



Final Report

Housing and children's development and wellbeing: evidence from Australian data

authored by

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1 INTRODUCTION

A positive environment for early child development sets the foundation for an individual's health and capability to participate in society economically and socially across the life-course. An extensive international literature demonstrates that the housing circumstances in which children are raised have significant impacts upon their development outcomes and wellbeing, and that housing may be an important mediating factor in the transmission of intergenerational and neighbourhood disadvantage. However, a recent scoping study highlighted the paucity of empirical evidence on the magnitude of these relationships for Australian families (Dockery et al. 2010—AHURI project 80551).

Following the recommendations of that scoping study, this report provides empirical evidence on the associations between key housing variables and early childhood health and development outcomes based on data from *Growing up in Australia: The Longitudinal Study of Australian Children* (LSAC) and *Footprints in Time: The Longitudinal Study of Indigenous Children* (LSIC).

Specifically, the research questions addressed are:

- RQ1: How strong are the empirical associations between housing factors and key indicators of children's development and wellbeing, and to what extent do these appear to be mediating relationships between socio-economic status and child outcomes. That is, what is the potential role of housing-related variables in shaping child outcomes and in the transmission of socio-economic disadvantage from parents and neighbourhoods to Australian children?
- RQ2: How do the links between housing factors and child development and wellbeing materialise over time? Do they change across development periods? Which period of child development is most sensitive to housing conditions? Are there critical developmental periods where housing exerts an influence on children's later development irrespective of intervening periods?
- RQ3: In what ways are the housing experiences of Indigenous children different from those experienced by non-Indigenous children?
- RQ4: To what extent do poor housing conditions faced by Indigenous children contribute to the profound differences in health and development outcomes between Indigenous and non-Indigenous children?
- RQ5: How do housing circumstances and child outcomes compare for those receiving various forms of housing assistance (HA)? What do these comparisons and the other empirical findings imply for the social return to HA, and for how such assistance should be targeted and provided?
- RQ6: What do the empirical findings imply for policies and practices relating to housing design and urban planning that impact upon families with children?

Given the limited existing empirical evidence for Australia, information on the magnitude of associations between housing variables and child outcomes are of considerable interest in themselves. Of even more importance for theory and policy formulation is evidence that can enhance our understanding of the causal determinants of child outcomes. For this latter endeavour, a number of methodological challenges have been highlighted (Dockery et al. 2010).

First, many housing and non-housing influences operate in concert, making it difficult to disentangle the linkages. Familial socio-economic status has been highlighted as a prime example—low socio-economic status is likely to be coincident with inferior parenting styles, living in worse neighbourhoods with negative peer effects and low

quality schools, frequent moves, housing stress and so on, even perhaps genetics. Second, there are trade-offs between variables, making the direction of effects ambiguous. Housing stress, for example, would be expected to negatively impact on children, but a family may go into housing stress by renting or purchasing better housing in a better neighbourhood. Equally, overcrowding or 'doubling up' may have a positive effect by reducing stress associated with affordability. Finally, longitudinal data will not offer the same power for addressing such issues as it does in other research contexts. The time frames over which housing variables impact on outcomes, and whether effects cumulate or erode over time, means that each child can only really be thought of as having one housing 'history'. Longitudinal data offers more complete histories and a longer window over which to monitor outcomes, but not 'repeat observations' on the one individual in the sense that longitudinal data is usually viewed.

The datasets explored contain a wide range of potential explanatory and dependent variables that could be modelled to address the research questions. Extensive analyses of these variables show that many of these are correlated with one another, and in order to keep the discussion tractable, a more limited and focused modelling was necessary for this report.

Three main domains of children's wellbeing and development are identified for which housing may have differential impacts: physical health; cognitive/school outcomes and emotional/behavioural wellbeing. The reported results from the LSAC concentrate on one summary outcome indicator for each of these domains: the existing 'outcome-indices' for physical health, learning and social-emotional outcomes. A summary measure of socio-economic status is also used. For analysis of the data in the LSIC, indicators for the three domains are chosen from the Parents' Evaluation of Development Status instrument, and supplemented with a parental assessment of the study child's general health.

Following a brief overview of relevant theoretical frameworks as a background to the analysis, Chapter 3 describes the data, key constructs and modelling approach. Chapters 4 to 6 present analyses of the links between housing variables and child outcomes in the three domains in turn: physical health, social and emotional wellbeing and learning/cognitive development using the LSAC. Chapter 7 looks in more detail at housing and outcomes for children in families receiving housing assistance in the form of public housing and Commonwealth Rent Assistance, and Chapter 8 focuses on the housing experiences of Indigenous children using both the LSAC and LSIC. Chapter 9 concludes with a discussion of the findings against each of the research questions.

2 CHILDREN'S DEVELOPMENT AND WELLBEING OUTCOMES—CONCEPTUAL FRAMEWORK

In the scoping study that preceded this report Dockery et al. 2010 provide an extensive review of the literature and theoretical frameworks relevant to the analysis of housing effects on children's development and wellbeing. They conclude that Bronfenbrenner's bio-ecological theory offers the most useful organising framework, along with the Family and Community Resource Framework developed by Brooks-Gunn and colleagues. A brief overview of these models are provided here, and we refer readers to the extensive review contained in Dockery et al. 2010 for greater details and discussion of the associated empirical literature.

2.1 Bio-ecological theory

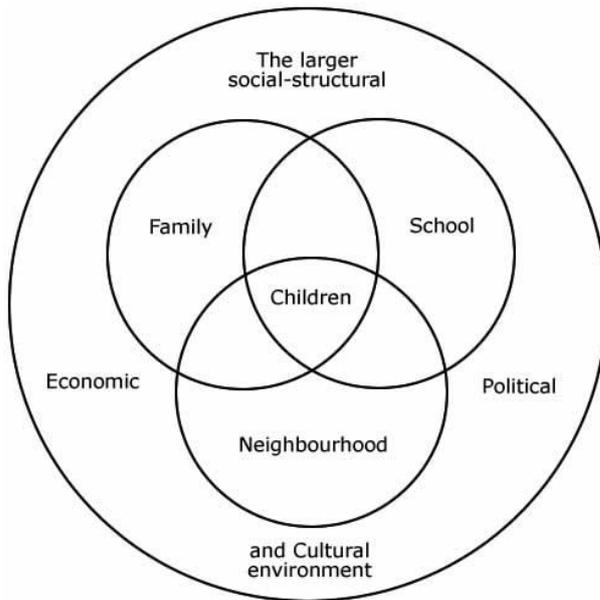
The discovery that social gradients are pervasive in both health and child development has fuelled speculation among population health researchers that poor outcomes result from common biological, psychological and social processes (Commission on Social Determinants of Health 2008; Hertzman 1999). Accumulating evidence from developmental neuroscience and developmental psychopathology of the complex functioning of the human central nervous system offers considerable support for this proposition (Cicchetti & Walker 2003; Shonkoff et al. 2009). Consequently, many researchers in the study of human development now share the belief that they should investigate this functioning through the assessment of genetic, physiological and neurocognitive aspects of ontogenesis and socio-emotional, environmental and cultural influences on behaviour (Cicchetti & Cohen 1995).

The belief that features outside the child's immediate environment can, and frequently do, impact on the child's development was popularised by developmental psychologist Urie Bronfenbrenner. Bronfenbrenner (1979a) conceived of development as occurring within:

- Nested settings beginning with the developing person, the *microsystem*.
- Immediate social settings of home, school and neighbourhood, the *mesosystem*.
- Settings that do not involve the developing person as an active participant, such as the parent's workplace, the *exosystem* and the wider society and culture, the *macrosystem* (see Figure 1).

Bronfenbrenner and his colleagues (Bronfenbrenner 1995; Bronfenbrenner & Ceci 1994) have subsequently extended the ecological model to include the biological processes of development. This approach has become known as the 'bio-ecological perspective'. By drawing attention to the proximal contexts of family, school and community and the distal 'structural' components of society, culture, economic influence and politics that are largely outside the sphere of the child's and family's influence, Bronfenbrenner's bio-ecological theory challenges the predominant view that individuals have the capacity to act independently and to make their own free choices. 'Structure' refers to those factors such as socio-economic status, social class, religion, gender, ethnicity, customs and institutions (e.g. education, law enforcement, health, welfare, and housing) that seem to limit or influence the opportunities that individuals have.

Figure 1: Ecological contexts shaping child development



Source: Modified from Jessor (1993).

2.2 The role of the home and neighbourhood

Bronfenbrenner's bio-ecological model of child development is concerned with the immediate social settings of the child's home (Bronfenbrenner 1979b; Bronfenbrenner & Ceci 1994). In more recent years, other academics such as Wohlwill (1980), Super and Harkness (1986) and Wachs (1990) have argued that the physical environment is essential to understanding the context of child development, and that the physical and social environment work jointly and independently to influence a child's development and interactions with his/her parents. Drawing on Bronfenbrenner's ecological model (Bronfenbrenner 1979b; Bronfenbrenner & Ceci 1994), Bartlett (1997) noted that the material, spatial and symbolic aspects of a child's physical home environment is founded on the view espoused by Bronfenbrenner (Bronfenbrenner 1979b; Bronfenbrenner & Ceci 1994) that a child's development is embedded within a set of social settings. Aspects of the home that have been empirically identified by the existing literature to influence children's development include:

- environmental allergens
- toxicants
- cleanliness, housing disrepair and safety
- building height and opportunities for outdoor play
- crowding
- housing affordability
- homeownership
- frequent residential moves
- homelessness
- neighbourhood characteristics.

As with the findings of Bronfenbrenner (Bronfenbrenner 1979b; Bronfenbrenner & Ceci 1994), numerous recent studies have noted that neighbourhood conditions have

the potential to improve or hinder the development of children (Brooks-Gunn et al. 1997a; 1997b; Leventhal & Brooks-Gunn 2000; 2003). Studies have identified five models that explain the pathways through which the neighbourhood impacts on child development (Jencks & Mayer 1990; Brooks-Gunn et al. 1993; Leventhal & Brooks-Gunn 2000):

- *Contagion (or epidemic) model*: primarily based on the premise that the negative behaviour of peers and neighbours strongly influences and/or spreads to problem behaviour being demonstrated by others.
- *Collective socialisation model*: proposes that neighbourhood factors influence children by means of community social organisation, such as the presence of adult role models, adult monitoring and supervision, along with the existence of routines and structures.
- *Competition model*: states that peers and neighbours compete for scarce community resources.
- *Relative deprivation model*: proposes that individuals evaluate their relative standing and situation through comparisons with their neighbours and peers.
- *Neighbourhood institutional resource model*: asserts that neighbourhood resources influence children through such things as police presence and access to resources that provide stimulating social and learning environments such as libraries, community centres and parks, along with the provision of community services that promote healthy development.

2.3 The family and community resource framework

Kendall and Li (2005) discuss Brooks-Gunn and colleagues' conceptualisation of the 'proximal' processes within the family and the community that mediate between socioeconomic factors and health, developmental, and educational outcomes. They identify key elements of this approach as being the attention given to development through the early childhood years and to effective early intervention. This resource framework integrates the research conducted in the field by scholars from macro perspectives (e.g. economists, sociologists, and demographers) and micro perspectives (e.g. developmental and clinical psychologists and paediatricians), and departs from previous approaches by making the links with disciplines that focus on familial and extrafamilial processes more explicit.

In broad terms, Kendall and Li 2005 identify four categories of resources in the family thought to be critical for early socialisation: income, time, human capital (parents' levels of formal schooling, together with special skills, training, and other characteristics), and psychological capital (e.g. mental health of the parents, beliefs about the parental role in childrearing). Community resources include a variety of contexts—child care settings, schools, peer groups, community groups, and wider social contexts (Brooks-Gunn, 1995). In this way the family and community resource framework has taken research in this area of children's development beyond the relatively unsophisticated measures of education, occupation, and income typically used in social epidemiology to capture the effect of socioeconomic factors. It is now supported by a large body of empirical work showing strong impacts of parental attitudes, beliefs, and values; a strong social gradient in children's social, emotional, behavioural, language, and cognitive development and their academic achievement (Kendall & Li 2005).

3 THE DATA AND MODELLING APPROACH

To investigate the links between housing and children’s outcomes, data from two surveys are analysed: the *Longitudinal Study of Australian Children* (LSAC) and *Footprints in Time: The Longitudinal Study of Indigenous Children* (LSIC). These datasets contain extensive background information on the families of the survey children, a range of indicators of child outcomes and wellbeing, and information on housing circumstances. They also have the advantage of being longitudinal, with surveys being administered every two years in the case of the LSAC and every one year for the LSIC. The analyses are based on data from three waves of the LSAC and two waves of the LSIC.

Both surveys contain two cohorts within their samples: infants mostly aged from 0 to 1 year at the start of the survey and pre-schoolers mostly aged from 4 to 5 years at the start of the survey. We follow the convention used in the survey documentation of denoting these as the B (baby) and K (kindergarten), cohorts respectively. The LSAC commenced in 2004 and the LSIC in 2008. The following table shows the survey waves and associated ages of each cohort. Data from Wave 3 of the LSAC were released in August of 2009, and data from Wave 2 of the LSIC were released publicly in late 2011.

Table 1: Sample frame for survey data

	Wave 1 (2004)	Wave 2 (2006)	Wave 3 (2008)
LSAC			
B cohort	3–19 months n=5,107	2–3 years n=4,606	4–5 years n=4,386
K cohort	4–5 years n=4,983	6–7 years n=4,464	8–9 years n=4,331
	Wave 1 (2008)	Wave 2 (2009)	
LSIC			
B cohort	3–15 months n=960	2–3 years n=866	
K cohort	4–5 years n=727	6–7 years n=614	

NB: Age ranges are approximate—a small number of survey children were outside these ranges at the time of the interviews.

The prime issues of interest are the relationships between elements of families’ housing circumstances and their children’s wellbeing and outcomes, and the nature of any causal channels that shape children’s outcomes and involve housing characteristics. The LSAC and LSIC contain a wide range of data items that capture different aspects of children’s development and wellbeing; literally hundreds of items that might potentially impact upon child outcomes, and numerous variables relating to housing. Further, many of these potential measures themselves are inter-correlated.

In order to keep the analysis tractable and the results digestible to the reader, it has been necessary to narrow the focus down to a set of core relationships of interest and an associated set of key constructs to empirically model those relationships. These have been chosen following an extensive exploration of the bivariate associations between outcome measures and ‘explanatory’ variables likely to influence outcomes,

and of bivariate associations between explanatory variables that may act as mediating relationships to their influence on children. With the large sample size available, many such relationships are found to be statistically significant and multivariate modelling is clearly necessary to isolate the main independent effects. The report focuses on the results of these multivariate models, and presents only those univariate statistics and bivariate associations considered integral to the reader's appreciation of the results. The following section sets out the approach taken in developing and refining these multivariate models.

