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Study of Mothers' and Infants' Life Events Affecting Oral Health (SMILE) birth cohort study: cohort profile

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ABSTRACT

Purpose The long-term goal of the Study of Mothers' and Infants' Life Events Affecting Oral Health (SMILE) birth cohort study is to identify and evaluate the relative importance and timing of critical factors that shape the oral health of young children. It will then evaluate those factors in their inter-relationship with socioeconomic influences.

Participants SMILE is a single-centre study conducted in Adelaide, Australia. All newborns at the main three public hospitals between July 2013 and August 2014 were eligible for inclusion. The final recruited sample at birth was 2181 mother/infant dyads. Participants were followed up with questionnaires when the child was 3 and 6 months of age, and 1, 2 and 5 years of age. Oral epidemiological examinations and anthropometric assessments were conducted at age 2 and 5 years.

Findings to date SMILE has contributed comprehensive data on dietary patterns of young children. Intakes of free sugars, core and discretionary foods and drinks have been detailed. There was a sharp increase in free sugars intake with age. Determinants of dietary patterns, oral health status and body weight during the first 5 years of life have been evaluated. Socioeconomic characteristics such as maternal education and household income and area-level socioeconomic profile influenced dietary patterns and oral health behaviours and status.

Future plan Funding has been obtained to conduct oral epidemiological examinations and anthropometric assessments at age 7–8 years. Plans are being developed to follow the cohort into adolescent years.

Strengths and limitations of the study

- ► Study of Mothers' and Infants' Life Events Affecting Oral Health (SMILE) focuses on childhood dental caries, the most prevalent chronic condition in children. It was designed as a population-based birth cohort study with sample recruitment exceeding other independent birth cohort studies in dental health internationally.
- ► SMILE has collected a wide range of data on sociodemographic and socioeconomic factors, health behaviours, dietary patterns, use of dental services, oral health-related quality of life, physical activities, and oral and anthropometric assessments of both the children and their mothers at multiple times since child birth.
- ► SMILE also allows for assessment of other related child chronic conditions such as childhood overweight and obesity.
- ► As a longitudinal study, SMILE suffers from sample attrition, which was relatively higher in those from a low socioeconomic background.

INTRODUCTION

Despite favourable living conditions and healthcare services, many Australian children still suffer from oral diseases from a very young age.[1] This most prevalent childhood chronic disease has significant negative impact on the affected children and their families,[2] as well as the healthcare system.[3] Experience of dental caries in childhood also foreshadows its occurrence in adulthood.[4] The burden of dental caries is disproportionately experienced by children from low socioeconomic backgrounds,[1] and this inequality has widened over time.[5] Understanding mechanisms by which certain groups have more diseases from an early age is important for developing appropriate policy and interventions to ensure a good start to life for all children.[6]

Cross-sectional evidence indicates that sociodemographic characteristics, and modifiable factors—such as infant feeding practices and dietary patterns, particularly intake of free sugars—are potential risk factors for child dental caries experience. In contrast, exposure to fluoride, and timely and appropriate dental care behaviours (toothbrushing/tooth cleaning and dental visiting) are protective.[7–9] However, longitudinal evidence is not available in Australia to confirm or refute their causal relationship. A number of longitudinal studies used only self-reported oral health outcomes.[10 11] Furthermore, timing of and interaction between these exposures in early childhood are potentially important. We lack crucial longitudinal evidence to comprehensively evaluate the timing and interaction between risk and protective factors influencing caries experience through childhood.

The use of fluoride is one of the most important factors in maintaining oral health.[12] Cross-sectional evidence has documented a risk–benefit balance in the use of fluoride in early childhood.[13] Certain sources of fluoride were found to be associated with a higher risk of dental fluorosis while having limited protective effect against dental caries.[13] Crucial longitudinal evidence is lacking to identify the timing and sources of fluoride in early childhood which determine that risk–benefit balance.

