

# Housing-related experiences of families with young children in contemporary Aotearoa New Zealand

How do these experiences differ for families living in  
rental or social housing and/or on low incomes?



## Authors

This report was written by Dr Emma J Marks<sup>1</sup>, Megan Somerville-Ryan<sup>2</sup>, Dr Caroline Walker<sup>1</sup>, Miranda Devlin<sup>3</sup>, Rachel Chen<sup>4</sup>, Associate Professor Polly Atatoa Carr<sup>5</sup>, Dr Sarah Berry<sup>6</sup>, Ashley Smith<sup>1</sup> and Professor Susan M B Morton<sup>1</sup>.

1. Social and Community Health, School of Population Health, University of Auckland
2. Kāinga Ora – Homes and Communities
3. Te Tūāpapa Kura Kāinga – Ministry of Housing and Urban Development (HUD)
4. Department of Statistics, University of Auckland
5. National Institute of Demographic and Economic Analysis, University of Waikato
6. Auckland War Memorial Museum: Tāmaki Paenga Hira

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The final decisions for data analyses and presentation rest with the authors, who fully take responsibility for any errors or omissions. The views and interpretations in this report are those of the researchers and not the official position of the Ministry of Social Development or Kāinga Ora – Homes and Communities or the Ministry of Housing and Urban Development.

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## Abbreviations

NZ – New Zealand  
SSA – Sequence State Analysis  
SDQ – Strengths and Difficulties Questionnaire  
GWT – Gift Wrap Task  
WHO – World Health Organization  
ECE – Early childhood education  
EAG – Expert Advisory Group



# Executive summary

Decreasing rates of home ownership and increasing rates of both rental housing and residential mobility are intensifying the impact of poor quality housing, especially for the most vulnerable children and whānau. The current study used data from the contemporary *Growing Up in New Zealand* study to better understand the housing experiences of New Zealand children, particularly those in rental accommodation and for those living in low incomes households in the first five years of life.

We have used both longitudinal data and sequence state cluster analyses to better understand the pathways and flux in tenure and income states families experience across time. Greater understanding of families with young children's journeys has the potential to be translated into policy, service and programme development in order to achieve better housing pathways and wellbeing outcomes for New Zealand families.

## Changes in housing tenure and income are common for families

Moving between housing tenure types was a common experience for families with 30% of families changing housing tenure at least once in the preschool period. Cohort families experienced a high degree of movement between income bands during their child's first four years of life. This was clearly demonstrated by the complexity of sequences present in the sequence state analysis (SSA) of the housing tenure/income band states. Home ownership with high ( $\geq$ \$100K per year) household income was the state least

likely to have changed across the four timepoints, while families in the private rental market and those in public housing experienced a much greater number of different housing and income journeys. Although research often shows long periods of low income for families to be more detrimental to the health and wellbeing of children than short periods there is less known about the effects of income instability over time on children's outcomes.

## Home ownership provided more stability for families compared to those living in public or private rental housing

Household tenure and income journeys for families were broadly categorised into four main types or clusters which differed in terms of the complexity of the journey as well as the states experienced. Each of these cluster groups had both distinct journeys as well as distinct characteristics in terms of the families who lived these experiences, and the characteristics of their housing and neighbourhood environment. The most common state experienced by families belonging to cluster Type 1 and 3 was home ownership. Compared to cluster Types 1 and 3, cluster Type 2 and 4 had less stability of states and therefore more complex journeys. Overall, home ownership in combination with high or medium income was associated with the greatest stability for families whereas those predominately living in public or private rental homes had the least stability. This suggests that home ownership and higher incomes may provide a buffer for families during the early years of their child's life.



## EXECUTIVE SUMMARY



### Moving house was a common experience for cohort families

Three quarters of cluster Type 2 families had experienced residential mobility at least once during their child's first four years, with nearly 20% moving three or more times. Cluster Type 2 are those families that spent the majority of their housing tenure journey in private rentals. In contrast, it was much less common for families in cluster Type 1 or 3 (those spending most of the housing tenure journey in home ownership) to experience residential mobility. For families in cluster Type 4 (predominately public rentals) it was less common to move house compared to cluster Type 2. These results are consistent with literature on residential mobility for New Zealanders. In families, major life events, particularly those that occur early in children's lives, are often related to residential mobility, for example, the birth of children, disruption to parental labour force status, and the rearrangement of families and households. It is important to note however that not all moves are alike, and for some, moving is a stressful experience coupled with other adverse family events. For others, mobility can be the result of (or can result in) improved family circumstances.

In families, major life events, particularly those that occur early in children's lives, are often related to residential mobility, for example, the birth of children, disruption to parental labour force status, and the rearrangement of families and households.

### Household composition differed by housing tenure and income cluster

Overall, living in a household with two parents was the most common experience for the cohort regardless of cluster type. Most families in the cohort did not experience household crowding, however, the proportion of families experiencing crowding differed by household tenure and income journey cluster. For cluster Type 1 and 3 (predominately home ownership) the majority of families did not experience crowding. However for cluster Types 2 and 4 experience of crowding was more common with the greatest proportion of crowding for cluster Type 4 families (those predominately living in public rentals). In addition, a greater proportion of children in cluster Type 2 and 4 were sharing a bed with their parents at three years of age. Crowding occurs for a variety of reasons and as such the solutions to crowding are similarly varied. Households renting are more likely to experience crowding and poor housing conditions.

Households renting are more likely to experience crowding and poor housing conditions.

### Most homes were insulated and heated during winter

Overall, for most homes, mothers reported that their home was insulated and that they were able to heat their home when needed. Families in cluster Type 1 and 3 (both predominately home ownership) more commonly reported that their home was insulated and that they heated their home when it was cold. Families in cluster Type 2 (mostly private rental) and 4 (mostly public rental) most commonly reported experiences of damp, condensation and mould in their homes compared to cluster Types 1 and 3.

## EXECUTIVE SUMMARY



### Experience of material hardship

Families experiencing material hardship occurred across all cluster types, however the level of material hardship experienced was greatest for Cluster Type 4, followed by 2, 1 and 3 at both timepoints. Material hardship has become increasingly recognised as an important area to study alongside income-based measures when measuring levels of deprivation and especially for children when assessing the implications of poverty.

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### Most families had good access to amenities in their neighbourhood

Overall, most mothers reported that they had good access to amenities in their neighbourhoods. This included access to good parks, playgrounds, and play spaces, good public transport, shopping facilities and services such as banks and medical clinics. The relative importance of the different reasons for living within a neighbourhood differed across the housing tenure and income clusters. The exception to this was living nearby to family and friends. Overall, a similar proportion (two in five) within each cluster valued being close to friends and family. For cluster Types 1, 2 and 3, the most commonly reported reason for living in their neighbourhood was because it was a good safe neighbourhood. However, this was much less commonly reported for cluster Type 4 (predominantly public rental) who most commonly reported affordable housing as the reason they lived within their neighbourhood.

### How these differences in experience related to child outcomes

Household tenure and income journeys were associated with differences in health and wellbeing outcomes for children. Specifically, there were differences in the odds of experiencing specific health diagnoses, cognitive development problems and educational outcomes between the cluster groups even after accounting for factors well known to be linked to these outcomes. Overall, the housing tenure and income journeys of families appears to be associated with children's health and wellbeing outcomes. The potential for these factors to continue to have a detrimental association with children's lives may have life-long consequences. The impacts of families experiencing these housing and income fluctuations, as well as some of the poorer housing quality effects may be able to be mediated through additional social interventions and policies targeted to those more vulnerable families. These results therefore highlight the need and importance of wrapping support around families who experience journeys associated with poor health and wellbeing outcomes.

The impacts of families experiencing these housing and income fluctuations, as well as some of the poorer housing quality effects may be able to be mediated through additional social interventions and policies targeted to those more vulnerable families.



# Key implications for policy makers

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Our study used the *Growing Up in New Zealand* longitudinal data to look at the outcomes of children living in homes with different tenures and levels of household income, to understand their lived experiences and to see who is doing well and how these circumstances differ. Children's outcomes have been at the forefront of the Government's agenda in recent years. Achieving improved wellbeing for all children and reducing exposure to poverty, along with measurement of progress, has recently been mandated through new and revised legislation. Four key themes emerged from our findings for policy makers to consider. For each theme we have identified current policies, legislation and public sector activity that support our themes, along with recommended actions to achieve greater impact.

## KEY IMPLICATIONS FOR POLICY MAKERS



- 
- 01 **Supporting families through income and housing tenure journeys during the first few years**, enhancing positive change, and reducing negative change.

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  - 02 **Improve security of tenure for families renting**, enable them to create a place to call home, facilitate residential stability and promote connected communities.

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  - 03 **Our results support current policy and legislation aimed at ensuring rental homes are warm, dry, and safe**. Maintain focus on reducing crowding through families accessing housing that meets their needs.

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  - 04 **Enable environments that contribute to optimal cognitive and educational outcomes for children** whether their families rent or own their home. Support opportunities for quality time between parents and their children.
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# Introduction

## STATE OF HOUSING IN AOTEAROA NEW ZEALAND

Decreasing rates of home ownership (73.8% in 1991 to 64.8% in 2013) and increasing rates of both rental housing and residential mobility are intensifying the impact of poor quality housing, especially for the most vulnerable children and whānau<sup>1</sup>. The emergent problem in NZ with housing supply has manifested in crowding and affordability issues. There is an increasing proportion of the population that will be in medium to long term rental accommodation; therefore there is a need to ensure the housing environment provides protection on quality and stability of housing, between renters and home owners, particularly for those renting on low incomes. Government policy needs to facilitate renting as a positive, affordable, safe and viable long term housing option like it is in many European countries.

There has been considerable research that has documented the state of housing in New Zealand (i.e. the recent Stocktake of New Zealand's Housing<sup>2</sup>), including by *Growing Up in New Zealand*. Their Residential Mobility Report<sup>3</sup> showed 38% of the cohort of nearly 7000 families had moved twice or more in the first two years of their child's life and that the major driver of mobility was housing tenure with those in private rental accommodation most likely to have moved. Their data also shows that 20% of families with young children report experiencing problems with dampness or condensation in their homes and 12% report problems with mould<sup>3</sup>. Heating sources also contribute to measures of housing quality. Within *Growing Up in New Zealand*, approximately 12% of families report the use of un-flued gas heaters and 25% the use of wood-burners, both of which have the potential to negatively influence child health<sup>4,5</sup>. Relative to children in other developed countries,

children in New Zealand experience high rates of respiratory illness including acute respiratory infections and asthma<sup>6</sup>. The quality and safety of housing are likely contributors to current concerns about increased rates of both infectious and non-infectious illnesses among New Zealand children<sup>7</sup>. Additionally, *Growing Up in New Zealand's* report on the Transition to School<sup>8</sup> showed a high level of school transience with 12% of cohort children having moved schools in the first year of the child's school life. Of those who had moved school the most common reason given by the parent was that they had moved house (61%, n=404). Given the considerable residential mobility among households with young children, in turn influencing children's schooling experiences and stability, there is the potential for school mobility to lead to poorer long term educational outcomes for children<sup>9</sup>.

Government data collected that looks at child health and housing is often limited by being cross-sectional in nature<sup>1</sup>, or data collected has focused on adult experiences of housing rather than children's outcomes, for example the General Social Survey or Household Economic Survey data. What longitudinal data can provide is the cumulative experience of housing on families across the lifetime of their children and the potential to then observe changes in outcomes across time and the effect of social policy interventions. This research can fill an important policy and knowledge gap by a) examining measures of housing type/quality specifically for families with young children; and b) by enabling an understanding of the experiences of families in social and low income housing as well as improving health outcomes for children.

<sup>1</sup> <https://dpmc.govt.nz/publications/child-poverty-related-indicators-report-html#section-3>

## INTRODUCTION



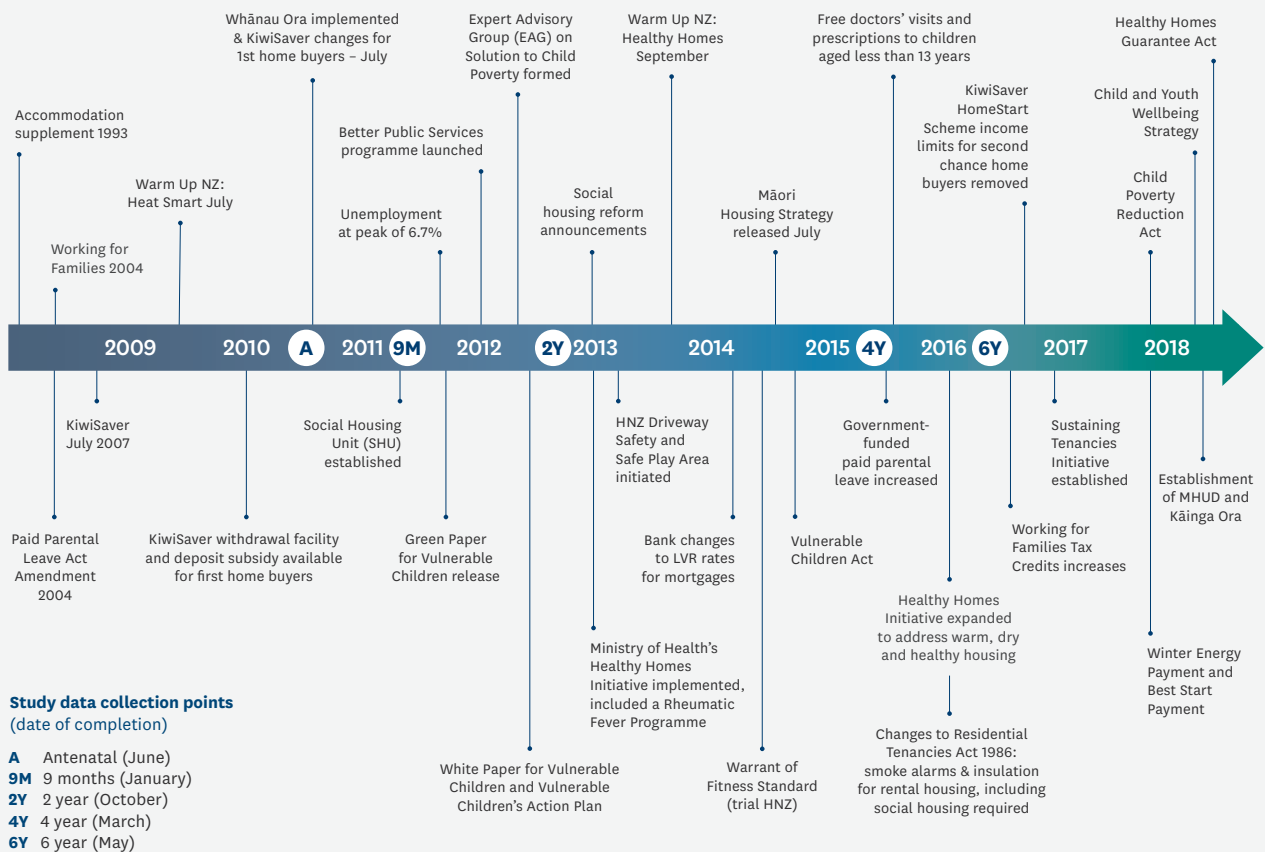
## THE POLICY CONTEXT IN AOTEAROA NEW ZEALAND

Policies and legislation are brought in to address problems or achieve certain outcomes. We need to consider our study results alongside the social and housing environment and the corresponding policy settings and legislative changes that occurred both during the period of data collection 2009 to 2016, as with more contemporary changes (key policies highlighted in Figure 1).

Note, it will be important to revisit this research with data collected at later timepoints and in conjunction with more recent policy and legislative changes in this space.

**FIGURE 1.** Housing and income policy changes timeline alongside the *Growing Up in New Zealand* data collection points

### PERTINENT HOUSING AND INCOME POLICY CHANGES



## INTRODUCTION



## Whānau and child outcomes

Across *Growing Up in New Zealand's* data collection period there have been a series of child-centered policy developments on the wellbeing and protection of vulnerable children, as well as activity focused on reducing the number of children experiencing poverty and alleviating the effects of poverty (see Figure 1). Policies and associated legislation in more recent years have broadened to encompass the wellbeing of all children and young people.

### KEY POLICY AND LEGISLATION CHANGES INCLUDE:

- In 2012 the White Paper for Vulnerable Children and the Children's Action Plan initiated a series of reforms to achieve greater protection of children at risk, improve the wellbeing of vulnerable children and prevent vulnerability. The Vulnerable Children's Act was passed in 2014. The Better Public Service Targets in 2012 set out the government's overall priorities and included specific targets for increasing participation rates for early child education (ECE), immunisation rates, reducing incidence of rheumatic fever and reducing the number of assaults on children. The Ministry for Vulnerable Children, Oranga Tamariki, was established in 2017, to be a dedicated standalone department focused on the protection of vulnerable children.
- In 2018, the government passed the Child Poverty Reduction Act and set up the Child Wellbeing and Poverty Reduction Group to lead the work on reducing child poverty specifically, and more generally improving the wellbeing of all children and young people in New Zealand. The Vulnerable Children's Act was renamed the Children's Act and amended to require successive governments to develop and publish a strategy to improve the wellbeing of children and young people, with a particular focus on child poverty and those with greater needs.
- In 2019 the Child and Young People's Wellbeing Strategy was released which sets the direction for government policy to improve wellbeing of children and young people. The Framework defines six outcomes and sets out measures to show progress. Measures cover material wellbeing, housing, family and whānau environment, learning and development, and health.

## Family support and welfare reform

In 2010 a programme of welfare reform was announced, which aimed to break the cycle of welfare dependency. Policies focused on increased obligations and incentives to increase participation in paid work and to move off welfare (see Figure 1). Over subsequent years a number of family and child support policies were implemented or changes made to existing policies to strengthen their impact or better target those in need.

### KEY POLICY CHANGES INCLUDE:

- Family and child support packages were introduced or amended including increases to the Working for Families Tax Credits; free doctor's visits and prescriptions extended to children aged under 14 years; the Child Material hardship package was introduced for low income families; a Families Package was introduced in 2018 which included increased rates for the Family Tax Credit, Winter Energy Payment, and the Best Start Payment to assist with children's early year costs.
- Welfare reforms included Work Obligations being applied to beneficiary parents and sole parents, when the youngest child turned five, revised in 2015 to age three; Social Obligations were introduced in 2012 for beneficiary parents around early childhood education and school attendance, GP enrolment and completing WellChild/Tamariki Ora checks; Work-focused Case Management was introduced in 2011 to assist beneficiaries to gain employment.
- In 2015 the Employment Relations Act was amended to extend flexible working arrangements to all employees.

