Creating and testing neighbourhood built environment indicators for better child development outcomes

Australian Early Development Census – Built Environment (AEDC-BE) study

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Report prepared for the Australian Government Department of Education, Skills and Employment

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Abbreviations

ABS	Australian Bureau of Statistics
ACECQA	Australian Children's Education & Care Quality Authority
AEDC	Australian Early Development Census
AIFS	Australian Institute of Family Studies
BE	Built environment
ARIA	Accessibility / Remoteness Index of Australia
DESE	Australian Government Department of Education, Skills and Employment
DV1	Developmentally vulnerable on one or more AEDC domains
ECD	Early childhood development
ECEC	Early childhood education and care
GIS	Geographic information systems
HREC	Human Research Ethics Committee
MCMC	Markov chain Monte Carlo
MCRI	Murdoch Children's Research Institute
MQL	Maximum Quasi Likelihood
NHSD	National Health Services Directory
NQS	National Quality Standard
POS	Public Open Space
PQL	Penalized Quasi Likelihood
PT	Public transport
RCH	Royal Children's Hospital
RMIT	Royal Melbourne Institute of Technology
SA1	Statistical Area 1 (from ABS)
SA2	Statistical Area 2 (from ABS)
SEIFA-IRSD	Socio-economic Index for Areas - Index of Relative Socio-economic Disadvantage
SRC	Social Research Centre
UNICEF	United Nations Children's Fund

Executive summary

Background

Healthy development in the early years lays the foundations for children's ongoing physical, emotional, and social development. Children grow and develop in multiple contexts, including their local neighbourhood.[1] The relationship between neighbourhood disadvantage and early childhood development (ECD) outcomes is well known, research into which factors might contribute to this relationship is mounting. In disadvantaged communities, lack of local resources and opportunities can contribute to worse ECD outcomes that can persist from one generation to the next.[2, 3] The neighbourhood built environment is an important facet of the neighbourhood context that is modifiable by policy and practice at scale; addressing inequitable provision of essential neighbourhood amenity and resources has been identified as a way to help reduce inequitable health outcomes. Built environment characteristics such as housing, walkability, traffic exposure, availability of services, facilities and parks, have been associated with a range of health and wellbeing outcomes across the life course[4, 5] but associations with outcomes in the early years are still emerging.[6, 7]

Global and Australian place-based initiatives increasingly advocate and seek to create healthy neighbourhoods for families and children and reduce inequities.[8, 9] Yet evidence-based metrics and data needed to inform more effective place-based interventions and leverage policy change for healthier and more equitable ECD are lacking. Recent academic reviews and perspectives emphasise the need for more research into the modifiable neighbourhood factors likely to benefit outcomes for young children.[10, 11] The overall aim of this report is to examine whether built environment features contribute to associations between neighbourhood disadvantage and ECD (**Figure 1**). To achieve this, our objectives are to:

- Objective 1: Analyse associations between neighbourhood disadvantage and ECD outcomes
- Objective 2: Examine associations between built environment features and ECD
- Objective 3: Examine whether built environment features contribute to associations between neighbourhood disadvantage and ECD

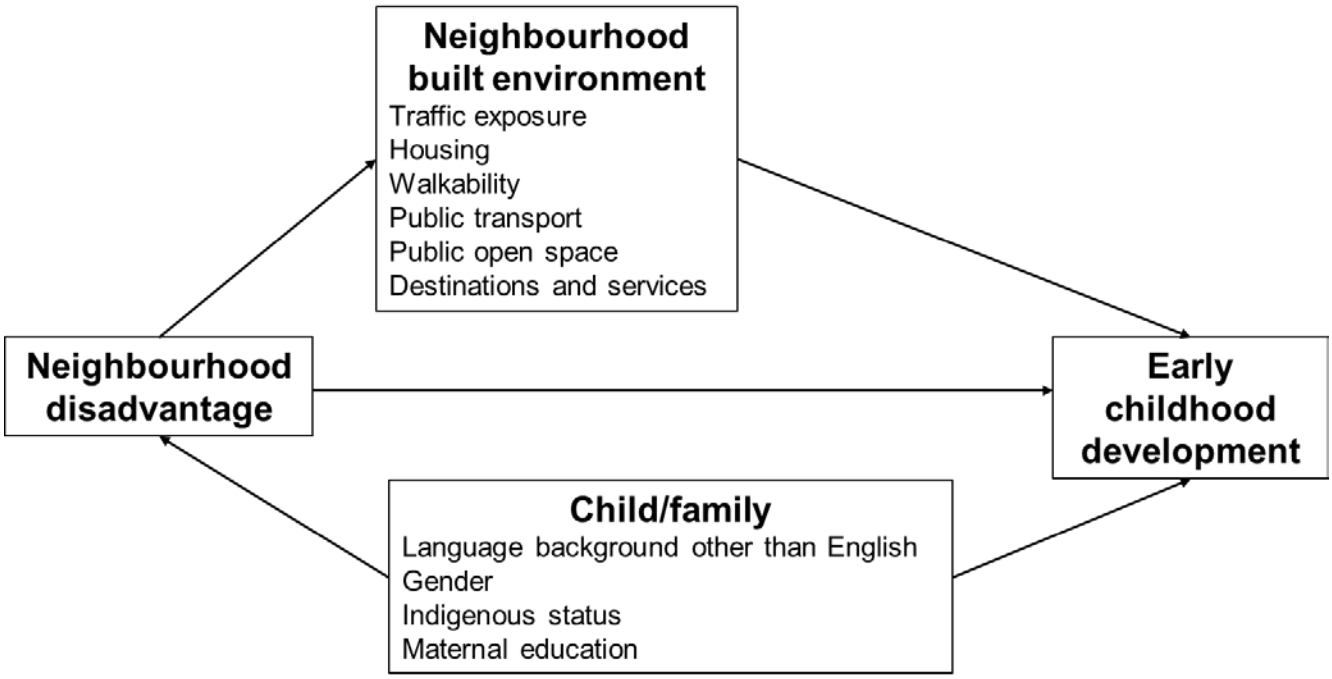

Figure 1. Framework for exploring built environment contributions to neighbourhood disadvantage and early childhood development

Methods

A dataset of spatial (objectively-measured) neighbourhood built environment (BE) measures harvested largely from open source data, were linked to participant addresses in the 2015 Australian Early Development Census (AEDC) for children living in the 21 largest (most populous) urban and regional Australian cities.[12, 13] This linked dataset (AEDC-BE) is the first of its kind worldwide, enabling the capacity to identify which features of the built environment are associated with ECD across Australia at scale (national coverage), and allow comparisons between diverse contexts. Australia is the only country internationally to have an ECD census, meaning it is representative of children at school entry, and makes the AEDC-BE globally unique. National coverage allows the statistical power to explore modelling that accounts for real-world complexities, e.g. variations in relationships by city, state/territory, remoteness.

The 2015 AEDC contains teacher-reported national data on five key child development domains for children in their first year of formal full-time schooling (approximately five years old). AEDC scores classified as 'developmentally vulnerable' (≤10th centile) were determined based on cut-off scores established in the 2009 AEDC. Over 40 built environment measures theoretically conceptualised as being important for ECD were tested with developmental vulnerability on at least one domain of the AEDC, an outcome commonly reported on in AEDC findings.

The built environment measures included traffic exposure, housing affordability, housing density, walkability, count of and distance to public transport, early childhood and education care services, and a range of local family-friendly destinations including public open space. These measures were specifically developed for each child's local area (e.g. 1,600m or 3,200m street network around a child's home address or small-area administrative level) allowing for a more accurate representation of an individual's 'local neighbourhood'. Multilevel binary logistic regressions were used to examine associations between neighbourhood disadvantage, built environment characteristics and developmental vulnerability across major cities and regional cities in Australia.

Findings

The final AEDC-BE analytic dataset consisted of complete case analysis for 205,030 children; 89.2% living in major cities. In major cities (a mixture of urban and large regional cities), we found that children with more ECEC services (OR 0.997) and preschool services (OR 0.991) exceeding Australian standards, and access to more healthier food outlets within 3,200m of their home (OR 0.999) had decreased odds of child developmental vulnerability, controlling for socioeconomic factors and neighbourhood disadvantage. We also found further distances to playgrounds was associated with lower odds of child developmental vulnerability. In regional cities, increased housing affordability stress (OR 1.004) and fewer high-rise density housing (OR 0.996) were associated with higher and lower odds of child developmental vulnerability respectively. Neighbourhood disadvantage remained significantly associated with child developmental vulnerability after adjustment for child/family variables and built environment characteristics. Neighbourhood disadvantage at all quintiles attenuated only slightly after adjustment for built environment characteristics, suggesting the built environment had a small influence on the relationship between neighbourhood disadvantage and ECD.

Implications and next steps

Based on our findings, access to ECEC services exceeding national quality standards (within 3,200m), and housing affordability and density were among the first set of promising indicators objectively related to ECD at a large scale. However, these indicators depend on context (e.g. major city vs. regional city) and potential inter- and intra-city differences need to be examined. Further research includes: 1) testing additional built environment measures conceptualised as important for ECD; and: 2) developing and utilising synthetic data to account for social, socio-demographic and neighbourhood compositional factors at the household level currently missing from the AEDC-BE dataset. This will enable better identification of the multiple and complete pathways in which the neighbourhood, including household-level disadvantage, influences ECD.

Part 1 Background

1.1 Early childhood development

The early years (0-8 years) is one of life's critical development periods seen as the foundation for human capital and the basis for future community and economic development.[14] Children who are exposed to positive, stimulating environments in their first eight years of life experience optimal foundations for their ongoing physical, social, emotional, and cognitive development.[7] Multiple factors, including children's individual, family, and environmental (both social and physical) characteristics in which they are raised shape early childhood development (ECD) outcomes.[2]

1.2 Neighbourhood importance for early childhood development

The neighbourhood setting is an important social determinant of ECD; previous research demonstrates local neighbourhood environments influence the capacity of families to raise their children in ways that promote good developmental outcomes.[15] Research consistently shows strong associations between geographic disadvantage and developmental outcomes.[16, 17] Disadvantaged neighbourhoods represent social and economic contexts that are often under-resourced or excluded from the opportunities needed to support good developmental outcomes.[17] Differences in area-level disadvantage have been associated with inequities in ECD outcomes such as developmental delay and behavioural and mental health problems.[18] For example, the 2015 Australian Early Development Census (AEDC), a population measure of ECD found that Australian children living in the most disadvantaged neighbourhoods, compared with the least, were 4.1 times more likely to be developmentally vulnerable on at least one of the five AEDC domains.[19] Addressing geographic disadvantage and inequitable ECD outcomes is gaining research and policy momentum[20], with actions on the social determinants of health viewed as a way to narrow ECD inequities at the population level.

1.3 Neighbourhood built environments and early childhood development

The neighbourhood built environment is one facet of neighbourhoods that can be modified by policy and practice intervention. This means finding the right leverage points can have wide-reaching and ongoing effects for population health and wellbeing.[21] Indeed, Australian place-based initiatives (e.g. Logan Together, Stronger Places Stronger People, Opportunity Child),[22, 23] international 'child-friendly city' agendas[8] and agencies[24] advocate the neighbourhood as a mechanism to promote ECD and wellbeing, with researchers, policymakers and practitioners wanting more targeted decision support analytics and tools to assist with designing 'child-friendly' neighbourhoods and reducing inequities.[25] In terms of the built environment, 'child-friendly' cities advocate for children to access safe, secure and clean built environments with quality social services, access to green spaces, and places to play and enjoy.[8] Other examples of potentially important neighbourhood built environment characteristics include housing type and layout, walkable street design, traffic exposure, and other social infrastructure (e.g. libraries, community centres).[26]

Research exploring neighbourhood built environment effects on child health outcomes is not new, with relationships between built environment and older children's physical activity, sedentary behaviours, and health outcomes (e.g. obesity, asthma) existing.[27-29] More recent research suggests that objective measures of the built environment are associated with early childhood outcomes,[30, 31] however the evidence base is still emerging.[32] Moreover, differences in the strength of associations may vary by neighbourhood disadvantage.

Evidence-based metrics and indicators are valuable policy and planning tools to benchmark and monitor neighbourhoods.[33] Yet neighbourhood built environment indicators that can be used to inform place-based initiatives are lacking, despite increasing policy and practice interest in evidence-based metrics. In other health and place-based research, spatial measures of the neighbourhood built environment (e.g. access to green space) have been linked to population datasets to explore objective relationships with well-being outcomes,[34] and subsequently used to develop spatial indicators that can be visualised and applied to planning healthy and liveable neighbourhoods.[34] Emerging methodological capabilities (e.g. data linkage, Geographic Information Systems (GIS) software) and big data availability can be used to pursue this research in the ECD context; objective measures of the built environment linked to ECD outcomes present new opportunities to identify and utilise meaningful ECD-relevant neighbourhood indicators.[35]

1.4 Aims and objectives

The relationship between neighbourhood disadvantage and ECD is well known, however research into which factors might contribute to this relationship is mounting. The built environment could be one platform to intervene. This research aims to examine whether built environment features contribute to associations between neighbourhood disadvantage and ECD. To achieve this, our objectives are to:

- Objective 1: Analyse associations between neighborhood disadvantage and ECD
- Objective 2: Examine associations between built environment features and ECD
- Objective 3: Examine whether built environment features contribute to associations between neighbourhood disadvantage and ECD

1.5 Foundational work

This work has been informed by an ongoing major 'child liveability' work program that draws from earlier reviews[6, 7] and the Kids in Communities Study, an investigation into community-level influences on ECD in 25 communities across five states and territories.[36] Using mixed methods, the study investigated factors in five community domains: governance, physical (built), service, social, and socioeconomic environments. From this investigation, a range of 'Foundational Community Factors' that plausibly lay the foundations of an optimal community for young children were identified. Built environment-specific Foundational Community Factors included parks, public transport, traffic safety, walkability, facilities and services, and housing emerged from qualitative findings,[37] but remain quantitatively untested. A key recommendation from the Kids in Communities Study was to develop quantitative indicators.

Funding from the Australian Federal Government Department of Social Services and the Bernard van Leer Foundation (Netherlands) supported the development of Australian Early Development Census – Built Environment dataset, a linked dataset of built environment spatial measures to the 2015 Australian Early Development Census (AEDC).[38] The linked dataset is hereafter referred to as the AEDC-BE. Further funding from the Australian Federal Government Department of Education, Skills and Employment supported our ongoing pilot testing of the AEDC-BE. The following sections presents the methods, analysis and findings of the AEDC-BE pilot testing.

Part 2 Methods

2.1 Study design

The AEDC-BE is a dataset of spatial neighbourhood-built environment measures linked to unique home addresses of children from the 2015 AEDC residing in Australia's 21 most populous cities as included in the National Cities Performance Framework[13] capital cities and 13 major cities with populations ≥80,000, plus Western Sydney.[39] Regional and remote areas were excluded as the built environment measures were conceptualised for urbanised areas. The cities span all of Australia's states and territories. Australia is the first country to have an ECD 'census', and to collect this point in time data at a national level. The AEDC is the most comprehensive collection of this kind in the world, and has an overall participation rate of 96.5% of children at school entry.[40] Consequently, the AEDC-BE is a globally unique dataset.

2.2 Data linkage process

The Social Research Centre provided the 2015 AEDC content data (geocoded addresses, demographics, outcome data, and other variables) to the Australian Institute of Family Studies (AIFS). The 2015 AEDC cohort includes 302,003 participants. AIFS, an approved data linkage body, provided a de-identified list of AEDC participants' geocoded home address locations to RMIT University (spatial analytical team) that included an additional ~5% false addresses to preserve participant anonymity (see **Figure 2**). Geocodes were linked to residential address points in the 21 cities for which local neighbourhood built environment measures had been calculated. Overall, 248,744 (99.96%) of supplied address points (including dummy addresses) were successfully linked with address level spatial measures of the local neighbourhood, with a median match distance of less than 2m (99th percentile of 64m; range 0-499m). There were 70,759 addresses which were not linkable to residential address points within the 21 cities. The linked dataset with local neighbourhood built environment measures was returned to AIFS, who then removed the false addresses, integrated the spatial measures with the AEDC data, and de-identified the dataset for return to the research team, resulting in records for 235,631 children living in the 21 largest cities, representing 78% of the total 2015 AEDC cohort.[41]

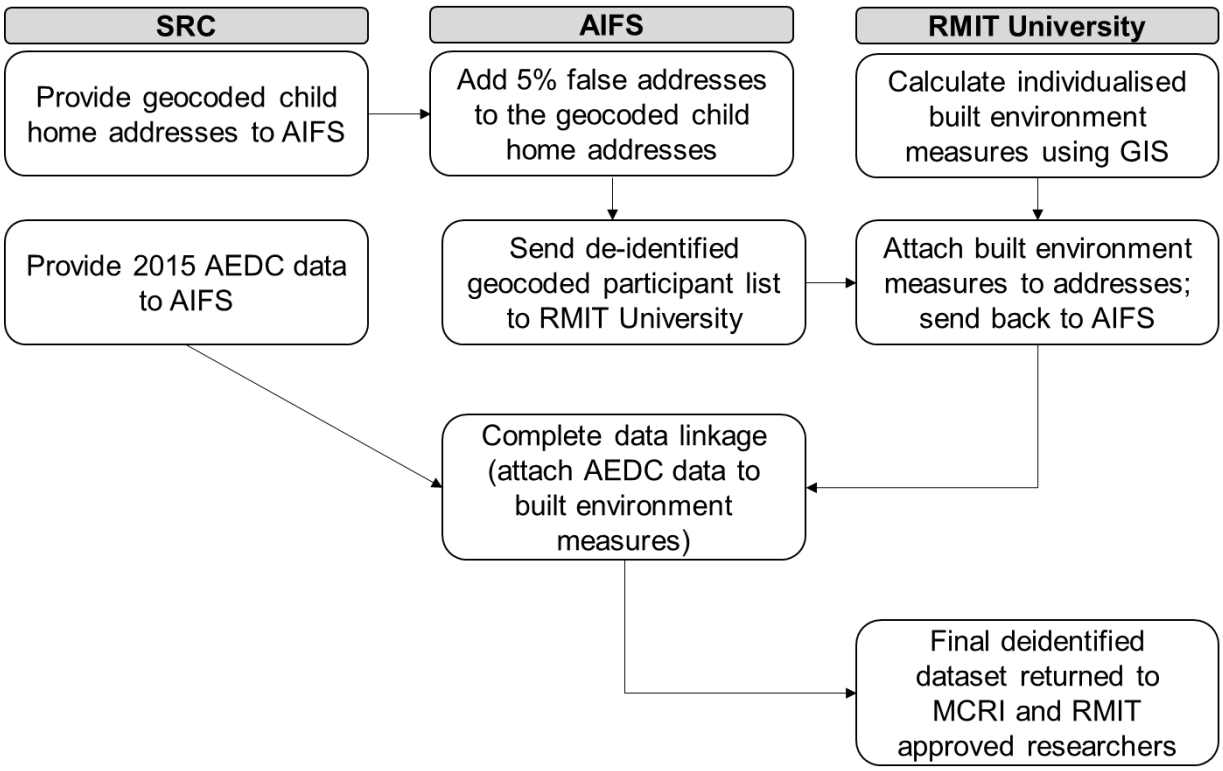

Figure 2. Data linkage process

Key: AEDC: Australian Early Development Census. AIFS: Australian Institute of Family Studies. MCRI: Murdoch Children's Research Institute. SRC: Social Research Centre. Source:[12]

2.3 Ethics approvals

Approvals from the Royal Children's Hospital (RCH) Human Research Ethics Committee (HREC) (#30016), RMIT University HREC (#20749), AEDC data custodians (DESE/SRC; 180130C), and the authorised data linkage agency (AIFS) were obtained for this project. A Memorandum of Understanding between AIFS and the Australian Government Department of Education, Skills and Employment was also agreed.

2.4 Early childhood development data

2.4.1 Australian Early Development Census

The Australian Government has made a commitment to collect the AEDC every three years as part of the Government's commitment to early childhood education and care. The first national AEDC data collection was in 2009 through a partnership between the Royal Children's Hospital, Murdoch Children's Research Institute's Centre for Community Child Health and the Telethon Kids Institute. Since the first national collection in 2009, the AEDC has been funded by the Australian Government through the Department of Education, Skills and Employment. The AEDC is an

internationally-validated and reliable Australian child population measure of ECD, and provides teacher-reported national data on five key child development domains for children in their first year of formal full-time schooling (approximately five years old): physical health and wellbeing, social competence, emotional maturity, language and cognitive skills (school-based) (e.g. academic learning), and communication skills and general knowledge.[40] (see **Table 1**). The full list of items contributing to the five developmental domains are available online (https://www.aedc.gov.au/).

Table 1. Descriptions of developmental domains in the AEDC

Domain	Domain description
Physical health and wellbeing	Children's physical readiness for the school day, physical independence and fine motor skills.
Language and cognitive skills (school-based)	Children's basic literacy, interest in literacy, numeracy and memory, advanced literacy and basic numeracy.
Emotional maturity	Children's pro-social and helping behaviours and absence of anxious and fearful behaviour, aggressive behaviour and hyperactivity and inattention.
Social competence	Children's overall social competence, responsibility and respect, approach to learning and readiness to explore new things.
Communication skills and general knowledge	Children's communication skills and general knowledge based on broad developmental competencies and skills.

Key: AEDC: Australian Early Development Census. **Notes:** Reproduced directly from source[19]

2.4.2 Outcome measure

The five AEDC domains are salient and interrelated aspects of ECD, with every child scored between zero and 10 on each domain; higher scores indicating better developmental status.[40] Each domain is then subsequently categorised as: 'developmentally vulnerable' (≤10th centile), 'developmentally at risk' (11th to 25th centile), or 'developmentally on track' (≥26th centile) based on cut-off scores established in 2009. The cut-off scores established in 2009 provide a reference point against which later AEDC results can be compared and they have remained the same across all collection cycles.[40] Children who were developmentally vulnerable (at risk) on one or more of the AEDC domains (i.e. DV1) was the outcome of interest for this report.

2.4.3 Other measures

Other AEDC measures used in this report either for descriptive or adjustment purposes in analytic models, are described in **Table 2**, and available in the AEDC data dictionary.[42] Demographic information for each child (age, sex, Indigenous status, language background and country of birth) was sourced from school administrative records or those held by various state government Departments of Education.[40] The child's home address is used to determine area-level remoteness and neighbourhood socioeconomic position based on Census administrative data.

Table 2. Descriptions of AEDC sociodemographic measures used in analyses presented in this report

Measure	Description	Categories
Maternal education*#	The highest level of schooling completed, post-school qualification pertaining to 'parent 1' as a proxy of maternal education	< Year 12 Year 12 (no post-school qualification) and/or other post-school qualification (e.g. Trade Certificate) Bachelor's degree or higher
Age group#	Age group of the child	< 5 years old 5 years old ≥ 6 years
Sex	Sex of the child	Male Female
Language background other than English	Child has a language background other than English	No Yes
Indigenous status	Child is of Aboriginal or Torres Strait Islander descent	No Yes
Special needs status	Child has special needs	No Yes
Neighbourhood disadvantage[43]	Socio-Economic Index For Areas – Index of Relative Socio-Economic Disadvantage (SEIFA-IRSD) of the $SA1_1$ of the child's home address	Quintile 1 (most disadvantaged) Quintile 2 Quintile 3 Quintile 4 Quintile 5 (least disadvantaged)
Remoteness[44#]	Accessibility and Remoteness Index of Australia (ARIA) code of the AEDC Local Community	Major city Regional city

Key: #Derived from original variable categories
Notes: SA1: Statistical Area Level 1, 400 persons on average (see report footnote1). *While parent 1 in the AEDC is treated as the mother, they might be male (e.g. father, grandfather). The highest level of schooling completed is often not a reliable indicator of overall education level, as the post-school qualification could be a university degree or Certificate III, recognised as being educated to higher than Year 12 completion. Source:[42]

2.5 Built environment data

2.5.1 Built environment measures and scales

Table 3 describes the built environment measures of this study. Further information is available in the metadata section of the Australian Urban Observatory[45] (https://auo.org.au/portal/metadata). Built environment measures (**Table 3**) were calculated at the smallest appropriate geographical scale available, in most instances being the parcel level (i.e. child's residential address). Using this fine-grained approach limits the impact of the modifiable areal unit problem (i.e. bias due to aggregating geographic scales) and ecological fallacy (i.e. inferences about individuals deduced from aggregated group data) that are associated with larger geographic units typically employed in child place-based research (e.g. cities, suburbs/postcodes).[46]

Street network analyses were used to calculate count of each destination type up to 3,200m and distance to the closest destination (e.g. distance to closest public library). Dependent on the neighbourhood feature of interest, scales of analysis (e.g. 1,600m or 3,200m) were chosen to

represent a child's local neighbourhood as appropriate. A 1,600m buffer has commonly been used in previous studies to represent a child's and adult's local neighbourhood; parents for example have reported that they would allow their child to walk a 1,600m round-trip from home.[47] To account for the likely presence of some destinations at larger area scales (e.g. less common that children have ECEC services[48] and family-friendly destinations such as public libraries and community centres within 1,600m of home), 3,200m was used for some attributes. This means that although some children may have had destinations available beyond 1,600m or 3,200m, analyses were capped at (limited to) these street network distances to reflect a child's local 'walkable' neighbourhood. Children with nearest destinations estimated to be beyond these thresholds were excluded from the relevant analyses. In addition to address-level distance-based measures of built environment characteristics and accessibility, SA1[1] neighbourhood characteristics were also examined.

[1] Australian Bureau of Statistics (ABS) administrative unit for geographic area of ~400 persons, akin to a local neighbourhood and the usual scale at which ABS census data (e.g. household income and expenses) is released.

Table 3. Built environment measures used in analyses presented in this report

Measure	Spatial unit	Description	Interpretation
Traffic			
Traffic exposure	SA1	Length of higher volume roads/length of lower volume roads (kilometre). It is based on 2017 PSMA Transport and Topography data (see **Appendix 1**). The calculation includes the length (km) of road types ((301 + 302 + 303 + 304)/ (305 + 309 + 400)). (301=national state highway; 302=arterial road; 303=sub-arterial road; 304=collector road; 305=local road; 309=access road; 400=pedestrian thoroughfare). Previous research has used traffic exposure ratios.[49]	Greater ratio = higher road volume exposure in SA1
Housing			
Housing affordability stress	SA1	Housing affordability stress is % people in the lowest 2 quintiles of income (bottom 40%) nationally paying more than 30% of household income on rent/mortgage (based on ABS 2016 Census data). This is a standard measure of Housing affordability stress used by the Australian Bureau of Statistics, and other Australian research.[50, 51]	Higher number= higher percent of people experiencing housing affordability stress in SA1
Housing density	SA1	Higher rise density housing refers to 4+ storeys (number of flats, units or apartments in a 4+ storey block).	Higher number = higher count of housing with 4+ storeys in SA1
Walkability			
Dwelling density	1,600m service area	Dwelling density / Ha for 1,600m street network distance. Note: also a component of housing. Dwelling density is calculated as the total number of dwellings located in Mesh Blocks intersecting each participant's local walkable neighbourhood divided by the neighbourhood size in hectares.	Higher number = higher dwelling density within 1,600m of child's home
Street connectivity	1,600m	Street connectivity per square kilometre for 1,600m street network distance. Street connectivity was calculated as the ratio of intersections to local walkable neighbourhood in square kilometres.	Higher number = better street connectivity within 1,600m of child's home
Daily living score	1,600m	Daily living destination access score for 1,600m street network distance. It refers to a broader set of neighbourhood destinations that people might frequent regularly. Presence or absence is 0 or 1 for the following 3 convenience destinations within 1,600m, and summed to provide a 'daily living score' between 0-3: 1) Convenience store, newsagent or petrol station; 2) supermarket; 3) PT stop.[52]	Higher number = higher daily living score.
Local living score	1,600m	Local living destination access score for 1,600m street network distance. It refers to neighbourhood destinations a person may walk to daily. Presence or absence is 0 or 1 for the following 11 destinations within 1,600m, and summed to provide a 'local living score' between 0-11: 1) Convenience store, supermarket; 2) PT stop; 3) speciality food (e.g. fruit, veggie, meat, fish); 4) post-office; 5) bank; 6) pharmacy; 7) GP/med centre; 8) dentist; 9) community centre/hall; 10) child care facility; 11) public library.[52]	Higher number = higher local living score.
Walkability score	1,600m service area	Walkability index for 1,600m service area, relative to study region. Traditionally combines land use mix (LUM), street connectivity, and residential density. LUM is difficult to calculate at a national level due to lack of data. There have been issues with the LUM entropy measure, hence the 'daily living score' is used as a replacement. This means that the walkability score was calculated as the sum of standardised scores of local neighbourhood attributes including street connectivity, dwelling density and the index of access to services of daily living described above.[52]	Higher number = more walkable within 1,600m.