The long-term goal of the present research is to identify and evaluate the relative importance and timing of critical factors that shape the oral health of young children and then to evaluate the inter-relationship of those factors with socioeconomic influences. The investigation applies a prospective study design to a cohort of socioeconomically diverse South Australian newborns and their mothers, following these dyads as the children grow to school age and beyond. The study aims to identify pathways through which modifiable factors (infant feeding practices, dietary patterns, free sugar intake, exposure to fluoride and dental care behaviours) influence the relationship between early life factors and child oral health. Further, the risk–benefit balance of the use of fluoride in early childhood will be evaluated with contemporary longitudinal evidence. The findings of this study will inform timely and effective preventive and interceptive measures early in life to avert the onset and progression of child dental diseases and conditions. This scientific evidence will inform actions to reduce socioeconomic inequality in child oral health, both in Australia and internationally.

Our overarching goal is that the knowledge gained from this study will elucidate the key factors that determine the oral health of children from different socioeconomic groups, leading to strategies to improve oral health in disadvantaged children who often have the majority of the dental disease burden. It is anticipated that a combined approach targeting both oral health and general health conditions (obesity and overweight) will yield considerably greater benefits for society.[14]

The Study of Mothers' and Infants' Life Events Affecting Oral Health (SMILE) was established in Adelaide, Australia, by a team of researchers in oral epidemiology, paediatric dentistry, public health nutrition and statistics from Australia, New Zealand and UK. The SMILE 2013–2017 cohort was funded by a National Health and Medical Research Council (NHMRC) Project Grant 2012–2017.[15] A second NHMRC Project Grant was secured in 2018 to follow the cohort until 2023, when the children will turn 8 years of age.

COHORT DESCRIPTION

Study design

SMILE applies an observational population-based study design to prospectively follow a cohort of socioeconomically diverse South Australian newborns and their mothers from birth of the children.[15] Women were informed that their participation was voluntary and informed consent was obtained.

Recruitment

SMILE is a single-centre study conducted in Adelaide, South Australia. All newborns at the main three public hospitals from 7/2013 to 8/2014 were eligible for inclusion. At the time of recruitment, these hospitals accounted for 67% of all births in Adelaide.[16] Pregnant women from all areas across Adelaide and of all socioeconomic backgrounds attend these major hospitals. Strategies were employed to recruit a population-representative sample by socioeconomic status (SES).

Recruitment typically took place within the first 48 hours after birth by trained health professionals (dental hygienist and dental therapists) who provided mothers with a written and verbal description of the study and who were willing to engage in discussion about oral health with the mothers if needed. Recruiting teams attended the hospitals on different weekdays and weekend days. All mothers with live birth were approached, regardless of birth weight and gestational age. Dental care packages were provided to mothers as incentives for participation. A total of 2181 mother/infant dyads were recruited, of which 2112 (96.8%) completed the baseline questionnaire.

Sample size calculation

The sample size required to be retained by the age of 2 years to achieve the objectives of the first four waves was calculated using standard methods.[17] It was estimated that a targeted baseline sample of 1677 newborns was needed to achieve the required sample size of 1174 at 2 years, allowing for expected attrition of 30% over 2 years.[15] Lower retention rates by people of low socioeconomic background was expected. Hence, attempts were made at baseline to oversample people from low socioeconomic areas. The final recruited sample (n=2181) exceeded the targeted sample size at recruitment (n=1677). Thus, the objective of recruiting a population-representative sample was fulfilled, with study sample characteristics mostly comparable to the population parameters (table 1). Relatively, more participants from the most disadvantaged areas were recruited (22.2%) compared with population parameters (10.7%).[18]

Follow-up times

Data collection waves for the first phase of the SMILE study occurred when the children turned 3 (wave 1 and), 6 (wave 2) months and 1 (wave 3) and 2 (wave 4) years (table 2). The second phase will collect data when children turn 5 (wave 5, ongoing) and 7 (wave 6) years of age. Mothers of the children were contacted using various means including phone, email, post and third-party contact to maximise the retention rate. Except for those participants who have formally withdrawn from the study,

Table 1 Study sample characteristics at baseline compared with population parameters

