, self-rated oral health and oral health related quality of life. • General health conditions (mother and child), health-related behaviours, physical activity, self-rated general health and dietary habits. • Socioeconomic factors. • Family functioning and home environment. • Child socioemotional well-being and cognitive outcomes. <p>Child height, weight, blood pressure, upper arm circumference Child dental examination</p>
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Table 3. Detail of variables collected at baseline and each follow-up phase

	Baseline (Pregnancy n=449)	2 years (n=324)	3 years (n=324)	5 years (n=299)	7 years (ongoing)
Oral health-related variables					
Dental examinations (child- dental caries, gingivitis, trauma)		✓	✓	✓	✓
Dental treatment needs (mother and child)	✓	✓	✓	✓	✓
Oral health-related behaviours (oral hygiene habits)	✓	✓	✓	✓	✓
Oral health self-efficacy (mother)	✓	✓	✓	✓	
Oral health literacy (mother)		✓	✓	✓	
Knowledge of children's oral health (mother)	✓	✓	✓	✓	
Oral health fatalism (mother and child)	✓	✓	✓	✓	
Dental perceptions			✓		
Oral health-related quality of life (mother and child)	✓	✓	✓	✓	✓
General health					
Anthropometric measurements (height weight, arm circumference, blood pressure) (child)		✓	✓	✓	✓
General health conditions and hospitalisations (child)	✓	✓	✓	✓	✓
Health-related behaviours (smoking, alcohol intake) (mother)	✓	✓	✓	✓	✓
Physical activity (child)			✓	✓	
Self-rated general and oral health (mother and child)	✓	✓	✓	✓	✓
24-hour dietary recalls (child)		✓			
Breastfeeding habits (child)		✓			
Other dietary-related habits (mother and child)	✓	✓	✓	✓	✓
Socioeconomic and psychosocial factors					
Income, education, socioeconomic hardship, employment (mother)	✓	✓	✓	✓	✓
Experience of Racism (mother)	✓	✓			✓

1					
2	Cultural identity (mother)	✓	✓		
3					
4	Self-stem (child)				✓
5					
6					
7	Social support and sense of self-	✓			
8	control (mother)				
9					
10	Family functioning and home environment				
11	Parental functioning and home		✓	✓	✓
12	environment (mother and child)				
13					
14	Time-use diaries (child)				✓
15					
16					
17	Child development				
18	Cognitive outcomes (child)			✓	✓
19					
20					
21	Social and emotional well-being			✓	✓
22	(child)				
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Table 4. Datasets to be included in data linkage

Database domain	Types of information
Hospital admissions	Length of stay, ICD codes describing each hospitalisation event
Presentations at hospital emergency departments	Presenting problem, diagnosis
Well-child health checks	Child growth and development collected by nurses at routine health checks and ad hoc visits to local health clinics
Perinatal information	Medical information about pregnancy and child's birth
Public dental care	Dental treatments received by child in public dental clinics
School Enrolment	Information provided by carers at the time the child was enrolled at school including carer education, languages spoken at home and school absences
Literacy and Numeracy	Results on reading, writing and numeracy collected from a national assessment program when child is in year 3 (approximate age 8) at school
Housing	Information about families living in homes provided by the government

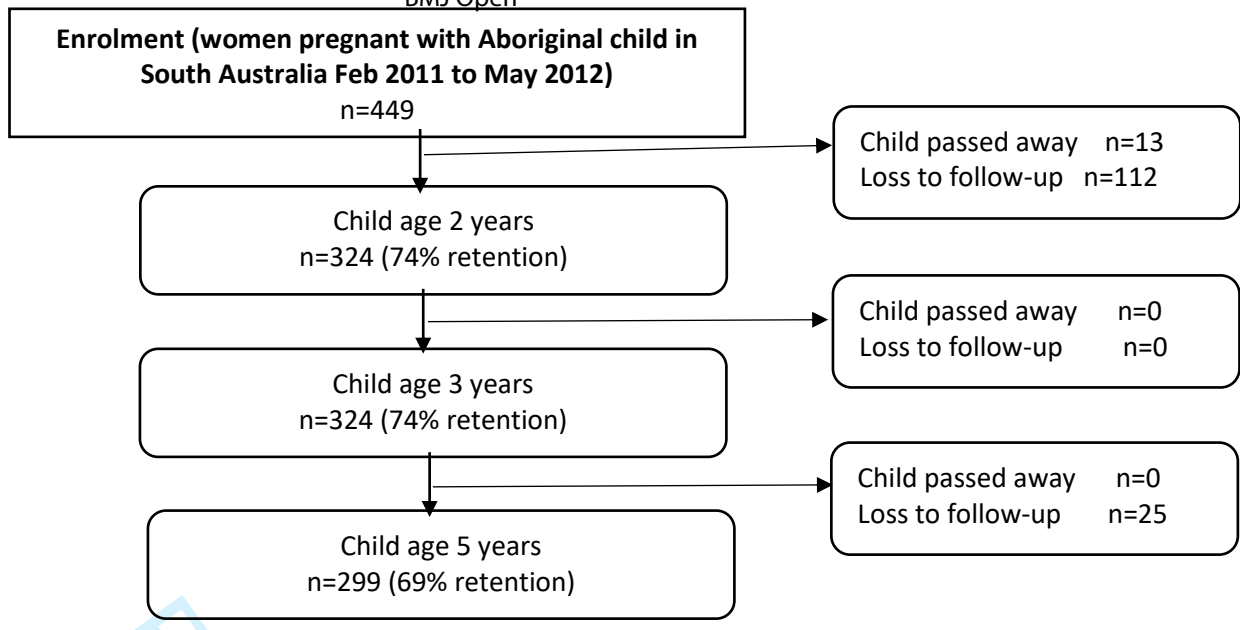


Fig 1: Flow diagram of participants through key stages of the cohort study

For peer review only

BMJ Open

Cohort Profile: South Australian Aboriginal Birth Cohort (SAABC); a prospective longitudinal birth cohort

