The Longitudinal Study of Australian Children's Child Health CheckPoint

Data User Guide

June 2020

Abbreviations

ABS	Australian Bureau of Statistics
ACR	Albumin-to-creatinine ratio
ADM	Administrative Data
AE	Arterial elasticity
AIFS	Australian Institute of Family Studies
AIx	Augmentation Index
apoA1	apolipoprotein A1
apoB	apolipoprotein B
AQoL	Assessment of Quality of Life Scale
ATS	American Thoracic Society
AVR	Arteriole-to-venule ratio
BIA	Bioelectrical impedance analysis
BMI	Body mass index
BMSLSS	Brief Multi-Dimensional Students' Life Satisfaction Scale
bpm	beats per minute
BSP	Biospecimen
CASI	Computer Assisted Self Interview
CATI	Computer-assisted telephone interview
CASS	Comprehensive Acne Severity Scale
CDC	Centers for Disease Control
CELF-4	Clinical Evaluation of Language Fundamentals - Fourth Edition, Australian version
CHU9D	Child Health Utility 9D
CRAE	Central retinal artery equivalent
CRVE	Central retinal vein equivalent
CSR	Child Self Report
daPa	dekapascals
DBP	Diastolic blood pressure
dB HL	Decibels hearing level
DD	Diameter distensibility
DSS	Australian Department of Social Services
ECG	Electrocardiogram
ECV	Ear canal volume
ERS	European Respiratory Society
F2F	Face-to-face
FEV	Forced expiratory volume
FEV_1	Forced expiratory volume in the first second
FrACT	Freiburg Visual Acuity and Contrast Test
FVC	Forced Vital Capacity
GlycA	Glycoprotein acetyls
HR	Heart rate
HRmax	maximum heart rate
IMT	Intima-media thickness
ISCOLE	International Study of Childhood Obesity, Lifestyle and the Environment
ISCW	International Survey of Children's Wellbeing
IVAN	Interactive Vessel Analysis Software
KDIGP	Kidney Disease Improving Global Outcomes

kHz	Kilohertz
LD	Lumen diameter
LiSN-S	Listening in Spatialized Noise-Sentences Test
LIWC	Linguistic Inquiry and Word Count
LSAC	Longitudinal Study of Australian Children
MAR	Minimum angle of resolution
MARCA	Multimedia Activity Recall for Children and Adults
MCRI	Murdoch Children's Research Institute
MEP	Middle ear pressure
MVPA	Moderate to vigorous physical activity
NaSSDA	National Secondary Students Diet and Activity questionnaire
NCLD	National Centre for Longitudinal Data
NHMRC	National Health and Medical Research Council
NIH	National Institutes of Health
NMR	Nuclear Magnetic Resonance
NPVT	National Institutes of Health Toolbox Picture Vocabulary Test
OLS	Overall Life Satisfaction
P1	Parent 1
P2	Parent 2
PDS	Pubertal Development Scale
PedsQL	Pediatric Quality of Life Inventory
pQCT	Peripheral quantitative computed tomography
PTA	Pure tone audiometry
PWA	Pulse wave analysis
PWV	Pulse wave velocity
qPCR	Quantitative polymerase chain reaction
RCH	The Royal Children's Hospital, Melbourne
REDCap	Research Electronic Data Capture
ROI	Region of interest
SBP	Systolic blood pressure
SEIFA	Socio-Economic Index for Areas
SIVA	Singapore "I" Vessel Assessment Software
SMS	Sexual Maturity Scale
SNR	Signal to noise ratio
SOP(s)	Standard operating procedure(s)
SRT	Speech reception threshold
VA	Visual Acuity
VO_2 max	Maximum volume of oxygen (maximum capacity of an individual's body to transport and use oxygen during incremental exercise, which reflects the physical fitness of the individual)
W	Watts
WR	Work rate
WRmax	maximum work rate

Acknowledgements and suggested citation

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The Child Health CheckPoint data files were prepared by the CheckPoint Data Team at the MCRI (Sarah Davies, Josh Muller and Katherine Lange), with the assistance of the LSAC teams at AIFS and the Australian Bureau of Statistics. Data users wishing to refer to the CheckPoint dataset should cite the latest LSAC data release (which contains the CheckPoint dataset). At the timing of writing, this is:

> Murdoch Children's Research Institute, 2020, "Growing Up in Australia: Longitudinal Study of Australian Children (LSAC) Release 8.0 (Child Health CheckPoint)", doi:10.26193/VTCZFF, MCRI, V2.

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1 Overview

This document provides data users with key information about the Longitudinal Study of Australian Children's (LSAC) Child Health CheckPoint study and data. Prior to using the CheckPoint dataset users should read both the LSAC Data User Guide and the Child Health CheckPoint Data User Guide (this document). This document presumes knowledge of the information within the LSAC Data User Guide, and thus does not repeat important information about using LSAC data in general.

This document provides information to assist users understand how and why data were collected (e.g. study methodology and measures descriptions) and navigate the CheckPoint dataset (e.g. variable naming conventions and using quality control flags).

Please also refer to the following documents for more specific information about the CheckPoint study and dataset:

- **Data dictionary**
- **Rationale** document, describing the rationale for each measure's inclusion and key references
- **Data Issues paper** (Davies et al., 2018), describing variations in data collection protocols and data processing decisions
- **Labelled questionnaires**, in which questions are labelled with corresponding variable names
- **Technical paper** (Ellul, Hiscock, Mensah, Clifford, & Carlin, 2018) describing the development and use of survey weights
- A paper **introducing the Child Health CheckPoint**, and the rationale for its inclusion in LSAC (Wake et al., 2014)
- A suite of papers published in BMJ Open in 2019 describing (i) the **sample and general methods** (Clifford, Davies, Wake, & Child Health CheckPoint Team, 2019) and (ii) **prevalence and child-parent concordance of key measures** (Catchpool, Gold, Grobler, Clifford, & Wake; Clifford, Gillespie, Olds, Grobler, & Wake; Dascalu et al.; Ellul et al.; Fraysse, Grobler, Muller, Wake, & Olds; Kahn et al.; Larkins et al.; Liu et al.; Matricciani et al.; Nguyen et al.; Smith et al.; Vivarini et al.; Vlok et al.; Welsh et al.)
- Data collection and data management **Standard Operating Procedures** (SOPs). Many SOPs are available from the CheckPoint team, on request.
- **Biospecimens Access Policy** for researchers who wish to apply to conduct assays/analyses on samples held in the CheckPoint biobank (in preparation, anticipated to be available on the CheckPoint website from mid-2020), and
- CheckPoint **Legal disclaimer**.

The content and purpose of each of these documents are described in section 7.5 'Documentation'. These documents are available on the MCRI website (checkpoint-lsac.mcri.edu.au) and/or via Dataverse (dataverse.ada.edu.au/dataverse/ncld). A link is also available on the Growing Up in Australia website (growingupinaustralia.gov.au/about-study) that will direct users to the MCRI CheckPoint website.

1.1 Getting more information

Reading these documents should answer most data user questions. For additional questions regarding:

- **Data items and measures in the released dataset -** If you have questions about the data files or variables, please submit your query via Dataverse at dataverse.ada.edu.au/dataverse/ncld.
- **Collaboration on CheckPoint measures -** data users can contact the Child Health CheckPoint team directly via lsac.childhealthcheckpoint@mcri.edu.au.

2 Introduction to LSAC's Child Health CheckPoint

Growing Up in Australia: the Longitudinal Study of Australian Children (LSAC) continues to examine the impact of Australia's unique social and cultural environment on the next generation. The study aims to build upon understandings of child development, inform social policy debate and identify opportunities for intervention and prevention strategies in policy areas concerning children and their families.

A comprehensive, one-off physical health and biomarker module, known as the Child Health CheckPoint, was added for the B cohort between LSAC waves 6 and 7. In 2015-16, the B cohort child and one of their parents participated in a comprehensive clinic appointment or shorter home visit. A second parent was also invited to provide a genetic sample. The study child was aged 11-12 years at the time of assessment.

2.1 The Child Health CheckPoint team

The Child Health CheckPoint module is led by Professor Melissa Wake at the Murdoch Children's Research Institute (MCRI). Professor Wake has played a key role in designing the health aspects of *Growing Up in Australia* since its inception in 2002, until 2017. For CheckPoint, she was joined by a large Investigator team, comprising researchers and clinicians from the MCRI, The Royal Children's Hospital (RCH) Melbourne, Deakin University, University of South Australia and Adelaide University. Each of the Investigators are leaders in their field of research or child health. In addition, there was representation from LSAC teams within the Australian Institute of Family Studies (AIFS) and the Department of Social Services (DSS). Since the project started many other collaborators have provided advice and input. Assisting the Investigator team is the project team based at the MCRI. Health assessments and all other data collection were undertaken by the MCRI project team. More information about the CheckPoint team is provided at checkpoint-lsac.mcri.edu.au.

2.2 Funding and in-kind support

Core funding for the Child Health CheckPoint was provided by the National Health and Medical Research Council (NHMRC) of Australia (Project Grants 1041352 and 1109355).

The CheckPoint team gratefully acknowledges the additional funding subsequently sourced from the following organisations: The Royal Children's Hospital Foundation (2014-241), the MCRI, The University of Melbourne, the National Heart Foundation of Australia (100660), the Foundation for Children (2014-055, 2016-310), the Victorian Deaf Education Institute, the National Centre for Longitudinal Data (NCLD, 90009327), the University of Auckland Faculty Research Development Fund (3712987), the New Zealand Ministry of Business, Innovation and Employment (UOAX1611), the New Zealand's 'A Better Start' National Science Challenge, and Cure Kids New Zealand (3713710).

The urinary albumin and creatinine quantification was funded directly through a NHMRC Program Grant (633003).

Substantial in-kind support was gratefully received from:

- MCRI, notably the Office of the Director, Population Health Theme, Biobanking Facility and Centre of Research Excellence in Child Language (development and use of iPad administration of Recalling Sentences and NVPT assessments)
- DSS, NCLD, AIFS, and the Australian Bureau of Statistics (ABS)
- Prof Tim Olds (use of the MARCA Multimedia Activity Recall for Children and Adults program)
- Centre for Eye Research Australia (loan of retinal camera)
- Phonak (use of the Listening in Spatialized Noise-Sentences Test hearing program)
- InBody (loan of bioelectrical impedance analysis scales)
- CEVA Logistics (road transport of study equipment and furniture)
- CHEP Australia (loan of pallets and storage containers)
- JLL Australia (assistance with locating Assessment Centre venues), and
- GM Holden, Charles Perkins Centre at the University of Sydney, Centre for Children's Health Research at the Lady Cilento Children's Hospital, Murdoch University, Edith Cowan University, University of Adelaide, Friendly Society Private Hospital Bundaberg, Cairns Hospital, Mackay Rehabilitation Hospital, Townsville Family Medical Centre, Royal Darwin Hospital, Menzies Institute for Medical Research at the University of Tasmania, and the Launceston Medical Centre at the Launceston Health Hub (Assessment Centre venues).

Child Health CheckPoint students made substantial in-kind contributions to the study. Over 60 research students (PhD, Masters, Honours and postgraduate Medicine) and 40 summer students and interns have completed projects within the study since 2014. Collectively, the students contributed thousands of hours to activities as diverse as scoping, design and testing of measures; data collection (both undertaking the assessments and laboratory processing); data coding and entry; scoring images and recordings; data cleaning; inter- and intra-rater design and ratings; and descriptive epidemiology of the measures. Individual students' contributions are acknowledged in relevant Standard Operating Procedures and descriptive and analytic publications wherever possible. However, we also acknowledge the many unnamed students and research assistants whose help with data collection was vital.

In-kind support was also received in the form of scoring and deriving data. Accelerometry data were processed and analysed using Cobra analytical software developed by Dr François Fraysse at the University of South Australia. MARCA time-use data were analysed using the MARCA's analytical module, developed by Prof Tim Olds. Retinal photographs were scored by research assistants at the Centre for Eye Research Australia, in Melbourne, Australia and Zhongshan Ophthalmic Center, Sun Yat-sen University, China. The remaining data were scored and derived by the Child Health CheckPoint team and other research groups at the MCRI.

2.3 Objectives

LSAC is recognised internationally for its richness of social and environmental data, but physical measures were limited to anthropometry, limited body composition and blood pressure, and no biological samples had been collected from the cohort. By enriching LSAC with objective health

assessments and biological samples, the Child Health CheckPoint has opened up new areas of research for the cohort. For a large subset of the LSAC sample, social and environmental factors can now be linked to objective and detailed measures of physiological indicators of health and/or disease risk. For example, it is now possible to detect fine-grained differences in physiology and look at their predictors and protective factors, years earlier than would have been possible using relatively blunt measures of self/parent-reported health outcomes. With detailed information collected about the study child and one of their parents, it may be possible to separate out the respective roles of biology (e.g. genes) and environment (e.g. lifestyle behaviours and physical/geographic environment) on health outcomes, to model how effective lifestyle interventions alone can be in changing outcomes.

More information about the rationale for supplementing LSAC with the Child Health CheckPoint can be found in the following paper (available at aifs.gov.au/publications/family-matters/issue-95/introducing-growing-australias-child-health-checkpoint):

> Melissa Wake, Susan Clifford, Elissa York, Fiona Mensah, Lisa Gold, David Burgner, Sarah Davies and the Child Health CheckPoint team. (2014). Introducing Growing Up in Australia's Child Health CheckPoint: A physical and biomarkers module for the Longitudinal Study of Australian Children. *Family Matters* 2014; 95, 15-23.

2.4 Integration of the CheckPoint into LSAC

The Child Health CheckPoint was an additional data collection module for the B cohort, between LSAC waves 6 and 7. As represented in Figure 1, it was conceptualised as a cross-sectional data collection module timed to coincide with children going through the 'checkpoint' between childhood and adolescence. It would provide *outcomes* of early family, psychosocial, educational and health predictors of the first six waves of LSAC, and *predictors* of subsequent psychosocial, educational, physical and economic participation outcomes, as LSAC continues into the future.

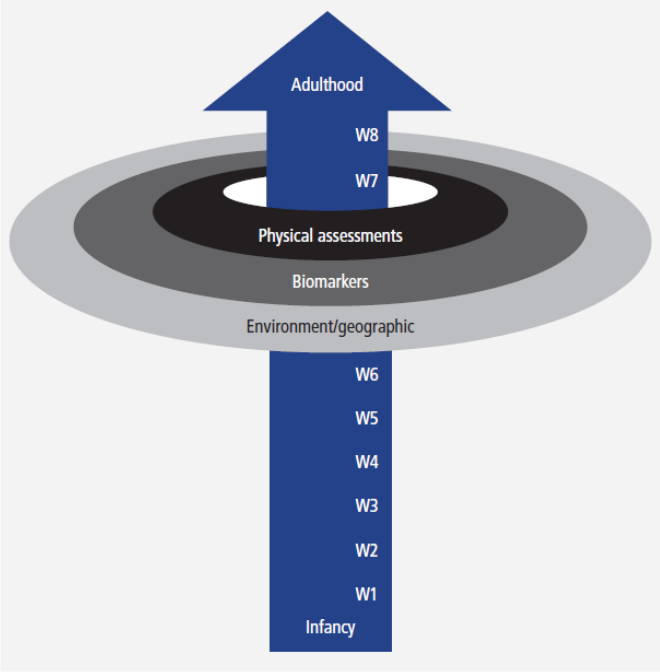

Figure 1. Conceptualisation of the integration of the Child Health CheckPoint into LSAC

Image reproduced with permission. Originally published in Family Matters (Wake et al., 2014)

2.5 Study participants

In LSAC waves prior to the CheckPoint, study participants include:

- The study child (SC).
- Parent 1 (P1) defined as the parent who knows the study child best; in most cases this is the child's biological mother. This can change from wave to wave at the family's discretion. A separate variable defines the relationship of the child to the designated P1 at each wave in that wave's released dataset (see below).
- Parent 2 (P2) defined as parent 1's partner or another adult in the home with a parental relationship to the study child; in most cases this is the biological father, but step-fathers are also common.
- Other informants (e.g. parents living elsewhere, teachers).

The invitation to participate in the Child Health CheckPoint module was extended to the LSAC B cohort study children and two of their parents/guardians. The study child and one parent/guardian were invited to participate in a comprehensive CheckPoint Assessment Centre or Home Visit. The second parent (where applicable) was invited to participate only to the extent of providing a genetic sample.

Throughout the documentation and dataset, CheckPoint participants are referred to using the following terminology:

- The *study child* is the B cohort child taking part in CheckPoint.
- The *attending parent* is the child's parent or guardian who participated in the CheckPoint Assessment Centre or Home Visit. For brevity, the adult who took part in the visit is referred to as a 'parent'; they could be a biological parent, non-biological parent or guardian of the study child. The attending parent is also referred to as *parent 1* (P1) in the CheckPoint dataset, data dictionary and other instances of restricted characters/ word length. Each family decided which parent would participate in the assessment; the CheckPoint team did not request that the attending parent be *Parent 1* from previous LSAC waves. As for LSAC, separate variable defines the relationship of the child to the designated P1 in the CheckPoint's released dataset (see below).
- The *non-attending parent* is a biological parent of the study child living with the child at the time of the CheckPoint assessment.. The attending parent took home a buccal swab collection kit and consent form for the non-attending parent to complete and mail to the study team. The non-attending parent is also referred to as *parent 2* (P2) in the CheckPoint dataset and other instances of restricted characters/ word length. For practical reasons, the study team did not seek to recruit biological parents living elsewhere.

***Parent 1* and *Parent 2* definitions differ between main LSAC waves and CheckPoint.**

- The CheckPoint *attending parent* is not necessarily the parent who knows the study child best, or who completed the *parent 1* surveys in previous LSAC waves.
- The CheckPoint *non-attending parent* is a biological parent living with the child, so some LSAC *parent 2* participants (e.g. step-parents) were not invited to participate as a non-attending parent.

Nonetheless, the vast majority of CheckPoint attending parents were both Parent 1 in wave 6 (n=1,674; 89.3%) and a biological parent (n=1,854; 98.9%), usually the biological mother (n=1,628; 87.8%). The majority of CheckPoint non-attending parents were male (n=937; 85.7%), and either parent 1 (n=131; 12.0%) or parent 2 (n=878; 80.2%) in wave 6.

2.5.1 Mother/Father data

In main LSAC waves, where extensive data is collected on both parent 1 and parent 2, separate mother and father variables are usually presented (for users who prefer to analyse the data by parent sex). Mothers should be taken to mean 'female parent or guardian'.

In the CheckPoint module, comprehensive data was collected on the attending parent, but much less (i.e. less than 30 variables) on the non-attending parent. Data are generally not presented as mother and father variables because fathers make up only 12% (n=230) of attending parents; thus, father variables would contain mostly missing data.

Data users wanting to conduct analyses on CheckPoint biological mothers can identify this subgroup of participants using the attending parent 'sex' (ff02m2cp) and 'relationship to child' (ff08fp1cp or fabiorel) variables in the CheckPoint dataset.

3 Study methodology

The key features of the Child Health CheckPoint study design and methodology are described in this section. More detailed descriptions can be found in previous publications (Clifford, Davies, et al., 2019; Wake et al., 2014).

3.1 Planning and protocol development

3.1.1 Scoping and study design

In 2007, AIFS commissioned a scoping report on the potential value, content and cost of a physical health and biomarkers module for LSAC (Wake et al., 2008). This was prepared by a number of the researchers already involved in LSAC and LSAC senior personnel based at AIFS. This report led to broad researcher and government support for such a module to be conducted.

In 2011, the initial CheckPoint Investigator Team came together. This group of senior researchers comprised diverse child health and economic expertise led from the MCRI (see section 2.1), in partnership with the DSS, AIFS, and the ABS. The team was awarded an NHMRC Project Grant in 2012 that covered the core child cardiorespiratory measures and enabled the module's implementation planning to commence. Throughout 2013-2014, the Investigator Team designed and tested the study protocol. As additional funding was obtained, it was able to expand the study beyond its limited original funded focus to more fully encompass the Scoping Report's recommendations, including other health domains and parent measurement.

3.1.2 Ethical approval

Ethical approval for the Child Health CheckPoint module was granted by the RCH Human Research Ethics Committee (33225) and AIFS Ethics Committee (14-26) in Jan–Feb 2014.

Ethics approval for the three-cohort '3C' study that doubled as a pilot for many of the CheckPoint measures (see section 3.1.3) was also granted by the RCH Human Research Ethics Committee (PEAS, LEAP2 and HopSCOTCH, cohort approval numbers 28135, 25006 and 28017, respectively) in November 2013.

3.1.3 Testing individual measures

Core CheckPoint assessments were included in the MCRI's '3C' study, in which three smaller longitudinal cohorts came together for a joint wave in 2014 to examine cardiorespiratory outcomes of lifecourse growth, diet and activity (Hanvey, Clifford, Mensah, & Wake, 2016; Hanvey, Mensah, Clifford, & Wake, 2017). Between February and September 2014, approximately 380 7-17 year old children in the PEAS (Wake, Gallagher, Poulakis, Morton-Allen, & Oberklaid, 2003), LEAP2 (Wake et al., 2009) and HopSCOTCH (Wake et al., 2012) cohorts participated in a clinic or home visit for anthropometric (body measurements), cardiovascular, dietary and fitness assessments. Gaining experience in these assessments helped the CheckPoint team to better understand the measurements protocols and equipment in a timed environment, and identified protocol efficiencies and participant document refinements. The '3C' study confirmed that these components could be completed within

time allocations, to high levels of data completeness for those attending, and that this mode of assessment was acceptable to participants.

3.1.4 Testing the overarching protocol

The overarching CheckPoint protocol was tested as a whole, later in 2014. At this point, the CheckPoint did not include child wellbeing and acne measures or the non-attending parent buccal sample, had a different protocol for oral photos, and only preliminary biospecimen processing protocols. Approximately 50 LSAC mini wave families living in Victoria participated in a CheckPoint Assessment Centre or Home Visit and post-visit follow-up activities. This allowed fine-tuning of recruitment, visit flow, timing and feasibility, and acceptability of the centre-based suite of measures ahead of the much larger bulk of children due to attend in 2015. As they proceeded through the assessments, mini wave study children and attending parents separately completed prospective evaluations of each measure (scored out of 10). The mini wave families reported high levels of recommending to others (child mean 7.7, parent mean 9.0), and enjoying the CheckPoint visit (child 8.8, parent 8.2). Children and parents rated how participating in the CheckPoint changed how they felt about being in LSAC overall on a scale from 0 ("Now I like it much less") to 10 ("Now I like it much more"). On average, participants liked being in the LSAC study much more after their CheckPoint experience (mean: child 8.4, parent 7.7).

3.1.5 Staff training

Assessments were undertaken by research assistants and students, after training by experts and under real-time quality checks. Inter-intra reliability for scorers was calculated where relevant and possible, and reported in initial publications for each measure (Dascalu et al., 2019; Fraysse et al., 2019; Kahn et al., 2019; Liu et al., 2019; Matricciani et al., 2019; Smith et al., 2019; Vlok et al., 2019; Welsh et al., 2019).

3.2 Data collection

Data collection for the Child Health CheckPoint spanned February 2015 to March 2016, between LSAC's waves 6 and 7.

For each B cohort family, participating in the Child Health CheckPoint module involved completing three to four components, typically over a two-week period:

1. A detailed Assessment Centre or shorter Home Visit for the study child and attending parent
2. A follow-up phone interview with the study child to collect additional time use data
3. Wearing physical activity monitors for a week for the study child and attending parent, and
4. Collection of a buccal swab (to be used for genetic analyses) for the non-attending biological parent, if applicable.

3.2.1 Participant eligibility and recruitment

B cohort families who participated in the LSAC wave 6 home interview were eligible for the Child Health CheckPoint module. Ideally, a physical health and biomarker module would have been offered to both B and K cohorts. However, because the CheckPoint was funded by a national competitive grant scheme, there were sufficient funds to assess only one of the two LSAC cohorts. The CheckPoint was offered to the B cohort because: (a) it contains more detailed pregnancy and birth data; (b) LSAC's data collections span the children's entire postnatal lives; (c) by this child age, there is a wide range in normal values of risk factors predicting adult preclinical markers of disease; and (d) experience suggested that the health measurements would be of greater interest (and so attract higher uptake) to children and parents at this age than to the K-cohort of 15–16 year olds, an age when many birth cohorts experience heightened attrition.

During the LSAC wave 6 home visit, the interviewer briefly introduced the Child Health CheckPoint and collected written consent to pass the family's contact details to the CheckPoint team solely for purposes of recruitment in to the module. The majority of the wave 6 interviews took place in March-September 2014 (see LSAC Data User Guide for more detail). Permission for contact was received from 3,513 families (93% of wave 6 families and 69% of the original cohort).

Prior to assessments starting in each city, the CheckPoint team mailed eligible families in the area a pre-notification postcard, followed by an invitation letter and Information and Consent booklet, and then made a recruitment and scheduling call. Families were first offered a Main Assessment Centre or Mini Assessment Centre (see section 3.2.3) appointment. To maximise participation amongst families living in regional and remote areas, contributions towards travel and accommodation costs were offered when possible. If it was not possible for a family to attend an Assessment Centre, a Home Visit was offered. In families with two parents, the family decided which parent would attend the visit with the child.

Recruitment began in December 2014, ahead of the first Main Assessment Centre opening in February 2015.

3.2.2 Consent

The attending parent provided written informed consent for their and their child's participation. Optional consent was requested for the collection, storage and non-genetic analysis of their own, and the study child's biological specimens. This consent was collected separately for each sample (allowing participants to consent to some samples and not others, e.g. a participant who declined a venous blood sample could agree to a blood finger-prick). Optional consent was also requested for genetic analyses of the biospecimens; sharing images and biospecimens with other researchers; and access to the child's birth data and newborn dried blood spots.

Non-attending biological parents provided written informed consent for the collection, storage and non-genetic analysis of their buccal swab. Optional consent was requested for genetic analyses and sharing the sample with other researchers.

3.2.3 *Visit types: Main Assessment Centre, Mini Assessment Centre and Home Visits*

Main LSAC wave data collection is based around a home visit with the study child and Parent 1, with additional questionnaires returned via mail.

In the CheckPoint module, children and parents were invited to a 3½ hour Main Assessment Centre visit. The 'pop-up' centre was set up sequentially in Melbourne, Canberra, Sydney, Newcastle, Brisbane, Adelaide and Perth. The second preference was for children and parents to attend a 2½ hour Mini Assessment Centre visit, operating in smaller regional centres close to clusters of LSAC families. Where neither was possible, a short Home Visit was offered.