Measure	Spatial unit	Description	Interpretation
Public transport			
Count of public transport stops	1,600m	Count of any type of public transport stop (e.g. ferry, tram, train, bus) within 1,600m street network distance	Higher number = more public transport stops within 1,600m of child's home
Distance (m) to closest public transport stop	1,600m	Distance to closest public transport stop of any type (i.e. ferry, tram, train, bus) within 1,600m street network distance	Higher number = closest public transport stop within 1,600m is further away from child's home
Count of public transport stops with a frequent weekday service	1,600m	Count of public transport stops (i.e. ferry, tram, train, bus) with a frequent weekday service (at least 30 min, 7am-7pm) within 1,600m street network distance	Higher number = more public transport stops with a frequent weekday timetable service within 1,600m of child's home
Distance (m) to closest public transport stop with a frequent weekday service	1,600m	Distance to closest public transport stop (i.e. ferry, tram, train, bus) with a frequent weekday service (at least 30 min, 7am-7pm) within 1,600m street network distance	Higher number = closest public transport stop with a frequent weekday timetable service within to 1,600m is further away from child's home
Public open space*			
Count of POS	1,600m	Count of any POS type of any size, within 1,600m street network distance	Higher number = more POS of any type within 1,600m
Distance (m) to closest POS	1,600m	Distance to closest POS of any type and size, within 1,600m street network distance	Higher number = closest POS of any type within 1,600m is further away from child's home
Count of POS $\leq$0.4 Ha	1,600m	Count of POS of any type $\leq$0.4 Ha, within 1,600m street network distance	Higher number = more POS $\leq$0.4 Ha within 1,600m
Distance (m) to closest POS $\leq$0.4 Ha	1,600m	Distance to closest POS of any type $\leq$0.4 Ha, within 1,600m street network distance	Higher number = closest POS $\leq$0.4 Ha within 1,600m is further away from child's home
Count of POS >0.4 to $\leq$1 Ha	1,600m	Count of POS of any type >0.4 to $\leq$1 Ha, within 1,600m street network distance	Higher number = more POS >0.4 to $\leq$1 Ha within 1,600m
Distance (m) to closest POS >0.4 to $\leq$1 Ha	1,600m	Distance to closest POS of any type >0.4 to $\leq$1 Ha, within 1,600m street network distance	Higher number = closest POS >0.4 to $\leq$1 Ha within 1,600m is further away from child's home
Count of POS >0.4 Ha	1,600m	Count of POS of any type >0.4 Ha, within 1,600m street network distance	Higher number = more POS >0.4 Ha within 1,600m
Distance (m) to closest POS >0.4 Ha	1,600m	Distance to closest POS of any type >0.4 Ha, within 1,600m street network distance	Higher number = closest POS >0.4 Ha within 1,600m is further away from child's home
Count of POS >1.5 Ha	1,600m	Count of POS of any type >1.5 Ha, within 1,600m street network distance	Higher number = more POS >1.5 Ha within 1,600m
Distance (m) to closest POS >1.5 Ha	1,600m	Distance to closest POS of any type >1.5 Ha, within 1,600m street network distance	Higher number = closest POS >1.5 Ha within 1,600m is further away from child's home
Count of playgrounds	1,600m	Count of playgrounds within 1,600m street network distance	Higher number = more playgrounds within 1,600m

Measure	Spatial unit	Description	Interpretation
Distance (m) to closest playground	1,600m	Distance to closest playground within 1,600m street network distance	Higher number = closest playground within 1,600m is further away from child's home
Early childcare and education services†^			
Count of childcare centres meeting national standards	3,200m	Count of childcare centres (any type meeting national quality standard) within 3,200m street network distance. The following ECEC were included: long day care, preschool service/kindergarten service (part of a school and standalone), Outside school Hours Care - After School, Before School and Vacation care.	Higher number = more childcare centres of any type meeting national quality standard within 3,200m of child's home
Distance (m) to closest childcare centre meeting national standards	3,200m	Distance to closest childcare centre (any type meeting national quality standard) within 3,200m street network distance. See above for child care included.	Higher number = closest childcare of any type meeting national quality standard within 3,200m is further away from child's home
Count of childcare centres exceeding national standards	3,200m	Count of childcare centres (any type exceeding national quality standard) within 3,200m street network distance. See above for child care included.	Higher number = more childcare centres of any type exceeding national quality standard within 3,200m of child's home
Distance (m) to closest childcare centre exceeding national standards	3,200m	Distance to closest childcare centre (any type exceeding national quality standard) within 3,200m street network distance. See above for child care included.	Higher number = closest childcare centre of any type exceeding national quality standard within 3,200m of child's home is further away
Count of preschool services meeting national standards	3,200m	Count of preschool service meeting national quality standard within 3,200m street network distance. Preschool service/Kindergarten - part of a school and standalone included.	Higher number = more preschool services meeting national quality standard within 3,200m of child's home
Distance (m) to closest preschool service meeting national standards	3,200m	Distance to closest preschool service meeting national quality standard) within 3,200m street network distance. See above for preschool service included.	Higher number = closest preschool service meeting national quality standard within 3,200m is further away from child's home
Count of preschool services exceeding national standards	3,200m	Count of preschool services exceeding national quality standards within 3,200m street network distance. See above for preschool service included.	Higher number = more preschool services exceeding national quality standard within 3,200m of child's home
Distance (m) to closest preschool service exceeding national standards	3,200m	Distance to closest preschool service exceeding national quality standard within 3,200m street network distance. See above for preschool service included.	Higher number = closest preschool service exceeding national quality standard within 3,200m of child's home is further away
Family-friendly destinations			
Count of sport facilities	3,200m	Count of sport facilities within 3,200m street network distance	Higher number = more sport facilities within 3,200m
Distance (m) to closest sport facility	3,200m	Distance to closest sport facility within 3,200m street network distance	Higher number = closest sport facility within 3,200m is further away from child's home
Count of public swimming pools	3,200m	Count of swimming pools within 3,200m street network distance	Higher number = more public swimming pools within 3,200m
Distance (m) to closest public swimming pool	3,200m	Distances to public swimming pools within 3,200m street network distance.	Higher number = closest public swimming pool within 3,200m is further away from child's home
Count of public libraries	3,200m	Count of public libraries within 3,200m street network distance.	Higher number = more libraries within 3,200m

Measure	Spatial unit	Description	Interpretation
Distance (m) to closest public library	3,200m	Distance to closest public library within 3,200m street network distance.	Higher number = closest public library within 3,200m is further away from child's home
Count of community centres	3,200m	Count of community centre within 3,200m street network distance. A community centre was defined as a place mostly used for local events, festivities and group activities including professional societies, union halls and other non-profit organisations.	Higher number = more community centres within 3,200m
Distance (m) to closest community centre	3,200m	Distance to closest community centre within 3,200m street network distance. See above for definition.	Higher number = closest community centre within 3,200m is further away from child's home
Count of activity centres	3,200m	Count of activity centre within 3,200m street network distance. Activity centres were defined as a commercially zoned Mesh Block with a major chain supermarket.[53] The presence of a supermarket in a recognised commercial area acts in practice as a proxy for co-location of other amenities; a hub where people go to.	Higher number = more activity centres within 3,200m
Distance (m) to closest activity centre	3,200m	Distance to closest activity centre within 3,200m street network distance. See above for definition.	Higher number = closest activity centre within 3,200m is further away from child's home
Family-friendly destinations score	3,200m	Family living destination access score for 3,200m around child's home. It refers to destinations families are likely to access in their local areas. Presence or absence is 0 or 1 for 5 destinations, and summed to provide a 'family-friendly destinations' score between 0-5: 1) Sport facilities; 2) public swimming pools; 3) public libraries; 4) community centres; 5) activity centres.	Higher number = more family-friendly destinations within 3,200m of child's home.
Food outlets			
Percentage of healthier food outlets	3,200m	Percentage of food outlets within 3,200m street network distance that provide healthier food options. Supermarkets, green grocers and fruit and vegetable vendors were included. Unhealthy options were those classified as fast food and takeaway regardless of whether they offered healthier food options (e.g. McDonalds was considered unhealthy even though they have healthier options on the menu and vice versa for supermarkets selling unhealthy food options).	Higher number = greater percentage of healthier food outlets within 3,200m of child's home

Key: Ha: hectare; m: metre. ABS: Australian Bureau of Statistics. NQS: National Quality Standard.[54] POS: public open space. PT: public transport. SA1: Statistical Area Level 1, 400 persons on average (see report footnote$_1$).[44]
Notes: †Many preschool services (e.g. standalone preschool services not part of a centre-based childcare service) in Tasmania and Western Australia were not within the scope of the National Quality Standard at the time of data harvesting. Hence, for early childhood education and care service measures, children in Tasmania (n=2,800 children) and Western Australia (n=22,111 children) were excluded due to these preschool services being beyond the scope of the NQS data. ^Based on NQS data provided by The Australian Children's Education & Care Quality Authority.
*Public open spaces of these sizes were used in previous research; different sized public open spaces have been associated with different physical activity behaviours.[55] See **Appendix 1** for data sources. Refer to the Australian Urban Observatory for more information[45]: https://auo.org.au/portal/metadata

2.5.2 Built environment data sources

Appendix 1 describes the data sources used to create the built environment measures, including: Australian Census (2016); OpenStreetMap; the Australian Children's Education & Care Quality Authority (ACECQA), the National Health and Services Directory (NHSD). OpenStreetMap is a community contributed global database of geographic information available to use under an open license. It was used as a source for national road data, open space, and for destinations where alternative nationally consistent sources were not available.[56] The National Quality Standard (NQS) assesses Australian ECEC and outside school hours care services against seven quality areas that are important outcomes for children, including educational program and practice, children's health and safety, physical environment, staffing arrangements, relationships with children, and collaborative partnerships with families and communities.[54] These services are assessed against each of the seven quality areas in the NQS and given an overall rating based on these results (e.g. meeting NQS, exceeding NQS).

2.6 Data cleaning

The AEDC-BE dataset was checked for missing data[2], and whether values were within a plausible range. Variables were collapsed where categories contained few cases (see **Table 2**). Of the 235,631 children in the linked dataset, 24 were removed due to a discrepancy between GIS and AEDC classifications for Local Government Area (LGA); these children were identified as living in remote/very remote areas. A further 30,601 children were removed from the analytic dataset because they had missing data on any of the key AEDC variables of interest (maternal education (8.2%), neighbourhood disadvantage (0.4%), and DV1 (5.1%); children may have missing data on more than one variable). Children with missing DV1 scores include children with special needs, they are less than four years old, their teacher does not feel they know the child well enough to complete the instrument (or has known the child for less than 1 month) or their teacher has answered less than 75% of the questions for any given domain. The final analytic dataset used for complete case analysis included 205,030 children. **Appendix 8** shows sociodemographic sample descriptives and built environment descriptives for the missing cases.

For built environment variables, outliers and assumptions were checked (e.g. linear relationship with log-odds, normality of the residuals). It is common for built environment variables to be highly skewed and distributional assumptions violated; others have noted that the resulting bias on estimates is minimal.[57] Considerable outliers were removed from the traffic exposure variable only; outliers were recoded into the 99th centile for this variable. Variables were not transformed or quantiled for analysis, and instead, treated continuously as per best practice.[58] Sensitivity analyses (not reported here) including and excluding outliers

[2] In the AEDC, children are coded as 'missing' for the variable DV1 if: the child has special needs, the child is less than four years old, the child's teacher does not feel they know the child well enough to complete the instrument (or has known the child for less than 1 month), or less than 75% of the child's relevant domain items were completed.

were conducted for a sample of built environment measures, however, they made little difference to the modelled estimates.

2.7 Analysis

Descriptive statistics for the sample were computed using Stata v16. Major (n=182,913) and regional city samples (n=22,117) were explored separately. The outcome variable of interest was DV1, developmentally vulnerable on one or more domains (yes (coded as 1), no (coded as 0)) (see 2.4.2 for description). As per data custodian reporting requirements, when reporting AEDC results, the total population represented in AEDC indicator scores should include at least 15 children with valid AEDC data. In some instances, the built environment descriptive statistics have reported values below 15, as these relate to the missing neighbourhood attribute data, rather than AEDC outcome scores.

Multilevel logistic regression analyses were used to examine associations between neighbourhood disadvantage (SEIFA-IRSD) and DV1, and built environment with DV1. Built environment characteristics shown in **Table 3** were entered into the models separately. All models accounted for clustering at the SA1 level (n= 39,429, n= 35,003, and n= 4,438 SA1 clusters for the national, major city, and regional city samples, respectively; as classification into 'major city' versus 'regional city' was based on child's home address rather than assigned to each SA1, a very small number of SA1s are included in both categories). Available AEDC variables known to be confounding between neighbourhood environments and child development were included in the models. These included child sex, Indigenous status, language background other than English, and age group. Neighbourhood disadvantage was determined using SEIFA-IRSD for the child's SA1 (see **Table 2**). Multicollinearity between independent variables were explored for all models; age group was subsequently dropped from the models due to the overall Variance Inflation Factor (VIF) exceeding 10, and age group variation in children being minimal.

The logistic regression models were fitted using Stata v16 and MLwiN v3.05 statistical software, using the *runmlwin* command to execute MLwiN within Stata.[59] For these models, 'distance to closest' built environment measures were scaled to 100m to enhance interpretability. Model parameters were estimated using second-order Penalized Quasi-likelihood (PQL) after starting values from Maximum Likelihood estimates. Markov chain Monte Carlo (MCMC) simulations for model parameters were considered and initially conducted. Due to length of time taken to process the MCMC simulations, sensitivity analyses were conducted on sub-samples of participants to test whether the fixed estimates produced by PQL and MCMC were similar (not reported here). PQL and MCMC estimates were similar, thus PQL was used for all subsequent analyses. All model results are reported as Odds Ratios (OR) with their 95% confidence intervals (CIs).

Summary of the modelling approach:

- Model 1: Neighbourhood disadvantage. Quintile 5 (i.e. the least disadvantaged neighbourhoods) was used as the reference category.
- Model 2: Model 1 plus adjustments for child/family variables
- Model 3: Model 2 plus built environment characteristics (entered into models separately)

Part 3 Findings

3.1 Sample characteristics

Key demographic characteristics of the AEDC-BE cohort are summarised in **Table 4**. A higher proportion of children classified as DV1 on at least one AEDC domain were male, had a language background other than English, Aboriginal or Torres Strait Islander, or had a parent whose highest level of qualification is less than Year 12.

Table 4. Study population demographics by developmental vulnerability

Variable	Developmentally vulnerable (DV1) n (%)*	Overall sample n (%)
Age group		
< 5 years	156 (20.4)	766 (0.4)
5 years	33,031 (21.7)	151,919 (74.1)
6+ years	9,258 (17.7)	52,345 (25.5)
Gender		
Female	14,608 (14.3)	101,927 (49.7)
Male	27,837 (27.0)	103,103 (50.3)
Language background other than English		
No	29,243 (19.0)	153,877 (75.0)
Yes	13,202 (25.8)	51,153 (24.9)
Indigenous status		
No	40,136 (20.2)	198,442 (96.8)
Yes	2,309 (35.0)	6,588 (3.2)
Maternal education		
Bachelor degree or higher	12,131 (15.0)	80,852 (39.4)
Year 12 / Other post-school qualification	22,101 (22.0)	100,421 (49.0)
< Year 12	8,213 (34.6)	23,757 (11.6)
Neighbourhood disadvantage		
Q1 (most disadvantaged)	9,637 (30.5)	31,579 (15.4)
Q2	8,405 (24.6)	34,128 (16.6)
Q3	8,124 (20.6)	39,422 (19.2)
Q4	8,196 (17.7)	46,408 (22.6)
Q5 (least disadvantaged)	8,083 (15.1)	53,493 (26.1)
Remoteness		
Major city	37,452 (20.5)	182,913 (89.2)
Regional city	4,903 (22.2)	22,117 (10.8)
Total	**42,445 (20.7)**	**205,030 (100.0)**

Key: DV1: Developmentally vulnerable on one or more AEDC domains. Q: Quintile. *Percentages in the DV1 column reflect percentage of DV1 for the row category.
Notes: See **Table 2** for measure descriptions.

3.2 Neighbourhood disadvantage and early childhood development

The highest proportion of children who were classified as DV1 lived in the most disadvantaged neighbourhoods; this pattern held across major and regional city samples (**Table 5**). A higher proportion of Aboriginal and Torres Strait Islander children, children who have a language background other than English, or children whose parent's highest level of education was less than Year 12 lived in the most disadvantaged neighbourhoods (see **Appendix 2**).

Table 5. Study population demographics in major and regional cities by developmental vulnerability

	Developmentally vulnerable on at least one domain (DV1)		
Variable	**National (n=205,030) n (%)**	**Major city (n=182,913) n (%)**	**Regional city (n=22,117) n (%)**
Age group			
< 5 years	156 (20.4)	135 (19.5)	21 (28.3)
5 years	33,031 (21.7)	29,411 (21.6)	3,620 (23.2)
6+ years	9,258 (17.7)	7,996 (17.4)	1,262 (19.6)
Gender			
Female	14,608 (14.3)	12,893 (14.2)	1,715 (15.5)
Male	27,837 (27.0)	24,649 (26.8)	3,188 (28.7)
Language background other than English			
No	29,243 (19.0)	24,865 (18.6)	4,378 (21.6)
Yes	13,202 (25.8)	12,677 (25.7)	525 (28.4)
Indigenous status			
No	40,136 (20.2)	35,901 (20.7)	4,235 (20.8)
Yes	2,309 (35.0)	1,641 (33.9)	668 (38.3)
Maternal education			
Bachelor degree or higher	12,131 (15.0)	11,243 (15.1)	888 (14.3)
Year 12 / Other post-school qualification	22,101 (22.0)	19,256 (21.9)	2,845 (22.8)
< Year 12	8,213 (34.6)	7,043 (34.7)	1,170 (34.0)
Neighbourhood disadvantage			
Q1 (most disadvantaged)	9,637 (30.5)	8,508 (30.4)	1,129 (31.7)
Q2	8,405 (24.6)	7,287 (24.5)	1,118 (25.5)
Q3	8,124 (20.6)	7,034 (20.4)	1,090 (21.7)
Q4	8,196 (17.7)	7,267 (17.6)	929 (18.3)
Q5 (least disadvantaged)	8,083 (15.1)	7,446 (15.1)	637 (15.6)
Remoteness			
Major city	37,452 (20.5)	37,542 (20.5)	N/A
Regional city	4,903 (22.2)	N/A	4,903 (22.2)
Total	**42,445 (20.7)**	**37,542 (20.5)**	**4,903 (22.2)**

Key: DV1: Developmentally vulnerable on one or more AEDC domains. N/A: not applicable. Q: Quintile.
Notes: See **Table 2** for measure descriptions.

3.2.1 Relationship between neighbourhood disadvantage and early childhood development

Poorer child development (DV1) was associated with living in the most disadvantaged neighbourhoods (OR 2.60, 95%CI 2.50-2.70). For major cities, a social gradient pattern held across the quintiles: each step of increasing neighbourhood disadvantage was associated with increasingly higher odds of DV1. For regional cities, despite a social gradient being evident, some of the quintile differences were not significant (**Table 6**).

Table 6. Neighbourhood disadvantage and odds of developmental vulnerability (DV1) in major and regional cities

	Model 1	Model 2
Major cities	**OR (95%CI)**	**OR (95%CI)**
Neighbourhood disadvantage		
Q5 (least disadvantaged)	1.00	1.00
Q4	1.22 (1.17-1.27)	1.11 (1.06-1.15)
Q3	1.48 (1.42-1.54)	1.25 (1.20-1.31)
Q2	1.87 (1.80-1.95)	1.47 (1.41-1.53)
Q1 (most disadvantaged)	2.54 (2.44-2.64)	1.73 (1.66-1.81)
Regional cities	**OR (95%CI)**	**OR (95%CI)**
Neighbourhood disadvantage		
Q5 (least disadvantaged)	1.00	1.00
Q4	1.21 (1.07-1.37)	1.19 (1.04-1.35)
Q3	1.52 (1.34-1.71)	1.36 (1.20-1.54)
Q2	1.89 (1.67-2.13)	1.59 (1.40-1.80)
Q1 (most disadvantaged)	2.57 (2.27-2.92)	1.92 (1.69-2.19)

Key: CI: Confidence intervals. DV1: Developmentally vulnerable on one or more AEDC domains. OR: Odds Ratio. Q: Quintile.
Notes: Q5 is the reference category. Model 1: Neighbourhood disadvantage adjusted for state/territory. Model 1 plus adjustment for child's indigenous status, language background other than English, parental education, and sex. Significant at p<0.001. See **Table 2** for measure descriptions.

3.3 Built environment and early childhood development

3.3.1 Children with no access to local destinations

Table 7 presents the proportion of children with no access within recommended distances to destinations and services locally in major and regional cities, by neighbourhood disadvantage. **Table 8** presents these patterns by DV1.

A higher proportion of children living in regional cities (compared to major cities) had no access to ECEC services exceeding national standards within 3,200m (33.7% regional vs. 5.0% major city), public open space (12.7% regional vs. <1% major city), or a playground (45.9% regional vs. 10.0% major city) within 1,600m. Both major and regional cities have high proportions of children with no public swimming pools (56.1% regional vs. 34.8% major city), public libraries (62.6% regional vs. 33.1% major city) and community centres (73.8% regional vs. 48.9% major city), available within 3,200m, necessitating travelling further to access family-oriented activities.

The distribution of children with *no local access* to the above destinations and services did not show a social gradient in the direction expected; a higher proportion of children in the least disadvantaged areas had no local destinations. For example, in major cities, while the vast majority of children from all types of neighbourhoods had some access to high quality ECEC services (only 5% had no access to high quality ECEC), there was an inverse association with neighbourhood disadvantage in terms of no access. That is, compared with the most disadvantaged, a higher proportion of children living in the least disadvantaged areas had no access to high quality ECEC in their neighbourhood (2.5% of children in the most disadvantaged quintile vs. 4.9% in the least disadvantaged quintile). For regional cities, 14.8% vs. 41.6% of children had no ECEC services exceeding national standards for the most disadvantaged and least disadvantaged neighbourhoods, respectively. The proportions of children with no access to these local destinations were similar by DV1.

Table 7. Proportion of children in major and regional cities with *no* (zero) local destinations/services by neighbourhood disadvantage

Neighbourhood disadvantage	Destinations 1,600m[1] from child's home address								Destinations 3,200m[1] from child's home address											
	Public transport n (%)		Public open space n (%)						Early childhood education and care services[†] n (%)				Family-friendly destinations n (%)						Food outlets n (%)	
	No public transport stops	No frequent public transport stops	No POS	No POS ≤0.4 Ha	No POS >0.4 to ≤1 Ha	Count of POS ≤0.4 Ha	No POS >1.5 Ha	No playgrounds	No childcare centres meeting national standards	No childcare centres exceeding national standards	No preschool services meeting national standards	No preschool services exceeding national standards	No sport facilities	No public swimming pools	No public libraries	No community centres	No activity centres	No family-friendly destinations	No healthier food outlets	#Total
Major city (n=182,913), n (%) without access																				
Q1	14 (0.1)	4,560 (16.3)	55 (0.2)	2,392 (8.5)	2,731 (9.8)	66 (0.2)	154 (0.6)	2,871 (10.3)	47 (0.2)	659 (2.5)	1,104 (4.2)	3,763 (14.4)	56 (0.2)	8,255 (29.5)	5,555 (19.8)	10,105 (36.1)	1,945 (6.9)	44 (0.2)	73 (0.3)	28,023 (100.0)
Q2	203 (0.7)	7,461 (25.1)	153 (0.5)	2,990 (10.1)	3,541 (11.9)	173 (0.6)	330 (1.1)	2,902 (9.8)	230 (0.9)	1,320 (5.0)	2,233 (8.5)	4,514 (17.1)	141 (0.5)	10,840 (36.5)	9,179 (30.9)	15,258 (51.3)	4,337 (14.6)	121 (0.4)	284 (1.0)	29,741 (100.0)
Q3	562 (1.6)	9,726 (28.3)	361 (1.1)	3,593 (10.5)	4,134 (12.0)	416 (1.2)	678 (2.0)	3,334 (9.7)	473 (1.6)	1,859 (6.1)	3,078 (10.1)	5,550 (18.2)	584 (1.7)	12,465 (36.2)	12,285 (35.7)	17,734 (51.6)	5,419 (15.8)	456 (1.3)	325 (1.0)	34,391 (100.0)
Q4	1,049 (2.5)	11,854 (28.7)	536 (1.3)	4,418 (10.7)	5,153 (12.5)	589 (1.4)	937 (2.3)	4,620 (11.2)	789 (2.2)	2,208 (6.2)	4,155 (11.6)	6,724 (18.8)	1,097 (2.7)	15,480 (37.5)	15,697 (38.0)	20,904 (50.6)	7,790 (18.8)	813 (2.0)	481 (1.2)	41,339 (100.0)
Q5	1,291 (2.6)	14,961 (30.3)	414 (0.8)	4,839 (9.8)	6,546 (13.3)	480 (1.0)	764 (1.6)	5,117 (10.4)	880 (2.1)	2,058 (4.9)	3,920 (9.3)	6,435 (15.3)	811 (1.6)	16,570 (33.5)	17,771 (36.0)	25,461 (51.5)	8,954 (18.1)	599 (1.2)	536 (1.1)	49,419 (100.0)
^Total	3,119 (1.7)	48,562 (26.6)	1,519 (0.8)	18,232 (10.0)	22,105 (12.1)	1,724 (0.9)	2,863 (1.6)	18,844 (10.3)	2,419 (1.5)	8,104 (5.0)	14,490 (9.0)	26,986 (16.7)	2,689 (1.5)	63,610 (34.8)	60,487 (33.1)	89,462 (48.9)	28,445 (15.6)	2,033 (1.1)	1,699 (0.9)	182,913 (100.0)
Regional city (n=22,117), n (%) without access																				
Q1	285 (8.0)	2,266 (63.7)	151 (4.3)	981 (27.6)	1,042 (29.3)	158 (4.4)	236 (6.6)	1,493 (42.0)	182 (6.6)	409 (14.8)	271 (9.8)	647 (23.4)	177 (5.0)	1,322 (37.2)	1,247 (35.1)	1,924 (54.1)	953 (26.8)	120 (3.4)	25 (0.7)	3,556 (100.0)
Q2	641 (14.6)	3,220 (73.4)	376 (8.6)	1,613 (36.8)	1,416 (32.3)	398 (9.1)	548 (12.5)	1,823 (41.6)	520 (13.7)	841 (22.2)	721 (19.0)	1,195 (31.5)	497 (11.3)	2,138 (48.7)	2,332 (53.2)	2,953 (67.3)	1,631 (37.2)	458 (10.4)	63 (1.4)	4,387 (100.0)
Q3	1203 (23.9)	4,050 (80.5)	827 (16.4)	2,272 (45.2)	2,171 (43.2)	875 (17.4)	1,075 (21.4)	2,228 (44.3)	923 (21.6)	1,646 (38.6)	1,384 (32.4)	2,117 (49.6)	945 (18.8)	3,050 (60.6)	3,381 (67.2)	3,871 (76.9)	2,609 (51.9)	875 (17.4)	100 (2.0)	5,031 (100.0)
Q4	1168 (23.0)	4,206 (83.0)	882 (17.4)	2,242 (44.2)	2,475 (48.8)	961 (19.0)	1,110 (21.9)	2,441 (48.2)	1,191 (27.6)	1,907 (44.2)	1,720 (39.8)	2,419 (56.0)	1,195 (23.6)	3,343 (66.0)	3,784 (74.7)	4,163 (82.1)	3,045 (60.1)	1,128 (22.3)	189 (3.7)	5,069 (100.0)
Q5	962 (23.6)	3,565 (87.5)	578 (14.2)	1,857 (45.6)	1,998 (49.0)	665 (16.3)	818 (20.1)	2,155 (52.9)	1,016 (27.5)	1,541 (41.6)	1,416 (38.3)	1,942 (52.5)	795 (19.5)	2,549 (62.6)	3,099 (76.1)	3,410 (83.7)	2,491 (61.1)	760 (18.7)	171 (4.2)	4,074 (100.0)
^Total	4259 (19.3)	17,307 (78.3)	2,814 (12.7)	8,965 (40.5)	9,102 (41.2)	3,057 (13.8)	3,787 (17.1)	10,140 (45.9)	3,832 (20.3)	6,344 (33.7)	5,512 (29.2)	8,320 (44.1)	3,609 (16.3)	12,402 (56.1)	13,843 (62.6)	16,321 (73.8)	10,729 (48.5)	3,341 (15.1)	548 (2.5)	22,117 (100.0)

Key: Q: quintile. Q1=most disadvantaged – Q5=least disadvantaged. [1]Walkable street network distance. ^Overall number of children with no access to destination type. [#]Overall number of children in neighbourhood disadvantage quintile. **Notes:** See notes in **Table 8**.