	SMILE baseline, n=2181		South Australia total birth, n=16231
	Estimate	95% CI	Estimate
Birth weight (g [mean])	3356	3333 to 3380	3312
Birth length (cm [mean])	49.4	49.3 to 49.5	–
Child sex (%)			
Male	52.7	50.5 to 54.8	52.0
Female	47.3	45.2 to 49.3	48.0
Mother's age at child birth (%)			
≤24 years	16.3	14.7 to 17.9	17.8
25–34 years	64.2	62.2 to 66.2	62.4
35+ years	19.5	17.8 to 21.2	19.8
Mother's country of birth (%)			
Australia, NZ and UK	73.0	71.1 to 74.9	79.0
Asia—other	11.4	10.1 to 12.8	7.4
India	8.9	7.6 to 10.1	4.0
Other	6.7	5.6 to 7.8	9.6
Indigenous status (%)			
Yes	2.5	1.9 to 3.2	3.6
No	97.5	96.8 to 98.1	96.4
Single parent status (%)			
Yes	8.0	6.8 to 9.1	8.8
No	92.0	90.9 to 93.2	91.2
Total number of children (%)			
3+ children	18.8	17.4 to 20.8	7.9
2 children	36.0	33.3 to 37.4	49.1
1 child	45.2	43.4 to 47.7	43.0
IRSAD (%)			
Deciles 1–2 (most disadvantaged)	22.2	20.4 to 24.0	10.7
Deciles 3–4	21.4	19.6 to 23.2	21.3
Deciles 5–6	18.7	17.1 to 20.5	18.7
Deciles 7–8	18.5	16.8 to 20.2	25.3
Deciles 9–10 (most advantaged)	19.1	17.4 to 20.8	24.0

South Australian parameters reported for 2013.[16]
The original table has .0 after this number (52.0) and other similar numbers.
IRSAD, Index of Relative Socio-economic Advantage and Disadvantage of Areas; SMILE, Study of Mothers' and Infants' Life Events Affecting Oral Health.

Table 2 Study sample characteristics at the first four waves (wave 5 is underway)

	Wave 1 (3 months), n=1590	Wave 2 (6 months), n=1479	Wave 3 (1 year), n=1275	Wave 4 (2 years), n=1172
Household income (%)				
Q1 (lowest) (≤AU$40k)	15.8	15.1	14.2	13.4
Q2 (AU$40k–80k)	32.5	33.4	32.7	32.3
Q3 (AU$80k–120k)	29.6	29.1	30.7	30.4
Q4 (highest) (AU$120+k)	22.1	22.4	22.4	24.0
Mother's age at child birth (%)				
≤24 years	12.5	12.5	12.3	10.8 *
25–34 years	66.9	67.1	67.0	68.1
35+ years	20.6	20.4	20.7	21.1
Maternal education completed (%)				
School	22.4	21.3	20.5	19.0
Vocational	26.7	26.2	25.8	25.7
Some university or higher	51.0	52.5	53.7	55.3
Mother's country of birth (%)				
Australia, NZ and UK	75.0	75.0	74.8	75.0
Asia—other	11.4	11.1	11.6	11.3
India	7.3	7.8	7.8	7.4
Other	6.4	6.1	5.9	6.3
Indigenous status (%)				
Yes	1.2	1.2	1.1	1.1
No	98.8	98.8	98.9	98.9
Single parent status (%)				
Yes	6.6	6.5	6.2	6.1
No	93.4	93.5	93.8	93.9
Total number of children (%)				
3+ children	17.1	16.7	15.8	16.5
2 children	35.1	34.7	34.8	35.8
One child	47.9	48.6	49.4	47.7
Mother's work status (%)				
Unemployed/home duties	26.4	26.3	25.0	24.9
Self-employed/ pensioner	3.9	3.9	4.1	4.2
Part-time	31.2	30.6	30.8	31.3
Full-time	38.5	39.2	40.1	39.6
IRSAD (%)				
Deciles 1–2 (most disadvantaged)	18.5	18.6	17.0*	16.9*
Deciles 3–4	21.3	21.1	20.9	21.0
Deciles 5–6	20.1	20.3	20.7	20.9
Deciles 7–8	18.4	17.8	18.7	19.1
Deciles 9–10 (most advantaged)	21.8	22.2	22.9	22.2

*Statistically significantly different from baseline estimate.
IRSAD, Index of Relative Socio-economic Advantage and Disadvantage of Areas.

all participants will be considered eligible to be contacted at each wave, regardless of their completion of previous waves.