3.1 The modelling approach

Leaving aside measurement and timing issues for the moment, the basic conceptualisation of the multivariate modelling is that child outcomes are influenced by a set of exogenous variables that can be observed through the early life course. By exogenous, we mean that the variables are determined independently of the child's outcomes, and are not themselves shaped by how the child develops or behaves. These will include genetic traits and various aspects of the family's background and environment, of which an important one is the family's socio-economic status. This vector of non-housing variables is denoted by X in equation 1, while the i subscripts denote the individual (the child):

$$(1) \quad Y_i = \alpha X_i + \beta H_i + \delta P_i$$

It is hypothesised that housing variables (H) are also significant in shaping children's outcomes. As expected, however, bivariate analyses confirm that housing variables tend to be closely related to socio-economic status. If socio-economic status and housing have separate and independent effects on child outcomes, but these effects are difficult to entangle simply because the variables are closely correlated, we would say one variable is a 'confounder' to the other. Consider the example where (a) socio-economic status has a large positive causal effect on child outcomes (Y) through the additional resources parents can invest in health and schooling, (b) housing has minimal influence on Y , and (c) socio-economic status and housing are closely correlated. If these three conditions all held and we estimated a model such as (1) without including a variable capturing socio-economic status, the model would spuriously suggest better housing has a positive effect on child outcomes. Hence, it is important to control for any potentially confounding variables when estimating the effect of housing on child outcomes.

Next, consider the example where socio-economic status has a large positive effect on child outcomes, but that this effect arises *because* people of higher socio-economic status can afford better housing, which in turn leads to better child outcomes. In this case, housing is a mediating variable. Including either socio-economic status or housing in the model would correctly indicate a positive association with child outcomes. Including both together would reduce the estimated coefficient on socio-economic status, as some of its effect would be captured through the coefficient on H .

Any effect of housing on Y may also be transmitted through other observable variables. A vector of variables, P , is included in equation 1 to represent mediating variables between housing and outcomes, though note these may also act as mediators for socio-economic status or other variables included in X . Following the literature review and analysis of bivariate associations, the variables included in P relate to parenting styles.

The empirical approach is to first estimate a 'base model' including background demographics and measures of socio-economic status among the regressors

($Y_i = \alpha X_i$). Housing variables are then each added separately to the base model to test the extent to which different aspects of housing mediate the relationship between socio-economic status and child outcomes, and to identify any effects of housing that appear to be independent of socio-economic status. The housing variables are then entered into the model jointly, and insignificant variables eliminated to arrive at a preferred, reduced form of $Y_i = \alpha X_i + \beta H_i$. Finally, variables capturing parenting styles are added to investigate whether relationships between housing and outcomes are transmitted through the impact of housing circumstances and parenting styles. The longitudinal data allows panel models to be estimated. Due to the stable nature of a number of the key variables of interest, notably housing-related variables, random effects rather than fixed effects models are mainly used. Details on the exact econometric forms and the use of the panel data to explore the timing of the effects are provided below.

This process is followed for outcomes variables capturing three dimensions of children's development and wellbeing: physical health (Chapter 4), social and emotional wellbeing (Chapter 5) and cognitive/school outcomes (Chapter 6). Four different aspects of the study child's housing circumstances are modelled: housing tenure, physical conditions and adequacy, housing affordability, and neighbourhood effects. The models developed are then built upon to analyse the role of housing in shaping outcomes for children whose families receive housing assistance (Chapter 7) and for Indigenous children (Chapter 8). A description of variables used from the LSIC is provided at the beginning of Chapter 8.

3.2 Constructs and variables

3.2.1 Child outcomes variables

The scoping paper (Dockery et al. 2010) highlighted that the role of housing factors in shaping children's wellbeing is likely to vary for different domains of child development and wellbeing. Three separate domains were identified to be investigated separately: physical health, social and emotional wellbeing and cognitive/school development. Even within these separate domains, there are numerous potential variables in the LSAC that could be used as an indicator of outcomes for the study child, some based upon existing established instruments. These include, among many others, parental assessments of the child's general health, the presence of a range of ongoing health conditions, number and type of injuries, hospitalisation, indicators of speech and understanding difficulties, the 'Peabody Picture Vocabulary Test' and measures from the Parental Evaluation of Development Status (PEDS) instrument, such as emotional functioning and motor skills.

Many of these show statistically significant relationships with housing variables contained in the LSAC, as well as with indicators of socio-economic status. For the multivariate modelling, we concentrate on one summary outcome variable for each of the three domains, with the preferred variables being the Outcomes Indices developed by Sanson et al. (2005) and included as derived variables in the LSAC data file. Major strengths of these variables are that they are available for both cohorts and for all waves of the survey, they summarise numerous indicators into a single measure, and internal consistency tests have been conducted on the variables contributing to the index. Further, sub-indices are generated for the key domains of interest: physical, social/emotional and learning. The variables included in the calculation of the index vary for the B and K cohorts due to the different questions they are asked, and Table 2 below shows the component variables. Each index is standardised to have a mean of 100 and standard deviation of 10, so that a score above or below 100 indicates deviation from the norm for other children of that age.

Table 2: Composition of LSAC outcomes index for four-year-olds

Outcomes index	Sub-component	Variables	
Physical	Health	Overall rating of health Special health-care needs screening Body mass index	
	Motor	PEDS QL Physical health summary	
Social/emotional	Social competence	SDQ ^a Prosocial SDQ Peer problems	
	Internalising	SDQ Emotional symptoms	
	Externalising	SDQ Hyperactivity SDQ Conduct	
Learning	Language	Peabody Picture Vocabulary Test	
	Literacy	Parent rating of reading skills Teacher rating of reading skills Teacher rating of writing skills	
		Numeracy	Teacher rating of numeracy skills
		Approach to learning	'Who am I' score

Source: Sanson et al. 2005, pp.10–11. a. SDQ—Strengths and Difficulties Questionnaire.

Details on the construction of the outcomes index can be found in Sanson et al. 2005, along with an assessment of its performance and some notes on limitations. Some important aspects to note, for the purposes here, are that the index does not include factors that may influence outcomes, such as poverty or maternal depression, so as to '... make a clear separation between actual current child functioning and possible causal influences' (Sanson et al. 2005, p.50). It also measures positive indicators as well as negative indicators, in contrast to many measures that are based on pathologies or indicators of 'ill-being'. However, the distributions do have longer left-hand tails, due to the existing variables being designed for 'discriminability' of developmental or behavioural problems.

3.2.2 Background demographics and socio-economic status

The variables included in the base model are gender; whether the study child is of Aboriginal or Torres Strait Islander descent, if the parent is a sole parent and English proficiency of the responding parent if their first language is other than English. To capture a pre-existing health condition of the study child, a variable is also included indicating whether or not the child had spent time in a neo-natal intensive care unit or special care nursery. This is chosen as it is safe to assume any complications at birth will not have been influenced by current housing conditions, which would not apply for indicators of current health problems or conditions. These are all dummy (0/1) variables.

Two indicators of socio-economic status are included. One is the 'socio-economic position' variable available as a derived variable in the LSAC file, and developed by Blakemore, Gibbings and Strazdins (2009). This is based on the parent's or parents' annual income, educational attainment and occupational prestige. The variable is calculated as a standardised z-score for the sample, and hence has a mean of zero and standard deviation of 1. The second indicator of socio-economic status is self-

assessed prosperity—or financial stress as it is termed in the survey documentation. Respondents were asked ‘Given your current needs and financial responsibilities, how would you say you and your family are getting on?’ with the prompt that this includes the partner and children living in the home. Responses were on a six-point scale ranging from very poor, poor, just getting along, reasonably comfortable, very comfortable and prosperous. For inclusion in the modelling, this was coded such that a higher value indicated greater financial wellbeing, and it is referred to as ‘self-assessed prosperity’. Although the variable ranges from 1 to 6, 95 per cent of the sample is clustered between the values of 3 (just getting along) and 5 (very comfortable).

As would be expected, there is a strong correlation (0.33) between the socio-economic position variable and self-assessed prosperity. However, analyses of bivariate associations between these two variables and a range of outcomes indicators suggested they also capture separate elements of socio-economic status, and have both been retained for the base model.

3.2.3 Housing variables

As noted, four main categories of housing influences have been identified as potentially impacting upon children’s outcomes in different ways: housing tenure, physical conditions and adequacy, housing affordability and neighbourhood effects. The key constructs and associated variables selected to be tested in the multivariate models are shown in Table 3 as a quick reference. Further clarification is provided below.

Housing tenure

Variables to capture housing instability, home ownership status, and housing assistance status are included in the modelling. Ownership status is categorised into owner (outright or paying off mortgage), renter (including under a rent-buy scheme) and ‘other’ (including life tenure scheme). These variables are available on a consistent basis for all waves, and home ownership is used as the default (or comparison) category. Following Taylor and Edwards (2012), frequency of moves was chosen as the best indicator of unstable housing. The alternative measure available relates to the duration the child has lived in the current home. However, this measure will be affected by the timing of the survey and a short existing tenure may be a result of a single move shortly before the survey in an otherwise very stable housing history. The variable indicating frequent moves was specified, as best as possible, to take on a value of one if the number of homes the child had lived in since birth was in the top 20 per cent for his or her age.

Two indicators of the family receiving housing assistance are included. One is an indicator of whether or not the family lives in public housing, based on the home being rented from a state or territory Housing Authority. The other is whether or not they receive Commonwealth Rent Assistance. In many models these are combined into a single ‘housing assistance’ variable, with separate effects explored in Chapter 7.

Physical conditions/adequacy of dwelling

Three indicators of the physical adequacy of the housing in which the study child lived were chosen. These are the type of dwelling, the external condition of the building and a measure of crowding. The categories for the type of dwelling initially included separate house, townhouse, flat/apartment, farm and ‘other’. However, where the coefficients for townhouse and flat/apartment were very similar and/or insignificant, these were combined into a single category of ‘unit’. External condition is interviewer-

rated on a scale ranging from 1 to 4, with 1 representing badly deteriorated, 2 in poor condition, 3 fair condition and 4 well-kept and in good repair.

A consistent measure of crowding is not available across the three waves. In Wave 1, for both the B and K cohorts, information is collected on the number of bedrooms and the number of adults and children living in the home. As a simple proxy, crowding was measured as the ratio of residents to bedrooms. However, where the child lived with both parents, the numerator (number of people) was reduced by one on the assumption that the parents would share a bedroom.

Housing affordability

Two main avenues for measuring housing affordability were tested for inclusion in the models. The first is based on the ratio of housing costs to income. A common housing affordability measure is a standard binary housing stress measure employed in many studies that assigns a household to stressed status if its housing cost burden exceeds 30 per cent of income. While supposedly objective in nature, recent studies have highlighted the deficiencies of this simplistic measure. For example, some families may have a housing cost burden in excess of 30 per cent, but be feeling reasonably comfortable financially or may be choosing to take on high housing cost burdens by choice (see e.g. Burke et al. 2007; Rowley & Ong 2012). Taking the housing cost burden as mortgage or rental payments as a proportion of gross income (including Commonwealth Rent Assistance), an exploration of bivariate associations revealed no strong correlations between child outcomes and whether or not a family has a housing cost burden of under or over 30 per cent in infancy and toddlerhood. However, the housing cost burden appeared to matter from pre-school onwards.

We also experimented with the use of another measure based on whether the family has reported difficulty in paying their mortgage or rent on time in the last year due to a shortage of money. While subjective, it could be argued that this more closely reflects the experience of housing stress. Stronger and more pervasive links between child outcomes and parents' ability to pay mortgage/rent on time were identified using this simple variable. When combined with the self-rated measure of prosperity, this potentially picks up financial stress that relates specifically to housing costs, and separably from other aspects of financial wellbeing. Consequently, this binary indicator was the preferred measure for inclusion in the multivariate modelling.

An example of where this specification may be an important improvement over the standard 30 per cent rule or a straight measure of the housing cost burden is where a family who is quite wealthy purchases or rents an expensive property. While they remain well off and may have no difficulty meeting repayments, they may meet the standard definition of housing affordability stress.

Neighbourhood environment

The LSAC data included a series of questions relating to the livability of the neighbourhood and available neighbourhood facilities. The responding parent was asked their agreement on a four-point scale with the statements:

- This is a safe neighbourhood.
- There are good parks, playgrounds and play spaces in this neighbourhood.

The mean of these questions was used as the livability scale. Although additional questions relating to neighbourhood livability were asked, only these two questions were asked in all waves and thus the scale based on these two items is used in the panel models. Similarly, three items comprise a neighbourhood facilities scale, based on agreement with the statements:

- There is access to close, affordable, regular public transport in this neighbourhood.
- There is access to basic shopping facilities in this neighbourhood.
- There is access to basic services such as banks, medical clinics, etc. in this neighbourhood.

The neighbourhood livability and neighbourhood facilities scale included here have a possible range from 1 to 4. The items have been coded such that a higher score represents greater livability and more facilities, as reflected by stronger agreement with the above statements.

Two other variables were included in the modelling to capture neighbourhood effects. The ABS Socio-economic index of disadvantage (SEIFA) for the collection district of the dwelling has been merged to the LSAC data. This is entered as a variable ranging from 1 to 10 representing the household's decile of the index within the pooled sample, with a higher score representing a neighbourhood of greater advantage.

Finally, the same four-point scale used by the interviewer to rate the external condition of the study child's dwelling was also used to rate the general condition of most buildings in the immediate vicinity.

Table 3: Housing constructs and variables: LSAC

Category	Construct	Variables [range]
Housing Tenure	Unstable housing	Frequent moves [0/1]
	Ownership status	Outright owner [#] ; renter, other [0/1]
	Receives housing assistance	Rents from a state housing authority. Receives Cwlth rent assistance
Physical conditions/ adequacy of dwelling	Dwelling type	Separate house [#] , townhouse or flat, farm, other [0/1]
	Dwelling condition	Interview rating of the external condition of the dwelling [1–4]
	Crowding	Ratio of persons living in the home to bedrooms [continuous]
Housing affordability	Housing stress	Had difficulty paying mortgage or rent on time [0/1]
Neighbourhood environment	Condition of nearby buildings	Interview rating of the external condition of the buildings in immediate vicinity [1–4]
	Neighbourhood livability	Livability scale [1–4]
	Neighbourhood facilities	Facilities scale [1–4]
	Neighbourhood socio-economic status	Australian Bureau of Statistics derived Socio-economic index of disadvantage for the collection district.

Notes: # denotes the category used as the omitted or comparison category in the models.