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2 Cohort Profile: South Australian Aboriginal Birth Cohort (SAABC); a prospective
3
4 longitudinal birth cohort
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7 BMJ Open
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1
2 ABSTRACT:
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6 PURPOSE: The South Australian Aboriginal Birth Cohort (SAABC) is a prospective, longitudinal
7 birth cohort established to: (1) estimate Aboriginal child dental disease compared with population
8 estimates; (2) determine the efficacy of an early childhood caries intervention in early versus late
9 infancy; (3) examine if efficacy was sustained over time and; (4) document factors influencing
10 social, behavioural, cognitive, anthropometric, dietary and educational attainment over time.
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16 PARTICIPANTS: The original SAABC comprised 449 women pregnant with an Aboriginal child
17 recruited Feb 2011 to May 2012. At child age 2 years, 324 participants were retained (74%), at
18 child age 3 years, 324 participants were retained (74%) and at child age 5 years, 299 participants
19 were retained (69%). Fieldwork for follow-up at child age 7 years is underway, with funding
20 available for follow-up at child age 9 years.
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26 FINDINGS TO DATE: At baseline, 53% of mothers were aged 14-24 years and 72% had high
27 school or less educational attainment. At child age 3 years, dental disease experience was higher
28 among those exposed to the intervention later rather than earlier in infancy. The effect was
29 sustained at child age 5 years, but rates were still higher than general child population estimates.
30 Experiences of racism were high among mothers, with impacts on both tooth brushing and
31 toothache. Compared with population estimates, levels of self-efficacy and self-rated oral health of
32 mothers at baseline were low.
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41 FUTURE PLANS: Our data has contributed to better understanding of the environmental,
42 behavioural, dietary, biological and psychosocial factors contributing to Aboriginal child oral and
43 general health, and social and emotional wellbeing. This is beneficial in charting the trajectory of
44 cohort participants' health and wellbeing overtime, particularly in identifying antecedents of
45 chronic diseases which are highly prevalent among Aboriginal Australians. Funding for continued
46 follow-up of the cohort will be sought.
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52 REGISTRATION: ACTRN12611000111976.
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2 STRENGTHS AND LIMITATIONS OF THIS STUDY:
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- 4 ● One of the largest, most contemporary Aboriginal Birth Cohorts in Australia (indeed, of an
5 Indigenous population in the world), that recruited during pregnancy and that will have follow-ups
6 at five key time-points (child age 2 years, 3 years, 5 years, 7 years (data currently being collected)
7 and 9 years (funding available)).
8
9 ● Established Aboriginal Reference Group who provide governance and oversight of all study
10 processes, strong rapport with South Australian Aboriginal community and excellent participant
11 retention.
12
13 ● There are very few insights into Aboriginal child development stemming from prospective
14 longitudinal birth cohorts; our richly characterised and representative information is able to answer
15 questions that Aboriginal communities want answered with respect to Aboriginal child health and
16 development.
17
18 ● Small sample size (n=449) due to the small sampling pool who were eligible during recruitment.
19
20 ● Follow-up at child age 7 years has been impacted due to social distancing restrictions necessitated
21 by the COVID-19 pandemic. This may impact our child age 9 years follow-up also.
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2 INTRODUCTION: Untreated dental caries (tooth decay) in children may cause substantial pain and
3 have severe consequences on eating, sleeping, playing, learning and general quality of life.¹ It is
4 associated with other chronic childhood conditions such as malnutrition, and is the strongest
5 predictor of poor oral health in adulthood.² Childhood caries is entirely preventable, yet Indigenous
6 Australian children experience high prevalence of the disease, with Indigenous children in some
7 areas having up to 5 times the prevalence of their non-Indigenous counterparts.³ In the 2012-14
8 National Child Oral Health Survey, the mean number of decayed, missing or filled tooth surfaces in
9 the primary dentition of Indigenous children aged 5 to 10 years was 6.3 compared with 2.9 among
10 non-Indigenous children.⁴
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19 Provision of dental care to young Indigenous children can pose many challenges because of child
20 stage of emotional and physical development, and consequent capacity for co-operation in the
21 dental chair. The issues are multiplied for Indigenous children in rural and remote locations, where
22 access to dental care is severely limited. Hospital-based treatment under general anaesthetic is an
23 increasingly utilised mode of dental treatment for such children, with Indigenous Australian
24 children having twice the rate of hospital admissions for dental care than non-Indigenous children.⁵
25 However, dental treatment under general anaesthetic does not prevent the occurrence of new dental
26 decay, with children frequently re-admitted for hospital-based dental general anaesthetic after their
27 initial treatment.⁶ Oral rehabilitation under general anaesthetic also does little to alleviate dental fear
28 or to change non-cooperative behaviour and may, in fact, heighten these characteristics. Moreover,
29 comprehensive dental care under general anaesthetic is not without risk, including the potential for
30 long-term adverse neuro-developmental effects.⁷⁻⁹ Dental general anaesthetics are extremely
31 expensive for the tax-payer and community more broadly, and require considerable time and
32 financial investments from carers (to transport child to hospital, stay overnight, ensure fasting prior
33 to operation etc). The estimated mean cost of dental general anaesthetics for Indigenous children is
34 substantially higher than the cost of care for non-Indigenous children.⁷ Preventive approaches that
35 can be undertaken in the homes or Aboriginal Community Controlled Health Organisations of
36 Indigenous children to reduce the number of children undergoing dental general anaesthetics is thus
37 urgently required.
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53 Regrettably, Australian Aboriginal children score worse on almost every indicator of general health
54 and well-being relative to their non-Aboriginal counterparts. There is a higher prevalence of
55 nutrition-related stunting, non-optimal blood pressure growth outcomes¹⁰ and poorer social and
56 emotional wellbeing.¹¹ Around one-fifth of Aboriginal children are overweight or obese,¹² and
57 around 30% may not be exercising at recommended levels.¹¹ Little is known about the dietary
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2 patterns of Aboriginal children but there is some evidence of low rates of fruit, vegetables, water
3 and milk consumption.¹³ The literature suggests that many of the conditions experienced in
4 Aboriginal childhood are antecedents to chronic disease in later life. Recent studies have shown that
5 growth in childhood, especially rapid weight gain around 4-5 years, is associated with increased risk
6 of being overweight,¹⁴ elevated blood pressure, clustered metabolic risk,¹⁵ coronary events¹⁶ and
7 stroke.¹⁷ Data suggest that individuals who are small in the first 2 years of life and subsequently
8 gain weight rapidly present the greatest levels of risk. Evidence from a recent national report on the
9 Australian Early Development Census, which contained information on almost 290,000 5-year old
10 Australian children, indicated that almost half the Aboriginal children were developmentally
11 vulnerable on one or more of the 5 domains (physical, social, emotional, cognitive/language and
12 communication). This was more than twice the proportion of non-Aboriginal children.¹⁸
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22 The South Australian Aboriginal Birth Cohort study was established in 2011 to provide direct
23 estimates of Aboriginal child dental disease in South Australia compared with general population
24 estimates, to determine if an intervention aiming to reduce prevalence of early childhood caries was
25 more effective in early versus late infancy, to examine if these differences were sustained over time,
26 and to document social, behavioural, cognitive, anthropometric, dietary and educational attainment
27 over time. Funding was originally received in 2011 to establish the cohort and to follow-up at child
28 ages 2 and 3 years.¹⁹ Further funding was received to follow-up the children at age 5 years, with
29 current funding received to follow-up the children at age 7 years (currently suspended due to
30 COVID-19 restrictions) and 9 years.
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40 At baseline, 449 women pregnant with an Aboriginal child were recruited and randomly allocated
41 to either an immediate intervention (n=223) or delayed intervention group (n=225) (Figure 1). The
42 immediate intervention group received the following:
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47 1. Dental care to pregnant mothers: Mothers who were allocated randomly to the immediate
48 intervention arm and who were eligible for publically-funded dental care (through ownership of a
49 means-tested Government health care card) received dental care through the South Australian
50 Dental Service (SADS). Study staff organised transport and appointments, through assistance from
51 SADS's Aboriginal Liaison Program. Six private dentists provided care to participants who were
52 not eligible for publically-funded care. Dental care included x-rays, check-ups, scale and
53 prophylaxis, fillings and extractions (including wisdom teeth). Not provided were cosmetic
54 dentistry, endodontics and orthodontics.
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2 2. Fluoride varnish applied at child ages 6, 12 and 18 months: The protocol for fluoride varnish was
3 based on that used by Slade and colleagues.²⁰ Study staff were trained in its use and applied it.

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5 Children were supine, with their teeth cleaned and dried with gauze. Fluoride varnish was applied
6 from the back teeth first, before moving forward to the front teeth. Children (through their carers)
7 were advised to not eat food or drink for half an hour.
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12 3. Anticipatory Guidance: Oral health educational packages that were tailored to contain dental-
13 specific information relevant for pregnant mothers (focus on dental treatment, pregnancy gingivitis)
14 and when children were aged 6 months (focus on first solids, caring for baby teeth upon initial
15 eruption), 12 months (focus on tooth brushing and fluoride, avoiding sugar-containing beverages
16 and foods) and 18 months (focus on child's first dental check-up, molar teeth eruption).
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23 4. Motivational interviewing (MI): In combination with anticipatory guidance, motivational
24 interviewing was implemented with pregnant mothers and at child ages 6, 12 and 18 months. Study
25 staff completed an initial two-day MI training course, followed by an intensive one-day follow-up.
26 One-day follow-up training was continued monthly for six months. This was followed by one-day
27 coaching every two months, with occasional telephone coaching, for a further year. Each MI
28 session was conducted on a one-to-one basis in venues where participants felt comfortable (for
29 example, community halls, local Aboriginal health services, participants' homes). MI sessions
30 ranged from 30 to 90 minutes. Pictorial prompts and plain English summaries were used.²¹ A
31 member of the Motivational Interviewing Network of Trainers conducted the fidelity testing of the
32 MI sessions, which was found to be acceptable.²²
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41 When children were aged 24 months, delayed intervention group mothers received dental care.
42 Fluoride varnish application, anticipatory guidance and motivational interviewing for delayed
43 intervention participants were delivered when children were aged 24, 30 and 36 months,
44 respectively.
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50 *Statistical Analysis:*

51 Intention-to-treat principles have been used for all data analyses to estimate the effect of the
52 intervention on dental caries experience. General linear regression models were used to compare the
53 efficacy of the intervention on mean dmft between immediate and delayed intervention groups at
54 child age five years. To account for any contributing factors, we adjusted for baseline maternal
55 socio-demographic, health status and dental behaviour characteristics. The "Proc genmod" function
56 was used in SAS, with link=identity and distribution=normal, so GLM could be fitted and the least
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1 squares estimates obtained. Because, at child age 5 years, nearly one-third of mother-child pairs
2 were lost to follow-up, a Fully Conditional Specification method was used to impute missing data,
3 based on the assumption that data was missing at random (MAR). Immediate and delayed
4 intervention groups were imputed separately. Fifty imputed datasets were created using 50
5 iterations, with the results from the imputed datasets combined using Rubin's rules via the 'Proc
6 mianalyse' function. Sensitivity analyses were conducted using the 'MNAR adjust statement', with
7 different scenarios for dental outcomes, which included different percentages of MAR assumptions
8 and maximum and minimum value imputations. SAS statistical software (SAS 9.4, SAS Institute
9 Inc., Cary, NC, USA) was used for all analysis and imputation.
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18 COHORT DESCRIPTION