The attrition rate during the first 2 years was higher than expected. As expected, the attrition rate was higher among those women of lower socioeconomic profile. The proportions of women from the most disadvantaged deciles at waves 3 and 4 and the proportions of women aged ≤24 years at wave 4 were significantly different from those same estimates at baseline. However, because the baseline sample was over-recruited, the study sample at wave 4 was representative of the SES profile of South Australian mothers as reported by the Australian Bureau of Statistics.[19]

Data items

Age-specific questionnaires were used in all data collection waves (table 3).

Socioeconomic status

Standard measures of SES (ie, parental education, household income and number of adults and children dependent on that income, Indigenous status, parental country of birth, household composition and employment status of the mothers and their partner) were collected at birth and subsequent waves 3–6. A measure of SES was determined using postcode-level Index of Relative Socio-Economic Advantage and Disadvantage (IRSAD).[18] When the families move their residential location, their new postcodes are added to the database and their IRSAD decile updated.

Health behaviours and practices

Age-specific parent/caregiver-reported questionnaires were used to collect data on a vast array of parental and child health behaviours and practices (table 3). For children, oral health practices (ie, tooth cleaning, tooth brushing, use of toothpaste and other dental care products) and dental visiting patterns were collected using items from the National Child Oral Health Study of Australia.[20] Child sedentary behaviours and physical activities were assessed as amount of time (reported as minutes or hours) undertaking certain activities and screen time during a typical weekday and weekend day. Items were adapted from instruments used in the Longitudinal Study of Australian Children.[21] Maternal diet, stress and coping, physical activities, alcohol consumption and smoking and physical activities were collected using standard indices.

Infant feeding practices

Information on infant feeding practices was collected via parental-reported questionnaires when children were 3 and 6 months and 1 and 2 years (waves 1–4). Information on breastfeeding, including age of cessation or commencement, frequency and amount, and daytime and night-time breastfeeding were collected. Infant formula use, type, its reconstituting methods and amount fed and night-time feeding practices at different ages were reported. Information on age of introduction to various solid foods and beverages was collected at all ages.

Dietary intake

Comprehensive dietary intake data were collected at wave 3 (1 year of age) using a combination of a single 24 hours recall and two non-consecutive days of estimated food records (3 days total). Dietary intakes were entered into Foodworks V8 (Xyris Software) for analysis using the AUSNUT 2011–2013 food composition database.[22]

At the wave 4 (2 years of age), dietary intake data were collected using an 89-item Food Frequency Questionnaire (SMILE-FFQ), developed specifically for the SMILE study to capture the leading dietary contributors to dental caries risk in toddlers.[23] It was sent to parents via their choice of post or email when their child reached 2 years of age. The SMILE-FFQ was designed to estimate usual intake of total and free sugars in Australian toddlers, and was assessed for repeatability and relative validity against repeat 24-hour recalls in an external cohort of toddlers aged 18–30 months.[23] Additional items were added for waves 5 and 6 to also assess diet quality of 4–11-year-old using a previously developed Short Food Survey.[24]

Physical assessment

Children and their mothers underwent a physical assessment at wave 4 which will occur again at waves 5 and 6. It includes a detailed oral epidemiological examination using criteria based on the existing standards for children.[20] These include surface-level assessment, visual–tactile assessment with aid of compressed air, recording of stages of caries process (non-cavitated, cavitated) and use of differential diagnostic criteria. The examinations of children collect tooth surface-level information on dental caries, developmental conditions and oral hygiene status. It also includes assessment of dental fluorosis on permanent teeth using the Thylstrup and Fejerskov Index of fluorosis when children turn 7 years.[25 26] The examinations of mothers collect tooth surface-level information on dental caries, and periodontal and oral hygiene status.