3.2.4 Parenting styles

As noted, parenting style was identified in the literature review as a possible mediator between socio-economic status and child outcomes, and between housing circumstances and child outcomes. Three variables were selected to proxy different aspects of parenting styles. The parent's self-rating of parental efficacy is based on the question 'Overall, as a parent do you feel that you are ...', with response options on a five point scale ranging from 1 'not very good at being a parent' to 5 'a very good parent'. A parental warmth scale is also available for all waves, and is constructed as the mean of a series of six questions on how often the parent undertakes various affectionate behaviours towards the study child. This variable can range from 1 to 5, with a higher score indicating a more affectionate parenting style. Both these variables relate to the responding 'parent 1'. Ideally, styles for both parents would be included, but this creates complications for the inclusion of both two-parent and sole parent families in the same models.

The final variable included to capture parenting style is an interviewer assessment of whether or not the home is cluttered. A further potential variable, the 'hostile parent scale' is available only for two waves and has not been included in the models reported here.

4 PHYSICAL HEALTH OUTCOMES

In this section we report empirical estimates of the associations between housing and Australian children's physical health outcomes using Waves 1–3 of the LSAC. The key outcome variable used is the physical outcomes index, as discussed in chapter 3, and described in detail in Sanson et al. 2005. For pooled observations on the study children over the three waves, this variable has a mean of just over 100 (100.3) and standard deviation just under 10 (9.8). Initially the base model described in Chapter 3 and including a basic range of demographic controls is estimated by random effects, ordinary least squares regression. More precisely, the model estimated takes the form of:

$$(2) \quad Y_{it} = \alpha X_{it} + \mu_i + \epsilon_{it}$$

Where the subscripts now denote both individuals (i) and time periods (t , t =Waves 1, 2 and 3). The initial model, reported as Model 4.1 in Table 4, has 27 713 observations, which represent observations on 10 036 individuals across the first three waves of the LSAC. With repeated observations on individuals, the random effects model decomposes the standard error term into two components: an individual-specific effect (μ_i) and the classical error term (ϵ_{it}) which is distributed normally with mean zero. The individual error term can allow for unobservables that are fixed individual-specific effects, for example, differences in the way some individuals interpret scales presented to them in surveys. The model is estimated using robust standard errors with clustering at the level of the individual. This random-effects specification is preferred to the fixed-effects model due to the fact that a number of the key variables of interest do not vary for many of the individuals, and the fixed-effects model can only estimate effects where there is individual level variation. However, comments on the robustness of the results to the use of the random- versus fixed-effects specifications are provided.

The base model overall is significant and each of the variables included are also significantly different from zero and have the expected signs. However, it must be noted that the model can explain only a very minor fraction of the variation in the physical outcomes index between the children. As the model is a linear regression, the coefficients have a simple interpretation—each unit change of independent variable is associated with a movement up the physical outcomes index by the value of the coefficient (or a movement down in the case of a negative coefficient).

The largest estimated effects are for the child having required intensive neo-natal care at birth and self-assessed prosperity. Recall the prosperity rating ranges from 1 to 6, but 95 per cent of the sample is clustered between the value of 3 (just getting along) and 5 (very comfortable). Having a parent from a non-English speaking background, has a substantial negative effect, even if the interviewer assessed them as speaking English well or very well. Children of Aboriginal or Torres Strait Islander descent, living in a sole-parent family and who are male also have lower measured health outcomes from the ages 0–1 to 8–9. These are all dummy (0/1) variables. Socio-economic status also has an independent effect beyond these variables. The coefficients of +0.36 on the variable for socio-economic position and of +0.78 on self-assessed prosperity indicate substantially better health for children of families of higher socio-economic status and who are financially comfortable.

Table 4: Physical health outcomes index, panel models, LSAC Waves 1–3

	Base model (Model 4.1)		With housing variables (Model 4.2)		Full model (Model 4.3)	
	β	p	β	p	β	p
Constant	98.28	0.000	94.69	0.000	86.48	0.000
Socio-demographics						
Male	-0.80	0.000	-0.73	0.000	-0.68	0.000
Aboriginal/TSI	-1.01	0.019	-0.74	0.114	-0.66	0.175
Intensive care at birth	-2.29	0.000	-2.20	0.000	-2.27	0.000
Sole parent	-0.69	0.001	-0.43	0.069	-0.37	0.133
English not first language and: Speaks English well/very well	-1.11	0.000	-1.02	0.000	-1.07	0.000
English poor/not at all	-1.45	0.006	-1.28	0.026	-1.45	0.021
Socio-economic position	0.36	0.000	0.23	0.008	0.25	0.006
Self-assessed prosperity	0.78	0.000	0.71	0.000	0.69	0.000
Housing						
Has moved frequently			-0.37	0.024	-0.32	0.052
Housing assistance			-0.25	0.290	-0.19	0.461
Dwelling type:						
Separate house			—		—	
Unit			-0.20	0.427	-0.13	0.607
Farm			0.99	0.013	1.14	0.005
Other			-0.34	0.618	-0.61	0.385
Dwelling condition			0.25	0.032	0.15	0.223
Housing stress			-0.73	0.006	-0.82	0.003
Neighbourhood environment:						
Livability scale			0.79	0.000	0.73	0.000
Facilities scale			0.17	0.088	0.14	0.166
Parenting styles						
Parental self-efficacy					0.64	0.000
Parental warmth scale					1.43	0.000
Home cluttered					-0.41	0.109
Observations	27713		25177		23688	
Individuals	10036		10006		9920	
Observations per individual	2.8		2.5		2.4	
R-squared:						
within	0.001		0.003		0.007	
between	0.040		0.045		0.061	
overall	0.025		0.030		0.044	
Wald chi2	342.5	0.000	391.2	0.000	589.5	0.000

Variables to capture different elements of housing circumstances—housing tenure, physical adequacy, affordability and neighbourhood environment are then added to the model. The sequential addition of variables to the base model allows individual associations to be identified providing some feel for the degree of interaction between the various effects, notably with socio-economic status. Results from this process are discussed below, and the final model presented in Model 4.2 of Table 4. It must be stressed to the reader that the results reflect associations only, and great caution must be taken in attempting to infer causal relationships.

4.1 Housing variables

4.1.1 Housing tenure

The variables designed to capture (a) housing instability, (b) home ownership status, and (c) housing assistance, were added to the basic model separately. Children having experienced frequent moves display significantly inferior physical health outcomes. The dummy variable has a coefficient (β) of -0.33 and the figure is significantly different from zero. Against the null hypothesis that the 'true' effect is zero, the estimated probability (p) of observing a coefficient of this magnitude is just 3 in a hundred (that is, $p=0.03$). Adding the ownership status variables to the basic model indicates that children residing in homes which their parent(s) rent rather than own have significantly lower scores on the physical health outcomes index ($\beta=-0.32$; $p=0.05$). There is no significant difference for the 'other' category, although only 4 per cent of the pooled sample is in this category.

When both the indicator of frequent moves and ownership status variables are included together, the magnitude and significance of the estimated coefficients for unstable housing and rental status are reduced slightly. As expected, this suggests some correlation between the state of being a renter and moving frequently, but there is a considerable additional effect of unstable housing beyond that of its association with renting.

Turning to housing assistance, children in families who are public renters are found to have substantially lower physical health outcomes ($\beta=-0.82$; $p=0.08$). The coefficient for the variable capturing receipt of rent assistance is also negative, but not significant ($\beta=-0.30$; $p=0.21$). The specification reported in the full model (Model 4.2) combines these into a single indicator of the study child's parents receiving one or other of those forms of housing assistance. Outcomes for children from families in receipt of housing assistance are explored in more detail in Chapter 7.

The coefficients for socio-economic status and prosperity are reduced only marginally by the inclusion of these variables. They are affected most by the inclusion of ownership status, reflecting the higher propensity for families of higher socio-economic status to own or be purchasing their own home. The estimated effects of socio-economic status and financial prosperity 'relative to needs' upon children's physical health outcomes remain large and robust independently of ownership status and the other modelled tenure effects.

4.1.2 Physical conditions and adequacy of housing

As the variables for type of dwelling are added to the basic model, a very pronounced positive effect on child physical health is estimated for living on a farm ($\beta=+0.87$, $p=0.02$). The external condition of the building, when added to the basic model, similarly has a strong correlation with physical health ($\beta=+0.26$, $p=0.02$). Recalling that the variable ranges from 1 to 4, this is potentially a sizeable effect in comparison to other estimates. The literal interpretation of the coefficient is that living in a dwelling in excellent condition as opposed to badly deteriorated would be associated with an

increase on the physical outcomes index of 0.78, though it must be noted that there is limited variation in this measure: 96 per cent of the observations are rated as 3 (fair condition) or 4 (well-kept and in good repair).

If the crowding measure derived for the study child in Wave 1 is included for the full sample, the measure is not significant, quite possibly because the measure is not applicable for those whose housing circumstances and family composition change after Wave 1. Restricting the sample to only Wave 1, which allows estimation across two cohorts, but provides no repeat observations on individuals, does show a negative effect on the physical health outcomes index, but the variable remains insignificant.

The results for each of the variables relating to physical conditions and adequacy are largely unchanged when they are entered into the model together, and this has minimal impact on the estimate for socio-economic status and prosperity. While several are significant in their own right, they add very little to the overall power of the model to account for variation between children's physical outcomes.

4.1.3 Housing affordability

When the binary indicator of whether or not the family had difficulty paying the rent or mortgage on time was added individually to the basic model, this variable capturing family's housing stress is highly significant and associated with substantially lower physical health outcomes for the study children ($\beta=-0.80$, $p=0.00$). Importantly, its inclusion only marginally affects the coefficient on financial prosperity, suggesting the variable does capture an element of housing affordability stress that is independent of wider prosperity.

4.1.4 Neighbourhood environment

When the variables reflecting the physical conditions of surrounding buildings, the neighbourhood livability scale, neighbourhood facilities scale and the SEIFA index of neighbourhood disadvantage were added individually to the basic model, the SEIFA variable was not significant. Any effect appears to be already captured within the measure of socio-economic status. The interviewer's rating of the conditions of surrounding buildings was also insignificant. The neighbourhood livability scale ($\beta=0.85$, $p=0.00$) seems to act as something of a mediator of socio-economic status, with its inclusion reducing the estimated coefficient of the latter variable from 0.36 in the basic model to 0.29. The neighbourhood facilities scale was also highly significant ($\beta=0.32$, $p=0.00$) and consequently the neighbourhood livability and neighbourhood facilities scales were retained in the fuller models.

4.2 Mediating relationships and parenting styles

A preferred model capturing basic demographics and housing characteristics is presented in Model 4.2. This is arrived at by initially including all the housing variables described above to capture the effects of the four different dimensions of housing circumstances on children's physical health outcomes, and methodically eliminating those that have coefficients which are both small in magnitude and with very low levels of significance (this is sometimes referred to as the 'general to specific' approach). Following elimination of the proxy for crowding, the ownership status variables are also found to be small and insignificant. This suggests the small, superior physical health outcomes for children of home-owners when compared to children of renters, to the extent that it can be attributed to housing circumstances at all, can be attributed to the more unstable housing of renters and other differences in renters' housing circumstances. The coefficients for the rating of the conditions of surrounding buildings and the SEIFA index of neighbourhood disadvantage are also small and insignificant, and dropped from the model.

The addition of these housing variables leads to a reduction in the magnitude of many of the background controls. This means, for example, a small portion of the disadvantage in physical health outcomes observed for children from sole parent families, for Indigenous children and for those from non-English speaking backgrounds are partly attributable to these groups' housing circumstances. The role that housing factors play for Indigenous children is analysed in more detail in Chapter 8. In contrast, the estimated coefficients for the child's gender and whether they required intensive care at birth are virtually unchanged.¹ As noted, the base model explains only a very small proportion of the variation in the physical health outcome index for the study children—approximately 2.5 per cent. The addition of variables to capture these four dimensions of housing circumstances—tenure, physical conditions and adequacy, housing costs and neighbourhood environment—increases this to just 3.0 per cent.

When Model 4.2 is estimated by fixed effects, many of the variables are insignificant. As noted, this is likely to be largely due to a lack of variation in variables at the individual level, meaning the estimate must be based on a small number of observations. Of the housing variables, having moved frequently and the neighbourhood livability and facilities scales remain significant in the fixed effects estimation.

4.2.1 Socio-economic status and housing

Of particular interest is the extent to which socio-economic status is mediated by housing variables. Do housing variables have an independent effect on children's outcomes, or do such relationships appear only because 'better' housing circumstances are an indicator of other benefits afforded to children raised in families of higher socio-economic status. If we accept that our measure of socio-economic status is a robust one, then the evidence here is that housing variables do have an additional, but minor independent effect on children's physical health outcomes. Of the four housing dimensions, it is the inclusion of the neighbourhood variables—the livability and facilities scale—that add the most additional explanatory power to the model. It is also the inclusion of these two variables that results in the biggest reduction in the estimated coefficient for socio-economic status. Thus neighbourhood characteristics, notably the neighbourhood livability scale, appear to be an important channel through which housing mediates the effect of parents' socio-economic status on children's physical outcomes.

4.2.2 Parenting styles

Initially, tests of association between the three indicators of parenting styles—the parental self-efficacy rating, the parenting warmth scale and whether or not the home was cluttered—were conducted against the housing variables and the socio-economic status index and the self-assessed rating of prosperity. Generally, people in better housing circumstances rate themselves as being better parents. Those who are renting (as opposed to owners), in receipt of housing assistance, who have moved frequently since their child was born and who are in housing affordability stress have a lower mean rating on the parental self-efficacy score. The score is positively correlated with the condition of their dwelling and the neighbourhood facility and livability scales, and with the parent's own higher socio-economic position and self-assessed prosperity. The parental warmth scale is positively correlated with the

¹ This negates some of the potential concern that there may be reverse causation between housing circumstances and the child's health at birth, which is possible since for most children their family's housing circumstances will be quite similar before and following the birth. These results give confidence that the variable can reasonably be considered exogenous with respect to the housing variables.

conditions of the dwelling, neighbourhood livability and facilities, and prosperity, but interestingly parents living on farms and of higher socio-economic status score lower on this scale. More cluttered homes are observed for those renting, in receipt of housing assistance, living in units as opposed to a separate house, in housing affordability stress, with dwellings in poorer conditions, neighbourhoods which are lower on the livability and facilities scales, of lower socio-economic position and financially less prosperous.

Although these associations are statistically significant, they are mostly so small in magnitude to be trivial. The exceptions are in regard to cluttered homes. For parents who are renters, receiving housing assistance and who have difficulty meeting housing costs, the home was around twice as likely to be reported as 'cluttered' (12–15% of homes as opposed to 6–7% of other homes). Parents whose home was cluttered were also, on average, substantially lower on the socio-economic positioning scale.