Table 8. Proportion of children in major and regional cities with *no* (zero) local destinations/services by developmental vulnerability (DV1)

	Destinations 1,600m[1] from child's home address								Destinations 3,200m[1] from child's home address											
	Public transport n (%)		Public open space n (%)						Early childhood education and care services[†] n (%)				Family-friendly destinations n (%)						Food outlets n (%)	
Developmental vulnerability (DV1)	No public transport stops	No frequent public transport stops	No POS	No POS ≤0.4 Ha	No POS>0.4 to ≤1 Ha	No POS >0.4 Ha	No POS >1.5 Ha	No playgrounds	No childcare centres meeting national standards	No childcare centres exceeding national standards	No preschool services meeting national standards	No preschool services exceeding national standards	No sport facilities	No public swimming pools	No public libraries	No community centres	No activity centres	No family-friendly destinations	No healthier food outlets	[#]Total
Major city (n=182,913), n (%) without access																				
Not DV1	2,549 (1.8)	38,747 (26.7)	1,203 (0.8)	14,408 (9.9)	17,588 (12.1)	1,369 (0.9)	2,276 (1.6)	15,099 (10.4)	1,966 (1.5)	6,409 (5.0)	11,688 (9.1)	21,391 (16.7)	2,174 (1.5)	50,350 (34.6)	47,996 (33.0)	71,456 (49.2)	22,796 (15.7)	1,630 (1.1)	1,337 (0.9)	145,371 (100.0)
DV1	570 (1.5)	9,815 (26.1)	316 (0.8)	3,824 (10.2)	4,517 (12.0)	355 (1.0)	587 (1.6)	3,745 (10.0)	453 (1.4)	1,695 (5.1)	2,802 (8.4)	5,595 (16.8)	515 (1.4)	13,260 (35.3)	12,491 (33.3)	18,006 (48.0)	5,649 (15.1)	403 (1.1)	362 (1.0)	37,542 (100.0)
*Total	3,119 (1.7)	48,562 (26.6)	1,519 (0.8)	18,232 (10.0)	22,105 (12.1)	1,724 (0.9)	2,863 (1.6)	18,844 (10.3)	2,419 (1.5)	8,104 (5.0)	14,490 (9.0)	26,986 (16.7)	2,689 (1.5)	63,610 (34.8)	60,487 (33.1)	89,462 (48.9)	28,445 (15.6)	2,033 (1.1)	1,699 (0.9)	182,913 (100.0)
Regional city (n=22,117), n (%) without access																				
Not DV1	3,354 (19.5)	13,581 (78.9)	2,213 (12.9)	6,998 (40.7)	7,171 (41.7)	2,409 (14.0)	2,994 (17.4)	7,803 (45.3)	3,039 (20.8)	5,009 (34.3)	4,394 (30.1)	6,610 (45.3)	2,839 (16.5)	9,787 (56.9)	10,898 (63.3)	12,918 (75.0)	8,472 (49.2)	2,636 (15.3)	443 (2.6)	17,214 (100.0)
DV1	905 (18.5)	3,726 (76.0)	601 (12.3)	1,967 (40.1)	1,931 (39.4)	648 (13.2)	793 (16.2)	2,337 (47.7)	793 (18.6)	1,335 (31.4)	1,118 (26.3)	1,710 (40.2)	770 (15.7)	2,615 (53.3)	2,945 (60.1)	3,403 (69.4)	2,257 (46.0)	705 (14.4)	105 (2.1)	4,903 (100.0)
^Total	4,259 (19.3)	17,307 (78.3)	2,814 (12.7)	8,965 (40.5)	9,102 (41.2)	3,057 (13.8)	3,787 (17.1)	10,140 (45.9)	3,832 (20.3)	6,344 (33.7)	5,512 (29.2)	8,320 (44.1)	3,609 (16.3)	12,402 (56.1)	13,843 (62.6)	16,321 (73.8)	10,729 (48.5)	3,341 (15.1)	548 (2.5)	22,117 (100.0)

Key: DV1: Developmentally vulnerable on one or more AEDC domains; Ha: Hectare; POS: public open space. ^Overall number of children with no access to destination type. [#]Overall number of children in DV1 status. [1]Walkable street network distance.
Note for Table 7 and Table 8: [†]Children in WA and TAS excluded from early childhood education and care services analysis (see Notes in **Table 3**). See **Table 2** for measure descriptions. See **Table 3** for built environment descriptions.

3.3.2 Built environment characteristics by neighbourhood disadvantage and developmental vulnerability

Detailed descriptive statistics (mean (standard deviation), and range) for built environment measures for major cities and regional cities are shown in **Appendix 3**. **Appendix 4** shows descriptive statistics for built environment characteristics by neighbourhood disadvantage quintile, with **Appendix 5** reporting built environment descriptive statistics by DV1. While not discussed in the main report the results for the national sample (i.e. major and regional cities combined) are included for completeness in **Appendix 6** and **Appendix 7**.

In the major city sample, on average the most disadvantaged neighbourhoods (Q1) had higher housing affordability stress (45.9% vs. 30.5% in Q5) and higher levels of walkability (0.4 vs. 0.2 in Q5) and exposed to more traffic (busy roads). For children with access to local destinations and services, those living in the least disadvantaged neighbourhoods (Q5) had better public open space access (i.e. more and closer public open spaces) than those living in the most disadvantaged neighbourhoods. Distance to closest, and count of, ECEC services exceeding national quality standards within 3,200m was on average, better in the least disadvantaged neighbourhoods (Q5), compared with the most disadvantaged neighbourhoods (Q1). For each step down in neighbourhood disadvantage (i.e. greater disadvantage), there were fewer quality ECEC services and the distance to those services increases.

In the regional sample, children living in the most disadvantaged neighbourhoods were exposed to more traffic, and more housing affordability stress. The most disadvantaged neighbourhoods also had slightly lower housing density, better walkability, and better access to public transport, public open space, ECEC services meeting and exceeding national quality standards and family-friendly destinations.

For the missing cases[2] on any of the key AEDC variables of interest (maternal education, neighbourhood disadvantage, and DV1, n=30,601; see **Appendix 8**), built environment characteristics were similarly distributed across neighbourhood disadvantage quintiles for all characteristics except for ECEC services in major cities and POS in regional cities, which produced mixed patterns.

3.3.3 Relationships between built environment and early childhood development

The final models are presented in **Table 9**, showing associations between built environment characteristics and DV1, adjusted for neighbourhood disadvantage, child's language background other than English, maternal education, and sex for major city and regional city samples.

For the major city sample (**Table 9**), many of the built environment measures analysed had significant but negligible effects with the odds of DV1 (shown in italicised text). Having more ECEC services exceeding national standards located within 3,200m of a child's home was associated with lower odds of developmental vulnerability, as was percentage of local healthier food outlets and further distance to the closest playground (shown in bold text). A higher daily living score (e.g. a composite score of a mix of local destinations within 1,600m) was associated with higher odds of DV1 as was more community centres within 3,200m (shown in bold text). For the regional city sample, higher housing affordability stress was associated with higher odds of DV1, and living in an SA1 with less high-rise density housing (four or more storeys) was associated with lower odds of DV1 (shown in bold text).

Table 9. Built environment characteristics and odds of developmental vulnerability (DV1) in major and regional cities

Measure	Major city (n=182,913) OR (95%CI)	Regional city (n=22,111) OR (95%CI)
Traffic[1]		
Traffic exposure to busy roads	0.999 (0.962-1.039)	0.998 (0.980-1.015)
Housing[1]		
Housing affordability stress	*1.004 (1.003-1.004)****	**✓1.004 (1.001-1.006)****
Housing density	*1.001 (1.000-1.001)****	**✓0.996 (0.994-0.999)****
Walkability[1]		
Dwelling density	1.002 (1.000-1.004)	0.996 (0.985-1.007)
Street connectivity	*1.001 (1.001-1.002)****	1.000 (0.998-1.001)
Daily living score	***1.032 (1.010-1.054)****	0.977 (0.937-1.018)
Local living score	1.002 (0.997-1.008)	0.998 (0.984-1.013)
Walkability score	*1.008 (1.001-1.015)**	1.005 (0.985-1.025)
Public transport access[2]		
Count of public transport stops	1.000 (1.000-1.001)	1.001 (0.998-1.003)
Distance (per 100m) to closest public transport stop	0.997 (0.991-1.002)	1.003 (0.991-1.016)
Count of public transport stops with a frequent weekday service	*1.001 (1.000-1.001)**	1.006 (0.999-1.014)
Distance (per 100m) to closest public transport stop with a frequent weekday service	0.997 (0.994-1.001)	0.993 (0.975-1.011)
Public open space (POS)[2]		
Count of POS	*1.001 (1.000-1.002)***	1.003 (0.999-1.007)

Measure	Major city (n=182,913) OR (95%CI)	Regional city (n=22,111) OR (95%CI)
Distance (per 100 m) to closest POS	0.997 (0.992-1.003)	0.997 (0.986-1.008)
Count of POS ≤0.4 Ha	*1.002 (1.000-1.003)**	1.003 (0.996-1.010)
Distance (per 100m) to closest POS ≤0.4 Ha	1.002 (0.999-1.006)	0.995 (0.984-1.007)
Count of POS >0.4 to ≤1 Ha	1.005 (1.000-1.009)	1.015 (0.997-1.033)
Distance (per 100m) to closest POS >0.4 to ≤1 Ha	1.002 (0.999-1.006)	1.000 (0.989-1.011)
Count of POS >0.4 Ha	1.002 (1.000-1.004)	1.006 (1.000-1.013)
Distance (per 100m) to closest POS >0.4 Ha	0.998 (0.994-1.000)	0.997 (0.986-1.008)
Count of POS >1.5 Ha	1.002 (0.998-1.005)	1.009 (0.999-1.020)
Distance (per 100m) to closest POS >1.5 Ha	0.997 (0.993-1.001)	0.999 (0.988-1.010)
Count of playgrounds	*1.008 (1.005-1.011)***	0.995 (0.982-1.009)
Distance (per 100m) to closest playground	**✓0.996 (0.992-0.999)***	1.006 (0.993-1.020)
Early childhood education and care[3†]		
Count of childcare centres meeting national standards	1.000 (0.999-1.001)	1.003 (0.997-1.010)
Distance (per 100m) to closest childcare centre meeting national standards	0.999 (0.997-1.002)	0.998 (0.991-1.005)
Count of childcare centres exceeding national standards	**✓0.997 (0.995-1.000)***	1.000 (1.000-1.000)
Distance (per 100m) to closest childcare centre exceeding national standards	*1.004 (1.002-1.006)****	0.996 (0.989-1.002)
Count of preschool services meeting national standards	0.996 (0.992-1.001)	1.007 (0.992-1.022)
Distance (per 100m) to closest preschool service meeting national standards	0.997 (0.995-1.000)	1.002 (0.995-1.008)
Count of preschool services exceeding national standards	**✓0.991 (0.985-0.997)****	1.014 (0.983-1.046)
Distance (per 100m) to closest preschool service exceeding national standards	1.002 (1.000-1.004)	1.000 (0.994-1.006)
Family friendly destinations[3]		
Count of sport facilities	1.000 (0.999-1.001)	1.002 (0.997-1.006)
Distance (per 100m) to closest sport facility	1.001 (0.999-1.004)	0.997 (0.991-1.003)
Count of public swimming pools	1.000 (1.000-1.000)	1.000 (0.997-1.004)
Distance (per 100m) to closest public swimming pool	0.998 (0.997-1.000)	*1.008 (1.001-1.015)***
Count of public libraries	0.998 (0.988-1.009)	0.965 (0.912-1.021)
Distance (per 100m) to closest public library	0.999 (0.997-1.001)	1.004 (0.996-1.012)
Count of community centres	***1.015 (1.007-1.023)*****	***1.061 (1.020-1.104)****
Distance (per 100m) to closest community centre	0.998 (0.996-1.001)	0.996 (0.988-1.004)
Count of activity centres	1.004 (1.000-1.009)	1.005 (0.979-1.032)
Distance (per 100m) to closest activity centre	0.999 (0.997-1.000)	1.001 (0.994-1.008)
Family-friendly destinations score	1.000 (1.000-1.000)	1.001 (0.998-1.003)
Food outlets[3]		
Percentage of healthier food outlets	**✓0.999 (0.998-1.000)****	0.999 (0.997-1.001)

Key: CI: confidence interval. DV1: Developmentally vulnerable on one or more AEDC domains. Ha: hectare; m: metre. OR: odds ratio. POS: public open space.[1]Spatial unit is Statistical Area Level 1 (SA1); [2]Spatial unit is 1,600m street network distance around child's home; [3]Spatial unit is 3,200m street network distance around child's home. ✓Bold text: association in expected direction; *Bold text: association in opposite direction to expected; Italicised text: negligible association. ***p<0.001; **p<0.01; *p<0.05.

Notes: Model adjusted for state/territory, neighbourhood disadvantage (SEIFA-IRSD at SA1 level); child's indigenous status, language background other than English, parental education, and sex. See **Table 2** for measure descriptions. Built environment characteristics were modelled separately. †Children in WA and TAS excluded from early childhood education and care services analysis (see Notes in **Table 3**). See **Table 3** for built environment descriptions.

Table 10 shows neighbourhood disadvantage estimates for DV1 before and after adjusting for built environment characteristics in the final models. Only built environment measures with significant associations are shown. Compared with the least disadvantaged quintile, neighbourhood disadvantage at all quintiles attenuated only slightly after adjustment for built environment characteristics.

Table 10. Neighbourhood disadvantage, built environment characteristics and odds of developmental vulnerability (DV1) in major and regional cities

	Model 1 OR (95%CI)	Model 2 OR (95%CI)	Model 3 (a-f) OR (95%CI)					
Major city (n=182,913)								
Neighbourhood disadvantage			3a. Adjusted for count of †childcare centres exceeding national standards[3]	3b. Adjusted for count of †preschool services exceeding national standards[3]	3c. Adjusted for % healthier food outlets[3]	3d. Adjusted for distance to closet playgrounds[2]	3e. Adjusted for daily living score[2]	3f. Adjusted for count of community centres[3]
Q5 (least disadvantaged)	1.00	1.00	1.00	1.00				
Q4	1.22 (1.17-1.27)	1.11 (1.06-1.15)	1.09 (1.05-1.14)	1.09 (1.05-1.14)	1.10 (1.06-1.14)	1.01 (1.05-1.14)	1.10 (1.06-1.15)	1.10 (1.06-1.15)
Q3	1.48 (1.42-1.54)	1.25 (1.20-1.31)	1.24 (1.19-1.30)	1.24 (1.19-1.29)	1.26 (1.20-1.31)	1.26 (1.21-1.31)	1.25 (1.20-1.30)	1.25 (1.20-1.31)
Q2	1.87 (1.80-1.95)	1.47 (1.41-1.53)	1.47 (1.40-1.53)	1.46 (1.40-1.53)	1.46 (1.40-1.52)	1.46 (1.40-1.53)	1.46 (1.40-1.52)	1.47 (1.41-1.53)
Q1 (most disadvantaged)	2.54 (2.44-2.64)	1.73 (1.66-1.81)	1.71 (1.64-1.79)	1.71 (1.64-1.79)	1.72 (1.64-1.79)	1.73 (1.65-1.81)	1.72 (1.65-1.79)	1.72 (1.65-1.80)
Regional city (n=22,111)								
	Model 4 OR (95%CI)	**Model 5 OR (95%CI)**	**Model 6a**	**Model 6b**				
Neighbourhood disadvantage			6a. Adjusted for housing affordability stress[1]	6b. Adjusted for housing density[1]				
Q5 (least disadvantaged)	1.00	1.00	1.00	1.00				
Q4	1.21 (1.07-1.37)	1.19 (1.04-1.35)	1.18 (1.04-1.34)	1.19 (1.05-1.35)				
Q3	1.52 (1.34-1.71)	1.36 (1.20-1.54)	1.35 (1.19-1.53)	1.37 (1.21-1.55)				
Q2	1.89 (1.67-2.13)	1.59 (1.40-1.80)	1.57 (1.38-1.78)	1.59 (1.40-1.80)				
Q1 (most disadvantaged)	2.57 (2.27-2.92)	1.92 (1.69-2.19)	1.89 (1.65-2.16)	1.92 (1.69-2.20)				

Key: CI: confidence interval. DV1: Developmentally vulnerable on one or more AEDC domains. OR: odds ratio. Q: quintile. [1]Spatial unit is Statistical Area Level 1 (SA1); [2]Spatial unit is 1,600m street network distance around child's home; [3]Spatial unit is 3,200m street network distance around child's home.
Notes: Q5 is the reference category. Model 1 (Major city) and Model 4 (Regional city): neighbourhood disadvantage adjusted for state/territory. Model 2 (Major city) and Model 5 (Regional city): Previous model (i.e. Model 1 for Major city or Model 4 for Regional city) plus child's indigenous status, language background other than English, parental education, and sex. See **Table 2** for measure descriptions. Model 3a-f (Major city) and 6a-b (Regional city): Previous model (i.e. Model 2 for Major city or Model 5 for Regional city, plus built environment characteristic. Built environment characteristics were modelled separately. Only built environment measures with significant associations are shown. †Children in WA and TAS excluded from early childhood education and care services analysis (see Notes in **Table 3**). See **Table 3** for built environment descriptions.

Part 4 Discussion

Neighbourhood disadvantage remained significantly associated with developmental vulnerability on one or more AEDC domains (DV1) after adjustment for child/family variables and built environment characteristics. Few built environment measures were associated with ECD in major cities and regional cities after final adjustments; those that were had small associations with DV1 and minimal contribution to the neighbourhood disadvantage – DV1 relationship. In the major city sample, having more ECEC and preschool services exceeding national quality standards within 3,200m of children's homes was associated with lower odds of DV1, as was more healthier food outlets. Further distances to the closest playground was associated with lower odds of DV1. In the regional sample, housing measures (greater affordability and fewer high-rise density housing) were associated with lower odds of DV1.

For children with no access to local destinations and services, descriptive statistics showed a social gradient in the opposite direction. That is, compared with the least disadvantaged quintile (Q5), there were fewer children living in more disadvantaged neighbourhoods who had no access to local destinations. For children with access to local destinations and services, those living in the most disadvantaged areas in the major cities (Q1) had on average, better access to public transport and better walkability, yet were exposed to more traffic and housing affordability stress. Children living in the least disadvantaged neighbourhoods (Q5) had on average, better access to public open spaces (i.e. more and closer public open spaces), more ECEC services exceeding national quality standards within 3,200m, and more healthier food outlets within 3,200m. For regional cities, children living in the most disadvantaged areas were also exposed to more traffic and housing affordability stress. On average, they also had better walkability, and better access to public transport, public open space, family-friendly destinations, and ECEC services exceeding national standards. Housing density was slightly higher in the least disadvantaged areas, and more healthier food outlets were available.

4.1 Neighbourhood disadvantage and early childhood development

Neighbourhood disadvantage was significantly associated with DV1 even after adjustment for child/family and built environment characteristics. This finding was unsurprising given it is well known that neighbourhood disadvantage is associated with worse ECD outcomes.[60] Using the full 2015 AEDC sample (including those living in rural and remote areas), children living in disadvantaged neighbourhoods were 4.1 times more likely to be classified as DV1, compared with

those from the least disadvantaged neighbourhoods (unadjusted).[19] While higher than what we have shown, differences are likely due to sampling. For example, our sample of 205,030 children (vs. 302,003 in the full 2015 AEDC cohort) includes: 1) major and regional cities thus excluding those in more remote areas; 2) complete case analysis for children with data on all AEDC variables used in this report, thus excluding >12,000 children with additional special needs.

Goldfeld and colleagues (2018) examined the association between exposure to four lenses of disadvantage (sociodemographic, geographic environments, health conditions and risk factors and a composite of these) from 0–9 years and child development at 10–11 years using data from the Longitudinal Study of Australian Children. Children in the most disadvantaged composite trajectory had seven times higher risk of poor outcomes on two or more developmental domains, compared with those most advantaged.[16] Exposure to the most advantaged trajectory across all lenses could reduce poor developmental outcomes by as much as 70%. This suggests the need to account for, where possible, measures of different types or 'lenses' of disadvantage.[61, 62]

After adjusting for child/family characteristics, the inclusion of the built environment in our study reduced the effect of the neighbourhood disadvantage - DV1 association only slightly, suggesting that at a national level, the contribution of the built environment to this relationship exists but is minimal. Still, when intervening at the population level, these small differences could translate to large impacts. Moreover, while the effects of the built environment are small nationally, they may be larger in some cities. The relationship between neighbourhood disadvantage and the built environment may be more salient in certain contexts and less so or non-existent in others. Mapping from previous pilot testing (not shown here) illustrated that the patterning of built environments across Australian cities and towns varies – some cities show stark geographic inequities; others show minimal or even opposite-than-expected geographic patterning. Pooling all cities into a national analysis (albeit stratified by major city/regional city) provides a 'big picture' idea but does not effectively show whether relationships are stronger or weaker in some cities. Future research is needed to more fully understand and compare different geographic contexts across Australia.

There may also be additional pathways and factors contributing to the association between neighbourhood disadvantage and ECD which are beyond this study. Our previous work in the Kids in Communities Study,[62] conceptualises that governance, service and social factors may also help explain neighbourhood disadvantage and ECD relationship. Others also suggest social factors such as social capital, sense of community, neighbourhood attachment, collective efficacy, perceived and actual crime may contribute to the relationship.[32, 63]

4.2 Built environment and early childhood development

4.2.1 Early childhood education and care services

Our finding of decreased developmental vulnerability associated with more local ECEC services and preschool services exceeding national quality standards reinforces benefits of being able to access high quality, local ECEC services. Our findings align with previous research indicating that successful ECD outcomes partly depend on availability and quality of ECEC programs.[64] International evidence indicates that quality early childhood programs that impact positively on children's social and cognitive outcomes are cost-effective and yield improved educational performance for all children, especially for those from disadvantaged backgrounds.[65]

In major cities, five percent of children had no local access to higher quality ECEC services. Of these children, there was an inverse association in terms of the social gradient: compared with the least disadvantaged areas, the most disadvantaged areas had a lower proportion of children with no local access to high-quality ECEC services. This suggests that the majority of children living in disadvantaged neighbourhoods will have at least one high-quality ECEC service available locally. However, for those who have access to at least one high-quality ECEC service within 3,200m, our findings show that compared with the least disadvantaged neighbourhoods, the most disadvantaged neighbourhoods in major cities have worse access (i.e. fewer options, further distance from home), with a slight social gradient evident across neighbourhood disadvantage quintiles. Simply put, access to high-quality ECEC improved as neighbourhoods become less disadvantaged. Findings were different for regional cities. Children living in the most disadvantaged neighbourhoods had better access to high-quality ECEC services. These findings suggest that disadvantaged neighbourhoods in regional cities do not necessarily have disproportionately worse access to these services. In this study, we do not know whether local physical availability of a service translates to actual 'access' and utilisation of the service. Other service measures contributing to access (e.g. cost, enrolment availability, parent employment) were not measured and are beyond the scope of this report, yet are important considerations, particularly for disadvantaged families.[66]

Our findings align with other Australian research showing fewer and lower than average quality ECEC services in disadvantaged areas compared with more advantaged areas despite differences in measurement such as use of different ECEC data sources, operationalisation of quality and availability of ECEC services, and neighbourhood disadvantage measures.[48] For example, for

quality of ECEC, Cloney and colleagues (2015) used a validated tool that measured quality aspects of ECEC environments based on education-child interactions, *availability* was measured as the availability of full-time places at services, and neighbourhood disadvantage as SEIFA- Index of Relative Socio-Economic Advantage and Disadvantage (IRSAD)[48]

4.2.2 Housing

In regional cities (but not major cities), children living in areas (SA1s) with less high-rise density housing (four or more storeys) had lower odds of developmental vulnerability. However, and perhaps not unsurprising, the presence of high-rise housing (four or more storeys) was largely absent for many neighbourhoods in regional cities. Other studies have shown high-rise density housing may influence child outcomes through negative perceptions of neighbourhood safety,[67] which then reduces local social interactions and networks,[68] having negative consequences on parent mental health, family practices and parent restrictions on outdoor children's movement and play.[69] Interestingly, we did not find the same associations in major cities; however, further investigation of the interplay between high-rise housing, socioeconomic factors, and children's development in the context of major cities is warranted. We did not investigate whether the presence of high-rise housing is indicative of the socio-economic status of an area's residents, for example. Further, in major cities, the presence of high-rise housing may partly reflect changes to the neighbourhood due to gentrification or investment in the area; compared with regional cities, gentrification processes may occur more quickly in major cities, and housing types such as apartment living are not uncommon.

Lower levels of housing affordability stress were also associated with lower odds of DV1 in regional cities. Indirect effects of housing affordability on children's ECD may occur in a number of ways: families with high housing costs might be forced into lower quality housing or forced to re-locate to neighbourhoods with less access to essential services,[70, 71] reduced consumption of basic necessities such as food and health care,[72] financial hardship which may influence parental stress and subsequently mental health and punitive parenting styles,[73] all of which may lead to poorer outcomes for children. [7171]

4.2.3 Playgrounds and other destinations

We did not find associations between public open space access measures with ECD, this may potentially be because children and adolescents do not necessarily use their closest park.[74] We found that the odds of developmental vulnerability decreased for every 100m increase in distance to closest park. While it may seem counterintuitive, it is unsurprising. An Australian study of park features and park use reported that only 27% of adolescents used their closest park for physical

activity,[75] with another reporting that families travelled to better quality parks located further away.[74] This could also be the case for playgrounds; others have suggested playground features, size, type (e.g. natural vs. traditional) are associated with park use and children's play.[76, 77] More generally, public open space use has been associated with the 'attractiveness' or 'quality' of the space (e.g. features such as presence of shade, sporting activities, lighting, public toilets).[6, 74, 75]

This analysis found children living in areas with a higher daily living score had increased odds of DV1. An area's daily living score is a composite score of a range of essential destinations and services identified in previous studies to be important and essential for daily living. Close proximity to a mix of local destinations is an important component of destination accessibility associated with other child health behaviours and outcomes,[78, 79] however it is unknown from our study whether the quality, accessibility, and co-location of these destinations and services with each other (or with other built environment characteristics such as dwelling density and traffic exposure) play a role in this association.

4.2.4 Contextualising the report findings in relation to other research

Many of the other built environment measures interrogated showed negligible but significant effects with ECD. This was not surprising given that neighbourhoods are regarded as distal influences of ECD in the conceptual frameworks published in the literature. With family and home environments being most proximal to ECD outcomes, neighbourhoods provide the conditions that can help facilitate or hinder family lifestyle choices and behaviours, which in turn, impact on ECD. Large built environment effects on ECD were thus not expected *a priori*. A review by Minh et al (2017) suggested that family-level variables (e.g. parenting practices and behaviours) explained all or part of the association between neighbourhoods and ECD, largely because families exist in relation to other people, resources and opportunities within the local setting.[10]

Recent studies using Western Australian AEDC data also found small associations between different types of built environment measures and specific AEDC sub-domains.[30, 31] For example, Bell et al. (2020) found that higher residential densities, presence of railway stations, more playgroups and kindergartens/pre-primary schools and less backyard space were associated with decreased odds in physical development vulnerability, but were not associated with social and emotional vulnerability.[30] Christian and colleagues (2017) found local communities with fewer main roads showed decreases in social and emotional competence development vulnerabilities.[31] While our report focuses on DV1, future research should seek to explore built environment characteristics associated with separate AEDC domains at the national level.

For many of our built environment measures in regional cities, our findings did not reveal inequitable distribution of neighbourhood built environment attributes by neighbourhood disadvantage. For major cities, these findings were mixed. However, further interrogation is warranted within settings and between locations (e.g. across each city and LGA). Previous studies have found that more disadvantaged areas (compared with less disadvantaged areas) frequently have disproportionately fewer services and destinations available.[80] In contrast, others have also found disadvantaged neighbourhoods have better access to public transport and are more walkable, likely because of the higher residential densities and land use mixes.[81-83]

4.3 Strengths

Strengths of the AEDC-BE include its national coverage and large sample size, use of existing data, and calculation and application of objective built environment measures implemented at a fine-grained scale. The AEDC-BE provides the breadth of major city and regional city coverage to explore associations across approximately 80% of the estimated five-year old population in Australia. Its ability to capitalise and extend on data linkage techniques maximises the use and efficiency of data already invested in and collected.

Our study used spatial measures specific to each child's home address, along with small-area local neighbourhood measures. Previous studies suggest that the choice of spatial unit is likely to generate different results depending on the type of spatial measure, potentially leading to measurement (aggregation) errors, and differences in the magnitude of associations with health outcomes.[84] Finer resolution, smaller spatial unit data are generally considered as most appropriate for studying neighbourhood effects[85] because: 1) they can be aggregated to larger spatial units;[86] 2) capture more spatial heterogeneity; and: 3) better represent the 'local' proximate neighbourhood, which appears to be better predictor of an individual's behaviour, rather than regional- or city- level attributes.[87]

We also analysed continuous built environment measures, rather than using transformed or quantile versions of the measures. The approach is consistent with current good practice for built environment measures to prevent loss of information and power, and enables comparability with other studies given quantile cut-points are based on the sample distribution.[58, 88] Future research may seek to compare differences between quantile and continuous built environment measures on the outcome with regard to identifying dose-response relationships.

4.4 Limitations

There is increasing emphasis on using context- and behaviour-specific measures in built environment and health studies.[89] The AEDC was not designed to explore associations between neighbourhood built environments and ECD. This means variables along the pathways in which the neighbourhood may influence ECD were not measured (e.g. play behaviour outside of school, parenting styles, parent mental health, school / service quality factors, time spent in neighbourhoods or living at residence). Socioecological frameworks of child development [1] suggest other factors required to examine a multilevel framework for child development (individual (child), family, school factors) are missing from the AEDC-BE. Aside from further data linkage to other sources that collect information from multiple informants and sources (e.g. children and parents), future research also includes developing synthetically-created data (constructed data similar to real data but without compromising the privacy of individuals) using imputation techniques to allocate social and neighbourhood indicators to individuals (e.g. parent income, occupation, neighbourhood-level education and employment).[90] Developing these additional measures will allow for adjustment for additional socio-economic and social factors.

This suite of built environment measures was conceptualised for urban environments, not regional areas. Taking the example of 'walkability', it was not expected regional towns would have the infrastructure or population to support walkable attributes such as street connectivity and residential density, which may require extensive retrofitting and/or mixed-use development. Future research should seek to explore regional-specific built environment measures, and potentially different scales to ECD outcomes.

We also do not know which local destinations and services families may or may not use. We do not know whether families use services and destinations families within their local neighbourhood or elsewhere. Future research may consider Global Positioning Systems (GPS), travel diaries, questionnaires or other technologies (e.g. SoftGIS)[91] to obtain travel and usage information. Based on health and place-based evidence, the built environment measures used in this report reflect those that should be universally available in the local neighbourhood; the absence and distribution of these destinations locally may further disadvantage families who are already disadvantaged. However, as we have shown earlier in the report, the most disadvantaged areas have smaller proportions of children with *no* local destination and service access. While we cannot tell from our dataset whether this ameliorates the social gradient, future research could address this. From our data we are also unable to determine the timing of infrastructure delivery and which built environment features came 'first'. For example, we are unable to untangle whether housing was built before schools, or whether the neighbourhood was earmarked as suitable for a school or type

of housing, resulting in more people moving into the area and a subsequent increase in housing density.