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21 *Who is in the cohort?* This prospective birth cohort study was developed in partnership with local
22 Aboriginal communities and endorsed by the study's Aboriginal Reference Group. Ethical
23 approvals were received from the University of Adelaide Human Research Ethics Committee (H-
24 057-2010), the Aboriginal Health Council of South Australia (04-09-362), the South Australian
25 Department for Health, including the human research ethics committees of participating South
26 Australian hospitals (Flinders Medical Centre: 435-10; Lyell McEwin Hospital: 2010-160; and the
27 Women's and Children's Hospital: REC2322/11/13). Participants provided signed informed
28 consent. Participants were 449 women pregnant with an Aboriginal child who were residing in
29 South Australia during the recruitment period of February 2011 to May 2012. Recruitment was
30 through the antenatal clinics of South Australian Aboriginal Community Controlled Health
31 Organisations and hospitals. The sample represented two-thirds of those who were eligible during
32 the recruitment period, and was representative by age, socio-economic position and tobacco
33 smoking status.²³ One child passed away in utero and a further 12 passed away before their 2nd
34 birthday. At child age 2 years, 324 participants were followed up (74% retention; Figure 1). At
35 child age 3 years, 324 participants were followed up (74% retention). At child age 5 years, 299
36 participants were followed up (69% retention).
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51 *How often have they been followed up?* Participants were recruited during pregnancy (baseline) and
52 have been followed up at child mean ages 2, 3, 5 and 7 years (currently suspended due to COVID-
53 19). Baseline and loss to follow-up sample characteristics are shown for pregnancy and child ages
54 2, 3 and 5 years in Table 1. At baseline, over half (53%) of mothers were aged 14 to 24 years and
55 72% had achieved high school or less as their highest educational attainment. Around 86% received
56 their income from Centrelink (Government agency who provide welfare based on means testing)
57 and 82% owned a health-care card (means-tested, allows access to some health services, for
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2 example, dental public health services that otherwise incur out-of-pocket expenses). Around 61%
3 resided in non-metropolitan locations and almost two-thirds (64%) usually visit a dentist because of
4 a problem. Three-quarters (75%) of mothers reported brushing their teeth the previous day and
5 while 55% rated their oral health as fair or poor, only 10% rated their general health as fair or poor.
6
7 A higher proportion of participants who were not followed-up at child ages two, three and five
8 years had (at baseline) lower educational attainment, received their income from Centrelink, owned
9 a healthcare card, resided in metropolitan locations, usually visited a dentist because of a problem,
10 did not brush their teeth the previous day, rated their oral health as fair or poor and rated their
11 general health as fair or poor.
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19 *What has been measured?* Broad categories of variables collected at baseline and each follow-up
20 phase are provided in Table 2, with more detail of these variables provided in Table 3. Most items
21 have been based on those used in other national surveys of child health in Australia, for example,
22 the Longitudinal Study of Indigenous Children and the National Child Oral Health Survey. Data
23 linkage to government repositories has been approved and is currently underway, with participant
24 consent. Details of the government linkage datasets is provided in Table 4. Self-report
25 questionnaires were completed with the assistance of trained research officers if required. Dental
26 examinations were standardised and conducted by three calibrated dental professionals. Procedures
27 appropriate for young children were used when children were aged 2 years and 3 years, for
28 example, in the 'knee-to-knee' position on their carer's lap. Before examinations, teeth were dried
29 with cotton pads. Standard infection control procedures were followed and a fibre-optic light used
30 as a light source. Diagnosis was based on visual criteria only. Any child diagnosed with carious
31 lesions was referred for dental care through the South Australian Dental Service (provided free of
32 charge). Weight was measured in duplicate to the nearest 0.1 kg using Seca model 803 scales and
33 averaged. If measures differed by >0.2 kg, a third measure was taken and the average of the two
34 closest values used in analyses. Height was measured in duplicate to the nearest 1 mm using a Seca
35 model 213 portable stadiometer, using a standard anthropometric procedure. If measures differed by
36 >5 mm a third measurement was taken and the average of the closest two used in analyses. Blood
37 pressure was measured using a portable oscillometric device (Omron HEM-7211) and a cuff
38 selected to suit the child's mid-upper arm circumference using a standard protocol.
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55 **PATIENT AND PUBLIC INVOLVEMENT:** The study's Aboriginal Reference Group has been
56 involved in the design, governance and general oversight of all phases of the research to date.
57 Study participants have been encouraged to communicate to the research team through Facebook
58 and other social media platforms. Newsletters and community presentations are frequently shared
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2 with participants and relevant key stakeholder groups. Members of the study's Aboriginal
3 Reference Group have presented the study findings at international conferences.
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7 FINDINGS TO DATE: The prevalence of mothers who were pregnant with their first child at
8 baseline was 38.5%. Rates of dental disease among Aboriginal children in South Australia were less
9 among those exposed to the intervention earlier rather than later in childhood.^{24, 25} The effect
10 appeared to be sustained at child age 5 years, although the rates of dental disease were still far
11 higher than estimates reported in Australia's National Child Oral Health Survey 2012-14.²⁶ Rates of
12 psychosocial stress among mothers pregnant with Aboriginal children were high compared with
13 general Australian population estimates.²⁷ Experiences of racism were high among mothers, with
14 impacts on tooth brushing behaviours²⁸ and experience of toothache.²⁹ Compared with population
15 estimates, levels of self-efficacy and self-rated oral health of study participants at baseline were
16 low,³⁰ with differences in the frame of reference regarding participants' self-rated oral health and
17 self-rated general health described.³¹ Smithers and colleagues reported that the proportion of total
18 energy from discretionary foods (including sugars in discretionary foods) was far higher for study
19 children at age 3 years than for non-Aboriginal Australian children.³² Haag and others described
20 how breastfeeding >24 months was associated with higher dental caries prevalence at child age 3
21 years compared with children who were never breastfed.³³ This is contrary to the many findings that
22 support prolonged breastfeeding among Indigenous Australians for better child health outcomes.
23 Santiago and colleagues demonstrated how social support was characterised among study
24 participants,³⁴ and the impact of personal control on self-reported health outcomes.³⁵ The
25 effectiveness of implementing a motivational interviewing approach to preventing poor oral health
26 among Indigenous children and their families was discussed,²² with comparisons made with other
27 studies involving motivational interviewing and the oral health of vulnerable children.³⁶
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45 STRENGTHS AND LIMITATIONS: The main strength of the study is the Aboriginal community
46 engagement, involvement and partnership, orchestrated through the study's Aboriginal Reference
47 Group, through the Aboriginal Community Controlled Health Organisation stakeholder groups and
48 by the Senior Aboriginal research officer (JH). This has, without doubt, contributed to the excellent
49 follow-up rates, which need to be taken into context. For example, this cohort study has been
50 undertaken over vast distances (e.g. travelling 700 km to the west of South Australia, 400 km east,
51 800 km north), involving highly disadvantaged participants who have not always enjoyed positive
52 research interactions. The fact that participants represented two-thirds of those eligible to be
53 recruited during the recruitment period demonstrates the widespread community support and
54 generalisability of the results. The main limitation is the small sample size, which was essentially
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1 limited by the small population size of Aboriginal people in South Australia (around 2% of the total
2 population). That we were able to recruit two thirds of those who were eligible at baseline (and have
3 had strong retention of participants since) suggests that had the target population size been larger at
4 baseline, the sample size of our study would consequently also be larger. Participants reported that
5 the dietary recalls (collected at child age 2 years) were burdensome and this may have increased
6 non-response or socially desirable responses. At the time of writing, follow-up at child age 7 years
7 was suspended due to social distancing restrictions necessitated by the COVID-19 pandemic. This
8 may impact our child age 9 years follow-up also.

17 CONTRIBUTORSHIP STATEMENT: Conceptualization, LMJ, JH, XJ, KK, CL, DH, PR, DM,
18 RR, LS; methodology, XJ, DH, LS, LMJ; resources, LMJ; data curation, LMJ, JH, XJ, KK, CL,
19 DH, PR, DM, RR, LS; writing—original draft preparation, LMJ; writing—review and editing, JH,
20 XJ, KK, CL, DH, PR, DM, RR, LS; visualization, LMJ, JH, XJ, KK, CL, DH, PR, DM, RR, LS. All
21 authors have read and agreed to the published version of the manuscript.

27 COMPETING INTERESTS: The authors declare no competing interests

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38 DATA SHARING STATEMENT: Study data are not freely available because of ethical and data
39 protection constraints. The de-identified data are stored at the University of Adelaide and cannot be
40 sent outside the institution. Proposals for possible collaborations in further analyses of the data
41 should be addressed to Lisa Jamieson (lisa.jamieson@adelaide.edu.au)
42 and will be reviewed by the SAABC research team and Aboriginal Reference Group.