When the parenting style variables are individually added to Model 4.2, each are significant and, when considered in the context of other effects, have a quite substantial association with the study child's physical health outcomes. They remain significant, or nearly so in the case of cluttering, when added jointly (Model 4.3), and their addition considerably increases the explanatory power of the model. However, their inclusion has little impact upon the estimated coefficients for either the housing variables or the variables for socio-economic status. Comparing the coefficients from Models 4.3 and 4.2, the addition of the parenting style variables leads to some reduction in the coefficients for receiving housing assistance, living in a unit as opposed to a house and the condition of the dwelling. The effect of receipt of housing assistance and living in a unit appears to be partly mediated through the extent of 'cluttering', while the effect of the external condition of the building is most affected by the inclusion of the variable for parental self-efficacy.

4.3 Time effects

The various aspects of housing conditions are likely to have differential impacts upon children at different stages of the life course. The neighbourhood environment, for example, can be expected to have limited relevance for very young babies, but a larger impact on the wellbeing of older children. Some effects, like housing instability, may also take time to materialise, or have a cumulative effect. Differences in the timing of housing effects are assessed in a number of ways. The most straightforward is to estimate models separately for the baby and kindergarten cohort. Results for these models are presented in Table 5. With the number of observations in the models now reduced by about half, the coefficients are estimated with less precision in a statistical sense.

The contrasts between the models for the baby (Model 5.1) and kindergarten cohorts (Model 5.2) will be muted somewhat by the fact that both contain one wave with children aged 4–5 years: Wave 3 for the Baby cohort and Wave 1 for the Kindergarten cohort. Hence models were also estimated separately for children aged 0 to 4 and 6 to 9 to provide a bigger and non-overlapping age gap as a further test (results not reported). Note that this further reduces the available observations.

Taking these results together, there do seem to be some differences by age. Compared to the baby cohort, the physical health of the older cohort appears to be more negatively impacted if their parent is from a non-English speaking background. The warm parenting scale is associated with better physical health for both samples, but the estimated effect is substantially larger for the baby cohort. The positive effect of the family being from higher socio-economic position materialises later in childhood.

In terms of housing variables, there is little evidence of differential effects upon the physical health of the younger and older children in the sample. An exception is in the model for the 6–7 and 8–9-year-olds (not reported), where a negative and significant coefficient is found for the family being in receipt of housing assistance.

The temporal nature of housing factors was also tested by specifying each of the housing variables on a two-wave average basis rather than entering only the contemporaneous value: each explanatory variable X takes on the value of $(X_{t-1}+X_t)/2$. The housing assistance variable, for example, could take on a value of zero if the parents received housing assistance in neither the current wave nor the previous wave; 0.5 if they were in receipt of assistance in one of those years, and 1 if they were in receipt of assistance in both years. The variable based on the frequency of moves since birth is already cumulative in nature, and is retained in its previous form. Again one wave of observations on outcomes must be dropped from the estimation sample, as prior values of the variables can only be observed in Waves 2 and 3. Under this specification, if the coefficient for a time varying variable remains unchanged, there is evidence of cumulative or persistent effects, since it implies that the value of the variable in a previous year has just as strong an impact as the current value.

Model 5.4 presents the results using these two-period averaged housing variables. The sample for this estimation must be restricted to Waves 2 and 3, and to enable a comparison of these ‘duration’ effects against current values of the variables, Model 5.3 shows the results from the standard specification but with the sample also restricted to Waves 2 and 3. These results indicate some degree of persistence or cumulative effects in the case of the negative effect of the family being in receipt of housing assistance and being in housing affordability stress, and the positive health effects of living on a farm, in a dwelling in better external condition and in a more livable neighbourhood. However, adding this additional historical information into the model does not improve its explanatory power. Further, variables that display persistence might also be expected to have a larger effect on the older cohort, but no such correspondence is found in the various models tested here. The simple inclusion of one-period lagged variables confirms that past housing variables offer little additional information in explaining the current value of the health outcomes index. However, the neighbourhood livability scale from two years earlier is significant and associated with better physical health outcomes.

Table 5: Physical health outcomes index, models by cohort and with duration effects, LSAC

	Baby cohort Model 5.1		Kindergarten cohort Model 5.2		Waves 2 and 3			
					Current housing variables Model 5.3		Two-period housing variables Model 5.4 ^a	
	β	p	β	p	β	p	β	p
Constant	84.81	0.000	87.18	0.000	84.87	0.000	84.46	0.000
Socio-demographics								
Male	-0.67	0.002	-0.66	0.007	-0.32	0.109	-0.36	0.096
Aboriginal/TSI	-0.46	0.487	-1.00	0.169	0.04	0.949	0.10	0.901
Intensive care at birth	-2.03	0.000	-2.51	0.000	1.80	0.000	-1.76	0.000
Sole parent	-0.71	0.066	-0.12	0.710	0.36	0.246	0.05	0.875
English not first language and: speaks English well/very well	-0.66	0.048	-1.44	0.000	1.81	0.000	-1.73	0.000
English poor/not at all	-1.80	0.042	-1.13	0.215	0.94	0.280	-0.28	0.763
Socio-economic position	0.00	0.973	0.51	0.000	0.34	0.002	0.26	0.030
Self-assessed prosperity	0.65	0.000	0.72	0.000	0.58	0.000	0.52	0.000
Housing								
Has moved frequently	-0.44	0.083	-0.23	0.293	-0.34	0.128	-0.48	0.053
Housing assistance	-0.26	0.469	0.03	0.939	0.54	0.124	-0.59	0.213
Dwelling type:								
Separate house	—		—		—		—	
Unit	0.02	0.955	-0.54	0.144	0.44	0.209	-0.27	0.525
Farm	1.13	0.080	1.02	0.043	1.63	0.003	2.09	0.011
Other	0.13	0.895	-1.24	0.175	0.30	0.722	-0.89	0.516
Dwelling condition	0.06	0.745	0.27	0.084	0.50	0.004	0.50	0.036
Housing stress	-0.94	0.019	-0.69	0.061	0.84	0.019	-1.10	0.056
Neighbourhood environment:								
Livability scale	0.75	0.000	0.57	0.000	1.07	0.000	1.24	0.000
Facilities scale	0.06	0.684	0.25	0.067	0.08	0.530	0.15	0.400
Parenting styles								
Parental self-efficacy	0.68	0.000	0.59	0.000	0.75	0.000	0.76	0.000
Parental warmth scale	1.87	0.000	1.26	0.000	1.27	0.000	1.26	0.000
Home cluttered	-0.59	0.129	-0.30	0.345	0.51	0.139	-0.65	0.085
Observations	11988		11700		13999		12505	
Individuals	5030		4890		8202		6764	
Obs. per individual	2.4		2.4		1.7		1.8	
R-squared:								
within	0.006		0.009		0.006		0.003	
between	0.062		0.063		0.062		0.061	
overall	0.042		0.050		0.050		0.048	
Wald chi2	286.9	0.000	340.0	0.000	454.9	0.000	371.2	0.000

Notes: a. All housing variables in Model 5.4 are two-period average, except 'moved frequently'.

4.4 Housing and childhood obesity

As explained earlier, it was considered preferable to model only summary outcome indices covering the key domains of physical health, social and emotional wellbeing and cognitive development in order to keep the analysis and report tractable. A drawback of using a composite outcomes index is that the explanatory variables may have different effects on the outcomes comprising the index, possibly even opposing effects, so that the modelling will fail to identify some of the processes at work in determining child outcomes. This limitation may be particularly acute with respect to the physical health outcomes index, which includes body mass index along with indicators of motor skills, special needs and a global health rating. Body mass index can be considered quite distinct from other concepts of physical health and likely to be shaped by different factors. Given also the emergence of obesity among Australian youth as a major public health concern, a cursory and supplementary analysis was conducted based on the body mass index data contained in the LSAC. This section provides a brief summary of that analysis, but the full results are not reported.

The body mass index is available for Waves 2 and 3 of the LSAC for children for whom permission was given to take physical measurements. Using the cut-off points provided in the data documentation, a dummy variable was constructed indicating whether the child's body mass index score placed them in the 'obese' category. Random effects logit models corresponding to the linear regression models reported in Table 4 were estimated. With the dependent variable for the obesity models being binary, rather than a linear variable, the key difference in interpretation is that the logit models estimate the impact of a variable on the probability that a child will be classified as obese.

The base model suggests that two background factors have a very large association with childhood obesity. If the responding parent's first language is not English, the likelihood of the study child being classified as obese approximately doubles. Second, higher parental socio-economic position substantially reduces the likelihood of child obesity. Both these effects are large in terms of the estimated magnitude of their effects and highly significant in the statistical sense. The addition of the range of variables capturing different aspects of housing circumstances and parenting styles had minimal impact on these results. So while low parental socio-economic background is a major risk factor for childhood obesity, housing and parenting styles are not key mediating channels of that association.

Of the housing variables, only the SEIFA index of neighbourhood disadvantage proved substantial and highly significant, suggesting that peer-group effects arising from neighbours of higher socio-economic status reduce the incidence of obesity. The family being in housing affordability stress was marginally significant and associated with a greater likelihood of obesity. Perhaps surprisingly, no significant effect was found for the neighbourhood livability or facilities scales. For the indicators of parenting styles, weak evidence is found that greater 'parental warmth' marginally increases the probability of obesity among children. In summary, of the variables tested, socio-economic background—both within the family and the immediate neighbourhood—is the major determinant of childhood obesity. This may arise conjointly with, or in addition to, limited family resources associated with housing affordability stress. However, no evidence is found of any robust associations between the incidence of childhood obesity and the physical characteristics of the home or neighbourhood environment, nor between childhood obesity and housing tenure.

5 SOCIAL AND EMOTIONAL WELLBEING

The set of models corresponding to those set out in Chapter 4, but with the social/emotional outcomes index as the dependent variable are presented in Tables 6 and 7. Each of the outcomes indices are standardised to have a mean of 100 and standard deviation of 10, so the magnitude of the coefficients between models are broadly comparable. The basic model (Model 6.1) shows stronger associations between the socio-emotional index and the demographic and socio-economic controls, and all with the same sign as with physical health. The negative coefficients for the study child being male, being of Aboriginal and Torres Strait Islander descent, and for the responding parent having a language other than English as their first language are markedly larger; and the gradient with socio-economic position much steeper. There is a particularly large and negative effect ($\beta=-4.57$; $p=0.00$) where the responding parent spoke a language other than English as their first language and were rated by the interviewer as speaking English either 'not well' or 'not at all'. As would be expected, the child having required intensive neo-natal care is more strongly correlated with physical health than with social-emotional wellbeing. All these controls are highly significant. With an R-squared of 6.3 per cent, the basic model can explain more of the variation in the socio-emotional outcomes index than in the physical health index, but still only a very minor proportion.

The preferred model including housing variables is presented as Model 6.2, and is arrived at as follows.

5.1 Housing variables

5.1.1 *Housing tenure*

Housing tenure was found to have significant associations with children's socio-emotional wellbeing. When the variables to capture housing instability and ownership tenure were entered separately, the family having moved frequently and renting as opposed to owning the home have negative associations with the study child's wellbeing. This is also true of being in receipt of housing assistance, with being in public housing associated with markedly worse social and emotional outcomes for the child ($\beta=-2.97$; $p=0.00$). None, of these effects, on their own, seem to proxy or to be already captured in the controls for socio-economic position and prosperity.

5.1.2 *Physical conditions and adequacy of housing*

Adding the set of variables capturing the type of dwelling the family lives in to the basic model, children living in town houses ($\beta=-0.56$; $p=0.04$) or flats ($\beta=-0.67$; $p=0.07$) are found to display lower socio-emotional outcomes than those living in a separate house. With the effects being similar, these are again combined into a single category of 'unit'. In contrast to physical health, no positive effect of living on a farm is found for socio-emotional outcomes.

Surprisingly, better external condition of the building is more strongly associated with children's socio-emotional outcomes than physical outcomes. It is difficult to see that this could be a causal relationship, but rather the condition of the building is likely to be correlated with some other factor. Its inclusion has little effect on the indicators of socio-economic status or others included in the basic model. The number of persons per bedroom in the household is negatively correlated with the child's wellbeing ($\beta=-0.80$, $p=0.00$).

5.1.3 Housing affordability

Where the responding parent reported that the family had difficulties paying their rent or mortgage in the 12 months prior to the survey, there is a strong negative effect on socio-emotional wellbeing of the child ($\beta=-0.88$, $p=0.00$). This effect seems additional to that captured by self-rated prosperity, and similar in magnitude to that observed for physical health outcomes.

5.1.4 Neighbourhood environment

Each of the variables capturing elements of the neighbourhood proves significant when added to the base model. Of these, the neighbourhood livability scale appears to have the largest association ($\beta=1.04$, $p=0.00$), but the socio-economic index of advantage for the neighbourhood, which enters in deciles and hence ranges from 1 to 10, also returns a substantive relationship ($\beta=0.10$, $p=0.00$).

5.2 Mediating relationships and parenting styles

It seems clear that correlations between the socio-emotional outcomes index and the range of observable variables, including those relating to housing circumstances, are more robust than is the case with children's physical health. When all the housing variables are entered together, almost all remain significant but with little addition to the overall explanatory power of the model. The crowding measure is not significantly different from zero, and recall that this is measured only in the first wave. The estimated effect of living on a farm is small and not significantly different from the default category of a separate house. However the effect of living in a unit (town house or flat) is significant and hence 'farm' is retained along with the 'other' category to complete the set of mutually exclusive variables capturing dwelling type.

The model is presented as Model 6.2 in Table 6. The addition of this range of variables relating to housing circumstances has a surprisingly small effect on the estimated coefficient for socio-economic position or self-assessed prosperity. Reductions are more substantial for the coefficients for the child being of Aboriginal or Torres Strait Islander descent and living in a sole-parent family. Thus the inferior social and emotional outcomes for children from these families appear to arise, in large part, through the inferior housing faced by those families.

Adding the variables in their grouping of tenure, physical adequacy, affordability and neighbourhood environment reveals that it is tenure, in particular, that mediates the inferior outcomes for sole parents. Ownership status plays the largest role, but the higher frequency of moves since their child's birth and higher proportion in receipt of housing assistance also contribute. For the lower socio-emotional wellbeing of Aboriginal and Torres Strait Islander children, the set of variables capturing neighbourhood status plays the largest mediating role, though note the coefficient on Indigenous status remains substantive even after controlling for all aspects of housing.