Other limitations include missing or unavailable data; for example, we did not have comprehensive ECEC data for Western Australia and Tasmania in the linked dataset, nor did we have outcome data available for children with special needs (n=12,102). The AEDC does not calculate domain categories for children with special needs as special needs children are already identified as having substantial developmental needs. Moreover, geographies (e.g. SA1) were taken from the 2016 census, while AEDC data was from 2015; however, the impacts of this temporal mismatch are minimal with only 1% of children in the dataset affected by LGA geographic boundary changes. (e.g. although area based estimates derived from the 2016 ABS census were measured a year later than the AEDC census items, it would be unlikely that neighbourhood conditions would have changed dramatically in a short interval). Nevertheless, neighbourhood measurement of ecological conditions such as housing affordability based on SA1 statistics may be a source of misclassification bias.[46] The small area estimates derived using SA1 geographies in this study are indicative of the neighbourhood in which child development occurs but does not necessarily reflect an individual's situation (e.g. household experiences of housing stress). While we used a multidimensional measure of neighbourhood socioeconomic disadvantage (SEIFA-IRSD), we were lacking a similar multidimensional measure of individual families' socioeconomic position. Our models controlled for maternal education, which has been shown to be the most strongly associated with children's developmental outcomes. However, future research using synthetic data sources should make sure of information on other family-level socioeconomic factors (e.g. household income, parents' occupation). Others have suggested proposing household level indices as an adjunct to SEIFA, to better understand heterogeneity of advantage and disadvantage within an area.[92]

4.5 Policy, practice and research implications

Evidence-based built environment metrics and indicators can be used as tools for identifying and monitoring ECD-supportive neighbourhoods, informing evidence-based place-based initiatives and reducing inequities in ECD at scale. Despite the small effects shown in this report, utilising these leverage points may have on-going and widespread impacts, particularly when targeting whole-of-population outcomes and vulnerable groups. Based on our findings, increasing local access to ECEC and preschool services exceeding national quality standards and healthier food outlets, making housing more affordable, and cautiously increasing housing density are among the first promising indicators objectively related to good ECD outcomes at a large scale. However, these indicators depend on context (e.g. urban vs. regional) and potential inter- and intra-city differences need to be examined.

Further research includes:

1) *Developing and applying synthetic data to account for social, socio-demographic and neighbourhood compositional factors currently missing from the AEDC-BE dataset.* This will enable identification of the multiple and complete pathways in which the neighbourhood, including disadvantage, influences ECD.

2) *Testing additional built environment measures conceptualised as important for ECD*. Due to resource limitations and the current COVID-19 climate, challenges were experienced with remote working and computer processing. However, it may be that further linkage to other relevant sources is possible in future.

Other avenues for exploration include comparing quantile and continuous built environment measures associations with ECD; exploring the built environment measures with specific AEDC domains; exploring ECD associations across diverse contexts; and identifying and investigating regional-specific built environment measures. Further work using this dataset may also re-classify neighbourhoods based on developmental vulnerability status. Future research may also explore the changes in built environment and AEDC results over time (i.e. every three years from 2009 to 2018).

Part 5 Conclusion

The built environment had a small influence on the relationship between neighbourhood disadvantage and ECD at the national level. Few built environment measures were significantly associated with ECD; those that were had small effects on developmental vulnerability on one or more AEDC domains. However, small effects at the population level may have ongoing and wide-ranging impacts, meaning that modifying the built environment at scale is promising for supporting good child outcomes.

Further work is needed to explore modifiable leverage points of ECD-supportive built environments across different geographic contexts (e.g. between states and territories, between cities, and specific to regional areas) and developmental subdomains (e.g. physical development, social and emotional development). The development and testing of the AEDC-BE so far has enabled further possibility in refining our linked measures, as well as testing additional measures such as public open space features and quality. Future data visualisation may help to identify neighbourhood inequities within suburbs and cities, and at a national scale, assist to develop interventions and strategies for areas lacking in resources, policies and infrastructure. Enabling a better understanding of how built environment characteristics are distributed by neighbourhood disadvantage, diversity, and ECD outcomes, may help address gaps in ECD inequities.

Part 6 References

1. Bronfenbrenner U. The Ecology of Human Development: Experiments by Nature and Design. Cambridge, Massachussets: Harvard University Press; 1979.

2. Leventhal T, Brooks-Gunn J. The neighborhoods they live in: the effects of neighborhood residence on child and adolescent outcomes. Psychological Bulletin. 2000;126(2):309-37.

3. Marmot M, Health CoSDo. Achieving health equity: from root causes to fair outcomes. The Lancet. 2007;370(9593):1153-63.

4. Ding D, Gebel K. Built environment, physical activity, and obesity: what have we learned from reviewing the literature? Health & place. 2012;18(1):100-5.

5. Sallis JF, Floyd MF, Rodríguez DA, Saelens BE. Role of built environments in physical activity, obesity, and cardiovascular disease. Circulation. 2012;125(5):729-37.

6. Christian H, Zubrick SR, Foster S, Giles-Corti B, Bull F, Wood L, et al. The influence of the neighborhood physical environment on early child health and development: A review and call for research. Health & place. 2015;33:25-36.

7. Villanueva K, Badland H, Kvalsvig A, O'Connor M, Christian H, Woolcock G, et al. Can the neighborhood built environment make a difference in children's development? Building the research agenda to create evidence for place-based children's policy. Academic pediatrics. 2016;16(1):10-9.

8. UNICEF. What is a child-friendly city? 2020 [Available from: https://childfriendlycities.org/what-is-a-child-friendly-city/.

9. Graham K, O'Neil D. Collective impact: The birth of an Australian movement. The Philanthropist. 2014;26(1).

10. Minh A, Muhajarine N, Janus M, Brownell M, Guhn M. A review of neighborhood effects and early child development: How, where, and for whom, do neighborhoods matter? Health & Place. 2017;46:155-74.

11. Clark H, Coll-Seck AM, Banerjee A, Peterson S, Dalglish SL, Ameratunga S, et al. A future for the world's children? A WHO–UNICEF–Lancet Commission. The Lancet. 2020;395(10224):605-58.

12. Alderton A, Villanueva K, Higgs C, Badland H, S G. The importance of the neighbourhood built environment for Australian children's development. A report on a data linkage

pilot project. . Melbourne, Australia2019.

13. Australian Government Department of Infrastructure Transport Cities and Regional Development. National Cities Performance Framework 2017 [Available from: https://smart-cities.dashboard.gov.au/all-cities/overview.

14. Shonkoff J, Richter L, van der Gaag J, Bhutta Z. An Integrated Scientific Framework for Child Survival and Early Childhood Development. Pediatrics. 2012;129(2):e460-e72.

15. Goldfeld S, Woolcock G, Katz I, Tanton R, Brinkman S, O'Connor E, et al. Neighbourhood Effects Influencing Early Childhood Development: Conceptual Model and Trial Measurement Methodologies from the Kids in Communities Study. Social Indicators Research. 2015;120(1):197-212.

16. Goldfeld S, O'Connor M, Chong S, Gray S, O'Connor E, Woolfenden S, et al. The impact of multidimensional disadvantage over childhood on developmental outcomes in Australia. International journal of epidemiology. 2018;47(5):1485-96.

17. Moore T, Arefadib N, Deery A, West S. The First Thousand Days: An Evidence Paper. Parkille, Victoria: Centre for Community Child Health,

Murdoch Children's Research Institute; 2017.

18. Woolfenden S, Goldfeld S, Raman S, Eapen V, Kemp L, Williams K. Inequity in child health: the importance of early childhood development. Journal of paediatrics and child health. 2013;49(9).

19. Australian Government Department of Education and Training. Australian Early Development Census National Report 2015: A Snapshot of Early Childhood Development in Australia. In: Commonwealth of Australia Department of Education and Training, editor. Australia2016.

20. Ryan C, Whelan S. Locational disadvantage, socio-economic status and mobility behaviour—evidence from Australia. Research School of Economics, Australian National University. 2010.

21. Goldfeld S, Gray S, Azpitarte F, Cloney D, Mensah F, Redmond G, et al. Driving precision policy responses to child health and developmental inequities. Health equity. 2019;3(1):489-94.

22. Australian Government Department of Social Services. Stronger Places, Stronger People Australia2019 [Available from: https://www.dss.gov.au/families-and-children-programs-services/stronger-places-stronger-people.

23. Logan Together. About Logan Together Australia2017 [Available from: https://logantogether.org.au/about-us/.

24. Irwin L. Early child development: A powerful equalizer. Final report for the World Health Organization's Commission on the social determinants of health. http://www who int/social_determinants/resources/ecd_kn_report_07_2007 pdf. 2007.

25. Woolcock G, Gleeson B, Randolph B. Urban research and child-friendly cities: a new Australian outline. Children's Geographies. 2010;8(2):177-92.

26. Badland H, Whitzman C, Lowe M, Davern M, Aye L, Butterworth I, et al. Urban liveability: emerging lessons from Australia for exploring the potential for indicators to measure the social determinants of health. Social science & medicine. 2014;111:64-73.

27. Smith M, Hosking J, Woodward A, Witten K, MacMillan A, Field A, et al. Systematic literature review of built environment effects on physical activity and active transport–an update and new findings on health equity. International Journal of Behavioral Nutrition and Physical Activity. 2017;14(1):158.

28. McGrath LJ, Hopkins WG, Hinckson EA. Associations of objectively measured built-environment attributes with youth moderate–vigorous physical activity: a systematic review and meta-analysis. Sports medicine. 2015;45(6):841-65.

29. Gascon M, Vrijheid M, Nieuwenhuijsen MJ. The built environment and child health: an overview of current evidence. Current environmental health reports. 2016;3(3):250-7.

30. Bell MF, Turrell G, Beesley B, Boruff B, Trapp G, Zubrick SR, et al. Children's neighbourhood physical environment and early development: an individual child level linked data study. J Epidemiol Community Health. 2020;74(4):321-9.

31. Christian H, Ball SJ, Zubrick SR, Brinkman S, Turrell G, Boruff B, et al. Relationship between the neighbourhood built environment and early child development. Health & place. 2017;48:90-101.

32. Komro KA, Flay BR, Biglan A, Consortium PNR. Creating nurturing environments: A science-based framework for promoting child health and development within high-poverty neighborhoods. Clinical child and family psychology review. 2011;14(2):111-34.

33. Giles-Corti B, Vernez-Moudon A, Reis R, Turrell G, Dannenberg AL, Badland H, et al. City planning and population health: a global challenge. The lancet. 2016;388(10062):2912-24.

34. Higgs C, Badland H, Simons K, Knibbs LD, Giles-Corti B. The Urban Liveability Index: developing a policy-relevant urban liveability composite measure and evaluating associations with transport mode choice. International journal of health geographics. 2019;18(1):14.

35. Villanueva K, Badland H, Giles-Corti B, Goldfeld S. Using spatial analysis of the A ustralian E arly D evelopment I ndex to advance our understanding of 'neighbourhood effects' research on child health and development. Journal of Paediatrics and Child Health. 2015;51(6):577-9.

36. Goldfeld S, Villanueva K, Lee J, Robinson R, Moriarty A, Peel D, et al. Foundational Community Factors (FCFs) for Early Childhood Development: A report on the Kids in Communities Study. 2018.

37. Goldfeld S, Mathews T, Brinkman S, Woolcock G, Myers J, Kershaw P, et al. The Kids in Communities Study: Measuring community level factors influencing children's development. Melbourne: Murdoch Childrens' Research Institute; 2010.

38. Alderton A, Villanueva K, Higgs C, Badland H, Goldfeld S. The importance of the neighbourhood built environment for Australian children's development. A report on a data linkage pilot project. Melbourne, Australia: Murdoch Children's Research Institute and RMIT University,; 2019.

39. Australian Government Department of Infrastructure T, Cities and Regional Development,. National Cities Performance Framework 2017 [Available from: https://smart-cities.dashboard.gov.au/all-cities/overview.

40. Brinkman SA, Gregory TA, Goldfeld S, Lynch JW, Hardy M. Data Resource Profile: The Australian Early Development Index (AEDI). International Journal of Epidemiology. 2014;43(4):1089-96.

41. Commonwealth of Australia Department of Education and Training. Australian Early Development Census National Report 2015: A Snapshot of Early Childhood Development in Australia. Department of Education and Training, ; 2016.

42. Australian Government Department of Education and Training. AEDC Data Dictionary 2019 (v5). In: Australian Government Department of Education and Training, editor. Australia2019.

43. Australian Bureau of Statistics. The Australian Statistical Geography Standard (ASGS) Last updated July 2018, [Available from: http://www.abs.gov.au/websitedbs/D3310114.nsf/home/Australian+Statistical+Geography+Standard+(ASGS.

44. Australian Bureau of Statistics, Hugo Centre for Population and Housing at the University of Adelaide. The Australian Statistical Geography Standard (ASGS) Remoteness Structure,. 2011.

45. Australian Urban Observatory [Internet]. 2019.

46. Greenland S, Morgenstern H. Ecological bias, confounding, and effect modification. International journal of epidemiology. 1989;18(1):269-74.

47. Timperio A, Ball K, Salmon J, Roberts R, Giles-Corti B, Simmons D, et al. Personal, family, social, and environmental correlates of active commuting to school. American journal of preventive medicine. 2006;30(1):45-51.

48. Cloney D, Cleveland G, Hattie J, Tayler C. Variations in the Availability and Quality of Early Childhood Education and Care by Socioeconomic Status of Neighborhoods. Early Education and Development. 2016;27(3):384-401.

49. Giles-Corti B, Wood G, Pikora T, Learnihan V, Bulsara M, Van Niel K, et al. School site and the potential to walk to school: The impact of street connectivity and traffic exposure in school neighborhoods. Health & place. 2011;17(2):545-50.

50. AHURI (Australian Housing and Urban Research Institute). Understanding the 30:40 indicator of housing affordability stress - Comparing household income with housing costs Canberra: Australian Housing and Urban Research Institute; 2019 updated 23 May 2019.

51. 2016 Census of Population and Housing, Customised Data Report. [Internet]. 2017.

52. Mavoa S, Boulangé C, Eagleson S, Stewart J, Badland HM, Giles-Corti B, et al. Identifying appropriate land-use mix measures for use in a national walkability index. Journal of Transport and Land Use. 2018;11(1):681-700.

53. Gunn LD, Mavoa S, Boulangé C, Hooper P, Kavanagh A, Giles-Corti B. Designing healthy communities: creating evidence on metrics for built environment features associated with walkable neighbourhood activity centres. International Journal of Behavioral Nutrition and Physical Activity. 2017;14(1):164.

54. Australian Children's Education & Care Quality Authority. National Quality Standard 2018 [29 September 2018]. Available from: https://www.acecqa.gov.au/nqf/national-quality-standard.

55. Edwards N, Hooper P, Trapp GS, Bull F, Boruff B, Giles-Corti B. Development of a public open space desktop auditing tool (POSDAT): a remote sensing approach. Applied Geography. 2013;38:22-30.

56. OpenStreetMap contributors. Planet dump. 2018.

57. Austin PC, Merlo J. Intermediate and advanced topics in multilevel logistic regression analysis. Statistics in medicine. 2017;36(20):3257-77.

58. Lamb KE, White SR. Categorisation of built environment characteristics: the trouble with tertiles. International Journal of Behavioral Nutrition and Physical Activity. 2015;12(1):19.

59. Leckie G, Charlton C. Runmlwin-a program to Run the MLwiN multilevel modelling software from within stata. Journal of Statistical Software. 2013;52(11):1-40.

60. Bradley RH, Corwyn RF. Socioeconomic status and child development. Annual review of psychology. 2002;53(1):371-99.

61. Goldfeld S, O'Connor M, Cloney D, Gray S, Redmond G, Badland H, et al. Understanding child disadvantage from a social determinants perspective. J Epidemiol Community Health. 2018;72(3):223-9.

62. Goldfeld S, O'Connor M, O'Connor E, Chong S, Badland H, Woolfenden S, et al. More than a snapshot in time: pathways of disadvantage over childhood. International journal of epidemiology. 2018;47(4):1307-16.

63. Drukker M, Kaplan C, Feron F, Van Os J. Children's health-related quality of life, neighbourhood socio-economic deprivation and social capital. A contextual analysis. Social science & medicine. 2003;57(5):825-41.

64. Goldfeld S, O'Connor E, O'Connor M, Sayers M, Moore T, Kvalsvig A, et al. The role of preschool in promoting children's healthy development: Evidence from an Australian population cohort. Early Childhood Research Quarterly. 2016;35:40-8.

65. Elliott A. Early childhood education: Pathways to quality and equity for all children. 2006.

66. Goldfeld S, Villanueva K, Lee J, Robinson R, Moriarty A, Peel D, et al. Foundational community factors (FCFs) for early childhood development: A report on the Kids in Communities Study. Melbourne, Australia, Murdoch Children's Research Institute; 2018.

67. Buys L, Miller E. Residential satisfaction in inner urban higher-density Brisbane, Australia: role of dwelling design, neighbourhood and neighbours. Journal of Environmental Planning and Management. 2012;55(3):319-38.

68. Hur M, Morrow-Jones H. Factors that influence residents' satisfaction with neighborhoods. Environment and behavior. 2008;40(5):619-35.

69. Carver A, Timperio A, Crawford D. Playing it safe: The influence of neighbourhood safety on children's physical activity—A review. Health & place. 2008;14(2):217-27.

70. Yates J, Milligan V, Berry M, Burke T, Gabriel M, Phibbs P, et al. Housing affordability: a 21st century problem. National research venture. 2007;3.

71. Dockery A, Kendall G, Li J, Mahendran A, Ong R, Strazdins L. Housing and children's development and wellbeing: a scoping study. Melbourne; 2010.

72. Harkness J, Newman SJ. Housing affordability and children's well-being: Evidence from the national survey of America's families. Housing Policy Debate. 2005;16(2):223-55.

73. Conger RD, Ge X, Elder Jr GH, Lorenz FO, Simons RL. Economic stress, coercive family process, and developmental problems of adolescents. Child development. 1994;65(2):541-61.

74. Veitch J, Bagley S, Ball K, Salmon J. Where do children usually play? A qualitative study of parents' perceptions of influences on children's active free-play. Health & place. 2006;12(4):383-93.

75. Edwards N, Hooper P, Knuiman M, Foster S, Giles-Corti B. Associations between park features and adolescent park use for physical activity. International Journal of Behavioral Nutrition and Physical Activity. 2015;12(1):21.

76. Hart CH, Sheehan R. Preschoolers' play behavior in outdoor environments: Effects of traditional and contemporary playgrounds. American educational research journal. 1986;23(4):668-78.

77. Little H, Eager D. Risk, challenge and safety: Implications for play quality and playground design. European Early Childhood Education Research Journal. 2010;18(4):497-513.

78. Ding D, Sallis JF, Kerr J, Lee S, Rosenberg DE. Neighborhood environment and physical activity among youth: a review. American journal of preventive medicine. 2011;41(4):442-55.

79. Jia P, Pan X, Liu F, He P, Zhang W, Liu L, et al. Land use mix in the neighbourhood and childhood obesity. Obesity Reviews. 2020.

80. Gordon-Larsen P, Nelson MC, Page P, Popkin BM. Inequality in the built environment underlies key health disparities in physical activity and obesity. Pediatrics. 2006;117(2):417-24.

81. King KE, Clarke PJ. A disadvantaged advantage in walkability: findings from socioeconomic and geographical analysis of national built environment data in the United States. American journal of epidemiology. 2015;181(1):17-25.

82. Turrell G, Haynes M, Wilson L-A, Giles-Corti B. Can the built environment reduce health inequalities? A study of neighbourhood socioeconomic disadvantage and walking for transport. Health & place. 2013;19:89-98.

83. Popkin BM, Duffey K, Gordon-Larsen P. Environmental influences on food choice, physical activity and energy balance. Physiology & behavior. 2005;86(5):603-13.

84. Learnihan V, Van Niel K, GILES-CORTI B, Knuiman M. Effect of scale on the links between walking and urban design. Geographical Research. 2011;49(2):183-91.

85. Hewko J, Smoyer-Tomic KE, Hodgson MJ. Measuring neighbourhood spatial accessibility to urban amenities: does aggregation error matter? Environment and Planning A. 2002;34(7):1185-206.

86. Kwan M-P. The uncertain geographic context problem. Annals of the Association of American Geographers. 2012;102(5):958-68.

87. Handy S. Critical assessment of the literature on the relationships among transportation, land use, and physical activity. Transportation Research Board and the Institute of Medicine Committee on Physical Activity, Health, Transportation, and Land Use Resource paper for TRB Special Report. 2005;282(1):1-81.

88. Bennette C, Vickers A. Against quantiles: categorization of continuous variables in epidemiologic research, and its discontents. BMC medical research methodology. 2012;12(1):21.

89. Giles-Corti B, Timperio A, Bull F, Pikora T. Understanding physical activity environmental correlates: increased specificity for ecological models. Exercise and sport sciences reviews. 2005;33(4):175-81.

90. Tanton R, Vidyattama Y, Nepal B, McNamara J. Small area estimation using a reweighting algorithm. Journal of the Royal Statistical Society: Series A (Statistics in Society). 2011;174(4):931-51.

91. Kyttä M, Broberg A, Tzoulas T, Snabb K. Towards contextually sensitive urban densification: Location-based softGIS knowledge revealing perceived residential environmental quality. Landscape and Urban Planning. 2013;113:30-46.

92. Wise P, Mathews R. Socio-Economic Indexes For Areas: Getting a Handle on Individual Diversity Within Areas. In: Statistics ABo, editor. Canberra2011.

Part 7 Appendices

Appendix 1. Built environment data sources

Table 11. Built environment data sources

Custodian	Year	Data source description	Purpose
Department of Education, Skills and Employment	2015	Australian Early Development Census	Child development data, child demographics including data relating to geography derived using publicly available ABS sources (SEIFA-IRSD of child's SA1, ASGS remoteness category)
ABS	2016	Census of population and housing, customised data report	Housing affordability
	2016	ASGS Volume 1 geopackage	Mesh Block, SA1, SA2, SA3, SA4, GCCSA boundaries
	2016	Mesh Block dwelling and person counts	Dwellings
	2016	Mesh Block - Suburb linkage csv	Suburb
	2016	Mesh Block - LGA linkage csv	LGA
	2016	SA1 urban centres and localities linkage	Section of State
	2016	ASGS Volume 3 geopackage	Suburb and LGA geometries
	2016	ASGS Volume 4 geopackage	Signficant Urban Area geometries
	2016	SEIFA IRSD 2011 (SA1)	IRSD related statistics
OpenStreetMap		Retrieved 1 October 2018	
	2018	Pedestrian network, generated using OSMnx, using Overpass API using hybrid walk-cycle network	Accessibility analysis
	2018	Intersections, generated using OSMnx with processed pedestrian network	Modelling street connectivity
	2018	Destinations (see definitions, elsewhere)	Accessibility analysis
	2018	Open Space (see definitions, elsewhere)	Accessibility analysis
ACECQA	2019	Australian Children's Education & Care Quality Authority child care centres (geocoded)	Accessibility analysis
ACARA	2019	Australian Curriculum, Assessment and Reporting Authority (ACARA), Primary and secondary schools, by sector (geocoded)	Accessibility analysis
NHSD	2017	National Health Services Directory (via AURIN Portal)	Accessibility analysis
Pitney Bowes	2014	Convenience stores	Accessibility analysis
Pitney Bowes	2014	Newsagencies	Accessibility analysis

Custodian	Year	Data source description	Purpose
Pitney Bowes	2014	Petrol stations	Accessibility analysis
HLC	2017	Additional geocoded datasets curated by Health Liveable Cities group from multiple sources (supermarket major chains, 2017; Australian Libraries, 2016-18)	Accessibility analysis
PSMA	2017	Transport and Topography	Traffic exposure
State Transport agencies	2018	GTFS feed data covering the period 8 October to 5 December for 2018	Accessibility and transport analysis

Key: ABS: Australian Bureau of Statistics. ACECQA: Australian Children's Education & Care Quality Authority. ASGS: Australian Standard Geography Structure. GCCSA: Greater Capital City Statistical Area. GTFS: General Transit Feed Specification. HLC: Healthy Liveable Cities Group (RMIT). LGA; Local Government Authority. NHSD: National Health Services Directory. SA1: Statistical Area Level 1; SA2: Statistical Area Level 2; Statistical Area Level 3; SA4: Statistical Area Level 4. SEIFA-IRSD: Socio-Economic Index For Areas – Index of Relative Socio-Economic Disadvantage.

Appendix 2. Sample descriptives by neighbourhood disadvantage for major and regional cities

Table 12. Sample descriptives by neighbourhood disadvantage for major and regional cities

	Major city (n=182,913)					Regional city (n=22,117)				
	Neighbourhood disadvantage n (%)					Neighbourhood disadvantage n (%)				
Variable	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**
Age group										
< 5 years	162 (23.4)	165 (23.8)	126 (18.2)	107 (15.4)	133 (19.2)	ND	ND	ND	ND	ND
5 years	21,718 (15.9)	22,620 (16.6)	25,656 (18.8)	30,384 (22.3)	35,918 (26.3)	2,520 (16.1)	3,129 (20.0)	3,494 (22.4)	3,564 (22.8)	2,916 (18.7)
6+ years	6,143 (13.4)	6,956 (15.1)	8,609 (18.7)	10,848 (23.6)	13,368 (29.1)	1,021 (15.9)	1,249 (19.4)	1,528 (23.8)	1,488 (23.2)	1,135 (17.7)
Gender										
Female	14,084 (15.5)	14,791 (16.3)	17,291 (19.0)	20,303 (22.3)	24,430 (26.9)	1,754 (15.9)	2,223 (20.2)	2,483 (22.5)	2,538 (23.0)	2,030 (18.4)
Male	13,939 (15.1)	14,950 (16.2)	17,100 (18.6)	21,036 (22.9)	24,989 (27.2)	1,802 (16.2)	2,164 (19.5)	2,548 (23.0)	2,531 (22.8)	2,044 (18.4)
Language Background other than English										
No	14,838 (11.1)	20,135 (15.1)	25,529 (19.1)	32,555 (24.4)	40,550 (30.3)	3,156 (15.6)	3,968 (19.6)	4,646 (22.9)	4,704 (23.2)	3,796 (18.7)
Yes	13,185 (26.7)	9,606 (19.5)	8,862 (18.0)	8,784 (17.8)	8,869 (18.0)	400 (21.7)	419 (22.7)	385 (20.8)	365 (19.8)	278 (15.0)
Indigenous status										
No	26,275 (14.8)	28,592 (16.1)	33,555 (18.8)	40,658 (22.8)	48,987 (27.5)	2,903 (14.2)	3,968 (19.5)	4,701 (23.1)	4,852 (23.8)	3,951 (19.4)
Yes	1,748 (36.1)	1,149 (23.7)	836 (17.2)	681 (14.0)	432 (8.9)	653 (37.5)	419 (24.0)	330 (18.9)	217 (12.5)	123 (7.1)
Maternal education										
Bachelor degree or higher	5,478 (7.31)	8,822 (11.8)	12,920 (17.3)	18,893 (25.3)	28,518 (38.2)	469 (7.5)	971 (15.6)	1,371 (22.0)	1,758 (28.3)	1,652 (26.6)
Other tertiary and/or Year 12	15,072 (17.1)	16,350 (18.6)	17,860 (20.3)	19,619 (22.3)	19,060 (21.7)	1,965 (15.8)	2,598 (20.8)	2,944 (23.6)	2,819 (22.6)	2,134 (17.3)
Less than Year 12	7,473 (36.8)	4,569 (22.5)	3,611 (17.8)	2,827 (13.9)	1,841 (9.1)	1,122 (32.6)	818 (23.8)	716 (20.8)	492 (14.3)	288 (8.4)
Child's home state/territory										
ACT	71 (1.7)	199 (4.8)	467 (11.3)	1,036 (25.1)	2,361 (57.1)	ND	ND	ND	ND	ND
NSW	12,588 (19.9)	10,576 (16.5)	10,266 (16.3)	11,717 (18.6)	17,967 (28.5)	359 (15.9)	363 (16.1)	518 (23.0)	673 (29.9)	339 (15.1)
NT	N/A	N/A	N/A	N/A	N/A	120 (7.3)	258 (15.7)	392 (23.8)	422 (25.6)	453 (27.5)
QLD	4,268 (12.4)	5,820 (17.0)	7,449 (21.7)	8,305 (24.2)	8,469 (24.7)	1,585 (17.5)	2,130 (23.5)	1,928 (21.3)	1,808 (20.0)	1,592 (17.6)
SA	2,432 (20.8)	2,577 (22.0)	2,278 (19.5)	2,474 (21.1)	1,948 (16.6)	36 (5.0)	96 (13.4)	229 (31.9)	195 (27.2)	162 (22.6)
TAS	N/A	N/A	N/A	N/A	N/A	724 (25.9)	518 (18.5)	600 (21.4)	610 (21.8)	348 (12.4)
VIC	6,843 (14.2)	7,265 (15.1)	10,142 (21.1)	12,334 (25.7)	11,447 (23.8)	671 (13.0)	944 (18.3)	1,199 (23.2)	1,193 (23.1)	1,155 (22.4)
WA	1,821 (8.4)	3,304 (15.3)	3,817 (17.6)	5,473 (25.3)	7,227 (33.4)	61 (13.0)	78 (16.6)	165 (35.2)	140 (29.8)	25 (5.3)
Total	28,023 (15.3)	29,741 (16.3)	34,391 (18.8)	41,339 (22.6)	49,419 (27.0)	3,556 (16.1)	4,387 (19.8)	5,031 (22.7)	5,069 (22.9)	4,074 (18.4)

Key: Q: Quintile. Q1=most disadvantaged – Q5= least disadvantaged. N/A: not applicable (there are no cities or towns in NT or TAS classified as 'Major City' in the ASGS Remoteness Areas). ND: not displayed due to data suppression.
Notes: ACT descriptives are presented for the whole state (not stratified by major city/regional) in order to preserve confidentiality and in compliance with AEDC data guidelines. See **Table 2** for measure descriptions.