There was sufficient equipment for only a single Assessment Centre to operate at any one time, so the 'pop-up' centre was set up sequentially in all major mainland Australian cities for between 2-10 weeks before being packed down and transported by road to the next location. At the Main Assessment Centres, the study child and attending parent rotated through 15 stations (or 13 stations for parents), each assessing a different aspect of physiology (see Figure 2). On each operating day, up to 24 families were invited to attend the Main Assessment Centre for a 3½ hour visit, with families arriving up to every 15 minutes.

Figure 2. Assessment stations within the CheckPoint Main Assessment Centre

Because of the large distances between Australian cities, it could take several days for the clinic equipment and furniture to reach its next destination, and only seven cities could accommodate a Main Assessment Centre within the constraints of the time, space and equipment available. To maximise the size and geographic reach of the sample, 'pop-up' Mini Assessment Centres operated in regional cities for up to a week while the bulk of heavy equipment was in transit. The 2¾ hour Mini Assessment Centre visit included most of the assessments offered at the Main Assessment Centres, except those involving large equipment that could not be checked in as personal luggage on commercial flights (e.g. pQCT scanner, retinal photography). The range of biospecimens collected depended on the laboratory facilities available at Mini Assessment Centre venues.

At both Main and Mini Assessment Centres, assessments were generally conducted one-on-one with an assessor. However, some assessments were conducted with the study child and attending parent both present (see Figure 3), a child and adult could be present at *Food Stop* (sitting separately, not the child's parent), or two children could be present at *Life at 25, Jumping Beans* and *Bike Hike*.

Shorter Home Visits were offered to those who could not attend an Assessment Centre. The 1½ hour Home Visit contained a subset of measures that could be conducted in the home, and could be collected by a trained generalist (i.e. not a phlebotomist). The assessments were generally conducted one-on-one with an assessor, with both study child and attending parent present throughout the visit.

Post-visit follow-up activities (i.e. child phone interviews, wearing physical activity monitors, and a non-attending biological parent providing a buccal sample) were the same for Assessment Centre and Home Visit families.

The measures and specimens collected at each visit type are described in detail in section 4.

3.2.3.1 Assessment sequence

Participants completed the assessments in a standard sequence, shown in Figure 3. In the Main and Mini Assessment Centres, participants advanced every 15 minutes to the next data collection station (except that child *Lung Fun* was 30 minutes), following the previous participant in their journey around the Centre. Home visits generally followed the same order of assessments as the Centre visits, although small changes were required to complete the assessments within the available time.

The assessment sequence was designed to minimise interdependencies between measures. The sequence allowed:

- Resting blood pressure to be measured towards the end of the Heart Lab station, after lying quietly for 5 minutes.
- The study child to be administrated a bronchodilator (Ventolin) after their cardiovascular assessment (as it can have short-term effects on blood pressure and heart rate) - parents did not have these measures.
- The study child’s fitness assessments to be conducted after cardiovascular, respiratory and biospecimen collection stations - parents did not have these measures.
- Blood collection to be late in the session to ensure all study children had at least 2 hours fasting from food (water was available throughout the session).
- A snack and water to be provided after the blood sample to rehydrate and allow for resting before exercise.
- Food to be consumed after the saliva sample and dental photos.

Each participant was provided with an iPad to carry throughout the session to allow them to complete their questionnaire during any downtime. If no iPads were available, attending parents were allocated a laptop workstation to return to throughout the visit.

Participants had dedicated time during the *Lung Fun* station to provide a urine sample, though were free to do this at any time before, during or after the visit that they preferred.

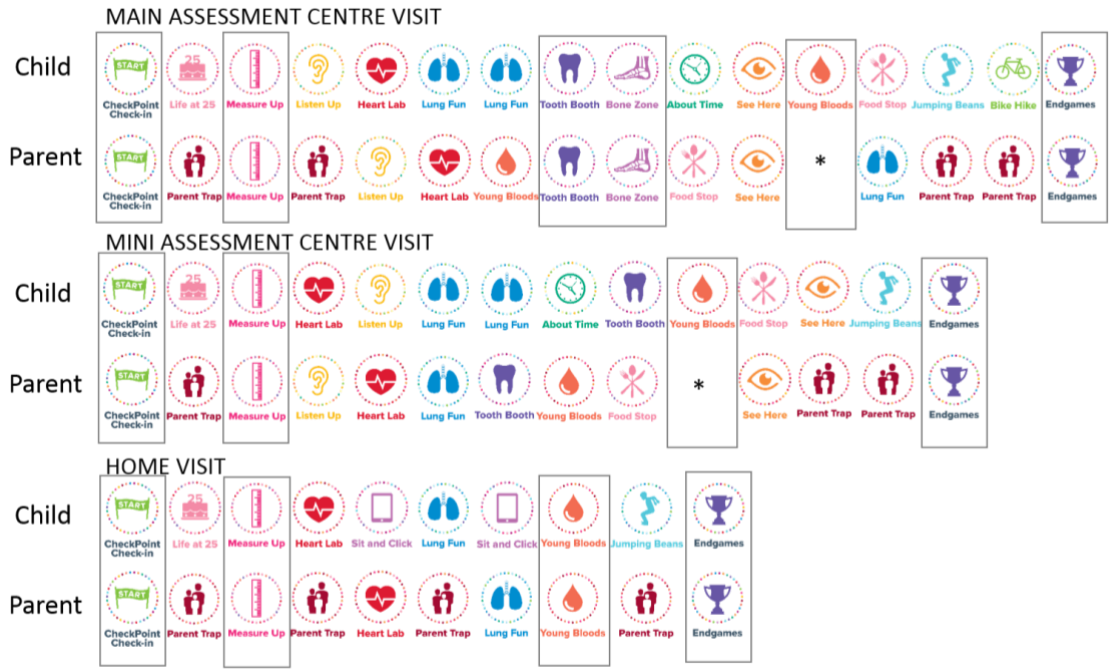

Figure 3. Assessment sequence, by participant and visit type

*Parents attended the *Young Bloods* stations twice; first for their own blood collection, then to accompany their child. Oblong box indicates child and parent attended the station together. *Food Stop* included consumption experiment at the Main Assessment Centre (i.e. data collected), but was simply offering refreshments at the Mini Assessment Centre (i.e. no data collected). The NIH Toolkit Vocabulary Picture Test was administered in *Bone Zone* at the Main Assessment Centre, and as part of *Sit and Click* in Mini Assessment Centre and Home Visits. In Home Visits, *Sit and Click* (child questionnaire) had allocated time between other assessments; for the assessment centre visits, *Sit and Click* did not have an allocated time or physical location (children completed the questionnaire in downtime at other stations). Post-visit activities (i.e. accelerometry, child follow-up phone interview and non-attending parent buccal swab) are not included in the diagram and followed the same protocol regardless of visit type.

3.2.4 Data collection instruments

The data collection instruments used are listed below. The instrument abbreviations (shown in bold) are used in the CheckPoint Data Dictionary and Rationale document to indicate the data collection method for each measure or variable.

The following methods were used to collect data:

- A face-to-face (**F2F**) interview with the attending parent at the start of the visit, to establish consent, refusal of specific measures or conditions potentially affecting participation in assessments.
- A Parent Questionnaire, delivered to the attending parent in a computer-assisted self-interview (**CASI**) format.

- A Child Self-Report (**CSR**) Questionnaire, delivered to the study child in a computer-assisted self-interview format.
- Physical Measures, also referred to as **Direct Measures**, are health assessments and biological sample analyses that are objectively or directly measured or collected without the participant's input, as opposed to participant actively participating or reporting information. Many of these data are collected via specialised medical or research equipment (e.g. accelerometer).
- **Direct Assessments,** which are health or functioning assessments that are collected using objective tests that require participant input, self-reported responses or staff interpretation of participant responses. These data are collected via participant response equipment connected to specialised medical or research equipment (e.g. spirometry, Pure tone audiometry, Freiburg visual acuity test), or iPad applications used by the participant directly (e.g. NIH Toolbox Picture Vocabulary Test) or staff assessment of participant responses (e.g. Recalling Sentences). Additionally, some physical measures data are not automatically captured by equipment software, but instead staff transcribe the objectively measured data into the Research Electronic Data Capture (REDCap) data entry database displayed on the equipment (e.g. broad jump distance, heart rate during *Bike Hike*).
- Biospecimen (**BSP**) barcode registration and tracking via the REDCap data entry and laboratory sample processing databases.
- Administrative Data (**ADM**) entered by staff into the REDCap data entry database to facilitate participant tracking and running the Assessment Centres, including date of assessment, visit type, location and postcode.
- Child computer-assisted telephone interview (**CATI**) after the visit, to collect MARCA time use data.
- Activity logs completed by parent after assessment (**P1L**).
- A buccal sample consent form completed by non-attending biological parents (**P2L**).

3.2.4.1 Collection and tracking of biospecimens

Biological samples were collected from study children and attending parents within the *Young Bloods* and *Lung Fun* stations at Main and Mini Assessment Centres, and a subset of samples were collected at Home Visits (see section 4.2). All sample collection vessels (i.e. tubes or envelopes) were pre-labelled with a unique barcode. At the time of sample collection, staff entered the sample type and source sample barcode into the participant's REDCap record, thereby linking the participant to the source sample.

In the Assessment Centre laboratory, staff processed and transferred the source sample into smaller aliquots. The source sample and aliquot barcodes were entered into a separate REDCap database, thereby linking the source to each stored aliquot.

After assessments were completed, staff linked the two REDCap databases to link participant ID to each aliquot.

The biospecimens are securely stored in a de-identified manner within the Melbourne Children's Bioresource Centre, at the MCRI.

3.2.4.2 Locations and dates

Main Assessment Centres operated between February 2015 and January 2016, for a period of 2-10 weeks in the cities of Perth, Adelaide, Melbourne, Canberra, Sydney, Newcastle and Brisbane. Mini Assessment Centres operated between August 2015 and February 2016, for approximately one week in each of the large regional cities Darwin, Hobart, Launceston, Bunbury, Townsville, Mackay and Bundaberg. A Mini Assessment Centre was also set up in Melbourne for two weeks to provide an additional opportunity for families who were unable to attend the Main Assessment Centre earlier in the year. Home visits occurred between July 2015 and March 2016 in all these cities as well as Alice Springs, Mount Gambier, Kalgoorlie, Albury-Wodonga and other regional towns. In total, the study visited over 30 cities and towns over the one-year data collection period.

Only one Main Assessment Centre operated at any one time, due to the specialist equipment and staff required. This contrasts to main LSAC waves, where home visits occur simultaneously across the states and territories, with each interviewer having a full set of assessment materials throughout. As the 'pop-up' Main and Mini Centres moved around the country, there are differences across states and territories in the month of the year when visits occurred, (see Figure 4) and the elapsed duration since the LSAC wave 6 interview (see Figure 5). The number of families seen peaked in the September (Brisbane) and January (Perth) school holidays. Home Visits occurred during and after the Assessment Centre operated in each area, and simultaneously in different cities and states or territories during peak demand periods (such as school holidays). Families living on Australia's East Coast were seen closer to their wave 6 interview (Figure 5), while families in other parts of the country were seen correspondingly closer to their subsequent wave 7 interview.

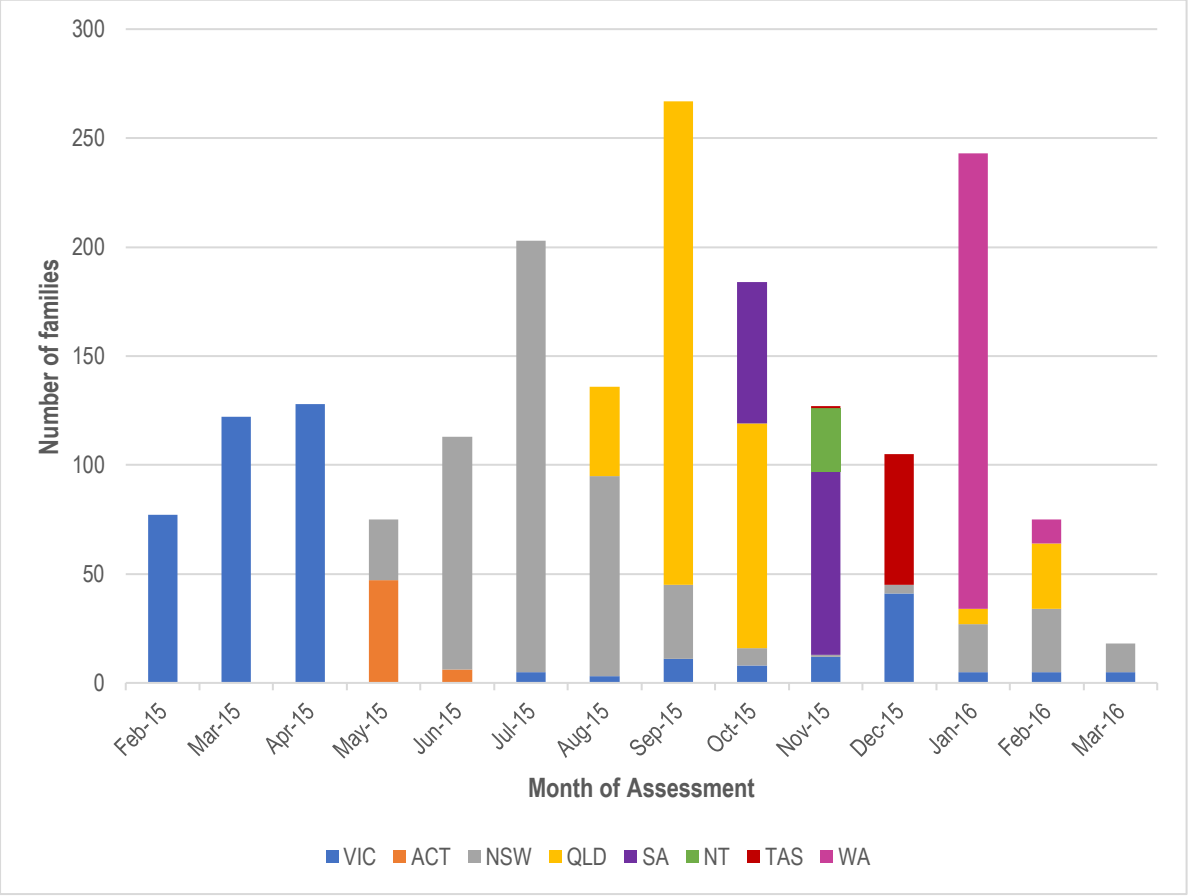

Figure 4. Month of assessment, by state or territory of residence

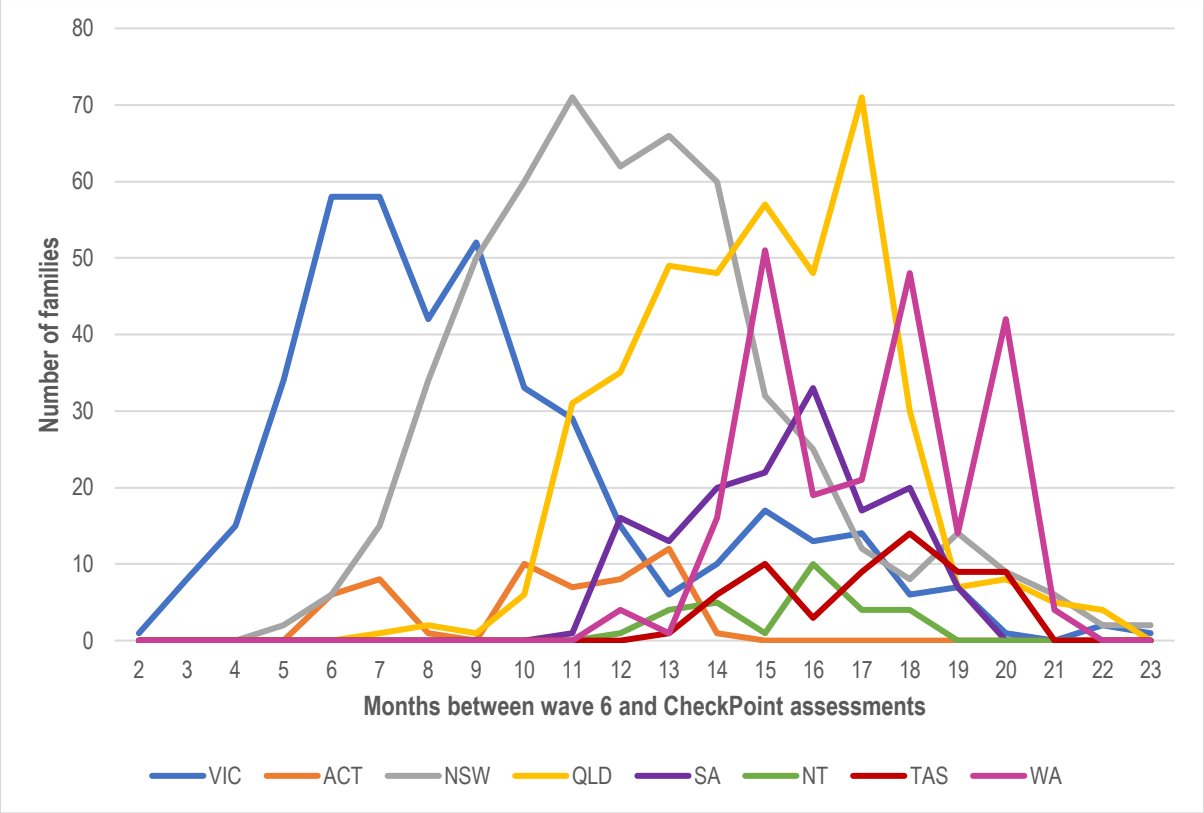

Figure 5. Months between wave 6 and CheckPoint visits, by state or territory of residence

3.2.5 Post-visit follow-up activities

At the end of the Assessment Centre visit (*Endgames* station) or Home Visit, the study child and attending parent were given a take home pack for post-visit follow-up activities:

1. A phone interview was scheduled with the study child to recall time use on two more days. The interviewer transcribed the child's activities into the MARCA program, using a similar protocol as the *About Time* station. The take home pack contained a card on which the study child could note the times of key events (e.g. wake time, lunch time, bed time) to help with their later recall.
2. Accelerometers were provided to the study child and attending parent to wear for 8 days. The take home pack also included an activity card for the participants to record wake and sleep times, and activities during periods of non-wear.
3. A buccal swab collection kit and consent form were included in the pack if the attending parent indicated that a biological parent of the study child lived with the child.

The take home pack also included a reply-paid express post satchel for the return of the accelerometers, activity cards, buccal swab and consent form.

3.3 Data Management

During the Child Health CheckPoint data collection phase (February 2015 to March 2016), data management activities included the secure backup, transfer and storage of all participant data, real-time data completeness checks and ongoing review of adherence to SOPs.

From the conclusion of the data collection phase and throughout 2017, the focus changed to preparing the source data and final datasets for analysis. The key activities fell into five sequential stages:

1. **Measure extraction** activities included file conversion (consolidating accumulative files, transcription, changing file types), validating IDs and cross-checking duplicate data, scoring images or loops, reviewing data quality and excluding poor quality data, checking for missing data and auditing the biospecimens held in the biobank. Note that many of the CheckPoint measures were essentially created well after the assessment; the assessment simply generated an image or digital recording with the measurement itself occurring later. This added considerable complexity and time to scoring, particularly for measures where agreement on extraction and scoring was still developing at the time of the CheckPoint.
2. **Reliability testing** to determine the inter-rater and intra-rater reliability of staff transcription and scoring of relevant measures.
3. **Data Derivation** included activities such as variable naming and labelling, incorporating changes from staff comments and flagging potentially unreliable data, recoding variables, deriving new variables such as z-scores, totals and averages, and checking distributions and ranges of derived data.
4. **Review of data** included range and distribution checks of key variables, reviewing summary scores and investigating reasons for unexpected missing data.
5. **Cataloguing** included naming and labelling all variables according to LSAC conventions, and preparing documents for data users, including the Child Health CheckPoint Data Dictionary, Rationale document and Data User Guide.

4 Measures and biospecimens collected

Measures and biospecimens collected in the Child Health CheckPoint module are described in this section. Table 1 summarises for each measure or biospecimen, the sample assessed (children/parents, Main Assessment/Mini Assessment/Home Visits), the station in which it was administered (hence sequence in the visit flow), and specific equipment or instruments used. Following the table, sections 4.1 and 4.2 provide additional information about each of the measures and biospecimens, including a brief summary of the protocol, data cleaning and/or scoring processes, key variables, the relevant SOPs containing more information and the CheckPoint Investigators to consult for collaborations and queries. Many SOPs are available from the CheckPoint team, on request.

The range and distribution of key child and parent measures, and child-parent concordance, are described in a series of Child Health CheckPoint papers published in BMJ Open.

Table 1. Measures and biospecimens collected, by participant and assessment type.

Construct & Measure	Main		Mini		Home		Station	Equipment/instrument*
	Ch	P	Ch	P	Ch	P		
Anthropometry								
Height (Marfell-Jones, Olds, Stewart, & Carter, 2006; World Health Organization, 1995)	●	●	●	●	●	●		Portable rigid stadiometer (Invicta IP0955, Leicester, UK).
Weight and body composition (Marfell-Jones et al., 2006; World Health Organization, 1995)	●	●	●	●	●	●		4-limb segmental (InBody230, Biospace, Seoul, Korea) or 2-limb (Tanita BC-351, Kewdale, Australia) body composition scales.
Waist circumference (Marfell-Jones et al., 2006; World Health Organization, 1995)	●	●	●	●	●	●		Steel anthropometric measuring tape (Lufkin Executive Diameter W606PM, Maryland, USA).
Pubertal status								
Pubertal development	●		●		●			Sexual Maturity Scale (Morris & Udry, 1980). Pubertal Development Scale (Petersen, Crockett, Richards, & Boxer, 1988).
Menstruation	●	●	●	●	●	●		Study-designed questions about menstruation.
Acne	●		●		●			Modified Comprehensive Acne Severity Scale for the face (Tan et al., 2007).
Bone and muscle measures								
Bone and muscle morphology, bone density (Moyer-Mileur, Quick, & Murray, 2008; Zemel, 2011)	●	●						Peripheral quantitative computed tomography (pQCT, Stratec XCT 2000L scanner and XCT 2000 software, Birkenfeld, Germany).
Cardiovascular measures								
Carotid intima-media thickness and distensibility (Stein et al., 2008; Touboul et al., 2012)	●	●	●	●				Portable ultrasound (GE Healthcare Vivid *i* BT06 with 10MHz linear array probe, Little Chalfont, UK) with electrocardiogram.
Arterial stiffness and blood pressure (Laurent et al., 2006)	●	●	●	●	●	●		SphygmoCor XCEL (AtCor Medical, West Ryde, Australia).
Microvascular structure (Wong et al., 2001)	●	●						Retinal camera (Canon CR-DGi, Tokyo, Japan), fitted with a digital SLR camera (Canon EOS 60D, Tokyo, Japan).
Respiratory measures								
Lung function	●	●	●	●	●	●		Spirometer (Miller et al., 2005) Vyntus, California (Ca), USA and Sentry Suite software (Ca, USA) for collection (v2.10) and download (v2.17).

Construct & Measure	Main		Mini		Home		Station	Equipment/instrument*
	Ch	P	Ch	P	Ch	P		
Language								
Expressive and receptive language	●	●	●	●				Recalling Sentences subtest, Pearson Clinical Evaluation of Language Fundamentals–4th edition, Australian version (Semel, Wiig, & Secord, 2006) iPad (Apple, Ca, USA), and headphones.
Receptive vocabulary	●	●	●	●	●	●		National Institutes of Health Picture Vocabulary test (Weintraub et al., 2013; NIH Toolbox software with Cognition package), iPad & headphones.
Hearing								
Hearing threshold (Niskar et al., 1998; Wake, Poulakis, Hughes, Carey-Sargeant, & Rickards, 2005)	●	●	●	●				Audiometer (Oscilla USB-330, version 3.3.4, Taastrup, Denmark) and Oscilla headphones. Data exported using version 4.0.0.
Middle ear function (Cone, Wake, Tobin, Poulakis, & Rickards, 2010)	●	●	●	●				Tympanometer (Oscilla TSM300, Taastrup, Denmark) and AudioConsole software (Version 3.3.4).
Speech reception threshold	●	●	●	●				Listening in Spatialised Noise – Sentences Test v1.104 (Cameron, Glyde, & Dillon, 2011; National Acoustic Laboratories, 2016), Phonak, NSW, Australia), laptop & headphones (Sennheiser HD215, Wedemark, Germany).
Diet and food choices								
Food choices	●	●						Digital weight scales accurate to 1 gram (Breville, BSK500BSS).
Physical activity and time use								
Physical activity, sedentary behaviour, sleep (Esliger et al., 2011)	●	●	●	●	●	●		Wrist-worn accelerometer (GENEActiv Original, Cambs, UK) and self-report activity log.
Time Use	●		●		●			Multimedia Activity Recall for Children and Adults (Foley et al., 2013; Olds, Ridley, Dollman, & Maher, 2010; Ridley, Ainsworth, & Olds, 2008) program.
Strength and fitness								
Eurofit broad jump (Ortega, Ruiz, Castillo, & Sjostrom, 2008)	●		●		●			Gym mat and measuring tape (Lufkin L610CME, Maryland, USA).
PWC170 VO_2 max test (Boreham, Paliczka, & Nichols, 1990)	●							Exercise bike (Monark 928G3, Manila, Philippines) and chest-worn heart rate monitor (Polar FT4, Smeaton Grange, Australia).

Construct & Measure	Main		Mini		Home		Station	Equipment/instrument*
	Ch	P	Ch	P	Ch	P		
Vision								
Visual acuity	●	●	●	●			See Here	Computerised adaptive Freiburg Visual Acuity and Contrast Test (Bach, 1996) with Landolt C optotypes (FrACT 3.8.2, Breisgau, Germany).
2D and 3D oral photography								
2D and 3D oral photography	●	●	●	●			Tooth Booth	*2D photography* - Digital SLR camera (Canon 70D, Tokyo, Japan). *3D photography* – 3-pod 3D camera (3dMD Trio system, Georgia, USA).
3D facial photography	●	●					Tooth Booth	3-pod 3D camera (3dMD Trio system, Georgia, USA).
Written story								
Handwriting, written language	●		●		●		Life at 25	Pen, paper. Using protocol adapted from 1958 UK National Child Development Study (Elliot & Morrow, 2007).
Wellbeing and quality of life								
General wellbeing	●		●		●		Sit and Click	International Survey of Children's Wellbeing ("Children's Worlds: International Survey of Children's Well-Being," 2017; Seligson, Huebner, & Valois, 2003). Pediatric Quality of Life (PedsQL) 4.0 General Wellbeing Scale (Varni, Seid, & Kurtin, 2001).
Health related quality of life	●		●		●		Sit and Click	PedsQL 4.0 Generic Core Scale (Varni et al., 2001).
Health related quality of life		●		●		●	Parent Trap	Assessment of quality of life 8D Scale (Richardson, Iezzi, Khan, & Maxwell, 2014).
Health related quality of life	●	●	●	●	●	●	Sit and Click Parent Trap	Child Health Utility 9D (Stevens, 2011).
Pain								
Pain	●	●	●	●	●	●	Sit and Click Parent Trap	Pain severity questions (Derogatis, Lipman, & Covi, 1973) with pain manikin adapted for on-line administration (Jones, Watson, Silman, Symmons, & Macfarlane, 2003).
Diet								
Diet	●	●	●	●	●	●	Sit and Click Parent Trap	Adapted National Secondary Students' Diet and Activity (Flood, Webb, & Rangan, 2005) questions, supplemented with adapted International Study of Childhood Obesity, Lifestyle and Environment (Saloheimo et al., 2015) items.