## INTRODUCTION



## The housing environment

- Through 2009 to 2016 with house prices remaining above long-term levels, housing affordability and home ownership rates were declining<sup>2,10</sup>. As home ownership decreased, the proportion of people living in rented homes increased, and rentals became less affordable<sup>10</sup>. Following the Productivity Commission's report on Housing Affordability released in 2011, the government initiated a number of measures to grow the supply of affordable housing and support people into home ownership (see Figure 1). Auckland was an area of focus.

### KEY POLICY AND LEGISLATION CHANGES INCLUDE:

- The Housing Accords and Special Housing Areas Act 2013 was passed, aimed at increasing housing affordability by facilitating an increase in land and housing supply.

### Public housing reform:

- In 2013 a programme of public housing reform began. Changes were made over the next few years including funding to grow the supply of public housing, along with development and growth of Community Housing Providers through stock transfers and making the rent subsidy available to them.
- Additional public housing reform included tightening of the public housing allocation criteria with only high priority applicants eligible; those with a lower priority housing need had to look to the private rental sector. Tenancy reviews were introduced for new public housing tenants, and those paying market rent i.e. not receiving a rent subsidy were encouraged to move to private rental accommodation. Roles/functions undertaken by Housing New Zealand (now Kāinga Ora) were transferred to other Crown agencies – the housing policy function was transferred to MBIE; and management of the public housing register and housing needs assessments were transferred to the Ministry of Social Development.
- In 2016 initiatives to support the housing needs of vulnerable people were initiated: The Housing First – supporting people experiencing homelessness into housing; Better Housing Outcomes – supporting public housing tenants at risk of eviction; and working with those who could move from public housing into home ownership or private rentals.
- In early 2017, as part of a refresh of the Better Public Service (BPS) targets, improving access to public housing was added as a priority, with a target to reduce the time it takes to house high priority applicants from the Housing Register. BPS targets were removed in 2018.

### Response to poor condition of rental housing:

- In response to growing evidence of the poor condition of rental housing, government funded programmes were implemented to provide subsidies for the retrofitting of insulation into homes, including Warm Up NZ and the Warm Up New Zealand Healthy Homes programme.
- A review of the Residential Tenancies Act 1986 (RTA) was announced in 2015, and over 2016 to 2018 new requirements for smoke alarms and insulation and better enforcement of the new laws were phased in. The RTA was amended by the Healthy Homes Guarantee Act in 2017, requiring rental houses to be properly insulated and contain an adequate heating source by 2024. It also allowed for the development of new Healthy Homes Standards to further improve the quality of rental housing. The Residential Tenancies Amendment Bill 2020 brought in tenancy protection mechanisms for increased security of tenure of tenants, requirements to make homes safer and more liveable, improving legislation compliance, along with controls around rent increases.
- The Winter Energy Payment was introduced in 2018 to assist with the cost of heating homes during winter. This was available to all community service card holders, welfare benefit recipients and superannuitants. Warmer Kiwi Homes – insulation and heating grant programme for low income households.

### Government's housing and urban development agenda:

- To lead the government's housing and urban development agenda, Te Tūāpapa Kura Kāinga – Ministry of Housing and Urban Development was established in 2018, to govern, manage and direct the housing sector, and be the regulatory authority for public housing. In addition a new urban development authority was formed, Kāinga Ora – Homes and Communities, bringing together Housing New Zealand, Kiwibuild and land development entity Hobsonville Land Company. Kāinga Ora's role is to lead small and large scale development projects delivering market, affordable and public housing, and to be the public housing landlord.
- In 2018 Kāinga Ora's Social Objectives were enshrined in legislation. These objectives cover housing condition and housing supply, stability of tenure, supporting tenants to live well with the greatest degree of independence, and contributing to thriving neighbourhoods and communities.
- Funding provision was made in the government's Budget 2020 to increase supply of affordable and public housing, as well as provision of emergency and transitional housing. In an effort to support more people into home ownership the Progressive Home Ownership Scheme was established.

## INTRODUCTION



**What this research can add:** This research facilitates a unique opportunity to describe experiences, and compare outcomes of children of a similar age but living in different housing tenure types and under different socioeconomic and family environments. Given the sample size of the *Growing Up in New Zealand* cohort we have adequate explanatory power to understand what works for our more vulnerable population sub-groups. This research takes a specific focus on the housing-related experience for families in social housing and with private rental tenancies, particularly those with low household income. In the last 25 years, Māori and Pacific home-ownership rates fell at a faster rate than for the total population (Statistics NZ, census data<sup>20</sup>). Further, there is increasing evidence of the contribution that the housing and neighbourhood environment makes to health inequities experienced by those that identify as Māori or Pacific. Housing policies have also contributed to population outcomes, particularly for Māori, for whom housing is much more than the physical dwelling and is connected to history, whakapapa, land, culture, identity and development priorities<sup>11</sup>. Our ability to describe housing-related pathways, and their association with child outcomes across the early years, therefore provides new evidence on the factors that may promote wellbeing for Māori and Pacific families, and support improved health equity.

**Achieving impact:** The findings of this research have the potential to be translated into policy, service and programme development in order to achieve better housing pathways and wellbeing outcomes for New Zealand families. Our research aligns with one of the Child and Youth Wellbeing Strategy outcomes that every child/family should have access to safe, affordable and secure housing. It will also facilitate future work both from government and external researchers in this field and enable discoveries to be made that will increase our understanding on the effects housing tenure and income changes have on New Zealand families. Moreover, we will be able to add valuable insight/evidence into both current and future policy decisions (for example, the Government Build Programme). Examples could include: policies, services and programmes that improve both housing and tenancy stability, quality and suitability of housing for families and also support positive outcomes in other wellbeing domains i.e. social connectedness and health (mental, physical and financial).

Our ability to describe housing-related pathways, and their contribution to child outcomes across the early years, therefore provides new evidence on the factors that may promote wellbeing for Māori and Pacific families, and support improved health equity.





## OBJECTIVES AND AIMS OF THIS STUDY

The **objective** of this research is to describe the living experiences in different housing tenure types and quality of housing that New Zealand children experience during their early years. This information will facilitate an understanding of how housing tenure changes over time for New Zealand families, and identify some of the key demographic, family, household and neighbourhood/community characteristics that are associated with these residential situations. It will also highlight the differences in early life child outcomes in New Zealand.

Using *Growing Up in New Zealand's* multidisciplinary, longitudinal information of children, their families and their environments we **aim** to answer the following **research questions**:

1. **What are the experiences of families with young children living in different housing tenure types in New Zealand today?**
2. **Do these experiences differ for those living in public/social housing and/or low incomes compared to other housing tenure types and income levels?**
3. **Are these differences in experience related to child health and wellbeing outcomes?**
4. **What are the housing factors that help children to thrive?**



# Methods

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## THE *GROWING UP IN NEW ZEALAND* STUDY

Participants were mothers and their children who are part of the *Growing Up in New Zealand* study's longitudinal pre-birth cohort. Mothers were recruited during pregnancy from three contiguous District Health Boards: Auckland, Counties Manukau and Waikato. This region was chosen because of its population size, ethnic and socio-economic diversity<sup>12</sup>. All pregnant women who lived within this region who were due to give birth between 25th April 2009 and 25th March 2010, were eligible. A multi-faceted strategy was used to recruit a sample broadly generalisable to the contemporary

New Zealand national birth cohort<sup>13</sup>. The enrolled child cohort included 11% of the births in New Zealand during the recruitment period and is broadly representative of all births between 2007 and 2010 with respect to ethnicity, maternal age, parity and socio-economic position<sup>14</sup>. Ethical approval was obtained from the Ministry of Health Ethics Committee. Written informed consent was obtained from all participating mothers. In total, 6,822 mothers were interviewed during pregnancy, who collectively gave birth to 6,853 children<sup>12</sup>.

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## DATA COLLECTION PROCEDURE

Mothers were interviewed about topics across the multiple domains described in the *Growing Up in New Zealand* conceptual framework. These domains include health, psychosocial and cognitive development, family and whānau, education, culture and identity, and neighbourhood and societal context<sup>12</sup>. Trained interviewers conducted interviews in mothers' homes when they were pregnant with the cohort child (the Antenatal interview), and when the cohort children were approximately 9 months, 2 years, and 4 years old.

Interviews were face-to-face and computer-assisted and took approximately 90 minutes to complete. This report has also used data from the 31 and 45 month (3 year) phone call to mothers which is incorporated into the 54 month data collection point (termed 4 year in this report). Note "Mother" in this report refers to the primary caregiver that completed the questionnaires at all four *Growing Up in New Zealand* timepoints and may not be the cohort child's biological mother.

## METHODS



## PREDICTOR VARIABLES USED

### How household tenure type was collected and derived

Household tenure was *initially* derived at the Antenatal interview from mother-report of housing ownership into the following four groups:

**Family ownership:** includes any of these 3 conditions:

1. Yes to residence ownership;
2. Yes to family trust;
3. Yes to mortgage payment.

**Private rental:** rentals from private person, trust, or business.

**Public rental:** rentals from government agents.

**Others:** others and/or unclassifiable situation/conditions excluding true missing (no answers/responses to this set of questions).

The number of families that were in the “Others” category was considered too small and diverse to be reliably incorporated into analyses and so were subsequently excluded. Note that it is not determined from our research questions, if the house is owned, who in the household is paying the mortgage and this therefore may not be the parent(s) of the cohort child.

Residential mobility was asked at each subsequent data collection wave (9 month, 2 year and 4 years). If there had not been residential mobility, then the same household tenure for subsequent waves was assumed from the previous wave. See **Table A, Appendix 1** for questions asked at each timepoint used to derive household tenure. Household tenure for each family at each timepoint was segmented into privately owned, public rental or private rental.

### How household income was collected and derived

Questions regarding household income were collected as categories of total household income before tax (<\$20,000, \$20,001–30,000, \$30,001–50,000, \$50,001–70,000, \$70,001–100,000, \$100,001–150,000 and >\$150,001) at each interview. Interview questions on household income are provided in **Table B, Appendix 1**. Note we have not equivalised income by household composition for this research. This means we have not taken into account differences in household size or composition when assessing total household income.

Derivation of income bands used for analyses were informed by pertinent government policies relevant to housing. Low income band thresholds were informed by the Ministry of Social Development’s public household thresholds which were in April 2019 \$948.81 a week (after tax) if you have a partner or children<sup>2</sup>. Using the income bands available this gave a threshold of \$50,000 per annum per family before tax. The medium income band used the Accommodation Supplement threshold of \$92,872.00 as at April 2019 for a sole parent with two or more children in Area 1 (Area 1 – Central Auckland Zone, Northern Auckland Zone, Pukekohe, Queenstown, Southern Auckland, Zone, Tauranga, Waiuku, Western Auckland Zone, Other locations<sup>15</sup>). Using the available data this gave a medium band upper threshold of \$100,000 per annum for a family. High income was then classified as any family with an annual income above this threshold.

In order to be inclusive of as many families, housing journeys as possible we have included those with missing income data or who answered, “Don’t know”, or “Prefer not to say” at any of the four timepoints. At the Antenatal timepoint this accounted for n=702 (13.5%) families, at 9 months it was n=671 (12.9%), 2 years n=465 (8.9%) and at 4 years there were n=744 (14.3%) families with missing data.

<sup>2</sup> <https://workandincome.govt.nz/housing/find-a-house/who-can-get-public-housing.html>



## THE RESEARCH COHORT AND MISSINGNESS

The data used in this research to examine tenure and income includes  $n=5215$  (76.1%) families from the full  $n=6853$  Antenatal cohort. In order to examine the missingness of the data and check for bias we have looked at a cross-sectional description of participants for those in and those excluded from this research (see **Table H, Appendix 2** for further detail). This analysis indicated the presence of attrition bias, with families with missing data on housing tenure across all the interviews more likely to be Māori, Pacific, Asian

and MELAA mothers as well as those in high deprivation neighbourhoods (NZDep2006 deciles 8–10<sup>17</sup>) or mothers 24 years or younger at the Antenatal interview. Additionally, mothers with fewer educational qualifications, those in public housing and those with a household annual income of \$30,000 or less were more likely to be missing in the cohort we have used in this research. No imputations were carried out for missing data.

## OTHER INPUT VARIABLES USED

We have used several socio-demographic input variables in this study to highlight the differences in housing and income journeys for the families and in our final models when investigating factors influencing child health and wellbeing outcomes at four years old. Detail about the questions asked at each interview stage can be found in **Appendix 1 (Tables C–G)**.

### Derived or re-classified variables

**Maternal smoking:** Mothers were asked if they were currently smoking at each of the data collection interviews (Antenatal, 9 month, 2 year and 4 years). A score of 1 was given for yes and 0 for a no answer. A cumulative score was then created giving a range from 0 to 4 for each mother.

**Maternal ethnicity:** At the Antenatal interview, we asked the mothers to identify all their ethnicities and then asked parents who identified with more than one ethnic group to self-prioritise their own ethnic identification by nominating their ‘main’ ethnic group<sup>16</sup>. Their ethnic identity, and self-prioritised ethnic identity was then classified into the broad Statistics New Zealand Level 1 Categories of: European, Māori, Pacific, Asian, Middle Eastern/Latin American/African (MELAA), Other and New Zealander. Due to small sample sizes for later analyses MELAA and New Zealander. In order to protect the anonymity of study participants; the small number of mothers choosing MELAA and New Zealander as their main ethnicity they were included in the Other category.

**Crowding:** Crowding was calculated using the number of people in the household and the number of available bedrooms. Household crowding was then defined as: low crowding (<1 person per bedroom); medium crowding ( $\geq 1$  to <2 people per bedroom); and high crowding ( $\geq 2$  people per bedroom). Although we have termed two or more people

per bedroom as high crowding it is a relatively low level of “high” crowding and thus we may have overestimated the levels of crowding and its effects in this report. However, this definition of crowding has typically been utilised in published *Growing Up in New Zealand reports*. To simplify the longitudinal analytic approach, the crowding exposure was dichotomised into either a family living in high crowding conditions (score = 1) or living in medium or low crowding conditions (score = 0) for each of the timepoints measured (Antenatal, 9 month, 2 year and 4 year). This gave a cumulative crowding score of between 0 to 4.

**Residential mobility:** At every interview we asked mothers if they have moved since we last interviewed them. This allows us to calculate residential mobility in the cohort. For this study we can estimate those mothers that have never moved, those that have moved at least once between interviews, those that have moved at least twice, and those that have moved address at every time we interviewed them. Note this is not an absolute number of moves as there may have been multiple moves between timepoints for some families.

**Dampness:** Questions about the dampness of homes were asked at the 9 month interview. The first was about how often the house where the child lived most was damp. The second related to how often there was heavy condensation in the room where the child slept at night. The third related to whether over the previous two weeks, there had been mould or mildew on the walls or ceilings in the room where the child slept at night. The four answer options for the first two questions were collated into two groups: “never/hardly ever” and “not very often” (Never to Not very often); and “quite often” and “always/almost always” (Quite often to Always). The third question had a yes or no response option.

## METHODS



**Deprivation index (NZDep):** We have used NZDep2006<sup>17</sup> for the Antenatal, 9 month and 2 year interviews. For the 4 year interview, NZDep2013<sup>18</sup> was used. To simplify the analytic approach, the exposure was dichotomised into either living in an area of high deprivation (decile 8, 9 or 10) or living in an area that was not high (deciles 1-7) for each of the timepoints. To create a final variable for the longitudinal analyses the experience of deprivation was further simplified and dichotomised according to the timing of exposure to high deprivation. Exposure during the first thousand days

was determined from the Antenatal, 9 month and 2 year interviews and exposure at preschool measured at the four year interview. Any experience of high deprivation during either the first 1000 days or during the preschool period meant children were classified as experiencing living in a high deprivation area during that period (*Any*), whereas those who did not experience living in a high deprivation area at any time during these two periods were classified as not high (*None*).

## SEQUENCE STATE ANALYSIS

### Background and rationale

Social sequence analysis is a special application of sequence state analysis (SSA), a set of statistical methods that were originally developed in bioinformatics to analyse genetic sequences,<sup>19</sup> that began in the 1980s but have now become increasingly prevalent in lifecourse epidemiology<sup>20</sup>. Pathway analysis used in conjunction with social science data presents a novel and insightful way of interpreting longitudinal information (a repeated explanatory variable such as housing tenure and income) in a way that more traditional multivariate analyses are less nuanced to do.

Utilising the *Growing Up in New Zealand* cohort we have charted housing and income journeys for families with preschool children over their initial five years of life. This tracing of income and housing states provides an understanding about the prevalence of the pathways and flux between states for contemporary NZ families with preschool children. Our use of longitudinal data and sequence state cluster analyses will make a significant contribution to building new longitudinal data use capability and demonstrate new applications of the *Growing Up in New Zealand* dataset to an important policy issue.

This research could not be undertaken without longitudinal data (i.e. with the use of cross-sectional data) as it requires following individuals/families over time in combination with related environmental data in order to be able to analyse changes in housing and tenure and its potential effects on child outcomes. The pathway models can then provide policy relevant information that helps our agency collaborator Kāinga Ora – Homes and Communities (previously Housing New Zealand) to determine how to better engage with families in this important period of their life journey and target their services better to meet their clients' needs.

### Methodology

#### STEP 1. DETERMINING THE SEQUENCE STATES

Family housing and income journeys are defined as sequences of categorical states through time. States used for sequence analysis have been determined using participant reported household income and housing type at four timepoints (Antenatal, 9 month, 2 year and 4 years) from pregnancy until their child was four years of age.

#### STEP 2. DEFINING SEQUENCE STATES – HOUSING AND INCOME CATEGORIES

Housing state was divided into three categories: Private home ownership, Private rental and Public rental. Annual household total income before tax was grouped into three categories: Low, Medium and High.

#### STEP 3. SEQUENCE STATE ANALYSIS (SSA)

The sequential combination of individual states at each timepoint is termed a sequence of states. Analysis of these sequences is termed sequence state analysis (SSA) and describes the journeys people or households take over time. Data analyses was performed using the TraMineR package in R<sup>21</sup>. If participants were missing state data at the Antenatal data point or if they only had the 4 year data point they were excluded from analyses. Initial SSA analyses included determining the distribution of states at each timepoint and the most common sequences. These are described in the Results section. The diversity of states at each timepoint, and the flux of states across a sequence (turbulence) are described in **Appendix 3**.