Appendix 3. Descriptive statistics for built environment characteristics across major and regional cities

Table 13. Descriptive built environment characteristics for major cities

	Major cities (n=182,917)						
	Mean	**SD**	**Median**	**P1**	**P99**	**Min**	**Max**
Traffic[1]							
Traffic exposure	0.3	0.3	0.2	0.0	1.8	0.0	1.8
Housing[1]							
Housing affordability stress	38.1	18.4	36.8	0.0	85.0	0.0	200.0
Housing density	9.3	55.7	0.0	0.0	239.0	0.0	2666.0
Walkability[2]							
Dwelling density	14.3	7.1	12.6	3.9	42.5	0.1	79.1
Street connectivity	80.3	23.8	77.9	20.6	161.8	0.0	249.2
Daily living score	2.3	0.6	2.5	0.2	3.0	0.0	3.0
Local living score	6.5	2.5	6.6	0.5	10.7	0.0	10.9
Walkability score	0.3	1.9	0.4	-4.8	6.1	-9.1	12.4
Public transport[2]							
Count of public transport stops	48.8	31.7	43.0	0.0	136.0	0.0	252.0
Distance (m) to closest public transport stop	321.1	237.1	272.0	7.0	1182.0	0.0	1600.0
Count of public transport stops with a frequent weekday service	21.2	29.20	10.0	0.0	120.0	0.0	353.0
Distance (m) to closest public transport stop with a frequent weekday service	627.5	407.0	542.0	28.0	1560.0	0.0	1600.0
Public open space[2]							
Count of POS	19.1	13.2	17.0	1.0	69.0	0.0	153.0
Distance (m) to closest POS	276.8	226.9	228.0	1.0	1081.0	0.0	1600.0
Count of POS <=0.4 Ha	7.7	9.5	5.0	0.0	49.0	0.0	116.0
Distance (m) to closest POS <=0.4 Ha	617.5	383.7	556.0	11.0	1541.0	0.0	1600.0
Count of POS >0.4 to <=1 Ha	3.5	2.9	3.0	0.0	13.0	0.0	28.0
Distance (m) to closest POS >0.4 to <=1 Ha	685.5	398.6	646.0	11.0	1557.0	0.0	1600.0
Count of POS >0.4 Ha	11.4	6.0	11.0	1.0	29.0	0.0	72.0
Distance (m) to closest POS >0.4 Ha	326.1	253.3	274.0	1.0	1165.0	0.0	1600.0
Count of POS >1.5 Ha	6.6	3.5	6.0	0.0	16.0	0.0	48.0
Distance (m) to closest POS >1.5 Ha	430.3	309.1	373.0	2.0	1366.0	0.0	1600.0
Count of playgrounds	4.8	4.1	4.0	0.0	17.0	0.0	46.0
Distance (m) to closest playground	644.3	354.6	584.0	66.0	1538.0	0.0	1600.0
Early childcare and education services[3†]							
Count of childcare centres meeting national standards	774.6	497.7	674.0	61.0	2545.0	0.0	3199.0
Distance (m) to closest childcare centre meeting national standards	18.0	13.8	14.0	0.0	67.0	0.0	101.0
Count of childcare centres exceeding national standards	7.6	7.2	6.0	0.0	37.0	0.0	68.0
Distance (m) to closest childcare centre exceeding national standards	1111.9	659.9	973.0	112.0	2984.0	0.0	3200.0
Count of preschool services meeting national standards	743.4	517.0	615.0	69.0	2593.0	0.0	3199.0
Distance (m) to closest preschool service meeting national standards	4.4	3.3	4.0	0.0	14.0	0.0	23.00
Count of preschool services exceeding national standards	1435.7	744.4	1331.0	177.0	3116.0	0.0	3200.0
Distance (m) to closest preschool service exceeding national standards	2.9	2.5	2.0	0.0	11.0	0.0	18.0

	Major cities (n=182,917)						
	Mean	**SD**	**Median**	**P1**	**P99**	**Min**	**Max**
Family-friendly destinations[3]							
Count of sport facilities	18.3	15.2	14.0	0.0	71.0	0.0	208.0
Distance (m) to closest sport facility	697.8	530.8	573.0	5.0	2543.0	0.0	3199.0
Count of public swimming pools	14.7	75.6	1.0	0.0	233.0	0.0	1438.0
Distance (m) to closest public swimming pool	1663.6	833.9	1641.0	62.0	3161.0	0.0	3200.0
Count of public libraries	1.2	1.3	1.0	0.0	6.0	0.0	10.0
Distance (m) to closest public library	1780.6	760.3	1770.0	277.0	3162.0	2.0	3200.0
Count of community centres	1.1	1.6	1.0	0.0	7.0	0.0	15.0
Distance (m) to closest community centre	1805.3	787.7	1811.0	258.0	3169.0	0.0	3200.0
Count of activity centres	2.95	2.8	2.0	0.0	12.0	0.0	34.0
Distance (m) to closest activity centre	1581.0	734.7	1521.0	241.0	3132.0	2.0	3200.0
Family-friendly destinations score	3.7	1.3	4.0	0.0	5.0	0.0	5.0
Food outlets[3]							
Percentage of healthier food outlets	43.6	17.1	41.7	8.2	100.0	0.0	100.0

Key: [1]Spatial unit is Statistical Area Level 1 (SA1); [2]Spatial unit is 1,600m street network distance around child's home; [3]Spatial unit is 3,200m street network distance around child's home. SD: Standard deviation; P1: 1st percentile; P99: 99th percentile.
Notes: [†]Children in WA and TAS excluded from early childhood education and care services analysis (see Notes in **Table 3**). See **Table 3** for built environment descriptions.

Table 14. Descriptive built environment characteristics for regional cities

	Regional cities (n=22,117)						
	Mean	**SD**	**Median**	**P1**	**P99**	**Min**	**Max**
Traffic[1]							
Traffic exposure	0.3	0.3	0.2	0.0	1.5	0.0	1.8
Housing[1]							
Housing affordability stress	35.3	15.6	33.8	0.0	79.0	0.0	166.7
Housing density	1.8	17.2	0.0	0.0	55.0	0.0	382.0
Walkability[2]							
Dwelling density	8.1	3.6	8.4	1.2	16.2	0.1	24.8
Street connectivity	54.2	24.9	59.5	3.0	104.3	0.0	162.6
Daily living score	1.7	0.9	1.8	0.0	2.9	0.0	3.0
Local living score	4..0	2.8	3.8	0.0	10.0	0.0	10.9
Walkability score	-0.4	2.3	-0.0	-6.3	3.3	-9.3	10.7
Public transport[2]							
Count of public transport stops	17.0	18.4	12.0	0.0	81.0	0.0	119.0
Distance (m) to closest public transport stop	448.5	336.2	360.0	11.0	1478.0	0.0	1600.0
Count of public transport stops with a frequent weekday service	1.7	4.8	0.0	0.0	23.0	0.0	42.0
Distance (m) to closest public transport stop with a frequent weekday service	813.1	427.7	776.0	50.0	1582.0	0.0	1600.0
Public open space[2]							
Count of POS	9.4	9.7	7.0	0.0	41.0	0.0	103.0
Distance (m) to closest POS	399.6	343.6	312.0	0.0	1474.0	0.0	1600.0
Count of POS <=0.4 Ha	2.9	5.3	1.0	0.0	25.0	0.0	86.0
Distance (m) to closest POS <=0.4 Ha	757.6	412.3	730.0	26.0	1573.0	0.0	1600.0
Count of POS >0.4 to <=1 Ha	1.7	2.2	1.0	0.0	10.0	0.0	17.0
Distance (m) to closest POS >0.4 to <=1 Ha	738.9	424.7	699.0	14.0	1570.0	0.0	1600.0
Count of POS >0.4 Ha	6.6	6.1	5.0	0.0	26.0	0.0	39.0
Distance (m) to closest POS >0.4 Ha	426.1	349.2	344.0	0.0	1487.0	0.0	1600.0
Count of POS >1.5 Ha	4.2	3.8	3.0	0.0	16.0	0.0	25.0
Distance (m) to closest POS >1.5 Ha	506.9	371.4	434.0	0.0	1508.0	0.0	1600.0
Count of playgrounds	2.1	3.23	1.0	0.0	14.0	0.0	21.0
Distance (m) to closest playground	716.7	393.5	658.0	62.0	1567.0	0.0	1600.0
Early childcare and education services[3†]							
Count of childcare centres meeting national standards	6.1	6.6	4.0	0.0	28.0	0.0	39.0
Distance (m) to closest childcare centre meeting national standards	1088.6	690.6	928.0	85.0	3063.0	0.0	3199.0
Count of childcare centres exceeding national standards	1.9	2.3	1.0	0.0	10.0	0.0	13.0
Distance (m) to closest childcare centre exceeding national standards	1480.5	768.8	1382.0	155.0	3137.0	14.0	3200.0
Count of preschool services meeting national standards	2.4	2.8	1.0	0.0	12.0	0.0	16.0
Distance (m) to closest preschool service meeting national standards	1091.6	779.5	861.0	74.0	3094.0	0.0	3200.0
Count of preschool services exceeding national standards	1.1	1.3	1.0	0.0	5.0	0.0	8.0
Distance (m) to closest preschool service exceeding national standards	1650.7	793.3	1605.0	181.0	3162.0	14.0	3200.0
Family-friendly destinations[3]							
Count of sport facilities	7.9	8.5	5.0	0.0	36.0	0.0	49.0
Distance (m) to closest sport facility	951.2	724.8	759.5	1.0	3021.0	00	3199.0
Count of public swimming pools	3.1	10.8	0.0	0.0	48.0	0.0	124.0
Distance (m) to closest public swimming pool	1719.2	788.0	1694.0	151.0	3155.0	0.0	3200.0
Count of public libraries	0.4	0.7	0.0	0.0	3.0	0.0	4.0
Distance (m) to closest public library	1954.7	754.8	2003.0	326.0	3171.0	33.0	3200.0

Regional cities (n=22,117)

	Mean	SD	Median	P1	P99	Min	Max
Count of community centres	0.4	0.9	0.0	0.0	4.0	0.0	7.0
Distance (m) to closest community centre	1859.4	806.0	1920.0	240.0	3177.5	17.0	3200.0
Count of activity centres	1.1	1.4	1.0	0.0	6.0	0.0	7.0
Distance (m) to closest activity centre	1790.9	753.3	1775.0	286.0	3162.0	7.0	3200.0
Family-friendly destinations score	2.4	1.6	2.0	0.0	5.0	0.0	5.0
Food outlets[3]							
Percentage of healthier food outlets	47.7	24.8	41.7	0.0	100.0	0.0	100.0

Key: [1]Spatial unit is Statistical Area Level 1 (SA1); [2]Spatial unit is 1,600m street network distance around child's home; [3]Spatial unit is 3,200m street network distance around child's home. SD: Standard deviation; P1: 1st percentile; P99: 99th percentile.
Notes: [†]Children in WA and TAS excluded from early childhood education and care services analysis (see Notes in **Table 3**). See **Table 3** for built environment descriptions.

Appendix 4. Descriptive statistics for built environment characteristics across neighbourhood disadvantage quintile

Table 15. Descriptive built environment characteristics by neighbourhood disadvantage for major cities

Major cities (n=182,917)	Neighbourhood disadvantage quintile									
	Q1 (most disadvantaged)		Q2		Q3		Q4		Q5 (least disadvantaged)	
	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range
Traffic[1]										
Traffic exposure	0.3 (0.4)	0.0-1.8	0.3 (0.4)	0.0-1.8	0.3 (0.3)	0.0-1.8	0.3 (0.3)	0.0-1.8	0.2 (0.3)	0.0-1.8
Housing[1]										
Housing affordability stress	45.9 (13.6)	0.0-106.2	43.3 (15.6)	0.0-137.5	39.8 (17.4)	0.0-116.7	36.7 (18.3)	0.0-150.0	30.5 (19.9)	0.0-200.0
Housing density	9.9 (48.3)	0.0-1168.0	9.8 (58.9)	0.0-2163.0	8.7 (58.3)	0.0-2666.0	8.2 (46.82)	0.0-1314.0	10.2 (62.2)	0.0-1724.0
Walkability[2]										
Dwelling density	15.2 (6.1)	0.6-72.1	14.1 (5.9)	0.2-78.0	14.0 (6.5)	0.2-78.2	14.2 (7.4)	0.5-79.1	14.2 (8.2)	0.1-76.8
Street connectivity	76.9 (19.3)	9.6-239.2	78.5 (18.8)	0.0-225.2	80.8 (23.0)	2.1-249.2	83.0 (26.3)	0.0-239.6	80.7 (26.8)	0.0-241.1
Daily living score	2.4 (0.5)	0.0-3.0	2.3 (0.6)	0.0-3.0	2.3 (0.6)	0.0-3.0	2.3 (0.7)	0.0-3.0	2.2 (0.7)	0.0-3.0
Local living score	7.1 (2.1)	0.0-10.8	6.5 (2.4)	0.0-10.9	6.4 (2.5)	0.0-10.8	6.3 (2.6)	0.0-10.9	6.2 (2.6)	0.0-10.9
Walkability score	0.4 (1.4)	-6.2-11.1	0.4 (1.5)	-7.9-12.4	0.4 (1.7)	-9.1-12.0	0.4 (2.0)	-8.6-12.3	0.2 (2.2)	-8.3-11.4
Public transport[2]										
Count of public transport stops	60.1 (31.7)	0.0-225.0	50.4 (32.4)	0.0-239.0	46.8 (31.2)	0.0-245.0	45.8 (30.9)	0.0-252.0	45.4 (30.6)	0.0-249.0
Distance (m) to closest public transport stop	273.1 (195.0)	0.0-1586.0	313.1 (225.9)	0.0-1600.0	320.0 (229.9)	0.0-1598.0	338.2 (248.5)	0.0-1600.0	340.4 (256.3)	0.0-1600.0
Count of public transport stops with a frequent weekday service	23.1 (27.4)	0.0-353.0	21.8 (29.3)	0.0-326.0	20.5 (29.0)	0.0-332.0	21.2 (30.1)	0.0-345.0	20.4 (29.4)	0.0-322.0

Major cities (n=182,917)	Neighbourhood disadvantage quintile									
	Q1 (most disadvantaged)		Q2		Q3		Q4		Q5 (least disadvantaged)	
	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range
Distance (m) to closest public transport stop with a frequent weekday service	598.5 (390.2)	0.0-1600.0	615.5 (402.4)	0.0-1600.0	617.3 (405.3)	0.0-1600.0	619.9 (408.0)	0.0-1600.0	668.9 (418.4)	0.0-1600.0
Public open space (POS)[2]										
Count of POS	17.4 (11.2)	0.0-121.0	17.7 (11.2)	0.0-124.0	18.7 (12.4)	0.0-122.0	20.2 (14.7)	0.0-149.0	203 (14.3)	0.0-153.0
Distance (m) to closest POS	293.3 (216.5)	0.0-1588.0	293.2 (227.9)	0.0-1594.0	280.3 (230.3)	0.0-1599.0	272.5 (233.7)	0.0-1600.0	258.6 (222.5)	0.0-1600.0
Count of POS <=0.4 Ha	6.8 (8.2)	0.0-103.0	6.7 (7.8)	0.0-107.0	7.5 (8.8)	0.0-106.0	8.5 (10.7)	0.0-113.0	8.4 (10.3)	0.0-116.0
Distance (m) to closest POS <=0.4 Ha	663.1 (388.5)	0.0-1600.0	645.7 (386.9)	0.0-1600.0	613.8 (381.8)	0.0-1600.0	596.0 (379.1)	0.0-1600.0	594.9 (380.7)	0.0-1600.0
Count of POS >0.4 to <=1 Ha	3.3 (2.5)	0.0-21.0	3.3 (2.6)	0.0-18.0	3.5 (2.8)	0.0-25.0	3.7 (3.1)	0.0-25.0	3.6 (3.0)	0.0-28.0
Distance (m) to closest POS >0.4 to <=1 Ha	714.4 (401.5)	0.0-1600.0	703.9 (396.8)	0.0-1600.0	693.1 (400.8)	0.0-1600.0	665.7 (394.6)	0.0-1600.0	668.6 (398.1)	0.0-1600.0
Count of POS >0.4 Ha	10.6 (5.0)	0.0-34.0	11.17 (5.4)	0.0-39.0	11.3 (5.7)	0.0-71.0	11.7 (6.4)	0.0-66.0	11.9 (6.5)	0.0-72.0
Distance (m) to closest POS >0.4 Ha	345.3 (242.9)	0.0-1579.0	345.1 (256.9)	0.0-1594.0	331.2 (256.5)	0.0-1599.0	323.2 (259.6)	0.0-1600.0	302.6 (247.29)	0.0-1600.0
Count of POS >1.5 Ha	6.2 (3.1)	0.0-22.0	6.4 (3.3)	0.0-24.0	6.4 (3.4)	0.0-46.0	6.7 (3.6)	0.0-45.0	6.9 (3.6)	0.0-48.0
Distance (m) to closest POS >1.5 Ha	466.3 (316.4)	0.0-1595.0	453.7 (311.3)	0.0-1595.0	438.2 (313.0)	0.0-1599.0	425.2 (310.7)	0.0-1600.0	394.4 (296.3)	0.0-1600.0
Count of playgrounds	4.4 (3.7)	0.0-35.0	4.6 (3.7)	0.0-31.0	5.2 (4.1)	0.0-37.0	5.1 (4.5)	0.0-43.0	4.6 (4.0)	0.0-46.0
Distance (m) to closest playground	684.5 (369.0)	0.0-1600.0	657.4 (357.6)	0.0-1600.0	622.8 (348.7)	0.0-1600.0	618.9 (347.8)	0.0-1600.0	649.5 (351.5)	0.0-1600.0
Early childcare and education services[3†]										
Count of childcare centres meeting national standards	17.7 (11.4)	0.0-96.0	17.0 (12.3)	0.0-101.0	17.4 (13.5)	0.0-98.0	18.5 (15.3)	0.0-96.0	18.8 (15.0)	0.0-98.0

Major cities (n=182,917)	Neighbourhood disadvantage quintile									
	Q1 (most disadvantaged)		Q2		Q3		Q4		Q5 (least disadvantaged)	
	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range
Distance (m) to closest childcare centre meeting national standards	682.3 (408.6)	0.0-3178.0	750.6 (461.1)	0.0-3183.0	773.7 (496.2)	0.0-3198.0	788.2 (524.5)	0.0-3199.0	837.4 (537.8)	0.0-3198.0
Count of childcare centres exceeding national standards	6.2 (5.0)	0.0-63.0	6.6 (5.7)	0.0-68.0	7.2 (6.7)	0.0-64.0	8.2 (8.2)	0.0-64.0	8.9 (8.3)	0.0-66.0
Distance (m) to closest childcare centre exceeding national standards	1136.1 (662.4)	1.0-3199.0	1135.6 (667.3)	0.0-3199.0	1098.5 (658.5)	0.0-3200.0	1083.6 (660.2)	0.0-3198.0	1115.1 (653.3)	0.0-3199.0
Count of preschool services meeting national standards	4.3 (2.5)	0.0-20.0	3.9 (2.7)	0.0-21.0	4.1 (3.1)	0.0-21.0	4.6 (3.7)	0.0-23.0	4.79 (3.81)	0.0-23.0
Distance (m) to closest preschool service meeting national standards	796.2 (530.8)	0.0-3199.0	747.2 (503.5)	0.0-3197.0	717.0 (508.8)	0.0-3198.0	712.7 (511.0)	0.0-3195.0	753.2 (524.3)	0.0-3196.0
Count of preschool services exceeding national standards	2.4 (1.9)	0.0-16.0	2.4 (2.1)	0.0-15.0	2.7 (2.4)	0.0-15.0	3.1 (2.8)	0.0-17.0	3.4 (2.9)	0.0-18.0
Distance (m) to closest preschool service exceeding national standards	1464.5 (749.5)	2.0-3200.0	1514.5(758.81)	0.0-3200.0	1447.8 (747.4)	0.0-3200.0	1379.1 (731.4)	0.0-3199.0	1407.0 (735.5)	0.0-3200.0
Family-friendly destinations[3]										
Count of sport facilities	17.3 (12.7)	0.0-124.0	16.6 (14.0)	0.0-160.0	17.2 (14.9)	0.0-208.0	18.8 (16.7)	0.0-204.0	20.2 (16.0)	0.0-167.0
Distance (m) to closest sport facility	684.0 (465.3)	0.0-3178.0	734.6 (519.4)	0.0-3196.0	712.4 (541.3)	0.0-3198.0	709.7 (561.4)	0.0-3199.0	663.5 (537.6)	0.0-3198.0
Count of public swimming pools	10.2 (51.9)	0.0-1415.0	16.7 (95.7)	0.0-1438.0	16.5 (90.9)	0.0-1434.0	16.3 (74.0)	0.0-1433.0	13.5 (61.3)	0.0-1433.0
Distance (m) to closest public swimming pool	1727.4 (832.8)	0.0-3200.0	1700.3 (828.1)	0.0-3200.0	1657.7 (834.8)	0.0-3200.0	1621.1 (845.9)	0.0-3200.0	1641.4 (824.8)	0.0-3200.0
Count of public libraries	1.3 (1.1)	0.0-10.0	1.2 (1.2)	0.0-10.0	1.1 (1.3)	0.0-9.0	1.1 (1.3)	0.0-9.0	1.2 (1.4)	0.0-10.0
Distance (m) to closest public library	1715.6 (763.7)	4.0-3200.0	1746.5 (762.3)	4.0-3200.0	1762.5 (760.0)	2.0-3200.0	1767.9 (760.4)	3.0-3200.0	1871.8 (748.4)	33.0-3200.0

Major cities (n=182,917)	Neighbourhood disadvantage quintile									
	Q1 (most disadvantaged)		Q2		Q3		Q4		Q5 (least disadvantaged)	
	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range
Count of community centres	1.5 (1.8)	0.0-14.0	1.0 (1.5)	0.0-15.0	1.0 (1.6)	0.0-15.0	1.0 (1.6)	0.0-15.0	1.0 (1.5)	0.0-14.0
Distance (m) to closest community centre	1739.9 (804.6)	0.0-3200.0	1817.3 (785.8)	17.0-3200.0	1787.3 (801.1)	18.0-3200.0	1788.1 (783.7)	27.0-3200.0	1874.1 (764.4)	1.0-3200.0
Count of activity centres	3.30(2.5)	0.0-33.0	3.0 (2.5)	0.0-32.0	3.00 (2.7)	0.0-34.0	2.9 (2.9)	0.0-34.0	2.8 (2.9)	0.0-34.0
Distance (m) to closest activity centre	1492.3 (730.1)	2.0-3199.0	1564.7 (740.6)	5.0-3200.0	1563.8 (729.1)	17.0-3200.0	1577.4 (739.6)	5.0-3200.0	1663.7 (725.5)	17.0-3200.0
Family-friendly destinations score	4.1 (1.0)	0.0-5.0	3.7 (1.2)	0.0-5.0	3.6 (1.7)	0.0-5.0	3.5 (1.3)	0.0-5.0	3.6 (1.2)	0.0-5.0
Food outlets[3]										
Percentage of healthier food outlets	41.2 (13.8)	0.0-100.0	42.1 (16.7)	0.0-100.0	42.6 (16.2)	0.0-100.0	43.7 (18.1)	0.0-100.0	46.5 (18.5)	0.0-100.0

Key: Q: Quintile. SD: Standard deviation. [1]Spatial unit is Statistical Area Level 1 (SA1); [2]Spatial unit is 1,600m street network distance around child's home; [3]Spatial unit is 3,200m street network distance around child's home. **Notes:** [†]Children in WA and TAS excluded from early childhood education and care services analysis (see Notes in **Table 3**). See **Table 3** for built environment descriptions.

Table 16. Descriptive built environment characteristics by neighbourhood disadvantage for regional cities

Regional (n=22,117)	Neighbourhood disadvantage quintile									
	Q1 (most disadvantaged)		Q2		Q3		Q4		Q5 (least disadvantaged)	
	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range
Traffic[1]										
Traffic exposure	0.3 (0.3)	0.0-1.8	0.3 (0.3)	0.0-1.8	0.3 (0.3)	0.0-1.8	0.2 (0.3)	0.0-1.8	0.2 (0.3)	0.0-1.8
Housing[1]										
Housing affordability stress	37.8 (10.4)	0.0-75.0	36.6 (12.3)	0.0-166.7	35.7 (14.8)	0.0-90.9	33.9 (16.6)	0.0-100.0	32.8 (20.7)	0.0-100.0
Housing density	0.8 (8.0)	0.0-210.0	0.8 (7.5)	0.0-122.0	2.1 (16.8)	0.0-272.0	3.3 (27.1)	0.0-382.0	1.6 (14.9)	0.0-310.0
Walkability[2]										
Dwelling density	9.6 (3.3)	0.3-19.9	8.7 (3.4)	0.1-19.4	7.7 (3.6)	0.1-24.8	7.5 (3.5)	0.15-19.3	7.5 (3.4)	0.2-22.6
Street connectivity	62.8 (17.3)	0.0-148.0	57.1 (22.6)	0.0-125.3	50.7 (26.8)	0.0-144.6	50.2 (27.5)	0.0-162.6	52.8 (24.7)	0.0-121.4
Daily living score	2.2 (0.7)	0.0-3.0	1.9 (0.9)	0.0-3.0	1.6 1.0)	0.0-3.0	1.4 (0.9)	0.0-3.0	1.3 (0.9)	0.0-3.0
Local living score	5.7 (2.5)	0.0-10.9	4.8 (2.8)	0.0-10.9	3.8 (2.8)	0.0-10.9	3.3 (2.7)	0.0-10.7	2.7 (2.3)	0.0-10.3
Walkability score	0.4 (1.9)	-6.2-3.9	0.1 (2.0)	-7.5-4.3	-0.5 (2.3)	-9.3-10.7	-0.9 (2.4)	-8.3-4.9	-1.3 (2.4)	-8.5-5.3
Public transport[2]										
Count of public transport stops	26.2 (19.2)	0.0-104.0	22.2 (20.0)	0.0-102.0	16.2 (19.1)	0.0-119.0	12.6 (15.9)	0.0-109.0	9.9 (11.5)	0.0-86.0
Distance (m) to closest public transport stop	353.0 (278.7)	0.0-1590.0	400.8 (300.7)	0.0-1600. 0	427.9 (315.5)	1.0-1589.0	498.9 (356.6)	1.0-1600.0	568.4 (381.9)	2.0-1600.0
Count of public transport stops with a frequent weekday service	2.6 (5.2)	0.0-32.0	2.6 (6.1)	0.0-41.0	1.8 (5.0)	0.0-38.0	1.3 (4.0)	0.0-42.0	0.8 (2.8)	0.0-26.0

Regional (n=22,117)	Neighbourhood disadvantage quintile									
	Q1 (most disadvantaged)		Q2		Q3		Q4		Q5 (least disadvantaged)	
	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range
Distance (m) to closest public transport stop with a frequent weekday service	796.4 (424.6)	0.0-1600.0	780.0 (442.8)	6.0-1599.0	791.9 (415.1)	3.0-1599.0	830.9 (431.7)	7.0-1600.0	941.7 (392.6)	3.0-1599.0
Public open space[2]										
Count of POS	11.5 (10.5)	0.0-103.0	11.3 (10.3)	0.0-68.0	9.1 (9.9)	0.0-92.0	7.9 (8.1)	0.0-60.0	8.0 (9.1)	0.0-53.0
Distance (m) to closest POS	395.9 (314.8)	0.0-1584.0	406.5 (335.2)	0.0-1599.0	408.8 (347.0)	0.0-1599.0	388.4 (350.5)	0.0-1598.0	397.8 (366.2)	0.0-1600.0
Count of POS <=0.4 Ha	3.9 (6.9)	0.0-86.0	3.4 (5.5)	0.0-56.0	2.8 (5.2)	0.0-75.0	2.1 (3.4)	0.0-41.0	2.4 (5.4)	0.0-47.0
Distance (m) to closest POS <=0.4 Ha	774.6 (410.7)	0.0-1599.0	749.9 (401.8)	0.0-1600.0	733.2 (405.1)	0.0-1600.0	754.5 (423.3)	0.0-1598.0	782.1 (419.9)	0.0-1600.0
Count of POS >0.4 to <=1 Ha	1.9 (2.2)	0.0-17.0	2.0 (2.3)	0.0-13.0	1.6 (2.1)	0.0-14.0	1.4 (2.0)	0.0-13.0	1.5 (2.3)	0.0-16.0
Distance (m) to closest POS >0.4 to <=1 Ha	778.8 (428.7)	0.0-1600.0	777.9 (419.9)	0.0-1600.0	741.4 (424.2)	0.0-1597.0	706.0 (421.8)	0.0-1600.0	672.3 (419.7)	0.0-1600.0
Count of POS >0.4 Ha	7.6 (5.6)	0.0-39.0	7.9 (6.5)	0.0-38.0	6.29 (6.2)	0.0-35.0	5.8 (5.8)	0.0-34.0	5.6 (5.8)	0.0-32.0
Distance (m) to closest POS >0.4 Ha	432.0 (328.1)	0.0-1587.0	435.2 (340.3)	0.0-1599.0	433.4 (348.1)	0.0-1599.0	413.6 (356.6)	0.0-1598.0	415.9 (370.9)	0.0-1600.0
Count of POS >1.5 Ha	4.9 (3.5)	0.0-23.0	5.1 (4.1)	0.0-25.0	4.0 (3.8)	0.0-20.0	3.6 (3.7)	0.0-19.0	3.6 (3.5)	0.0-21.0
Distance (m) to closest POS >1.5 Ha	527.9 (365.3)	0.0-1598.0	501.2 (358.2)	0.0-1598.0	514.4 (365.8)	0.0-1600.0	488.8 (375.1)	0.0-1600.0	505.3 (393.2)	0.0-1600.0
Count of playgrounds	2.4 (3.6)	0.0-21.0	2.4 (3.4)	0.0-21.0	2.1 (3.2)	0.0-21.0	2.0 (3.2)	0.0-21.0	1.5 (2.6)	0.0-19.0