Table 6: Social and emotional outcomes index, panel models, LSAC Waves 1–3

	Base model (Model 6.1)		With housing variables (Model 6.2)		Full model (Model 6.3)	
	β	p	β	p	β	p
Constant	98.79	0.000	94.27	0.000	75.21	0.000
Socio-demographics						
Male	-2.19	0.000	-2.06	0.000	-2.01	0.000
Aboriginal/TSI	-2.76	0.000	-1.81	0.000	-1.60	0.001
Intensive care at birth	-0.89	0.000	-0.81	0.001	-0.86	0.000
Sole parent	-0.99	0.000	-0.60	0.019	-0.49	0.049
English not first language and: Speaks English well/very well	-1.67	0.000	-1.43	0.000	-1.55	0.000
English poor/not at all.	-4.57	0.000	-4.35	0.000	-4.00	0.000
Socio-economic position	1.15	0.000	0.87	0.000	0.92	0.000
Self-assessed prosperity	0.87	0.000	0.74	0.000	0.64	0.000
Housing						
Has moved frequently			-0.80	0.000	-0.59	0.000
Ownership status						
Owner			—		—	
Renter			-0.47	0.025	-0.63	0.002
Other			-0.13	0.729	-0.30	0.406
Housing assistance			-0.55	0.046	-0.47	0.081
Dwelling type:						
Separate house			—		—	
Unit			-0.44	0.074	-0.60	0.014
Farm			0.18	0.842	0.49	0.570
Other			0.44	0.464	0.37	0.523
Dwelling condition			0.65	0.000	0.58	0.001
Housing stress			-0.53	0.043	-0.55	0.033
Neighbourhood environment:						
Condition of buildings			-0.34	0.068	-0.35	0.052
Livability scale			0.88	0.000	0.74	0.000
Facilities scale			0.32	0.003	0.20	0.052
SEIFA Index of advantage			0.07	0.018	0.09	0.002
Parenting styles						
Parental self-efficacy					1.34	0.000
Parental warmth scale					3.37	0.000
Observations	25609		22113		22007	
Individuals	9823		9436		9427	
Obs. per individual	2.6		2.3		2.3	
R-squared:						
within	0.001		0.002		0.018	
between	0.102		0.109		0.196	
overall	0.063		0.073		0.141	
Wald chi2	916.4	0.000	960.6	0.000	2116.9	0.000

5.2.1 Parenting styles

The variables capturing parenting style are included in Model 6.3. The interviewer rating of the house being 'cluttered' appears to be associated with children's physical health, but not social emotional outcomes. Hence only the parenting self-efficacy scale and the parenting warmth scale are retained to capture parenting styles. These are very strongly associated with the child's social and emotional outcomes index. Their inclusion results in a large increase in the proportion of variation in the index that can be explained by the models, from 7.3 per cent in Model 6.2 to 14.1 per cent in Model 6.3. Just these two indicators of parenting style therefore explain far more of the difference between the children's outcome index than do the battery of housing related variables. There may be some degree of reverse causation here, as parents may rate their own parenting efficacy lower if a child displays socio-emotional difficulties, or may be less inclined to display the feelings and behaviours that contribute to the parental warmth scale. However, the results do support what would seem an intuitively sensible finding, that parenting styles are of considerable more importance for socio-emotional wellbeing of children than is the case for children's physical health. Inclusion of the parenting style variables does not negate the independent influences already identified for the family's socio-economic position and prosperity or their housing circumstances.

As noted, estimation by fixed effects offers limited ability to identify significant effects, since for many variables the estimates will be dependent on only a small number of children for which changes are observed. However, the fixed effects specification does provide stronger evidence of 'casual' impacts by more rigorously controlling for unobserved, fixed individual effects. Estimation of Model 6.3 using the fixed effects specification confirms positive effects of housing stability, family prosperity, living in a separate standing house rather than a flat or town house, and the strong influence of parenting styles.

5.3 Time effects

Results for the full model estimated separately for the baby and kindergarten cohorts are presented as Models 7.1 and 7.2 of Table 7. There is evidence of some substantive changes in the way various factors impact upon children's social and emotional wellbeing by age. These developments as children grow up are also confirmed by comparison of results for the sample of children aged 0–1 year and 2–3 years with those for the children aged 6–7 years and 8–9 years. On average, boys have lower (worse) scores on the outcomes index than girls, and this gap widens with age. The inferior outcomes for children from non-English speaking backgrounds are most pronounced for young children, but persist to those aged between 6 and 9. As expected, a warm parenting style has the strongest associations for very young children.

In contrast, the benefits of parental socio-economic position on socio-emotional wellbeing materialise more strongly with age. This is also the case with the decile of socio-economic advantage of the neighbourhood in which the child lives. Of the other housing variables, the deleterious effects of the family experiencing housing affordability stress affects only older children, with no significant association identified for the baby cohort. Testing the two-year cumulative values of the variables suggests that there is potentially some influence of housing histories with respect to living in rental housing, having received housing assistance, having lived in a house in better external condition, having been in housing stress and the neighbourhood livability and facilities scales.

The inclusion of one-period lags of the housing variables supports these findings, suggesting a persistent effect of housing assistance and a more livable neighbourhood on children's socio-emotional wellbeing. As with physical health, adding information on housing histories does not improve the model's ability to account for differences in the social and emotional outcomes of the study children.

Table 7: Social and emotional outcomes index, models by cohort and with duration effects, LSAC

	Baby cohort (Model 7.1)		Kindergarten cohort (Model 7.2)		Waves 2 and 3			
					Current housing variables (Model 7.3)		2-period housing variables, (Model 7.4)	
	β	p	β	p	β	p	β	p
Constant	71.48	0.000	78.50	0.000	75.12	0.000	75.12	0.000
Socio-demographics								
Male	-1.50	0.000	-2.53	0.000	-2.56	0.000	-2.56	0.000
Aboriginal/TSI	-1.09	0.066	-2.45	0.001	0.75	0.191	-0.94	0.146
Intensive care at birth	-0.62	0.034	-1.12	0.001	0.94	0.001	-1.04	0.000
Sole parent	-0.43	0.265	-0.53	0.101	0.77	0.010	-0.53	0.116
English not first language and: Speaks English well/v. well	-2.19	0.000	-1.09	0.000	-1.46	0.000	-1.67	0.000
English poor/not at all	-7.66	0.000	-1.58	0.069	3.34	0.001	-3.04	0.003
Socio-economic position	0.52	0.000	1.30	0.000	1.10	0.000	0.95	0.000
Self-assessed prosperity	0.70	0.000	0.50	0.000	0.41	0.000	0.27	0.021
Housing								
Has moved frequently	-0.70	0.006	-0.53	0.011	-0.56	0.011	-0.48	0.056
Housing assistance	-0.95	0.001	-0.27	0.342	0.71	0.005	-0.87	0.011
Ownership status:								
Owner	—		—		—		—	
Renter	-0.07	0.875	-0.67	0.231	0.22	0.648	-0.74	0.282
Other	-0.19	0.620	-0.65	0.064	0.74	0.041	-1.26	0.016
Dwelling type:								
Separate house	—		—		—		—	
Unit	-0.27	0.409	-0.82	0.021	0.01	0.970	-0.28	0.514
Farm	-0.64	0.682	0.96	0.282	0.04	0.979	2.97	0.271
Other	0.13	0.880	0.58	0.436	0.56	0.388	0.32	0.802
Dwelling condition	0.51	0.049	0.57	0.007	0.94	0.000	1.08	0.001
Housing stress	-0.03	0.935	-0.93	0.007	-0.66	0.050	-1.02	0.051
Neighbourhood environment:								
Condition of Buildings	-0.41	0.140	-0.17	0.451	-0.40	0.099	-0.55	0.114
Livability scale	0.68	0.000	0.71	0.000	0.80	0.000	1.12	0.000
Facilities scale	0.21	0.161	0.22	0.122	0.40	0.002	0.44	0.015
SEIFA Index of advantage	0.04	0.349	0.10	0.011	0.10	0.003	0.12	0.005
Parenting styles								
Parental self-efficacy	1.36	0.000	1.25	0.000	1.35	0.000	1.37	0.000
Parental warmth scale	4.22	0.000	2.80	0.000	3.21	0.000	3.10	0.000
Observations	10790		11217		13260		11558	
Individuals	4598		4829		7915		6336	
Observations per individual	2.3		2.3		1.7		1.8	
R-sq: within	0.023		0.013		0.020		0.021	
between	0.185		0.228		0.187		0.187	
overall	0.122		0.176		0.158		0.154	
Wald chi2	1097	0.000	1143	0.000	1649	0.000	1381	0.000

6 COGNITIVE OUTCOMES

The ability of the survey measures to accurately differentiate between the cognitive and learning outcomes of children is likely to be quite limited for young children. The basic model for the learning outcomes index (Model 8.1) displays the same general pattern of advantage and disadvantage by socio-demographic background. That is, children of parents of higher socio-economic position and prosperity display more positive outcomes, while male children and those from Indigenous and non-English speaking backgrounds experience lower scores. Compared to the results for physical health and social and emotion outcomes, a notable difference in the results for learning outcomes is the absence of any significant negative effect for children living in sole-parent families. All other variables included are highly significant. The gradient between the outcomes index and parental socio-economic position is steepest for learning outcomes, most likely reflecting the influence of parents' education, which is a major component of the socio-economic position variable. As with the models for physical and socio-emotional outcomes, the overall model explains less than 10 per cent of the overall variation in the index, at 7.7 per cent.

6.1 Housing variables

6.1.1 *Housing tenure*

Of the housing tenure variables, having moved frequently did not appear to have any additional effect on learning outcomes over those factors already included in the base model. However, when the dummies capturing ownership status are added to the base model, there is significant difference in outcomes between home owners and renters ($\beta=-0.52$, $p=0.00$). A large gap is also identified for the children of families in public housing ($\beta=-3.84$; $p=0.00$) and a smaller, weakly significant gap for those whose parents receive Commonwealth Rent Assistance ($\beta=-0.42$; $p=0.08$). The strong socio-economic gradient observed in the base model is robust to the addition of each of these variables.

6.1.2 *Physical conditions and adequacy of housing*

The variables capturing the type of dwelling the family lives in are found to be completely insignificant in the case of learning outcomes. However, there is a significant and positive association between learning outcomes and the external condition of the dwelling ($\beta=0.47$; $p=0.00$). As with social and emotional outcomes, it seems most likely that this variable is capturing some other unobserved factor which correlates with both home maintenance and learning outcomes. Learning and cognitive development stands out as the domain being the most sensitive to crowding. Even though we can only generate a value for this in Wave 1, and it is held constant for Waves 2 and 3, the coefficient signifies a very large effect for each additional person per bedroom ($\beta=-2.24$; $p=0.00$). Crowding does seem to partly proxy or mediate lower socio-economic position and lower prosperity, with minor reductions in the magnitude of the coefficients for those variables when the measure of crowding enters the model.

6.1.3 *Housing affordability*

The parent reporting difficulties in paying the rent or mortgage in the past 12 months has a negligible impact on the learning outcomes index. Hence, in the case of learning, housing affordability stress seems to have no additional effect over that already captured in the existing self-rated prosperity and socio-economic position variables.

6.1.4 Neighbourhood environment

There seems to be a broad relationship in which a better neighbourhood environment is associated with better child learning outcomes. When added separately to the basic model, each of the four variables capturing elements of the neighbourhood are found to be significant: the condition of surrounding buildings ($\beta=+0.36$; $p=0.00$), the neighbourhood livability scale ($\beta=+0.56$; $p=0.00$), neighbourhood facilities ($\beta=0.18$; $p=0.05$), and the decile of the neighbourhood's SEIFA index of advantage ($\beta=0.16$; $p=0.00$). These are each highly correlated, but even when included jointly it again seems that these neighbourhood effects operate separately to any effects of the family's own socio-economic position and prosperity, rather than as mediating relationships.

6.2 Mediating relationships and parenting styles

When all the housing variables are entered into the model, progressive elimination of the small and insignificant variables leads to the Model 8.2 in Table 8. Although being a renter as opposed to a home owner is insignificant, the 'other' variable capturing ownership status does attain significance and is of some magnitude ($\beta=+0.78$; $p=0.02$). Only 4 per cent of the observations are of children whose families are neither renters nor home-owners, and the 'other' category includes 'occupied under a life tenure scheme' and 'none of these'. Exactly what might lead to the children in this 'other' category displaying superior learning outcomes is difficult to fathom. Housing factors do seem to play a substantive role in the inferior outcomes for children of Indigenous and non-English speaking backgrounds. Overall, however, the inclusion of housing variables again contributes little to the capacity of the model to account for variation in the learning outcomes index between children and over time.

6.2.1 Socio-economic status and housing

Housing factors also mediate the relationship between socio-economic status and learning outcomes to a modest degree. The addition of the housing variables reduces the estimated magnitude of both the socio-economic position variable and the self-rated prosperity scale by around one-fifth, with the physical conditions/adequacy playing the strongest mediating role with prosperity, and neighbourhood environment most interrelated with socioeconomic position.

Table 8: Learning outcomes index, panel models, LSAC Waves 1–3

	Base model (Model 8.1)		With housing variables (Model 8.2)		Full model (Model 8.3)	
	β	p	β	p	β	p
Constant	100.90	0.000	100.22	0.000	95.26	0.000
Socio-demographics						
Male	-2.44	0.000	-2.48	0.000	-2.41	0.000
Aboriginal/TSI	-2.72	0.000	-1.76	0.000	-1.59	0.001
Intensive care at birth	-1.63	0.000	-1.64	0.000	-1.64	0.000
Sole parent	-0.11	0.620	0.23	0.334	0.31	0.198
English not first language and: Speaks English well/very well	-0.64	0.006	-0.35	0.136	-0.41	0.091
English poor/not at all	-2.02	0.000	-1.30	0.031	-1.13	0.078
Socio-economic position	1.81	0.000	1.46	0.000	1.45	0.000
Self-assessed prosperity	0.34	0.000	0.29	0.000	0.27	0.001
Housing						
Ownership status						
Owner			—		—	
Renter			0.03	0.872	-0.07	0.744
Other			0.78	0.015	0.54	0.104
Housing assistance			-0.87	0.001	-0.78	0.005
Dwelling condition			0.21	0.087	0.06	0.637
Crowding (persons/bedroom)			-1.96	0.000	-1.81	0.000
Neighbourhood environment: Livability scale			0.44	0.000	0.43	0.000
SEIFA Index of advantage			0.13	0.000	0.12	0.000
Parenting styles						
Parental self-efficacy					0.16	0.037
Parental warmth scale					1.12	0.000
Home cluttered					-0.67	0.008
Observations	25866		24493		23032	
Individuals	9943		9911		9777	
Obs. per individual	2.6		2.5		2.4	
R-squared:						
within	0.000		0.000		0.001	
between	0.113		0.121		0.113	
overall	0.077		0.081		0.080	
Wald chi2	1136	0.000	1303	0.000	1236	0.000

6.2.2 Parenting styles

Each of the three variables included to capture parenting styles are significant. Unlike the case with social and emotional outcomes, however, they do not improve the explanatory power of the model. The largest estimated association with children's learning outcomes is with the parental warmth scale ($\beta=+1.12$; $p=0.00$), while the parental self-efficacy rating and presence of clutter in the home have the expected signs. The inclusion of these variables has little effect on the estimates for socio-economic status or the housing variables with the exception of the interviewer rating of the external condition of the dwelling. This variable now becomes trivial in magnitude and insignificant. Separate inclusion of the parenting style variables shows that each contributes roughly equally to the mediation of the dwelling condition estimate, suggesting that the interviewer rating of the dwelling condition may in fact be capturing parenting styles or parental attributes rather than housing circumstances.