## METHODS



## STEP 4. OUTPUTS AND PLOTS

Sequence plots have been used in this report to provide a visual representation of categorical data across the first four years of the cohort children's lives. At each timepoint (e.g. Antenatal, 9 month, 2 year, and 4 years), families are grouped into exclusive categories or 'states' (by household income and tenure type). For each family, their 'sequence' is determined by joining these categories up across time. In this way we see the journey each family takes over the time period under investigation. For some families, the category or state they belong to will not change across time and their sequence will be represented visually by a single colour. For others there may be movement between different categories at each timepoint creating a sequence that contains multiple colours (representing changes in state/category). The potential complexity of these sequences is determined by the number of possible categories and the number of timepoints but also the lived realities of families (i.e. how common it is to move between categories over time). The proportion of participants experiencing a specific sequence is directly proportional to the height of the sequence on the y-axis. The sequence plots present individual participant journeys ordered by the proportion of participants who experience the same journey such that the most common sequence will be presented at the bottom of the y-axis. For further explanation see the example plot and associated description (Figure 2).

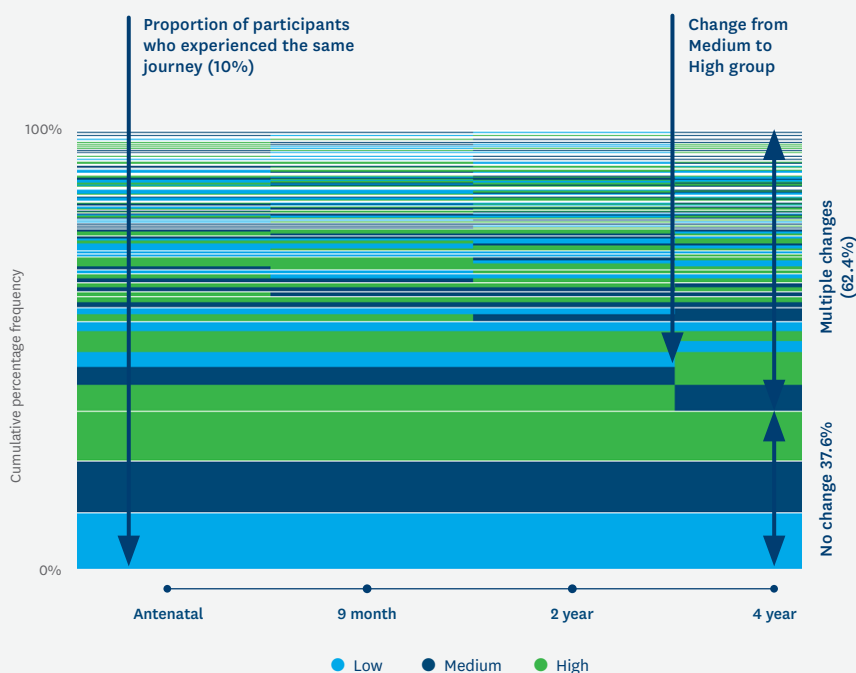
## EXAMPLE FREQUENCY PLOT AND DESCRIPTION – FIGURE 2

The sequence frequency plot demonstrates the trajectories present in an example cohort with regards to three groups (low, medium, high), who had this data at each of the timepoints under investigation (Antenatal, 9 month, 2 year and 4 years). The most common sequences or trajectories are represented at the bottom of the y-axis and represent those participants (37.6%) who did not change group at any of the timepoints. The remainder of the participants (62.4%) experienced at least one change in group at one of the timepoints, with many experiencing multiple changes (visualised as colour changes from one timepoint to the next) over this time.

## STEP 5 CLUSTERING OF SIMILAR FAMILIES' JOURNEYS

We have explored our families' journeys further by using a statistical methodology that groups clusters of similar patterns of sequences across the households. See **Appendix 3** for clustering methodology and sequence complexity of each cluster. We then examined how the families who belong to these clusters (i.e. those with similar journeys) differed in terms of socio-demographics and child health and wellbeing outcomes at four years of age.

FIGURE 2. Sequence frequency plot example



## METHODS



## CHILD OUTPUT VARIABLES USED AT FOUR YEARS

We have used a range of child outputs measured at the four year interview to investigate the effects of sociodemographic factors and tenure/income cluster type. Child health outcomes, as reported by the child's mother, range from general health status to more specific illnesses and infections, accidents, and injuries, as well as number of visits to the doctor (to indicate high need health issues) (see **Table 1**, **Appendix 4** for details). The socio-behavioural development of the preschoolers was assessed by using a measure of child self control, the Gift Wrap Task (GWT;<sup>22</sup>), and by using the Strengths and Difficulties Questionnaire (SDQ;<sup>23</sup>). The (SDQ) was completed by mothers and the

outcomes are separated into four distinct areas including; emotion problems, hyperactivity and inattention, peer relationships and prosocial behaviour. Results were then categorised into normal, borderline and abnormal behaviour. Lastly, we looked at numeracy and literacy by using the Name and Numbers task completed by the children. The first task asked the children to write their name and were scored for letter/name recognisability. The second measure asked the children to count out loud from 0–10. See **Appendix 4** for further details on the output variables used and **Table 1** for how those variables were derived for use in the final regression models.

**TABLE 1.** Child output variables.

Output variable	Description
<b>Child health</b>	
<b>General health</b>	Binary variable – child health scale (poor + fair vs. good + very good + excellent)
<b>Diagnosis of asthma</b>	Binary: Yes = 1, no = 0
<b>Other respiratory infections</b>	Binary: Yes to any = 1, no to all = 0
<b>Skin infection</b>	Binary: Yes to any = 1, no to all = 0
<b>Injury (hospitalisations)</b>	Numerical: Number of injuries
<b>GP visits</b>	Binary: 0+1+2 visits in last 12 months=0, 3+ visits=1
<b>Socio-behavioural development</b>	
<b>Self control – Gift Wrap Task</b>	Binary: Child never peeked=1, child peeked 1 or more times=0
<b>SDQ (emotion)</b>	Binary: Normal=0, Borderline +Abnormal=1
<b>SDQ (prosocial)</b>	Binary: Normal=0, Borderline +Abnormal=1
<b>SDQ (peer relationships)</b>	Binary: Normal=0, Borderline +Abnormal=1
<b>SDQ (hyper and inattention)</b>	Binary: Normal=0, Borderline +Abnormal=1
<b>Education</b>	
<b>Name and Numbers (Writing)</b>	Binary: Score 0+1+2=0 vs. 3+4=1
<b>Name and Numbers (Counting)</b>	Binary: Incomplete sequence 0–9=0, complete sequence 0–10=1

## STATISTICAL ANALYSIS

For regression models investigating sociodemographic factors and SSA cluster type on child health outputs at four years a P-value of <0.05 was considered statistically significant. A multiple correction test was applied to the

analyses creating an adjusted P-value for significance. All analyses were carried out using R<sup>24</sup> on the External *Growing Up in New Zealand* data access platform (Guacamole v.0.8.4).



# Results

## HOUSING TENURE

The percentage of families within each tenure state are presented in Table 2. Nearly 60% of the families were in the home ownership group. There is little change in the proportion of families living in public rental housing over

time, a small decrease in families living in private rental housing, and a small increase over time in those living in a house that is privately owned.

TABLE 2. Housing states across the four timepoints.

Housing state	COLLECTION WAVE			
	Antenatal	9 month	2 year	4 year
	n (%)	n (%)	n (%)	n (%)
Private home ownership	2924 (56.1%)	2953 (56.6%)	2989 (57.3%)	3131 (60.0%)
Private rental	1970 (37.8%)	1950 (37.4%)	1925 (36.9%)	1772 (34.0%)
Public rental	321 (6.2%)	312 (6.0%)	301 (5.8%)	312 (6.0%)
<b>Total N</b>	5215	5215	5215	5215

### Changes in housing tenure type across different timepoints

Approximately 70% of families did not change tenure type across the four timepoints (Table 3). For those families that had changed their tenure type over this time period (n= 1646), nearly one-quarter changed tenure once. Less than 10% changed tenure type twice or more. For the 31.6%

of families that did change tenure type at any point, 12.4% went from family home ownership at the Antenatal timepoint to private rental at one timepoint, 15.3% were first in private rental and changed to family home ownership and 3.8% went either between private rental to public rental or vice versa across the timepoints. Of the n=321 families in public rental housing at the Antenatal timepoint, n=176 (54.8%) stayed in public rental across all the timepoints.

TABLE 3. Changes in tenure type across time.

Housing tenure type at four different timepoints (N=5215)			
Same house tenure types across four timepoints (n=3569, 68.4%)		Change in house tenure type at any of the four timepoints (n=1646, 31.6%)	
Home ownership	2276 (43.6%)	Changed once	1262 (24.2%)
Private rental	1117 (21.4%)	Changed twice	356 (6.8%)
Public rental	176 (3.4%)	Changed three times	28 (0.5%)



## RESULTS



## HOUSEHOLD INCOME

The percentage of participants categorised as low (less than or equal to \$50,000), medium (less than or equal to \$100,000 and greater than \$50,000) and high income (greater than \$100,000) at each timepoint is presented in Table 4. On average, approximately 20% of families were in

the low income group and a third in each of the medium and high income groups. Additionally, there are relatively similar proportions of families in each income group across the four timepoints. On average, 12% of families had missing income information at each timepoint.

**TABLE 4.** Household income across the four timepoints.

Income	TIMEPOINT				Average
	Antenatal	9 month	2 year	4 year	
	n (%)	n (%)	n (%)	n (%)	%
<b>Low ≤ 50K</b>	935 (17.9)	1214 (23.3)	1231 (23.6)	772 (14.8)	19.9
<b>Medium ≤ 100K</b>	1795 (34.4)	2065 (39.6)	1823 (35)	1662 (31.9)	35.2
<b>High &gt; 100K</b>	1783 (34.2)	1265 (24.3)	1696 (32.5)	2037 (39.1)	32.5
<b>Missing</b>	702 (13.5)	671 (12.9)	465 (8.9)	744 (14.3)	12.4
<b>Total N</b>	5215	5215	5215	5215	

RESULTS

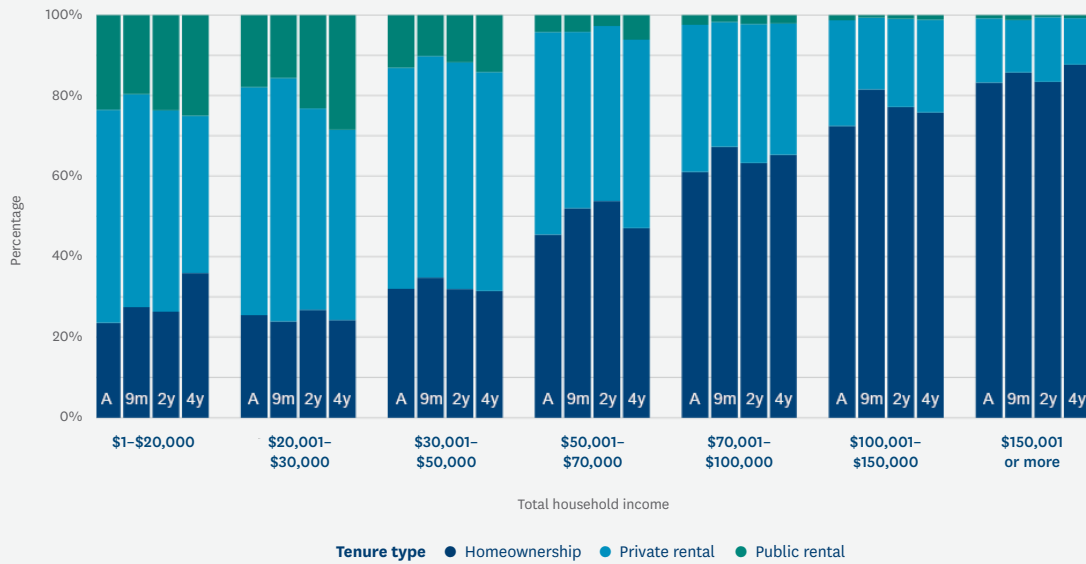


## INCOME AND HOUSING

The relationship between total household income and tenure type is presented in Figure 3. The proportion of families who lived in a family owned home was greater in those reporting the highest total household income. In contrast, living in public housing or private rentals was more common for those families with lower total household income. Overall, although the proportions of families living in the different tenure types did not change markedly across the four time

periods there were small differences in the proportion of tenure types for each income group. Note that as this study has not used equivalised income but total family income there are over 20% of cohort participants with very low annual income (<\$20,000 per annum) in the home ownership group and conversely a small number of participants with over \$150,000 total annual income in the public rental tenure type.

**FIGURE 3.** Household income by housing type over time. Key: A=Antenatal, 9m=9 month, 2y=2 year, 4y=4 year interview



## RESULTS



When looking at categories of housing and income including those families with missing income data (NA=missing) there are nine possible categories. The percentage of families in each of the nine combinations across the whole cohort (N=5215) for each of the four timepoints is presented in Table 5. The missing income data for each of the three tenure types is between 0.8–5.8% of families and similar

across the four timepoints (Table 5). The most common category (over 20% of the cohort) described is the home ownership with high income group across all the timepoints. However, there are small but important proportions of families living in private rental with low income (n=514–678) and in public rental with low income (n=149–195) across the four timepoints.

**TABLE 5.** Income and tenure type sequence states. NA = missing.

Category	Label	COLLECTION WAVE			
		Antenatal	9 month	2 year	4 year
		n (%)	n (%)	n (%)	n (%)
<b>1_1</b>	Ownership low income	272 (5.2)	379 (7.3)	370 (7.1)	272 (5.2)
<b>1_2</b>	Ownership medium income	982 (18.8)	1240 (23.8)	1074 (20.6)	982 (18.8)
<b>1_3</b>	Ownership high income	1367 (26.2)	1051 (20.2)	1354 (26)	1367 (26.2)
<b>1_NA</b>	Ownership missing income	303 (5.8)	283 (5.4)	191 (3.7)	303 (5.8)
<b>2_1</b>	Private rental low income	514 (9.9)	678 (13)	666 (12.8)	514 (9.9)
<b>2_2</b>	Private rental medium income	756 (14.5)	765 (14.7)	704 (13.5)	756 (14.5)
<b>2_3</b>	Private rental high income	396 (7.6)	203 (3.9)	329 (6.3)	396 (7.6)
<b>2_NA</b>	Private rental missing income	304 (5.8)	304 (5.8)	226 (4.3)	304 (5.8)
<b>3_1</b>	Public rental low income	149 (2.9)	157 (3)	195 (3.7)	149 (2.9)
<b>3_2</b>	Public rental medium income	57 (1.1)	60 (1.2)	45 (0.9)	57 (1.1)
<b>3_3</b>	Public rental high income	20 (0.4)	11 (0.2)	13 (0.2)	20 (0.4)
<b>3_NA</b>	Public rental missing income	95 (1.8)	84 (1.6)	48 (0.9)	95 (1.8)
<b>Total</b>	N	5215	5215	5215	5215

RESULTS



## SEQUENCE STATE ANALYSIS

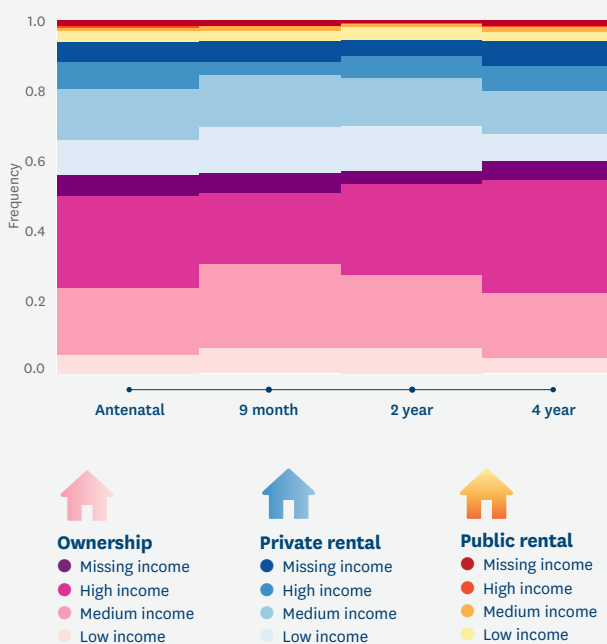
Initial SSA analyses including the diversity of states at each timepoint and the flux of states across a sequence can be found in Appendix 3.

### General characteristics of SSA

#### STATE DISTRIBUTION

The distribution or proportion of families who were categorised as each state at each timepoint are presented in Figure 4. At the Antenatal timepoint the most common state is home ownership with high income followed by home ownership with medium income. At the 9 month interview the proportion of families in the home ownership and low income group has increased as has the home ownership medium income group with a decrease in the frequency of home ownership high income families. The private rental high income frequency has also decreased whereas the proportion of those living in a private rental with low income has increased. By the 2 year interview the frequencies of home ownership with high income and private rental with high income had increased to the levels at the Antenatal period. At the 4 year interview there was again an increase in frequency of those families in the home ownership high income group and a further decrease in the private rental low income group.

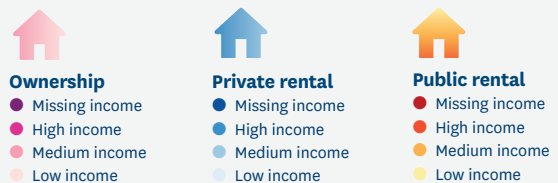
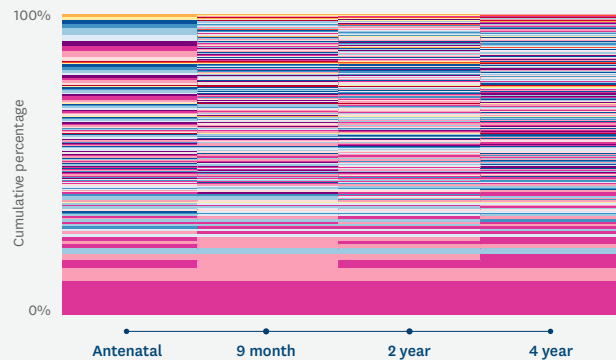
FIGURE 4. State distribution plot. The proportion of families in each state at each timepoint



#### SEQUENCE FREQUENCY

There were 1306 unique sequences or journeys in the dataset. Each of these unique sequences are presented in Figure 4 in order of their relative proportions (most common sequence is presented at the bottom of the y-axis with the height being proportional to the percentage). Overall, for most families, their sequence included multiple changes in state at each timepoint (represented by changes in colour between timepoints in Figure 5). However, in terms of the individual sequences with the highest proportion (most common sequence), were those in the home ownership with high income group at each timepoint (i.e. they did not change across the four timepoints, hence representing stability for families)(11.4%), followed by those living in the home ownership and medium income group at each timepoint (4.6%).