Regional (n=22,117)	Neighbourhood disadvantage quintile									
	Q1 (most disadvantaged)		Q2		Q3		Q4		Q5 (least disadvantaged)	
	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range
Distance (m) to closest playground	737.1 (402.6)	4.0-1598.0	721.5 (394.2)	2.0-1600.0	708.5 (382.0)	0.0-1600.0	679.6 (387.6)	4.0-1599.0	751.4(403.2)	0.0-1600.0
Early childcare and education services[3†]										
Count of childcare centres meeting national standards	9.4 (7.6)	0.0-39.0	8.2 (7.5)	0.0-35.0	5.8 (6.7)	0.0-37.0	4.3 (4.9)	0.0-29.0	4.1 (4.3)	0.0-23.0
Distance (m) to closest childcare centre meeting national standards	856.1 (547.8)	0.0-3166.0	938.7 (596.1)	0.0-3181.0	1050.0 (702.0)	2.0-3193.0	1249.0 (751.6)	0.0-3199.0	1356.7 (700.5)	31.0-3198.0
Count of childcare centres exceeding national standards	2.9 (2.5)	0.0-12.0	2.5 (2.6)	0.0-13.0	1.8 (2.4)	0.0-1200	1.4 (1.8)	0.0-12.0	1.5 (1.9)	0.0-10.0
Distance (m) to closest childcare centre exceeding national standards	1303.3 (736.8)	14.0-3190.0	1420.1 (727.5)	30.0-3199.0	1463.9 (753.5)	36.0-3200.0	1572.4 (779.9)	17.0-3198.0	1674.4 (807.2)	35.0-3200.0
Count of preschool services meeting national standards	3.9 (3.3)	0.0-15.0	3.3 (3.2)	0.0-15.0	2.3 (2.8)	0.0-16.0	1.7 (2.1)	0.0-11.0	1.5 (1.8)	0.0-10.0

Regional (n=22,117)	Neighbourhood disadvantage quintile									
	Q1 (most disadvantaged)		Q2		Q3		Q4		Q5 (least disadvantaged)	
	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range
Distance (m) to closest preschool service meeting national standards	1089.7 (779.2)	26.0-3200.0	1051.1(751.0)	2.0-3198.0	1036.9(743.3)	0.0-3189.0	1075.3 (788.7)	4.0-3200.0	1220.6 (826.8)	0.0-3195.0
Count of preschool services exceeding national standards	1.6 (1.4)	0.0-8.0	1.4 (1.5)	0.0-8.0	1.0 (1.3)	0.0-8.0	0.7 (1.1)	0.0-6.0	0.7 (1.0)	0.0-6.0
Distance (m) to closest preschool service exceeding national standards	149.3 (772.1)	14.0-3195.0	1597.1(755.7)	30.0-3199.0	1597.9(773.6)	81.0-3195.0	1720.0 (800.8)	17.0-3198.0	1905.8 (821.6)	43.0-3200.0
Family-friendly destinations[3]										
Count of sport facilities	11.7 (9.0)	0.0-42.0	10.0 (9.4)	0.0-48.0	7.3 (8.7)	0.0-49.0	5.0 (7.7)	0.0-43.0	5.5 (5.9)	0.0-42.0
Distance (m) to closest sport facility	792.4 (629.5)	0.0-3198.0	825.5 (653.2)	0.0-3187.0	939.7 (711.8)	0.0-3199.0	1041.6 (760.0)	0.0-3196.0	1171.5 (796.7)	0.0-3197.0
Count of public swimming pools	4.3 (10.8)	0.0-120.0	3.1 (9.0)	0.0-124.0	3.1 (10.1)	0.0-122.0	2.3 (11.2)	0.0-123.0	3.3 (12.8)	0.0-123.0
Distance (m) to closest public swimming pool	1588.7 (765.7)	1.0-3199.0	1654.9(773.6)	0.0-3200.0	1712.8(807.9)	1.0-3200.0	1784.5 (788.4)	16.0-3199.0	1939.3 (761.3)	0.0-3197.0
Count of public libraries	0.8 (0.8)	0.0-4.0	0.6 (0.7)	0.0-4.0	0.4 (0.6)	0.0-3.0	0.3 (0.5)	0.0-3.0	0.3 (0.5)	0.0-3.0
Distance (m) to closest public library	1756.2 (753.5)	33.0-3199.0	2014.4(727.1)	93.0-3198.0	1959.0(794.5)	47.0-3198.0	1910.1 (733.4)	167.0-3198.0	2350.3 (583.9)	300.0-3200.0

Regional (n=22,117)	Neighbourhood disadvantage quintile									
	Q1 (most disadvantaged)		Q2		Q3		Q4		Q5 (least disadvantaged)	
	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range
Count of community centres	0.8 (1.2)	0.0-7.0	0.5 (1.0)	0.0-7.0	0.4 (0.8)	0.0-7.0	0.3 (0.7)	0.0-4.0	0.24 (0.60)	0.0-3.0
Distance (m) to closest community centre	1690.4 (812.4)	17.0-3187.0	1944.1(731.7)	105.0-3200.0	1933.9(771.7)	104.0-3200.0	1813.5 (873.9)	58.0-3197.0	2023.4 (830.2)	76.0-3200.0
Count of activity centres	1.8 (1.7)	0.0-7.0	1.5 (1.6)	0.0-7.0	1.1 (1.4)	0.0-7.0	0.7 (1.1)	0.0-6.0	0.7 (1.1)	0.0-6.0
Distance (m) to closest activity centre	1584.3 (715.4)	39.0-3196.0	1736.3(748.8)	7.0-3199.0	1801.4(768.0)	42.0-3200.0	1825.9 (731.6)	63.0-3199.0	2165.0 (680.1)	205.0-3197.0
Family-friendly destinations score	3.4 (1.4)	0.0-5.0	2.8 (1.6)	0.0-5.0	2.2 (1.6)	0.0-5.0	1.9 (1.6)	0.0-5.0	1.9 (1.52)	0.0-5.0
Food outlets[3]										
Percentage of healthier food outlets	44.4 (19.0)	0.0-100.0	45.7 (22.5)	0.0-100.0	48.3 (25.0)	0.0-100.0	50.5 (27.9)	0.0-100.0	50.2 (28.7)	0.0-100.0

Key: Q: Quintile. SD: Standard deviation. [1]Spatial unit is Statistical Area Level 1 (SA1); [2]Spatial unit is 1,600m street network distance around child's home; [3]Spatial unit is 3,200m street network distance around child's home. **Notes:** [†]Children in WA and TAS excluded from early childhood education and care services analysis (see Notes in **Table 3**).
See **Table 3** for built environment descriptions.

Appendix 5. Descriptive statistics for built environment characteristics by developmental vulnerability for major and regional cities

Table 17. Descriptive built environment characteristics by developmental vulnerability (DV1) for major and regional cities

	Major city (n=182,917)				Regional city (n=22,117)			
	Not DV1		DV1		Not DV1		DV1	
	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range
Traffic[1]								
Traffic exposure	0.3 (0.3)	0.0-1.8	0.3 (0.3)	0.0-1.8	0.25 (0.3)	0.0-1.8	0.3 (0.3)	0.0-1.8
Housing[1]								
Housing affordability stress	37.4 (18.3)	0.0-200.0	40.7 (18.2)	0.0-200.0	34.8 (15.7)	0.0-166.7	37.1 (15.4)	0.0-100.0
Housing density	8.9 (53.6)	0.0-2666.0	11.0 (63.1)	0.0-2666.0	2.0 (17.8)	0.0-382.0	1.3 (15.0)	0.0-382.0
Walkability[2]								
Dwelling density	14.3 (7.2)	0.1-79.1	14.1 (6.8)	0.7-76.2	8.0 (3.6)	0.1-24.8	8.4 (3.5)	0.1-19.8
Street connectivity	80.3 (24.0)	0.0-249.2	80.4 (23.2)	0.0-239.6	53.9 (25.0)	0.0-162.6	55.2 (24.5)	0.0-162.6
Daily living score	2.3 (0.6)	0.0-3.0	2.3 (0.6)	0.0-3.0	1.6 (0.9)	0.0-3.0	1.7 (0.9)	0.0-3.0
Local living score	6.5 (2.5)	0.0-10. 9	6.5 (2.5)	0.0-10.9	3.9 (2.8)	0.0-10.9	4.2 (2.3)	0.0-10.8
Walkability score	0.3 (1.9)	-9.1-12.4	0.3 (1.8)	-8.5-12.3	-0.5 (2.3)	-9.3-10.7	-0.2 (2.2)	-8.26-4.7
Public transport[2]								
Count of public transport stops	48.9 (31.6)	0.0-249.0	48.7 (32.0)	0.0-252.0	16.8 (18.4)	0.0-119.0	17.7 (18.2)	0.0-118.0
Distance (m) to closest public transport stop	321.7 (236.9)	0.0-1600.0	318.9 (237.8)	0.0-1599.0	450.8 (337.2)	0.0-1600.0	440.4 (332.5)	0.0-1600.0
Count of public transport stops with a frequent weekday service	21.4 (29.3)	0.0-353.0	20.5 (28.6)	0.0-345.0	1.7 (4.8)	0.0-42.0	2.0 (4.9)	0.0-39.0
Distance (m) to closest public transport stop with a frequent weekday service	627.5 (406.8)	0.0-1600.0	627.7 (407.8)	0.0-1600.0	820.7 (427.8)	0.0-1600.0	789.5 (426.5)	3.00-1599.0
Public open space (POS)[2]								
Count of POS	19.2 (13.5)	0.0-153.0	19.0 (13.3)	0.0-132.0	9.3 (9.5)	0.0-101.0	10.0 (10.3)	0.0-103.0
Distance (m) to closest POS	276.5 (226.9)	0.0-1600.0	278.0 (227.2)	0.0-1600.0	400.5 (344.0)	0.0-1600.0	396.5 (341.7)	0.0-1599.0

	Major city (n=182,917)				Regional city (n=22,117)			
	Not DV1		DV1		Not DV1		DV1	
	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range
Count of POS <=0.4 Ha	7.7 (9.5)	0.0-116.0	7.60 (9.54)	0.0-106.0	2.8 (5.2)	0.0-84.0	3.0 (5.7)	0.0-86.0
Distance (m) to closest POS <=0.4 Ha	614.8 (382.8)	0.0-1600.0	628.4 (386.8)	0.0-1600.0	759.0 (411.2)	0.0-1600.0	752.8 (415.9)	0.0-1600.0
Count of POS >0.4 to <=1 Ha	3.5 (2.9)	0.0-28.0	3.5 (2.9)	0.0-28.0	1.6 (2.2)	0.0-17.0	1.8 (2.3)	0.0-15.0
Distance (m) to closest POS >0.4 to <=1 Ha	685.9 (398.6)	0.0-1600.0	684.0 (398.8)	0.0-1600.0	736.2 (423.8)	0.0-1600.0	748.0 (427.8)	0.0-1600.0
Count of POS >0.4 Ha	11.4 (6.0)	0.0-72.0	11.4 (5.9)	0.0-68.0	6.5 (6.0)	0.0-36.0	7.0 (6.4)	0.0-39.0
Distance (m) to closest POS >0.4 Ha	326.1 (253.6)	0.0-1600.0	326.0 (252.3)	0.0-1600.0	427.0 (350.2)	0.0-1600.0	423.0 (345.5)	0.0-1599.0
Count of POS >1.5 Ha	6.6 (3.5)	0.0-48.0	6.5 (3.4)	0.0-45.0	4.1 (3.7)	0.0-24.0	4.4 (4.0)	0.0-25.0
Distance (m) to closest POS >1.5 Ha	429.8 (309.3)	0.0-1600.0	432.4 (309.5)	0.0-1598.0	507.5 (372.1)	0.0-1600.0	505.1 (368.8)	0.0-1600.0
Count of playgrounds	4.8 (4.1)	0.0-46.0	4.9 (4.0)	0.0-40.0	2.1 (3.2)	0.0-21.0	2.1 (3.3)	0.0-21.0
Distance (m) to closest playground	645.0 (354.4)	0.0-1600.0	641.4 (355.4)	0.0-1600.0	712.9 (391.9)	0.0-1600.0	730.7 (399.4)	1.0-1600.0
Early childcare and education services[3†]								
Count of childcare centres meeting national standards	18.2 (14.1)	0.0-101.0	17.2 (12.9)	0.0-101.0	5.9 (6.4)	0.0-38.0	6.9 (7.1)	0.0-39.0
Distance (m) to closest childcare centre meeting national standards	775.2 (499.7)	0.0-3199.0	772.1 (490.1)	0.0-3198.0	1101.7 (694.5)	0.0-3199.0	1044.8 (675.5)	0.0-3185.0
Count of childcare centres exceeding national standards	7.8 (7.4)	0.0-68.0	6.9 (6.5)	0.0-68.0	1.9 (2.2)	0.0-13.0	2.2 (2.5)	0.0-12.0
Distance (m) to closest childcare centre exceeding national standards	1103.2 (655.6)	0.0-3199.0	1145.3 (675.3)	1.0-3200.0	1493.3 (777.1)	14.0-3199.0	1438.8 (739.6)	35.0-3200.0
Count of preschool services meeting national standards	4.4 (3.4)	0.0-23.0	4.3 (3.13)	0.0-22.0	2.3 (2.7)	0.0-16.0	2.8 (3.0)	0.0-15.0
Distance (m) to closest preschool service meeting national standards	744.3 (517.0)	0.0-3198.0	740.2 (516.6)	0.0-3199.0	1083.1 (776.5)	0.0-3200.0	1121.7 (789.4)	1.00-3197.0
Count of preschool services exceeding national standards	2.9 (2.6)	0.0-18.0	2.7 (2.4)	0.0-17.0	1.0 (1.3)	0.0-8.0	1.2 (1.4)	0.0-8.0
Distance (m) to closest preschool service exceeding national standards	1428.9 (742.5)	0.0-3200.0	1462.0 (751.3)	1.0-3200.0	1659.0 (801.5)	14.0-3200.0	1624.6 (766.5)	35.00-3200.0

	Major city (n=182,917)				Regional city (n=22,117)			
	Not DV1		DV1		Not DV1		DV1	
	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range
Family-friendly destinations[3]								
Count of sport facilities	18.5 (15.3)	0.0-204.0	17.4 (14.9)	0.0-208.0	7.8 (8.5)	0.0-48.0	8.2 (8.5)	0.0-49.0
Distance (m) to closest sport facility	693.8 (530.4)	0.0-3199.0	713.4 (532.4)	0.0-3194.0	958.6 (729.8)	0.0-3199.0	925.3 (706.9)	0.0-3187.0
Count of public swimming pools	14.9 (75.2)	0.0-1438.0	14.0 (76.9)	0.0-1437.0	3.1 (11.1)	0.0-124.0	3.3 (10.0)	0.0-123.0
Distance (m) to closest public swimming pool	1660.4 (833.4)	0.0-3200.0	1676.1 (836.0)	0.0-3200.0	1720.5 (789.9)	0.0-3200.0	1714.8 (781.6)	2.0-3199.0
Count of public libraries	1.2 (1.3)	0.0-10.0	1.1 (1.2)	0.0-10.0	0.4 (0.7)	0.0-4.0	0.5 (0.7)	0.0-4.0
Distance (m) to closest public library	1780.4 (758.4)	2.0-3200.0	1781.5 (767.4)	8.0-3200.0	1960.2 (752.5)	33.0-3200.0	1937.1 (762.2)	93.0-3198.0
Count of community centres	1.1 (1.6)	0.0-15.0	1.1 (1.6)	0.0-15.0	0.4 (0.9)	0.0-7.0	0.5 (1.0)	0.0-7.0
Distance (m) to closest community centre	1808.4 (786.2)	0.0-3200.0	1793.7 (793.2)	1.0-3200.0	1872.9 (803.5)	25.0-3200.0	1820.5 (812.2)	17.0-3194.0
Count of activity centres	3.0 (2.8)	0.0-34.0	2.9 (2.7)	0.0-34.0	1.1 (1.4)	0.0-7.0	1.2 (1.5)	0.0-7.0
Distance (m) to closest activity centre	1582.2 (733.1)	2.0-3200.0	1576.5 (740.8)	7.0-3200.0	1797.7 (754.9)	7.0-3199.0	1768.3 (747.8)	42.0-3200.0
Family-friendly destinations score	3.7 (1.3)	0.0-5.0	3.7 (1.2)	0.0-5.0	2.4 (1.6)	0.0-5.0	2.6 (1.7)	0.0-5.0
Food outlets[3]								
Percentage of healthier food outlets	43.8 (17.3)	0.0-100.0	42.8 (16.6)	0.0-100.0	48.1 (25.1)	0.0-100.0	46.6 (23.7)	0.0-100.0

Key: DV1: Developmentally vulnerable on one or more AEDC domains. SD: Standard deviation. [1]Spatial unit is Statistical Area Level 1 (SA1); [2]Spatial unit is 1,600m street network distance around child's home; [3]Spatial unit is 3,200m street network distance around child's home.

Notes: [†]Children in WA and TAS excluded from early childhood education and care services analysis (see Notes in **Table 3**). See **Table 3** for built environment descriptions.

Appendix 6. Descriptive results for national sample

Table 18. National sample descriptives by neighbourhood disadvantage

National (n=205,030)					
	Neighbourhood disadvantage quintile n (%)				
Variable	**Q1 (most disadvantaged)**	**Q2**	**Q3**	**Q4**	**Q5 (least disadvantaged)**
Age group					
< 5 years	177 (23.1)	174 (22.7)	135 (17.6)	124 (16.2)	156 (20.4)
5 years	24,238 (15.9)	25,749 (16.9)	29,150 (19.2)	33,948 (22.3)	38,834 (25.6)
6+ years	7,164 (13.7)	8,205 (15.7)	10,137 (19.4)	12,336 (23.6)	14,503 (27.7)
Gender					
Female	15,838 (15.5)	17,014 (16.7)	19,774 (19.4)	22,841 (22.4)	26,460 (26.0)
Male	15,741 (15.3)	17,114 (16.6)	19,648 (19.1)	23,567 (22.9)	27,033 (26.2)
Language background other than English					
No	17,994 (11.7)	24,103 (15.7)	30,175 (19.6)	37,259 (24.2)	44,346 (28.8)
Yes	13,585 (26.6)	10,025 (19.6)	9,247 (181)	9,149 (17.9)	9,147 (17.9)
Indigenous status					
No	29,178 (14.7)	32,560 (16.4)	38,256 (19.3)	45,510 (22.9)	52,938 (26.7)
Yes	2,401 (36.4)	1,568 (23.8)	1,166 (17.7)	898 (13.6)	555 (8.4)
Maternal education					
Bachelor degree or higher	5,947 (7.4)	9,793 (12.1)	14,291 (17.7)	20,651 (25.5)	30,170 (37.3)
Other tertiary and/or Year 12	17,037 (17.0)	18,948 (18.9)	20,804 (20.7)	22,438 (22.3)	21,194 (21.1)
Less than Year 12	8,595 (36.18)	5,387 (22.7)	4,327 (18.2)	3,319 (14.0)	2,129 (9.0)
Child's home state/territory					
ACT	71 (1.7)	199 (4.8)	439 (10.6)	1,064 (25.7)	2,361 (57.1)
NSW	12,947 (19.8)	10,939 (16.7)	10,784 (16.5)	12,390 (18.9)	18,306 (28.0)
NT	120 (7.3)	258 (15.7)	392 (23.8)	422 (25.6)	453 (27.5)
QLD	5,853 (13.5)	7,950 (18.3)	9,377 (21.6)	10,113 (23.3)	10,061 (23.2)
SA	2,468 (19.9)	2,673 (21.5)	2,507 (20.2)	2,669 (21.5)	2,110 (17.0)
TAS	724 (25.9)	518 (18.5)	600 (21.4)	610 (21.8)	348 (12.4)
VIC	7,514 (14.1)	8209 (15.4)	11,341 (21.3)	13,527 (25.4)	12,602 (23.7)
WA	1,882 (8.5)	3,382 (15.3)	3,982 (18.0)	5,613 (25.4)	7,252 (32.8)
Total	31579 (15.4)	34128 (16.7)	39422 (19.2)	46408 (22.6)	53493 (26.1)

Key: Q: Quintile.
Notes: See **Table 2** for measure descriptions.

Table 19. National built environment descriptive statistics

National (n=205,030)	Mean	SD	Median	P1	P99	Min	Max
Traffic[1]							
Traffic exposure	0.3	0.3	0.2	0.0	1.8	0.0	1.8
Housing[1]							
Housing affordability stress	37.8	18.1	36.4	0.0	84.6	0.0	200.0
Housing density	8.5	53.0	0.0	0.0	228.0	0.0	2666.0
Walkability[2]							
Dwelling density	13.6	7.1	12.2	2.5	41.7	0.1	79.1
Street connectivity	77.5	25.3	76.2	11.1	159.0	0.0	249.2
Daily living score	2.2	0.7	2.4	0.0	3.0	0.0	23.0
Local living score	6.2	2.7	6.4	0.0	10.7	0.0	10.9
Walkability score	0.3	1.9	0.3	-5.2	6.0	-9.3	12.4
Public transport[2]							
Count of public transport stops	45.4	32.1	40.0	0.0	135.0	0.0	252.0
Distance (m) to closest public transport stop	332.6	250.3	278.0	7.0	1253.0	0.0	1600.0
Count of public transport stops with a frequent weekday service	19.1	28.3	7.0	0.0	117.0	0.0	353.0
Distance (m) to closest public transport stop with a frequent weekday service	633.9	409.2	549.0	28.0	1562.0	0.0	1600.0
Public open space[2]							
Count of POS	18.1	13.2	16.0	0.0	67.0	0.0	153.0
Distance (m) to closest POS	288.6	243.3	234.0	0.0	1186.5	0.0	1600.0
Count of POS <=0.4 Ha	7.2	9.2	5.0	0.0	47.0	0.0	116.0
Distance (m) to closest POS <=0.4 Ha	627.9	387.6	567.0	12.0	1546.0	0.0	1600.0
Count of POS >0.4 to <=1 Ha	3.3	2.9	3.0	0.0	13.0	0.0	28.0
Distance (m) to closest POS >0.4 to <=1 Ha	689.5	400.9	649.0	11.0	1559.0	0.0	1600.0
Count of POS >0.4 Ha	10.9	6.2	10.0	0.0	29.0	0.0	72.0
Distance (m) to closest POS >0.4 Ha	335.6	265.5	279.0	1.0	1251.0	0.0	1600.0
Count of POS >1.5 Ha	6.3	3.6	6.0	0.0	16.0	0.0	48.0
Distance (m) to closest POS >1.5 Ha	437.4	316.4	378.0	1.0	1395.0	0.0	1600.0
Count of playgrounds	4.5	4.1	4.0	0.0	17.0	0.0	46.0
Distance (m) to closest playground	649.2	357.9	589.0	66.0	1541.0	0.0	1600.0
Early childcare and education services[3†]							
Count of childcare centres meeting national standards	6.1	6.6	4.0	0.0	280.0	0.0	39.0
Distance (m) to closest childcare centre meeting national standards	1088.6	690.6	928.0	85.0	3063.00	0.0	3199.0
Count of childcare centres exceeding national standards	1.9	2.3	1.0	0.0	10.0	0.0	13.0
Distance (m) to closest childcare centre exceeding national standards	1480.5	768.8	1382.0	155.0	3137.0	14.0	3200.0
Count of preschool services meeting national standards	2.4	2.8	1.0	0.0	12.0	0.0	16.0
Distance (m) to closest preschool service meeting national standards	1091.6	779.5	861.0	74.0	3094.0	0.0	3200.0

National (n=205,030)	Mean	SD	Median	P1	P99	Min	Max
Count of preschool services exceeding national standards	1.1	1.3	1.0	0.0	5.0	0.0	8.0
Distance (m) to closest preschool service exceeding national standards	1650.7	793.3	1605.0	181.0	3162.0	14.0	3200.0
Family-friendly destinations[3]							
Count of sport facilities	17.2	15.0	13.0	0.0	69.0	0.0	208.0
Distance (m) to closest sport facility	721.4	556.7	586.0	5.0	2665.0	0.0	3199.0
Count of public swimming pools	13.5	71.6	1.0	0.0	209.0	0.0	1438.0
Distance (m) to closest public swimming pool	1667.7	830.7	1646.0	65.0	3161.0	0.0	3200.0
Count of public libraries	1.1	1.2	1.0	0.0	6.0	0.0	10.0
Distance (m) to closest public library	1791.6	761.1	1784.0	280.0	3163.0	2.0	3200.0
Count of community centres	1.0	1.6	0.0	0.0	7.0	0.0	15.0
Distance (m) to closest community centre	1808.4	788.9	1817.0	257.0	3170.0	0.0	3200.0
Count of activity centres	2.8	2.7	2.0	0.0	12.0	0.0	34.0
Distance (m) to closest activity centre	1595.4	737.9	1538.00	244.0	3136.0	2.0	3200.0
Family-friendly destinations score	3.5	1.4	4.0	0.0	5.0	0.0	5.0
Food outlets[3]							
Percentage of healthier food outlets	43.9	18.0	41.7	0.0	100.0	0.0	100.0

Key: [1]Spatial unit is Statistical Area Level 1 (SA1); [2]Spatial unit is 1,600m street network distance around child's home; [3]Spatial unit is 3,200m street network distance around child's home. SD: Standard deviation; P1: 1st percentile; P99: 99th percentile.
Notes: [†]Children in WA and TAS excluded from early childhood education and care services analysis (see Notes in **Table 3**). See **Table 3** for built environment descriptions.