The physical assessments also include anthropometric measurements of the children and their mothers. Calibrated electronic scales are used to measure weight (in kg) with light clothes. A medical standalone stadiometer is used to measure standing height (in cm) without shoes. The examination teams are trained to collect those measures in duplicate as recommended by the WHO Training Manual.[27] The collected measurements are used to calculate Body Mass Index (BMI, kg/m^2) for the mothers and age-specific and sex-specific BMI Z-scores for the children using the WHO reference.[27]

KEY FINDINGS TO DATE

Since data collection began in 2013, SMILE has contributed to the literature in a number of areas, summarised below.

Development and validation of an FFQ for young children

For wave 4, an FFQ was developed to assess intakes of total and free sugars in Australian toddlers. FFQs are considered one of the most appropriate data collection methods for large, prospective studies because they are quick and inexpensive to administer and process, can be self-administered and rapidly analysed, and they capture dietary intake over a long period of time. In comparison,

Table 3 Data collected from the SMILE birth cohort sample from birth (baseline) to 7 years of age (wave 6)

	Waves						
		1	2	3	4	5	6
Items	**Baseline**	**3 months**	**6 months**	**12 months**	**24 months**	**5 years**	**7 years**
Family							
SES (income, education, Indigenous status)	+			+	+	+	+
Residential location	+			+	+	+	+
Area-level SES	+			+	+	+	+
Household composition	+			+	+	+	+
Partner health behaviours							
Mother							
Mother health	+	+			+	+	+
Antenatal care	+						
Self-rated oral and general health			+		+	+	+
Dental visiting pattern	+			+	+	+	+
Mother health behaviours	+		+		+	+	+
Physical activities					+	+	+
Stress and coping		+			+	+	+
Dental examination (caries, periodontal diseases)					+	+	+
Anthropometrics	+				+	+	+
Smoking and alcohol use	+			+		+	+
Social support				+		+	+
Child							
Birth events	+						
Birth weight/length	+						
Breastfeeding		+	+	+	+		
Infant feeding practices		+	+	+	+		
Solid foods			+	+	+		
Infant feeding aids		+	+	+	+		
Water consumption				+	+	+	+
24 hours recall and dietary diary (1+2 days)				+			
Food Frequency Questionnaire					+	+	+
Infant/child health	+	+	+	+	+	+	+
Medications		+	+	+	+	+	+
Tooth cleaning/brushing			+	+	+	+	+
Toothpaste use				+	+	+	+
Dental visiting pattern				+	+	+	+
Physical activities					+	+	+
Stress and coping							+
Oral health-related quality of life						+	+
Dental examination (caries, oral hygiene status, developmental conditions, dental fluorosis)					+	+	+
Anthropometrics*					+	+	+
Saliva and plaque						+	+
Fluoride from exfoliated teeth							+

An 89-item FFQ collects information on 29 food/drink groups at the wave 24 months. Data are being collected for the wave age-5 year using a 106-item FFQ.
Height and weight measured during physical assessment.
FFQ, Food Frequency Questionnaire; SES, socioeconomics status; SMILE, Study of Mothers' and Infants' Life Events Affecting Oral Health.

24 hours are time-consuming and burdensome to administer, complete, and analyse and only capture dietary intake for a 24 hours period. Investigations of the validity of the newly developed SMILE-FFQ found that it performs comparably to three non-consecutive 24-hour recalls for assessing both total and free sugars, although the assessment of total sugars performed better at the individual level than free sugars.[23] It is also most effective for ranking participants rather than determining absolute intakes.[23]