Estimation of Model 8.3 using fixed effects shows little evidence of an effect of changes in housing circumstances for individuals' learning outcomes, with changes in the parent's English ability, the parental warmth scale and self-assessed prosperity having the strongest associations with improved learning outcomes.

6.3 Time effects

The same modelling procedure as that used to investigate the evolution of the various associations with physical health and socio-emotional wellbeing is followed for the learning outcomes index. Models for separate estimation by cohort are reported as Model 9.1 (baby cohort) and 9.2 (kindergarten cohort) of Table 9, and validation of any differences by age are further tested through separate estimates (not reported) of models for the baby cohort up to age 3 (Waves 1 and 2) and the kindergarten cohort from age 6 and over (Waves 2 and 3). Following the results after inclusion of the parenting style variables discussed above, the interviewer rating of the dwelling condition is dropped from these models.

The first thing to note is that the model for the kindergarten cohort is able to explain around twice as much of the variation in the learning outcomes index than is the case for the younger, baby cohort. It is the superior ability to explain more variation between the older children, rather than variation over time for each individual, that leads to this improvement. The results for the more restrictive models confirm this, and a likely explanation is that the outcome measures that make up the index are more reliable for older children. Focusing on the differences confirmed in both sets of models, the key differences by age in the factors influencing learning outcomes are that inferior scores for children of Indigenous background materialise later in childhood, as do the benefits of being born into a family of higher socio-economic position. A warmer parenting style has a large positive association for the learning outcomes of babies, but not for older children.

For housing variables, the key finding is that the lower learning outcomes observed for children in families receiving housing assistance applies only in early childhood. There is also evidence that the positive association with being a home-owner for child learning outcomes dissipates beyond the age of around 4 or 5 years. The inclusion of one-period lags of the housing finds evidence of a significant lagged effect only for the neighbourhood's SEIFA index of advantage, and this comes at the expense of a considerable reduction in the estimated coefficient for the current period.

Table 9: Learning outcomes index, models by cohort and with duration effects, LSAC

	Baby cohort (Model 9.1)		Kindergarten cohort (Model 9.2)		Waves 2 and 3			
					Current housing variables (Model 9.3)		2-period housing variables (Model 9.4 ^a)	
	β	p	β	p	β	p	β	p
Constant	86.43	0.000	102.83	0.000	98.57	0.000	97.62	0.000
Socio-demographics								
Male	-2.61	0.000	-2.36	0.000	-2.24	0.000	-2.19	0.000
Aboriginal/TSI	-0.36	0.570	-3.72	0.000	3.03	0.000	-3.35	0.000
Intensive care at birth	-1.62	0.000	-1.70	0.000	1.62	0.000	-1.80	0.000
Sole parent	0.64	0.092	0.06	0.842	0.44	0.140	0.30	0.366
English not first language and: Speaks English well/very well	-0.14	0.675	-0.84	0.013	0.65	0.024	-0.69	0.023
English poor/not at all	-1.19	0.150	-1.11	0.225	0.77	0.304	-1.24	0.123
Socio-economic position	0.66	0.000	2.27	0.000	2.20	0.000	2.04	0.000
Self-assessed prosperity	0.33	0.008	0.06	0.573	0.19	0.073	0.25	0.029
Housing								
Ownership status								
Owner	—		—		—		—	
Renter	0.35	0.205	-0.56	0.041	-0.21	0.416	-0.25	0.455
Other	0.66	0.129	0.17	0.726	0.19	0.669	-0.55	0.359
Housing assistance	-1.19	0.004	-0.08	0.818	0.37	0.297	-0.31	0.552
Crowding (persons/bedroom)	-1.85	0.000	-2.34	0.000	-1.72	0.000	-1.43	0.000
Neighbourhood environment: Livability scale	0.37	0.032	0.36	0.014	0.74	0.000	0.89	0.000
SEIFA Index of advantage	0.11	0.005	0.10	0.006	0.14	0.000	0.18	0.000
Parenting styles								
Parental self-efficacy	0.25	0.031	0.12	0.236	0.08	0.399	0.10	0.340
Parental warmth scale	2.94	0.000	-0.03	0.871	0.33	0.057	0.32	0.086
Home cluttered	-0.85	0.021	-0.46	0.136	0.77	0.020	-0.58	0.103
Observations	11420		11711		14021		12663	
Individuals	4917		4878		8206		6848	
Observations per individual	2.3		2.4		1.7		1.8	
R-squared:								
within	0.006		0.000		0.001		0.001	
between	0.098		0.186		0.136		0.131	
overall	0.069		0.129		0.111		0.105	
Wald chi2	619	0.000	985	0.000	1300	0.000	1052	0.000

Notes: a. All housing variables in Model 9.4 are two-period average, except 'crowding'.

7 HOUSING ASSISTANCE AND CHILDREN'S OUTCOMES

The previous chapters point to children of families in receipt of housing assistance displaying marginally inferior outcomes after controlling for a range of demographic, housing and parenting style factors. In terms of physical health and socio-emotional outcomes, negative associations with housing assistance were most apparent for older children; while for learning outcomes, the associations were concentrated among the baby cohort. There is weak evidence that a family's time in housing assistance has cumulative or persistent effects on children's outcomes.

To date, the analysis has grouped children of families in public housing and in receipt of CRA together. Table 10 shows the means for the range of variables used in the preceding analysis for children from families of each type, along with the means for children of families not in receipt of any housing assistance. These are calculated for the data pooled over all three waves, so individuals may contribute up to three observations. Of the 27 799 observations on study children for whom housing assistance status can be observed, just under 3 per cent of the families were in public housing (748 observations) and around 9 per cent (2461 observations) in receipt of CRA. There were 60 families that reported both living in public rental accommodation and receiving some Commonwealth Rent Assistance. For the calculation of the means and t-tests, persons receiving both forms of assistance are included in each category. The t-test calculates the likelihood that the mean for those receiving assistance is the same as that for those receiving no assistance. For example, the three asterisks against the physical outcomes index mean for children in public housing indicates that, on the basis of the null hypothesis of no difference in the means, the probability of observing such a large difference for the two groups (98.16 versus 100.47) by pure chance is less than 1 in 100. We therefore reject the null hypothesis.

Looking firstly at the three outcomes indices, lower scores in each domain are observed for children living in families receiving rent assistance, and the scores are lower still for children living in public housing. For the demographic and socio-economic background variables, it is clear that families in both of the housing assistance categories have less advantaged backgrounds, with highly significant differences observed for almost all variables. Around one-fifth of the children living in public housing are of Indigenous descent.² Roughly half of public housing tenants and CRA recipient families are sole-parent families, compared to just 8 per cent for those not in receipt of housing assistance. The socio-economic position variable provides a stark contrast. Since the variable is in the form of the z-score of the distribution, the average position for public housing tenants equates to a point at about the 10th percentile (from the bottom), and for CRA recipients at the 25th percentile of the distribution. There are also differences in the measures of parenting style, notably with regard to the interviewer's assessment of whether or not the home was cluttered.

² This is in no way intended to imply being Indigenous of itself is an indicator of disadvantage, and refers simply to the well-established statistical gap in outcomes for Indigenous and non-Indigenous Australians.

Table 10: Variable means by housing assistance status

	Public housing	Commonwealth Rent Assistance	No housing assistance
Outcomes indices			
Physical	98.16 ***	98.83 ***	100.47
Social and emotional	94.19 ***	97.74 ***	100.95
Learning	93.91 ***	98.32 ***	100.97
Socio-demographics			
Male	0.49	0.50	0.51
Aboriginal/TSI	0.22 ***	0.08 ***	0.03
Intensive care at birth	0.15	0.17 **	0.16
Sole parent	0.50 ***	0.45 ***	0.08
English not first language:			
Speaks English well/very well	0.16 **	0.10 ***	0.14
English poor/not at all	0.05 ***	0.03 ***	0.02
Socio-economic position	-1.24 ***	-0.76 ***	0.11
Self-assessed prosperity	3.45 ***	3.46 ***	3.99
Housing			
Has moved frequently	0.22 *	0.46 ***	0.19
Home ownership status			
Owner	0.00 ***	0.00 ***	0.79
Renter	0.99 ***	0.95 ***	0.16
Other	0.01 ***	0.03 ***	0.04
Dwelling type:			
Separate house	0.46 ***	0.42 ***	0.31
Unit (flat or townhouse)	0.29 ***	0.20 ***	0.07
Farm	0.00 ***	0.00 ***	0.02
Other	0.00 ***	0.01	0.01
External condition	3.05 ***	3.43 ***	3.74
Crowding (persons/bedroom)	1.39 ***	1.19 ***	0.99
Housing stress	0.09 ***	0.20 ***	0.06
Neighbourhood environment:			
Condition of buildings	3.16 ***	3.56 ***	3.78
Livability scale	2.72 ***	3.03 ***	3.18
Facilities scale	3.00	3.04 **	3.00
SEIFA Index of advantage	3.94 ***	4.78 ***	5.81
Parenting styles			
Parental self-efficacy	3.93 *	3.89 ***	4.00
Parental warmth scale	4.43 **	4.50	4.48
Home cluttered	0.21 ***	0.12 ***	0.06
Minimum observations	570	2218	24650
Maximum observations	748	2461	22874

Notes: ***, ** and * indicate the mean is statistically different from that for families receiving no housing assistance at the 1, 5 and 10 per cent levels, respectively, based on t-test.

In terms of housing variables, the inferior circumstances for those in housing assistance can also be seen. This includes more crowded housing, less livable neighbourhoods, less stable housing and a higher incidence of housing affordability stress. With regard to these latter two measures, those in receipt of CRA fare worse than public tenants, suggesting that public housing provides both added housing stability and relief from housing affordability stress among those in need. There seems little difference in individuals' ratings of the quality of neighbourhood facilities by housing assistance status.

The raw differences in the means for the outcomes indices provide a measure of the disadvantage faced by children living in families in receipt of housing assistance, recalling that each of these variables are standardised to have a mean of 100 and a standard deviation of 10. The socio-economic and demographic background variables indicate that much of this disadvantage is likely to arise from pre-existing attributes of the families who access housing assistance. A test of this is to add the housing assistance variables only to the base models used in the preceding chapters.

For brevity, Table 11 reports only the coefficients and significance levels for these two variables. Clearly much of the gap in outcomes observed for those in housing assistance across the three domains is accounted for by these background socio-demographic factors, but even after allowing for these characteristics, children in public housing fare worse than those whose families receive rent assistance. The largest gap is for the learning outcomes index, with the coefficient suggesting that, on average, the effect of being in public housing is for the child to score lower on the index by 3.85 than a 'like' child whose family receives no housing assistance. The raw difference in the means is much larger, at 7.06. For both the learning and socio-emotional outcomes index, the basic socio-demographic controls account for around half the difference observed in the raw means for public housing tenants, and about one-third of the gap in the case of the physical outcomes index. For families in receipt of CRA, the socio-demographic controls account for around 15–20 per cent of the gap in child outcomes, but note the statistical precision of these estimates is weaker. Further controlling for the three variables capturing parenting styles largely accounts for the lower physical health scores of children in public housing, but only marginally affects the estimates for the socio-emotional and learning outcomes indices.

A key question is whether the less favourable housing circumstances of families in receipt of housing assistance, as highlighted in Table 10, impacts upon children's development and wellbeing. This is addressed in two ways. First, the housing variables previously identified as significant in the full regression models in Chapters 4–6 are added to the models containing the public housing and CRA variables. As the bottom panel of Table 11 demonstrates, these estimates continue to indicate lower socio-emotional and learning outcomes for children in public housing. Only the estimate for the effect of public housing on learning outcomes is robust to estimation using the fixed effects specification ($\beta=-2.87$; $p=0.00$).

Table 11: Regression coefficients for housing assistance variables

	Physical outcomes index		Social and emotional outcomes index		Learning outcomes index	
	β	p	β	p	β	p
Base model only						
Public Housing	-0.82	0.083	-3.14	0.000	-3.85	0.000
CRA	-0.30	0.207	-0.60	0.014	-0.42	0.081
+ parenting style variables						
Public Housing	-0.30	0.562	-2.78	0.000	-3.44	0.000
CRA	-0.28	0.241	-0.64	0.000	-0.55	0.030
+ housing variables						
Public Housing	-0.32	0.591	-2.01	0.001	-2.78	0.000
CRA	-0.19	0.465	-0.10	0.709	-0.33	0.255

Second, it is possible to use the regression estimates to predict the scores of the children conditional upon different values for the housing variables. A reduced form of (1) is estimated as follows:

$$(3) \quad Y_{it} = \alpha X_{it} + \beta H_{it} + \mu_i + \epsilon_{it}$$

This model omits the parenting style variables and also the variable capturing housing assistance. The estimated vector of coefficients, β , for the housing variables therefore represents the average estimated effect of each housing variable across the full sample, irrespective of whether or not the family receives housing assistance or the type of assistance. Using the estimated coefficients, we can then calculate the predicted value of the outcome variables using the means of the housing variables for those in public housing ($\beta \bar{H}^{PH}$), those in receipt of CRA ($\beta \bar{H}^{CRA}$) and those receiving no housing assistance ($\beta \bar{H}^{HA=0}$). This provides three predicted outcomes under those respective housing scenarios:

$$(4.1) \quad Y = \hat{\alpha} X_{it} + \hat{\beta} \bar{H}^{PH}$$

$$(4.2) \quad Y = \hat{\alpha} X_{it} + \hat{\beta} \bar{H}^{CRA}$$

$$(4.3) \quad Y = \hat{\alpha} X_{it} + \hat{\beta} \bar{H}^{HA=0}$$

where the 'hats' on α and β denote the estimated values of the variables in those vectors.

Note that since the parenting style variables are not included in the estimation of (3), any potential mediating effects between housing variables are captured in the estimates of β , as a more encompassing test of the effect of housing circumstances. These differences in the predicted outcomes for children are presented in Table 12, as the 'housing effect'. By a similar decomposition, the predicted effect of the 'exogenous' differences in socio-demographic profiles of those in public housing, in receipt of CRA and who do not receive any housing assistance, can be calculated, holding housing variables at their means for the full sample.