FIGURE 5. Sequence frequency plot for the whole cohort (N=5215)



## RESULTS



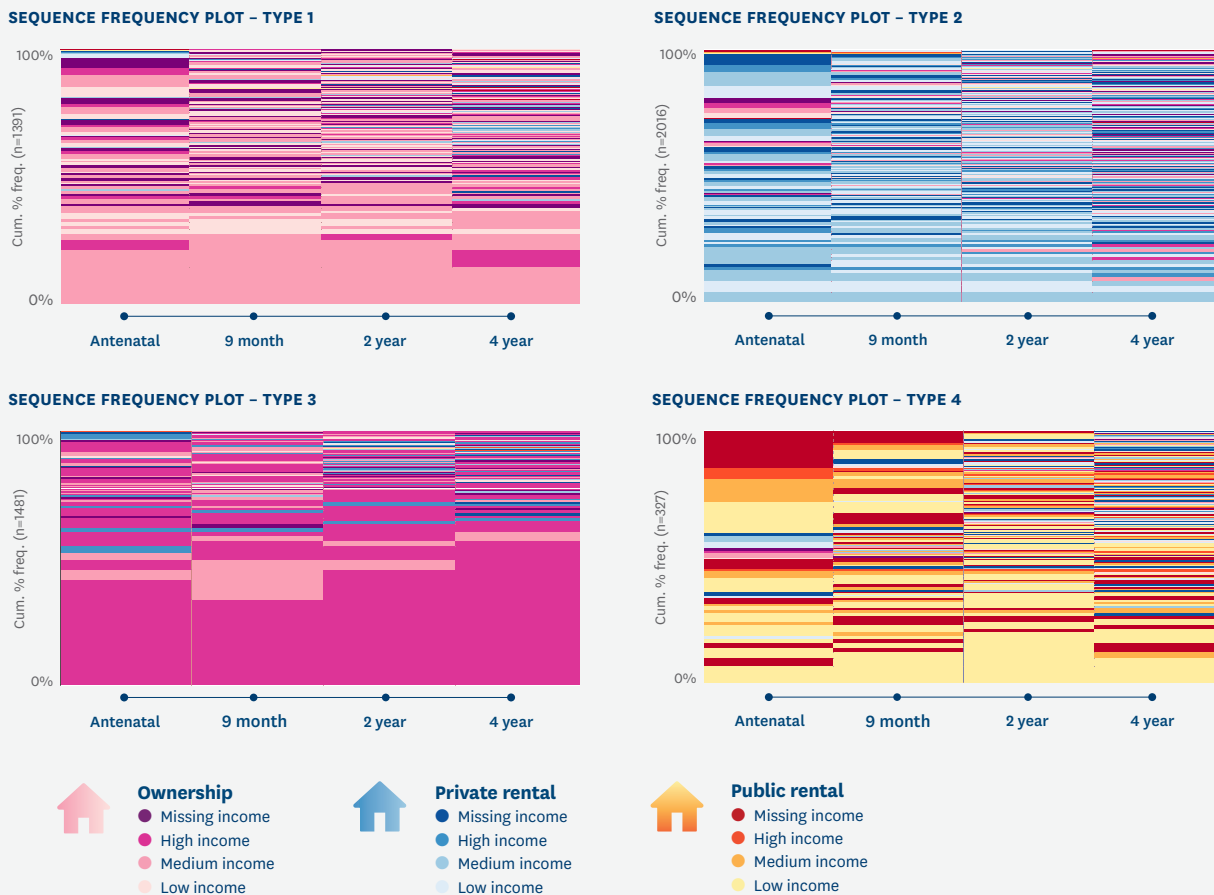
### Sequence states present within each cluster

In order to determine the common sequence journeys for families, the similarities and distances between sequences for all possible pairs of sequences was calculated. These were then clustered (see **Appendix 3** for greater detail) and gave four distinct clusters. The frequency of the sequences within each of the four cluster types are presented in Figure 6. In the figure, sequences that are a single colour (representing stability over time) were most common for cluster Type 1 and 3 compared to cluster Type 2 and 4 which had a low proportion of sequences of one colour. This highlights the complexity of the families journeys,

for cluster Type 2 and 4. Cluster Type 1 represents  $n=1391$  of the 5215 families in the cohort, cluster Type 2 represents  $n=2016$ , cluster Type 3  $n=1481$  and cluster Type 4 is the smallest cluster of  $n=327$ .

Sequence complexity as measured using turbulence differed for each of the cluster type groups. A sequence that has many distinct states and state changes between timepoints is more turbulent than a series with fewer unique states and state changes. Cluster Type 2 had the greatest sequence complexity (mean = 3.25), followed by cluster Type 4 (mean = 2.96) and cluster Type 1 (mean = 2.85). Cluster Type 3 had the lowest sequence complexity (mean = 2.25).

**FIGURE 6.** Sequence frequency plot for the four cluster types for the whole cohort



*Note: These plots are presented to highlight the differences in tenure and income groups between the cluster types and also to demonstrate the complexity of journeys for families; especially those in cluster Type 2 and 4.*

RESULTS



The distribution of states in each of the clusters (Figure 7) shows the majority of families in cluster Type 1 are in the home ownership medium income group and the proportion of this group is relatively constant across the timepoints. There can be seen at 9 months and 2 years an increase in families in the home ownership low income group and a comparable decrease in home ownership high income group. Also, of note is that at the 4 year timepoint this pattern has reverted to one more similar to the Antenatal pattern of states except there is an increase of families at this timepoint in the private rental groups.

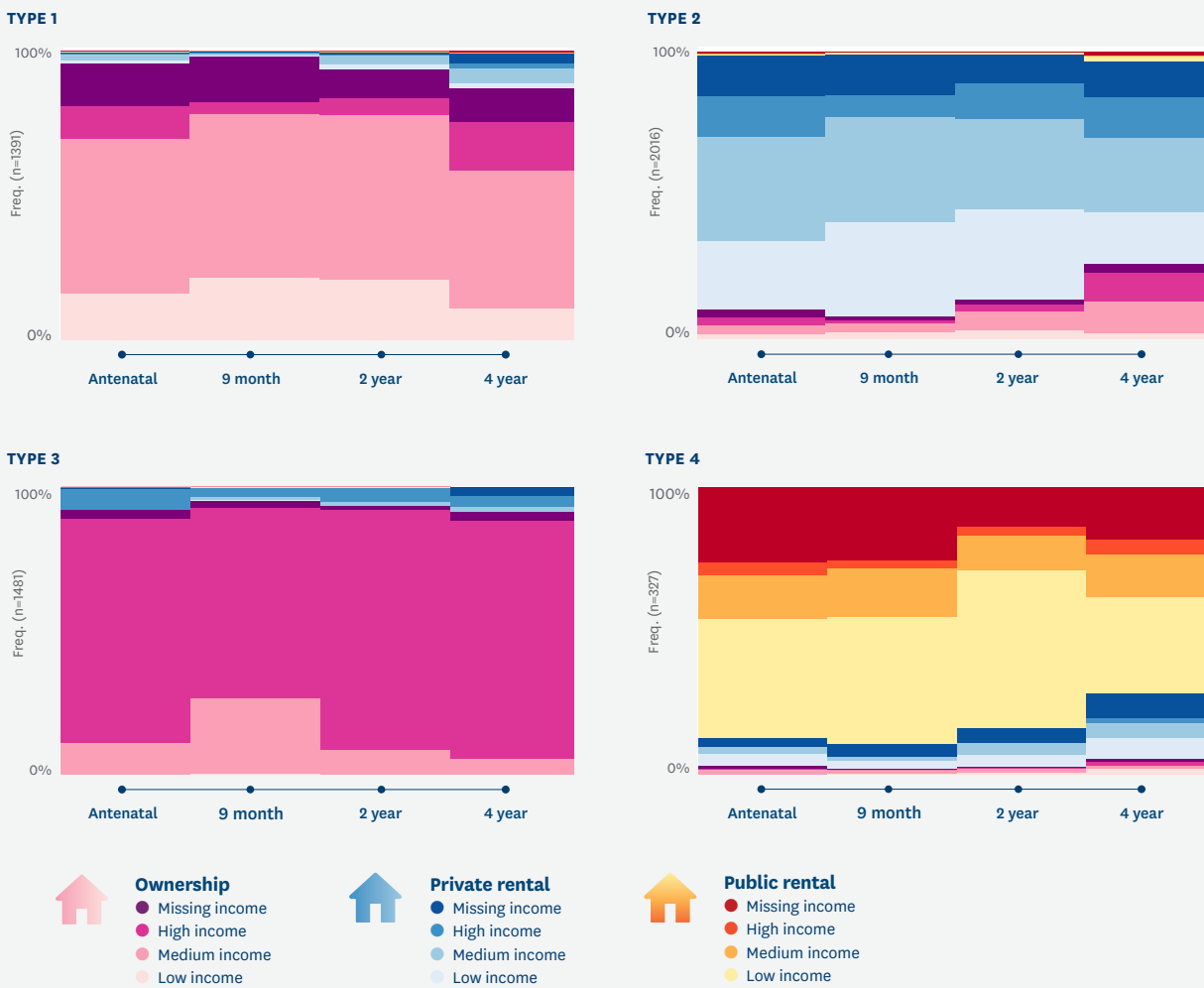
Cluster Type 2 is dominated by the private rental states (low, medium and high income) with a small proportion of families in the home ownership groups. This proportion of families is smallest at the 9 month timepoint and then

increases at both 2 year and again at the 4 year timepoints as the proportion of families in the private rental low and medium groups decreases.

The great majority of cluster Type 3 are home ownership high income families and only at the 9 month timepoint do we see a decrease in this proportion and an increase in the medium income group which has declined again by the next timepoint at two years.

Lastly, cluster Type 4 is mostly made up of families in the public housing tenure type of all income groups. The proportions of these states are relatively constant across the timepoints with a slight decrease in families in the low income group at the 4 year timepoint. There is also an increase of families in the private rental groups from the 9 month timepoint onwards in this cluster.

FIGURE 7. Distribution plot of states at each timepoint within each cluster



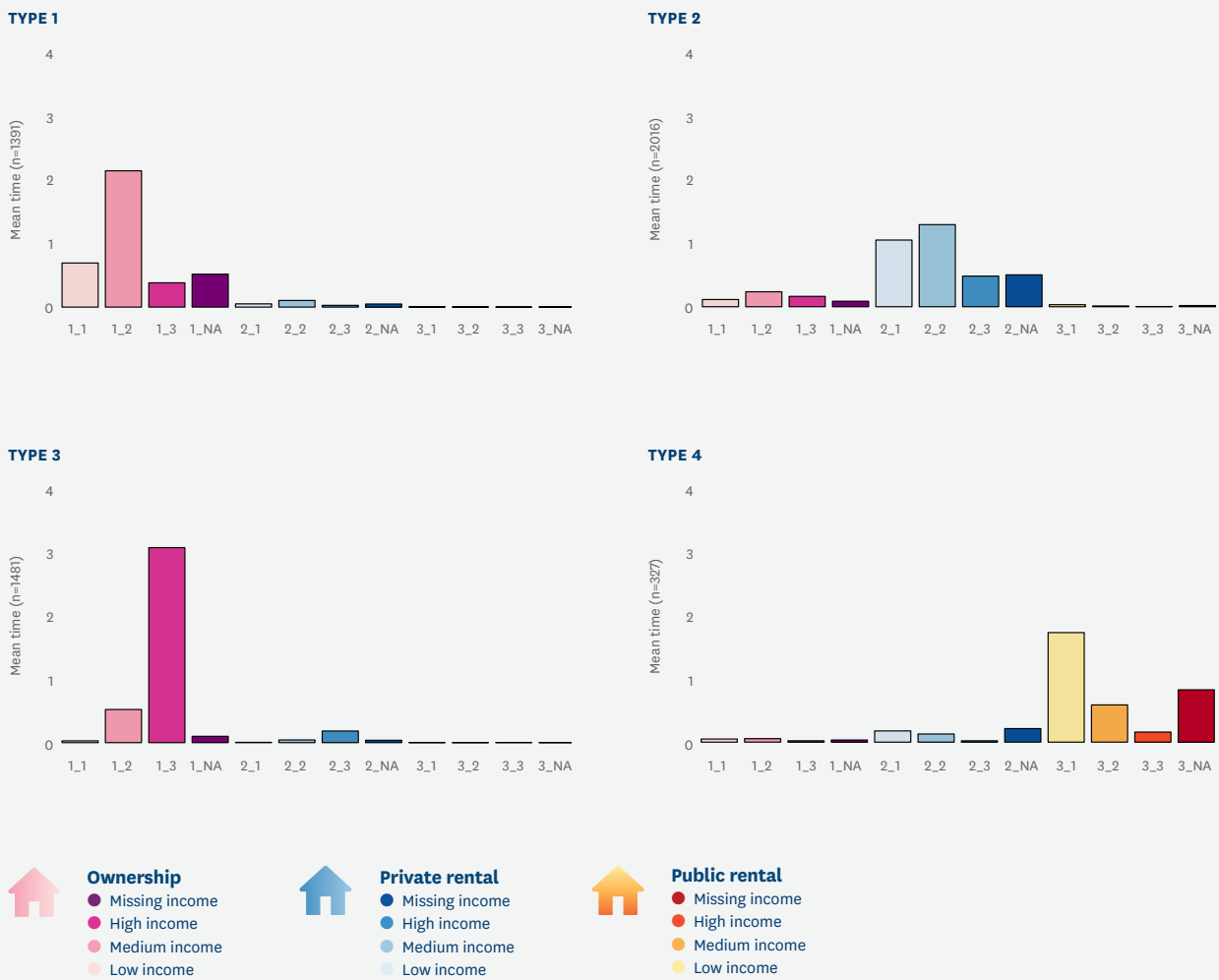
RESULTS



The average amount of time spent in each unique state across the four cluster types is presented in Figure 8. The families that spent the longest time in any one state was the home ownership with high income, followed by the home ownership medium income families. The other states that families spent a noticeable amount of time in were those in private rental homes with medium or low income or in public rental housing with low income. Note families in private rental homes in cluster Type 2 had a lower average time spent in state than across the income groups compared to the other three cluster types.

The families that spent the longest time in any one state was the home ownership with high income, followed by the home ownership medium income families.

FIGURE 8. Mean time spent in each state across the four cluster types



## RESULTS



## Detailed description of clusters

# Cluster Type 1

This cluster (Type 1) contains  $n=1391$  families (26.7% of the total cohort). The 20 most common sequences in the cluster represents 52% of all sequences in the whole cluster (Figure 9). Most of the sequences within this cluster include states predominately from families who were classified as home ownership with medium income (●) and a smaller proportion of sequences including home ownership with low income (●) at each timepoint (although they tend to move between the different income groups as represented by changes in the shade of pink/purple). The most common sequence in this cluster is made up of home ownership with medium income across all four timepoints. The next most common sequence was for families that owned their homes but moved from high to medium income and vice versa. The home ownership with medium and low income journeys are the next most frequent for this cluster followed by those families that owned their homes but had missing income states.

## Characteristics of cluster Type 1

On average cluster Type 1 mothers had their cohort child at 30 years old. These mothers were in good health and most of them were non-smokers (86.8%). Nearly two out of five (39.1%) of these mothers had a degree. At least two out of every three of the children in cluster Type 1 had two parents at home (69.5% at the 2 year timepoint), a further 22.3 percent (at the two year timepoint) had the extra company of extended family. Most of the children had siblings (86.9%). At 9 months over half (58.8%) the cluster Type 1 cohort families had experienced at least one hardship in the 12 months prior to the interview, this had reduced by the time the children were four to just over a third (38.4%).

FIGURE 9. 20 most common family journeys for cluster Type 1





## RESULTS



## Characteristics of cluster Type 1

## Mothers' characteristics

Note: The percentages presented may not add to 100% as the missing and non-response items have not been displayed. Complete data n (%) can be found in the Cluster Comparison section and in Appendix 5.

Maternal age  
(Antenatal)

**30.68**  
years old  
MEAN AGE

## Pre-pregnancy health



**19.8%**  
EXCELLENT



**37.5%**  
VERY GOOD



**33.6%**  
GOOD

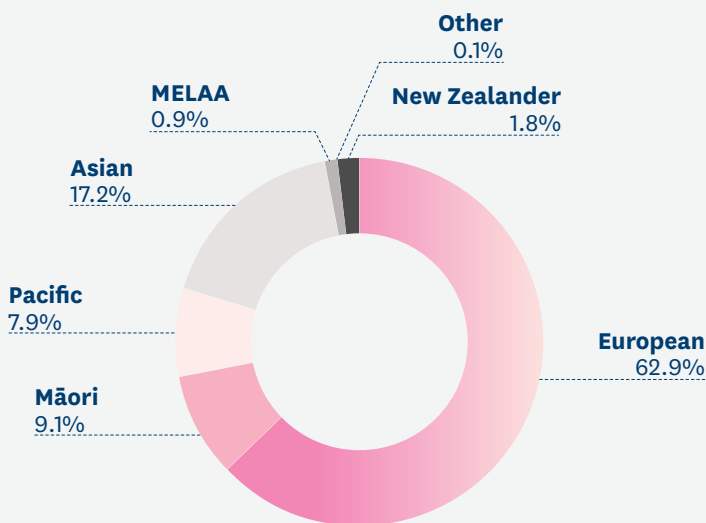


**7.3%**  
FAIR



**1.9%**  
POOR

## Ethnicity

Education  
(Antenatal)

<b>2.7%</b>	No secondary qualification
<b>24.2%</b>	Secondary school / NCEA 1
<b>34%</b>	Diploma/Trade certificate/ NCEA 5–6
<b>25.2%</b>	Bachelor's degree
<b>13.9%</b>	Higher degree

## Smoking score (cumulative across time)



0

86.8%

1

4.0%

2

2.4%

3

3.6%

4

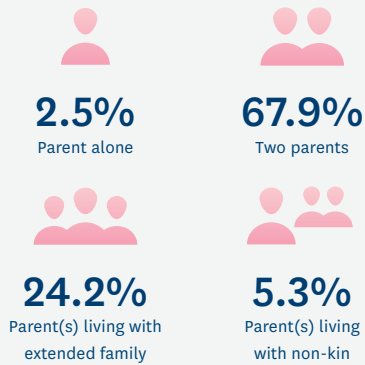
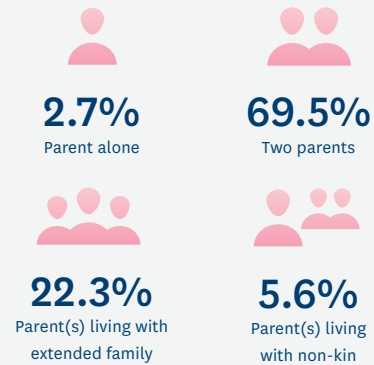
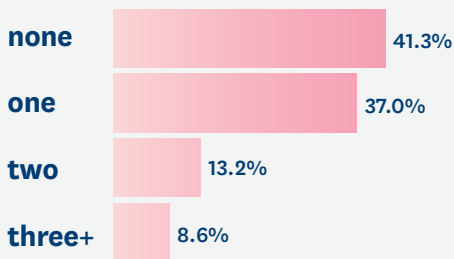
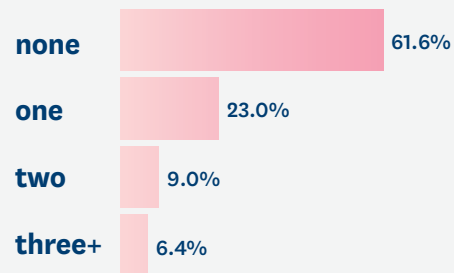
3.2%

## RESULTS



## Characteristics of cluster Type 1

## Family characteristics

Structure  
(Antenatal)Structure  
(2 year)Number of hardships  
(9 month)Number of hardships  
(4 year)

Mothers of children in cluster Type 1 noted their reasons for living in their current neighbourhood at the Antenatal timepoint. The most common reason was a good and safe neighbourhood, followed by having friends and family nearby. When their children were 2 years old the majority of mothers (over 80%) agreed or strongly agreed they had access to basic shopping facilities and services such

as banks. Additionally, more than 70% agreed or strongly agreed that there was access to good playgrounds and play spaces and they had access to affordable and regular public transport.