Construct & Measure	Main		Mini		Home		Station	Equipment/instrument*
	Ch	P	Ch	P	Ch	P		
Allergy, eczema and colouring								
Family allergies and pet exposure		●		●		●	Parent Trap	Allergy and pet exposure questions from the HealthNuts study (Koplin et al., 2015; Peters et al., 2017); parent-reported.
Eczema severity and treatment	●		●		●		Parent Trap	Eczema questions from the International Study of Asthma and Allergies in Childhood study (Asher et al., 1995); parent-reported.
Natural skin, hair and eye colouring	●	●	●	●	●	●	Parent Trap	Questions adapted to self-report format from Paediatric Autoimmune Disease study (Pezic et al., 2013) colour chart; parent-reported.
Medications and supplements								
Current medications and supplements	●		●		●		Parent Trap	Medications and supplements questions modified from LSAC (Australian Institute of Family Studies, 2018); parent-reported.
Health, welfare and community services								
Hospital admissions and health insurance	●		●		●		Parent Trap	Child lifetime hospitalisations, health care card and insurance coverage questions modified from LSAC (Australian Institute of Family Studies, 2018); parent-reported.
Health service use	●		●		●		Parent Trap	Use of services questions modified from LSAC (Australian Institute of Family Studies, 2018); parent-reported.
Community participation	●		●		●		Parent Trap	Community activity use questions modified from LSAC (Australian Institute of Family Studies, 2018); parent-reported.
Biological samples								
Venous blood	●	●	●	●			Young Bloods	S-Monovette vacutainers: 2.7ml potassium EDTA (05.1167.001), 9 ml K3 EDTA (02.1066.001), 7.5ml Lithium Heparin liquid (01.1608.001), 9ml Serum Gel with Clotting Activator (02.1388.001), Sarstedt, Australia
Dried blood spot	●	●	●	●	●	●	Young Bloods	Lancet (1.6mm (#85.1018) or 1.8mm (#85.1016) depth, Sarstedt Australia), Guthrie filter paper card.
Urine	●	●	●	●	●	●	Lung Fun	70mL screw cap polypropylene sterile pot (#75.9922.731, Sarstedt, Australia)
Saliva	●	●	●	●			Lung Fun	50mL polypropylene sterile tube (#FAL352070, Falcon, Corning Inc., Corning, NY, USA)

Construct & Measure	Main		Mini		Home		Station	Equipment/instrument*
	Ch	P	Ch	P	Ch	P		
Buccal swab		○	●	○	●	○	Lung Fun	Buccal swab (Oracollect DNA OCR-100, The Hague, Netherlands. If not available, FloqSwab COPAN Flock Technologies, Brescia, Italy).
Hair	●	●	●	●			Lung Fun	String, aluminium foil, envelope, scissors.
Toenails	●		●		●		Lung Fun	Scissors, envelope.

Questionnaire measures were self-reported, unless indicated they were parent-reported. *All questionnaire items administered by iPad or laptop, except the pain manikin, which was completed on paper at Home Visits. For brevity, iPad or laptop is not listed for every questionnaire item. Open circles indicate sample collected from non-attending parent. Ch: Data/sample collected relates to child participant; P: Data/sample collected relates to parent participant; Ca: California, USA; FrACT: Freiburg Visual Acuity and Contrast Test; LSAC: Longitudinal Study of Australian Children; PedsQL: Pediatric Quality of Life Inventory; NIH: National Institutes of Health; UK: United Kingdom; USA: United States of America; VO_2max: Maximum volume of oxygen consumed; 2D: Two dimensional; 3D: Three dimensional.

4.1 Physical health assessments

The physical health measures that make up the CheckPoint module were selected to capture many of the major health issues confronting Australian children and adults. As well as practical considerations about their acceptability, feasibility and cost, we aimed to measure aspects of health that are important in regards to prevalence, cost, policy and relevance not only to families but to the burden of the 'diseases of ageing' that are confronting most nations in the 21st century. For each aspect of health, we sought to identify cutting-edge, comprehensive measures, aiming for a balance between innovation and employing protocols similar to significant childhood cohort studies around the world. Measures needed to have a wide variation within the 'normal' range that might confer meaning; to be fundamentally continuous rather than categorical (even if categorised later); and to be relevant to both children and mid-life adults, so that paired parent-child cross-generational measures could be obtained. Lastly, we also included measures of wellbeing, health-related quality of life, healthcare utilisation and community participation to allow data users to explore how health impacts on these.

The majority of physical health assessments in the CheckPoint module were new to LSAC. Notably, height, weight, girth, body fat and blood pressure have been directly assessed in both LSAC and CheckPoint, using similar measurement protocols but different equipment (see the LSAC Data User Guide and below for the respective protocols). Because of its focus, the CheckPoint equipment was generally more costly, precise and/or sophisticated (e.g. 4-limb rather than 2-limb bioelectrical impedance analysis) so these measures, with the exception of height and weight, are not directly referable to earlier waves. Thus, data users should refer to the data collection protocols and be mindful that differences in an individual's values between wave 6, CheckPoint and wave 7 may be partially due to protocol differences.

In addition to the general quality checks and data cleaning applied to all of the data, measure-specific quality checks and data cleaning steps are described in the relevant sections below, the Rationale Document (in the 'Scoring' column) and the Standard Operating Procedures.

4.1.1 Anthropometry

Detailed information about data collection and preparation is provided in the *Measure Up data collection* and *Anthropometry data management* SOPs.

Professor Tim Olds led the anthropometry assessments with Professor Melissa Wake. Collaboration on projects using these data is encouraged. Please email timothy.olds@unisa.edu.au.

4.1.1.1 Height

An Invicta stadiometer (IP0955) was used to measure the standing height (Marfell-Jones et al., 2006; World Health Organization, 1995) of the child and parent. The head was positioned in the Frankfort plane and shoes and socks were not worn. Two measurements were taken. If the two measurements differed by 0.5cm or more, a third measurement was taken. Average height was calculated from mean of closest two measurements and is included in the data file.

4.1.1.2 Weight and body composition

In addition to measuring body weight, bioelectrical impedance analysis (BIA) was used to measure body composition. Four-limb BIA scales (InBody230 four-limb segmental body composition analyser) were used in Main Assessment Centre and Mini Assessment Centres, and some home visits.

Two-limb BIA scales (Tanita BC-351) were used in most home visits, when 4-limb scales were not available.

Children and parents were measured once, in light clothing without shoes or socks. When the four-limb BIA scales were used, the participant stood on the scales and held onto two horizontal handles. The staff member entered participant ID number, age, sex and mean height into the scales as these are pre-requisites for automated body composition calculations. Using patented InBody body composition equations, the analyser calculated total body lean and fat mass, segmental lean and fat mass (i.e. of the right arm, left arm, trunk, right leg and left leg), and other variables. The staff member transcribed weight and total body fat mass into REDCap. Complete data was exported to USB at the end of each day.

When the two-limb BIA scales were used in home visits, the participant stood on the scale, and the staff member entered participant age, sex, and height into the scales. Patented Tanita body composition equations then calculated body fat percentage. The staff member transcribed weight and total body fat percentage into REDCap.

Both the two- and four- limb BIA analysers measured body weight at the same time as body composition. All equipment was calibrated prior to the commencement of data collection.

Body mass index (BMI) was calculated as kg/m^2. Weight status (e.g. underweight, normal weight, overweight and obesity) was derived using the World Health Organisation BMI definitions for adults (World Health Organization, 2000; a single variable), and US Centers for Disease Control (CDC; Kuczmarski et al., 2000) and International Obesity Task Force (Cole, Flegal, Nicholls, & Jackson, 2007) definitions for children (i.e. two alternative variables for user flexibility). For study children, we also derived BMI z-score using both the CDC and UK 1990 (Cole & Lobstein, 2012) reference values, and BMI percentile (e.g. 88th percentile) using the CDC values (Kuczmarski et al., 2000). The derivation of other body composition variables is described elsewhere (Clifford, Gillespie, et al., 2019).

4.1.1.3 Waist circumference

Child and parent waist circumference was measured at the narrowest point between the lower costal (10^{th} rib) border and the top of the iliac crest, using a steel anthropometric measuring tape (Lufkin Executive Diameter, W606PM). If no narrowing was observed, the measurement was taken at the midpoint between the 10th rib and the iliac crest. Waist circumference was measured twice; if the values differed by 1cm or more, a third measurement was taken. Average waist circumference was calculated from mean of closest two measurements and is included in the data file. For study children, waist z-score was calculated using UK 1990 growth charts (McCarthy, Jarrett, & Crawley, 2001).

Approximately 40 child and 30 parent anthropometry variables are included in the data file. Key variables include height, weight, body mass index, percent body fat and waist circumference.

4.1.2 Pubertal status

Detailed information about data collection and preparation is provided in the *Sit and Click data collection* and *Pubertal status data management* SOPs.

Dr Peter Azzopardi led the pubertal development, menstruation and acne measures. Collaboration on projects using these data is encouraged. Please email peter.azzopardi@burnet.edu.au.

4.1.2.1 Pubertal development

Sexual Maturity Scale

Children were presented one (boys) or two (girls) sets of five sex-specific drawings from the Sexual Maturity Scale (SMS; Morris & Udry, 1980). Drawings illustrate the five Tanner stages of pubertal development. Boys were presented one set of five drawings illustrating male genitalia, testicular size and pubic hair development. Girls were presented two sets of five drawings illustrating pubertal breast development and pubic hair development separately. Children were asked to select one picture per set that looked most like their own body on the day. The female SMS score was calculated by averaging responses from the two sets of pictures and rounding to the nearest category. Scores are only available for girls who provided a response to both picture sets. The male SMS score is the response from the single set of male pictures.

Pubertal Development Scale

Children were asked five sex-specific questions from the Pubertal Development Scale (PDS; Petersen et al., 1988) about the progress of pubertal changes in their body. Both males and females were asked about their growth spurt in height, body hair development and skin changes. Males were also asked about deepening of their voice and facial hair, and females were asked about breast growth and menarche. Response options for all questions were ‘has not started’, ‘has barely started’, ‘has definitely started’ and ‘seems complete’.

The Total PDS score was the sum of responses to the five questions presented to either sex. This score was also divided by five to assign each participant to one of five pubertal development categories: ‘Prepubertal’, ‘Early pubertal’, ‘Midpubertal’, ‘Late pubertal’, or ‘Postpubertal’.

The Pubertal Development Scale was completed by parents for the B cohort in previous LSAC waves, whereas in CheckPoint and subsequent LSAC waves this was completed by the children. The Total PDS score (Bond et al., 2006) and five pubertal development category variables (Crockett, unpublished manuscript 1988) described above, and provided in the CheckPoint dataset, are not available in previous LSAC B cohort waves.

4.1.2.2 Menstruation

Girls were asked if they had begun to menstruate, and if so, their age in years and months when they began. Girls who had begun to menstruate and female parents were asked if they were menstruating on the day of assessment to aid interpretation of blood in urine samples.

4.1.2.3 Acne

Children were asked if they have ever had acne or pimples. Those who answered yes were presented five sex-specific digitally altered photos of a young boy or girl's face. Images represented ‘clear’ skin, ‘almost clear’ skin, ‘mild acne’, ‘moderate acne’ and ‘severe acne’. The facial pictures were based on the face subscale of the Comprehensive Acne Severity Scale (CASS; Tan et al., 2007).

Approximately 20 child pubertal status variables are included in the data file. Key variables include the Sexual Maturity Scale score, the Pubertal Development Scale category, age at the beginning of menses and acne severity.

4.1.3 Bone and muscle morphology, bone density

Detailed information about data collection and preparation is provided in the *Bone Zone data collection* and *Bone data management* SOPs.

Dr Peter Simm led the bone and related assessments. Collaboration on projects using these data is encouraged. Please email peter.simm@rch.org.au.

Peripheral quantitative computerised tomography (pQCT) scans are used to measure bone and muscle morphology (shape and structure). Two pQCT scans of the lower leg were performed using a Stratec XCT 2000L scanner and XCT 2000 software.

We scanned the leg preferentially used to kick a ball (Hoffman, Schrader, Applegate, & Koceja, 1998). Children and parents sat with their lower leg extended through the scanner gantry, and their thigh resting on a support and foot secured to a footrest. After measuring the length of the participant's tibia, the staff member took a scout scan of the ankle area, to determine the location of the distal epiphyseal plate, and therefore accurately determine the location of subsequent scans. The participant was asked to keep still, and the scanner moved up the leg from the foot towards the knee. Scans were taken at 4% and 66% of the length of tibia. The 4% site is just above the ankle and a region with a high proportion of trabecular bone. The 66% site is close to the middle of the calf and a region with a high proportion of cortical bone. The scanner's gantry diameter was only 14cm, so the 66% site scan was not possible for participants with larger calves; a 4% site scan was taken as usual for these participants.

Using the Stratec XCT 2000 software (version 6.20C), two CheckPoint team members reviewed the regions of interest (ROI) around the total image at both the 4% and 66% sites, and made adjustments as necessary. Then, the software's MACRO analysis function applied cut-points to the density data to classify tissue types (e.g. cortical bone, trabecular bone, fat, muscle) and derive bone health measures (e.g. cortical body mineral density).

Scoring of image quality

Each pQCT scan was reviewed to score the image quality, based on image resolution, presence of motion artefacts, and a clearly definable ROI (Blew, Lee, Farr, Schiferl, & Going, 2014). In consultation with bone density experts, each image was given a quality score, being:

1 = Excellent image with no motion artefact and clearly defined ROI.

2 = Above average quality image with insignificant motion artefact and clearly defined ROI.

3 = Average quality image with minimal motion artefact likely to have minor effects on data analysis and/or definition of the ROI.

4 = Below average quality image with moderate motion artefact likely to have an effect (possibly significant) on data analysis and/or definition of the ROI.

5 = Poor quality image with severe motion artefact likely to have a major effect on data analysis and/or ROI boundaries could not be defined.

Where ROIs were not clearly defined (i.e. image quality 4 and 5), a team member manually adjusted the ROI boundaries to ensure the most appropriate ROI was used.

Data derived from images with a quality score of 1-3 were included in the dataset. Additional quality scoring was undertaken on images scored 4 and 5, and data were included or excluded from the dataset depending on the degree and location of motion artefact in the image.

Detailed quality scores for the 4% site were:

> 4a = **moderate** motion artefact present in the **outer** 45% region of the ROI. Trabecular bone data only were included in dataset.
>
> 4b = **moderate** motion artefact present in the **inner** 45% of the ROI. All bone data were excluded from the dataset.
>
> 5a = **severe** motion artefact present in the **outer** 45% of the ROI. Trabecular data were checked for extreme values; and if they fell within normal ranges were included in the dataset. Other bone data were excluded.
>
> 5b = **severe** motion artefact present in the **inner** 45% of the ROI. All bone data were excluded from the dataset.

Detailed quality scores for the 66% site were:

> 4a = **moderate** motion artefact largely not affecting the cortical shell. All pQCT data were checked for extreme values; and if they fell within normal ranges, were included in the dataset.
>
> 4b = **moderate** motion artefact, extensive movement affecting the cortical shell. All pQCT data were excluded from the dataset.
>
> 5a/b = **severe** motion artefact, extensive movement affecting the shape of the cortical shell and creating regions of lower density parallel to the movement artefact. All pQCT data were excluded from the dataset.

Derivation of bone, fat and muscle variables

The MACRO analysis function of the Stratec XCT 2000 software was used to derive bone and muscle morphology and density variables. The Analysis Thresholds used in this MACRO can be found in the *Bone data management* SOP. The following variables were calculated, where relevant, for each of the 4% site, 66% site, total cross-sectional area (66% site) and total muscle (66% site):

- Total, trabecular and cortical bone mineral content and bone mineral density
- Tibia cross-sectional area
- Cortical thickness
- Periosteal and endosteal circumference
- Stress-strain index, and
- Muscle, bone and fat cross-sectional area.

Due to the complex nature of pQCT data, we recommend reading the *Bone data management SOP* before proceeding with analyses (available from the CheckPoint team, on request).

Approximately 50 child and 50 parent pQCT variables are included in the data file. Key variables include total bone mineral content, trabecular bone mineral content, cortical bone mineral content, total bone mineral density, trabecular bone mineral density, cortical bone mineral density, tibia cross-

sectional area, cortical thickness, periosteal circumference, endosteal circumference, stress-strain index, muscle cross-sectional area, bone cross-sectional area and fat cross-sectional area.

4.1.4 Cardiovascular assessments

4.1.4.1 Carotid intima-media thickness and other attributes

Detailed information about data collection and preparation is provided in the *Heart Lab data collection* and *Cardiovascular (carotid intima-media thickness) data management* SOPs.

Professor David Burgner led the carotid intima-media thickness and related assessments. Collaboration on projects using these data is encouraged. Please email david.burgner@mcri.edu.au.

Carotid intima-media thickness (IMT) is a measure of large arterial structure. Ultrasound of the right carotid artery wall, with concurrent electrocardiogram (ECG), was performed on children and parents using a portable ultrasound machine (GE Vivid *i* BT06 with 10MHz L-RS linear array probe, GE Healthcare). The procedure was developed in accordance with recommendations of the American Society of Echocardiography and Mannheim Consensus statements (Stein et al., 2008; Touboul et al., 2012). All participants lay supine with their head turned approximately 45 degrees to the left, to expose the right side of neck. A Meijer Carotid Arc was not used to standardize the angle of image acquisition, instead we recorded images from the single best angle for each participant, which was at approximately 45 degrees. The right carotid artery was chosen to harmonize with other right-sided vascular measures in CheckPoint. Real-time B mode ultrasound cine-loops were captured in triplicate by one of four trained technicians. Modified 3-lead ECG was performed concurrently. At least three 5-10 cardiac cycle loops were saved in RAW DICOM format for later analysis.

All loops were reviewed by one technician, who selected the best three loops for each participant, according to the key optimisation parameters: a clear near and far wall intima-media, clear lumen, straight vessel, presence of the carotid bulb and an ECG trace. Then, these loops were trimmed to only keep the best quality 5-7 cardiac cycle segment of each loop, and saved in DICOM format for later analysis.

The image quality of the trimmed loops was graded for far wall clarity, length of clarity, position of clarity relative to carotid bulb, clear lumen and straightness of the vessel. Image quality were scored as follows:

1 = cannot be analysed.

2 = does not meet minimum standards.

3 = meets minimum standards (i.e. 5mm of clarity over a minimum of 3 cardiac cycles).

4 = good, surpasses minimum standards to have 10mm of clarity over 5 cardiac cycles.

Images scored '1' were excluded, and images scored 2-4 were retained in the dataset.

Using Carotid Analyzer (Medical Imaging Applications, Coralville, IA, USA), a commercially available semi-automatic edge detection software program, carotid IMT was measured approximately 10 mm proximal to the carotid bulb, over a distance of 5-10 mm, as the mean of 3-5 still frames captured at end-diastole (timed on the R wave of the ECG).

Additional measures of vascular distensibility and elasticity were derived automatically by the Carotid Analyzer software from at least three maximum and minimum lumen diameter (LD) frame pairs. Distensibility was calculated as follows:

Diameter distensibility (DD, %)

$$DD = \frac{VD_{max} - VD_{min}}{LD_{min}} \times 100\%$$

Arterial elasticity was derived in accordance to previously published work from the Cardiovascular Risk in Young Finns Study (Juonala et al., 2005; Koivistoinen et al., 2012) and other related studies (Marlatt, Kelly, Steinberger, & Dengel, 2013):

Arterial elasticity (AE, %/mmHg)

$$AE = \frac{\left(\frac{LD_{max} - LD_{min}}{LD_{min}}\right)}{\Delta P} \times 100\%$$

Pulse pressure (ΔP) was calculated as the difference between systolic and diastolic pressures. VD denotes maximum and minimum vessel diameter (which includes near and far wall intima-media layers), and LD denotes maximum and minimum lumen diameter (excluding intima, media and adventitia).

Six trained raters measured all cine-loops. Training consisted of scoring thirty example cine-loops that were subsequently assessed for consistency by an expert rater. Drift from protocol and reliability between raters were assessed by the raters reanalyzing a random subset of 105 images in quadruplicate.

Data users should consider including end-diastolic intima-intima lumen diameter (five frames vessel diameter, R-wave) in regression models of the study children's data. This may be a suitable method to adjust for vessel size during periods of rapid growth. Please refer to McCloskey et al. (2015) for a more detailed discussion.

Six child and six parent IMT variables are included in the data file. Key variables include average and maximum far wall carotid IMT thickness measurements and the vessel distensibility and elasticity measures.

4.1.4.2 Arterial stiffness and blood pressure

Detailed information about data collection and preparation is provided in the *Heart Lab data collection* and *Cardiovascular (arterial stiffness and blood pressure) data management* SOPs.

Professor Michael Cheung led the arterial stiffness and blood pressure assessments. Collaboration on projects using these data is encouraged. Please email michael.cheung@rch.org.au.

Aortic-femoral pulse wave velocity (PWV) was measured in children and parents following a 5-minute rest, using the SphygmoCor XCEL operating system (Atcor Medical, West Ryde, Australia). PWV is a measure of the average velocity of a pressure wave travelling between two locations in the arterial system, and is a measure of arterial stiffness. With participants lying supine, a blood pressure cuff was placed around the right upper thigh and a tonometer placed over the pulse on the right carotid artery. The staff member used a measuring tape to measure the distances from the carotid

pulse to the suprasternal notch, suprasternal notch to right femoral pulse (estimated by the crease between thigh and torso with knee bent to 90 degrees) and femoral pulse to top of thigh cuff, and entered these data into the SphygmoCor software. The SphygmorCor was set to 'PWV' mode, and three measurements were taken and the device estimated PWV. The SphygmoCor device provides a quality control variable that classifies each PWV measurement as acceptable or unacceptable. Those deemed unacceptable were reviewed by staff to determine if single PWV measurements should be excluded from the calculation of average PWV. Carotid-femoral PWV (in meters/second) was exported from the SphygmoCor device.

Pulse wave analysis (PWA) was also measured in children and parents. The aortic pressure waveform generated from pulse wave analysis (PWA) can be analysed to provide estimates of central blood pressure and systemic arterial stiffness, including Augmentation Pressure (AP) and Augmentation Index (AIx). A blood pressure cuff was wrapped around the right upper arm. With the SphygmoCor switched to 'PWA' mode, three PWA measurements were taken one minute apart. PWA also provided peripheral blood pressure and heart rate. Quality checks of individual pulse waveforms were undertaken, and only pulse waveforms which met all of the following criteria (i.e. fell within normal ranges) were retained in the dataset:

- Average pulse height: The average height of all pulses was greater than 80 units.
- Pulse height variation: The variation in pulse heights from the three separate measurements was no greater than 5%.
- Diastolic variation: The variation in the diastolic portion of the pulse wave was no greater than 5%.
- Shape deviation: The amount of variation in shape during systole was no greater than 4%.
- Operator index (from the SphygmoCor clinical report): The operator index of at least 75 out of 100. This score is derived from the quality check parameters described.
- Blood pressure: Systolic blood pressure (SBP) was between 50 and 200 mmHg.
- Waveform shape: There was consistency in (i) the waveform shape and definition of single arterial waveforms; (ii) the three arterial waveform shapes from the same participant; and (iii) the values derived from the three arterial waveform (e.g. heart rate, blood pressure).

All valid measurements were used to calculate mean and median values for heart rate, brachial systolic and diastolic blood pressures, central systolic and diastolic blood pressures, pulse wave velocity, pulse wave velocity distance, brachial and central pulse pressure, pulse pressure amplification, central arterial pressure, central augmentation pressure, central diastolic time index, central end systolic pressure, central Buckberg sub-endocardial viability ratio, central time to first and second systolic inflection points, central tension time, ejection duration, and pulse transit time and standard deviation.

Ratios were calculated for pulse pressure amplification and systolic blood pressure amplification for each repeated measure, and the mean and median of these ratios were derived.

Children's blood pressure was converted to a z-score and percentile based on age, sex and height, and these percentiles used to categorise child blood pressure as normal, prehypertensive ($\geq 90^{th}$ but $< 95^{th}$ percentile), or hypertensive ($\geq$95% percentile) using normative data from a US sample of children (National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents, 2004). Parent's blood pressure was classified as normal, prehypertensive (SBP $\geq$120mmHg and <140mmHg or diastolic blood pressure (DBP) $\geq$80mmHg and <90mmHg) or

hypertensive (SBP ≥140mmHg or DBP ≥90mmHg; Chobanian et al., 2003). Binary hypertension variables were also calculated for children and parents, i.e. not hypertensive (including normal and pre-hypertensive above) and hypertensive.

The SphygmoCor device used a mathematical transfer functions to derive multiple measures. This transfer function has been validated in adults but not children (Chen et al., 1997; Kahn et al., 2019). Central SBP and DBP are estimates of the maximum and minimum blood pressure at the aorta. Central pulse pressure is the difference between central SBP and central DBP. Finally, the Augmentation Index is calculated as a composite measure of the speed and magnitude of the reflected pressure wave.

Approximately 140 child and 130 parent PWV, PWA and blood pressure variables are included in the data file. Key variables include pulse wave velocity, mean arterial pressure and brachial systolic and diastolic blood pressure.

4.1.4.3 Microvascular structure

Detailed information about data collection and preparation is provided in the *See Here data collection* and *Cardiovascular (retinal photography) data management* SOPs.

Professor Tien Wong led the microvascular structure assessments, while Professor Ming He's team undertook much of the IVAN scoring. Collaboration on projects using these data is encouraged. Please email tien_yin_wong@nuhs.edu.sg.