Table 20. National built environment descriptive statistics by neighbourhood disadvantage

National (n=205,030)	Neighbourhood disadvantage quintile									
	Q1 (most disadvantaged)		Q2		Q3		Q4		Q5 (least disadvantaged)	
	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range
Traffic[1]										
Traffic exposure	0.3 (0.4)	0.0-1.8	0.3 (0.3)	0.0-1.8	0.3 (0.3)	0.0-1.8	0.3 (0.3)	0.0-1.8	0.2 (0.3)	0.0-1.8
Housing[1]										
Housing affordability stress	45.0 (13.6)	0.0-106.2	42.5 (15.4)	0.0-166.7	39.3 (17.1)	0.0-116.7	36.4 (18.1)	0.0-150.0	30.7 (20.0)	0.0-200.0
Housing density	8.9 (45.6)	0.0-1168.0	8.6 (55.2)	0.0-2163.0	7.9 (54.9)	0.0-2666.0	7.7 (45.1)	0.0-1314.0	9.5 (60.0)	0.0-1724.0
Walkability[2]										
Dwelling density	14.5 (6.1)	0.3-72.1	13.4 (5.9)	0.1-78.0	13.2 (6.5)	0.1-78.2	13.4 (7.4)	0.1-79.1	13.7 (8.1)	0.1-76.8
Street connectivity	75.3 (19.6)	0.0-239.2	75.7 (20.6)	0.0-225.2	77.0 (25.6)	0.0-249.2	79.4 (28.4)	0.0-239.6	78.6 (27.6)	0.0-241.1
Daily living score	2.4 (0.5)	0.0-3.0	2.3 (0.63)	0.0-3.0	2.2 (0.7)	0.0-3.0	2.2 (0.7)	0.0-3.0	2.1 (0.7)	0.0-3.0
Local living score	6.9 (2.2)	0.0-10.9	6.3 (2.5)	0.0-10.9	6.1 (2.7)	0.0-10.9	6.0 (2.8)	0.0-10.9	5.9 (2.8)	0.0-10.9
Walkability score	0.4 (1.5)	-6.2-11.1	0.3 (1.6)	-7.912.4	0.3 (1.8)	-9.3-12.0	0.3 (2.1)	-8.6-12.3	0.1 (2.2)	-8.5-11.4
Public transport[2]										
Count of public transport stops	56.3 (32.4)	0.0-225.0	46.8 (32.5)	0.0-239.0	42.9 (31.6)	0.0-245.0	42.2 (31.4)	0.0-252.0	42.7 (31.1)	0.0-249.0
Distance (m) to closest public transport stop	281.5 (206.8)	0.0-1590.0	322.9 (237.1)	0.0-1600.0	333.0 (242.2)	0.0-1598.0	352.3 (263.8)	0.0-1600.0	354.3 (271.1)	0.0-1600.0
Count of public transport stops with a frequent weekday service	20.8 (26.7)	0.0-353.0	19.3 (28.2)	0.0-326.0	18.1 (27.8)	0.0-332.0	19.0 (29.1)	0.0-345.0	18.9 (28.8)	0.0-322.0

National (n=205,030)	Neighbourhood disadvantage quintile									
	Q1 (most disadvantaged)		Q2		Q3		Q4		Q5 (least disadvantaged)	
	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range
Distance (m) to closest public transport stop with a frequent weekday service	608.8 (394.5)	0.0-1600.0	623.7 (406.1)	0.0-1600.0	624.0 (407.0)	0.0-1600.0	625.9 (410.2)	0.0-1600.0	672.9 (419.3)	0.0-1600.0
Public open space (POS)[2]										
Count of POS	16.8 (11.3)	0.0-121.0	16.9 (11.3)	0.0-124.0	17.5 (12.5)	0.0-122.0	18.9 (14.7)	0.0-149.0	19.3 (14.3)	0.0-153.0
Distance (m) to closest POS	304.5 (231.5)	0.0-1588.0	306.7 (246.0)	0.0-1599.0	294.4 (249.2)	0.0-1599.0	283.2 (249.2)	0.0-1600.0	267.9 (237.4)	0.0-1600.0
Count of POS <=0.4 Ha	6.5 (8.1)	0.0-103.0	6.2 (7.6)	0.0-107.0	6.9 (8.6)	0.0-106.0	7.8 (10.4)	0.0-113.0	7.9 (10.1)	0.0-116.0
Distance (m) to closest POS <=0.4 Ha	673.3 (391.9)	0.0-1600.0	655.4 (389.5)	0.0-1600.0	623.6 (385.2)	0.0-1600.0	607.3 (384.5)	0.0-1600.0	603.7 (384.8)	0.0-1600.0
Count of POS >0.4 to <=1 Ha	3.1 (2.5)	0.0-21.0	3.2 (2.6)	0.0-18.0	3.2 (2.8)	0.0-25.0	3.5 (3.1)	0.0-25.0	3.4 (3.0)	0.0-28.0
Distance (m) to closest POS >0.4 to <=1 Ha	720.2 (404.4)	0.0-1600.0	711.4 (399.8)	0.0-1600.0	697.3 (403.1)	0.0-1600.0	668.4 (396.6)	0.0-1600.0	668.7 (399.1)	0.0-1600.0
Count of POS >0.4 Ha	10.3 (5.1)	0.0-39.0	10.7 (5.7)	0.0-39.0	10.6 (6.0)	0.0-71.0	11.1 (6.6)	0.0-66.0	11.4 (6.7)	0.0-72.0
Distance (m) to closest POS >0.4 Ha	354.7 (254.9)	0.0-1587.0	355.8 (269.8)	0.0-1599.0	342.4 (269.9)	0.0-1599.0	331.5 (271.2)	0.0-1600.0	310.0 (258.7)	0.0-1600.0
Count of POS >1.5 Ha	6.0 (3.2)	0.0-23.0	6.2 (3.5)	0.0-25.0	6.1 (3.5)	0.0-46.0	6.3 (3.8)	0.0-45.0	6.6 (3.7)	0.0-48.0
Distance (m) to closest POS >1.5 Ha	472.9 (322.5)	0.0-1598.0	459.2 (317.5)	0.0-1598.0	446.2 (319.8)	0.0-1600.0	430.9 (317.5)	0.0-1600.0	401.3 (304.5)	0.0-1600.0
Count of playgrounds	4.2 (3.8)	0.0-35.0	4.3 (3.7)	0.0-31.0	4.8 (4.1)	0.0-37.0	4.8 (4.5)	0.0-43.0	4.4 (4.0)	0.0-46.0
Distance (m) to closest playground	688.5 (371.9)	0.0-1600.0	663.0 (361.4)	0.0-1600.0	629.9 (352.3)	0.0-1600.0	623.0 (350.9)	0.0-1600.0	653.7 (354.4)	0.0-1600.0

National (n=205,030)	Neighbourhood disadvantage quintile									
	Q1 (most disadvantaged)		Q2		Q3		Q4		Q5 (least disadvantaged)	
	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range
Early childcare and education services[3†]										
Count of childcare centres meeting national standards	9.4 (7.6)	0.0-39.0	8.2 (7.5)	0.0-35.0	5.8 (6.7)	0.0-37.0	4.3 (4.9)	0.0-29.0	4.1 (4.3)	0.0-23.0
Distance (m) to closest childcare centre meeting national standards	856.1 (547.8)	0.0-3166.0	938.7 (596.1)	0.0-3181.0	1050.0 (702.0)	2.0-3193.0	1249.0 (751.6)	0.0-3199.0	1356.7 (700.5)	31.0-3198.0
Count of childcare centres exceeding national standards	2.9 (2.5)	0.0-12.0	2.5 (2.6)	0.0-13.0	1.8 (2.4)	0.0-12.0	1.4 (1.8)	0.0-12.0	1.5 (1.9)	0.0-10.0
Distance (m) to closest childcare centre exceeding national standards	1303.3 (736.8)	14.0-3190.0	1420.1 (727.5)	30.0-3199.0	1463.9 (753.5)	36.0-3200.0	1572.4 (779.9)	17.0-3198.0	1674.4 (807.2)	35.0-3200.0
Count of preschool services meeting national standards	3.9 (3.3)	0.0-15.0	3.3 (3.2)	0.0-15.0	2.3 (2.8)	0.0-16.0	1.7 (2.1)	0.0-11.0	1.5 (1.8)	0.0-10.0
Distance (m) to closest preschool service meeting national standards	1089.7 (779.2)	26.0-3200.0	1051.1 (751.0)	2.0-3198.0	1036.9 (743.3)	0.0-3189.00	1075.3 (788.7)	4.0-3200.0	1220.6 (826.8)	0.0-3195.0

National (n=205,030)	Neighbourhood disadvantage quintile									
	Q1 (most disadvantaged)		Q2		Q3		Q4		Q5 (least disadvantaged)	
	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range
Count of preschool services exceeding national standards	1.6 (1.4)	0.0-8.0	1.4 (1.50)	0.0-8.0	1.0 (1.3)	0.0-8.0	0.7 (1.1)	0.0-6.0	0.7 (1.0)	0.0-6.0
Distance (m) to closest preschool service exceeding national standards	1496.3 (772.1)	14.0-3195.0	1597.1 (755.7)	30.0-3199.0	1597.9 (773.6)	81.0-3195.0	1720.0 (800.8)	17.0-3198.0	1905.7 (821.6)	43.0-3200.0
Family-friendly destinations[3]										
Count of sport facilities	16.7 (12.5)	0.0-124.0	15.8 (13.7)	0.0-160.0	15.9 (14.6)	0.0-208.0	17.4 (16.4)	0.0-204.0	19.1 (15.9)	0.0-167.0
Distance (m) to closest sport facility	695.6 (486.8)	0.0-3198.0	745.2 (537.4)	0.0-3196.0	736.9 (566.5)	0.0-3199.0	738.9 (589.1)	0.0-3199.0	695.6 (571.1)	0.0-3198.0
Count of public swimming pools	9.6 (49.0)	0.0-1415.0	14.9 (89.5)	0.0-1438.0	14.8 (85.1)	0.0-1434.0	14.8 (70.0)	0.0-1433.0	12.7 (59.1)	0.0-1433.0
Distance (m) to closest public swimming pool	1713.3 (827.3)	0.0-3200.0	1695.5 (822.6)	0.0-3200.0	1662.2 (832.7)	0.0-3200.0	1631.3 (843.4)	0.0-3200.0	1654.6 (824.4)	0.0-3200.0
Count of public libraries	1.2 (1.0)	0.0-10.0	1.1 (1.2)	0.0-10.0	1.0 (1.2)	0.0-9.0	1.0 (1.3)	0.0-9.0	1.1 (1.3)	0.0-10.0
Distance (m) to closest public library	1719.4 (762.9)	4.0-3200.0	1770.8 (763.1)	4.0-3200.0	1776.2 (764.1)	2.0-3200.0	1774.7 (759.7)	3.0-3200.0	1886.1 (748.4)	33.0-3200.0
Count of community centres	1.4 (1.8)	0.0-14.0	0.9 (1.4)	0.0-15.0	0.9 (1.5)	0.0-15.0	0.9 (1.5)	0.0-15.0	1.0 (1.5)	0.0-14.0
Distance (m) to closest community centre	1735.8 (805.4)	0.0-3200.0	1828.8 (781.9)	17.0-3200.0	1796.9 (800.0)	18.0-3200.0	1789.2 (787.7)	27.0-3200.0	1878.1 (766.6)	1.0-3200.0

National (n=205,030)	Neighbourhood disadvantage quintile									
	Q1 (most disadvantaged)		Q2		Q3		Q4		Q5 (least disadvantaged)	
	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range
Count of activity centres	3.1 (2.5)	0.0-33.0	2.8 (2.5)	0.0-32.0	2.7 (2.7)	0.0-34.0	2.7 (2.9)	0.0-34.0	2.6 (2.9)	0.0-34.0
Distance (m) to closest activity centre	1500.6 (729.2)	2.0-3199.0	1581.4 (743.1)	5.0-3200.0	1582.1 (734.9)	17.0-3200.0	1591.5 (741.3)	5.0-3200.0	1682.6 (730.1)	17.0-3200.0
Family-friendly destinations score	4.0 (1.1)	0.0-5.0	3.6 (1.3)	0.0-5.0	3.4 (1.4)	0.0-5.0	3.3 (1.5)	0.0-5.0	3.5 (1.4)	0.0-5.0
Food outlets[3]										
Percentage of healthier food outlets	41.6 (14.5)	0.0-100.0	42.5 (17.5)	0.0-100.0	43.2 (17.4)	0.0-100.0	44.2 (19.1)	0.0-100.0	46.7 (19.2)	0.0-100.0

Key: Neighbourhood disadvantage: Socio-Economic Index For Areas-Index of Relative Disadvantage. Q: Quintile. SD: Standard deviation. [1]Spatial unit is Statistical Area Level 1 (SA1); [2]Spatial unit is 1,600m street network distance around child's home; [3]Spatial unit is 3,200m street network distance around child's home. **Notes:** [†]Children in WA and TAS excluded from early childhood education and care services analysis (see Notes in **Table 3**). See **Table 3** for built environment descriptions.

Table 21. Proportion of children nationally with *no* (zero) access to local destinations and services by neighbourhood disadvantage

Neighbourhood disadvantage	Destinations 1,600m[1] from child's home address								Destinations 3,200m[1] from child's home address										
	Public transport n (%)		Public open space n (%)						Early childhood education and care services[†] n (%)				Family-friendly destinations n (%)						Food outlets n (%)	[#]Total
	No public transport stops	No frequent public transport stops	No POS	No POS ≤0.4 Ha	No POS >0.4 to ≤1 Ha	Count of POS ≤0.4 Ha	No POS >1.5 Ha	No playgrounds	No childcare centres meeting national standards	No childcare centres exceeding national standards	No preschool services meeting national standards	No preschool services exceeding national standards	No sport facilities	No public swimming pools	No public libraries	No community centres	No activity centres	No family-friendly destinations	No healthier food outlets	
National (n=205,030), n (%) without access																				
Q1	299 (1.0)	6,826 (21.6)	206 (0.7)	3,373 (10.7)	3,773 (12.0)	224 (0.7)	390 (1.2)	4,364 (13.8)	229 (0.8)	1,068 (3.7)	1,375 (4.8)	4,410 (15.2)	233 (0.7)	9,577 (30.3)	6,802 (21.5)	12,029 (38.1)	2,898 (9.2)	164 (0.5)	98 (0.3)	31,579 (100.0)
Q2	844 (2.5)	10,681 (31.3)	529 (1.6)	4,603 (13.5)	4,957 (14.5)	571 (1.7)	878 (2.6)	4,725 (13.8)	750 (2.5)	2,161 (7.2)	2,954 (9.8)	5,709 (18.9)	638 (1.9)	12,978 (38.0)	11,511 (33.7)	18,211 (53.4)	5,968 (17.5)	579 (1.7)	347 (1.0)	34,128 (100.0)
Q3	1,765 (4.5)	13,776 (34.9)	1,188 (3.0)	5,865 (14.9)	6,305 (16.0)	1,291 (3.3)	1,753 (4.5)	5,562 (14.1)	1,396 (4.0)	3,505 (10.1)	4,462 (12.8)	7,667 (22.0)	1,529 (3.9)	15,515 (39.4)	15,666 (39.7)	21,605 (54.8)	8,028 (20.4)	1,331 (3.4)	425 (1.1)	39,422 (100.0)
Q4	2,217 (4.8)	16,060 (34.6)	1,418 (3.1)	6,660 (14.4)	7,628 (16.4)	1,550 (3.3)	2,047 (4.4)	7,061 (15.2)	1,980 (4.9)	4,115 (10.2)	5,875 (14.6)	9,143 (22.8)	2,292 (4.9)	18,823 (40.6)	19,481 (42.0)	25,067 (54.0)	10,835 (23.4)	1,941 (4.2)	670 (1.4)	46,408 (100.0)
Q5	2,253 (4.2)	18,526 (34.6)	992 (1.9)	6,696 (12.5)	8,544 (16.0)	1,145 (2.1)	1,582 (3.0)	7,272 (13.6)	1,896 (4.1)	3,599 (7.8)	5,336 (11.6)	8,377 (18.3)	1,606 (3.0)	19,119 (35.7)	20,870 (39.0)	28,871 (54.0)	11,445 (21.4)	1,359 (2.5)	707 (1.3)	53,493 (100.0)
^Total	7,378 (3.6)	65,869 (32.1)	4,333 (2.1)	27,197 (13.3)	31,207 (15.2)	4,781 (2.3)	6,650 (3.2)	28,984 (14.1)	6,251 (3.5)	14,448 (8.0)	20,002 (11.1)	35,306 (19.6)	6,298 (3.1)	76,012 (37.1)	74,330 (36.3)	105,783 (51.6)	39,174 (19.1)	5,374 (2.6)	2,247 (1.1)	205,030 (100.0)

Key: Q: quintile. Q1=most disadvantaged – Q5=least disadvantaged. [1]Walkable street network distance. ^Overall number of children with no access to destination type. [#]Overall number of children in neighbourhood disadvantage quintile. **Notes:** [†]Children in WA and TAS excluded from early childhood education and care services analysis (see Notes in **Table 3**). See **Table 3** for built environment descriptions.

Table 22. Proportion of children nationally with *no* (zero) access to local destinations and services by developmental vulnerability

	Destinations 1,600m[1] from child's home address								Destinations 3,200m[1] from child's home address										
	Public transport n (%)		Public open space n (%)						Early childhood education and care services[†] n (%)				Family-friendly destinations n (%)						Food outlets n (%)	
Developmental vulnerability	No public transport stops	No frequent public transport stops	No POS	No POS ≤0.4 Ha	No POS>0.4 to ≤1 Ha	No POS >0.4 Ha	No POS >1.5 Ha	No playgrounds	No childcare centres meeting national standards	No childcare centres exceeding national standards	No preschool services meeting national standards	No preschool services exceeding national standards	No sport facilities	No public swimming pools	No libraries	No community centres	No activity centres	No family-friendly destinations	No healthier food outlets	[#]Total
National (n=205,030), n (%) without access																				
Not DV1	5,903 (3.6)	52,328 (32.2)	3,416 (2.1)	21,406 (13.2)	24,759 (15.2)	3,778 (2.3)	5,270 (3.2)	22,902 (14.1)	5,005 (3.5)	11,418 (8.0)	16,082 (11.3)	28,001 (19.7)	5,013 (3.1)	60,137 (37.0)	58,894 (36.2)	84,374 (51.9)	31,268 (19.2)	4,266 (2.6)	1,780 (1.1)	162,585 (100.0)
DV1	1,475 (3.5)	13,541 (31.9)	917 (2.2)	5,791 (13.6)	6,448 (15.2)	1,003 (2.4)	1,380 (3.3)	6,082 (14.3)	1,246 (3.3)	3,030 (8.1)	3,920 (10.4)	7,305 (19.4)	1,285 (3.0)	15,875 (37.4)	15,436 (36.4)	21,409 (50.4)	7,906 (18.6)	1,108 (2.6)	467 (1.1)	42,445 (100.0)
*Total	7,378 (3.6)	65,869 (32.1)	4,333 (2.1)	27,197 (13.3)	31,207 (15.2)	4,781 (2.3)	6,650 (3.2)	28,984 (14.1)	6,251 (3.5)	14,448 (8.0)	20,002 (11.1)	35,306 (19.6)	6,298 (3.1)	76,012 (37.1)	74,330 (36.3)	105,783 (51.6)	39,174 (19.1)	5,374 (2.6)	2,247 (1.1)	205,030 (100.0)

Key: DV1: Developmentally vulnerable on one or more AEDC domains; Ha: Hectare; POS: public open space. ^Overall number of children with no access to destination type. [#]Overall number of children in DV1 status. [1]Walkable street network distance. **Notes:** [†]Children in WA and TAS excluded from early childhood education and care services analysis (see Notes in **Table 3**). See **Table 2** for measure descriptions. See **Table 3** for built environment descriptions.

Appendix 7. Multilevel results for national sample

Table 23. Neighbourhood disadvantage and odds of developmental vulnerability for the national sample

	Model 1	Model 2
National sample n=205,030	**OR (95%CI)**	**OR (95%CI)**
Neighbourhood disadvantage		
Q5 (least disadvantaged)	1.00	1.00
Q2	1.87 (1.80-1.95)	1.48 (1.42-1.54)
Q3	1.47 (1.42-1.53)	1.27 (1.22-1.32)
Q4	1.21 (1.17-1.26)	1.11 (1.07-1.16)
Q1 (most disadvantaged)	2.60 (2.50-2.70)	1.75 (1.68-1.83)

Key: Q: Quintile. OR: Odds Ratio. CI: Confidence Interval.
Notes: Model 1 adjusted for state/territory and remoteness. Model 2: Model 1 plus child's indigenous status, language background other than English, parental education, and sex. Q5 is the reference category. Neighbourhood disadvantage: Socio-Economic Index For Areas-Index of Relative Disadvantage. See **Table 2** for measure descriptions.

Table 24. Built environment characteristics and odds of developmental vulnerability for the national sample (n=205,030)

National sample n=205,030 Built environment characteristic	Model 3 OR (95%CI)
Traffic[1]	
Traffic exposure	1.001 (0.964-1.038)
Housing[1]	
Housing affordability stress	*1.004 (1.003-1.004)****
Housing density	*1.001 (1.000-1.001)****
Walkability[2]	
Dwelling density	1.001 (1.000-1.003)
Street connectivity	*1.001 (1.000-1.001)****
Daily living score	*1.019 (1.000-1.038)**
Local living score	1.002 (0.997-1.007)
Walkability score	*1.008 (1.002-1.015)**
Public transport[2]	
Count of public transport stops	1.000 (1.000-1.001)
Distance (per 100m) to closest public transport stop of	0.998 (0.993-1.003)
Count of public transport stops with a frequent weekday service	*1.001 (1.000-1.001)**
Distance (per 100m) to closest public transport stop with a frequent weekday service	0.997 (0.993-1.001)
Public open space access (POS)[2]	
Count of POS	*1.001 (1.001-1.002)***
Distance (per 100m) to closest POS	0.997 (0.992-1.002)
Count of POS <=0.4 Ha	*1.002 (1.001-1.003)***
Distance (per 100m) to closest POS <=0.4 Ha	1.002 (0.998-1.005)
Count of POS >0.4 to <=1 Ha in size	*1.005 (1.001-1.010)**
Distance (per 100m) to closest POS >0.4 to <=1 Ha	0.998 (0.994-1.001)
Count of POS >0.4 Ha	*1.003 (1.001-1.005)**
Distance (per 100m) to closest POS >0.4 Ha	0.997 (0.992-1.001)
Count of POS >1.5 Ha	1.002 (0.999-1.006)
Distance (per 100m) to closest POS >1.5 Ha	0.997(0.994-1.001)
Count of playgrounds	*1.008 (1.005-1.011)****
Distance (per 100m) to closest playground	**✓0.996 (0.993-1.000)***
Early childcare and education services[3†]	
Count of childcare centres meeting national standards	1.000 (0.999-1.001)
Distance (per 100m) to closest childcare centre meeting national standards	0.999 (0.997-1.002)
Count of childcare centres exceeding national standards	**✓0.998 (0.996-1.000)***
Distance (per 100m) to closest childcare centre exceeding national standards	*1.003 (1.0001-1.005)***
Count of preschool services meeting national standards	**✓0.992 (0.987-0.998)***
Distance (per 100m) to closest preschool service meeting national standards	1.002 (1.000-1.004)
Family-friendly destinations[3]	
Count of sport facilities	1.000 (0.999-1.001)
Distance (per 100m) to closest sport facility	1.000 (0.998-1.003)
Count of public swimming pools	1.000 (1.000-1.000)
Distance (per 100m) to closest public swimming pool	0.999 (0.997-1.001)
Count of public libraries	0.998 (0.987-1.008)
Distance (per 100m) to closest public library	1.000 (0.998-1.002)
Count of community centres	***1.017 (1.009-1.025)****
Distance (per 100m) to closest community centre	0.998 (0.996-1.000)
Count of activity centres	1.005 (1.000-1.009)
Distance (per 100m) to closest activity centre	0.999 (0.997-1.001)
Family-friendly destinations score	1.002 (0.993-1.012)
Food outlets[3]	
Percentage of healthier food outlets	**✓0.999 (0.998-1.000)****

Key: CI: confidence interval. DV1: Developmentally vulnerable on one or more AEDC domains. Ha: hectare; m: metre. OR: odds ratio. POS: public open space.[1]Spatial unit is Statistical Area Level 1 (SA1); [2]Spatial unit is 1,600m street network distance around child's home; [3]Spatial unit is 3,200m street network distance around child's home. ✓Bold text: association in expected direction; *****Bold text: association in opposite direction to expected; Italicised text: negligible association. ***p<0.01; **p<0.01; *p<0.05.

Notes: Model adjusted for state/territory, neighbourhood disadvantage (SEIFA-IRSD at SA1 level); child's indigenous status, language background other than English, parental education, and sex. See **Table 2** for measure descriptions. Built environment characteristics were modelled separately. †Children in WA and TAS excluded from early childhood education and care services analysis (see Notes in **Table 3**). See **Table 3** for built environment descriptions.

Table 25. Associations between neighbourhood disadvantage, built environment characteristics and developmental vulnerability for the national sample (n=205,030)

Neighbourhood disadvantage	Model 1 OR (95%CI)	Model 2 OR (95%CI)	Model 3 (a-c) OR (95%CI)		
			3a. Count of childcare centres exceeding national quality standards[3†]	3b. Count of preschool services exceeding national quality standards[3†]	3c. %healthier food outlets[3†]
Q5 (least disadvantaged)	1.00	1.00	1.00	1.00	1.00
Q2	1.87 (1.80-1.95)	1.48 (1.42-1.54)	1.48 (1.42-1.54)	1.47 (1.42-1.53)	1.47 (1.41-1.53)
Q3	1.47 (1.42-1.53)	1.27 (1.22-1.32)	1.25 (1.20-1.31)	1.26 (1.21-1.31)	1.26 (1.21-1.31)
Q4	1.21 (1.17-1.26)	1.11 (1.07-1.16)	1.10 (1.06-1.15)	1.11 (1.07-1.15)	1.11. (1.06-1.15)
Q1 (most disadvantaged)	2.60 (2.50-2.70)	1.75 (1.68-1.83)	1.73 (1.66-1.81)	1.75 (1.68-1.82)	1.73 (1.66-1.80)

Key: Q: Quintile. OR: Odds Ratio. CI: Confidence Interval. [3]Spatial unit is 3,200m street network distance around child's home. **Notes:** p<0.0001 for Models 1, 2, 3 (a-c). Q5 is the reference category. Model 1 neighbourhood disadvantage adjusted for state/territory and remoteness. Model 2: Model 1 plus child's indigenous status, language background other than English, parental education, and sex. See **Table 2** for measure descriptions. Model 3 (a-c): Model 2 plus built environment feature. Built environment characteristics were modelled separately. [†]Children in WA and TAS excluded from early childhood education and care services analysis (see Notes in **Table 3**). See **Table 3** for built environment descriptions.

Appendix 8. Missing cases

Table 26. Missing case sample descriptives by developmental vulnerability for major and regional cities

	Major cities n= 26,635 n (%)				Regional cities n= 3,966 n (%)			
	Not vulnerable	**Vulnerable**	**Missing**	**Total**	**Not vulnerable**	**Vulnerable**	**Missing**	**Total**
Age group								
5 years or younger*	8,680 (46.9)	3,368 (18.2)	6,427 (33.8)	18,475 (100.0)	1,190 (49.0)	481 (19.8)	756 (31.1)	2,427 (100.0)
6+ years	2,949 (36.1)	872 (10.7)	4,339 (53.2)	8,160 (100.0)	712 (46.3)	247 (16.1)	580 (37.7)	1,539 (100.0)
Gender								
Female	6,278 (56.2)	1,539 (13.8)	3,357 (30.0)	11,174 (100.0)	1,029 (58.8)	262 (15.0)	459 (26.2)	1,750 (100.0)
Male	5,351 (34.6)	2,701 (17.5)	7,409 (47.9)	15,461 (100.0)	873 (39.4)	466 (21.0)	877 (39.6)	2,216 (100.0)
Language background other than English								
No	8,099 (42.7)	2,571 (13.6)	8,298 (43.8)	18,968 (100.0)	1,715 (48.6)	593 (16.8)	1,219 (34.6)	3,527 (100.0)
Yes	3,530 (46.0)	1,669 (21.8)	2,468 (32.2)	7,667 (100.0)	187 (42.6)	135 (30.8)	117 (26.7)	439 (100.0)
Indigenous status								
No	11,343 (44.4)	3,982 (15.6)	10,242 (40.1)	25,567 (100.0)	1,744 (49.6)	581 (16.5)	1,189 (33.8)	3,514 (100.0)
Yes	286 (26.8)	258 (24.2)	524 (49.1)	1,068 (100.0)	158 (35.0)	147 (32.5)	147 (32.5)	452 (100.0)
Maternal education								
Bachelor degree or higher	245 (7.1)	51 (1.5)	3,163 (91.4)	3,459 (100.0)	ND	ND	252 (93.7)	269 (100.0)
Year 12 or less / Other post-school qualification*	283 (4.3)	108 (1.6)	6,246 (94.1)	6,637 (100.0)	ND	ND	862 (93.7)	920 (100.0)
Missing	11,101 (67.1)	4,081 (24.7)	1,357 (8.2)	16,539 (100.0)	ND	ND	ND	ND
Neighbourhood disadvantage								
Q1 (most disadvantaged)	1,814 (35.5)	1,093 (21.4)	2,203 (43.1)	5,110 (100.0)	369 (41.8)	214 (24.2)	300 (34.0)	883 (100.0)
Q2	1,778 (38.6)	833 (18.1)	1,996 (43.3)	4,607 (100.0)	362 (43.7)	162 (19.6)	304 (36.7)	828 (100.0)
Q3	1,972 (42.3)	685 (14.7)	2,002 (43.0)	4,659 (100.0)	400 (46.8)	156 (18.3)	298 (34.9)	854 (100.0)
Q4	2,365 (44.8)	700 (13.3)	2,219 (42.0)	5,284 (100.0)	387 (52.2)	110 (14.8)	244 (32.9)	741 (100.0)
Q5 (least disadvantaged)	3,107 (50.3)	751 (12.2)	2,314 (37.5)	6,172 (100.0)	317 (55.2)	73 (12.7)	184 (32.1)	574 (100.0)
Missing	593 (73.9)	178 (22.2)	32 (4.0)	803 (100.0)	ND	ND	ND	ND
Remoteness								
Major city	11,629 (43.7)	4,240 (15.9)	10,766 (40.4)	26,635 (100.0)	N/A	N/A	N/A	N/A
Regional city	N/A	N/A	N/A	N/A	1,902 (48.0)	728 (18.4)	1,336 (33.7)	3,966 (100.0)

Key: Q: Quintile. Q1=most disadvantaged – Q5= least disadvantaged. *Categories suppressed as per AEDC data publication guidelines. ND: Not displayed due to data suppression. N/A: Not applicable. **Notes:** Developmentally vulnerable on one or more domains (DV1). Missing cases$_2$: Missing on maternal education, neighbourhood disadvantage, and DV1, total n=30,601; See **Table 2** for measure descriptions and report footnote$_2$. Missing category in the table = missing cases for the relevant row or column.