Half the children in this group had not moved house by the 4 year timepoint, with only 2.2% having moved three or more times.

## RESULTS



## Characteristics of cluster Type 1

## Housing characteristics

Residential mobility  
(cumulative across time)

<b>never moved</b>	50.8%
<b>moved once</b>	33.4%
<b>moved twice</b>	12.8%
<b>moved three or more times</b>	2.2%

Crowding score  
(cumulative across time)

<b>zero</b>	80.5%
<b>one</b>	17.2%
<b>two</b>	1.2%
<b>three</b>	0.5%
<b>four</b>	0.5%

Sleeping arrangements  
of cohort child (3 year)

<b>46.5%</b>	Separate room alone
<b>30.3%</b>	Separate bed in a shared room with other children
<b>3.3%</b>	Shared bed with other children
<b>4.9%</b>	Separate bed in a shared room with parents
<b>12.6%</b>	Shared bed with parents
<b>0.8%</b>	Separate bed in a shared room with other adults
<b>1.7%</b>	Shared bed with other adults

Dwelling type  
(2 year)

	<b>87.3%</b>	Separate
	<b>3.9%</b>	Semi-detached
	<b>3.1%</b>	Flat/unit/apartment
	<b>0.2%</b>	Caravan/cabin
	<b>0.3%</b>	House/flat attached to shop/office
	<b>4.6%</b>	Farmhouse/building
<b>OTHER</b>	<b>0.5%</b>	Not sighted/other

At the 2 year timepoint the majority of the cluster Type 1 children were living in detached dwellings (87.3%). At age three nearly half of them had their own room (46.5%), 30.3% shared a room with other children, and just over one-in-ten (12.6%) shared a bed with their parents. However, about one-in-five of the children in cluster Type 1 had lived in a crowded ( $\geq 2$  people per bedroom) dwelling at least once by the 4 year timepoint.

When asked about dampness in their homes when the cluster Type 1 children were 9 months old 16% of families

stated they were often or always damp, nearly a fifth (18.8%) stated their houses had condensation often or always, fewer than one-in-ten (8.4%) said the house was mouldy or had mildew. Once the children were 4 years old nearly a third of the families had installed insulation and a third had installed a heating system. Of those that had installed either insulation or a heat pump, nearly 30% had used the Warm Up NZ or a similar subsidy. Even if they had made no alterations (34.4%) nine in ten of the houses had insulation and 95% were heating their houses when needed.

## RESULTS



## Characteristics of cluster Type 1

## Housing characteristics

Alterations to current house  
(4 year)

31.7%	Insulation installed	17.3%	HRV / DVS / similar installed
22.1%	Heat pump installed	5.0%	Double glazing installed
29.6%	Heat pump / insulation subsidised by Warm Up NZ or similar	34.4%	No changes made
10.9%	Other heating system installed		

Insulation in house  
(4 year)

90.8%

Yes

51.9%

Yes, under the floor

86.6%

Yes, in the ceiling

47.6%

Yes, in the walls

Heating in house  
(4 year)

94.5%

Yes

3.9%

No, even if  
house was cold

1.6%

No, house  
was not cold

## dampness

PRESENT (9 MONTH)

16.0%

Quite often / always / almost always

## condensation

PRESENT (9 MONTH)

18.8%

Quite often / always / almost always

## mould &amp; mildew

PRESENT (9 MONTH)

8.4%

Yes

## RESULTS



## Characteristics of cluster Type 1

## Neighbourhood characteristics

Experience of  
high deprivation

39.5%  
at any timepoint

Reasons for living in current neighbourhood  
(Antenatal)



Work  
27.4%



Good education  
16.0%



Like the  
local lifestyle  
32.7%



Spouse / partner /  
family house here  
34.5%



Handy to shops  
and amenities  
36.9%



Good / safe  
neighbourhood  
44.0%



Friends and  
family nearby  
40.2%



Better / more  
affordable houses /  
rentals  
37.8%



78.8%

AGREE / STRONGLY AGREE

Access to good parks /  
playgrounds/play spaces  
(2 year)



71.8%

AGREE / STRONGLY AGREE

Access to close / affordable /  
regular public transport  
(2 year)



88.4%

AGREE / STRONGLY AGREE

Access to basic  
shopping facilities  
(2 year)



82.8%

AGREE / STRONGLY AGREE

Access to basic services  
i.e. banks, medical clinics etc.  
(2 year)

## RESULTS



## Characteristics of cluster Type 1

## Child characteristics – health

## General health



	9 MONTH	2 YEAR	4 YEAR
<b>Excellent</b>	60.3%	49.9%	50.1%
<b>Very good</b>	27.7%	35.0%	34.9%
<b>Good</b>	8.3%	11.0%	12.1%
<b>Fair</b>	2.9%	3.5%	2.8%
<b>Poor</b>	0.6%	0.7%	0.1%

## Parental concern of health (4 year)



<b>42.2%</b>	No worry / concern
<b>34.2%</b>	A little worry / concern
<b>13.1%</b>	Some worry / concern
<b>5.4%</b>	Quite a bit worry / concern
<b>3.0%</b>	A lot of worry / concern

## Childhood illnesses had – last 12 months (4 year)



<b>1.7%</b>	Whooping cough/pertussis	<b>12.2%</b>	Asthma
<b>14.2%</b>	Chest infection/bronchiolitis etc.	<b>23.4%</b>	Eczema or dermatitis
<b>13.8%</b>	Cough lasting more than 4 weeks	<b>11.2%</b>	Skin infection
<b>12.4%</b>	Wheezing in the chest	<b>23.0%</b>	Throat infection or tonsillitis

The cohort children's general health for cluster Type 1 was asked of mothers at three timepoints and for half the children their mother reported they were in excellent health at all the timepoints. Additionally, at 4 years old nearly half of mothers had no worry and concern about their children's health.

Over 10% of the cohort children at 4 years old had had a range of childhood illnesses in the last 12 months, including chest infections, wheezing in the chest, skin infections and asthma and nearly a quarter of the children had a throat infection or eczema or dermatitis.

Over 80% of the cohort children had had all their immunisations due at 4 years old, consequently the incidence of vaccine preventable diseases in this cluster was 0.1–1.4%, the exception being chicken pox, which was not on the Immunisation Schedule<sup>3</sup>. Nearly 40% of the children had had chicken pox.

Nearly a third of the children had not had a course of antibiotics in the last 12 months and over two-thirds had not had an accident in their lifetime. If they had had an accident 20% were head injuries and nearly 20% were broken bones.

<sup>3</sup> Chicken pox added to the Immunisation Schedule on 1 July 2017.

## RESULTS



## Characteristics of cluster Type 1

## Child characteristics – health

## Immunisations due at 4 years – received



14.5% – no    1.5% – yes    83.5% – yes

SOME NOT ALL

## Vaccine preventable illnesses – ever had (4 year)

1.4%	Measles including German (Rubella)
0.1%	Mumps
39.7%	Chicken pox
0.4%	Meningitis
0.1%	Rheumatic fever
0.4%	Scarlet fever

## Courses antibiotics – last 12 months (4 year)

32.9%	None
43.5%	One–two courses
13.8%	Three–four courses
5.6%	Five–six courses
3.8%	Seven or more courses

## Accidents and injuries in their lifetime (4 year)



66.9%	None
23.4%	One
6.2%	Two
3.2%	Three or more

## Most severe/only injury since 2 years old (4 year)



20.1%	Head injury – no loss of consciousness
19.3%	Broken bone/fracture/dislocation
12.7%	Cut needing stitches or glue
14.9%	Injury to mouth/tooth
7.4%	Fall

## RESULTS



## Characteristics of cluster Type 1

## Child's characteristics – parent &amp; child interactions (4 year)

## Telling stories



20.8% SELDOM / NEVER

53.6% ONCE / SEVERAL TIMES A WEEK

25.7% ONCE / SEVERAL TIMES A DAY

## Encouraged to read words

cat  
hat

19.5% SELDOM / NEVER

48.5% ONCE / SEVERAL TIMES A WEEK

32% ONCE / SEVERAL TIMES A DAY

## Reading books



3.8% SELDOM / NEVER

33.4% ONCE / SEVERAL TIMES A WEEK

62.7% ONCE / SEVERAL TIMES A DAY

## Encouraged to count

1-2-3

2.2% SELDOM / NEVER

42.3% ONCE / SEVERAL TIMES A WEEK

54.6% ONCE / SEVERAL TIMES A DAY

## Sing songs / play music



5.2% SELDOM / NEVER

47.8% ONCE / SEVERAL TIMES A WEEK

47% ONCE / SEVERAL TIMES A DAY

## Encouraged to recognise numbers

1 7  
9 2 3 8  
5 6 4

9.6% SELDOM / NEVER

47.8% ONCE / SEVERAL TIMES A WEEK

42.5% ONCE / SEVERAL TIMES A DAY

## Encouraged to print letters / words / numbers

hello  
my name  
is John

10.5% SELDOM / NEVER

55.8% ONCE / SEVERAL TIMES A WEEK

33.6% ONCE / SEVERAL TIMES A DAY

When we asked mothers about their interactions with their children at 4 years old, over half told them stories and a third read books to their children once to several times a week. Additionally, nearly half of mothers in cluster Type 1 were singing songs or playing music once to several times a day with their child. A third of mothers were encouraging their children to print words or letters or read words at least daily. Over 40% of mothers were encouraging their child to count or recognise numbers once to several times a day.



## RESULTS



## Characteristics of cluster Type 1

## Child's characteristics – development factors

Child self control – Gift Wrap Task  
(4 year)

<b>70.5%</b>	DID NOT PEEK
<b>13.4%</b>	PEEKED ONCE
<b>13.0%</b>	PEEKED MORE THAN ONCE
<b>3.1%</b>	PEEKED MORE THAN ONCE AND REMAINED PEEKING
<b>0.0%</b>	CHILD PEEKED AND TOUCHED THE GIFT

SDQ – Emotion problems  
(4 year)

<b>85.2%</b>	NORMAL
<b>7.1%</b>	BORDERLINE
<b>7.7%</b>	ABNORMAL

SDQ – Hyperactivity/  
inattention (4 year)

<b>80.2%</b>	NORMAL
<b>7.8%</b>	BORDERLINE
<b>12.0%</b>	ABNORMAL

SDQ – Peer relationships  
(4 year)

<b>76.9%</b>	NORMAL
<b>12.3%</b>	BORDERLINE
<b>10.8%</b>	ABNORMAL

SDQ – Prosocial  
behaviour (4 year)

<b>86.2%</b>	NORMAL
<b>9.7%</b>	BORDERLINE
<b>4.1%</b>	ABNORMAL

## Name and Numbers score – My name is (4 year)

<b>2.5%</b>	NO RESPONSE	<b>18.1%</b>	RECOGNISABLE NAME – LETTERS CAN BE POORLY FORMED
<b>6.0%</b>	SCRIBBLE / NO RECOGNISABLE LETTERS	<b>38.4%</b>	RECOGNISABLE NAME – LETTERS CLEAR
<b>28.5%</b>	SOME RECOGNISABLE LETTERS		

Name and Numbers  
score – I can count  
up to 10 (4 year)

<b>74.6%</b>	YES (COMPLETE SEQUENCE FROM 0-10)
--------------	--------------------------------------

The cohort children's level of self control was measured at four years and over 70% of the children did not peek during the exercise demonstrating self control.

Their emotion problems, measured using the Strengths and Difficulties Questionnaire, showed over 85% were in the normal range at four years old. This pattern was similar for measures of prosocial behaviour. Over 80% were on the normal range for hyperactivity and inattention and three quarters were in the normal range for peer relationships.

Over half the children in cluster Type 1 were able to write their name recognisably, and nearly three-quarters could count out loud to ten.

## RESULTS



## Detailed description of clusters

# Cluster Type 2

This cluster (Type 2) contains n=2016 families (38.7% of the total cohort). The 20 most common sequences in the cluster, which represent 32.5% of all sequences in the whole cluster, are presented in Figure 10. Cluster Type 2 contains sequences dominated by families who were classified as private rental with medium income (●) and private rental with low income (●). The largest proportion of this cluster is made up of private rental with medium income across all four timepoints. The next most common journey was for families in private rental homes with low incomes across all four timepoints. Also seen in this cluster is a pattern of tenure changes at the 4 year timepoint with families moving from private rental (blue) homes into home ownership (pink). What is also noteworthy about this cluster is the high number of sequence changes for families across a relatively short period of time.

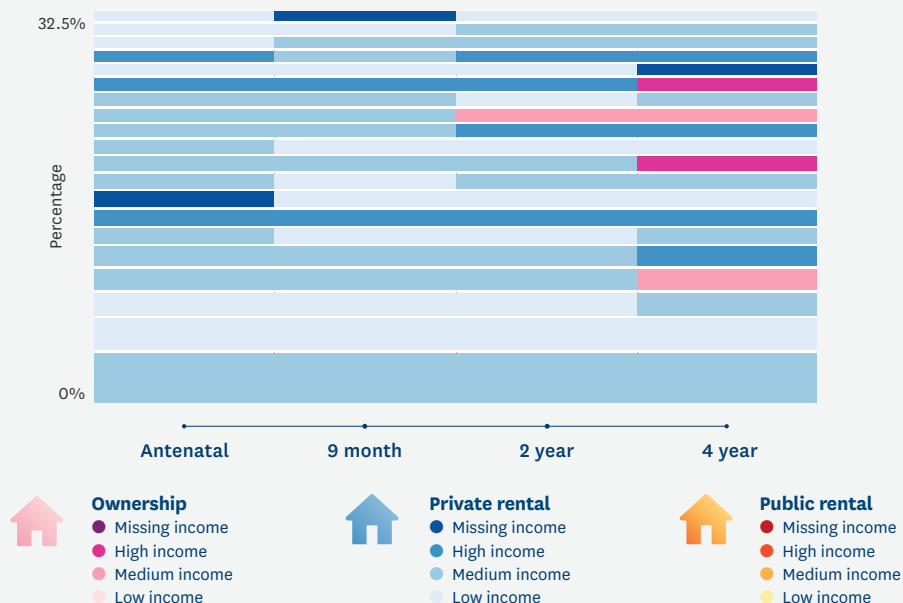
## Characteristics of cluster Type 2

Cluster Type 2 can be described as having mothers who were on average 28.5 years old when they gave birth and being predominately in good health prior to pregnancy.

Half the mothers in this cluster were of European ethnicity and nearly one in five were Māori. Nearly a third of mothers had a Bachelor's or higher degree and three-quarters had never been a smoker either before their child was born or in the four years after.

Family structure at both Antenatal and when the children were two years old was predominately made up of two parents, but the proportions of solo parents and those living with non-related kin had increased from when the cohort child was nine months to two years old. The number of hardships experienced by the families was measured when the cohort children were nine months old and again at four years old. At nine months just over a third of all our families in this cluster had experienced no hardships, in the previous year, but over a quarter had experienced one hardship. Once the children were four years old the number of families experiencing no hardships had increased to just over a half and those experiencing one hardship had decreased to less than a quarter.

FIGURE 10. 20 most common family journeys for cluster Type 2



## RESULTS



## Characteristics of cluster Type 2

## Mothers' characteristics

Note: The percentages presented may not add to 100% as the missing and non-response items have not been displayed. Complete data n (%) can be found in the Cluster Comparison section and in Appendix 5.