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51 Flinders' Medical Centre, Aboriginal Family Support Services, Aboriginal Primary Health Unit,
52 Metro Aboriginal Family Birthing Program, Kura Yerlo Centre, Aboriginal Legal Rights
53 Movement, Wodlitinattoai Program, Ninko Kutangga Patpangga, Kanggawodli Step Down Service,
54 Kaurna Plains, Fleurieu Families, Gilles Plains Community Health, MADEC Community Support
55 Services, Naporendi Aboriginal Forum, Nunga MiMinar, Aboriginal Strategy Unit of Families

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2 South Australia, Inbarendi College, Para West Adult Campus, Pangula Mannanurna Aboriginal
3 Health Corporation and the Muno Parra Medical Centre, Second Story, Inner Southern Health
4 Service, The Corner House, Louise Place, PARKS, Talking Realities Program, Child Youth
5 Women's Health Services, Southern Junction Community Services, TAFE campuses, GP Plus
6 centres, employment programs, childcare centres, women's centres, domestic violence shelters, and
7 primary and high schools.
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2 **FIGURE LEGEND:**

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4 **Figure 1: Flow diagram of participants through key stages of the study**

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6 Intervention comprised: (1) dental care to mother; (2) Anticipatory guidance (mother); 3) Motivational
7 interviewing (mother) and; (4) Fluoride varnish application (child).

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9 Intervention delivered during pregnancy to child aged 18 months for immediate intervention group, at child
10 aged 24 to 36 months for delayed intervention group.
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Table 1. Baseline and follow-up/loss to follow-up characteristics at child age 2 years, 3 years and 5 years

	Baseline (pregnancy) (n=448)	Child age 2 years follow-up (n=324)	Child age 2 years loss to follow-up (n=112)	Child age 3 years follow-up (n=324)	Child age 3 years loss to follow-up (n=112)	Child age 5 years follow-up (n=299)	Child age 5 years loss to follow-up (n=137)
Maternal age							
14-24	238 (53.1)	172 (53.1)	66 (53.2)	173 (53.2)	59 (52.7)	156 (52.2)	76 (55.5)
25+	210 (46.9)	152 (46.9)	58 (46.8)	152 (46.8)	53 (47.3)	143 (47.8)	61 (44.5)
Education							
High school or less	322 (72.4)	226 (70.0)	88 (79.3)	232 (72.1)	82 (73.2)	203 (68.4)	111 (81.0)
Trade or University	123 (27.6)	97 (30.0)	23 (20.7)	90 (28.0)	30 (26.8)	94 (31.7)	26 (19.0)
Income							
Job	62 (14.0)	56 (17.34)	4 (3.7)	55 (17.1)	5 (4.5)	47 (15.9)	13 (9.6)
Centrelink	381 (86.0)	267 (82.7)	105 (96.3)	267 (82.9)	106 (95.5)	249 (84.1)	123 (90.4)
HCC status							
Yes	358 (82.2)	254 (79.9)	95 (89.6)	252 (79.3)	97 (91.5)	236 (80.8)	113 (85.6)
No	77 (17.8)	64 (20.1)	11 (10.4)	66 (20.8)	9 (8.5)	56 (19.2)	19 (14.4)
Residential location							
Metropolitan	171 (38.7)	116 (36.3)	55 (45.1)	116 (36.1)	51 (46.0)	132 (44.8)	35 (25.7)
Non- metropolitan	271 (61.3)	204 (63.8)	67 (54.9)	205 (63.9)	60 (54.1)	163 (55.2)	101 (74.3)
Usual reason visit dentist							
Problem	275 (64.0)	195 (61.9)	72 (69.2)	194 (62.4)	74 (67.9)	184 (63.7)	83 (63.8)
Check-up	155 (36.1)	120 (38.1)	32 (30.8)	117 (37.6)	35 (32.1)	105 (36.3)	47 (36.2)
Brush yesterday							
Yes	321 (75.0)	239 (76.0)	74 (69.8)	240 (77.4)	74 (67.9)	217 (75.9)	96 (72.7)
No	107 (25.0)	73 (23.4)	32 (30.2)	70 (22.6)	35 (32.1)	69 (24.1)	36 (27.3)
Self-rated oral health							
Excellent, very good or good	203 (45.3)	153 (47.2)	43 (38.4)	151 (46.5)	46 (41.1)	130 (43.5)	66 (48.2)
Fair or poor	245 (54.7)	171 (52.8)	69 (61.6)	174 (53.5)	66 (58.9)	169 (56.5)	71 (51.8)
Self-rated general health							
Excellent, very good or good	402 (89.9)	294 (91.0)	97 (86.6)	298 (92.0)	94 (83.9)	272 (91.0)	119 (87.5)
Fair or poor	45 (10.1)	29 (9.0)	15 (13.4)	26 (8.0)	18 (16.1)	27 (9.0)	17 (12.5)

Table 2. Broad categories of variables collected at baseline and each follow-up phase

Phase	Measurements
Baseline	Mother self-reported questionnaire <ul style="list-style-type: none"> • Dental treatment needs, oral health-related behaviours, maternal oral self-efficacy, self-rated oral health and oral health related quality of life. • General health conditions, health-related behaviours and self-rated general health. • Socioeconomic and psychosocial factors, including income, education, employment, experience of racism and cultural identity.
Child mean age 2 years	Carer self-reported questionnaire <ul style="list-style-type: none"> • Dental treatment needs, oral health-related behaviours, maternal oral health literacy, self-efficacy, dental perceptions, self-rated oral health and oral health related quality of life. • General health conditions (mother and child), health-related behaviours, physical activity, self-rated general health, 24-hour dietary recalls (child), breastfeeding habits. • Socioeconomic and psychosocial factors, including income, education, employment, experience of racism and cultural identity. • Family functioning and home environment Child height, weight, blood pressure, upper arm circumference Child dental examination
Child mean age 3 years	Carer self-reported questionnaire <ul style="list-style-type: none"> • Dental treatment needs, oral health-related behaviours, maternal oral health literacy, self-efficacy, dental perceptions, self-rated oral health and oral health related quality of life. • General health conditions (mother and child), health-related behaviours, physical activity, self-rated general health and dietary habits • Socioeconomic factors. Child height, weight, blood pressure, upper arm circumference Child dental examination
Child mean age 5 years	Carer self-reported questionnaire <ul style="list-style-type: none"> • Dental treatment needs, oral health-related behaviours, maternal oral health literacy, self-efficacy, dental perceptions, self-rated oral health and oral health related quality of life. • General health conditions (mother and child), health-related behaviours, physical activity, self-rated general health and dietary habits. • Socioeconomic factors. • Family functioning and home environment. • Child socioemotional well-being and cognitive outcomes. Child height, weight, blood pressure, upper arm circumference Child dental examination

<p>1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60</p> <p>Child mean age 7 years</p>	<p>Carer self-reported questionnaire</p> <ul style="list-style-type: none"> • Dental treatment needs, oral health-related behaviours, maternal oral health literacy, self-efficacy, dental perceptions, self-rated oral health and oral health related quality of life. • General health conditions (mother and child), health-related behaviours, physical activity, self-rated general health and dietary habits. • Socioeconomic factors. • Family functioning and home environment. • Child socioemotional well-being and cognitive outcomes. <p>Child height, weight, blood pressure, upper arm circumference Child dental examination</p>
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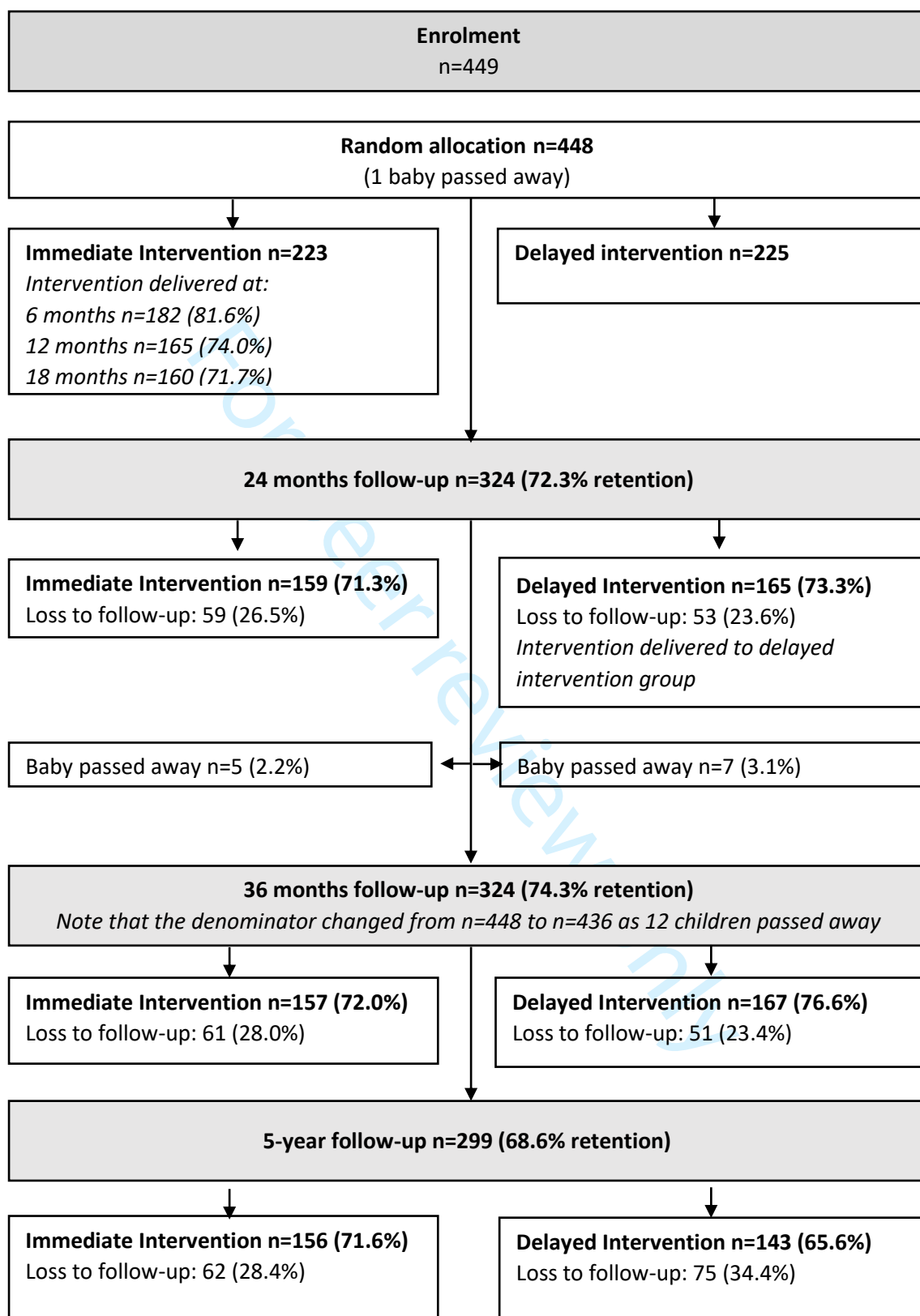
Table 3. Detail of variables collected at baseline and each follow-up phase