Table 12: Decomposition of the effects of housing circumstances and socio-demographics on children’s outcomes, by housing assistance status

	Physical outcomes index	Social and emotional outcomes index	Learning outcomes index
<i>Public housing tenants</i>			
Housing effect	-0.65	-1.53	-1.60
Socio-demographic effect (Diff. in raw means)	-1.11 (-2.31)	-2.37 (-6.76)	-2.48 (-7.06)
<i>CRA recipients</i>			
Housing effect	-0.47	-1.21	-0.85
Socio-demographic effect (Diff. in raw means)	-0.83 (-1.64)	-1.50 (-3.21)	-1.54 (-2.65)

The results indicate that the quality of housing available to people who rent from state housing authorities in Australia can be predicted to have a small effect on their children’s outcomes. If families in public housing were instead to live in the same quality houses and neighbourhoods as those who do not receive housing assistance, their children can be predicted to score 0.65 of a point higher on the physical outcomes scale—or the equivalent of moving up the distribution of children’s physical health by about 2 percentiles from the mean.

The estimated housing effect is larger for the socio-emotional and learning outcomes indices, with the housing effect translating roughly to a 5 percentile move along the distribution of child outcomes. It can be seen that the effects are smaller for CRA recipients, as follows intuitively given their better mean housing circumstances. In all cases the differences in socio-demographic background, holding housing circumstances constant, has a much larger predicted impact. The estimated effect of socio-demographic characteristics of public housing tenants, relative to those not in housing assistance, on their children’s learning outcomes, for example, equates to a move of around one decile (or 10 percentile points) down from the distribution from the mean.

8 HOUSING AND INDIGENOUS CHILDREN'S OUTCOMES

8.1 Indigenous children in the LSAC

The results of the panel models estimated in Chapters 4 to 6 using data from the LSAC highlight how the barriers faced by Indigenous children over their life course commence right from early childhood. Children of Aboriginal and Torres Strait Islander descent score lower on the outcomes indices for the physical, socio-emotional and learning domains, and in the case of learning outcomes the gap between Indigenous and non-Indigenous children seems to widen with age. Controls for socio-demographic background, housing circumstances and parenting styles, account for only a portion of this disadvantage.

For the purposes of multivariate regression analysis, these findings are based on a modest sample of children of Aboriginal or Torres Strait Islander descent, declining from 4.1 per cent (or 417 children) of the sample in Wave 1, to 3.1 per cent in Wave 3 (273 children). The analysis in this chapter, firstly, further interrogates the LSAC data to analyse outcomes for Indigenous children and to make comparisons between Indigenous and non-Indigenous children and, secondly, draws upon the larger sample available through the LSIC to assess the importance of housing factors in shaping the wellbeing of Aboriginal and Torres Strait Islander children.

The means for the variables used in the preceding modelling are presented separately for Aboriginal and non-Aboriginal children in the LSAC in Table 13. Again, these are calculated simply on the samples pooled across the three waves. The broad nature of Indigenous disadvantage is apparent across these measures, and are particularly stark with respect to the proportion of children living in sole-parent families, the socio-economic position of their family, the degree of home ownership and receipt of housing assistance (particularly public housing). Most pertinently, Indigenous children score far lower on the outcomes indices, with the gap particularly pronounced for social and emotional wellbeing and the learning outcomes index.

There are only a handful of indicators on which the Indigenous families in the study are not significantly worse off. They are less likely to speak a language other than English at home, and the parents of Indigenous and non-Indigenous children rank similarly on the parental warmth scale.

An analogous decomposition analysis to that performed for children living in families receiving housing assistance can be conducted to isolate the predicted contribution of housing variables to the gap in outcomes observed for Indigenous and non-Indigenous children. These results are presented in Table 14. The estimates suggest that if a child from a family with otherwise mean characteristics lived in the same housing conditions as the average Indigenous child, the predicted effect would be to reduce the indices for their physical, socio-emotional and learning outcomes indices by 0.55, 1.32 and 1.42 respectively. These correspond to movements along the distribution from the means by around 2 percentile places for physical outcomes and 6 percentile places for socio-emotional and learning outcomes. The predicted impact of the inferior housing in which Indigenous families live is larger than the predicted difference due to socio-demographic factors.

Table 13: Selected LSAC variable means by Indigenous status

	Indigenous	Non-Indigenous	t-test
Outcomes indices			
Physical	98.69	100.33	***
Social and emotional	96.83	100.64	***
Learning	95.94	100.74	***
Socio-demographics			
Male	0.51	0.51	
Intensive care at birth	0.19	0.16	***
Sole parent	0.34	0.12	***
English not first language:			
Speaks English well/very well	0.05	0.14	***
English poor/not at all	0.00	0.02	***
Socio-economic position	-0.87	0.03	***
Self-assessed prosperity	3.72	3.94	***
Housing			
Has moved frequently	0.34	0.21	***
Home ownership status			
Owner	0.32	0.72	***
Renter	0.60	0.24	***
Other	0.08	0.04	***
Public housing	0.16	0.02	***
CRA	0.19	0.08	***
Dwelling type:			
Separate house	0.84	0.87	***
Unit (flat or townhouse)	0.10	0.09	*
Farm	0.01	0.02	
Other	0.01	0.01	
External condition rating	3.28	3.71	***
Crowding (persons/bedroom)	1.26	1.00	***
Housing stress	0.13	0.07	***
Neighbourhood environment:			
Condition of buildings	3.38	3.75	***
Livability scale	2.92	3.17	***
Facilities scale	2.84	3.01	***
SEIFA Index of advantage	4.01	5.74	***
Parenting styles			
Parental self-efficacy	3.84	4.00	***
Parental warmth scale	4.50	4.48	
Home cluttered	0.14	0.07	***
Minimum observations	856	24873	
Maximum observations	1023	26854	

Notes: ***, ** and * indicate the Indigenous and non-Indigenous means are statistically different at the 1, 5 and 10 per cent levels, respectively, based on t-test.

The main contributors to the lower physical outcomes for Indigenous children are the lower livability of their neighbourhoods and the poorer condition of the dwellings in which they live. For the social and emotional outcomes index, the reduction is driven primarily by the higher incidence of Indigenous families living in public housing and the inferior condition of their dwellings; and for the learning outcomes index the degree of crowding and the proportion in public housing are the main contributors to the lower predicted outcome for Indigenous children. Caution should be taken in the interpretation of these results as they are based on the assumption of common regression coefficient (β 's) for Indigenous and non-Indigenous children. In reality, this may not be the case. For cultural reasons, for example, crowding may not have the same impact on outcomes for Indigenous children as it does for non-Indigenous children. Indeed this may be true for other cultural groups within the sample.

Table 14: Decomposition of the effects of housing circumstances and socio-demographics on children's outcomes, by Indigenous status

	Physical outcomes index	Social and emotional outcomes index	Learning outcomes index
Housing effect	-0.55	-1.32	-1.42
Socio-demographic effect	-0.46	-0.89	-1.36
(diff. in raw means)	(-1.64)	(-3.81)	(-4.80)

8.2 Housing, children's outcomes and the LSIC

To the extent possible, an analysis comparable to that undertaken with the LSAC was undertaken of the links between housing circumstances and Indigenous children's development and wellbeing using the expanded Indigenous sample available through the LSIC. Initially we attempted to derive comparable datasets from the LSAC and LSIC which could be merged, thus enabling analysis of the pooled data, and direct statistical tests of differences in the associations for Indigenous and non-Indigenous children. However, given differences in the data collected, the wording of questions and the response options, it was decided that the risk of spurious conclusions arising from this approach was too great. Instead, a parallel analysis is based on the LSIC data only, and a more general comparison of the findings noted.

8.2.1 The survey and data

The LSIC, also known as 'Footprints in Time', is an initiative of the Commonwealth Government of Australia, with the aim of providing high quality quantitative and qualitative data that can:

- Be used to provide a better insight into how a child's early years affect their development.
- Be drawn upon to help close the gap in life circumstances between Indigenous and non-Indigenous Australians (FaHCSIA, 2009, p.6).

The sample was drawn from 11 different sites around Australia, designed to '... cover the range of socio-economic and community environments where Aboriginal and Torres Strait Islander children live' and provide roughly equal representation of urban, regional and remote areas, among other criteria. The first wave interviews were conducted from April 2008 to February 2009 for around 150 children from each site, or 1650 in total (see Table 1)—FaHCSIA estimate that this represents around 6 per cent of the total Indigenous population in each cohort (2009, p.12). Note that with the

sample drawn from 11 sites, it cannot be taken as representative of the wider Aboriginal and Torres Strait Islander population.

Child outcome variables

The LSIC does not contain summary outcomes indices like those available as derived variables in the LSAC. As indicators of children's outcomes we draw upon responses to a standardised questionnaire, the Parents' Evaluation of Development Status, which was adopted and incorporated into the 'Parental concerns about language and development' section of the LSIC questionnaire. While these are based on simple questions put to parents, the instrument has been shown to have strong diagnostic power as a screening device for problems in a number of different domains (Glascoe 2000). For the purposes here, the PEDS has a number of important advantages. First, it contains measures relating to the physical, socio-emotional and learning domains. Second, measures are available for children of all ages in the survey, enabling the panel nature to be exploited, although with only two waves the full value of this cannot yet be realised. On the downside, the measures do concentrate on ill-being or 'pathologies' to the neglect of positive outcomes over and above the norm. The measures are also in the form of binary indicators of whether or not the parent has concerns, which does not offer the same degree of discriminability in the modelling as that provided by Sanson et al.'s (2005) continuous outcomes indices. The PEDS identifies concerns in the areas of motor skills, language, learning and emotions and behaviour. The constructs used for the analysis are shown in Table 15.

Table 15: PEDS parental concerns about language and development indicators

Domain	Do you have any concerns about how (study child) ...? (Yes/a little/no)
Physical (motor skills)	... uses her hands and fingers to do things such as (B) feeding herself/(K) holding a pencil? ... uses her arms or legs, such as (B) crawling, starting to walk or reaching for things/(K) such as running, hopping throwing or catching?
Social emotional	... behaves? ... gets along with others?
Learning and development	... understands what you say to her? ... is learning to do things for herself? ... about study child's learning or development

Notes: B—prompt if child is baby, K—prompt if child is older.

In addition to the PEDS indicators, the parent's rating of the child's general health is also investigated. This is recorded on a five-point scale with possible responses of 'excellent', 'very good', 'good', 'fair' or 'poor'.

Housing variables

The information on housing circumstances is considerably more limited in the LSIC than is the case with the LSAC. The variables constructed are set out in Table 16. Some important differences to note are that there is no direct measure of housing affordability; and the indicators of housing assistance now include only being in public housing (renting from a state or territory housing authority), as receipt of CRA is not documented. There are more limited measures of the neighbourhood environment,

though for the Indigenous sample we also include two dummy variables capturing remoteness, which is likely to correlate negatively with the availability of facilities and services. The SEIFA indices are included in the LSIC data but only in Wave 2.

Table 16: LSIC housing constructs and variables

Category	Construct	Variables [range]
Housing tenure	Unstable housing	Frequent moves [0/1]
	Ownership status	Outright owner [#] ; renter, other [0/1]
	Public housing	Rents from a state housing authority.
Physical conditions/ adequacy of dwelling	Dwelling type	Separate house [#] , townhouse or flat, other [0/1]
	Dwelling condition	Home needs major repairs [1–4]
	Crowding	Ratio of persons living in the home to bedrooms [continuous]
Neighbourhood environment	Remoteness (level of relative isolation)	None/Low [#] Remote (moderate) [0/1] Very remote (high) [0/1]
	Neighbourhood livability	Livability scale [1–4]

Notes: # denotes the category used as the omitted or comparison category in the models.

To derive the dummy variable for frequency of moves, the number of homes the child has lived in since birth, divided by the child's age in months, is first calculated. The dummy variable then takes on a value of 1 for children in the top 20 per cent of that figure, and the cut-off point equates to just over one move per year. Hence the variable is age specific. As before, the crowding variable takes account of couple families by assuming one shared bedroom in those cases (reducing the numerator by 1).

Table 17 presents the means for these housing variables derived from the LSIC sample pooled across both waves. Where there is a reasonably similar construct available from both surveys, the mean for the non-Indigenous sample from the LSAC has also been included. The discrepancy in the proportion of families renting rather than owning their own home and the extent of crowding are confirmed and seem more pronounced than for the Indigenous sample from the LSAC.

Table 17: Means of housing variables, LSIC

	LSIC	Non-Indigenous LSAC
Home ownership status		
Owner	0.16	0.72
Renter	0.74	0.24
Other	0.02	0.04
Public housing	0.37	0.02
Dwelling type:		
Separate house	0.90	0.87
Town house	0.05	
Flat	0.04	
Unit (flat or townhouse)	(0.09)	(0.09)
Other	0.00	0.03
Repairs needed	0.38	
Crowding (persons/bedroom)	1.42	1.00
Neighbourhood environment:		
Livability scale	3.64	3.17
Remote	0.11	
Very remote	0.11	
Minimum observations	3058	24,873
Maximum observations	3428	26,854

Socio-demographic controls

As an instrument for socio-economic status a 'prosperity' variable can again be included. This ranges from 1 to 6 and is based on a question on the family's 'money situation' with responses ranging from 'we run out of money before payday' at the lower end to 'we can save a lot' at the upper end. Unfortunately, information on the responding parent's highest level of education was not collected, only information on any current enrolments. It is also difficult to derive a marital status variable from the LSIC. Here a 'two-parent' dummy variable has been derived based on whether both the mother and the father were living in the home. This is imperfect as it does not necessarily require that the parents are married or in a relationship, and does not indicate clearly how a parent's partner is considered if they are not the natural father or mother of the child. Hence, the 'two-parent' variable is not the precise inverse of the 'sole-parent' variable used from the LSAC.

Finally, measures of parenting style have not been included in the models based on the LSIC data. While the parental warmth scale was included, it is available only for the kindergarten cohort in Wave 1 and the baby cohort in Wave 2, meaning the scale cannot be derived for all children on a common basis by age.

8.2.2 Modelling and results

The outcome indicators from PEDS are dummy variables indicating the presence of a concern, and therefore these are estimated using a panel logit model of the probability of the parenting expressing concerns. For consistency in interpreting the sign of the

coefficients across the models, the general health variable has also been coded as a dummy variable indicating a poor health rating ('good', 'fair' or 'poor' as opposed to 'very good' or 'excellent'). By this measure around 25 per cent of the pooled sample is rated as having poor health.

As the questions asked differ by cohort and are not age standardised (see Table 15) we add controls for the age of the study child and cohort in the model. The random effects logit models are found to have very limited explanatory ability and the testing of these, along with various other specifications, frequently generated unrealistic estimates, both in terms of their magnitude and unexpected signs of the coefficients. In the model for the parental concerns of motor skills the variables were jointly insignificant and results for this indicator of physical health have not been reported.