Retinal photos are a non-intrusive method of measuring microvascular structure. Children and parents attended the *See Here* station separately. The trained operator explained the procedure to each participant while they entered the dark room. The participant rested their chin and forehead on the headrest of the digital retinal camera (Canon CR-DGi with EOS 60D SLR camera).Children and parents each had four photos taken, without mydriasis. Two photos were taken per eye; one centred on the optical disk and the other centred on the macula; right eye first then left eye. After taking each photo there was a short break (~1 minute) to allow for pupil re-dilation.

For each participant, right eye optic disc-centred images were selected as the first choice for retinal vascular calibre (i.e. diameter) scoring. Left eye images were scored instead when right eye images were deemed ungradable. Issues preventing grading of images included poor image focus (potentially blurring vessel edges), dark images (increasing the difficulty for graders to visually validate the vessel trace), and confounding pathology (which can obscure the vessels). Most images were scored from right eyes (87% and 92% for children and parents, respectively). A limited number of participants (19 children and 53 parents) had no gradable photos.

IVAN scoring

Retinal vascular calibre was measured using a validated computer program - the Interactive Vessel Analysis (IVAN) software (Hubbard et al., 1999). The software automatically identifies retinal vessels within a specific grading (i.e. the area half to one disc-diameter from the optic disc) as arterioles or venules. Graders reviewed every image, and made corrections if the software incorrect classified vessels as arterioles or venules.

The software then traced a segment of each vessel within the grading area for scoring. The graders reviewed the automated display and modified as necessary for issues like vessel trace with obvious outliers.

After ensuring the vessel segments were traced correctly, diameters of all the selected segments were measured automatically by the IVAN software.

The calibre of the largest six arterioles and venules are summarized as the Central Retinal Artery Equivalent (CRAE) and the Central Retinal Vein Equivalent (CRVE), respectively (Knudtson et al., 2003). The arteriole-to-venule ratio (AVR) is also calculated as CRAE divided by the CRVE.

Flag variables in the dataset alert users to availability of IVAN scoring for retinal photos for each participant (fcivava and faivava).

SIVA scoring

Retinal microvascular structure has also been analysed using the Singapore "I" Vessel Assessment (SIVA) software (Cheung et al., 2010; Cheung et al., 2011), which generated retinal geometric parameters.

As opposed to the IVAN scoring that provides information on retinal vascular diameter measured in an area of 0.5-1 disc diameter from the margin of the optic disc, SIVA scoring provides more information on retinal vessel architecture, in addition to retinal vascular caliber.

SIVA measures a larger region on the retinal image: 0.5 and 2.0 disc diameters away from the disc margin. Additional retinal parameters calculated from SIVA including 1) fractal dimensions, which summarise the whole branching pattern of the retinal microvascular tree; 2) tortuosity, which is the relative length variation between the curvatures of the vessel and the shortest distance of the vessel path; and 3) branching angle, which is the first angle subtended between two daughter vessels at each bifurcation (Liu et al., 2020). These parameters could inform more geometric variation of the microvasculature.

The SIVA data are in preparation and could be included in future data releases.

4.1.5 Respiratory assessment

Detailed information about data collection and preparation is provided in the *Lung Fun data collection* and *Respiratory data management* SOPs.

Professor Sarath Ranganathan led the respiratory assessments. Collaboration on projects using these data is encouraged. Please email sarath.ranganathan@rch.org.au.

Children and parents completed spirometry testing to assess lung function. Spirometry was performed using a calibrated Vyntus Spirometer (CFN-V-171466) and the SentrySuite software (Version 2.10).

Wearing a nose clip and breathing through the spirometer, the participants performed the Forced Vital Capacity (FVC) manoeuvre. This manoeuvre has three phases, each of which equate to a key variable in the dataset:

1. maximal inspiration i.e. taking a full breath in (Total Lung Capacity),
2. a blast of exhalation (Forced Expiratory Volume in the first second, FEV_1), and
3. continued exhalation until as much air as possible was expelled (Forced Expiratory Volume, FEV)

The FVC manoeuvre was repeated at least three times, until valid results were obtained. However, participants completed the manoeuvre no more than eight times to prevent them feeling light-headed.

Children completed spirometry, then received four puffs of bronchodilator (400 micrograms of Ventolin), waited ten minutes and repeated the spirometry testing. Measuring spirometry pre- and post-Ventolin was designed to assess if any reductions in lung function were due to airway restriction, and if this could be reversed by the common asthma medication. Parents completed spirometry once, without taking a bronchodilator.

Data were exported from SentrySuite (Version 2.17) software using Data Cube. Each FVC manoeuvre produced an image called a flow-volume 'loop'. Trained graders reviewed the quality of all loops to determine if two acceptable manoeuvres were obtained (see quality scoring below) and identified each participant's best loop (children had a best pre- and post-Ventolin loop). FVC & FEV_1 scores were derived from the best loop. These data were converted to z-scores using the Global Lung Initiative equations (Quanjer et al., 2012).

The quality of all loops were reviewed using the joint American Thoracic Society (ATS) and European Respiratory Society (ERS) guidelines (Miller et al., 2005). A quality score between 1 and 5 was assigned to each loop:

1. Meets all of the ATS/ERS criteria.
2. Meets all ATS/ERS criteria except for repeatability. Two largest FVC values had a difference of >150 mls.
3. Meets all ATS/ERS criteria except for repeatability. Two largest FEV1 values had a difference >150 mls.
4. Does not meet ATS/ERS guidelines; data excluded from dataset.
5. Meets all ATS/ERS criteria except for repeatability. Two largest FVC and FEV_1 values had a difference >150 mls.

Loops that were assigned a quality control score of 1, 2, 3 or 5 are included in the dataset. The quality score for each participant's best loop is included in the dataset (fcscore, fscore2, fascore).

Approximately 60 child and 30 parent spirometry variables are included in the data file. Key variables include FVC, FEV_1 and the quality score.

4.1.6 Language

Professor Melissa Wake led the language assessments. Collaboration on projects using these data is encouraged. Please email melissa.wake@mcri.edu.au.

4.1.6.1 Expressive and receptive language

Detailed information about data collection and preparation is provided in the *Listen Up data collection* and *Language (Expressive and receptive language) data management* SOPs.

The Recalling Sentences subtest of the Pearson Clinical Evaluation of Language Fundamentals 4 (CELF-4), Australian version (Semel et al., 2006) measured the ability of the child and parent to recall and reproduce sentences of varying length and syntactic complexity.

Recalling Sentences was chosen following both external research and internal research with existing datasets to identify which subscale best predicts the overall CELF-4 score (ROC = 0.96, data unpublished). With permission from Pearson, a Recalling Sentences iPad application was developed

by the Centre of Research Excellence in Child Language at the MCRI. The iPad application facilitated the fast and consistent delivery of the test to a large sample.

Recalling Sentences involved participants wearing a headset containing both headphones and a microphone attached to the iPad. A CheckPoint team member operated the iPad. Participants were presented with an audio recording of a sentence and instructed to repeat it back verbatim, without any visual cues. Up to 32 pre-recorded sentences of increasing length and difficulty were presented. The Recalling Sentences has age-dependent starting points (Semel et al., 2006). Children started the test at sentence six (the recommended starting point for 9-13 year olds), whilst the attending parent started at sentence nine (the starting point for those aged 14 years and older, since Recalling Sentences is validated only for individuals up to age 21 years). As per the Recalling Sentences protocol (Semel et al., 2006), if the first two sentences were repeated correctly (i.e. score=3), all prior sentences were automatically scored three. If the first two sentences were not repeated correctly, the test restarted from sentence one and sentences were scored according to how correct they were.

The CheckPoint team member scored each repeated sentence in real-time as 'correct' (no errors), 'partially correct' (one to three errors) or 'incorrect' (four or more errors). The headset microphone recorded the participant repeating sentences and this saved audio file was later used for data quality checks. The test ended at sentence 32 or after three consecutive 'incorrect' scores. More detailed procedures are described elsewhere (Akshoomoff et al., 2014).

After data collection was completed, sentence scoring was initially checked (for half of all participants) by listening to *all* audio recordings and correcting the originally entered score as needed. Reviewing all sentences compared to just those that were scored ‘partially correct’ at the time of assessment resulted in <0.1% differences in raw scores; therefore, only ‘partially correct’ sentences were reviewed and updated as necessary for the remainder of the participants.

A total raw score (range 0-96) was the sum of all the individual sentence scores. It was also converted into an age-related scaled score (range 1-18, mean 10, standard deviation 3) and corresponding percentile rank score using Australian population normative data (Semel et al., 2006).

Approximately 35 child and 35 parent Recalling Sentences variables are included in the data file. Key variables include the total raw score, percent rank score and scaled scores.

4.1.6.2 Receptive vocabulary

Detailed information about data collection and preparation is provided in the *Bone Zone data collection* (because for logistic reasons this test was self-administered immediately before the bone scan) and *Language (Receptive* vocabulary*) data management* SOPs.

The National Institutes of Health Toolbox Picture Vocabulary Test (NPVT) was used to assess receptive vocabulary ability in children and parents (Weintraub et al., 2013). The NVPT was developed by National Institutes of Health (NIH) as a computerized adaptive version of the existing Picture Vocabulary Test. Participants are presented with an audio recording of a word through headphones and four pictures on an iPad screen, and are instructed to selected the picture that most closely represented the meaning of the word. Participants enter their age and education level, which determines the test starting point. After two practice words, the test involved 25 words, and the difficulty of the words presented depended on the participants' initial performance. The test quickly approximates and then precisely pinpoints participant ability using computer-based algorithms.

With permission from the NIH, the NVPT test was modified for iPad rather than web-based delivery with words re-recorded in an Australian accent. The NPVT iPad application contained a pool of 624 words and took approximately 3 minutes to administer.

Participant's responses and response times were recorded by the iPad application. A 'theta score' was calculated from all of the participant's responses, using the NIH norms; a higher theta score indicated a greater receptive vocabulary ability. In addition, age-corrected scaled theta scores and percentile rank theta scores were derived using the 2010 US Census as a reference population (Casaletto et al., 2015).

Seven child and seven parent variables are included in the data file. Key variables include the NPVT scaled and standard scores and the percentile rank scores.

4.1.7 Hearing

Detailed information about data collection and preparation is provided in the *Listen Up data collection* and *Hearing data management* SOPs.

Professor Melissa Wake led the hearing related assessments with Dr Peter Carew. Collaboration on projects using these data is encouraged. Please email melissa.wake@mcri.edu.au.

4.1.7.1 Pure tone threshold level

Pure Tone Audiometry (PTA) assesses an individual's hearing threshold response at four different frequencies (1, 2, 4 and 8 kilohertz (kHz)). Trained examiners conducted air-conduction pure-tone audiometry on children and parents using an Oscilla USB-330 (version 3.3.4) computer-based audiometer with Oscilla headphones.

Participants were asked to remove hearing aids where possible, and were not tested where not possible. Responses were recorded in the database. Those with hearing loss started the test at 1 kHz frequency at 60dB, otherwise the test started at 30dB. To determine the participant's hearing threshold at each frequency, the participant was asked to press a button when they heard a sound. If the participant didn't respond, the next sound presented was 20 dB higher. If the participant did respond, the next sounds presented were at 10 dB lower intensities until the participant did no longer responded. When the responses stopped, the intensity was increased in 5dB steps until the participant responded again. The first sound then heard (as the sounds increased in intensity) indicated the participants hearing threshold. The test was repeated to confirm the results. When the same hearing threshold had been identified twice for a frequency, the test progressed to the next frequency (i.e. 2 kHz) until hearing thresholds at all four frequencies had been identified. From July 2015, PTA assessments were conducted with the participant sitting inside a sound proof booth. Prior to this (February to June 2015), the participant sat in a quiet room facing away from the staff member.

Approximately 70 child and 70 parent variables are included in the data file. Our primary hearing measure was the three-frequency pure tone average or "Fletcher Index" (fc3fl, fc3fr, fa3fl, fa3fr) because of its relevance to the speech spectrum (i.e. 1, 2 and 4 kHz). Other key variables include the following commonly-used indices: four-frequency pure tone average (1, 2, 4 and 8 kHz), low-frequency average (1 and 2 kHz) and high-frequency average (4 and 8 kHz, believed to be most affected by noise exposure) in each and either ear. We grouped hearing loss (HL) severity using the following groups: no impairment (less than 16 decibels hearing level (dB HL)), slight (16 to 25 dB

HL), mild (26 to 40 dB HL), moderate (41 to 60 dB HL), and severe (61 to 80 dB HL) or profound (≥81dB HL) hearing loss. We reported hearing abilities for left, right and better ear (i.e. ear with a lower Fletcher Index). For all indices, we defined bilateral hearing loss as hearing thresholds ≥16dB HL in the better ear, and unilateral hearing loss as hearing thresholds ≥16dB HL in the worse ear, but normal hearing (≤15dB HL) in the better ear. Unilateral and bilateral hearing loss were each categorised using the HL severity thresholds above into 6 levels (as for HL severity above), 3 levels (no impairment, slight, and mild or higher impairment), and 2 levels (no impairment, and slight or higher impairment) of hearing loss.

4.1.7.2 Speech reception threshold

Children and parent's speech reception threshold (SRT) was assessed using the adaptive Listening in Spatialized Noise-Sentences (LiSN-S, Phonak) Test (Cameron et al., 2011; National Acoustic Laboratories, 2016).

The LiSN-S test involved participants listening to an audio recording of 30 simple sentences of varying loudness, against background noise (conversations in other voices) of constant volume (55 dB). The participant was instructed to repeat each sentence verbatim. After each sentence, the CheckPoint team member entered the number of words repeated correctly into the LiSN-S software. The computer-adaptive test then altered the signal to noise (SNR) ratio of the next sentence, based on the previous response. If at least 50% of the words were repeated correctly the next sentence was 4dB lower; if not, the next sentence was 2 dB lower. If exactly 50% of the words were correct, the intensity was unchanged for the next sentence. Between sentence 22 and 30, the SRT was automatically calculated. If there was not enough time to complete the 30 sentences, the SRT was estimated from the first 22 sentences (by which time the SRT closely approximates that from the full test). The SRT was the lowest intensity sound (in dB) at which 50% of overall sentences were repeated correctly.

After July 2015 the test was completed in a sound proof booth; prior to this (February to June 2015), the test was conducted in a quiet room.

Two child and two parent variables are included in the data file. These are the SRT and a ‘test discontinued early’ flag variable.

4.1.7.3 Middle ear function

Tympanometry was used to assess middle ear function in children and parents. Understanding middle ear function can help determine if any hearing loss is due to conductive or sensorineural reasons.

A tympanometer was inserted into the ear canal. The device varies the air pressure within the ear canal to make the ear drum (tympanic membrane) move back and forth, and measures the ear canal volume, middle ear pressure and compliance during a pressure sweep. This test was conducted using an Oscilla TSM500 tympanometer and the AudioConsole participant database (version 3.3.4).

Tympanograms for each ear were reviewed and classified by trained graders as described below, according to the widely-used Jerger criteria (Jerger, 1970). A modified cut-off of 0.25 mmho (Cone et al., 2010) was used to prevent over-diagnosis of middle ear effusion.

- Type A: Suggests normal middle ear function. Ear canal volume (ECV): 0.6-1.5 cm^3; Middle ear pressure (MEP): -100 to +50 dekapascals (daPa); Compliance: 0.25 to 1.4 mmho.

- Type B: Suggests middle ear effusion, tympanic membrane perforation, cerumen occlusion, or a probe sealed against the canal wall. ECV: 0.6-1.5 cm^3; MEP: -100 to +50 daPa; Compliance: < 0.25 mmho.
- Type C: Suggests negative middle ear pressure. ECV: 0.6-1.5 cm^3; MEP: < -100 daPa; Compliance: 0.25 to 1.4 mmho.

Thirteen child and 13 parent variables are included in the data file. Key variables include the middle ear pressure, middle ear compliance, volume of the ear canal, and tympanogram width.

4.1.8 Food choices

Detailed information about data collection and preparation is provided in the *Food Stop data collection* and *Snack observation data management* SOPs.

Dr Jessica Kerr led the food choices assessment. Collaboration on projects using these data is encouraged. Please email jessica.kerr@mcri.edu.au.

Participants were offered a snack at the 15-minute *Food Stop* station, and we measured individual snack food choices in response to varied snack box size and number of prepacked snack food items offered. When the participant left the station, the food box was collected and all items that were only partially consumed were weighed using Breville kitchen scales (BSK500BSS). All items that had been fully consumed were recorded as such.

Four combinations of box size and food contents were offered ('conditions', see below). One of the four combinations were randomly selected each day to be presented to participants, therefore children and their parent received the same snack box (although within each condition parents were offered more food than children). The four conditions were:

- Condition 1: Small snack box, smaller number of snack food items.
- Condition 2: Large snack box, smaller number of snack food items.
- Condition 3: Small snack box, larger number of snack food items.
- Condition 4: Large snack box, larger number of snack food items.

The small snack box dimensions were 18.0cm x 12.0cm x 5.0cm; a total volume of 1080cm^3. The large snack box dimensions were 19.5cm x 14.0cm x 6.5cm; a total volume of 1774.5cm^3.

Small number of items supplied 15-20% of participant's recommended daily energy intake (www.nrv.gov.au/dietary-energy). Study child small number items provided 1522 kilojoules and attending parent small number portions provided 1942 kilojoules per box.

Large number of items supply 25-30% of participant's recommended daily energy intake (www.nrv.gov.au/dietary-energy). Study child large number items provided 2472 kilojoules and attending parent large number portions provided 2892 kilojoules per box.

The food items contained in each condition are described in Table 2. Additional details about these items are available in the *Food Stop* data collection SOP (available from the CheckPoint team, on request).

Table 2. Snack box contents by Food Stop condition

Snack food item	Child conditions		Parent conditions	
	1 & 2	3 & 4	1&2	3 & 4
Peaches in syrup (150g)	x1	x1	x1	x1
Miniature animal shaped biscuits (25g)	x1	x1	-	-
Miniature Oreo biscuits (27g)	-	-	x1	x1
Flavoured rice crackers (18g)	x1	x1	x1	x1
Miniature milk chocolate bar (13g)	x1	x2	x1	x2
Miniature wheat fruit bites (22g)	-	x1	-	x1
Cheese wedge (20g)	x1	x1	x1	x1
Fruit muesli bar (24g)	-	x1	x1	x2

The condition offered to each participant (fch14c01a, fch14a01a) is included in the dataset for data users who wish to analyse consumption by experimental condition.

Approximately 25 child and 25 parent variables are available in the dataset. Key variables include total energy (kilojoules) consumed and total grams of food consumed. Data are available for consumed grams of carbohydrates, total fat, saturated fat, protein, sugar and milligrams of sodium. Other variables of interest include participants' self-rated hunger, the time that they last ate before *Food Stop* (both collected in another station unrelated to *Food Stop*), the duration in minutes that they spent at *Food Stop*, activity/distractions during *Food Stop*, or whether participants voiced awareness that their eating was being monitored at *Food Stop*.

4.1.9 Physical activity, sedentary behaviour and sleep

Detailed information about data collection and preparation is provided the *Endgames data collection* and *Accelerometry and activity cards data management* SOPs.

Professor Tim Olds led the physical activity assessments. Collaboration on projects using these data is encouraged. Please email timothy.olds@unisa.edu.au.

Child and parent physical activity, sedentary behaviour and sleep characteristics were quantified using wrist-worn, tri-axial GENEActiv accelerometers (Esliger et al., 2011) and activity log books. Accelerometers were worn on the non-dominant wrist for eight full days, with Day 1 counted as the day after the CheckPoint visit. Non-wear times, activities performed when not wearing the device, sleep and wake times and the type of day (school/non-school day) were self-reported in an accompanying activity log book.

Accelerometers were returned via reply paid mail. The study team downloaded and converted accelerometry data to .csv files with epoch length set to 60 seconds.

Sleep onset and waking time were identified from the activity cards. When this self-reported data were missing or there was a large discrepancy between activity cards and accelerometry data, the accelerometry data was used instead.

Total and mean counts were calculated for each day. Each 60 second epoch of waking time was classified as sedentary, light, moderate or vigorous activity (MVPA) using the Phillips cut points (Phillips, Parfitt, & Rowlands, 2013) for children and the Esliger cut points (Esliger et al., 2011) for parents. Minutes spent in sedentary, light, moderate and vigorous activity were calculated for individual days, all weekdays, all weekend days, and for all days.

Data validity checks were performed, with 'valid' days defined as containing a visible and expected accelerometer trace and less than 6 hours of non-wear time (see the CheckPoint Data Issues Paper for more detail; Davies et al., 2018). Participants with at least four full days of valid data, including at least three weekdays (Monday to Friday, excluding state public/school holidays) and one weekend day (Saturday or Sunday, or state public/school holidays) were defined as 'valid' participants. Derived summary variables were calculated for all 'valid' days.

The dataset includes summary variables with a 1:1 and 5:2 weighting. In the 1:1 set of variables, weekdays and weekend/holidays were given equal weighting; this is appropriate for children who spend about 200 days a year (roughly 50%) at school (e.g. the mean of: the average of the 5 weekdays + the average of the 2 weekend days). In the 5:2 set of variables, weekdays are weighted more strongly than weekends (e.g. (5x (average of the weekdays) + 2x (average of the weekend days))/7).

Approximately 491 child and 491 parent variables are included in the data file. Key variables include total wear time and time spent in sedentary, light and moderate to vigorous physical activity, and sleep duration.

4.1.10 Time use

Detailed information about data collection and preparation is provided in the *About Time data collection* and *Time use data management* SOPs.

Professor Tim Olds led the time use assessments. Collaboration on projects using these data is encouraged. Please email timothy.olds@unisa.edu.au.

Time use data were collected from children using the Multimedia Activity Recall for Children and Adults (MARCA) program (Foley et al., 2013; Olds et al., 2010; Ridley et al., 2008). The child was asked to recall their activities from the previous day (24 hours), in increments of 5 minutes. The MARCA program contains over 250 activities to choose from, grouped into inactivity, transport, play/sport, school, self-care, chores and other activities categories. For each activity, we recorded the start and end time, and for physical activities, the intensity level.

Three days were recalled in total, including one school and one non-school day. One day was recalled at the *About Time* station during an Assessment Centre visit and two additional days were recalled during a phone interview with a CheckPoint team member, usually in the week following the visit. To help the study child remember their activities for the two days to be recalled over the phone, children were given an activity card to fill out during the days to later be recalled. This prompted the child to record information about the key events of the day, and the time they occurred (e.g. wake time, school breaks times and bed time) helping the child to break their day into segments.

All activities were classified into categories based on a hierarchical structure of superdomains (e.g. Physical Activity), macrodomains (e.g. Sport), and meso- and microdomains (e.g. Athletics; Ridley, Olds, & Hill, 2006). The dataset includes both the total time spent in each activity (within these domains) each day, and the average in time spent in each activity across the three days.

Approximately 330 child variables are included in the data file. Key variables include total time in MVPA, total daily energy expenditure and total sitting time.

4.1.11 Strength – large muscle power

Detailed information about data collection and preparation is provided in the *Jumping Beans data collection* and *Strength data management* SOPs.

Professor Tim Olds led the strength assessments. Collaboration on projects using these data is encouraged. Please email timothy.olds@unisa.edu.au.

The maximum distance children could jump was assessed using the Eurofit broad jump test (Ortega et al., 2008) protocol, as a measure of large muscle power. Children jumped horizontally onto a gym mat from a standing start, with a double leg take off. After one practice jump, the child jumped three times and a team member measured the distance of each jump. Using Australian population normative broad jump data for child age and sex (Catley & Tomkinson, 2013), the maximum distance jumped was used to generate a broad jump population percentile for each participant.

Six child variables are included in the dataset. Key variables include the maximum broad jump distance and the broad jump population percentile.

4.1.12 Cardiorespiratory fitness

Detailed information about data collection and preparation is provided in the *Bike Hike data collection* and *Fitness data management* SOPs

Professor Tim Olds led the fitness assessments. Collaboration on projects using these data is encouraged. Please email timothy.olds@unisa.edu.au.

Child cardiorespiratory fitness was measured using the PWC170 VO_2 max test (maximum volume of oxygen; Boreham et al., 1990) protocol. Children pedalled on a Monark 928G3 exercise bike, while their heart rate was measured by a heart rate monitor (Polar FT4) worn on a chest strap against the skin. The PWC170 bike fitness test is used to calculate the work rate that can be performed at a steady-state heart rate (HR) of 170 beats per minute (bpm). The test consists of 3 or 4 two-minute stages at an increasing work rate (WR).

Children started with a two-minute warm up cycling at 60 rpm with the work rate set to 15 W (the minimum resistance setting on the bike). The child then immediately began the test, with a two-minute bout of cycling at 60 rpm with a work rate of 20 W (Stage 1). The child's heart rate was measured in the last 15 seconds of the each stage. The heart rate was used to calculate the increase in resistance (by between 15 and 120 W) to be made for the next stage. This formula is provided in the *Fitness data management* SOP. Children completed three stages, unless their heart rate at the end of Stage 3 was <150 bpm, in which case they performed a fourth stage. The child was given time to warm down on the bike set to 15 W, and could get off the bike once their heart rate was below 100 bpm. There were no breaks between stages. If a child's heart rate exceeded 165 bpm, the test was ended.

Aerobic work capacity (VO_2 max) was calculated as follows:

- Estimate maximum heart rate (HRmax) using the equation: HRmax = 207 - (0.8 x age).
- Regress heart rate (HR) against work rate (WR) at each stage to estimate maximum work rate (WRmax) at HRmax.
- VO2max (L/min) = 0.012 x WRmax + 0.36
- VO2max (ml/kg/min) = 1000 x VO2max (L/min) / body mass (kg).

Predicated power output at projected heart rate of 170 bpm (PWC170) was also calculated by regressing heart rate against work rate at each stage and estimating work rate at heart rate of 170 bpm.

Fifteen child variables are included in the dataset. The key variables are the absolute and relative aerobic work capacity (VO_2 max), and PWC170.

4.1.13 Visual acuity

Detailed information about data collection and preparation is provided in the *See Here data collection* and *Vision data management* SOPs.

Professor Melissa Wake led the vision assessments with Dr Richard Liu. Collaboration on projects using these data is encouraged. Please email melissa.wake@mcri.edu.au

The visual acuity (VA) of children and parents was tested using the computerised adaptive Freiburg Visual Acuity and Contrast Test (FrACT 3.8.2) (Bach, 2006). Visual acuity was tested on the right and left eyes separately, without glasses.

The participant was seated three metres from a computer screen, wearing glasses blocking vision of one eye, and holding a customised keypad connected to the computer. The FrACT test presents one of eight Landolt optotypes (an incomplete ring, or letter 'C', rotated into one of eight positions, see Figure 6). The participant selects the corresponding key to indicate which optotype was presented. The FrACT is an adaptive test; a new optotype is presented every five seconds, in varying sizes, to quickly approximate, then precisely pinpoint VA. The program calculates a decimal VA score for each eye.