	Baseline (Pregnancy n=449)	2 years (n=324)	3 years (n=324)	5 years (n=299)	7 years (ongoing)
Oral health-related variables					
Dental examinations (child- dental caries, gingivitis, trauma)		✓	✓	✓	✓
Dental treatment needs (mother and child)	✓	✓	✓	✓	✓
Oral health-related behaviours (oral hygiene habits)	✓	✓	✓	✓	✓
Oral health self-efficacy (mother)	✓	✓	✓	✓	
Oral health literacy (mother)		✓	✓	✓	
Knowledge of children's oral health (mother)	✓	✓	✓	✓	
Oral health fatalism (mother and child)	✓	✓	✓	✓	
Dental perceptions			✓		
Oral health-related quality of life (mother and child)	✓	✓	✓	✓	✓
General health					
Anthropometric measurements (height weight, arm circumference, blood pressure) (child)		✓	✓	✓	✓
General health conditions and hospitalisations (child)	✓	✓	✓	✓	✓
Health-related behaviours (smoking, alcohol intake) (mother)	✓	✓	✓	✓	✓
Physical activity (child)			✓	✓	
Self-rated general and oral health (mother and child)	✓	✓	✓	✓	✓
24-hour dietary recalls (child)		✓			
Breastfeeding habits (child)		✓			
Other dietary-related habits (mother and child)	✓	✓	✓	✓	✓
Socioeconomic and psychosocial factors					
Income, education, socioeconomic hardship, employment (mother)	✓	✓	✓	✓	✓
Experience of Racism (mother)	✓	✓			✓

Cultural identity (mother)	✓	✓			
Self-stem (child)					✓
Social support and sense of self-control (mother)	✓				
Family functioning and home environment					
Parental functioning and home environment (mother and child)		✓		✓	✓
Time-use diaries (child)					✓
Child development					
Cognitive outcomes (child)				✓	✓
Social and emotional well-being (child)				✓	✓

Table 4. Datasets to be included in data linkage

Database domain	Types of information
Hospital admissions	Length of stay, ICD codes describing each hospitalisation event
Presentations at hospital emergency departments	Presenting problem, diagnosis
Well-child health checks	Child growth and development collected by nurses at routine health checks and ad hoc visits to local health clinics
Perinatal information	Medical information about pregnancy and child's birth
Public dental care	Dental treatments received by child in public dental clinics
School Enrolment	Information provided by carers at the time the child was enrolled at school including carer education, languages spoken at home and school absences
Literacy and Numeracy	Results on reading, writing and numeracy collected from a national assessment program when child is in year 3 (approximate age 8) at school
Housing	Information about families living in homes provided by the government



BMJ Open

Cohort Profile: South Australian Aboriginal Birth Cohort (SAABC); a prospective longitudinal birth cohort

Journal:	<i>BMJ Open</i>
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1
2 Cohort Profile: South Australian Aboriginal Birth Cohort (SAABC); a prospective
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4 longitudinal birth cohort
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2 ABSTRACT:
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6 PURPOSE: The South Australian Aboriginal Birth Cohort (SAABC) is a prospective, longitudinal
7 birth cohort established to: (1) estimate Aboriginal child dental disease compared with population
8 estimates; (2) determine the efficacy of an early childhood caries intervention in early versus late
9 infancy; (3) examine if efficacy was sustained over time and; (4) document factors influencing
10 social, behavioural, cognitive, anthropometric, dietary and educational attainment over time.
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16 PARTICIPANTS: The original SAABC comprised 449 women pregnant with an Aboriginal child
17 recruited Feb 2011 to May 2012. At child age 2 years, 324 participants were retained (74%), at age
18 3 years, 324 participants were retained (74%) and at age 5 years, 299 participants were retained
19 (69%). Fieldwork for follow-up at age 7 years is underway, with funding available for follow-up at
20 age 9 years.
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26 FINDINGS TO DATE: At baseline, 53% of mothers were aged 14-24 years and 72% had high
27 school or less educational attainment. At age 3 years, dental disease experience was higher among
28 children exposed to the intervention later rather than earlier in infancy. The effect was sustained at
29 age 5 years, but rates were still higher than general child population estimates. Experiences of
30 racism were high among mothers, with impacts on both tooth brushing and toothache. Compared
31 with population estimates, levels of self-efficacy and self-rated oral health of mothers at baseline
32 were low.
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41 FUTURE PLANS: Our data has contributed to a better understanding of the environmental,
42 behavioural, dietary, biological and psychosocial factors contributing to Aboriginal child oral and
43 general health, and social and emotional wellbeing. This is beneficial in charting the trajectory of
44 cohort participants' health and wellbeing overtime, particularly in identifying antecedents of
45 chronic diseases which are highly prevalent among Aboriginal Australians. Funding for continued
46 follow-up of the cohort will be sought.
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52 REGISTRATION: ACTRN12611000111976.
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2 STRENGTHS AND LIMITATIONS OF THIS STUDY:
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- 4 ● One of the largest, most contemporary Aboriginal Birth Cohorts in Australia (indeed, of an
5 Indigenous population in the world), that recruited during pregnancy and that will have follow-ups
6 at five key time-points (child age 2 years, 3 years, 5 years, 7 years (data currently being collected)
7 and 9 years (funding available)).
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9 ● Established Aboriginal Reference Group who provide governance and oversight of all study
10 processes, strong rapport with South Australian Aboriginal community and excellent participant
11 retention.
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13 ● There are very few insights into Aboriginal child development stemming from prospective
14 longitudinal birth cohorts; our richly characterised and representative information is able to answer
15 questions that Aboriginal communities want answered with respect to Aboriginal child health and
16 development.
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18 ● Small sample size (n=449) due to the small sampling pool who were eligible during recruitment.
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20 ● Follow-up at age 7 years has been impacted due to social distancing restrictions necessitated by
21 the COVID-19 pandemic. This may impact our age 9 years follow-up also.
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INTRODUCTION

Untreated dental caries (tooth decay) in children may cause substantial pain and have severe consequences on eating, sleeping, playing, learning and general quality of life.¹ It is associated with other chronic childhood conditions such as malnutrition, and is the strongest predictor of poor oral health in adulthood.² Childhood caries is entirely preventable, yet Indigenous Australian children experience high prevalence of the disease, with Indigenous children in some areas having up to 5 times the prevalence of their non-Indigenous counterparts.³ In the 2012-14 National Child Oral Health Survey, the mean number of decayed, missing or filled tooth surfaces in the primary dentition of Indigenous children aged 5 to 10 years was 6.3 compared with 2.9 among non-Indigenous children.⁴

Provision of dental care to young Indigenous children can pose many challenges because of child stage of emotional and physical development, and consequent capacity for co-operation in the dental chair. The issues are multiplied for Indigenous children in rural and remote locations, where access to dental care is severely limited. Hospital-based treatment under general anaesthetic is an increasingly utilised mode of dental treatment for such children, with Indigenous Australian children having twice the rate of hospital admissions for dental care than non-Indigenous children.⁵ However, dental treatment under general anaesthetic does not prevent the occurrence of new dental decay, with children frequently re-admitted for hospital-based dental general anaesthetic after their initial treatment.⁶ Oral rehabilitation under general anaesthetic also does little to alleviate dental fear or to change non-cooperative behaviour and may, in fact, heighten these characteristics. Moreover, comprehensive dental care under general anaesthetic is not without risk, including the potential for long-term adverse neuro-developmental effects.⁷⁻⁹ Dental general anaesthetics are extremely expensive for the tax-payer and community more broadly, and require considerable time and financial investments from carers (to transport child to hospital, stay overnight, ensure fasting prior to operation etc). The estimated mean cost of dental general anaesthetics for Indigenous children is substantially higher than the cost of care for non-Indigenous children.⁷ Preventive approaches that can be undertaken in the homes or Aboriginal Community Controlled Health Organisations of Indigenous children to reduce the number of children undergoing dental general anaesthetics is thus urgently required.