Intake of free sugars and discretionary food intake

Although the Australian Infant Feeding Guidelines advise against consumption of foods or drinks containing added or free sugars during the first year of life, 21% of infants had consumed these foods and/or drinks by 6–9 months.[28] At 1 year, 96% of children had consumed discretionary foods, which contributed on average 11.2% of total energy.[29] Between 1 and 2 years, intake of free sugars increased sharply, contributing 3.6% (IQR: 1.6–4.8) of total energy intake at 1 and 22.5% at 2 years (IQR: 12.8–37.7).[30] The proportion of participants that exceeded the WHO recommendations that <10% of energy should come from free sugars[9] increased substantially from 1 (2.5%) to 2 years (38.0%). A quarter of participants exceeded the WHO <5% energy from free sugars recommendation[9] at 1 year, increasing to 71.1% at 2 years.[31] The greatest contributors to free sugars intake at 1 year were commercial infant foods (26.6%) and cereal-based products (19.7%). At 2 years, the main sources were discretionary foods, such as fruit juice, biscuits, cakes, desserts and confectionery; with yoghurt and non-dairy milk alternatives two notable core-food exceptions.[31] Together, these findings highlight substantial contributions of commercial infant foods and discretionary foods to free sugars intakes in the complementary feeding phase.

Nutrient intake, food sources and milk feeding in the first 2 years of life

We have reported the intake of key nutrients in the first 2 years of life according to milk feeding method. Breast milk and formula milk made a substantial contribution to the nutrient intake of those toddlers consuming them, contributing to approximately one-third (breastmilk, 28% and formula, 34%) of total energy intake and one-quarter (16% and 26%) of protein intake.[32] While the majority of children had intakes which met or exceeded their nutrient requirements, those who only consumed breastmilk as their milk feed were at greater risk of having intakes below the estimated average requirement (EAR) for iron, calcium and thiamine compared with those children consuming formula (either alone or in combination with breast milk).[32]

At 1 year, one-fifth of children had iron intakes below the EAR of 4 mg/day, potentially placing them at risk of developing iron deficiency. Commercial infant and toddler food products (16.3%) and formulas (29.6%) were the main contributors to iron intake.[22] In comparison, breast milk and cow's milk contributed 0.5% and 1.0% of total iron intake, respectively.[22]

Usual iron intake was strongly associated with milk feeding method, with formula-fed children (either alone or in combination with breast milk) having significantly higher usual iron intakes, and less likely to have intakes below the EAR.[22] For those children who consumed it, formula was a major contributor of iron.

Early life socioeconomic gradients in health behaviours and practices

SMILE has shown early life differentiation of risk and protective factors. Early introduction of foods or drinks containing free sugars was strongly associated with socioeconomic factors (low household income, young maternal age and low educational attainment).[28] Children from the lowest income quintile were more likely to have been exposed to foods and drinks high in free sugars at 6 months than the highest income group (adjusted prevalence ratio (PR): 1.80 (1.20–2.90)).[28]

At both 1 and 2 years of age, there were a clear SES gradient in free sugars intake. Children from households with the greatest socioeconomic disadvantage were more likely to exceed the WHO recommendations that <10% of energy should come from free sugars than the least disadvantaged.[30] Those children were also more likely to be in the top tertile for free sugars intake (PR: 1.58 (1.19–2.10)) than the least disadvantaged. Further differences in health behaviours and practices beyond free sugars intake have been found according to sociodemographic factors. Mothers with school-only education were more likely to introduce solid foods early (≤17 weeks) and less likely to clean their child's teeth than those with tertiary education. At 2 years, mothers with a school-only education were less likely to brush their child's teeth before bed and more likely to give bottled water to their child than tertiary-educated mothers.[30]

Breastfeeding determinants and associations with obesity and dental caries

Despite the recommendation to breastfeed to 12 months and beyond, only one-third of children were still being breastfed at 12 months of age.[33] By 2 years of age, this had dropped to 7.5%. Not returning to work by 12 months was a key determinant of continued breastfeeding at 1 or 2 years of age.[33] Multiparous, educated women, with partners who preferred breastfeeding over bottle feeding were more likely to still be breastfeeding at 12 months. These findings highlight key determinants of continued breastfeeding, most of which are either modifiable or could be used to identify women who would benefit from additional support. Further, a lower risk of overweight/obesity in children breastfed for 12 months or more compared with those breastfed for <17 weeks was reported (AOR: 0.49 (0.27–0.90)).[34]