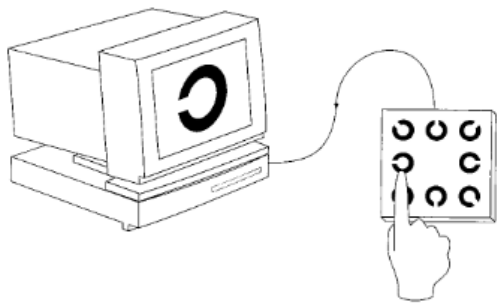

Figure 6. Representation of visual acuity test.

Image reproduced without permission from (Bach, 1996).

If the VA score was less than 1.0 for either eye, the test was repeated with the participant wearing a pinhole lens covering that eye.

Visual acuity was tested at a distance of three meters, instead of the commonly used six meters or 20 feet, due to space restrictions. This observer distance was entered into the FrACT settings page. In several instances, observer distance was not updated when the station was set up and participants completed the test with the observer distance incorrectly entered as 3.99 meters. Following consultation with the developer of the FrACT software, Prof Michael Bach (University Medical Centre, Freiburg University), data were corrected for a three metre test distance. More information is provided in the CheckPoint Data Issues Paper (Davies et al., 2018).

Approximately 25 child and 25 parent variables are included in the dataset. Key variables include the left and right eye unaided decimal VA, minimum angle of resolution (MAR), log MAR, Snellen denominator and Snellen fraction. The dataset indicates whether or not visual aids (glasses/contacts) were worn during the test, and includes unaided and pinhole test values.

4.1.14 2D and 3D oral and facial photography

Detailed information about data collection and preparation is provided in the *Tooth Booth data collection* and *2D and 3D photography data management* SOPs.

Professor Melissa Wake led the 2D and 3D photography. Collaboration on projects using these data is encouraged. Please email melissa.wake@mcri.edu.au

4.1.14.1 2D and 3D oral photography

The teeth and tongue of children and parents were photographed.

A set of three 2D digital photographs of the teeth and tongue were taken using a Canon 70D digital SLR camera. Specifically, we photographed:

- the dorsum of the tongue fully extruded
- the teeth in occlusion with lip retractors in place, and
- the teeth slightly apart with lower incisal edges visible and lip retractors in place.

A 3-pod 3D camera (3dMD Trio system) was used to take a 3D photograph of the teeth in occlusion with lip retractors in place. Digital photos were saved and are currently being analysed. Additional data could be included in future data releases. Flag variables in the dataset alert users to availability of 2D oral photos (fcph2dav and faph2dav) and 3D oral and facial photos (fcph3dav and faph3dav) for each participant.

4.1.14.2 3D facial photography

A 3D photograph of face of the child and parent was taken, using a 3-pod 3D camera (3dMD Trio system). The participant was asked to remove glasses, hats and jewellery and wear a headband or hair net to expose their hairline, if it was not already visible. The staff member directed the participant to adopt a neutral expression (e.g. not smiling) and position their head so the camera pod would capture the face, hairline, both ears, and the under chin area.

A 3-pod 3D camera (3dMD Trio system) was used to take a 3D photograph of the teeth in occlusion with lip retractors in place. Digital photos were saved and are currently being analysed. Additional data could be included in future data releases. To find out about accessing the photos for research purposes, please refer to checkpoint-lsac.mcri.edu.au or contact Prof Melissa Wake.

Flag variables in the dataset alert users to availability of 3D oral and facial photos (fcph3dav and faph3dav) for each participant.

4.1.15 Written story

Detailed information about data collection and preparation is provided in the *Life at 25 data collection* and *Written story data management* SOPs.

Dr Kate Lycett and Professor Melissa Wake led the written story assessment. Collaboration on projects using these data is encouraged. Please email kate.lycett@mcri.edu.au.

Children were asked to handwrite a short story about what they imagined their life would be like when they are 25 years old. The *Life at 25* assessment was based on the 1958 UK birth cohort's storytelling activity (Elliot & Morrow, 2007). Handwriting samples can be used to assess fine motor skills and handwriting competency. Story content can be used to assess linguistic (e.g. vocabulary, grammar) or psychological constructs (e.g. optimism vs. pessimism).

Children were provided with a lined sheet of A4 paper with the following prompt written at the top: "Imagine you are now 25 years old. Write about the life you are leading, your interests, your home life and your work at the age of 25. (You have 15 minutes to do this)." Staff also read this prompt to each child before they started the task and encouraged the child if this was required.

Each child was given approximately 15 minutes to write their story; however, some children were given more or less time. This was because *Life at 25* was the first activity completed by the child at the Assessment Centre whilst their parent provided consent. When families arrived late or the parent had a long discussion about consent, the child had less or more time to complete their story, respectively. The time spent on the activity was not recorded.

These stories were scanned shortly after completion and saved in PDF format. A transcription company (Savant, http://www.savant.net.au/cp/company_profile.htm) were engaged to generate two versions of the stories:

- '**raw**' –all written text was transcribed exactly as it is written, including spelling, grammatical and punctuation errors.
    a. Where words are illegible, the text 'xxx' was inserted for each illegible word.
    b. Where capitals or underlined words were used for emphasis, the transcribed text included capitals but not underlining.
    c. Where a picture had been drawn, it was replaced with the text '{illustration}'.
- '**marked-up**' – all written text was transcribed with spelling, punctuation and grammatical errors corrected so the story content could be analysed further by computer programs.
    a. Spelling was corrected to match the Oxford American Dictionary. Where words did not exist, the CheckPoint team were contacted for clarification (N.B. illegible words remained in text as 'xxx').
    b. Punctuation:
        - Punctuation was added to break up inappropriately long sentences. A full stop was added to the end of a sentence if missing.
        - Slashes '/' were replaced with the text 'or'.

c. Non-terminating full stops were removed (e.g. 'U.S.A' written with full stops between letters was changed to 'USA').
d. Extra words not written by the child were not inserted or removed unless there is no single proper American English word to replace the word with (e.g. 'wanna' was replaced with 'want to' (2 words)).
e. The use of capitals or underlined words for emphasis were not transcribed.
f. Where a picture was drawn, no text was transcribed.
g. Digits were left as they are (e.g. '9' was not changed to 'nine').
h. Common abbreviations were replaced with full text (see below).

Abbreviation	**Replace with full text**
w/	with
b/	between
&	And
'cause or 'cos	because
and/or	and – or
'n	and
sec	second
mo's	months
@	at
love heart symbol	"love"

Transcribers were asked to notify the CheckPoint team of stories which did not make sense.

Original transcriptions were undertaken by two individuals who each transcribed a distinct set of stories. Each transcriber generated two versions of transcription per participant; a 'raw' and 'marked-up' version. A third individual then checked all of the stories.

Transcription reliability was assessed by comparing a subset of 40 randomly selected writing samples for differences in the words and symbols transcribed, comparing both transcriptions made by the two individuals and transcriptions made by the same individual. Minor differences were observed in both the transcriptions comparison between the two individuals and the same individual. Of the minor differences observed, these were often due to differences in spelling and punctuation marks (e.g. full stop vs. comma). In general, most discrepancies observed across 'marked-up' text files appeared to follow on from discrepancies observed in 'raw' text files. The discrepancies found were minor and unlikely to be of great influence.

Automated analyses of the *Life at 25* written texts were undertaken. These aimed to capture both the linguistic attributes and underlying psychology (e.g. positive and negative affect) of the text content.

4.1.15.1 Coh-Metrix linguistic analysis

Automated linguistic analysis of the transcribed 'raw' and 'marked-up' written stories was performed using the Coh-Metrix (http://cohmetrix.memphis.edu/cohmetrixhome/) program (Graesser & McNamara, 2011; Graesser, McNamara, Louwerse, & Cai, 2004). Coh-Metrix analysis measures the coherence and cohesion (Graesser et al., 2003) of written text. As described on the company website (Coh-Matrix, 2020), the program generates108 indices in 11 key areas:

1. Descriptive indices (e.g. number and length of words, sentences, paragraphs)
2. Text easability principal component scores (e.g. syntactic simplicity), which describe multiple components of readability.
3. Referential cohesion (e.g. noun overlap) which describe the overlap in words in neighbouring sentences, and within paragraphs.
4. Latent semantic analysis, which describe "measures of semantic overlap between sentences or between paragraphs".
5. Lexical diversity (e.g. type-token ratio) which describe the variety of unique words ('type') as a ratio of the total number of words ('token'). High lexical diversity (e.g. all the words in the text are unique) often indicates the text is very short or very low in cohesion. Alternatively, lower lexical diversity indicates higher cohesion, with the same words used multiple times throughout the text.
6. Connectives (e.g. number of connectives), which describe the number and types of connecting words (e.g. 'because', 'although') which link ideas or clauses.
7. Situation model (e.g. number of causal verbs) which captures "the level of mental representation for a text that involves much more than the explicit words".
8. Syntactic complexity (e.g. number of words before main verb) variables. Complex syntax makes sentences harder to process, whilst simple syntax is easier to process.
9. Syntactic pattern density (e.g. number of noun phrases) describes syntactic patterns, word types and phrase types.
10. Word information (e.g. number of nouns, verbs, adjectives, preposition, pronouns).
11. Readability scores (e.g. Flesch Reading Ease).

4.1.15.2 Linguistic Inquiry and Word Count (LIWC) analysis

Automated computerised linguistic analysis of the 'marked up' transcribed written stories was also performed using the Linguistic Inquiry and Word Count (LIWC, https://liwc.wpengine.com/) software (Pennebaker et al., 2015). LIWC categorizes and quantifies word use by checking each word in a text file against an international dictionary of almost 6,400 words, word stems and emoticons. Each word in the transcribed stories found in the LIWC2015 dictionary was assigned into language variable categories of word use e.g. the 'positive emotion' language variable dictionary includes 620 words (e.g. 'kind' and 'proud'). Language variables were calculated as the number of times a word in the LIWC2015 dictionary is used, as a proportion of the number of words used in the story. For example, if a 20-word story contained two words in the positive emotion dictionary, the positive emotion score would be 10%.

Text analysis provides 75 indices across 4 key areas:

1. Word count
2. Summary language variables (eg analytic, clout)
3. Linguistic dimensions (eg function words, pronouns)
4. Psychological (eg affective processes, positive emotions)

A flag variable in the dataset alerts users to availability of *Life at 25* written story (fcla25av) for each child. Approximately, 216 child Coh-Metrix and 75 LIWC variables are included in the data file.

4.1.16 Wellbeing and quality of life

Detailed information about data collection and preparation is provided in the *Sit and Click data collection* (for the study child), *Parent Trap data collection* (for the attending parent) and *Wellbeing and quality of life data management* SOPs.

Associate Professor Lisa Gold led the wellbeing and quality of life measures. Collaboration on projects using these data is encouraged. Please email lisa.gold@deakin.edu.au.

4.1.16.1 General wellbeing

International Survey of Children's Wellbeing

Children completed six questions taken from two psychometric subscales of the International Survey of Children's Wellbeing (ISCW; "Children's Worlds: International Survey of Children's Well-Being," 2017; Seligson et al., 2003) which is a measure of subjective wellbeing. These were the five-item Brief Multi-Dimensional Students' Life Satisfaction Scale (BMSLSS) and single-item Overall Life Satisfaction scale (OLS).

Eight child variables are available in the dataset. These variables include the individual item responses, BMSLSS score and OLS score.

PedsQL 4.0 General Wellbeing questionnaire

Children completed the 7-item Pediatric Quality of Life Inventory (PedsQL) 4.0 General Wellbeing instrument, which is used to assess quality of life (Varni et al., 2001).

Nine child variables are available in the dataset. These variables include individual item responses, General Wellbeing (questions 1-6) subscale score and General Health (question 7) subscale score.

4.1.16.2 Health related quality of life

PedsQL 4.0 Generic Core Scale

Children completed the 23-item PedsQL 4.0 Generic Core Scale, which is a measure of physical and psychosocial health (Varni et al., 2001). This scale has been administrated in previous LSAC waves; however, as quality of life changes over time, it is considered important to measure health related quality of life simultaneously with the CheckPoint physical health measures.

Approximately 30 child variables are included in the dataset. Key variables include physical and psychosocial health summary scores and a total score.

Assessment of Quality of Life Scale 8D

Parents completed the 35-item Assessment of Quality of Life Scale (AQoL) 8D, which is used to assess adult's health-related quality of life (Richardson et al., 2014; Richardson, Sinha, Iezzi, & Khan, 2011).

Approximately 45 parent variables are included in the dataset. Key variables include physical and psychological super-dimension scores, and an AQoL 8D utility score.

Child Health Utility 9D

The child and their parent completed the 9-item Child Health Utility 9D (CHU9D; Stevens, 2011), each reporting on their own health related quality of life.

The CHU9D is a preference based measure of health-related quality of life; the responses to questionnaire items can be combined with available preference weights to give a utility score. The CHU9D is copyrighted by The University of Sheffield (18.01.2008). Permission to use the CHU9D was granted conditional on any published results citing the key CHU9D references (Stevens, 2009, 2011; Stevens, 2010).

Ten child and ten parent variables are included in the dataset. Key variables include the CHU9D utility scores.

4.1.17 Pain

Detailed information about data collection and preparation is provided in the *Sit and Click data collection* (study child), *Parent Trap data collection* (attending parent) and *Pain data management*

Professor Melissa Wake led the pain assessment. Collaboration on projects using these data is encouraged. Please email melissa.wake@mcri.edu.au.

Children and parents were asked to report if they had felt pain that lasted a whole day or longer in the past month. If they had, they were asked to report when the pain started.

Children who reported pain were asked to indicate the body regions where they experienced pain on the Manchester pain manikin (Jones et al., 2003).

Approximately 110 child variables and 2 parent variables are included in the dataset. Key variables include the presence of pain in the past month, timing of pain onset, area of pain, and the number of times the pain gets in the way of normal activities.

4.1.18 Diet

Detailed information about data collection and preparation is provided in the *Sit and Click data collection* (study child), *Parent Trap data collection* (attending parent) and *Diet data management*.

Professor Louise Baur and Dr Jessica Kerr led the diet assessment. Collaboration on projects using these data is encouraged. Please email louise.baur@sydney.edu.au and jessica.kerr@mcri.edu.au.

Children and parents completed a 26-item food frequency survey of their usual intake of a range of different foods (e.g. fruits and vegetables). Of the 26-items, 23 were drawn from the larger National Secondary Students Diet and Activity (NaSSDA) questionnaire developed by Cancer Council

Australia and the National Heart Foundation of Australia (Flood et al., 2005). The NaSSDA questionnaire was based on survey items developed by the New South Wales Centre for Public Health and Nutrition (Rutishauser, Webb, Abraham, & Allsopp, 2001). The remaining three items included in CheckPoint's food frequency survey (about intake of cheese, milk products and energy drinks) are not part of the NaSSDA questionnaire but were drawn from the International Study of Childhood Obesity, Lifestyle and the Environment (ISCOLE) study (Saloheimo et al., 2015). The response options for these three questions were modified to match the NaSSDA response format.

The survey asked how often certain foods were consumed per day or week (e.g. serves of red meat per week; vegetables per day; fruit juice per day or week; see annotated questionnaires for specific response options). In the original NaSSDA questionnaire, the most frequent response option was "2 or more times a day", for consuming ice cream, hot chips, potato crisps, takeaways, confectionary and sweet foods. However, in the CheckPoint questionnaire, the most frequent response option for these foods was "every day".

The data were checked for "extreme" self-reporting. We removed data for two study children who selected the most extreme response item for *every* question. Three other study children selected a high number of extreme values, but their data were not removed as these three study children also selected at least five values that were not extreme.

Twenty six child and 26 parent variables are included in the dataset. Researchers have analysed individual food items (e.g. fruit, sugar-sweetened beverages) within the NaSSDA questionnaire (Niven et al., 2015; Scully et al., 2012). The Child Health CheckPoint team are currently developing various summary scores of overall diet quality, using the 26 items administered in CheckPoint. For further information about these scores, please contact Prof Louise Baur and Dr Jessica Kerr.

4.1.19 Allergy, eczema and colouring

Detailed information about data collection and preparation is provided in the *Parent Trap data collection* and *Allergy, eczema and colouring data management* SOPs.

Prof Melissa Wake led the allergy, eczema and colouring items with Prof Katie Allen. Collaboration on projects using these data is encouraged. Please email melissa.wake@mcri.edu.au.

4.1.19.1 Family allergies and pet exposure

Parents reported on asthma, eczema, hayfever, latex allergy, insect allergy or food allergy in the child's siblings and parents. They also reported whether the family had pets, and the number and type of pets living inside and outside.

Approximately 100 family variables are included in the dataset. Key variables include family history of asthma, eczema, hayfever and food allergy; family pet status and type of exposure to pets. Additional data regarding family insect allergies, food allergies and other types of pets are provided in the supplementary dataset.

4.1.19.2 Eczema severity and treatment

Parents answered a series of branched questions about the child's history of itchy rash, eczema and dry skin, and use of moisturisers or steroid creams to treat their symptoms. These questions were drawn from the HealthNuts study (Peters et al., 2017).

Approximately 20 child eczema variables are included in the dataset. Key variables include child current eczema (defined using International Study of Asthma and Allergies in Childhood standards) and age of child eczema onset (Asher et al., 1995). Name of moisturisers and steroid creams used in the last 12 months are included in the supplementary dataset.

4.1.19.3 Natural skin, hair and eye colouring

Parents reported their own and the child's natural hair, skin and eye colour. These six variables are in the dataset.

4.1.20 Medications and Supplements

Detailed information about data collection and preparation is provided in the *Parent Trap data collection* and *Medications and Supplements data management* SOPs.

Associate Professor Lisa Gold led the medications and supplements assessments. Collaboration on projects using these data is encouraged. Please email lisa.gold@deakin.edu.au.

Parents were asked if the child was currently taking any medication or supplements on a regular basis. If they responded 'yes', they were asked to report the medication/supplement name, condition it was used to treat, price and how long one packet lasted.

Approximately 50 child medications and vitamins/supplements variables are included in the dataset. Key variables include current medication use, and current supplement use. The name of the medication/supplement and the condition that medication/supplement was taken for are included in the supplementary dataset.

4.1.21 Health, welfare and community services

Detailed information about data collection and preparation is provided in the *CheckPoint Check-In data collection*, *Parent Trap data collection*, and *Health, welfare and community services data management* SOPs.

4.1.21.1 Hospital admissions

Associate Professor Lisa Gold led the hospitalization assessments. Collaboration on projects using these data is encouraged. Please email lisa.gold@deakin.edu.au.

Professor David Burgner led the infection-related assessments. Collaboration on projects using these data is encouraged. Please email david.burgner@mcri.edu.au.

Parents were asked whether the child was covered by a Health Care Card or private health insurance. Parents also reported if the child had even been admitted to hospital overnight, excluding birth. For each hospital admission, parents reported the child's age, reason for admission, length of stay and out of pocket costs borne by the family. If the hospitalisation was due to one or more infections, the type of infection was also asked.

Approximately 74 child health insurance and hospitalisation variables are included in the dataset. Key variables include child Health Care Card cover, private health insurance cover, the number of child hospitalisations in last 12 months and the number of child hospitalisations prior to the last 12 months.

4.1.21.2 Health and community service use

Parents were asked to identify the health, welfare and other community services they had used for their child in the last 12 months. Examples of services include the hospital emergency department, dietician, and naturopath. Family services, such as housing services were also covered. If the family had used a service, the parent was asked to report the cost, number of times the services were used, and if they needed to take time off work to access the service.

Approximately 170 child variables are included in the dataset. Key variables include individual services used in last 12 months.

4.1.21.3 Community participation

Parents were asked to identify community activities the child had participated in over the last 12 months. The question was modified from LSAC (variable he09). Parents were asked about participation in community groups or clubs (e.g. scouts, guides, cultural group)' team sports (e.g. football, cricket, netball); art, music or performance lessons (e.g. piano, dance, choir, drama); classes to learn new skills (e.g. computing or learning another language); religious services or classes; or other activities. Additional details about the activity were also recorded (e.g. the type of activity, hours spent per week, and cost).

Approximately 140 child variables are included in the dataset. Key variables include activity description, hours per week participating in activity, cost of activity and a flag variable to indicate where multiple activity responses were provided in the text field with single set of time and cost responses (multi-response). Please refer to the CheckPoint Data Issues Paper (Davies et al., 2018) for further information.

4.2 Biospecimens

Many non-communicable diseases are 'diseases of ageing' that encompass virtually every body system. Such conditions increasingly drive Australia's burden of disease. Fixed genetic variation represents the cornerstone of disease risk, on which environmental and psychosocial factors are overlaid and modulated.

An important and novel aspect of the Child Health CheckPoint was the collection of a range of biological specimens from the LSAC cohort for the first time. These enable measurement of a range of intermediate biological factors that may underpin health and disease. Some of these samples have already undergone laboratory analysis, generating the initial biomarker variables which are included in the dataset.

Following parent written consent and child assent, a range of biospecimens were collected from participants and processed on-site. At the completion of each Assessment Centre, a single batch of all frozen samples were shipped on dry ice to the Melbourne Children's Bioresource Centre at MCRI for long-term storage at -80°C (except buffy coat aliquots are stored in vapour phase liquid nitrogen). All other samples, kept at room temperature, were transported at the same time.

Detailed information about biospecimen collection and processing is provided in the *Young Bloods data collection*, *Biospecimen processing*, and *Biospecimens audit and availability data management* SOPs.

For information about how to access and analyse the stored biosamples, see the Biospecimen Access policy becoming available at checkpoint-lsac.mcri.edu.au in late 2020.

Professor Richard Saffery led the biospecimens collection. Collaboration on projects using these data is encouraged. Please email richard.saffery@mcri.edu.au.

4.2.1 Venous blood

Participants were asked how long since they had last eaten or had a drink. At a minimum, they were fasted for at least the period during which they were completing other CheckPoint assessments (2½ hours for children and 75 minutes for parents).

A semi-fasted venous blood sample was collected at the Main Assessment Centres and most Mini Assessment Centres. An experienced phlebotomist collected approximately 28mL of blood from the brachial vein of the non-dominant arm of semi-reclining (°45) participants. Bloods were collected in four vacutainers using a butterfly needle so only a single venepuncture was required. Tubes were filled in the following order: 1) 2.7mL EDTA tube, 2) 9mL EDTA tube, 3) 9mL serum tube, 4) 7.5mL Lithium Heparin (Heparin) tube. EDTA and Heparin tubes were immediately inverted 6 times to ensure mixing with anticoagulant, and all tubes were transferred to the on-site laboratory.

Blood samples were processed into various blood fractions, as summarised in Table 3. Samples were generally processed within an hour (range 1 minute to 3.8 hours, median 53 minutes), into 0.5mL aliquots and frozen at -80 °C (except Guthrie blood spot cards, stored at room temperature).

Table 3. Venous blood sample processing

Collection tube	Blood fractions
2.7mL EDTA	3 aliquots of whole blood 1x dried blood spot (from May 2015 onwards, see below)
9mL EDTA	6 aliquots of plasma 6 aliquots of buffy coat
9mL serum	6 aliquots of serum 2 aliquots of blood clot (Feb – July 2015)
7.5mL Heparin	6 aliquots of plasma 6 aliquots of buffy coat

Initially, blood clots were processed and stored. It was later identified that whole blood aliquots and dried blood spot require less processing but can be used for comparable analyses (i.e. both contain cells for DNA analyses). Blood samples collected in Melbourne (February to April 2015) were processed for blood clots, in Canberra and Sydney (May to July 2015) processed for both blood clots and whole blood aliquots and dried blood spots, and from Newcastle onwards (August 2015 onwards), only whole blood aliquots and dried blood spots.

Some Mini Assessment Centres, typically operating for only five days in each regional city, did not have the staff or laboratory facilities to process all of the blood products. Centres in Bundaberg and Mackay collected and stored whole blood and EDTA plasma aliquots, and dried blood spots. Centres in Cairns and Townsville only collected and processed dried blood spots. The remaining Mini

Assessment Centres (Hobart, Launceston, MCRI and Bunbury) collected and processed all blood samples.

4.2.2 Dried blood spot

Those who declined a venous blood sample, or who attended a home visit or Mini-Assessment Centre where venous blood samples were not collected, were asked if they were willing to provide a fingerprick blood sample. The middle finger of the non-dominant hand was wiped with alcohol. Once dry, the finger was pricked using a sterile lancet. Blood droplets were collected to fill four pre-marked circles on a barcoded Guthrie card.

Dried blood spots were produced on Guthrie cards (i.e. Whatman blotting paper). For participants at Main Assessment Centres and some Mini-Assessment Centres who gave a venous blood sample (see above), 0.1mL of whole blood was pipetted from the 2.7mL EDTA tube (see section 4.2.1) onto a barcoded Guthrie card in the on-site laboratory as part of blood sample processing.

Once completely dry, the cards were stored in envelopes at room temperature.

4.2.3 Urine

Children and parents were provided with a barcoded 30 mL sterile urine pot to collect a spot urine sample. Written instructions asked for as much sample as possible, or until the pot was full, but did not specify a mid-stream collection. The child and parent questionnaires included a question for female participants about if they were menstruating that day. Urine samples were collected at all Main and Mini-Assessment Centres, and most home visits. Participants could provide a sample at any time during the visit.

Processing involved gently swirling the sample, noting if the appearance was cloudy, aliquoting into up to twelve 0.7mL aliquots and freezing at -80°C.

A total of 56% of samples were processed within 3 hours (range 1 minute to 9 days, median 71 minutes). At Assessment Centres, the sample was refrigerated in the laboratory until a staff member was available to process the sample. For urine samples collected at Home Visits and Mini Assessment Centres where there were no laboratory facilities, there was an unavoidable delay in sample processing. Some urine samples collected in the field were refrigerated overnight before being processed at the Main Assessment Centre the next day. Other samples were sent express post (not refrigerated) to the MCRI laboratory for processing. The time from collection to aliquoting and storage was recorded for all samples and will be an important consideration in subsequent analysis of urine-derived measures.

4.2.4 Saliva

A passive drool saliva sample was collected from children and parents at the Main Assessment Centres, and Mini-Assessment Centres in Bunbury, Darwin, Hobart, Launceston and MCRI. The participant was given a sterile barcoded pot and instructed to drool for 5 minutes, without talking. A CheckPoint team member timed the participant using a stop watch. The sample was collected before the participant ate a snack at the *Food Stop* station.

In the on-site laboratory, saliva pots were weighed on precision digital scales as a proxy for volume, aliquoted into up to six 0.5mL aliquots, and frozen at -80°C. Saliva samples were generally processed within an hour of collection (range 1 minute to 5.7 hours, median 44 minutes).