Regrettably, Australian Aboriginal children score worse on almost every indicator of general health and well-being relative to their non-Aboriginal counterparts. There is a higher prevalence of nutrition-related stunting, non-optimal blood pressure and growth outcomes¹⁰ and poorer social and emotional wellbeing.¹¹ Around one-fifth of Aboriginal children are overweight or obese,¹² and

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2 around 30% may not be exercising at recommended levels.¹¹ Little is known about the dietary
3 patterns of Aboriginal children but there is some evidence of low rates of fruit, vegetables, water
4 and milk consumption.¹³ The literature suggests that many of the conditions experienced in
5 Aboriginal childhood are antecedents to chronic disease in later life. Recent studies have shown that
6 growth in childhood, especially rapid weight gain around 4-5 years, is associated with increased risk
7 of being overweight,¹⁴ elevated blood pressure, clustered metabolic risk,¹⁵ coronary events¹⁶ and
8 stroke.¹⁷ Data suggest that individuals who are small in the first 2 years of life and subsequently
9 gain weight rapidly present the highest levels of risk. Evidence from a recent national report on the
10 Australian Early Development Census, which contained information on almost 290,000 5-year old
11 Australian children, indicated that almost half the Aboriginal children were developmentally
12 vulnerable on one or more of the 5 domains (physical, social, emotional, cognitive/language and
13 communication). This was more than twice the proportion of non-Aboriginal children.¹⁸

24 METHODS

25 STUDY DESIGN

26 The South Australian Aboriginal Birth Cohort study was established in 2011 to provide direct
27 estimates of Aboriginal child dental disease in South Australia compared with general population
28 estimates, to determine if an intervention aiming to reduce prevalence of early childhood caries was
29 more effective in early versus late infancy, to examine if these differences were sustained over time,
30 and to document social, behavioural, cognitive, anthropometric, dietary and educational attainment
31 over time. Funding was originally received in 2011 to establish the cohort and to follow-up at child
32 ages 2 and 3 years.¹⁹ Further funding was received to follow-up the children at age 5 years, with
33 current funding received to follow-up the children at age 7 years (currently suspended due to
34 COVID-19 restrictions) and 9 years.

35 At baseline, 449 women pregnant with an Aboriginal child were recruited and randomly allocated
36 to either an immediate intervention (n=223) or delayed intervention group (n=225) (Figure 1). The
37 immediate intervention group received the following:

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52 1. Dental care to pregnant mothers: Mothers who were allocated randomly to the immediate
53 intervention arm and who were eligible for publically-funded dental care (through ownership of a
54 means-tested Government health care card) received dental care through the South Australian
55 Dental Service (SADS). Study staff organised transport and appointments, through assistance from
56 SADS's Aboriginal Liaison Program. Six private dentists provided care to participants who were
57 not eligible for publically-funded care. Dental care included x-rays, check-ups, scale and
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2 prophylaxis, fillings and extractions (including wisdom teeth). Not provided were cosmetic
3 dentistry, endodontics and orthodontics.
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7 2. Fluoride varnish applied at child ages 6, 12 and 18 months: The protocol for fluoride varnish was
8 based on that used by Slade and colleagues.²⁰ Study staff were trained in its use and applied it.
9 Children were supine, with their teeth cleaned and dried with gauze. Fluoride varnish was applied
10 from the back teeth first, before moving forward to the front teeth. Children (through their carers)
11 were advised to not eat food or drink for half an hour.
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17 3. Anticipatory Guidance: Oral health educational packages that were tailored to contain dental-
18 specific information relevant for pregnant mothers (focus on dental treatment, pregnancy gingivitis)
19 and when children were aged 6 months (focus on first solids, caring for baby teeth upon initial
20 eruption), 12 months (focus on tooth brushing and fluoride, avoiding sugar-containing beverages
21 and foods) and 18 months (focus on child's first dental check-up, molar teeth eruption).
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27 4. Motivational interviewing (MI): In combination with anticipatory guidance, motivational
28 interviewing was implemented with pregnant mothers and at child ages 6, 12 and 18 months. Study
29 staff completed an initial two-day MI training course, followed by an intensive one-day follow-up.
30 One-day follow-up training was continued monthly for six months. This was followed by one-day
31 coaching every two months, with occasional telephone coaching, for a further year. Each MI
32 session was conducted on a one-to-one basis in venues where participants felt comfortable (for
33 example, community halls, local Aboriginal health services, participants' homes). MI sessions
34 ranged from 30 to 90 minutes. Pictorial prompts and plain English summaries were used.²¹ A
35 member of the Motivational Interviewing Network of Trainers conducted the fidelity testing of the
36 MI sessions, which was found to be acceptable.²²
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47 When children were aged 24 months, delayed intervention group mothers received dental care.
48 Fluoride varnish application, anticipatory guidance and motivational interviewing for delayed
49 intervention participants were delivered when children were aged 24, 30 and 36 months,
50 respectively.
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54 *Statistical Analysis:*

55 Intention-to-treat principles have been used for all data analyses to estimate the effect of the
56 intervention on dental caries experience. General linear regression models were used to compare the
57 efficacy of the intervention on mean number of decayed, missing and filled teeth (dmft) between
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2 immediate and delayed intervention groups at child age five years. To account for any contributing
3 factors, we adjusted for baseline maternal socio-demographic, health status and dental behaviour
4 characteristics. The ‘Proc genmod’ function was used in SAS, with link=identity and
5 distribution=normal, so GLM could be fitted and the least squares estimates obtained. Because, at
6 age 5 years, nearly one-third of mother-child pairs were lost to follow-up, a Fully Conditional
7 Specification method was used to impute missing data, based on the assumption that data was
8 missing at random (MAR). Immediate and delayed intervention groups were imputed separately.
9 Fifty imputed datasets were created using 50 iterations, with the results from the imputed datasets
10 combined using Rubin’s rules via the ‘Proc mianalyse’ function. Sensitivity analyses were
11 conducted using the ‘MNAR adjust statement’, with different scenarios for dental outcomes, which
12 included different percentages of MAR assumptions and maximum and minimum value
13 imputations. SAS statistical software (SAS 9.4, SAS Institute Inc., Cary, NC, USA) was used for all
14 analysis and imputation.
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26 COHORT DESCRIPTION