Maternal age  
(Antenatal)

**28.49**  
years old  
MEAN AGE

## Pre-pregnancy health



**15.8%**  
EXCELLENT



**34.7%**  
VERY GOOD



**38.1%**  
GOOD

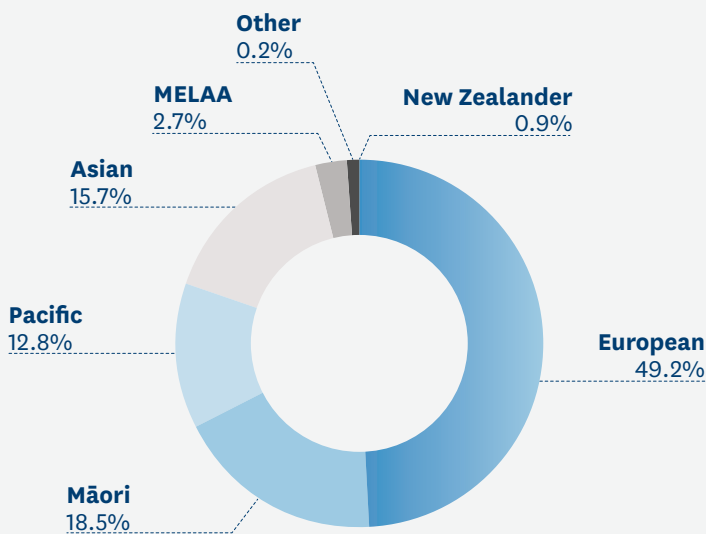


**9.2%**  
FAIR



**2.1%**  
POOR

## Ethnicity

Education  
(Antenatal)

<b>8.6%</b>	No secondary qualification
<b>25.3%</b>	Secondary school / NCEA 1
<b>34.8%</b>	Diploma/Trade certificate/ NCEA 5-6
<b>20.1%</b>	Bachelor's degree
<b>11.1%</b>	Higher degree

## Smoking score (cumulative across time)



0

75.7%

1

4.8%

2

4.4%

3

5.8%

4

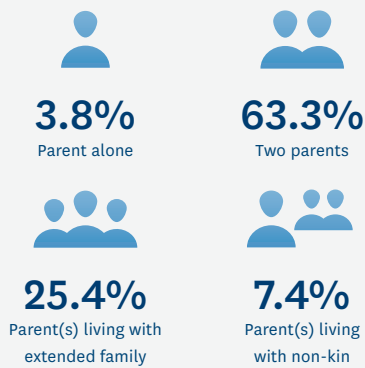
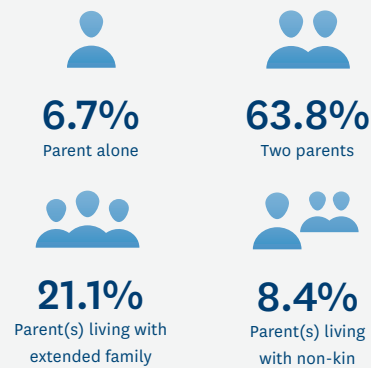
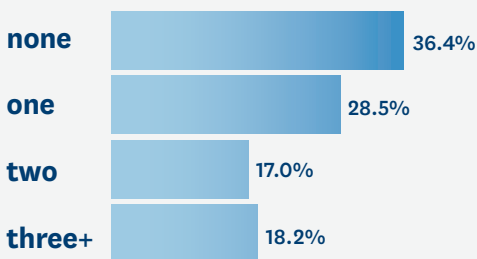
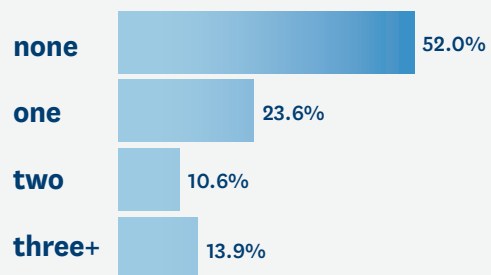
9.3%

## RESULTS



## Characteristics of cluster Type 2

## Family characteristics

Structure  
(Antenatal)Structure  
(2 year)Number of hardships  
(9 month)Number of hardships  
(4 year)

Only 15% of cluster Type 2 had never moved in their cohort child's first 4 years and nearly 20% of families had moved three or more times. However, sixty-five percent of the children had never lived in crowded ( $\geq 2$  people per bedroom) housing. Forty percent of the cohort children at 3 years old were sleeping in their own room alone and nearly 18% were sharing their bed with a parent.

When the children were 2 years old nearly three-quarters lived in detached houses and 12.7% were living in a unit or flat/apartment. At the 4 year timepoint 13.7% of families had had insulation installed; and 8.5% had had a heat pump or similar installed.

Of those that had either insulation, or a heat pump installed, nearly 40% had used the Warm Up NZ or a similar subsidy. Of note was that as these families were mostly in rental homes 7.3% did not know if the Warm Up NZ subsidy had been used. Even if there had been no alterations to the house (61.6%), three-quarters of the houses had insulation and over 90% were heating the house when needed. When asked about dampness in their homes when the children were nine months old a quarter of families stated they were often or always damp, with a quarter also stating their houses had condensation often or always. Additionally, over 15% said the houses had mould and mildew present.

## RESULTS



## Characteristics of cluster Type 2

## Housing characteristics

Residential mobility  
(cumulative across time)

<b>never moved</b>	15.8%
<b>moved once</b>	32.6%
<b>moved twice</b>	32.8%
<b>moved three or more times</b>	18.4%







Crowding score  
(cumulative across time)

<b>zero</b>	65.0%
<b>one</b>	23.9%
<b>two</b>	6.4%
<b>three</b>	3.3%
<b>four</b>	1.4%

Sleeping arrangements  
of cohort child (3 year)

<b>39.8%</b>	Separate room alone
<b>29.2%</b>	Separate bed in a shared room with other children
<b>4.5%</b>	Shared bed with other children
<b>7.1%</b>	Separate bed in a shared room with parents
<b>17.5%</b>	Shared bed with parents
<b>1.0%</b>	Separate bed in a shared room with other adults
<b>0.9%</b>	Shared bed with other adults

Dwelling type  
(2 year)

	<b>74.2%</b>	Separate
	<b>7.0%</b>	Semi-detached
	<b>12.7%</b>	Flat/unit/apartment
	<b>0.2%</b>	Caravan/cabin
	<b>0.6%</b>	House/flat attached to shop/office
	<b>4.8%</b>	Farmhouse/building
<b>OTHER</b>	<b>0.1%</b>	Not sighted/other

Over half of the families had experienced living in a high deprivation neighbourhood at some point across the four years. At the Antenatal period we asked mothers the reason they lived in their current neighbourhood, over 40% stated the reason was it was a good and safe neighbourhood and a similar proportion gave being nearby to friends and family as a reason. Over a third of mothers chose work, their house being close to shops and amenities, and having better or more affordable houses/rentals in the neighbourhood as a reason.

When their children were two years old mothers were asked about access to neighbourhood amenities and over 80% of mothers agreed or strongly agreed that their neighbourhood had access to basic shopping facilities (88.6%) and services such as banks (81.8%). Additionally, over 70% agreed or strongly agreed that there was access to good playgrounds and play spaces and they had access to affordable and regular public transport.

## RESULTS



## Characteristics of cluster Type 2

## Housing characteristics

Alterations to current house  
(4 year)

13.2%	Insulation installed	5.3%	HRV / DVS / similar installed
8.5%	Heat pump installed	1.5%	Double glazing installed
36.3%	Heat pump / insulation subsidised by Warm Up NZ or similar	61.6%	No changes made
4.2%	Other heating system installed		

Insulation in house  
(4 year)

76.3%

Yes

40.7%

Yes, under the floor

68.7%

Yes, in the ceiling

37.3%

Yes, in the walls

Heating in house  
(4 year)

91.7%

Yes

3.1%

No, even if  
house was cold

5.2%

No, house  
was not cold

## dampness

PRESENT (9 MONTH)

25.4%

Quite often / always / almost always

## condensation

PRESENT (9 MONTH)

25.4%

Quite often / always / almost always

## mould &amp; mildew

PRESENT (9 MONTH)

15.4%

Yes

## RESULTS



## Characteristics of cluster Type 2

## Neighbourhood characteristics

Experience of  
high deprivation

53.0%  
at any timepoint

Reasons for living in current neighbourhood  
(Antenatal)



Work  
35.1%



Good education  
13.9%



Like the  
local lifestyle  
26.7%



Spouse / partner /  
family house here  
20.7%



Handy to shops  
and amenities  
33.5%



Good / safe  
neighbourhood  
41.9%



Friends and  
family nearby  
40.9%



Better / more  
affordable houses /  
rentals  
37.1%



78.0%

AGREE / STRONGLY AGREE

Access to good parks /  
playgrounds/play spaces  
(2 year)



73.7%

AGREE / STRONGLY AGREE

Access to close / affordable /  
regular public transport  
(2 year)



88.6%

AGREE / STRONGLY AGREE

Access to basic  
shopping facilities  
(2 year)



81.8%

AGREE / STRONGLY AGREE

Access to basic services  
i.e. banks, medical clinics etc.  
(2 year)

## RESULTS



## Characteristics of cluster Type 2

## Child characteristics – health

## General health



	9 MONTH	2 YEAR	4 YEAR
<b>Excellent</b>	57.2%	50.6%	46.4%
<b>Very good</b>	29.7%	34.7%	36.9%
<b>Good</b>	10.0%	10.6%	13.6%
<b>Fair</b>	2.9%	3.6%	2.6%
<b>Poor</b>	0.2%	0.5%	0.4%

## Parental concern of health (4 year)



<b>43.7%</b>	No worry / concern
<b>34.0%</b>	A little worry / concern
<b>13.0%</b>	Some worry / concern
<b>6.2%</b>	Quite a bit worry / concern
<b>3.1%</b>	A lot of worry / concern

## Childhood illnesses had – last 12 months (4 year)



<b>2.6%</b>	Whooping cough/pertussis	<b>16.1%</b>	Asthma
<b>14.2%</b>	Chest infection/bronchiolitis etc.	<b>23.0%</b>	Eczema or dermatitis
<b>14.1%</b>	Cough lasting more than 4 weeks	<b>12.6%</b>	Skin infection
<b>15.3%</b>	Wheezing in the chest	<b>21.6%</b>	Throat infection or tonsillitis

The cohort children's general health for cluster Type 2 was asked of mothers at three timepoints and roughly half the children were in reported excellent health at all the timepoints. Additionally, at 4 years old over 40% of mothers had no worry or concern about their child's health.

In the year prior to the 4 year interview, over 20% of the cohort children had had eczema or dermatitis or a throat infection or tonsillitis. Between 12–16% of the children had had a range of other childhood illnesses including, chest infections, wheezing in the chest, a cough lasting more than 4 weeks, skin infections or asthma.

Over 80% of the cohort children had had all the vaccinations that were due by 4 years old, consequently the incidence of vaccine preventable diseases in this cluster was between 0.2–1.1%, the exception being chicken pox, which was not on the Immunisation Schedule<sup>4</sup> then and nearly 40% of the children had had it.

Nearly half of the children had been prescribed 1–2 courses of antibiotics in the last prior 12 months and a quarter had had one accident in their lifetime. If they had had an accident over 20% were broken bones, fractures, or dislocations and approximately 16% were either head injuries or cuts that required stitches or glue.

<sup>4</sup> Chicken pox added to the Immunisation Schedule on 1 July 2017.





## Characteristics of cluster Type 2

### Child characteristics – health

#### Immunisations due at 4 years – received



15.5% – no    1.0% – yes    83.1% – yes

SOME NOT ALL

#### Vaccine preventable illnesses – ever had (4 year)

1.1%	Measles including German (Rubella)
0.3%	Mumps
38.4%	Chicken pox
0.2%	Meningitis
0.3%	Rheumatic fever
0.6%	Scarlet fever

#### Courses antibiotics – last 12 months (4 year)

30.9%	None
41.8%	One–two courses
16.8%	Three–four courses
6.4%	Five–six courses
3.6%	Seven or more courses

#### Accidents and injuries in their lifetime (4 year)



65.2%	None
25.0%	One
6.4%	Two
3.2%	Three or more

#### Most severe/only injury since 2 years old (4 year)



16.9%	Head injury – no loss of consciousness
20.8%	Broken bone/fracture/dislocation
15.9%	Cut needing stitches or glue
11.0%	Injury to mouth/tooth
7.0%	Fall



## Characteristics of cluster Type 2

### Child's characteristics – parent & child interactions (4 year)

#### Telling stories



20.2% SELDOM / NEVER

53.8% ONCE / SEVERAL TIMES A WEEK

25.8% ONCE / SEVERAL TIMES A DAY

#### Encouraged to read words

cat  
hat

18.7% SELDOM / NEVER

44.3% ONCE / SEVERAL TIMES A WEEK

37.0% ONCE / SEVERAL TIMES A DAY

#### Reading books



5.7% SELDOM / NEVER

41.2% ONCE / SEVERAL TIMES A WEEK

51.3% ONCE / SEVERAL TIMES A DAY

#### Encouraged to count 1-2-3

3.7% SELDOM / NEVER

41.4% ONCE / SEVERAL TIMES A WEEK

54.9% ONCE / SEVERAL TIMES A DAY

#### Sing songs / play music



4.9% SELDOM / NEVER

44.7% ONCE / SEVERAL TIMES A WEEK

50.4% ONCE / SEVERAL TIMES A DAY

#### Encouraged to recognise numbers



9.5% SELDOM / NEVER

46.1% ONCE / SEVERAL TIMES A WEEK

44.4% ONCE / SEVERAL TIMES A DAY

#### Encouraged to print letters / words / numbers



11.4% SELDOM / NEVER

50.9% ONCE / SEVERAL TIMES A WEEK

37.7% ONCE / SEVERAL TIMES A DAY

When we asked mothers about their interactions with their children at 4 years old, over half told them stories and 40% read books to their children once to several times a week. Additionally, half of mothers were singing songs or playing music with their child once to several times a day. A third of mothers in this cluster were encouraging their children to print words or letters or read words at least daily. Over 40% of mothers were encouraging their child to count or recognise numbers once to several times a day.

## RESULTS



## Characteristics of cluster Type 2

## Child's characteristics – development factors

Child self control – Gift Wrap Task  
(4 year)

<b>71.6%</b>	DID NOT PEAK
<b>13.0%</b>	PEEKED ONCE
<b>12.1%</b>	PEEKED MORE THAN ONCE
<b>3.3%</b>	PEEKED MORE THAN ONCE AND REMAINED PEEKING
<b>0.1%</b>	CHILD PEEKED AND TOUCHED THE GIFT

SDQ – Emotion problems  
(4 year)

<b>77.8%</b>	NORMAL
<b>10.7%</b>	BORDERLINE
<b>11.5%</b>	ABNORMAL

SDQ – Hyperactivity/  
inattention (4 year)

<b>72.3%</b>	NORMAL
<b>12.0%</b>	BORDERLINE
<b>15.7%</b>	ABNORMAL

SDQ – Peer relationships  
(4 year)

<b>69.4%</b>	NORMAL
<b>14.4%</b>	BORDERLINE
<b>16.2%</b>	ABNORMAL

SDQ – Prosocial  
behaviour (4 year)

<b>87.4%</b>	NORMAL
<b>8.6%</b>	BORDERLINE
<b>4.0%</b>	ABNORMAL

## Name and Numbers score – My name is (4 year)

<b>1.6%</b>	NO RESPONSE	<b>15.5%</b>	RECOGNISABLE NAME – LETTERS CAN BE POORLY FORMED
<b>9.2%</b>	SCRIBBLE / NO RECOGNISABLE LETTERS	<b>32.6%</b>	RECOGNISABLE NAME – LETTERS CLEAR
<b>31.3%</b>	SOME RECOGNISABLE LETTERS		

Name and Numbers  
score – I can count  
up to 10 (4 year)

<b>68.0%</b>	YES (COMPLETE SEQUENCE FROM 0-10)
--------------	--------------------------------------

The cohort children's level of self control was measured at 4 years and over 70% of the children did not peek during the exercise demonstrating self control.

Their emotion problems measured using the Strengths and Difficulties Questionnaire showed over three-quarters were in the normal range at 4 years old. The pattern of proportions was similar for measures of hyperactivity/inattention and peer relationships with roughly 70% in the normal range and

16% in the abnormal range. The results for prosocial behaviour showed nearly 90% were in the normal range for this cluster.

Nearly half the children in Cluster Type 2 were able to write their name recognisably, and nearly 70% could count out loud to ten.

## RESULTS



## Detailed description of clusters

# Cluster Type 3

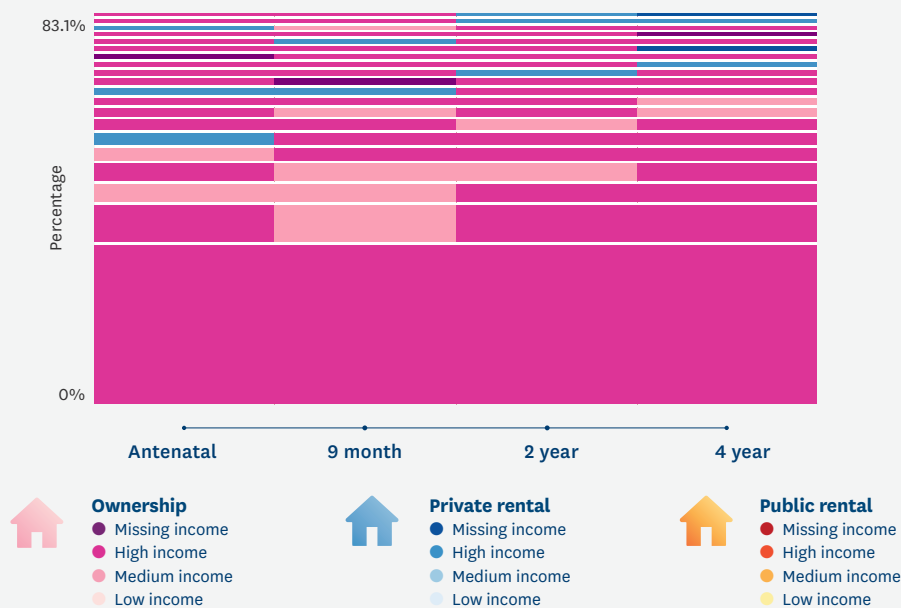
This cluster (Type 3) contains n=1481 families (28.4% of the total cohort). The 20 most common sequences in the cluster which represent 83.1% of all sequences in the whole cluster, are presented in Figure 11. Cluster Type 3 contains sequences dominated by families who were classified as home ownership with high income (●), a small proportion of home ownership with medium income (●) and an even smaller number of families in the private rental with high income group (●). The largest proportion of this cluster is made up of home ownership with high income across all four timepoints. The next most common journey was for families who owned their homes and were in the high income group and then their family income fell to the medium range when their child was 9 months old and then had increased again when their child was 2 years old. The next few pathways show changes in income from high to medium and vice versa for one to two timepoints across the four in total. Lastly, what can be seen are the private rental families with high income moving into the home ownership group at some point across the 4 years. What is also noteworthy about this cluster is the high degree of stability these families have experienced in the four timepoints of this study.

## Characteristics of cluster Type 3

Cluster Type 3 can be described as having mothers who were on average 33.4 years old when they gave birth and being predominately in very good health prior to pregnancy. Nearly 80% of mothers in this cluster stated they were of European ethnicity and less than 10% were of any of the other ethnicities in our cohort. Nearly 70% of mothers had a Bachelor's or higher degree and 95% had never been a smoker either before their child was born or in the four years after.