4.2.5 Buccal swab

Buccal swabs were collected from children and parents at home visits and some Mini-Assessment Centres. We also collected buccal samples from non-attending biological parents.

Children and parents were given a buccal swab collection kit (OCR-100) and instructed to rub the swab over their gums 20 times and inner cheeks 20 times on the left and right side of the mouth. The swab was then immersed in the kit preserving liquid and sealed. The OCR-100 preserving liquid was aliquoted into two 0.5mL aliquots and frozen at -80 °C within 60 days of collection (the period for which the sample remains stable at room temperature). Buccal swabs were collected from study children and attending parents completing home visits, and attending the Bundaberg, Mackay and Townsville Mini-Assessment Centres (saliva was collected instead at the other Mini-Assessment Centres). A small number of participants attending the Main Assessment Centre who were unable or not willing to provide a saliva sample provided a buccal sample instead.

Parents were asked if the child lived with a biological parent (not themselves), and if so, were willing to take home a buccal swab collection kit for this parent. This kit included a buccal swab kit, instructions (as summarised above), a consent form and a reply-paid envelope. Most non-attending parents received an OCR-100 collection kit, and the sample was collected and processed as described above. When these kits were not available, non-attending parents were sent two sterile COPAN FloqSwab swabs instead. The parent used one swab for the left side of the mouth, the other for the right side of the mouth, rubbing the gums and cheek 20 times, as described above. The parent sealed each swab back in the sterile contained, and mailed them back to the study team. The swabs were frozen at -80°C on receipt. The aim of collecting a buccal sample via return mail from the child's non-attending biological parent was to obtain DNA samples from the study child-mother-father triad. If the child's other biological parent lived elsewhere, we did not ask the attending parent to take home a kit. However, in a small number of cases the attending parent offered to take a kit to provide to a biological parent living elsewhere, and a kit was provided to these parents. Because the purpose of collecting these samples was DNA analyses of heritability, we did not ask the attending parent to take a kit for non-biological parents living with the study child.

The consent form and buccal sample outer label asked for the non-attending parent's name and date of birth, the study child's name and date of birth, and the date the sample was collected. This information was partially missing for some participants, but most samples had sufficient information to link the sample to the participant. OCR-100 samples remain stable at room temperature for at least 60 days. In some instances, the sample was returned more than 60 days after collection, or the date of collection was not recorded. These samples were processed and frozen as per usual. A flag variable allows users to identify these samples.

4.2.6 Hair

For children and parents, two locks of hair (approximately 4mm total diameter) were tied with string and cut close to the occipital scalp (under the crown). Hair was wrapped in aluminium foil, with the

end closest to the scalp clearly identified, and stored in a barcoded envelope at room temperature. Hair was collected at Main and Mini-Assessment Centres. Hair was collected in some home visits, when time permitted.

4.2.7 Toenails

For children only, toenails >3mm were trimmed from the right big toe and stored in a barcoded envelope at room temperature. If the right big toenail was too short, clippings from the left big toe and fingernails were collected instead, and noted. Parents were mailed an envelope before the CheckPoint visit, into which they could collect and seal a sample of their child's toenails, if they preferred. Nail samples were collected at all visit types.

5 Biomarker analyses

5.1 Renal function

Detailed information about data collection and preparation is provided in the *CheckPoint Check-In data collection* and *Urinary albumin creatinine ratio* SOPs.

Prof Melissa Wake led the urinary albumin-creatinine ratio and related analyses with Professor Jonathan Craig. Collaboration on projects using these data is encouraged. Please email melissa.wake@mcri.edu.au.

Albumin and creatinine were quantified in urine to assess for albuminuria; the presence of excess amounts of albumin in the urine that can indicate kidney damage (Atkins et al., 2004). Albuminuria is an important predictor of risk of progressive renal disease, cardiovascular disease, and mortality (Damsgaard, Froland, Jorgensen, & Mogensen, 1990; Yudkin, Forrest, & Jackson, 1988).

Urine samples were defrosted, centrifuged, 0.12mL aliquoted into Cobas tubes and refrozen for transport to the Metabolomics Laboratory at the Baker Heart and Diabetes Institute (Melbourne, Australia) for analysis. A Cobas Integra ® 400 plus analyzer performed the measurements, determining albumin using an immunoturbimetric assay (ALBT2 kit, Test ID 0-171, Roche Diagnostics, Germany), and creatinine using the enzymatic colorimetric method (Creatinine plus version2 CREP2U kit, Test ID 0-512, Roche Diagnostics, Germany). The detectable range of albumin was 3-200 mg/L. Samples with an albumin concentration higher than 200mg/L were re-run following automated machine dilution. The dilution factor is included in the dataset to indicate higher potential for read errors. Each data point represents a single reading of albumin and creatinine in the same aliquot, not an average of repeated readings.

Albumin-to-creatinine ratio (ACR) was calculated as albumin divided by creatinine. The ACR was classified as normal, microalbinuria or macroalbinuria using the Kidney Disease Improving Global Outcomes (KDIGO) 2012 guidelines (Stevens & Levin, 2013) and the sex-specific cut-points recommended by the Australasian Proteinuria Consensus Working Group (Johnson et al., 2012). Urinary albumin can be affected by factors other than chronic kidney disease, including menstruation, urinary tract infections, acute febrile illness and heavy exercise in the previous 24 hours (Johnson et al., 2012).

Approximately 10 child and 10 parent variables are included in the data file. Key variables include urinary ACR and albuminuria status, using both the KDIGO 2012 and Australasian Proteinuria Consensus Working Group cut-points.

5.2 Serum NMR metabolites

Detailed information about data collection and preparation is provided in the *Young Bloods data collection* and the *Serum metabolites* SOPs.

Professors David Burgner, Richard Saffery and John Carlin led the serum metabolites analysis. Collaboration on projects using these data is encouraged. Please email david.burgner@mcri.edu.au and richard.saffery@mcri.edu.au.

A 0.5mL serum aliquot for each participant was shipped in a single batch on dry ice to Nightingale Health (www.nightingalehealth.com, Helsinki, Finland. Previously trading as Brainshake) for Nuclear Magnetic Resonance (NMR) metabolomics. The Nightingale® NMR metabolomics platform was used to quantify 228 metabolic biomarkers from 0.35mL of serum.

These metabolomics data offer novel insights into the mechanisms underlying chronic diseases to enable improved risk prediction (Soininen, Kangas, Wurtz, Suna, & Ala-Korpela, 2015; Soininen et al., 2009). It includes molar concentrations of amino acids, fatty acids, glycolysis metabolites, and lipoprotein subclasses in addition to the clinically used standard lipids.

Whilst widely used for epidemiological research, the NMR-based quantification has not been certified for clinical diagnostics. Further analytical validation of the quantification protocols for the biomarker subset routinely used in clinical settings (e.g. established cholesterol measures and creatinine) is expected to lead to recalibration of certain metabolite concentrations to better match clinical gold standards (Wurtz et al., 2017).

Two sets of metabolites data were generated using Nightingale's 2016 (v2016) and Nightingale's 2017 (v2017) bioinformatics protocol, respectively. Depending on the metabolites that you plan to use in your analysis, please note the following guidelines:

a. If the analysis involves only metabolites from the following 9 measures: glucose, glycoprotein acetyls (GlycA), LDL cholesterol, HDL cholesterol, cholesterol (Total cholesterol), apolipoprotein A1, apolipoprotein B, triglycerides (Total triglycerides), creatinine; the v2017 version of data are recommended.
b. If the analysis involves metabolites other than the above 9 measures, the v2016 version of results are recommended. Mixing and matching data from v2016 and v2017 are not recommended.

   If you are still unsure about what version to use for your analyses or you have further queries, please contact Professor David Burgner *david.burgner@mcri.edu.au.*

There are several reasons for missing metabolomics data (coded ".e" in the dataset). Reasons include the value being rejected by the automatic sample and measurement quality control, the value not being quantified due to an irregularity in the sample (e.g. excess antigens present), and a derived value or ratio not be calculated due to low concentration in the original measurements.

Both the v2016 version and a subset of v2017 version of metabolites quantification are included in the data file (as advised by Nightingale). Approximately 242 study child and 242 attending parent variables are included in the data file. Key variables include total cholesterol, LDL cholesterol, HDL cholesterol, total triglycerides, glucose, glycoprotein acetyls, apolipoprotein A1 (apoA1), and apolipoprotein B (apoB). Quality control variables are also included to indicate instances where high ethanol, high lactate or isopropyl alcohol was detected.

5.3 Telomere length

Detailed information about data collection and preparation is provided in the *Young Bloods data collection* and the *telomere length quantification* SOPs.

Professor Richard Saffery led the telomere length analysis. Collaboration on projects using these data is encouraged. Please email richard.saffery@mcri.edu.au

Genomic DNA was extracted from a single 0.5ml whole blood aliquot or single clot aliquot (where whole blood was not available) per participant, using a QIAcube workstation and QIAamp DNA Blood Kit (Qiagen) according to the manufacturer's instructions. Relative telomere length was assessed using quantitative real-time polymerase chain reaction (qPCR) (Cawthon, 2009). Telomere length is expressed as a ratio (T/S) of telomere repeat length (T) to copy number of a single copy gene (S). This method measures the amount of telomeric DNA (T) and a single copy gene (beta-globin, S) for each sample.

For each participant, telomere length assessment was measured in quadruplicates comprising 4 µl of diluted genomic DNA at 5 ng/µl, 5 µl of SensiFAST SYBR No-ROX Kit master mix (Bioline, Sydney, Australia) and 0.5 µl of each forward and reverse primer at 2 µM. The primer sequences were tel1 (5'-CGG TTT GTT TGG GTT TGG GTT TGG GTT TGG GTT TGG GTT), tel2 (5'-GGC TTG CCT TAC CCT TAC CCT TAC CCT TAC CCT TAC CCT), bg1 (5'-GCA GGA GCC AGG GCT GGG CAT AAA AGT CA) and bg2 (5'-GGG CCT CAC CAC CAA CTT CAT CCA CGT TC). The reference single copy gene was the beta-globin gene. All 'T' and 'S' reactions were performed in 384-well plates on MCRI's in-house MCRI's in-house Roche Light Cycler 480 (Roche, Melbourne, Australia). The cycling conditions were: 95°C for 10 minutes, followed by 35 cycles of (i) 95°C for 15 seconds and (ii) 62°C for 60 seconds.

Approximately 6 child and 6 parent variables are included in the data file. Key variables include relative telomere length, and flag variables that may affect some data analyses (eg. analysis plate number and sample type used for DNA extraction).

5.4 Biomarker data in preparation

5.4.1 Genotyping

Professor Richard Saffery and Associate Professor Justin O'Sullivan led the genotyping analyses. Collaboration on projects using these data is encouraged. Please email Richard.saffery@mcri.edu.au.

Genotyping was carried out using genomic DNA to generate data for >500,000 single nucleotide polymorphisms using the Illumina Global Screening Array platform (http://glimdna.org/global-screening-array.html). This data was further imputed to include >7 million additional genotypes using the Sanger Imputation Service (https://imputation.sanger.ac.uk/). Polygenic risk scores are in preparation.

Data such as a range of polygenic risk scores could be included in future data releases.

5.4.2 Micronutrients

Professor Richard Saffery and Associate Professor Justin O'Sullivan led the micronutrient analyses. Collaboration on projects using these data is encouraged. Please email Richard.saffery@mcri.edu.au.

Molecular and nutritional phenotyping data are in preparation (Andraos et al., 2020). Water- and lipid-soluble vitamins are being quantified using proprietary mass spectrometry panels at the Liggins Institute, University of Auckland, New Zealand. Markers of one-carbon metabolism, a key regulator of metabolic processes, are also being quantified.

M*icronutrient data could be included in future data releases.*

6 Accessing the Child Health CheckPoint data

The first Child Health CheckPoint data is released as part of the LSAC wave 7 Data Release in 2018 and was updated as part of LSAC wave 8 Data Release. There is potential for additional data to be generated and released in the coming years.

Data Users will receive the General Release CheckPoint dataset, and documentation described in section 7.5.

Restricted Release and Supplementary CheckPoint datasets are also available to approved data users.

Each of the datasets are described in this section.

Access to the CheckPoint dataset follows the same process as accessing the LSAC dataset. Interested researchers or policy makers submit the standard LSAC dataset application process (see LSAC Data User Guide).

Access to CheckPoint data not contained in the CheckPoint dataset (such as digital images) and access to biospecimens will be considered, on application to the CheckPoint Data and Biospecimen Access Committees. Access is granted on a cost-recovery basis, with the understanding that the data derived will be included in future releases of the CheckPoint dataset to LSAC Data Users. In addition, requests for biospecimen use must meet the principles for sample access. For more information, please see the CheckPoint Data and Biospecimen Access Guidelines (in preparation, anticipated to be available from checkpoint-lsac.mcri.edu.au by late-2020).

7 Child Health CheckPoint datasets and documentation

7.1 General Release CheckPoint dataset

The General Release CheckPoint dataset contains data collected via:

- self-report questionnaires
- direct assessment measures (raw and derived data)
- biomarkers
- administrative processes (e.g. date of interview, type of assessment, consent for additional items such as blood sample), and the
- Australian Bureau of Statistics Census of Population and Housing.

7.1.1 Confidentialisation of the General Release dataset

To maintain participants' anonymity, a series of data confidentialisation techniques have been applied to the General Release dataset. These include removing some variables from the dataset, transforming values, collapsing responses or top-coding (i.e. recoding outlying values to a less extreme value) variables.

The dataset does not contain participants' names, addresses and other contact information. Each Australian postcode was replaced with a postcode indicator. Therefore, Data Users cannot identify which suburb participants live in, but can identify which participants live within the same postcode.

The following items have been transformed by rounding to a neighbouring value:

- Assessment date, date of birth and accelerometry recording date variables were converted to the 1st day of the month.
- Socio-Economic Index for Areas (SEIFA) variables were rounded to the nearest 10.
- Cost of medications, vitamins and supplements, hospital admissions, health and community services, and community activities were rounded to the nearest 10.
- Hours per week of community activities were rounded logarithmically.

The following items had response categories collapsed (i.e. if a response was reported fewer than 5 times, these responses with neighbouring responses to form a category with more than 5 respondents, or recoded to "other"):

- Attending parent's relationship to study child
- Number of pets in family home
- Number of hospital admissions and nights in hospital, and
- Body mass index categories.

Collapsed numerical categories are represented in the data dictionary as:

- Number (collapsed categories), e.g. " Number (4, 4-10 | 10, >10)" indicates values from 4 to 10 were collapsed to 4 and values greater than 10 were collapsed to 10, or

- Categorical numbers (where a drop-down selection was used), e.g. "1, 1 | 2, 2 | 3, 3-4 | 5, 5+ " indicates all drop-down selections 3 and 4 were collapsed to 3 and greater than 5 were collapsed to 5.

The following data items are top-coded:

- Height, weight, waist circumference, body mass index, and total body fat percentage
- Brachial systolic and diastolic blood pressure
- Forced expiratory volume and forced vital capacity, and
- Study child's eczema symptoms age at onset.

7.2 Restricted Release CheckPoint dataset

Access to the Restricted Release dataset may be granted where data users are able to demonstrate a genuine need for the additional data and that they meet the necessary additional security requirements.

The dataset does not contain participants' names, addresses and other contact information, but it does contain the participants' residential postcode. Other data confidentialisation techniques applied to the General Release dataset (see section 7.1.1) have not been applied to the Restricted Release dataset.

7.3 Supplementary CheckPoint dataset

The supplementary file only includes qualitative data from the Computer Assisted self- reported Interview/Questionnaire (CASI) with the attending parent.

The following items are included in the supplementary file:

- Family member specific food and insect allergies
- Other types of pets in the family
- Name of moisturisers, topical steroid creams and ointments used by study child
- Name and condition for medications, vitamins and supplements used by study child, and
- Description of community activities study child participates in.

These items may contain specific information about participants that could be identifying e.g. the specific type and number of medications used. Data users are not to publish these data at an individual participant level.

7.4 What data are not released to Data Users?

CheckPoint has collected some data that is not included in either the General Release, Restricted Release or Supplementary CheckPoint datasets. These include:

- Administrative data that is not meaningful to data users (e.g. ECG dots fitted (yes/no), Pulse Wave Analysis Wave form date-and-time stamp).

- ‘Raw’ data from specialised equipment that the CheckPoint Investigator Team do not think will be useful for data users (e.g. 100khertz-left leg Impedance from the BIA machine).
- Some ‘raw’ questionnaire data that have been reshaped during the cleaning process (e.g. community activities).
- Data that are still being scored (e.g. 3D photographs of the face and teeth) or have not been scored. The CheckPoint dataset contains variables to indicate if data were collected for each participant.

The CheckPoint team welcomes enquires about access to data not yet released.

7.5 Documentation

A series of documents have been developed to help users understand the Child Health CheckPoint study and dataset. These are described in this section, and are available on the MCRI website at checkpoint-lsac.mcri.edu.au and via Dataverse at dataverse.ada.edu.au/dataverse/ncld. A link is also available on the Growing Up in Australia website (growingupinaustralia.gov.au/about-study) that will direct users to the MCRI CheckPoint website.

7.5.1 Data dictionary

The CheckPoint data dictionary describes each variable in the CheckPoint dataset. It uses the same format as the LSAC data dictionary. If the value is fixed for all CheckPoint variables, it is written in square brackets below.

Information provided for each variable includes:

- File order (denotes the order of variables within the data file)
- File [B11]
- Wave [6.5]
- Cohort [B]
- Variable name
- Variable name without age indicator (allows repeated variables across waves to be easily located)
- Topic number (allows raw and derived items from the same source data to be sorted together)
- Question ID (variable name without age or person indicator)
- Question position (location of question in questionnaires, participant forms or interviews)
- Person label (the person whom the data pertains to, not necessarily who provided the data)
- Child’s age [11-12 years]
- Variable label (briefly describes each data item)
- Topic [CheckPoint Health or CheckPoint Biomarkers]
- Construct (aspect of physiology or other attribute being assessed. This allows raw and derived items from the same source data to be sorted together.

- Measure (specific test or measure)
- Question (worded as appears in the questionnaires or asked, or as close as possible if characters limited; or the detailed measure name)
- Values (response format)
- Confidentialised values (infrequent responses which were collapsed/recoded to maintain participant privacy)
- SAS format (format style applied to variables in SAS version of the dataset)
- Confidentialisation (data transformations applied to the General Release dataset to protect participant privacy)
- Population (all or subgroups eligible for collection of data), and
- Notes (other information users should know about the data item).

The data dictionary is an Excel spreadsheet. See the LSAC Data User Guide for tips on how to search and sort Excel documents using filters and wildcards.

7.5.2 Rationale document

The CheckPoint rationale document describes the source of each measure, it's rationale for inclusion in CheckPoint, how it was administered and scored, and any modifications from the original measure or previous LSAC waves. The rationale document is an Excel spreadsheet. It uses the same format as the LSAC rationale documents. If the value is fixed or one of a short list for all CheckPoint measures, the values or options are written in square brackets below.

Information provided for each measure includes:

- Theme
- Sub-theme
- Unit [CheckPoint Health or CheckPoint Biomarkers]
- Theme (the specific measure of physiology that was measured)
- Measure (specific test or measure)
- Question ID range
- Source reference (key reference/s for the protocol)
- Wave and cohort [wave 6.5: B]
- Participant & Collection type
- Item/s (Either the question wording or a brief description of the assessment protocol)
- Response format (input values allowed, or direct assessment)
- Scoring (how this measure was scored)
- Differences between waves in LSAC
- Scale modifications from original source scale (any modification from original protocol)
- Past research & scale psychometrics
- Scale summary & notes (also identifies variables that may be of use to the data user such as quality control variables), and
- Rationale for inclusion.

More detail about the rationale for enriching LSAC with the Child Health CheckPoint can be found in the following paper (available at aifs.gov.au/publications/family-matters/issue-95/introducing-growing-australias-child-health-checkpoint):

> Melissa Wake, Susan Clifford, Elissa York, Fiona Mensah, Lisa Gold, David Burgner, Sarah Davies and the Child Health CheckPoint team. (2014). Introducing Growing Up in Australia's Child Health CheckPoint: A physical and biomarkers module for the Longitudinal Study of Australian Children. *Family Matters* 2014; 95, 15-23.

7.5.3 Technical papers

CheckPoint has one technical paper which describes the creation of the cross-sectional sample survey weights provided in the CheckPoint dataset:

> Susan Ellul, Richard Hiscock, Fiona Mensah, Susan Clifford and John Carlin. (2018). Longitudinal Study of Australian Children's Child Health CheckPoint Technical Paper 1: Weighting and Non-Response. Melbourne: Murdoch Children's Research Institute. doi: 10.25374/MCRI.5687593

Future additional CheckPoint technical papers will be available on the MCRI website at checkpoint-lsac.mcri.edu.au and/or via Dataverse at dataverse.ada.edu.au/dataverse/ncld. A link is also available on the Growing Up in Australia website at growingupinaustralia.gov.au/about-study that will direct users to the MCRI CheckPoint website.

7.5.4 BMJ Open Special Issue

The CheckPoint team has published a Special Issue in BMJ Open in 2019. This series includes a preface, cohort summary and study methodology paper, and 14 papers describing the methodology, epidemiology and parent-child concordance of key CheckPoint measures, spanning cardiovascular, respiratory, bone, kidney, hearing and language, body composition, metabolic profiles, telomere length, sleep, physical activity, snack choice and health-related quality of life. References of these papers are:

> 1. Clifford SA, Davies S, Wake M, et al. Child Health CheckPoint: Cohort summary and methodology of a physical health and biospecimen module for the Longitudinal Study of Australian Children. BMJ Open 2019;9(suppl 3):3–22. doi: 10.1136/bmjopen-2017-020261
>
> 2. Liu RS, Dunn S, Grobler AC, et al. Carotid artery intima-media thickness, distensibility, and elasticity: Population epidemiology and concordance in Australian children aged 11-12 years and their parents. BMJ Open 2019;9(suppl 3):23–33. doi: 10.1136/bmjopen-2017-020264
>
> 3. Kahn FK, Wake M, Lycett K, et al. Vascular function and stiffness: Population epidemiology and concordance in Australian children aged 11-12 years and their parents. BMJ Open 2019;9(suppl 3):34–43. doi: 10.1136/bmjopen-2017-020896

4. Dascalu J, Liu M, Lycett K, et al. Retinal microvasculature: Population epidemiology and concordance in Australian children aged 11-12 years and their parents. BMJ Open 2019:9(suppl 3) 44 – 52.

5. Welsh L, Kathriachchige G, Raheem T, et al. Lung function: Population epidemiology and concordance in Australian children aged 11-12 years and their parents. BMJ Open 2019;9(suppl 3):53–62. doi: 10.1136/bmjopen-2018-022399

6. Vlok J, Simm PJ, Lycett K, et al. pQCT bone geometry and strength: Population epidemiology and concordance in Australian children aged 11-12 years and their parents. BMJ Open 2019;9(suppl 3):63–74. doi: 10.1136/bmjopen-2018-023486

7. Larkins NG, Kim S, Carlin JC, et al. Albuminuria: Population epidemiology and concordance in Australian children aged 11-12 years and their parents. BMJ Open 2019;9(suppl 3):75–84. doi: 10.1136/bmjopen-2017-020262

8. Smith J, Wang J, Grobler AC, et al. Hearing, speech reception, vocabulary and language: Population epidemiology and concordance in Australian children aged 11-12 years and their parents. BMJ Open 2019;9(suppl 3):85–94. doi: 10.1136/bmjopen-2018-023196

9. Clifford SA, Gillespie AN, Olds T, et al. Body composition: Population epidemiology and concordance in Australian children aged 11-12 years and their parents. BMJ Open 2019;9(suppl 3):95–105. doi: 10.1136/bmjopen-2018-023698

10. Ellul S, Wake M, Clifford SA, et al. Metabolomics: Population epidemiology and concordance in Australian children aged 11-12 years and their parents. BMJ Open 2019;9(suppl 3):106–17. doi: 10.1136/bmjopen-2017-020900

11. Nguyen MT, Lycett K, Vryer R, et al. Telomere length: Population epidemiology and concordance in Australian children aged 11-12 years and their parents. BMJ Open 2019;9(suppl 3):118–26. doi: 10.1136/bmjopen-2017-020263

12. Matricciani L, Fraysse F, Grobler AC, et al. Sleep: Population epidemiology and concordance in Australian children aged 11-12 years and their parents. BMJ Open 2019. 9(suppl 3): 127–35. doi: 10.1136/bmjopen-2017-020895

13. Fraysse F, Grobler AC, Muller J, et al. Physical activity and sedentary activity: Population epidemiology and concordance in Australian children aged 11-12 years and their parents. BMJ Open 2019;9(suppl 3):136–46. doi: 10.1136/bmjopen-2018-023194

14. Vivarini P, Kerr JA, Clifford SA, et al. Food choices: Concordance in Australian children aged 11-12 years and their parents. BMJ Open 2019;9(suppl 3):147–56. doi: 10.1136/bmjopen-2017-020898

15. Catchpool M, Gold L, Grobler AC, et al. Health-related quality of life: Population epidemiology and concordance in Australian children aged 11-12 years and their parents. BMJ Open 2019;9(suppl 3):157–64. doi: 10.1136/bmjopen-2018-022398

7.5.5 Data Issues paper

The CheckPoint Data Issues paper summarises data issues that users should be aware of when using the dataset:

> Sarah Davies, Susan Clifford, Alanna Gillespie, Katherine Lange, Josh Muller, Melissa Wake on behalf of LSAC's Child Health CheckPoint team (2018). Longitudinal Study of Australian Children's Child Health CheckPoint Data Issues Paper – December 2018. Melbourne: Murdoch Children's Research Institute. doi:10.25374/MCRI.5821230.

Issues include variations in data collection protocols, and issues that occurred during the data preparation processes (i.e. during raw data extraction, data combining, data cleaning or when creating derived variables). The Issues paper highlights where substantial changes have been made to the data, and provides advice for interpretation of results.

The Data Issues paper is available on the MCRI website at checkpoint-lsac.mcri.edu.au and/or via Dataverse at dataverse.ada.edu.au/dataverse/ncld. A link is also available on the Growing Up in Australia website (growingupinaustralia.gov.au/about-study) that will direct users to the MCRI CheckPoint website.

7.5.6 Standard Operating Procedures

Many data collection and management SOPs, also known as protocols, are available from the CheckPoint team, on request. These protocols document the key steps undertaken by the study team from greeting the participant at the data collection station, through to generating the data that appears in the dataset. Accurate SOPs were important for maintaining quality control and repeatability of CheckPoint data collection and data preparation processes.