27 *Who is in the cohort?* This prospective birth cohort study was developed in partnership with local
28 Aboriginal communities and endorsed by the study’s Aboriginal Reference Group. Ethical
29 approvals were received from the University of Adelaide Human Research Ethics Committee (H-
30 057-2010), the Aboriginal Health Council of South Australia (04-09-362), the South Australian
31 Department for Health, including the human research ethics committees of participating South
32 Australian hospitals (Flinders Medical Centre: 435-10; Lyell McEwin Hospital: 2010-160; and the
33 Women’s and Children’s Hospital: REC2322/11/13). Participants provided signed informed
34 consent. Participants were 449 women pregnant with an Aboriginal child who were residing in
35 South Australia during the recruitment period of February 2011 to May 2012. Recruitment was
36 through the antenatal clinics of South Australian Aboriginal Community Controlled Health
37 Organisations and hospitals. The sample represented two-thirds of those who were eligible during
38 the recruitment period, and was representative by age, socio-economic position and tobacco
39 smoking status.²³ One child passed away in utero and a further 12 passed away before their 2nd
40 birthday. At child age 2 years, 324 participants were followed up (74% retention; Figure 1). At age
41 3 years, 324 participants were followed up (74% retention). At age 5 years, 299 participants were
42 followed up (69% retention).
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57 *How often have they been followed up?* Participants were recruited during pregnancy (baseline) and
58 have been followed up at child mean ages 2, 3, 5 and 7 years (currently suspended due to COVID-
59 19). Baseline and loss to follow-up sample characteristics are shown for pregnancy and child ages
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2 2, 3 and 5 years in Table 1. At baseline, over half (53%) of mothers were aged 14 to 24 years and
3 72% had achieved high school or less as their highest educational attainment. Around 86% received
4 their income from Centrelink (Government agency who provide welfare based on means testing)
5 and 82% owned a health-care card (means-tested, allows access to some health services, for
6 example, dental public health services that otherwise incur out-of-pocket expenses). Around 61%
7 resided in non-metropolitan locations and almost two-thirds (64%) usually visit a dentist because of
8 a problem. Three-quarters (75%) of mothers reported brushing their teeth the previous day and
9 while 55% rated their oral health as fair or poor, only 10% rated their general health as fair or poor.
10 A higher proportion of participants who were not followed-up at child ages two, three and five
11 years had (at baseline) lower educational attainment, received their income from Centrelink, owned
12 a healthcare card, resided in metropolitan locations, usually visited a dentist because of a problem,
13 did not brush their teeth the previous day, rated their oral health as fair or poor and rated their
14 general health as fair or poor.
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26 *What has been measured?* Broad categories of variables collected at baseline and each follow-up
27 phase are provided in Table 2, with more detail of these variables provided in Table 3. Most items
28 have been based on those used in other national surveys of child health in Australia, for example,
29 the Longitudinal Study of Indigenous Children and the National Child Oral Health Survey. Data
30 linkage to government repositories has been approved and is currently underway, with participant
31 consent. Details of the government linkage datasets is provided in Table 4. Self-report
32 questionnaires were completed with the assistance of trained research officers if required. Dental
33 examinations were standardised and conducted by three calibrated dental professionals. Procedures
34 appropriate for young children were used when children were aged 2 years and 3 years, for
35 example, in the 'knee-to-knee' position on their carer's lap. Before examinations, teeth were dried
36 with cotton pads. Standard infection control procedures were followed and a fibre-optic light used
37 as a light source. Diagnosis was based on visual criteria only. Any child diagnosed with carious
38 lesions was referred for dental care through the South Australian Dental Service (provided free of
39 charge). Weight was measured in duplicate to the nearest 0.1 kg using Seca model 803 scales and
40 averaged. If measures differed by >0.2 kg, a third measure was taken and the average of the two
41 closest values used in analyses. Height was measured in duplicate to the nearest 1 mm using a Seca
42 model 213 portable stadiometer, using a standard anthropometric procedure. If measures differed by
43 >5 mm a third measurement was taken and the average of the closest two used in analyses. Blood
44 pressure was measured using a portable oscillometric device (Omron HEM-7211) and a cuff
45 selected to suit the child's mid-upper arm circumference using a standard protocol.
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2 PATIENT AND PUBLIC INVOLVEMENT: The study's Aboriginal Reference Group has been
3 involved in the design, governance and general oversight of all phases of the research to date.
4 Study participants have been encouraged to communicate to the research team through Facebook
5 and other social media platforms. Newsletters and community presentations are frequently shared
6 with participants and relevant key stakeholder groups. Members of the study's Aboriginal
7 Reference Group have presented the study findings at international conferences.
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14 FINDINGS TO DATE: The prevalence of mothers who were pregnant with their first child at
15 baseline was 38.5%. Rates of dental disease among Aboriginal children in South Australia were less
16 among those exposed to the intervention earlier rather than later in childhood.^{24, 25} The effect
17 appeared to be sustained at age 5 years, although the rates of dental disease were still far higher than
18 estimates reported in Australia's National Child Oral Health Survey 2012-14.²⁶ Rates of
19 psychosocial stress among mothers pregnant with Aboriginal children were high compared with
20 general Australian population estimates.²⁷ Experiences of racism were high among mothers, with
21 impacts on tooth brushing behaviours²⁸ and experience of toothache.²⁹ Compared with population
22 estimates, levels of self-efficacy and self-rated oral health of study participants at baseline were
23 low,³⁰ with differences in the frame of reference regarding participants' self-rated oral health and
24 self-rated general health described.³¹ Smithers and colleagues reported that the proportion of total
25 energy from discretionary foods (including sugars in discretionary foods) was far higher for study
26 children at age 3 years than for non-Aboriginal Australian children.³² Haag and others described
27 how breastfeeding >24 months was associated with higher dental caries prevalence at child age 3
28 years compared with children who were never breastfed.³³ This is contrary to the many findings that
29 support prolonged breastfeeding among Indigenous Australians for better child health outcomes.
30 Santiago and colleagues demonstrated how social support was characterised among study
31 participants,³⁴ and the impact of personal control on self-reported health outcomes.³⁵ The
32 effectiveness of implementing a motivational interviewing approach to preventing poor oral health
33 among Indigenous children and their families was discussed,²² with comparisons made with other
34 studies involving motivational interviewing and the oral health of vulnerable children.³⁶
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52 STRENGTHS AND LIMITATIONS: The main strength of the study is the Aboriginal community
53 engagement, involvement and partnership, orchestrated through the study's Aboriginal Reference
54 Group, through the Aboriginal Community Controlled Health Organisation stakeholder groups and
55 by the Senior Aboriginal research officer (JH). This has, without doubt, contributed to the excellent
56 follow-up rates, which need to be taken into context. For example, this cohort study has been
57 undertaken over vast distances (e.g. travelling 700 km to the west of South Australia, 400 km east,
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2 800 km north), involving highly disadvantaged participants who have not always enjoyed positive
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4 research interactions. The fact that participants represented two-thirds of those eligible to be
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6 recruited during the recruitment period demonstrates the widespread community support and
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8 generalisability of the results. The main limitation is the small sample size, which was essentially
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10 limited by the small population size of Aboriginal people in South Australia (around 2% of the total
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12 population). That we were able to recruit two thirds of those who were eligible at baseline (and have
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14 had strong retention of participants since) suggests that had the target population size been larger at
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16 baseline, the sample size of our study would consequently also be larger. Participants reported that
17
18 the dietary recalls (collected at child age 2 years) were burdensome and this may have increased
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20 non-response or socially desirable responses. At the time of writing, follow-up at age 7 years was
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22 suspended due to social distancing restrictions necessitated by the COVID-19 pandemic. This may
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24 impact our age 9 years follow-up also.

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26 CONTRIBUTORSHIP STATEMENT: Conceptualization, LMJ, JH, XJ, KK, CL, DH, PR, DM,
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28 RR, LS; methodology, XJ, DH, LS, LMJ; resources, LMJ; data curation, LMJ, JH, XJ, KK, CL,
29
30 DH, PR, DM, RR, LS; writing—original draft preparation, LMJ; writing—review and editing, JH,
31
32 XJ, KK, CL, DH, PR, DM, RR, LS; visualization, LMJ, JH, XJ, KK, CL, DH, PR, DM, RR, LS. All
33
34 authors have read and agreed to the published version of the manuscript.

35
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42
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46 DATA SHARING STATEMENT: Study data are not freely available because of ethical and data
47
48 protection constraints. The de-identified data are stored at the University of Adelaide and cannot be
49
50 sent outside the institution.

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52 COLLABORATIONS: Proposals for possible collaborations in further analyses of the data should
53
54 be addressed to Lisa Jamieson (lisa.jamieson@adelaide.edu.au) and will be reviewed by the
55
56 SAABC research team and Aboriginal Reference Group.
57

58
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Australian Aboriginal Birth Cohort study participants, study staff and partners: South Australian

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2 Dental Service, Colgate Palmolive, Women's and Children's Hospital, Lyell McEwen Hospital,
3 Flinders' Medical Centre, Aboriginal Family Support Services, Aboriginal Primary Health Unit,
4 Metro Aboriginal Family Birthing Program, Kura Yerlo Centre, Aboriginal Legal Rights
5 Movement, Wodlitanattoai Program, Ninko Kutangga Patpangga, Kanggawodli Step Down Service,
6 Kaurna Plains, Fleurieu Families, Gilles Plains Community Health, MADEC Community Support
7 Services, Naporendi Aboriginal Forum, Nunga MiMinar, Aboriginal Strategy Unit of Families
8 South Australia, Inbarendi College, Para West Adult Campus, Pangula Mannanurna Aboriginal
9 Health Corporation and the Muno Parra Medical Centre, Second Story, Inner Southern Health
10 Service, The Corner House, Louise Place, PARKS, Talking Realities Program, Child Youth
11 Women's Health Services, Southern Junction Community Services, TAFE campuses, GP Plus
12 centres, employment programs, childcare centres, women's centres, domestic violence shelters, and
13 primary and high schools.
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2 **FIGURE LEGEND:**

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4 **Figure 1: Flow diagram of participants through key stages of the study**

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6 Intervention comprised: (1) dental care to mother; (2) Anticipatory guidance (mother); 3) Motivational
7 interviewing (mother) and; (4) Fluoride varnish application (child).