The association between breastfeeding duration and dental caries was not significant.[35 36]

Dietary patterns and outcomes of early childhood caries (ECC) and obesity

Investigation of dietary patterns at 1 year of age and risk of obesity and early childhood caries (ECC) at 2 years of age showed that although no association was found, associations of dietary patterns with intermediate outcomes of free sugars and energy intakes suggest that obesity and ECC may not yet have manifested due to the short follow-up period. That is, higher free sugar and energy intakes, risk factors for both obesity and ECC, were positively associated with the 'cow's milk and discretionary combination' pattern (reflecting poorer-quality diet), and lower free sugars intake positively associated with both the 'family diet' pattern and higher diet quality scores (both reflecting higher quality diet). At 2 years of age, high free sugars intakes and greater socioeconomic disadvantage, but not breastfeeding duration were associated with greater risk of ECC.[36]

Future analysis plans

Using the longitudinal structure of the data from six waves of data collection from birth to 7 years of age, we will explain the expected causal relationships between parents and their children, and between life stages during childhood, with dental caries and overweight/obesity outcomes. Trajectories of child dental caries experience in the first 7 years of life, and socioeconomic differences, will be identified and characterised using multilevel mixed models. Multilevel mixed models consider the clustering of individual (repeated) dental caries experience at different ages. Both the intercept and slope will be computed as a random effect, which allows the intercept to vary for each participant (ie, reflecting different starting points on the trajectory) and the slopes to vary (reflecting different rates of change in pattern scores over time). We will then examine the influences of community and individual socioeconomic factors and parental health behaviours on dental caries trajectories. We will examine the mediating effect of protective and risk factors on the longitudinal development of socioeconomic differences in child dental caries experience in the first 7 years of life. Trajectories of child nutrient and dietary patterns will also be elucidated. At wave 6, dental fluorosis (a biomarker of early life exposure to fluoride) will be analysed to examine the risk and benefit balance of fluoride use in early childhood.

Strengths and limitations

Strengths

SMILE has been established with a population-representative sample. Strategies were employed at recruitment to achieve representativeness of the sample and to account for the anticipated relatively higher long-term attrition rate in the low SES groups. The high number of mother/child dyads in this cohort makes it one of the largest studies internationally investigating child oral health.

The SMILE cohort has a strong intergenerational focus. Comprehensive data are collected on both the children and their mothers. These data include clinical oral epidemiological and anthropometric data collected using standardised measures, detailed dietary data and general and oral health behaviours and practices. SMILE allows for application of the common risk factor approach[14] to identify factors affecting general and dental health.

Weaknesses

As with any longitudinal research, the SMILE cohort suffers from sample attrition. Such attrition was largest during the first 6 months of the study. The sample has been reasonably stable since wave 2 (1 year onwards). As anticipated, the low SES groups were more likely to drop out.

The study's main focus was on influences of socioeconomic determinants and dietary patterns on child oral health. Hence, oral microbial assessment of the children was not undertaken during the first phase.

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Contributors LD leads the project. LD, JS, DHH, WMT, AJS, RG, DM and SL are named investigators in the research grants for this research project. LD, DHH, LB and GD drafted the manuscript. LD, JS, DHH, WMT, AJS, RG, DM, SL, LB and GD critically revised the manuscript and approved the final version.

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Competing interests None declared.

Patient consent for publication Not required.

Ethics approval Ethical approval for SMILE was obtained from a number of Human Research Ethics Committees across South Australia (HREC#50.13,28/02/2013, HREC#13/WCHN/69,07/08/2013, HREC#H-2018-017,16/10/2018).

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Data availability statement Data are available upon reasonable request. Collaborations with the research team are welcome. Available data are listed in table 3. Researchers interested in collaboration are invited to contact Professor Loc G Do at loc.do@adelaide.edu.au. Data access requests will be assessed by the Chief Investigators of the SMILE study.

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