Data collection SOPs describe all measures collected within a single data collection station (e.g. *Heart Lab*, *Lung Fun*). Data management SOPs describe data handling for individual measures (e.g. Bone, Respiratory) after it was collected, including data extraction, scoring, reshaping, cleaning, range checks and derivation

Each SOP describes the purpose and scope of the document, staff responsibilities and training, abbreviations and definitions, equipment, data collection or management procedure in detail, and described troubleshooting and key decisions.

7.5.7 Labelled questionnaires

Children and parents each completed a questionnaire on an iPad or laptop. Throughout CheckPoint documentation, these questionnaires are referred to as the study child Self Report Questionnaire (CSR) and the attending parent Computer Assisted Self Interview (CASI).

An annotated version of each questionnaire is available at on the MCRI website at checkpoint-lsac.mcri.edu.au and/or via Dataverse at dataverse.ada.edu.au/dataverse/ncld. A link is also available on the Growing Up in Australia website (growingupinaustralia.gov.au/about-study) that will direct users to the MCRI CheckPoint website. The annotated questionnaire provides the following information for each question/item (see Figure 7 for an example):

- Branching rules: Some questions were only presented to a subset of participants who responded positively to a previous question (e.g. those who have gone through menarche are asked the age at which this occurred). Branched questions are labelled with a flag 'BRANCHING:' and details of the previous response that triggers the question to be presented to the participant (e.g. fch27c02a=1).
- Variable name: Where the item corresponds to a variable in the dataset, the variable name is written inside curved brackets, e.g. {fch27c02a}. Not all items have a corresponding variable in the dataset; free text responses have been excluded for confidentiality and coded to new derived variables where possible (e.g. 'What other kind of infections?), or cleaned and provided in a supplementary or in-confidence datasets available upon request (e.g. 'Name of medication').
- Response type and Question position: Written inside square brackets e.g. [CASI D78.1].
- Response coding and labels (e.g. 1 'Yes').

Question sections, that have known data issues, are preceded by a description of the issue indicated by "***PLEASE TAKE NOTE REGARDING DATA FOR THIS SECTION***". Data users are encouraged to read the CheckPoint Data Issues paper for further details.

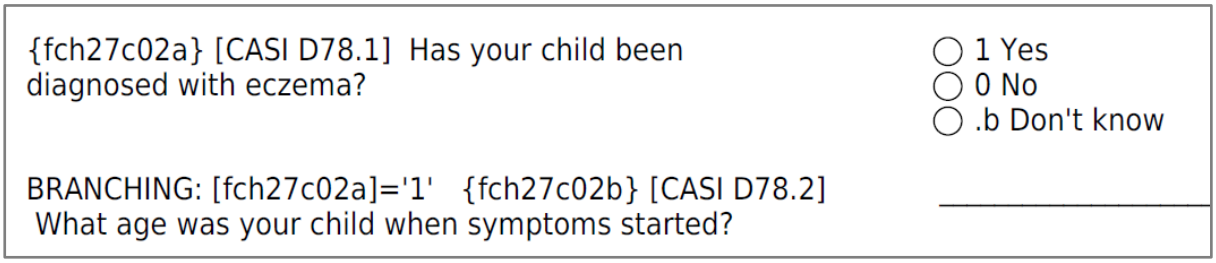

Figure 7. Example of the marked-up attending parent questionnaires

7.5.8 Weighted summary tables

Summary tables are provided; listing weighted frequencies for categorical variables, and weighted mean, standard deviation, minimum and maximum for continuous variables. These summary tables specify which of the survey weights provided in the CheckPoint dataset should be used for analyses of each measure. For more information about the survey weights, see section 10.1 and the CheckPoint Technical Paper 1 (Ellul et al., 2018).

7.5.9 Legal disclaimer

Data Users are asked to read the Child Health CheckPoint legal disclaimer, available at checkpoint-lsac.mcri.edu.au.

8 Variable naming conventions

The CheckPoint variable naming convention follows the same logic as the LSAC convention, with some exceptions which are outlined below. This section summarises the CheckPoint variable name convention, and provides both the LSAC and CheckPoint variable names for the small number of CheckPoint items that had been included in earlier LSAC waves (e.g. height, weight, blood pressure, PedsQL Total Score).

Raw variables are the least processed variables for each measure. They are often the original data collected at the time of assessment (e.g. questionnaire responses, blood pressure values exported from the assessment computer, measurements scored from an image or total minutes spent in each physical activity level measured by accelerometry).

Derived variables are calculated after the time of assessment from one or more 'raw' variables, and are often the synthesis of multiple aspects of a measure (e.g. questionnaire scale total score, hearing impairment status, body mass index z-score).

8.1 Raw Variables

Raw variable names generally follow a standard format:

A tt00 xxxxx

Where:

A = child age indicator

tt00 = topic indicator

xxxxx = specific question identifier.

8.1.1 Child age indicator (alpha)

The first character of the variable name is a child age indicator, representing the study child's age at the data collection wave. The age indicator for CheckPoint data is *f*, indicating data were collected when the study children were 11-12 years. Please note that *f* is also the child age indicator in the LSAC wave 6 dataset indicating data were collected when the children were 10-11 years old.

Child sex (zf02fm1) and date of birth (zf04m1) variables are given the age indicator z. This allows these data to have a consistent variable name across waves regardless of the age of the child when the information was collected.

8.1.2 Topic indicator (alphanumeric)

The second to fifth characters of the variable name indicate the topic and topic number to which the variable belongs.

The second and third characters are letters representing the two topics within which all CheckPoint variables fall:

CheckPoint Health: ch

CheckPoint Biomarkers: cb

CheckPoint Biomarkers include variables relating to biospecimens; all other raw variables belong to the *CheckPoint Health* topic.

The fourth and fifth characters of the variable name indicate the topic number. Within the two topics, each content area has been assigned an arbitrary two-digit topic number. Table 4 lists the 31 topic numbers within the CheckPoint Health topic (ch01-ch31), and four content areas within the CheckPoint Biomarkers topic (cb01-cb04). Items of related content are grouped together as much as possible, for example:

f**ch23**a16c (Parent's report of how often pain interferes with their usual activities) has “ch23” as the second to fifth digits of the variable name to indicate this variable falls within the *CheckPoint Health* “Wellbeing & quality of life” topic.

f**cb03**c01a (Child urinary albumin concentration) has “cb03” as the second to fifth digits of the variable name to indicate this variable falls within the *CheckPoint Biomarkers* “Renal health” topic.

Table 4. CheckPoint topic indicators

Topic indicator	Topic and content area
ch	**CheckPoint Health**
ch01	Reference
ch02	Anthropometry
ch03	Pubertal status
ch04	Bone
ch05	Cardiovascular: Carotid intima-media thickness
ch06	Cardiovascular: Arterial stiffness and blood pressure
ch07	Cardiovascular: Microvascular structure
ch08	Respiratory
ch09	Language: Expressive and receptive
ch10	Language: Receptive vocabulary
ch11	Hearing: Pure tone threshold
ch12	Hearing: Middle ear function
ch13	Hearing: Speech threshold
ch14	Food choices
ch15	Physical activity
ch16	Time use
ch17	Strength
ch18	Fitness
ch19	Vision
ch20	Oral health
ch21	Facial morphology
ch22	Child written story
ch23	Wellbeing & quality of life
ch24	Pain
ch25	Diet
ch26	Allergy
ch27	Eczema
ch28	Colouring
ch29	Medications and Supplements
ch30	Health and Support Services
ch31	Community activities
cb	**CheckPoint Biomarkers**
cb01	Biospecimens collection
cb02	Serum metabolites
cb03	Renal Health
cb04	Telomere length

8.1.3 Specific question identifier (alphanumeric)

The remaining digits of a raw variable name are unique to the specific item. Most raw variables have a 'specific question identifier' of up to five letters and numbers, although some variable names were longer.

The sixth digit of the variable name is generally an informant or subject indicator. As many CheckPoint variables were collected for both the study child and attending parent, the sixth digit of raw variable name is usually the subject indicator. When a variable is only collected on either children or parents, the sixth digit often indicates the subject, for consistency in variable naming across the dataset.

The subject indicators used are:

a Attending parent

b Non-attending parent

c Study child

m Mother

f Father

For example:

> Both the study child and attending parent were asked if they experienced pain(s) for at least one day. The child variable is fch24**c**01a and the parent variable is fch24**a**01a.
>
> Only study children were asked about how often pain interferes with usual activity. This variable is fch24**c**01c.

For variables referring to family members other than those specified above, or the family home as a whole, the sixth digit is used to indicate the informant. There were a small number of questions in the parent questionnaire that ask "if the study child's siblings have asthma, eczema etc.?" and "if the family have pets at home?". For these variables, the sixth digit of the variable name is *a,* indicating the attending parent is the informant.

For example:

> fch26**a**03d is the attending parent's report on if the study child's brother has asthma
>
> fch26**a**03e is the attending parent's report on if the study child's sister has asthma
>
> fch26**a**05d is the attending parent's report on if the study child's brother has hayfever

The remaining 'specific question identifier' component of the variable name is a combination of letters and numbers. Similar raw variables are grouped together by sharing the same two digits, and repeat measurements are grouped by sharing the same three digits in this component of the variable name.

This component of the variable name can also contain the question number, in the case of questionnaire items that are part of a validated or published scale (e.g. AQoL 8D).

The 'specific question identifier' also indicates the name of the relevant scale or subscale, where applicable and character limits allow.

Table 5 provides examples of how the variables within the Independent Living Dimension and Happiness Dimension subscales of the AQoL 8D are named.

As shown:

- The 6th character in the variable name is a subject indicator: *a* is for the attending parent.
- The 7th character indicates the AQoL 8D subscale: *9* for Independent Living and *10* for Happiness.
- The final character uniquely identifies each item.

Table 5. AQoL 8D Independent Living and Happiness Dimension subscale variable names

Variable name	AQoL 8D subscale and variable label
	Independent Living
fch23a9a	How much help do you need with jobs around the house
fch23a9b	How easy/difficult get around by yourself out
fch23a9c	Your mobility, including using any aids or equipment
fch23a9d	Washing yourself, toileting, dressing, eating
	Happiness
fch23a10a	How content are you with your life?
fch23a10b	How enthusiastic do you feel?
fch23a10c	How often do you feel happy?
fch23a10d	How often do you feel pleasure?

8.2 Derived Data variables

Derived variable names generally follow the standard format:

A t xxxxxx [cp]

Where:

A = child age indicator

t = informant or subject indicator

xxxxx = mnemonic that relates to the subject matter of the derived item

[cp is added to the end of CheckPoint variable names that are identical to wave 6 variable names; see explanation below]

There are a small group of measures which were collected both in LSAC wave 6 and CheckPoint (see section 8.3 and Table 6). Because the same child age indicator *f* is used in both datasets, these wave 6 and CheckPoint variables would have identical names. To delineate these, the letters cp are added to the end of the CheckPoint variable names. For example, the child body mass index variable in the wave 6 dataset is 'fcbmi' and in the CheckPoint dataset is 'fcbmicp'.

8.3 Measures and variables in both the CheckPoint and earlier LSAC waves

Table 6 lists CheckPoint measures and variables which are also included in previous LSAC waves (waves 1-6) for the B cohort.

The CheckPoint dataset also includes information about the child and parents' medical conditions, which are similar to but not identical to family demographics questions in LSAC previous waves (LSAC question IDs f17* and f18*; these variables are not listed in Table 6).

Table 6. CheckPoint measures and variables also included in earlier LSAC waves

Measures / variables	LSAC question ID	CheckPoint question ID
Household Composition:		
Present for wave	f01	f01_cp
Sex	f02	f02_cp
Age (years)	f03	f03_cp
Date of birth (rounded)	f04	f04_cp
Relationship with child	f08	f08_cp
Indicators:		
Hicid	hicid	hicid
Cohort	cohort	cohort
Wave	wave	wave
Wave 1 stratum (for weights)	stratum	stratum
Wave 1 selection postcode indicator (for weights)	pcodes	pcodenw
Current location:		
Current postcode	pcode	pcodecp
Postcode indicator	pcoden	pcodencp
SLA/ASGS	sla*/sa*	sla*cp/sa*cp
State of residence	state	statecp
Region of residence	region	regioncp
Remoteness area (ABS)	absra	absracp
SEIFA	cn_s*	seifa*
Member number	mn	mncp
Sample weight	weights	weightscp
Date of interview/Study date	datint	study
Current medical conditions	f13, f17*, f18*,	ch01_07* to ch01_09*
Wears glasses	hs31a	glasses
Parent 1 has a partner	partner	ch01_01b
Height	hs23_1	height
Weight	hs23_2	weight
Body fat[1]	bodyfat	fatm/fatper
Waist girth	hs23_3	waist
Body Mass Index	bmi	bmi
Blood pressure, systolic and diastolic	hs40*	ch06_01*, ch06_02*
Puberty:		
Puberty Development Scale	hs36*, pubrty	ch03_01*, pds*, ch03_02*
Menstruation		

Measures / variables	LSAC question ID	CheckPoint question ID
Asthma, Eczema, Hayfever	hs29*, hs44_1, hs44_2, hs44_3	ch01_08*, ch26_03* to ch26_05*, ch27*
Food allergies	hs39*	ch01_07c, ch26_08*
Pediatric Quality of Life Inventory	gd04*, peds*	ch23_01* to ch23_06*, pq*
Child Health Utility 9D	gd09*, chu9d	ch23_07*, chuuti
Pain	f13a, f18b	ch24*
Activity and Sleep[2]	hb14*, he05*, he06*, he07*, he17*, he28*, he26b, hs21*	ch15*, ch16*
Nutrition[3]	hb13*, hb21*	ch25*
Health service use (Health insurance and Hospital admissions)	fn04j*, fn08, hs18*, hs19*	ch30_01* to ch30_12*
Community service use (Visits with health providers)	sc12*, sc13*, pc30*, pc56*, he12*, he26*	ch30_13* to ch30_54*
Community activities	he08*, he09*, fd13_2	ch31*
Medications and supplements	hb02*, hs17l*	ch29*
Pets in household (Pet exposure)	ho08*	ch26_09*
NVPT/PPVT	ppvt	ch10*

[1] CheckPoint collected body composition of which body fat (mass in kg, and %) is a component

[2] CheckPoint collected both a time use diary of daily activities, and accelerometry measure of physical activity and sleep, of which the LSAC items are a subset

[3] CheckPoint collected all items on the NASSDA, of which the LSAC items are a subset

8.4 Household composition variables

Household composition variables names generally follow the standard format:

A f ##xmmm [cp]

Where:

A = Child age indicator

f = f (for "family"). "f" is a constant to indicate that it is the household composition that is being described.

= Question number (numeric)

x = Sub-question indicator (optional)

mmm = member number (person identifier)

[cp is added to the end of CheckPoint variable names; see explanation below]

Because the same child age indicator *f* is used in both datasets, wave 6 and CheckPoint household composition variables would have identical names. To delineate these, and for ease of use the letters 'cp' has been added to the end of all CheckPoint household composition variables.

Table 7 lists the household member characteristic variables available for the study child, attending parent and non-attending parent in the CheckPoint dataset.

Table 7. Household member characteristics variables in the CheckPoint dataset

Topic number	Question	Study child	Attending parent (P1)	Non-attending parent (P2)
f01	Present for wave	ff01m1cp	ff01m2cp	ff01fp2cp
f02	Sex	zf02m1cp	ff02m2cp	ff02fp2cp
f03	Age (years)	ff03m1cp	ff03fp1cp	ff03fp2cp
f04	Date of birth (rounded)	zf04m1cp	ff04fp1cp	ff04fp2cp
f08	Relationship to study child	-	ff08fp1cp	-

8.5 Indicator variables

Indicator variables summarise how complete the raw data are for **each measure** (i.e. the participant has no data, partial data, or complete data). These indicator variables relate to the raw data, and not derived data for each measure.

Indicator variables can be found in the data dictionary under the measure "Data completeness indicator".

Indicator variable names follow the format:

A t din xx## [n]

Where:

A = child age indicator

t = subject indicator

din = abbreviation for data indicator

xx## = topic number for relevant measure

[n = an arbitrary letter is added to the end of a limited number of data indicator variable names, where a topic contains two content areas that differ substantially such that the indicator variables are more useful for data users when separated]

8.6 Variable labelling convention

Each variable is labelled with a brief description of the data, generally following the standard format:

(Age) - (Subject/Informant) - (Questionnaire position) - (Description)

The child age indicator, representing the study child's age at the data collection wave, is 11-12.

The next component of the variable label is usually the subject (i.e. SC for study child, P1 for attending parent or P2 for non-attending parent), or less frequently, the informant.

Questionnaire position indicates the location of the question the data were obtained from within the CheckPoint questionnaires or face-to-face interview (e.g., CASI D1 is question D1 of the parents Computer Assisted Interview). Question position is not included in the variable labels of derived items such as scales, direct assessments and other non-input items.

The remainder of the variable label is a brief description of the variable.

8.7 Missing data coding conventions

The LSAC missing value convention uses negative numeric values to code missing data (e.g. -2 = don't know). A number of CheckPoint variables contain data that have legitimate negative numeric values. Therefore, the CheckPoint missing value convention classifies reasons for missing data into similar categories as previous LSAC waves, but using corresponding 'dot alpha' values (e.g. '.b'). Table 8 describes the CheckPoint missing values convention, and how it relates to LSAC's convention.

Table 8. Missing data coding conventions

CheckPoint value	LSAC value	Definition
.a	-1	Not applicable (when explicitly available as an option in the questionnaire)
.b	-2	Don't know (when explicitly available as an option in the questionnaire)
.c	-3	Refused or not answered (for questionnaire items only)
-	-4	Section refused (Not applicable to CheckPoint data)
.d	-9	Data missing where it would be expected to be missing. In CheckPoint, data were not collected due to one of the following reasons: • Parental consent for an assessment or biosample was not provided. • The study child or attending parent refused to participate in an assessment or biosample collection. • A question was not asked due to the answer to a preceding question (e.g. if a child was not currently using any medication, the following question regarding what type of medication was not asked). • The question or assessment wasn't offered as part of the assessment type protocol (e.g. some assessments omitted from Home Visit due to time restrictions and practicalities)
.e	-99	Data missing where it might be expected to exist. In CheckPoint, data were not collected, or were removed, due to one of the following reasons: • Equipment malfunctioned or was not available (e.g. the retinal camera was not working; the pQCT scanner was not available as the radiation use licence was not yet approved) • Deviation from protocol that could not be corrected retrospectively (e.g. visual acuity data collected using incorrect unknown calibration values) • Data were removed due to an impossible value (e.g. weight of attending parent is recorded as 800 kg). • Derived data missing due to insufficient input data (e.g. mean blood pressure requires at least 2 blood pressures readings; data are missing for participants with a single blood pressure reading) • Data missing without a known reason (the participant did not refuse, but no data were recorded) • Not clear which participant the data relates to (e.g. blood sample barcode not linked to a participant)

9 Data imputations and transformations

Data users should be aware of the following data imputations and transformations. Detailed information about the data preparation for each measure are provided in the Data Management SOPs, available from the CheckPoint team, on request. The CheckPoint Data Issues paper provides more detailed information about the data issues and imputations summarised below (available from checkpoint-lsac.mcri.edu.au).

9.1 Data imputation

Limited data imputation was undertaken to resolve the data issues described below. In general, imputation occurred only when there was clear contradiction between data items and good reason to believe one item's accuracy over the other. The specific processes undertaken to investigate and correct the data are provided in the Data Management SOPs and CheckPoint Data Issues paper.

- *Child data of birth: Inconsistencies between data sources.* The Australian Bureau of Statistics provided the CheckPoint team with children's sex and date of birth. These data were checked and/or collected again from the attending parent when they were contacted over the phone, at the *CheckPoint Check-In* (beginning of the assessment visit), on the CheckPoint consent form and at various points during the CheckPoint assessment (e.g. sex and date of birth were entered into the spirometry software prior to lung function testing). Please see the *Demographic Data Management* SOP for more information
- *Weight and body composition: Inconsistencies in repeated measures/Confirmation of participant ID.* These data were recorded in two locations (exported via USB from the BIA machines and manually transcribed into the REDCap data entry page). Incontinences between these data files were investigated and where possible, resolved.
- *Expressive and receptive language: Imputation of incomplete audio recordings*. During the Recalling Sentences subtest of the CELF-4, the CheckPoint team member scored the accuracy of each recalled sentence. An audio recording of the participant's responses was also recorded. One of the iPads used to administer the test had a faulty microphone and in some tests, the audio recording dropped out mid-sentence. There were some instances where a score was not recorded at the face-to-face test, the audio recording drops out, but then resumes, indicating the CheckPoint team member continued the test. We imputed that the missing sentence was recalled correctly.
- *Hospital admissions: data from two sources combined to address incorrect questionnaire branching.* The Parent Questionnaire included questions about the child's overnight hospital admissions (excluding birth). Parents were asked first if their child had hospital admissions (1) 'in the past 12 months', and/or (2) 'prior to the past 12 months'. It was intended that if either or both of these two periods were selected, branched questions would open to ask for more detail about these admissions. Unfortunately, there was an error in the branching logic for hospitalisation questions relating to hospitalisations 'not in the last 12 months'. A total of 641 attending parents reported hospitalisations more than 12 months ago, but additional questions about these admissions were only presented if the attending parent also reported more than one hospitalisation within the last 12 months (64 attending parents).

  In preparation for attending a CheckPoint visit, parents were asked to complete a Pre-Visit Checklist. This checklist reminded attending parents of what to bring, and asked the parent to recall the study child's history of hospital admissions. The CheckPoint staff made a

copy of this document, and passed it back to the parent to use as a prompt when completing the Parent Questionnaire. Hospitalisation data collected on the Pre-Visit Checklist has been transcribed and combined with the attending parent questionnaire responses for a more complete dataset.

9.2 Reshaping of data

Parents reported in their questionnaire if their child had participated in community activities over the last 12 months, and if so, provided details. To assist data users, these data were reshaped and rearranged into variables ready to use in analyses (e.g. fcactc01to fcactc09). This reshaping means that variables do not exactly reflect the way in which questions were asked, but rather how the data collected presented itself. Each activity was assigned a category and sub-category, to allow simple description of the data and remove reliance on string variables (included in our supplementary data file). More information is provided in the CheckPoint Data Issues Paper.

9.3 Consistency of repeated measures across LSAC waves and the CheckPoint module

Some measures in the CheckPoint have also been collected in other LSAC waves (see Table 6 for a list of CheckPoint measures also administered in earlier LSAC waves). Some of these measures are expected to change over time (i.e. body weight), and therefore the CheckPoint data has not been transformed to match other LSAC waves.

Some data not expected to change over time (i.e. date of birth, child-parent biological relationship) were collected in both CheckPoint and other LSAC waves. There are a few instances of discrepancies between the datasets. This may be due to different sources of information (administrative databases vs self-report). The CheckPoint data has not been transformed to match other LSAC waves.

9.3.1 Derivation of summary scores

Derived variables, including summary scores, have been calculated for many measures. The calculation of these variables was based on advice from the CheckPoint Investigators and/or content experts of that particular measure. Given the breadth of CheckPoint measures, decision making on how to generate summary scores, including the treatment of missing data, has been on a measure-by-measure basis.

Where measures in CheckPoint have also been collected in other LSAC waves (see Table 6 for a list of CheckPoint measures also administered in earlier LSAC waves), any summary scores in the CheckPoint dataset may not have been calculated using the same way as previous LSAC waves.

For example, the LSAC wave 6 scoring of the CHU9D was adapted from a 2005 algorithm based on weightings from a sample of the UK general population (The University of Sheffield, 2017) and from a sample of Australian adolescents. The CheckPoint scoring of the CHU9D items used two 2016 weighted algorithms from a sample of Australian adolescents/adults (version 1.0 and 1.1 Dr Gang Chen and Professor Julie Ratcliffe, Flinders University).

Detailed information about how summary scores were derived can be found in the CheckPoint Rationale Document and Data Management SOPs.

10 Important issues for data analysis

Data users should refer to the Child Health CheckPoint Data Issues paper for detailed information about data issues relating to specific measures, including variations in data collection protocols, issues that occurred during the data preparation processes, and where meaningful changes have been made to the data. The Data Issues paper is available on the MCRI website at checkpoint-lsac.mcri.edu.au and/or via Dataverse at dataverse.ada.edu.au/dataverse/ncld. A link is also available on the Growing Up in Australia website (growingupinaustralia.gov.au/about-study) that will direct users to the MCRI CheckPoint website.

More general information relevant to data analysis is provided in this section.

CheckPoint includes a subsample of wave 6 participants; LSAC B cohort families who completed a LSAC wave 6 assessment were eligible and invited to participate in CheckPoint. As such, the principles of the original LSAC study design (see LSAC Data User Guide, and below) are applicable with consideration of CheckPoint participants as subsamples according to the CheckPoint assessment types. The specific CheckPoint subsamples are:

- those who took part at any CheckPoint assessment type
- those who attended a Main or Mini Assessment Centre (rather than Home Visit)
- those who attended a Main Assessment Centre (rather than a Mini Assessment Centre or Home Visit), and
- those who provided a blood sample.

Participants who attended a Main Assessment Centre had the opportunity to undertake the full protocol of measures, and those attending a Main or Mini Assessment Centre had the opportunity to undertake at least most of the measures. Although blood sample collection was offered at most Main and Mini Assessment Centres, the reduced number of participants who provided blood samples resulted in this additional sub-group for analysis purposes.

As summarised in Table 9, there are differences in the demographic and other characteristics of those who participated and did not participate in CheckPoint, hence the use of weights in analyses is an important consideration.

10.1 Weighting and external validity

The LSAC study design, based on a complex probability sample, is specifically designed to produce valid estimates at the population level. Unlike clinically-based or convenience samples, the LSAC sample is population based by design. By properly accounting for the survey design when analysing the data, it is possible not only to make inferences about the study children and families participating in the study but to make valid inferences about the entire population of children in the relevant age groups.

The LSAC and hence CheckPoint sampling strategy has three important elements that distinguish it from a simple random sample:

- *stratification* to ensure proportional representation of all states and both capital city and ex-metropolitan areas.

- *clustering* by postcode to both reduce field enumeration costs and allow the study of community-level effects on children's development and wellbeing.
- *weighting* to adjust for potential non-response bias and to provide population estimates.

It is the responsibility of data users to determine when and how each of these needs to be accounted for when developing their analyses.

10.1.1 Stratification

In LSAC, stratification by state and part of state, was employed to ensure that all geographic areas within Australia are represented in the sample in proportion to their population. This produces a more even distribution of the sample across geographic areas than could be expected from a simple random sample.

The use of stratification can be expected to reduce standard errors compared with a simple random sample with no control over the geographic spread of the sample. As such, when trying to extrapolate to the population, the stratification should be incorporated in the analysis of LSAC or CheckPoint results from the survey in order to correctly calculate standard errors and confidence intervals.