The 'other' variable for housing ownership status and dwelling had to be dropped due to the small number of observations and the effect this had on the model fit. Hence this is now combined with their respective default categories, but the small number of observations will mean that this will be inconsequential for the estimates. The preferred results for the remaining three models are reported in Table 18, and have been arrived at after elimination of variables that were small in magnitude and with very low levels of significance.

The results are reported as odds ratios, which indicate the impact of a one-unit increase in the explanatory variable on the probability of the outcome variable occurring. Taking the coefficient of 1.18 for males in Model 18.1, for example, this indicates that parents are 18 per cent (1.18–1.00) more likely to report a male child has poor health than a female child. In contrast, the coefficient of 0.81 for the kindergarten cohort, indicates that parents are 19 per cent (1.00–0.81) less likely to report their child is in poor health than parents of the baby cohort (though both these effects are not significantly different from 1.00).

It is the case that parents of male children were significantly more likely to report concerns regarding their child's behaviour and learning. Both parents living in the home had an inconsistent effect: it increased the likelihood of concerns regarding behaviour and learning, but reduced the probability of reporting poor general health. A greater sense of prosperity reduces the likelihood of concerns across all measures, but was significant only in the case of the child's general health.

The results for housing variables also tend to be inconsistent across the domains. The results here seem to suggest that being in public housing is associated with less health and learning difficulties for Indigenous children, while living in a town house is associated with a dramatic increase in the incidence of socio-emotional difficulties. The home needing major repairs is also associated with reported socio-emotional and learning difficulties, but has the opposite effect on general health. There is little evidence that crowding has a negative impact on Indigenous children in these models.

Finally, turning to neighbourhood effects, neighbourhoods considered to be more livable (safer, more spaces to play, a good community for kids) are found to be associated with fewer health and learning problems, and living in remote areas with fewer reported behavioural problems for Indigenous children. However, we caution against reading too much into these results given the sensitivity of the results to different model specifications and their inconsistency across the different domains of children's outcomes.

Table 18: Health, socio-emotional and learning outcomes: panel logit models, LSIC Waves 1 and 2

	General health (Model 18.1)		Concerns with social/emotional behaviour (Model 18.2)		Concerns with learning (Model 18.3)	
	β	p	β	p	β	p
Constant	0.49	0.137	0.05	0.000	0.04	0.000
Socio-demographics						
Male	1.18	0.222	1.52	0.010	1.64	0.004
Cohort —Kindergarten	0.81	0.462	1.63	0.147	2.20	0.028
Study child's age (months)	1.02	0.027	1.02	0.080	1.01	0.142
Two-parent family	0.76	0.051	1.31	0.096	1.41	0.049
Self-assessed prosperity	0.89	0.015	0.95	0.327	0.95	0.399
Housing						
Has moved frequently	0.80	0.270	1.32	0.251	0.68	0.210
Ownership status						
Owner/other	—		—		—	
Renter	1.58	0.018	0.79	0.269	0.79	0.311
Public housing	0.67	0.008			0.67	0.046
Dwelling type:						
Separate house	—		—		—	
Town house			1.84	0.065		
Flat			0.86	0.697		
Unit (flat or townhouse)	0.67	0.087				
Repairs needed	0.69	0.004	2.19	0.000	1.58	0.005
Crowding (persons/bedroom)	1.18	0.103	0.81	0.100		
Neighbourhood environment:						
Livability scale	0.75	0.000			0.80	0.033
Remote			0.62	0.096		
Very remote			0.41	0.003		
Observations	2739		2826		2800	
Individuals	1502		1549		1537	
Observations per individual	1.8		1.8		1.8	
Wald chi2	58.9	0.000	78.5	0.000	75.9	0.000

9 CONCLUSIONS

This report has sought to present empirical evidence on the importance of housing-related factors in the wellbeing and development of children using Australian specific data, primarily data from the Longitudinal Survey of Australian Children (LSAC). The findings are consistent with a large overseas literature that has found associations between housing circumstances and a range of child outcomes. The key finding of the analysis is that there are highly *statistically* significant relationships between a range of aspects of young children's housing and their outcomes. In terms of their magnitude, however, the effect of housing variables appears to be quite modest. While the large samples available in the LSAC mean that estimates of individual housing effects are often statistically significant, the available housing variables explain very little of the variation in child outcomes beyond what can already be accounted for by a relatively small set of variables capturing background family socio-demographic characteristics.

The factors shaping outcomes also vary across different domains of development and wellbeing. Given the general level of housing enjoyed by Australian children, housing plays a small role in shaping physical health, though undoubtedly the effect would be more substantive given greater extremes in living conditions, such as those experienced in third world countries. Living on a farm and in more livable neighbourhood conditions contribute to better physical health. For children's social and emotional outcomes, the family aspects of a home are of greater relative importance than physical properties of the buildings. Parenting styles have a much stronger impact than housing variables, while among housing variables it is the things likely to impact upon the quality of relationships—frequent moves, renting rather than owning and being in financial stress—that appear to impact upon children's social and emotional wellbeing. Crowding has the largest negative impact for learning outcomes. We stress again that these associations do not necessarily imply causal effects running from housing to children's outcomes. However, they do appear to be factors that operate in addition to families' socio-economic status.

The key findings are discussed in more detail against each of the Research Questions posed in the introduction, and we conclude with a note on methodology and future research directions.

9.1 Findings against research questions

9.1.1 *How strong are the empirical associations and do they mediate relationships between socio-economic status and child outcomes*

The analysis has unearthed strong relationships in a statistical sense, but it must be said that on the available evidence the role of housing in shaping children's development and wellbeing is really quite modest. All models explain only a small amount of the variation in outcomes, so either other factors that we have failed to identify are of great importance, or there is a great deal of random variation in the measures relative to that arising from housing. Even the largest estimated housing effects suggest an impact of a movement of only a few percentile points along the distribution of outcomes from the mean.

Housing is a channel through which parental socio-economic status is transmitted into advantage or disadvantage for children, however the evidence suggests that housing accounts for only a small part of this socio-economic gradient. Parental socio-economic position and financial prosperity have substantial impacts in each outcome domain, and the estimated effects are typically reduced by around one-quarter to one-

third with the introduction of housing variables. Thus socio-economic status and housing have independent and separate effects. The most important housing-related channel between a family's socioeconomic status and child outcomes is through neighbourhood effects, notably more livable neighbourhoods in terms of being safe and with good play spaces. Therefore, it seems that the benefits that flow to a child from being of a higher socio-economic background come largely from the family getting into a 'better' area rather than a better house. Better neighbourhood conditions, in particular, seem to mediate parental socio-economic status and learning outcomes and this may be linked to the quality of schools and pre-schools in the area.

However, housing does seem to play an important part in the disadvantage faced by particular groups, notably sole parents and Aboriginal and Torres Strait Islanders. Being Indigenous or a sole parent does not necessarily consign one to being of low socio-economic status, which is usually measured with reference to education, employment and income. However, the statistical correlation is well known.

9.1.2 How do the links between housing factors and child development and wellbeing materialise over time?

The benefits of family socio-economic status on child outcomes generally widen as the child ages, while parenting styles have larger effects on outcomes for very young children. For physical health, there is little difference in the impact of housing variables for children of different ages. In the other outcome domains, being in housing assistance has a larger negative impact for pre-school aged children. Limited evidence is found of persistence or cumulative effects of housing variables, and generally the inclusion of past information on housing did not significantly add to the information contained in the current housing variables when it came to explaining child outcomes. However, there is some evidence of persistent or cumulative negative effects of the family having been in receipt of housing assistance and affordability stress upon physical health and socio-emotional outcomes. It should be noted that with the available data, it was only really possible to test for differences in these relationships either side of the age of 4–5 years. There is nothing to say that this is the correct 'break point' to use. The results may also have been different if variables could be measured over longer periods, but here sample size limitations due to only three waves preclude this. Indeed, cumulative effects or differences in effects by age may well be different for different children.

9.1.3 In what ways are the housing experiences of Indigenous children different from those experienced by non-Indigenous children?

On average, Indigenous children live in starkly inferior housing circumstances than non-Indigenous children. This is apparent in terms of a low level of home ownership among Indigenous Australians, a high proportion living in public housing and in receipt of CRA, more frequent moves, more crowded homes and generally inferior neighbourhoods. Indigenous children are also much more likely to live in a sole-parent family, and fare significantly worse on all the outcomes measures.

9.1.4 To what extent do poor housing conditions faced by Indigenous children contribute to differences in health and development?

On the basis of the LSAC models, we can estimate that the inferior housing conditions faced by Indigenous families in fact contribute more to their children's lower outcomes, compared to non-Indigenous children, than differences in key socio-demographic characteristics. For physical health, it is the inferior neighbourhood conditions and poorer conditions of their dwellings that are estimated to be the biggest contributors, among the housing variables, to the gap in child outcomes. For socio-

emotional wellbeing and learning outcomes, the higher proportion living in public housing is estimated to be a major contributor to the inferior outcomes for Indigenous children, while greater crowding is also estimated to impact upon learning outcomes.

An important policy implication of this finding is that it suggests that improvements in housing can be expected to translate into gains in child development outcomes for Indigenous children over and above the socio-economic characteristics of the family. In total, the estimated effect of differences in the average housing circumstances of Indigenous children equates to Indigenous children being around two percentile places lower on the distribution of child physical health outcomes, and around six percentile places for socio-emotional wellbeing and learning outcomes. Note, however, that these estimates and conclusions assume that housing variables have the same effects on Indigenous and non-Indigenous children's outcomes, which may not be the case. Models based on the LSIC data were not robust enough to make comparisons with the results obtained for the LSAC sample, and future research should be directed to ascertain whether outcomes for Indigenous and non-Indigenous children are equally as sensitive to changes in housing circumstances.

9.1.5 How do housing circumstances compare for those receiving various forms of housing assistance?

A family's receipt of housing assistance is consistently associated with lower child outcomes, and there is some evidence of persistence in these effects over time. Families on housing assistance live in more crowded housing and in less livable neighbourhoods. Recipients of CRA in particular, face greater housing affordability stress and have less housing stability. Their children have significantly lower outcomes in each of the three domains, with the worst outcomes observed for children in public housing, and learning outcomes the domain most affected. Much of this gap for those in housing assistance, however, can be attributed to differences in socio-demographic background and parenting styles rather than housing. Based on the estimated effects of housing variables on children's outcomes, differences in housing characteristics are likely to play a relatively modest role in the lower outcomes of children of those receiving housing assistance.

It is important to note that while families in receipt of housing assistance may display inferior outcomes to those who do not receive assistance, that is not the most pertinent comparison to make if one is interested in evaluating housing assistance programs. Ideally, housing assistance would be targeted at people *in need* of assistance, and therefore would be expected to be associated with less favourable outcomes across at least some of life's domains. From an evaluation point of view, the more important question is 'What would the outcomes have been if those same families had not received housing assistance?'. This is not a question we can address definitively in this report, but the fundamental difference in these two comparisons should be borne in mind. Given the likely unobservable factors affecting outcomes for children from such families (from the point of view of our data), the estimated effects of being in receipt of housing assistance in the multivariate models are likely to overstate any causal link between housing assistance and inferior outcomes. In this light, it would appear that housing assistance in Australia does provide quite an effective safety net for children of those families who access it.

9.1.6 Implications for policy and practice

The findings with respect to neighbourhood livability, and also for the positive physical health effects of living on farms, are likely to arise through the greater opportunity for children to play and explore, and be physically active within a safe environment. The consistent appearance of neighbourhood affects as significant in models across each

of the outcome domains highlights this as a key aspect in the design of urban areas to promote the health and happiness of children. A surprising finding was the lack of any difference between living in town houses and flats, when the latter are the main dwelling types which will involve multi-storey and high-rise living.

Taken together, these findings suggest a more important role of neighbourhood effects over the characteristics of individual dwellings in promoting the wellbeing of children, particularly once they pass toddlerhood. Urban planning that features parks, playgrounds and other open areas are likely to be conducive to children's development and wellbeing even if achieved at the expense of higher density of the actual dwellings. These findings support arguments presented elsewhere in the literature for the valuation of urban development to take account of the social benefits of parks and play spaces (Chiesura 2004) and in planning for higher density housing to address housing supply issues (Byrne & Sipe 2010). From the analysis here it is not possible to tell how much of these neighbourhood effects arise through differences in the quality of schools and early learning centres, but this is also likely to be a potential policy instrument for improving outcomes for children from families of lower socio-economic status.

Two key groups stand out for whom their children's outcomes are particularly affected by their inferior housing positions: sole parents and Indigenous Australians. There would therefore seem to be a case for closer targeting of existing housing assistance programs for these groups, and the development of forms of assistance that address their particular needs. Disadvantage for Indigenous children, in particular, increases as children age, suggesting benefits of earlier rather than later interventions if the gap in outcomes for Indigenous Australians is to be reduced in upper primary school, secondary school, and in the school-to-work transition.

Finally, close attention should be given to neighbourhood amenities in the allocation of housing assistance. First, a share of community and state housing developments need to provide good play areas and other neighbourhood amenities if they are to cater to families with children. Second, neighbourhood amenity should be taken into consideration in the allocation process of families to public housing properties when there are young children.

9.2 A note on methodology and future research

It must be noted that the models presented here all had relatively low explanatory power. Although such outcome variables are inherently difficult to model, the robustness of models based on the data from the LSIC was particularly disappointing. This may be because key determinants of the outcomes, notably physical health outcomes, are largely unobservable, possibly with genetics playing a major role. Alternatively, there may simply be a large random component to the outcomes, or the dependent variables may be poor at discriminating between the underlying outcomes they are intended to measure. Generally the models perform better in explaining variation between individuals rather than over time for the same individual. This is partly because of the limited longitudinal nature of the data (three waves for the LSAC, and two for LSIC), and that variation in the dependent variables arises largely from relatively fixed traits of the children's circumstances, such as their family traits, rather than varying circumstances within that timeframe.

There are a number of reasons to be hopeful that results can be improved substantially as additional waves of data from the two surveys become available, particularly in the case of the LSIC. Additional observations on each study child will enable individual effects to be estimated more accurately, plus provide more variation in the independent variables to support fixed effects models. Measures of outcomes

may also be more accurate for older children, and the longer time frame will allow duration and lagged effects to be estimated with less of a sacrifice in sample size. Finally, some of the limitations noted above will have been compounded by the use of composite outcomes indices as the dependent variables. There is extensive scope for more detailed studies of individual outcomes, such as childhood obesity, hyperactivity, or gender differences in numeracy, and of specific hypotheses relating to causation to contribute to a greatly enhanced understanding of child development and wellbeing in Australia.

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