Family structure at both Antenatal and when the children were two years old was predominately made up of two parents, and the proportions were stable at over 80% at the two timepoints. The proportions of families living with extended kin stayed constant from Antenatal to two years at 11%. The numbers of hardships experienced by the families was measured when the cohort children were nine months old and again at four years old. At nine months 64% of all our families in this cluster had experienced no hardships, while over a quarter had experienced one hardship. Once the children were four years old the number of families experiencing no hardships had increased to over 80% and those experiencing one hardship had decreased to 13%.

FIGURE 11. 20 most common family journeys for cluster Type 3



## RESULTS



## Characteristics of cluster Type 3

## Mothers' characteristics

Note: The percentages presented may not add to 100% as the missing and non-response items have not been displayed. Complete data n (%) can be found in the Cluster Comparison section and in Appendix 5.

Maternal age  
(Antenatal)

**33.39**  
years old  
MEAN AGE

## Pre-pregnancy health



**31.7%**  
EXCELLENT



**44.4%**  
VERY GOOD



**21.1%**  
GOOD

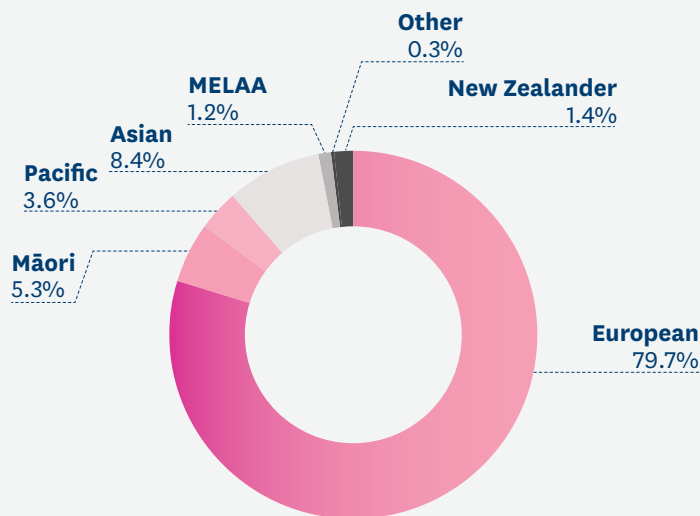


**2.1%**  
FAIR



**0.7%**  
POOR

## Ethnicity

Education  
(Antenatal)

<b>0.7%</b>	No secondary qualification
<b>11.4%</b>	Secondary school / NCEA 1
<b>20.3%</b>	Diploma/Trade certificate/ NCEA 5–6
<b>34.4%</b>	Bachelor's degree
<b>33.3%</b>	Higher degree

## Smoking score (cumulative across time)



**0**  
95.0%

**1**  
1.8%

**2**  
0.9%

**3**  
1.1%

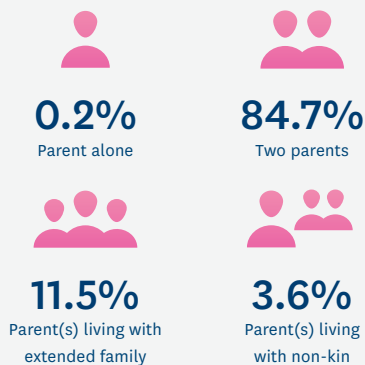
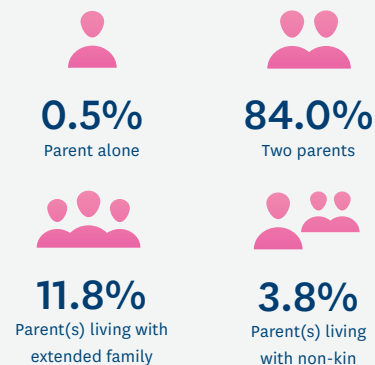
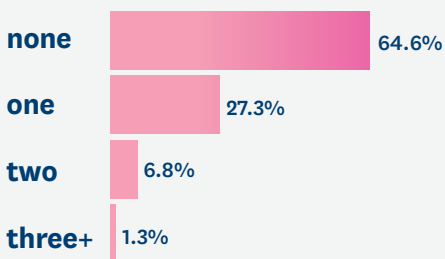
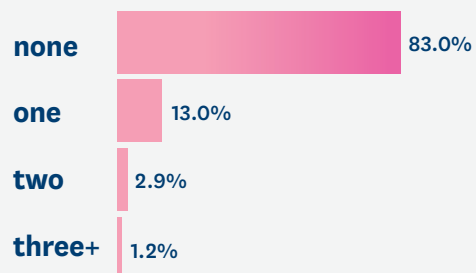
**4**  
1.1%

## RESULTS



## Characteristics of cluster Type 3

## Family characteristics

Structure  
(Antenatal)Structure  
(2 year)Number of hardships  
(9 month)Number of hardships  
(4 year)

Forty-four percent of cluster Type 3 had never moved in their cohort child's first 4 years and only 2% of families had moved three or more times. Additionally, over 90% of the children had never lived in crowded ( $\geq 2$  people per bedroom) housing. Nearly 70% of the cohort children at three years old were sleeping in their own room alone with just under a quarter sleeping in a bedroom with other children.

When the children were two years old over 90% were living in detached houses. At four years old and in the house they were currently living over a third of families had had insulation or a

heat pump installed. Of those that had either insulation, or a heat pump installed, a quarter had used the Warm Up NZ or similar subsidy. Even if there had been no alterations to the house (30.2%), over 95% of the houses had insulation or were heating their house when needed. Less than 10% of mothers when asked about dampness, or condensation in their houses, when the children were nine months old, stated they were often or always damp or had condensation. Additionally, only 5.8% said the house had mould and mildew present.

## RESULTS



## Characteristics of cluster Type 3

## Housing characteristics

Residential mobility  
(cumulative across time)

<b>never moved</b>	44.2%
<b>moved once</b>	37.5%
<b>moved twice</b>	15.9%
<b>moved three or more times</b>	2.2%

Crowding score  
(cumulative across time)

<b>zero</b>	93.4%
<b>one</b>	5.9%
<b>two</b>	0.6%
<b>three</b>	0.1%
<b>four</b>	0.0%

Sleeping arrangements  
of cohort child (3 year)

<b>66.6%</b>	Separate room alone
<b>23.0%</b>	Separate bed in a shared room with other children
<b>0.9%</b>	Shared bed with other children
<b>1.4%</b>	Separate bed in a shared room with parents
<b>3.9%</b>	Shared bed with parents
<b>0.5%</b>	Separate bed in a shared room with other adults
<b>0.8%</b>	Shared bed with other adults

Dwelling type  
(2 year)

	<b>91.1%</b>	Separate
	<b>3.8%</b>	Semi-detached
	<b>1.0%</b>	Flat/unit/apartment
	<b>0.1%</b>	Caravan/cabin
	<b>0.1%</b>	House/flat attached to shop/office
	<b>4.0%</b>	Farmhouse/building
<b>OTHER</b>	<b>0.1%</b>	Not sighted/other

Less than 20% of families had experienced living in a high deprivation neighbourhood at some point across the four years. At the Antenatal period we asked mothers the reason they lived in their current neighbourhood. Over 60% stated the reason was it was a good and safe neighbourhood and nearly half stated it was because they like the local lifestyle or it was handy to shops and amenities. Over 40% chose having friends and family nearby and a third chose work or better/more affordable housing as a reason.

When their children were two years old mothers were asked about access to neighbourhood amenities and over 90% of mothers agreed or strongly agreed that their neighbourhood had access to basic shopping facilities and over 80% agreed or strongly agreed that there was access to good playgrounds and play spaces and basic services such as banks. Three-quarters agreed or strongly agreed that their neighbourhood had access to affordable and regular public transport.

## RESULTS



## Characteristics of cluster Type 3

## Housing characteristics

Alterations to current house  
(4 year)

34.3%	Insulation installed	18.1%	HRV / DVS / similar installed
30.8%	Heat pump installed	8.2%	Double glazing installed
25.3%	Heat pump / insulation subsidised by Warm Up NZ or similar	30.2%	No changes made
14.9%	Other heating system installed		

Insulation in house  
(4 year)

95.1%

Yes

59.5%

Yes, under the floor

89.7%

Yes, in the ceiling

59.4%

Yes, in the walls

Heating in house  
(4 year)

91.7%

Yes

0.5%

No, even if  
house was cold

2.4%

No, house  
was not cold

## dampness

PRESENT (9 MONTH)

8.0%

Quite often / always / almost always

## condensation

PRESENT (9 MONTH)

9.9%

Quite often / always / almost always

## mould &amp; mildew

PRESENT (9 MONTH)

5.8%

Yes



## RESULTS



## Characteristics of cluster Type 3

## Neighbourhood characteristics

Experience of  
high deprivation

17.8%  
at any timepoint

Reasons for living in current neighbourhood  
(Antenatal)



Work  
36.9%



Good education  
24.4%



Like the  
local lifestyle  
49.4%



Spouse / partner /  
family house here  
22.2%



Handy to shops  
and amenities  
49.9%



Good / safe  
neighbourhood  
60.2%



Friends and  
family nearby  
44.0%



Better / more  
affordable houses /  
rentals  
33.2%



87.4%

AGREE / STRONGLY AGREE

Access to good parks /  
playgrounds/play spaces  
(2 year)



77.2%

AGREE / STRONGLY AGREE

Access to close / affordable /  
regular public transport  
(2 year)



90.9%

AGREE / STRONGLY AGREE

Access to basic  
shopping facilities  
(2 year)



86.2%

AGREE / STRONGLY AGREE

Access to basic services  
i.e. banks, medical clinics etc.  
(2 year)

## RESULTS



## Characteristics of cluster Type 3

## Child characteristics – health

## General health



	9 MONTH	2 YEAR	4 YEAR
<b>Excellent</b>	65.4%	55.8%	58.8%
<b>Very good</b>	24.6%	31.4%	32.3%
<b>Good</b>	7.6%	9.6%	7.6%
<b>Fair</b>	1.8%	2.7%	1.1%
<b>Poor</b>	0.5%	0.5%	0.1%

## Parental concern of health (4 year)



<b>43.0%</b>	No worry / concern
<b>40.0%</b>	A little worry / concern
<b>11.8%</b>	Some worry / concern
<b>3.3%</b>	Quite a bit worry / concern
<b>1.8%</b>	A lot of worry / concern

## Childhood illnesses had – last 12 months (4 year)



<b>0.6%</b>	Whooping cough/pertussis	<b>9.2%</b>	Asthma
<b>13.7%</b>	Chest infection/bronchiolitis etc.	<b>21.1%</b>	Eczema or dermatitis
<b>14.7%</b>	Cough lasting more than 4 weeks	<b>9.3%</b>	Skin infection
<b>10.3%</b>	Wheezing in the chest	<b>20.9%</b>	Throat infection or tonsillitis

The cohort children's general health for cluster Type 3 was asked of mothers at three timepoints and over half the children were in reported excellent health at all the timepoints. Additionally, at 4 years old over 40% of mothers had no worry or concern about their child's health.

In the year prior the 4 year interview, over 20% of the cohort children had had eczema or dermatitis, or a throat infection or tonsillitis. Between 13–15% of the children had had chest infections or a cough lasting more than four weeks. Roughly 10% of the children had had wheezing in the chest, a skin infection or asthma.

Over 85% of the cohort children had had all the vaccinations they were due by 4 years old, consequently the incidence of vaccine preventable diseases in this cluster was between 0.1–1.1%, the exception being chicken pox, which was not on the Immunisation Schedule<sup>5</sup> then; and a third of the children had had it.

Over 40% of the children had been prescribed 1–2 courses of antibiotics in the last 12 months and a quarter had had one accident in their lifetime that required medical treatment. If they had had an accident approximately 20% were broken bones, fractures or dislocations or head injuries.

<sup>5</sup> Chicken pox added to the Immunisation Schedule on 1 July 2017.

## RESULTS



## Characteristics of cluster Type 3

## Child characteristics – health

## Immunisations due at 4 years – received



10.6% – no    1.8% – yes    87.5% – yes

SOME NOT ALL

## Vaccine preventable illnesses – ever had (4 year)

1.1%	Measles including German (Rubella)
0.1%	Mumps
33.8%	Chicken pox
0.1%	Meningitis
0.1%	Rheumatic fever
0.3%	Scarlet fever

## Courses antibiotics – last 12 months (4 year)

38.6%	None
42.9%	One–two courses
12.2%	Three–four courses
4.1%	Five–six courses
2.0%	Seven or more courses

## Accidents and injuries in their lifetime (4 year)



65.2%	None
25.7%	One
6.3%	Two
2.6%	Three or more

## Most severe/only injury since 2 years old (4 year)



19.6%	Head injury – no loss of consciousness
20.8%	Broken bone/fracture/dislocation
16.9%	Cut needing stitches or glue
13.2%	Injury to mouth/tooth
8.0%	Fall

## RESULTS



## Characteristics of cluster Type 3

## Child's characteristics – parent &amp; child interactions (4 year)

## Telling stories



18.4% SELDOM / NEVER

53.0% ONCE / SEVERAL TIMES A WEEK

25.6% ONCE / SEVERAL TIMES A DAY

## Encouraged to read words

cat  
hat

20.0% SELDOM / NEVER

46.9% ONCE / SEVERAL TIMES A WEEK

33.1% ONCE / SEVERAL TIMES A DAY

## Reading books



1.6% SELDOM / NEVER

23.7% ONCE / SEVERAL TIMES A WEEK

74.7% ONCE / SEVERAL TIMES A DAY

## Encouraged to count

1-2-3

2.8% SELDOM / NEVER

43.8% ONCE / SEVERAL TIMES A WEEK

53.4% ONCE / SEVERAL TIMES A DAY

## Sing songs / play music



4.7% SELDOM / NEVER

48.6% ONCE / SEVERAL TIMES A WEEK

46.7% ONCE / SEVERAL TIMES A DAY

## Encouraged to recognise numbers

1 7  
9 2 3 8  
5 6 4

9.3% SELDOM / NEVER

51.7% ONCE / SEVERAL TIMES A WEEK

39.0% ONCE / SEVERAL TIMES A DAY

## Encouraged to print letters / words / numbers

hello  
my name  
is John

9.6% SELDOM / NEVER

58.4% ONCE / SEVERAL TIMES A WEEK

32.0% ONCE / SEVERAL TIMES A DAY

When we asked mothers about their interactions with their children at four years old, roughly half told them stories or sang songs or played music to their children once to several times a week. Additionally, nearly three-quarters of mothers read books to their children at least once daily. Roughly a half of mothers were encouraging their children to print words or letters or read words at least once a week and over 40% of mothers were encouraging their child to count or recognise numbers at least once a week.

## RESULTS



## Characteristics of cluster Type 3

## Child's characteristics – development factors

Child self control – Gift Wrap Task  
(4 year)

<b>77.0%</b>	DID NOT PEEK
<b>10.6%</b>	PEEKED ONCE
<b>10.1%</b>	PEEKED MORE THAN ONCE
<b>2.2%</b>	PEEKED MORE THAN ONCE AND REMAINED PEEKING
<b>0.1%</b>	CHILD PEEKED AND TOUCHED THE GIFT

SDQ – Emotion problems  
(4 year)

<b>89.7%</b>	NORMAL
<b>5.4%</b>	BORDERLINE
<b>4.9%</b>	ABNORMAL

SDQ – Hyperactivity/  
inattention (4 year)

<b>84.7%</b>	NORMAL
<b>7.2%</b>	BORDERLINE
<b>8.0%</b>	ABNORMAL

SDQ – Peer relationships  
(4 year)

<b>87.9%</b>	NORMAL
<b>6.5%</b>	BORDERLINE
<b>5.5%</b>	ABNORMAL

SDQ – Prosocial  
behaviour (4 year)

<b>87.5%</b>	NORMAL
<b>9.1%</b>	BORDERLINE
<b>3.4%</b>	ABNORMAL

## Name and Numbers score – My name is (4 year)

<b>1.4%</b>	NO RESPONSE	<b>18.4%</b>	RECOGNISABLE NAME – LETTERS CAN BE POORLY FORMED
<b>4.9%</b>	SCRIBBLE / NO RECOGNISABLE LETTERS	<b>46.9%</b>	RECOGNISABLE NAME – LETTERS CLEAR
<b>23.4%</b>	SOME RECOGNISABLE LETTERS		

Name and Numbers  
score – I can count  
up to 10 (4 year)

<b>83.4%</b>	YES (COMPLETE SEQUENCE FROM 0-10)
--------------	-----------------------------------

The cohort children's level of self control was measured at four years and 77% of the children did not peek during the exercise demonstrating self control.

Their emotion problems measured using the Strengths and Difficulties Questionnaire showed over 80% were in the normal range at four years old. The pattern of proportions was similar for measures of hyperactivity/inattention, peer relationships and prosocial behaviour with over 80% in the normal range, and less than 10% in the abnormal range.

Over 60% the children in Cluster Type 3 were able to write their name recognisably, and over 80% could count out loud to ten.

## RESULTS



## Detailed description of clusters

# Cluster Type 4

This cluster (Type 4) contains n=327 families (6.3% of the total cohort). What is noteworthy about this cluster is the high degree of instability these families have experienced in the four timepoints of this study as represented by the top 20 most common pathways only representing a third (37.6%) of the sequences in this cluster. These most common sequences are presented in Figure 12. Cluster Type 3 is dominated by families living in public rental accommodation with low income (●), a smaller proportion of public rental families with medium income (●), and a number of public rental families with missing income information (●). The largest proportion of this cluster is made up of public rental families with low income across all four timepoints. The next most common journey was for families in living in public rental accommodation for whom we are missing their family income information for one timepoint. There are also a number of families that over the timepoints who have moved from low to medium income and vice versa. A small proportion of families have moved from private rental with low income (●) into public rental housing and some that have moved from public housing into the private rental housing groups with medium or missing income groups (● and ●).