10.1.2 Clustering

The use of clustering in the LSAC sample design has important consequences for the analysis of data from the LSAC and CheckPoint studies. Clustering is useful in reducing the field costs associated with the survey enumeration. Clustering also has the added benefit of making possible the analysis of community-level effects, by ensuring that sufficient sample is selected from each postcode included in the survey.

However, the use of clustering violates the standard assumption of independence of the observations that is fundamental to many statistical routines in major statistical packages. When children or carers have more similar characteristics within a given postcode than children or carers selected purely at random, the responses within postcodes will be correlated. This correlation will lead to an increase in the standard errors and size of the confidence intervals. The extent of this increase is measured by the *design effect*, which is the ratio of the variance of an estimate from the survey to the variance that would have been achieved by a simple random sample of the same size.

Failure to account for clustering in LSAC or CheckPoint analysis can lead to under-estimating the size of standard errors and confidence intervals. In some circumstances this can result in misleading conclusions of statistical significance.

10.1.3 Weighting

The wave 1 weights provided in the LSAC dataset take into account both the probability of selecting each child in the study and an adjustment for non-response. At each subsequent wave of data collection and the CheckPoint, weights have been adjusted to account for the differential probability of response. The weights are then calibrated back to the stratum benchmarks and a small number of cases have their weights top or bottom coded to prevent any case having too great or small an effect on the data.

Since wave 3 of LSAC, child sample weights (cross-sectional and longitudinal) and child population weights (cross-sectional and longitudinal) have been included in the LSAC B cohort dataset. Prior to wave 3, only cross-sectional weights were available (sample, population and time use data). For CheckPoint, only cross-sectional sample (survey) weights have been produced. If cross-sectional population weights are needed, the weights can be multiplied by a constant multiplier provided in Table 9.

The cross-sectional survey weights for CheckPoint should be used to estimate population descriptive quantities such as means, standard deviations, proportions, percentages and medians and may be used for cross-sectional analyses. Cross-sectional survey weights may be used for longitudinal analyses only if the full CheckPoint sample available is used and missing data techniques are applied to address the missing data in previous waves. It is important to note when undertaking weighted analyses for CheckPoint that the variable to use for the primary sampling unit is 'fpcodenw' and 'fstratumw' should be used when specifying the strata.

More detailed information on weighting and survey design in LSAC can be found in the LSAC Data User Guide and in LSAC Technical Papers No. 3, 5, 6, 9, 10, 15 and 20 (see dss.gov.au/about-the-department/national-centre-for-longitudinal-data).

The CheckPoint weighting variables are described in Table 9. For further information about which weighting variable to use, please refer to the technical paper available from checkpoint-lsac.mcri.edu.au:

> Susan Ellul, Richard Hiscock, Fiona Mensah, Susan Clifford and John Carlin. (2018). Longitudinal Study of Australian Children's Child Health CheckPoint Technical Paper 1: Weighting and Non-Response. Melbourne: Murdoch Children's Research Institute. doi: 10.25374/MCRI.5687593

Table 9. Child Health CheckPoint weighting variables

Variable name	CheckPoint subsample	Type/To be used for	Multiplier to use to obtain population weights*
fweightscp	All CheckPoint participants	Cross-sectional survey weight to be used for measures conducted with all study children or all attending parents[1] who participated in CheckPoint. *n=1874*	129.68
fweightsmn	Main Assessment Centre participants	Cross-sectional survey weight to be used for measures conducted with all study children or all attending parents who attended a Main Assessment Centre (not those who had a Mini Assessment Centre or Home Visit). *n=1356*	179.22
fweightsac	Main Assessment Centre AND Mini Assessment Centre participants	Cross-sectional survey weight to be used for measures conducted with all study children or all attending parents who attended a Main Assessment or Mini Assessment Centre (not those who had a home visit). *n=1509*. **Note**: if a measure was only available at the Main Assessment Centre and not the Mini Assessment Centre then the Main Assessment Centre weights should be used.	161.05
fcweightsb	Study child participants who provided a blood sample	Cross-sectional survey weight to be used for measures conducted with study children who provided a blood sample (n=1237) or for pairs of study children and attending parents who both provided a blood sample (n=1200)	196.46
faweightsb	Attending parents who provided a blood sample	Cross-sectional survey weight to be used for measures conducted with attending parents who provided a blood sample (n=1373)	177.00

[1]Attending parents includes adults who participated in CheckPoint who are not biological parents of the study child. *multiplier is the Australian Bureau of Statistics estimated resident population counts of children aged 0 years at end of March 2004 (243,026) divided by the relevant CheckPoint subsample size

11 Response rates and sample characteristics

11.1 Response rates

A total of 5,107 B cohort families participated in LSAC wave 1. Of these, 3,764 (74%) were retained through to LSAC wave 6 and 3,513 (93% of Wave 6 sample) agreed to be contacted by the Child Health CheckPoint.

The main reasons given to interviewers for not consenting to be contacted by the CheckPoint team were being not interested/too busy (57%), not capable/moving/overseas (9%), the husband refused (9%), illness/death (8%) or other reasons (4%). The remaining 13% of families could not be contacted, despite intensive efforts from interviewers.

Approximately half (53%, 1874 families) of the wave 6 sample participated in the Child Health CheckPoint. The majority of visits took place at a Main Assessment Centre (72%, n=1356), with some families choosing to complete their visit at a Mini Assessment Centre (8%, n=153) or as a Home Visit (20%, n=365).

Table 10 provides the total sample size for each CheckPoint data collection instrument and measure. Most of the 1874 CheckPoint families participated in all stations leading to high response rates for all measures (>90%). The exceptions were accelerometry (74-77%, discussed in the Issues Paper) and the Manchester Pain Manikin (62%, discussed in the Issues paper).

Biospecimen collection rates was also high for blood (venous or finger prick, 91% of children and 96% of attending parents) and other biological samples (>70%). Most (95%) of children and parents had either a saliva (collected when laboratory facilities were available) or buccal swab (stable for 60 days before processing) sample. Buccal samples were also collected from 1,051 non-attending parents. In total, 1,021 (55%) families have at least one sample available for the child and both biological parents.

Figures 8 and 9 summarise the number of children and parents with full, partial and no data for each measure, respectively.

Table 10. Sample size and response rates

	Study child			Attending parent			
	Eligible* N	Data available N	Response rate %	Eligible* N	Data available N	Response rate %	Question ID/s
Instruments							
Consent	1874	1874	100%	1874	1874	100%	ch01_03-06
Pre-visit checklist	1874	1874	100%	1874	1874	100%	ch01_07-09
Questionnaire	1874	1863	99.4%	1874	1870	99.8%	ch03*, ch23*, ch24*, ch01_01a-b
Measures							
Height	1874	1872	99.9%	1874	1865	99.5%	height
Waist circumference	1874	1869	99.7%	1874	1848	98.6%	waist
Bioelectrical impedance analysis (2- or 4-limb scales)	1874	1873	99.9%	1874	1862	99.4%	wght, fatm, fatper
Bioelectrical impedance analysis (4-limb scales)	1530	1478	96.6%	1530	1483	96.9%	ch02_01-20
Sexual maturity scale	1874	1752	93.5%	N/A	N/A	N/A	ch03_03a-c
Puberty development scale	1874	1799	96.0%	N/A	N/A	N/A	ch03_01a-g
Menstruation[a]	919	844	91.8%	1644	1610	97.9%	ch03_01g, ch03_02c
Modified Comprehensive Acne Severity Scale	1874	1762	94.0%	N/A	N/A	N/A	ch03_04a
Peripheral Quantitative Computed Tomography	1356	1271	93.7%	1356	1250	92.2%	ch04_02a-s, ch04_05a-o
Vascular ultrasound	1509	1489	98.7%	1509	1476	97.8%	ch05_05a, ddper
Pulse Wave Velocity	1874	1803	96.2%	1874	1675	89.4%	pvavmn
Pulse Wave Analysis	1874	1735	92.6%	1874	1717	91.6%	any of cspmn, cdpmn, caixmn
Blood pressure (peripheral)	1874	1777	94.8%	1874	1749	93.3%	brspmn or brdpmn
Retinal photography	1356	1307	96.4%	1356	1317	97.1%	ivava
Spirometry	1874	1759	93.9%	1874	1774	94.7%	ch08_02a, ch08_04a
Recalling sentences subtest of the CELF-4	1509	1441	95.5%	1509	1446	95.8%	rstotal
National Institutes of Health Picture Vocabulary test	1530	1443	94.3%	1530	1457	95.2%	ch10_02
Pure tone audiometry	1509	1488	98.6%	1509	1493	98.9%	3fbest
Tympanometry	1158	1099	94.9%	1158	1101	95.1%	tm3l, tm3r
Listening in Spatialised Noise – Sentence Test	1509	1483	98.3%	1509	1482	98.2%	ch13_01
Snack observation	1357	1299	95.7%	1357	1274	93.9%	grams

	Study child			Attending parent			
	Eligible* N	Data available N	Response rate %	Eligible* N	Data available N	Response rate %	Question ID/s
Accelerometry and activity logs	1874	1382	73.7%	1874	1440	76.8%	ch15_01a
Multimedia Activity Recall for Children and Adults (MARCA)	1874	1830	97.7%	N/A	N/A	N/A	profiles
Eurofit broad jump	1874	1771	94.5%	N/A	N/A	N/A	dstmax
PWC170 VO_2 max test	1356	1301	95.9%	N/A	N/A	N/A	vo2mxl
Freiburg Visual Acuity Test (FrACT)	1513	1494	98.7%	1513	1491	98.5%	ch19_01a-b
2D and 3D digital photographs of the teeth and tongue	1509	1486	98.5%	1509	1480	98.1%	ph2dav, ph3dav
3D digital photographs of the face	1356	1331	98.2%	1356	1316	97.1%	ph3dav
Handwritten story about life at age 25	1874	1811	96.6%	N/A	N/A	N/A	la25av
International Survey of Children's Wellbeing	1874	1854	98.9%	N/A	N/A	N/A	ch23_08a-f
PedsQL General Wellbeing Scale Child, Adolescent and Young Adult Report	1874	1860	99.3%	N/A	N/A	N/A	ch23_01-02
Pediatric Quality of Life Inventory (PedsQL) version 4.0 child self-report	1874	1854	98.9%	N/A	N/A	N/A	ch23_03-06
Assessment of Quality of Life AQoL 8D	N/A	N/A	N/A	1874	1863	99.4%	ch23_09-16
Child Health Utility 9D	1874	1850	98.7%	1874	1863	99.4%	ch23_07a-i
Manchester Pain manikin	1874	1586	84.6%	1874	1859	99.2%	ch24_01a-c, ch24_02a-ch24_03y ch24_01a
Modified National Secondary Students' Diet and Activity	1874	1846	98.5%	1874	1862	99.4%	ch25_01a-03b
Family allergies	N/A	N/A	N/A	1874	1849	98.7%	ch26_03a-08h
Pet exposure	N/A	N/A	N/A	1874	1860	99.3%	ch26_09a
Eczema severity and treatment	1874	1857	99.1%	N/A	N/A	N/A	ch27_01a, ch27_02a
Natural skin, hair and eye colouring	1874	1859	99.2%	1874	1859	99.2%	ch28_01a-c
Medications and supplement use	1874	1853	98.9%	N/A	N/A	N/A	ch29_01a, ch29_06a
Health insurance	1874	1858	99.1%	N/A	N/A	N/A	ch30_01a, ch30_01b
Hospital admissions	1874	1858	99.1%	N/A	N/A	N/A	ch30_56a, hadmcnt

	Study child			Attending parent			
	Eligible* N	Data available N	Response rate %	Eligible* N	Data available N	Response rate %	Question ID/s
Visits with health providers	1874	1859	99.2%	1874	1840	98.2%	ch30_13a-ch30_40f, ch30_4, ch30_42a-ch30_51f, ch30_52a
Community Activities	1874	1822	97.2%	N/A	N/A	N/A	ch31_01a-g
Biospecimens							
Venous blood	1489	1237	83.1%	1489	1373	92.2%	cb01_01a
Whole blood	1162	929	79.9%	1162	1016	87.4%	cb01_01h
Plasma	1489	1230	82.6%	1489	1371	92.1%	cb01_01d, cb01_01f
Buffy coat	1452	1200	82.6%	1452	1335	91.9%	cb01_01e, cb01_01g
Serum	1452	1191	82.0%	1452	1336	92.0%	cb01_01b
Blood clot	660	531	80.5%	660	591	89.5%	cb01_01c
Dried blood spot	1874	1424	76.0%	1874	1467	78.3%	cb01_02a
5-minute drool saliva	1439	1375	95.6%	1439	1392	96.7%	cb01_01j
Buccal swab	435	398	91.5%	435	390	89.7%	cb01_01k
Urine	1874	1595	85.1%	1874	1686	90.0%	cb01_01i
Hair	1561	1390	89.0%	1561	1439	92.2%	cb01_02b
Toenail	1874	1586	84.6%	N/A	N/A	N/A	cb01_02c

* If the instrument/measure was available at visit type participants were eligible, participants who refused were eligible as were those where an equipment malfunction occurred; [a]question only administered to female participants; N/A instrument/measures not offered. Where multiple question IDs are listed, data available from any of these questions was included.

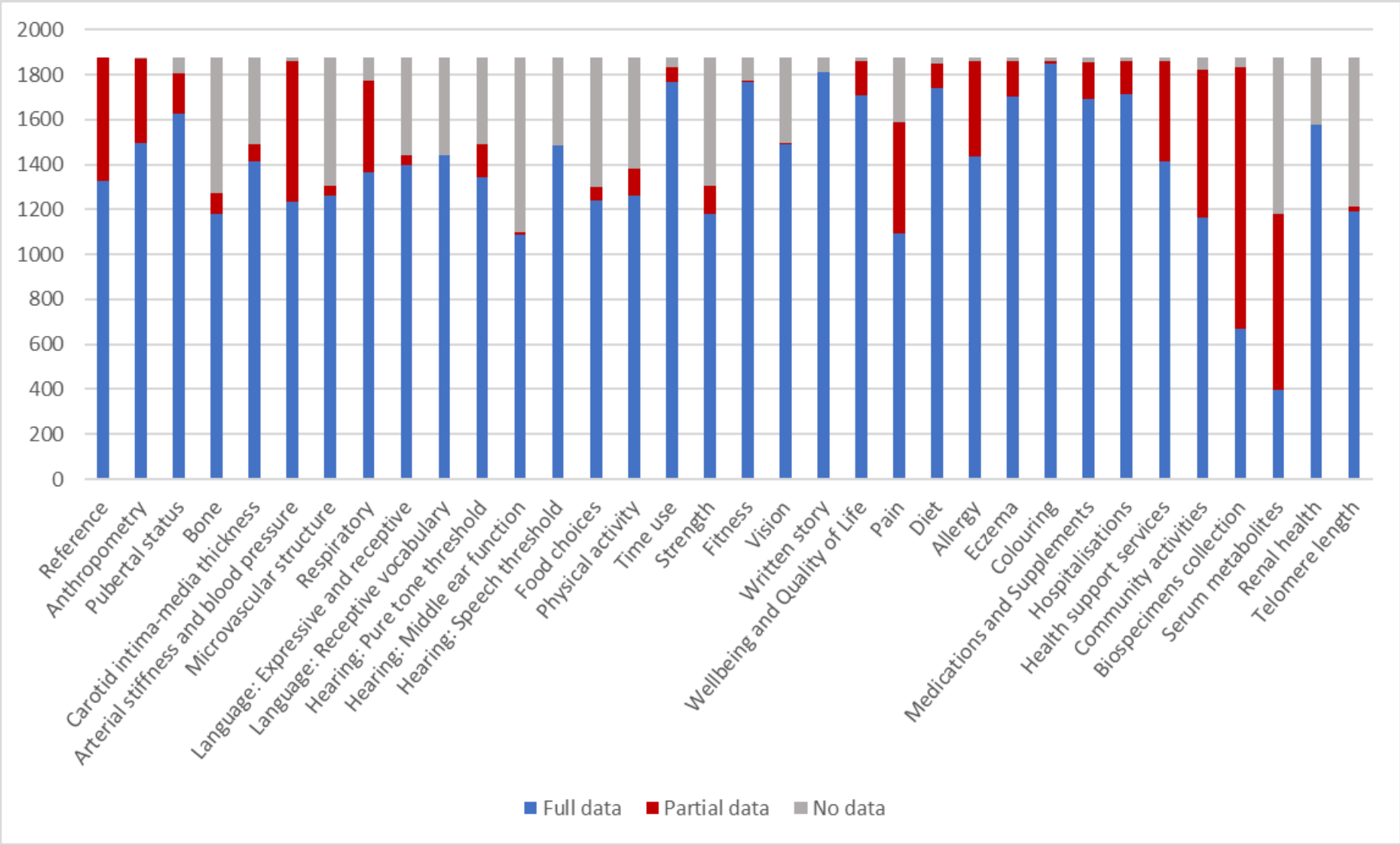

Figure 8. Data completeness per measure for study children

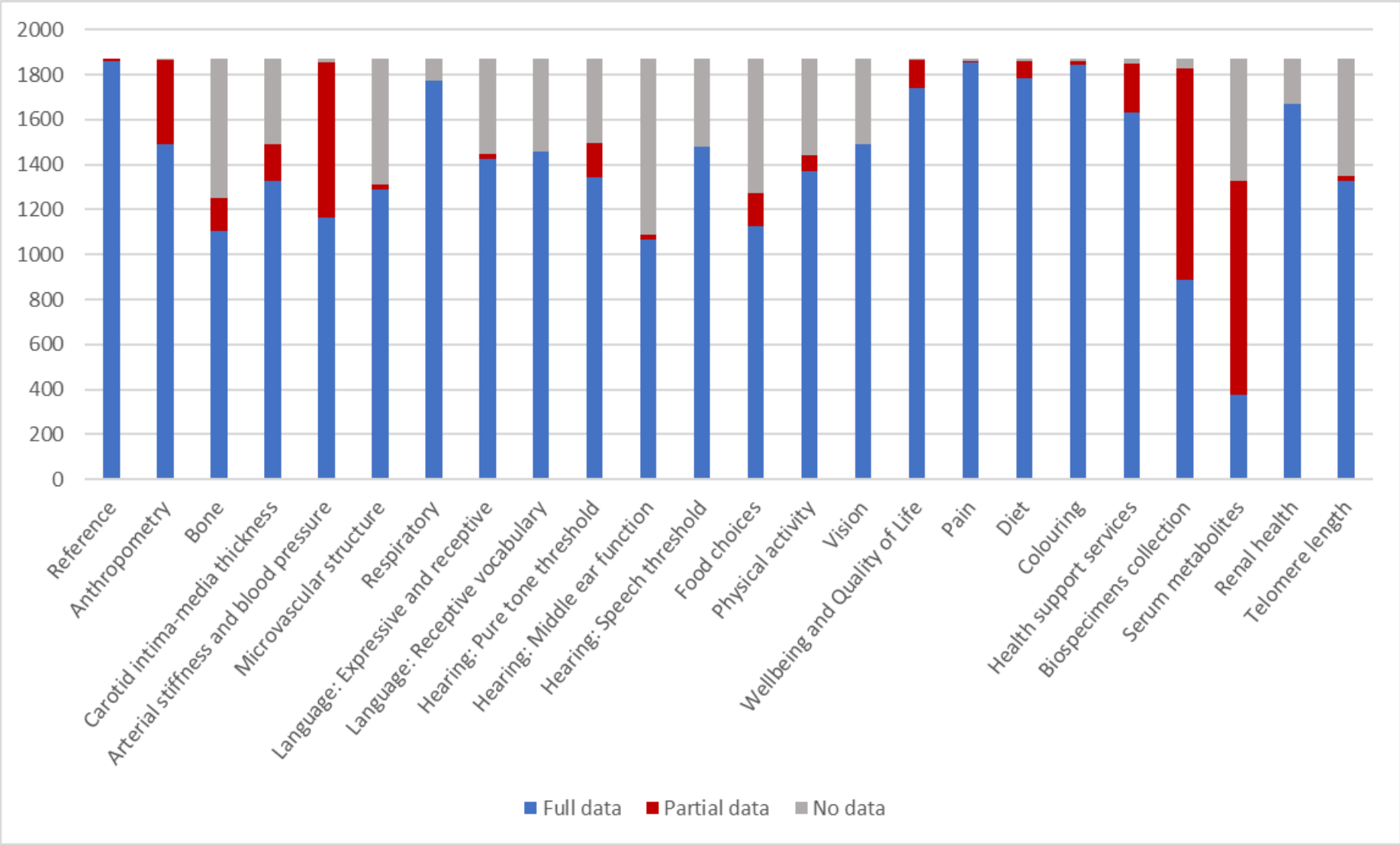

Figure 9. Data completeness per measure for attending parents

11.2 Sample characteristics

Table 11 describes the baseline characteristics (collected at LSAC wave 1) of the CheckPoint sample, and the families who participated in LSAC wave 6 but not CheckPoint. The age and sex of CheckPoint responders and non-responders were similar; however, CheckPoint attending parents were slightly older, more likely to have completed university studies and more likely to live in a less disadvantaged areas than those who did not participate in CheckPoint.

The CheckPoint dataset contains sample weights which enable analyses that are more reflective of LSAC's original design sample of Australian children and their families. More information is available elsewhere (Ellul et al., 2018).

Table 11. Baseline sample characteristics of CheckPoint responders and non-responders

Characteristic (%, unless indicated)	**Baseline characteristics** (2004)[2]	
	In CheckPoint n=1,874 families	**Not in CheckPoint** n=3,233 families
Child age in years, mean (SD)	0.8 (0.2)	0.8 (0.2)
Parent age in years, mean (SD)[1]	32.1 (4.9)	30.4 (5.7)
Female child	49.0	48.9
Female parent	98.7	98.5
Child is biological child of parent	99.7	99.7
Australian state or territory of residence		
Aust. Capital Territory	2.9	1.6
Northern Territory	2.9	1.6
New South Wales	29.9	32.6
Queensland	20.0	20.1
South Australia	7.5	6.4
Tasmania	3.2	1.6
Victoria	22.2	25.8
Western Australia	11.8	9.7
Neighbourhood disadvantage[3], mean (SD) and % in national quintiles	1018.6 (61.2)	1003.1 (58.9)
1 (least disadvantaged quintile)	29.0	18.9
2	20.3	19.8
3	19.3	21.6
4	19.8	21.7
5 (most disadvantaged quintile)	11.6	18.1
Parent's highest level of education*		
Did not complete high school	21.4	39.0
High school	42.3	39.9
Undergraduate degree (to Bachelor level)	26.6	15.5
Postgraduate degree (Honours, Masters, Doctorate)	9.7	5.7
Parent has a spouse/partner	95.7	91.3

[1] Parent data relates to the parent who participated in the CheckPoint visit ('Attending parent'). [2]Data collected in 2004 during LSAC wave 1. Parent data relates to the parent who knew most about the study child at time of wave 1 interview ('Parent 1'). The parent who attended the CheckPoint visit was the same person as wave 1 Parent 1 for 89.3% of families. [3]Australia Bureau of Statistics 2011 SEIFA Index of Relative Socioeconomic Disadvantage([ref] (Australian Bureau of Statistics, 2011)) *Data collected in LSAC wave 6.

11.2.1 Child age at assessment

Different ages of study children should be accounted for in any analyses focused on age-dependent measures (e.g. puberty). Figure 10 shows the age distribution of children when they had their Child Health CheckPoint visit. Children were aged on average 12.4 years (standard deviation 0.4) and attending parents averaged 44.4 years (standard deviation 5.2) of age. Because the Child Health CheckPoint assessment required expensive medical equipment and a large experienced staff (10-12 staff in school term, up to 24 staff in school holidays), a single 'pop-up' Assessment Centre travelled city to city across Australia (see section 3.2.3). This resulted in small age differences in the study children seen in each state and territory.

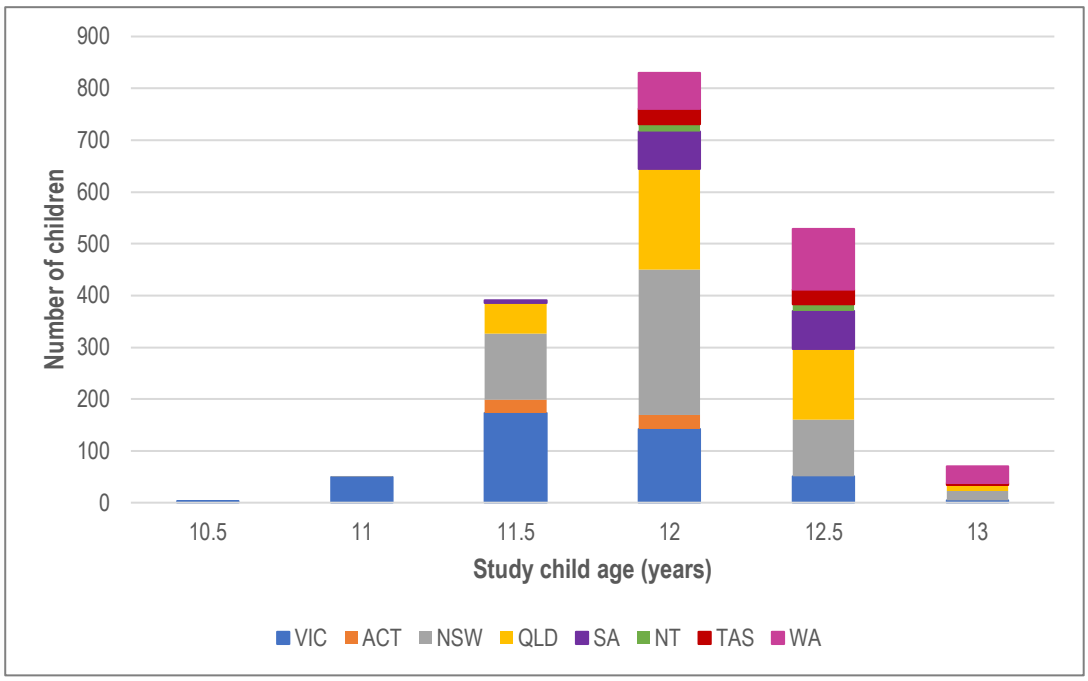

Figure 10. Study child age distribution, by state or territory

Towards the end of data collection (i.e. Dec 2015-March 2016), individual staff travelled to a city or town for 2-4 days to undertake Home Visits. For example, while the Main Assessment Centre was operating in Perth, a small number of Home Visits were taking place in Queensland and New South Wales. These interstate home visits facilitated a higher response rate than had only Assessment Centre visits been offered and resulted in a wider age range in each state.

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