Table 27. Missing cases - sample descriptives by neighbourhood disadvantage for major and regional cities

	Neighbourhood disadvantage (Major cities n=26,635) n (%)							Neighbourhood disadvantage (Regional cities n=3,966) n (%)						
	Q1	**Q2**	**Q3**	**Q4**	**Q5**	**Missing**	**Total**	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Missing**	**Total**
Age group														
5 years or younger*	3,681 (19.9)	3,322 (18.0)	3,233 (17.5)	3,616 (19.6)	4,031 (21.8)	604 (3.3)	18,475 (100.0)	509 (21.0)	536 (22.1)	504 (20.8)	466 (19.2)	412 (17.0)	ND	2,427 (100.0)
6+ years	1,429 (17.5)	1,285 (15.8)	1,438 (17.6)	1,668 (20.4)	2,141 (26.2)	199 (2.4)	8,160 (100.0)	374 (24.3)	292 (19.0)	350 (22.7)	275 (17.9)	248 (16.1)	ND	1,539 (100.0)
Gender														
Female	2,149 (19.2)	1,943 (17.4)	1,922 (17.2)	2,117 (19.0)	2,652 (23.7)	391 (3.5)	11,174 (100.0)	393 (22.5)	362 (20.7)	368 (21.0)	317 (18.1)	261 (14.9)	49 (2.8)	1,750 (100.0)
Male	2961 (19.2)	2,664 (17.2)	2,737 (17.7)	3,167 (20.5)	3,520 (22.8)	412 (2.7)	15,461 (100.0)	490 (22.1)	466 (21.0)	486 (21.9)	424 (19.1)	313 (14.1)	37 (1.7)	2,216 (100.0)
Language background other than English														
No	2,841 (15.0)	3,114 (16.4)	3,463 (18.3)	4,141 (21.8)	4,933 (26.0)	476 (2.5)	18,968 (100.0)	77 (22.0)	718 (20.4)	771 (21.9)	667 (18.9)	525 (14.9)	70 (2.0)	3,527 (100.0)
Yes	2,269 (29.6)	1,493 (19.5)	1,196 (15.6)	1,143 (14.9)	1,239 (16.2)	327 (4.3)	7,667 (100.0)	107 (24.4)	110 (25.1)	83 (18.9)	74 (16.9)	49 (11.2)	16 (3.6)	439 (100.0)
Indigenous status														
No	4,732 (18.5)	4,331 (16.9)	4,504 (17.6)	5,141 (20.1)	6,072 (23.8)	787 (3.1)	25,567 (100.0)	ND	ND	ND	ND	ND	ND	ND
Yes	378 (35.4)	276 (25.8)	155 (14.5)	143 (13.4)	100 (9.4)	16 (1.5)	1,068 (100.0)	ND	ND	ND	ND	ND	ND	ND
Maternal education														
Bachelor degree or higher	279 (8.1)	433 (12.5)	573 (16.6)	778 (22.5)	1,089 (31.5)	307 (8.9)	3,459 (100.0)	29 (10.8)	57 (21.2)	56 (20.8)	53 (19.7)	56 (20.8)	18 (6.7)	269 (100.0)
Year 12 or less / Other post-school qualification*	1,590 (23.9)	1,267 (19.1)	1,196 (18.0)	1,196 (18.0)	980 (14.8)	408 (6.1)	6,637 (100.0)	229 (24.9)	194 (21.1)	194 (21.1)	169 (18.4)	95 (10.3)	63 (6.8)	920 (100.0)
Missing	3,241 (19.6)	2,907 (17.6)	2,890 (17.5)	3,310 (20.0)	4,103 (24.8)	88 (0.5)	16,539 (100.0)	ND	ND	ND	ND	ND	ND	ND
Remoteness														
Major city	5,110 (19.2)	4,607 (17.3)	4,659 (17.5)	5,284 (19.8)	6,172 (23.2)	803 (3.0)	26,635 (100.0)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Regional city	N/A	N/A	N/A	N/A	N/A	N/A	N/A	883 (22.3)	828 (20.9)	854 (21.5)	741 (18.7)	574 (14.5)	86 (2.2)	3,966 (100.0)

Key: Q: Quintile. Q1=most disadvantaged – Q5= least disadvantaged. ND: Not displayed due to data suppression. *Categories suppressed as per AEDC data publication guidelines. N/A: Not applicable. **Notes:** Missing cases$_2$: Missing on maternal education, neighbourhood disadvantage, and DV1, total n=30,601; See **Table 2** for measure descriptions and report footnote$_2$. Missing category in the table = missing cases for the relevant row or column.

Table 28. Missing cases - built environment characteristics by neighbourhood disadvantage in major cities

	Neighbourhood disadvantage									
Major cities n=26,635	**Q1 (most disadvantaged)**		**Q2**		**Q3**		**Q4**		**Q5 (least disadvantaged)**	
	Mean (SD)	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**
Traffic[1]										
Traffic exposure	0.3 (0.4)	0.0-1.8	0.3 (0.3)	0.0-1.8	0.3 (0.3)	0.0-1.8	0.2 (0.3)	0.0-1.8	0.2 (0.3)	0.0-1.8
Housing[1]										
Housing affordability stress	45.3 (13.3)	0.0-100.0	44.0 (15.8)	0.0-100.0	40.5 (17.3)	0.0-115.8	38.0 (18.7)	0.0-150.0	32.1 (21.2)	0.0-166.7
Housing density	10.2 (49.3)	0.0-728.0	8.7 (59.9)	0.0-2163.0	7.6 (56.8)	0.0-2666.0	6.5 (44.0)	0.0-1314.0	10.8 (67.3)	0.0-1476.0
Walkability[2]										
Dwelling density	14.6 (6.1)	1.1-63.3	13.5 (5.5)	1.0-67.3	13.2 (5.9)	0.3-74.3	13.1 (6.9)	0.8-75.5	13.4 (7.8)	0.8-81.0
Street connectivity	78.6 (21.7)	13.2-239.5	77.7 (18.4)	0.0-213.4	79.6 (22.0)	0.0-205.5	83.4 (25.9)	2.3-231.5	81.7 (26.2)	0.0-218.4
Daily living score	2.4 (0.5)	0.3-3.0	2.3 (0.6)	0.0-3.0	2.3 (0.6)	0.0-3.0	2.2 (0.7)	0.0-3.0	2.1 (0.7)	0.0-3.0
Local living score	7.0 (2.1)	0.3-10.9	6.2 (2.3)	0.0-10.9	6.2 (2.4)	0.0-10.9	5.9 (2.6)	0.0-10.8	5.9 (2.6)	0.0-10.8
Walkability score	0.4 (1.5)	-5.8-11.1	0.2 (1.5)	-7.5-11.4	0.2 (1.7)	-8.5-11.2	0.3 (1.9)	-8.1-11.3	0.0 (2.1)	-7.3-10.9
Public transport[2]										
Count of public transport stops	55.5 (30.1)	0.0-232.0	46.7 (30.6)	0.0-244.0	43.7 (29.8)	0.0-233.0	41.5 (29.07)	0.0-228.0	41.2 (29.1)	0.0-245.0
Distance (m) to closest public transport stop	281.7 (196.4)	1.0-1572.0	327.6 (237.4)	0.0-1596.0	327.1 (236.4)	0.0-1561.0	350.6 (252.1)	0.0-1596.0	357.5 (263.8)	0.0-1594.0
Count of public transport stops with a frequent weekday service	23.2 (27.1)	0.0-332.0	19.3 (27.6)	0.0-322.0	18.3 (27.3)	0.0-341.0	18.0 (27.39)	0.0-315.0	17.9 (26.7)	0.-228.0
Distance (m) to closest public transport stop with a frequent weekday service	593.9 (388.4)	1.0-1600.0	643.9 (401.2)	0.0-1600.0	645.6 (412.9)	0.0-1600.0	664.1 (419.0)	1.0-1600.0	687.9 (420.3)	0.0-1599.0
Public open space[2]										
Count of POS	18.2 (12.1)	0.0-105.0	17.6 (11.3)	0.0-109.0	18.5 (12.5)	0.0-115.0	20.7 (16.0)	0.0-139.0	20.7 (14.8)	0.0-143.0
Distance (m) to closest POS	286.8 (216.2)	0.0-1592.0	290.7 (235.8)	0.0-1593.0	280.3 (242.3)	0.0-1597.0	259.8 (229.1)	0.0-1599.0	245.9 (216.5)	0.0-1586.0

	Neighbourhood disadvantage									
Major cities n=26,635	**Q1 (most disadvantaged)**		**Q2**		**Q3**		**Q4**		**Q5 (least disadvantaged)**	
	Mean (SD)	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**
Count of POS <=0.4 Ha	7.3 (9.1)	0.0-86.0	6.5 (7.9)	0.0-85.0	7.1 (8.9)	0.0-101.0	8.4 (11.5)	0.0-103.0	8.3 (10.2)	0.0-108.0
Distance (m) to closest POS <=0.4 Ha	652.5 (394.8)	0.0-1598.0	647.3 (395.9)	0.0-1600.0	626.5 (389.0)	0.0-1600.0	612.4 (383.9)	0.0-1599.0	592.0 (383.4)	0.0-1600.0
Count of POS >0.4 to <=1 Ha	3.39 (2.7)	0.0-18.0	3.34 (2.6)	0.0-17.0	3.5 (2.9)	0.0-20.0	3.6 (3.3)	0.0-25.0	3.8 (3.3)	0.0-31.0
Distance (m) to closest POS >0.4 to <=1 Ha	707.8 (403.2)	0.0-1600.0	706.0 (398.1)	0.0-1599.0	695.9 (403.1)	0.0-1600.0	655.6 (399.3)	0.0-1600.0	647.1 (396.6)	0.0-1600.0
Count of POS >0.4 Ha	10.8 (5.2)	0.0-33.0	11.1 (5.5)	0.0-34.0	11.4 (6.0)	0.0-67.0	12.3 (7.0)	0.0-59.0	12.4 (7.2)	000-69.0
Distance (m) to closest POS >0.4 Ha	338.2 (241.7)	0.0-1596.0	340.9 (261.6)	0.0-1593.0	325.2 (264.9)	0.0-1600.0	301.7 (250.7)	0.0-1599.0	284.6 (239.8)	0.0-1586.0
Count of POS >1.5 Ha	6.2 (3.1)	0.0-20.0	6.4 (3.3)	0.-20.0	6.5 (3.6)	0.0-44.0	7.0 (3.9)	0.0-36.0	7.1 (3.9)	0.0-44.0
Distance (m) to closest POS >1.5 Ha	461.9 (314.6)	0.0-1600.0	447.1 (316.8)	0.0-1593.0	428.9 (317.2)	0.0-1597.0	397.5 (300.8)	0.0-1598.0	381.4 (297.9)	0.0-1597.0
Count of playgrounds	4.5 (3.9)	0.0-34.0	4.6 (3.6)	0.0-30.0	5.0 (4.0)	0.0-35.0	4.9 (4.4)	0.0-40.0	4.5 (3.8)	0.0-41.0
Distance (m) to closest playground	665.7 (366.7)	5.0-1599.0	648.5 (361.3)	4.0-1600.0	633.4 (346.1)	12.0-1600.0	622.7 (352.8)	1.0-1600.0	645.8 (353.9)	11.0-1600.0
Early childcare and education services[3†]										
Count of childcare centres meeting national standards	17.0 (11.1)	0.0-93.0	15.9 (11.2)	0.0-94.0	16.2 (12.4)	0.0-94.0	16.1 (13.3)	0.0-92.0	16.9 (13.9)	0.0-88.0
Distance (m) to closest childcare centre meeting national standards	702.1 (419.5)	3.0-3073.0	775.2 (475.4)	5.0-3199.0	793.7 (503.6)	0.0-3127.0	836.2 (550.8)	1.0-3198.0	871.8 (545.5)	0.0-3194.0

	Neighbourhood disadvantage									
Major cities n=26,635	**Q1 (most disadvantaged)**		**Q2**		**Q3**		**Q4**		**Q5 (least disadvantaged)**	
	Mean (SD)	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**
Count of childcare centres exceeding national standards	6.1 (4.9)	0.0-61.0	6.4 (5.4)	0.0-63.0	6.7 (6.1)	00-62.0	7.1 (7.1)	0.0-61.0	8.0 (7.5)	0.0-57.0
Distance (m) to closest childcare centre exceeding national standards	1164.3 (671.1)	5.0-3192.0	1151.7 (679.8)	5.0-3199.0	1134.6 (676.3)	1.0-3196.00	1115.0 (669.5)	2.0-3182.0	1143.6 (664.5)	0.0-3199.0
Count of preschool services meeting national standards	4.4 (2.5)	0.0-20.0	3.8 (2.7)	0.0-18.0	3.9 (2.9)	0.0-21.0	4.1 (3.5)	0.0-22.0	4.2 (3.5)	0.0-19.0
Distance (m) to closest preschool service meeting national standards	775.7 (531.8)	5.0-3174.0	724.6 (488.7)	4.0-3117.0	720.4 (496.8)	12.0-3189.0	714.6 (514.6)	1.0-3173.0	747.0 (529.4)	11.0-3189.0
Count of preschool services exceeding national standards	2.5 (1.9)	0.0-12.0	2.5 (2.1)	0.0-14.0	2.5 (2.3)	0.0-14.0	2.8 (2.7)	0.0-15.0	3.0 (2.8)	0.0-16.0
Distance (m) to closest preschool service exceeding national standards	1451.2 (728.4)	5.0-3192.0	1539.7 (768.0)	17.0-3199.0	1501.9 (760.1)	39.0-3189.0	1426.1 (748.0)	2.0-3200.0	1464.1 (752.4)	0.0-3199.0
Family-friendly destinations[3]										
Count of sport facilities	17.9 (15.1)	0.0-123.0	16.1 (14.9)	0.0-159.0	16.43 (15.57)	0.0-207.0	17.17 (16.72)	0.0-178.0	18.9 (15.7)	0.0-175.0

	Neighbourhood disadvantage									
Major cities n=26,635	**Q1 (most disadvantaged)**		**Q2**		**Q3**		**Q4**		**Q5 (least disadvantaged)**	
	Mean (SD)	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**
Distance (m) to closest sport facility	699.8 (490.0)	0.0-3162.0	788.3 (551.5)	0.0-3139.0	730.9 (559.1)	0.0-3140.0	739.5 (585.4)	0.0-3186.0	687.1 (559.3)	0.0-3192.0
Count of public swimming pools	11.7 (39.9)	0.0-1041.0	18.0 (101.1)	0.0-1435.0	18.4 (99.8)	0.0-1434.0	17.9 (85.9)	0.0-1432.0	17.9 (102.3)	0.0-1433.0
Distance (m) to closest public swimming pool	1720.1 (838.3)	0.0-3200.0	1732.7 (835.1)	0.0-3199.0	1683.1 (828.2)	0.0-3199.0	1656.0 (845.5)	0.0-3200.0	1644.5 (844.1)	0.0-3200.0
Count of libraries	1.2 (1.1)	0.0-8.0	1.0 (1.1)	0.0-10.0	1.0 (1.2)	0.0-8.0	0.9 (1.2)	0.0-8.0	1.0 (1.3)	0.0-9.0
Distance (m) to closest public library	1745.2 (754.1)	87.0-3199.0	1791.2 (758.4)	19.0-3200.0	1822.3 (769.8)	2.0-3198.0	1816.8 (772.8)	39.0-3199.0	1915.2 (741.6)	72.0-3199.0
Count of community centres	1.3 (1.8)	0.0-13.0	0.9 (1.3)	0.0-13.0	0.9 (1.3)	0.0-14.0	0.9 (1.3)	0.0-15.0	0.9 (1.4)	0.0-13.0
Distance (m) to closest community centre	1774.2 (801.9)	1.0-3197.0	1868.3 (790.9)	46.0-3200.0	1848.1 (791.6)	62.0-3198.0	1817.9 (793.8)	91.0-3199.0	1897.3 (754.4)	24.0-3197.0
Count of activity centres	3.2 (2.6)	0.0-29.0	2.8 (2.3)	0.0-32.0	2.7 (2.5)	0.0-31.0	2.6 (2.6)	0.0-30.0	2.5 (2.6)	0.0-32.0
Distance (m) to closest activity centre	1541.8 (725.9)	30.0-3195.0	1586.9 (738.6)	19.0-3199.0	1617.3 (735.1)	35.0-3198.0	1633.3 (752.2)	8.0-3198.0	1722.5 (734.5)	4.0-3200.0
Family-friendly destinations score	4.0 (1.0)	0.0-5.0	3.6 (1.2)	0.0-5.0	3.5 (1.3	0.0-5.0	3.4 (1.4)	0.0-5.0	3.5 (1.3)	0.0-5.0
Food outlets[3]										
Percentage of healthier food outlets	40.8 (13.8)	0.0-100.0	41.5 (16.7)	0.0-100.0	42.6 (15.9)	0.0-100.0	43.7 (18.8)	0.0-100.0	47.0 (18.5)	0.0-100.0

Key: Neighbourhood disadvantage: Socio-Economic Index For Areas-Index of Relative Disadvantage. Q: Quintile. SD: Standard deviation. [1]Spatial unit is Statistical Area Level 1 (SA1); [2]Spatial unit is 1,600m street network distance around child's home; [3]Spatial unit is 3,200m street network distance around child's home. **Notes:** Missing cases$_2$: Missing on maternal education, neighbourhood disadvantage, and DV1, total n=30,601; See **Table 2** for measure descriptions and report footnote$_2$. [†]Children in WA and TAS excluded from early childhood education and care services analysis (see Notes in **Table 3**). See **Table 3** for built environment descriptions.

Table 29. Missing cases - built environment characteristics by neighbourhood disadvantage in regional cities

	Neighbourhood disadvantage									
Regional cities n=3,966	**Q1 (most disadvantaged)**		**Q2**		**Q3**		**Q4**		**Q5 (least disadvantaged)**	
	Mean (SD)	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**
Traffic[1]										
Traffic exposure	0.3 (0.3)	0.0-1.8	0.3 (0.3)	0.0-1.8	0.3 (0.3)	0.0-1.8	0.2 (0.3)	0.0-1.8	0.2 (0.3)	0.0-1.8
Housing[1]										
Housing affordability stress	38.6 (10.2)	0.0-75.0	36.6 (12.2)	0.0-79.5	36.1 (14.8)	0.0-90.9	33.4 (17.0)	0.0-100.0	31.7 (20.2)	0.0-100.0
Housing density	0.9 (8.1)	0.0-89.0	0.5 (4.2)	0.0-69.0	2.7 (19.0)	0.0-272.0	1.6 (17.8)	0.0-306.0	1.4 (14.9)	0.0-310.0
Walkability[2]										
Dwelling density	9.5 (3.1)	0.4-18.7	8.9 (3.3)	0.5-20.3	8.1 (3.6)	0.4-17.7	7.7 (3.5)	0.5-18.9	7.5 (3.4)	0.5-18.6
Street connectivity	62.3 (15.9)	0.0-135.5	57.7 (21.3)	0.0-102.2	51.0 (25.7)	0.0-124.3	51.4 (27.5)	0.0-158.5	50.7 (24.5)	0.0-122.0
Daily living score	2.2 (0.7)	0.0-23.0	2.0 (0.9)	0.0-3.0	1.7 (1.0)	0.0-3.0	1.5 (0.9)	0.0-3.0	1.3 (0.9)	0.0-3.0
Local living score	5.6 (2.5)	0.0-10.7	5.0 (2.8)	0.0-10.7	4.1 (3.0)	0.0-10.7	3.4 (2.8)	0.0-10.2	2.7 (2.5)	0.0-10.3
Walkability score	0.4 (1.8)	-6.0-3.8	0.2 (1.9)	-7.2-4.4	-0.5 (2.4)	-8.0-4.7	-0.8 (2.4)	-8.3-5.0	-1.4 (2.4)	-7.0-5.3
Public transport[2]										
Count of public transport stops	28.7 (21.9)	0.0-100.0	25.3 (22.2)	0.0-114.0	19.8 (23.7)	0.0-120.0	15.1 (19.2)	0.0-110.0	11.3 (14.6)	0.0-93.0
Distance (m) to closest public transport stop	342.2 (290.3)	0.0-1598.0	372.8 (288.8)	1.0-1595.0	415.1 (334.7)	2.0-1597.0	457.5 (355.6)	1.0-1586.0	556.2 (394.1)	8.0-1591.0
Count of public transport stops with a frequent weekday service	3.2 (5.9)	0.0-30.0	2.9 (6.9)	0.0-41.0	2.4 (6.4)	0.0-39.0	1.8 (5.0)	0.0-33.0	1.1 (3.5)	0.0-28.0
Distance (m) to closest public transport stop with a frequent weekday service	760.6 (397.2)	20.0-1595.0	769.6 (475.2)	18.0-1598.0	777.8 (402.9)	73.0-1600.0	839.3 (424.4)	35.0-1593.0	820.8 (445.5)	56.0-1598.0
Public open space[2]										
Count of POS	10.4 (9.5)	0.0-90.0	11.4 (10.3)	0.0-79.0	8.9 (9.5)	0.0-67.0	8.0 (8.1)	0.0-45.0	6.9 (7.5)	0.0-50.0
Distance (m) to closest POS	403.6 (305.2)	0.0-1590.0	408.1 (330.8)	0.0-1593.0	439.2 (355.6)	0.0-1597.0	377.7 (337.3)	0.0-1588.0	410.6 (372.0)	0.0-1566.0

	Neighbourhood disadvantage									
Regional cities n=3,966	**Q1 (most disadvantaged)**		**Q2**		**Q3**		**Q4**		**Q5 (least disadvantaged)**	
	Mean (SD)	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**
Count of POS <=0.4 Ha	3.4 (6.1)	0.0-80.0	3.5 (6.0)	0.0-69.0	2.8 (5.1)	0.0-51.0	2.0 (3.2)	0.0-35.0	1.8 (3.6)	0.0-44.0
Distance (m) to closest POS <=0.4 Ha	744.4 (395.4)	0.0-1597.0	763.1 (401.1)	9.0-1599.0	727.8 (386.2)	10.0-1600.0	754.2 (428.7)	1.0-1583.0	729.3 (421.6)	0.0-1599.0
Count of POS >0.4 to <=1 Ha	1.8 (2.0)	0.0-12.0	1.9 (2.1)	0.0-11.0	1.5 (2.0)	0.0-13.0	1.4 (2.1)	0.0-17.0	1.3 (2.1)	0.0-14.0
Distance (m) to closest POS >0.4 to <=1 Ha	779.0 (436.7)	0.0-1599.0	776.7 (405.1)	1.0-1595.0	735.9 (404.8)	1.0-1600.0	721.9 (414.7)	0.0-1594.0	736.0 (431.8)	0.0-1593.0
Count of POS >0.4 Ha	7.0 (5.1)	0.0-34.0	8.0 (6.3)	0.0-38.0	6.1 (5.8)	0.0-34.0	6.0 (5.9)	0.0-30.0	5.1 (5.2)	0.0-32.0
Distance (m) to closest POS >0.4 Ha	445.8 (323.2)	0.0-1590.0	436.1 (336.8)	0.0-1593.0	466.3 (356.7)	0.0-1597.0	408.8 (353.1)	0.0-1597.0	436.9 (373.7)	0.0-1566.0
Count of POS >1.5 Ha	4.4 (3.2)	0.0-19.0	5.2 (4.2)	0.0-23.0	3.8 (3.5)	0.0-18.0	3.8 (3.6)	0.0-17.0	3.2 (3.2)	0.0-16.0
Distance (m) to closest POS >1.5 Ha	563.6 (373.6)	0.0-1571.0	517.8 (364.0)	0.0-1594.0	554.6 (385.8)	0.0-1597.0	471.4 (369.6)	0.0-1597.0	522.0 (397.1)	0.0-1590.0
Count of playgrounds	2.1 (3.0)	0.0-20.0	2.3 (3.1)	0.0-23.0	2.2 (3.4)	0.0-19.0	2.1 (3.3)	0.0-22.0	1.5 (2.6)	0.0-15.0
Distance (m) to closest playground	761.9 (401.6)	0.0-1599.0	701.2 (377.8)	62.0-1582.0	705.0 (383.1)	46.0-1593.0	660.0 (378.2)	19.0-1599.0	692.4 (387.9)	0.0-1580.0
Early childcare and education services[3†]										
Count of childcare centres meeting national standards	9.4 (7.7)	0.0-34.0	8.2 (7.6)	0.0-34.0	5.7 (6.7)	0.0-33.0	4.5 (5.5)	0.0-29.0	4.0 (4.1)	0.0-24.0
Distance (m) to closest childcare centre meeting national standards	869.9 (518.7)	10.0-3118.0	915. 9 (584.4)	1.0-2837.0	1051.3 (711.2)	1.0-3175.0	1309.8 (801.6)	62.0-3188.0	1372.2 (745.7)	79.0-3195.0

	Neighbourhood disadvantage									
Regional cities n=3,966	**Q1 (most disadvantaged)**		**Q2**		**Q3**		**Q4**		**Q5 (least disadvantaged)**	
	Mean (SD)	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**
Count of childcare centres exceeding national standards	2.9 (2.6)	0.0-11.0	2.4 (2.7)	0.0-12.0	1.7 (2.4)	0.0-12.0	1.3 (1.8)	0.0-12.0	1.4 (1.7)	0.0-8.0
Distance (m) to closest childcare centre exceeding national standards	1339.5 (746.6)	11.0-3198.0	1379.0 (699.3)	8.0-3126.0	1404.7 (790.8)	55.0-3196.0	1615.1 (758.7)	91.0-3200.0	1699.3 (822.3)	79.0-3198.0
Count of preschool services meeting national standards	3.9 (3.2)	0.0-14.0	3.4 (3.3)	0.0-15.0	2.2 (2.8)	0.0-15.0	1.8 (2.3)	0.0-11.0	1.4 (1.7)	0.0-10.0
Distance (m) to closest preschool service meeting national standards	1134.7 (780.1)	0.0-3172.0	1080.0 (788.8)	62.0-3166.0	985.9 (707.0)	46.0-3176.0	1064.6 (783.2)	19.0-3159.0	1195.1 (838.4)	0.0-3154.0
Count of preschool services exceeding national standards	1.6 (1.4)	0.0-8.0	1.4 (1.5)	0.0-8.0	0.9 (1.3)	0.0-7.0	0.7 (0.9)	0.0-5.0	0.7 (0.9)	0.0-5.0
Distance (m) to closest preschool service exceeding national standards	1524.8 (742.5)	11.0-3198.0	1607.1 (787.0)	8.0-3167.0	1489.9 (788.7)	55.0-3196.0	1781.9 (810.8)	91.0-3200.0	1921.6 (803.1)	79.0-3196.0
Family-friendly destinations[3]										
Count of sport facilities	11.3 (9.6)	0.0-41.0	10.7 (9.9)	0.0-43.0	8.0 (9.0)	0.0-41.0	6.6 (8.4)	0.0-42.0	5.3 (6.5)	0.0-42.0

Regional cities n=3,966	Neighbourhood disadvantage									
	Q1 (most disadvantaged)		Q2		Q3		Q4		Q5 (least disadvantaged)	
	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range
Distance (m) to closest sport facility	790.8 (615.5)	0.0-3180.0	778.5 (647.6)	0.0-3183.0	910.6 (706.3)	0.0-3182.0	971.1 (725.1)	0.0-3139.0	1206.9 (835.6)	0.0-3145.0
Count of public swimming pools	3.1 (9.0)	0.0-122.0	4.9 (16.2)	0.0-123.0	3.4 (12.3)	0.0-107.0	2.0 (8.7)	0.0-120.0	2.6 (12.4)	0.0-122.0
Distance (m) to closest public swimming pool	1699.7 (809.9)	22.0-3192.0	1643.8 (801.0)	14.0-3173.0	1731.4 (864.2)	10.0-3197.0	1884.7 (821.4)	41.0-3197.0	1927.5 (778.9)	116.0-3198.0
Count of libraries	0.8 (0.7)	0.0-4.0	0.5 (0.7)	0.0-4.0	0.4 (0.6)	0.0-3.0	0.3 (0.5)	0.0-3.0	0.2 (0.5)	0.0-3.0
Distance (m) to closest public library	1743.1 (757.6)	61.0-3197.0	1998.7 (803.6)	85.0-3197.0	1967.3 (814.5)	277.0-3199.0	2078.8 (731.4)	284.0-3197.0	2301.7 (610.7)	726.0-3195.0
Count of community centres	0.9 (1.3)	0.0-7.0	0.5 (0.9)	0.0-5.0	0.4 (0.8)	0.0-5.0	0.3 (0.7)	0.0-4.0	0.2 (0.6)	0.0-3.0
Distance (m) to closest community centre	1755.4 (810.8)	31.0-3185.0	1873.2 (743.9)	97.0-3191.0	1854.6 (714.3)	272.0-3186.0	1741.4 (836.4)	208.0-3131.0	1867.0 (943.3)	175.0-3153.0
Count of activity centres	1.7 (1.7)	0.0-7.0	1.5 (1.6)	0.0-6.0	1.1 (1.4)	0.0-7.0	0.8 (1.2)	0.0-5.0	0.7 (1.1)	0.0-6.0
Distance (m) to closest activity centre	1577.1 (731.4)	39.0-3197.0	1643.7 (772.5)	24.0-3178.0	1766.3 (789.2)	167.0-3188.0	1916.6 (716.1)	235.0-3186.0	2197.1 (652.2)	144.0-3166.0
Family-friendly destinations score	3.3 (1.4)	0.0-5.0	2.8 (1.6)	0.0-5.0	2.3 (1.6)	0.0-5.0	2.0 (1.6)	0.0-5.0	1.8 (1.5)	0.0-5.0
Food outlets[3]										
Percentage of healthier food outlets	42.5 (19.6)	0.0-100.0	43.0 (21.1)	0.0-100.0	49.8 (25.5)	0.0-100.0	49.8 (26.4)	0.0-100.0	55.3 (29.7)	0.0-100.0

Key: Neighbourhood disadvantage: Socio-Economic Index For Areas-Index of Relative Disadvantage. Q: Quintile. SD: Standard deviation. [1]Spatial unit is Statistical Area Level 1 (SA1); [2]Spatial unit is 1,600m street network distance around child's home; [3]Spatial unit is 3,200m street network distance around child's home. **Notes:** Missing cases$_2$: Missing on maternal education, neighbourhood disadvantage, and DV1, total n=30,601; See **Table 2** for measure descriptions and report footnote$_2$. [†]Children in WA and TAS excluded from early childhood education and care services analysis (see Notes in **Table 3**). See **Table 3** for built environment descriptions.