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9 Intervention delivered during pregnancy to child aged 18 months for immediate intervention group, at child
10 aged 24 to 36 months for delayed intervention group.
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For peer review only

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Table 1. Baseline and follow-up/loss to follow-up characteristics at child age 2 years, 3 years and 5 years

	Baseline (pregnancy) (n=448)	Child age 2 years follow-up (n=324)	Child age 2 years loss to follow-up (n=112)	Child age 3 years follow-up (n=324)	Child age 3 years loss to follow-up (n=112)	Child age 5 years follow-up (n=299)	Child age 5 years loss to follow-up (n=137)
Maternal age							
14-24	238 (53.1)	172 (53.1)	66 (53.2)	173 (53.2)	59 (52.7)	156 (52.2)	76 (55.5)
25+	210 (46.9)	152 (46.9)	58 (46.8)	152 (46.8)	53 (47.3)	143 (47.8)	61 (44.5)
Education							
High school or less	322 (72.4)	226 (70.0)	88 (79.3)	232 (72.1)	82 (73.2)	203 (68.4)	111 (81.0)
Trade or University	123 (27.6)	97 (30.0)	23 (20.7)	90 (28.0)	30 (26.8)	94 (31.7)	26 (19.0)
Income							
Job	62 (14.0)	56 (17.34)	4 (3.7)	55 (17.1)	5 (4.5)	47 (15.9)	13 (9.6)
Centrelink	381 (86.0)	267 (82.7)	105 (96.3)	267 (82.9)	106 (95.5)	249 (84.1)	123 (90.4)
HCC status							
Yes	358 (82.2)	254 (79.9)	95 (89.6)	252 (79.3)	97 (91.5)	236 (80.8)	113 (85.6)
No	77 (17.8)	64 (20.1)	11 (10.4)	66 (20.8)	9 (8.5)	56 (19.2)	19 (14.4)
Residential location							
Metropolitan	171 (38.7)	116 (36.3)	55 (45.1)	116 (36.1)	51 (46.0)	132 (44.8)	35 (25.7)
Non- metropolitan	271 (61.3)	204 (63.8)	67 (54.9)	205 (63.9)	60 (54.1)	163 (55.2)	101 (74.3)
Usual reason visit dentist							
Problem	275 (64.0)	195 (61.9)	72 (69.2)	194 (62.4)	74 (67.9)	184 (63.7)	83 (63.8)
Check-up	155 (36.1)	120 (38.1)	32 (30.8)	117 (37.6)	35 (32.1)	105 (36.3)	47 (36.2)
Brush yesterday							
Yes	321 (75.0)	239 (76.0)	74 (69.8)	240 (77.4)	74 (67.9)	217 (75.9)	96 (72.7)
No	107 (25.0)	73 (23.4)	32 (30.2)	70 (22.6)	35 (32.1)	69 (24.1)	36 (27.3)
Self-rated oral health							
Excellent, very good or good	203 (45.3)	153 (47.2)	43 (38.4)	151 (46.5)	46 (41.1)	130 (43.5)	66 (48.2)
Fair or poor	245 (54.7)	171 (52.8)	69 (61.6)	174 (53.5)	66 (58.9)	169 (56.5)	71 (51.8)
Self-rated general health							
Excellent, very good or good	402 (89.9)	294 (91.0)	97 (86.6)	298 (92.0)	94 (83.9)	272 (91.0)	119 (87.5)
Fair or poor	45 (10.1)	29 (9.0)	15 (13.4)	26 (8.0)	18 (16.1)	27 (9.0)	17 (12.5)

Table 2. Broad categories of variables collected at baseline and each follow-up phase

Phase	Measurements
Baseline	Mother self-reported questionnaire <ul style="list-style-type: none"> • Dental treatment needs, oral health-related behaviours, maternal oral self-efficacy, self-rated oral health and oral health related quality of life. • General health conditions, health-related behaviours and self-rated general health. • Socioeconomic and psychosocial factors, including income, education, employment, experience of racism and cultural identity.
Child mean age 2 years	Carer self-reported questionnaire <ul style="list-style-type: none"> • Dental treatment needs, oral health-related behaviours, maternal oral health literacy, self-efficacy, dental perceptions, self-rated oral health and oral health related quality of life. • General health conditions (mother and child), health-related behaviours, physical activity, self-rated general health, 24-hour dietary recalls (child), breastfeeding habits. • Socioeconomic and psychosocial factors, including income, education, employment, experience of racism and cultural identity. • Family functioning and home environment Child height, weight, blood pressure, upper arm circumference Child dental examination
Child mean age 3 years	Carer self-reported questionnaire <ul style="list-style-type: none"> • Dental treatment needs, oral health-related behaviours, maternal oral health literacy, self-efficacy, dental perceptions, self-rated oral health and oral health related quality of life. • General health conditions (mother and child), health-related behaviours, physical activity, self-rated general health and dietary habits • Socioeconomic factors. Child height, weight, blood pressure, upper arm circumference Child dental examination
Child mean age 5 years	Carer self-reported questionnaire <ul style="list-style-type: none"> • Dental treatment needs, oral health-related behaviours, maternal oral health literacy, self-efficacy, dental perceptions, self-rated oral health and oral health related quality of life. • General health conditions (mother and child), health-related behaviours, physical activity, self-rated general health and dietary habits. • Socioeconomic factors. • Family functioning and home environment. • Child socioemotional well-being and cognitive outcomes. Child height, weight, blood pressure, upper arm circumference Child dental examination

<p>Child mean age 7 years</p>	<p>Carer self-reported questionnaire</p> <ul style="list-style-type: none"> • Dental treatment needs, oral health-related behaviours, maternal oral health literacy, self-efficacy, dental perceptions, self-rated oral health and oral health related quality of life. • General health conditions (mother and child), health-related behaviours, physical activity, self-rated general health and dietary habits. • Socioeconomic factors. • Family functioning and home environment. • Child socioemotional well-being and cognitive outcomes. <p>Child height, weight, blood pressure, upper arm circumference Child dental examination</p>
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Table 3. Detail of variables collected at baseline and each follow-up phase

	Baseline (Pregnancy n=449)	2 years (n=324)	3 years (n=324)	5 years (n=299)	7 years (ongoing)
Oral health-related variables					
Dental examinations (child- dental caries, gingivitis, trauma)		✓	✓	✓	✓
Dental treatment needs (mother and child)	✓	✓	✓	✓	✓
Oral health-related behaviours (oral hygiene habits)	✓	✓	✓	✓	✓
Oral health self-efficacy (mother)	✓	✓	✓	✓	
Oral health literacy (mother)		✓	✓	✓	
Knowledge of children's oral health (mother)	✓	✓	✓	✓	
Oral health fatalism (mother and child)	✓	✓	✓	✓	
Dental perceptions			✓		
Oral health-related quality of life (mother and child)	✓	✓	✓	✓	✓
General health					
Anthropometric measurements (height weight, arm circumference, blood pressure) (child)		✓	✓	✓	✓
General health conditions and hospitalisations (child)	✓	✓	✓	✓	✓
Health-related behaviours (smoking, alcohol intake) (mother)	✓	✓	✓	✓	✓
Physical activity (child)			✓	✓	
Self-rated general and oral health (mother and child)	✓	✓	✓	✓	✓
24-hour dietary recalls (child)		✓			
Breastfeeding habits (child)		✓			
Other dietary-related habits (mother and child)	✓	✓	✓	✓	✓
Socioeconomic and psychosocial factors					
Income, education, socioeconomic hardship, employment (mother)	✓	✓	✓	✓	✓
Experience of Racism (mother)	✓	✓			✓

Cultural identity (mother)	✓	✓			
Self-stem (child)					✓
Social support and sense of self-control (mother)	✓				
Family functioning and home environment					
Parental functioning and home environment (mother and child)		✓		✓	✓
Time-use diaries (child)					✓
Child development					
Cognitive outcomes (child)				✓	✓
Social and emotional well-being (child)				✓	✓

Table 4. Datasets to be included in data linkage

Database domain	Types of information
Hospital admissions	Length of stay, ICD codes describing each hospitalisation event
Presentations at hospital emergency departments	Presenting problem, diagnosis
Well-child health checks	Child growth and development collected by nurses at routine health checks and ad hoc visits to local health clinics
Perinatal information	Medical information about pregnancy and child's birth
Public dental care	Dental treatments received by child in public dental clinics
School Enrolment	Information provided by carers at the time the child was enrolled at school including carer education, languages spoken at home and school absences
Literacy and Numeracy	Results on reading, writing and numeracy collected from a national assessment program when child is in year 3 (approximate age 8) at school
Housing	Information about families living in homes provided by the government