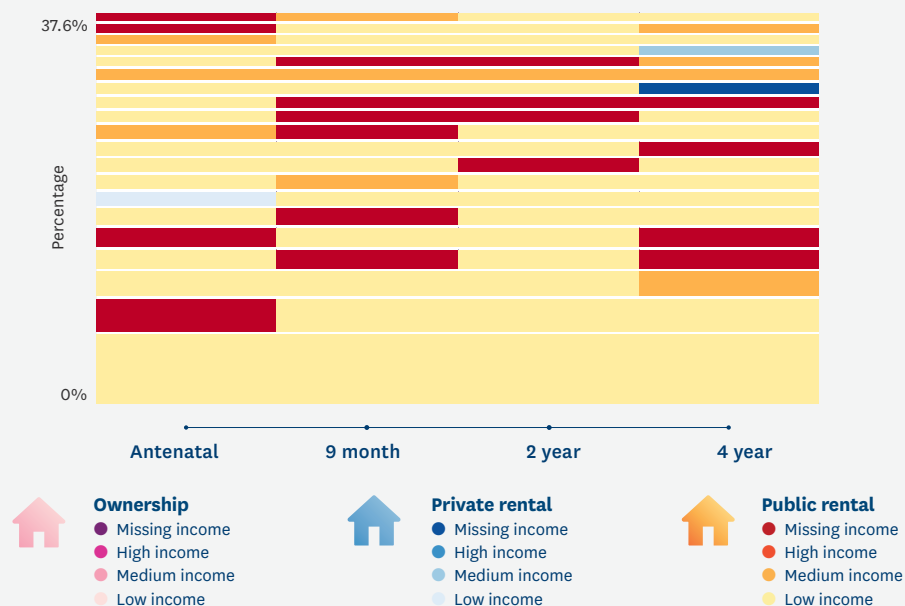
Note, the highest proportion of participants excluded due to missing data (see Appendix 2), by tenure was for those in public housing (34.0%). Thus the results for cluster Type 4 are more muted than they might have been should data have been available for those families.

## Characteristics of cluster Type 4

The average age of cluster Type 4 mothers when they gave birth to the cohort children was 28 years. Most of these mothers had secondary school qualifications or above (79.2%). About half of cluster Type 4 mothers were non-smokers (52.9%) and three-quarters of them (77.1%) were in good, very good or excellent health at the Antenatal timepoint.

At the Antenatal timepoint about half (49.8%) of the cohort children in cluster Type 4 had the company of extended family living with them, this was reduced to just over a third (36.6%) at the 2 year timepoint. Two-in-five (44.4%) of the children had two parents living with them at the 2 year timepoint. Hardships were a common experience for this cluster with most having experienced at least one at both the 9 month (78%), and 4 year (77.1%) timepoints.

FIGURE 12. 20 most common family journeys for cluster Type 4



## RESULTS



## Characteristics of cluster Type 4

## Mothers' characteristics

Note: The percentages presented may not add to 100% as the missing and non-response items have not been displayed. Complete data n (%) can be found in the Cluster Comparison section and in Appendix 5.

Maternal age  
(Antenatal)

**28.09**  
years old  
MEAN AGE

## Pre-pregnancy health



**13.5%**  
EXCELLENT



**21.7%**  
VERY GOOD



**41.9%**  
GOOD

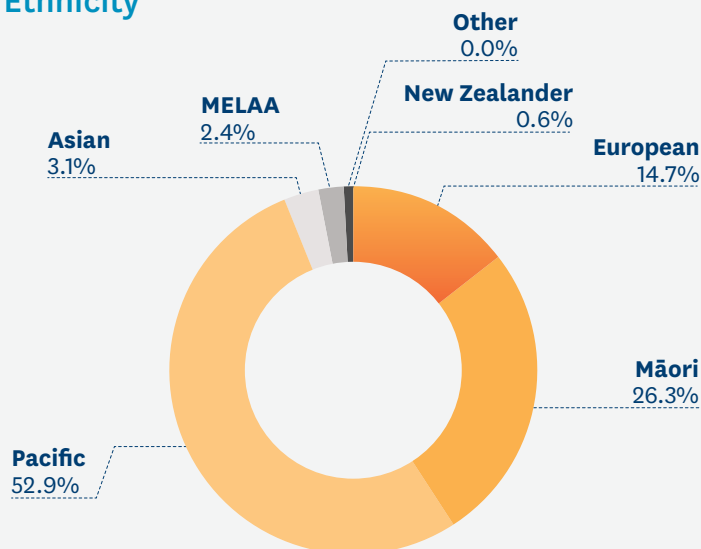


**17.1%**  
FAIR



**5.8%**  
POOR

## Ethnicity

Education  
(Antenatal)

<b>19.6%</b>	No secondary qualification
<b>37.0%</b>	Secondary school / NCEA 1
<b>36.1%</b>	Diploma/Trade certificate/ NCEA 5–6
<b>3.7%</b>	Bachelor's degree
<b>2.4%</b>	Higher degree

## Smoking score (cumulative across time)



0

52.9%

1

8.0%

2

6.1%

3

13.8%

4

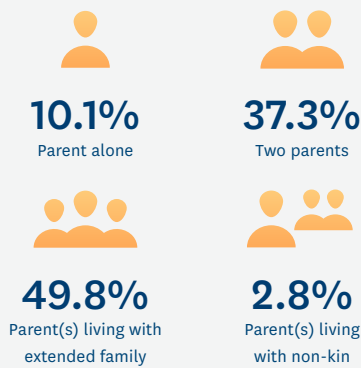
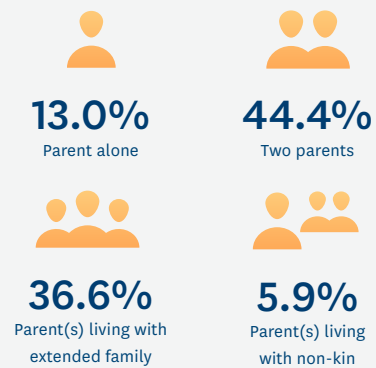
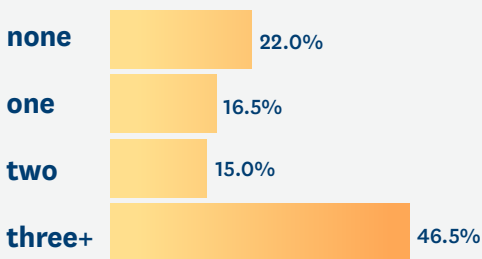
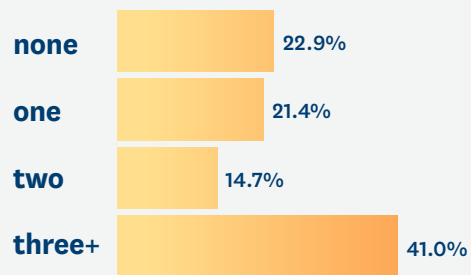
19.3%

## RESULTS



## Characteristics of cluster Type 4

## Family characteristics

Structure  
(Antenatal)Structure  
(2 year)Number of hardships  
(9 month)Number of hardships  
(4 year)

Mothers of children in cluster Type 4 noted their reasons for living in their current neighbourhood at the Antenatal timepoint. The most common reason was better or more affordable housing/rentals (41.9%), followed by having friends and family nearby (36.4%). When their children were two years old the majority of mothers agreed or strongly agreed they had access to basic shopping facilities (92.0%) and services such as banks (86.2%). Additionally, most agreed, or strongly agreed that there was access to good playgrounds and play spaces (72.8%) and they had access to affordable and regular public transport (84.1%).

Two-thirds of the children in this cohort had moved house once, or not at all by the 4 year timepoint; however nearly one-in-ten (9.2%) had moved three or more times.

At the 2 year timepoint the majority of the cluster Type 4 children were living in detached dwellings (81.6%). At age three nearly a third of them shared a bed with their parents (34.5%), 41% shared a room with other children (including 11.3% who shared a bed with other children). Slightly more than one-in-ten (13.2%) of the cluster Type 4 children had their own room. Just over half (55.7%)



## RESULTS



## Characteristics of cluster Type 4

## Housing characteristics

Residential mobility  
(cumulative across time)

<b>never moved</b>	34.3%
<b>moved once</b>	32.1%
<b>moved twice</b>	23.9%
<b>moved three or more times</b>	9.2%

Crowding score  
(cumulative across time)

<b>zero</b>	44.3%
<b>one</b>	41.7%
<b>two</b>	4.3%
<b>three</b>	5.7%
<b>four</b>	4.0%

Sleeping arrangements  
of cohort child (3 year)

<b>13.2%</b>	Separate room alone
<b>29.7%</b>	Separate bed in a shared room with other children
<b>11.3%</b>	Shared bed with other children
<b>8.7%</b>	Separate bed in a shared room with parents
<b>34.5%</b>	Shared bed with parents
<b>1.3%</b>	Separate bed in a shared room with other adults
<b>1.3%</b>	Shared bed with other adults

Dwelling type  
(2 year)

	<b>81.6%</b>	Separate
	<b>11.2%</b>	Semi-detached
	<b>5.9%</b>	Flat/unit/apartment
	<b>0.0%</b>	Caravan/cabin
	<b>0.3%</b>	House/flat attached to shop/office
	<b>1.0%</b>	Farmhouse/building
<b>OTHER</b>	<b>0.0%</b>	Not sighted/other

of the children in cluster Type 4 had lived in a crowded ( $\geq 2$  people per bedroom) dwelling at least once by the 4 year timepoint.

When asked about dampness in their homes when the cluster Type 4 children were nine months old 41.4% of families stated they were often or always damp, 41.4% stated their houses had condensation often or always, and over a quarter (29.1%) said the house was mouldy or had mildew. Once the children were four years old most of them lived in insulated dwellings (70.0%); however only a fifth had insulation in the walls (20.0%). Most

of the children lived in houses that had heating, or were warm (83%); however 17.1% did not heat their homes, even when the house was cold.

## RESULTS



## Characteristics of cluster Type 4

## Housing characteristics

Alterations to current house  
(4 year)

12.8%	Insulation installed	0.9%	HRV / DVS / similar installed
6.1%	Heat pump installed	0.0%	Double glazing installed
43.5%	Heat pump / insulation subsidised by Warm Up NZ or similar	60.9%	No changes made
3.4%	Other heating system installed		

Insulation in house  
(4 year)

70.0%

Yes

42.8%

Yes, under the floor

59.2%

Yes, in the ceiling

20.0%

Yes, in the walls

Heating in house  
(4 year)

75.5%

Yes

17.1%

No, even if  
house was cold

7.5%

No, house  
was not cold

## dampness

PRESENT (9 MONTH)

41.4%

Quite often / always / almost always

## condensation

PRESENT (9 MONTH)

41.4%

Quite often / always / almost always

## mould &amp; mildew

PRESENT (9 MONTH)

29.1%

Yes

## RESULTS



## Characteristics of cluster Type 4

## Neighbourhood characteristics

Experience of  
high deprivation

91.1%  
at any timepoint

Reasons for living in current neighbourhood  
(Antenatal)



Work  
17.7%



Good education  
11.0%



Like the  
local lifestyle  
16.5%



Spouse / partner /  
family house here  
26.9%



Handy to shops  
and amenities  
22.0%



Good / safe  
neighbourhood  
26.0%



Friends and  
family nearby  
36.4%



Better / more  
affordable houses /  
rentals  
41.9%



72.8%

AGREE / STRONGLY AGREE

Access to good parks /  
playgrounds/play spaces  
(2 year)



84.1%

AGREE / STRONGLY AGREE

Access to close / affordable /  
regular public transport  
(2 year)



92.0%

AGREE / STRONGLY AGREE

Access to basic  
shopping facilities  
(2 year)



86.2%

AGREE / STRONGLY AGREE

Access to basic services  
i.e. banks, medical clinics etc.  
(2 year)

## RESULTS



## Characteristics of cluster Type 4

## Child characteristics – health

## General health



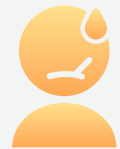
	9 MONTH	2 YEAR	4 YEAR
<b>Excellent</b>	54.7%	56.2%	52.9%
<b>Very good</b>	29.4%	30.4%	30.0%
<b>Good</b>	11.6%	9.9%	13.8%
<b>Fair</b>	3.7%	3.2%	3.1%
<b>Poor</b>	0.6%	0.3%	0.3%

## Parental concern of health (4 year)



<b>55.4%</b>	No worry / concern
<b>25.4%</b>	A little worry / concern
<b>9.5%</b>	Some worry / concern
<b>6.1%</b>	Quite a bit worry / concern
<b>3.7%</b>	A lot of worry / concern

## Childhood illnesses had – last 12 months (4 year)



<b>1.8%</b>	Whooping cough/pertussis	<b>15.6%</b>	Asthma
<b>9.8%</b>	Chest infection/bronchiolitis etc.	<b>20.2%</b>	Eczema or dermatitis
<b>9.5%</b>	Cough lasting more than 4 weeks	<b>19.3%</b>	Skin infection
<b>16.8%</b>	Wheezing in the chest	<b>14.4%</b>	Throat infection or tonsillitis

The cohort children's general health for cluster Type 4 was asked of mothers at three timepoints and over half the children were in reported excellent health at all the timepoints. Additionally, at 4 years old over 50% of mothers had no worry or concern about their children's health.

In the year prior to the 4 year interview, approximately 20% of the cohort children had had eczema or dermatitis or a skin infection. Between 14–16% of the children had had wheezing in the chest, asthma or a throat infection or tonsillitis.

Over 80% of the cohort children had had all the vaccinations they were due by 4 years old, consequently the incidence of vaccine preventable diseases in this cluster was between 0.0–1.2%, the exception being chicken pox, which was not on the Immunisation Schedule<sup>6</sup> and over 40% of the children had had it.

Nearly 40% of the children had been prescribed 1–2 courses of antibiotics in the last 12 months and just under 20% had had one accident in their lifetime that required medical treatment. If they had had an accident 27% were broken bones, fractures, or dislocations and a fifth were or head injuries or a cut that required stitches or glue.

<sup>6</sup> Chicken pox added to the Immunisation Schedule on 1 July 2017.

## RESULTS



## Characteristics of cluster Type 4

## Child characteristics – health

## Immunisations due at 4 years – received



14.1% – no      0.9% – yes      84.1% – yes

SOME NOT ALL

## Vaccine preventable illnesses – ever had (4 year)

1.2%	Measles including German (Rubella)
0.6%	Mumps
41.2%	Chicken pox
0.3%	Meningitis
0.3%	Rheumatic fever
0.0%	Scarlet fever

## Courses antibiotics – last 12 months (4 year)

27.2%	None
39.8%	One–two courses
18.7%	Three–four courses
6.7%	Five–six courses
6.1%	Seven or more courses

## Accidents and injuries in their lifetime (4 year)



70.6%	None
19.3%	One
3.7%	Two
5.8%	Three or more

## Most severe/only injury since 2 years old (4 year)



24.2%	Head injury – no loss of consciousness
27.4%	Broken bone/fracture/dislocation
22.1%	Cut needing stitches or glue
7.4%	Injury to mouth/tooth
5.3%	Fall

## RESULTS



## Characteristics of cluster Type 4

## Child's characteristics – parent &amp; child interactions (4 year)

## Telling stories



19.6% SELDOM / NEVER

56.3% ONCE / SEVERAL TIMES A WEEK

24.1% ONCE / SEVERAL TIMES A DAY

## Encouraged to read words

cat  
hat

13.8% SELDOM / NEVER

53.5% ONCE / SEVERAL TIMES A WEEK

32.7% ONCE / SEVERAL TIMES A DAY

## Reading books



13.8% SELDOM / NEVER

53.8% ONCE / SEVERAL TIMES A WEEK

32.4% ONCE / SEVERAL TIMES A DAY

## Encouraged to count

1-2-3

4.3% SELDOM / NEVER

48.3% ONCE / SEVERAL TIMES A WEEK

47.4% ONCE / SEVERAL TIMES A DAY

## Sing songs / play music



2.8% SELDOM / NEVER

41.3% ONCE / SEVERAL TIMES A WEEK

56.0% ONCE / SEVERAL TIMES A DAY

## Encouraged to recognise numbers

1 7  
9 2 3 8  
5 6 4

9.8% SELDOM / NEVER

52.6% ONCE / SEVERAL TIMES A WEEK

37.6% ONCE / SEVERAL TIMES A DAY

## Encouraged to print letters / words / numbers

hello  
my name  
is John

15.0% SELDOM / NEVER

50.5% ONCE / SEVERAL TIMES A WEEK

34.5% ONCE / SEVERAL TIMES A DAY

When we asked mothers about their interactions with their children at four years old, over half told them stories and read books to their children once to several times a week. Additionally, over 50% of mothers in this cluster sang songs or played music at least once a day. Roughly half of mothers were also encouraging their children to print words or letters or read words, count, or recognise numbers at least once a week.

## RESULTS



## Characteristics of cluster Type 4

## Child's characteristics – development factors

Child self control – Gift Wrap Task  
(4 year)

<b>65.0%</b>	DID NOT PEAK
<b>16.2%</b>	PEEKED ONCE
<b>15.9%</b>	PEEKED MORE THAN ONCE
<b>2.9%</b>	PEEKED MORE THAN ONCE AND REMAINED PEEKING
<b>0.0%</b>	CHILD PEEKED AND TOUCHED THE GIFT

SDQ – Emotion problems  
(4 year)

<b>62.1%</b>	NORMAL
<b>11.0%</b>	BORDERLINE
<b>26.9%</b>	ABNORMAL

SDQ – Hyperactivity/  
inattention (4 year)

<b>62.4%</b>	NORMAL
<b>15.6%</b>	BORDERLINE
<b>22.0%</b>	ABNORMAL

SDQ – Peer relationships  
(4 year)

<b>50.8%</b>	NORMAL
<b>19.0%</b>	BORDERLINE
<b>30.3%</b>	ABNORMAL

SDQ – Prosocial  
behaviour (4 year)

<b>84.7%</b>	NORMAL
<b>11.0%</b>	BORDERLINE
<b>4.3%</b>	ABNORMAL

## Name and Numbers score – My name is (4 year)

<b>6.1%</b>	NO RESPONSE	<b>10.4%</b>	RECOGNISABLE NAME – LETTERS CAN BE POORLY FORMED
<b>18.3%</b>	SCRIBBLE / NO RECOGNISABLE LETTERS	<b>20.2%</b>	RECOGNISABLE NAME – LETTERS CLEAR
<b>35.5%</b>	SOME RECOGNISABLE LETTERS		

Name and Numbers  
score – I can count  
up to 10 (4 year)

<b>53.2%</b>	YES (COMPLETE SEQUENCE FROM 0-10)
--------------	--------------------------------------

The cohort children's level of self control was measured at four years and 65% of the children did not peek during the exercise demonstrating self control.

Their emotion problems measured using the Strengths and Difficulties Questionnaire showed over 60% were in the normal range at 4 years old but over a quarter in the abnormal range. The pattern of proportions was similar for hyperactivity/inattention with 22% in the abnormal range. The measure of peer relationships was only 50% of children

in the normal range and over 30% in the abnormal range. Prosocial behaviour differed as over 80% of children were within the normal range.

To assess potential educational outcomes at four years old we asked the children to write their name and were scored for how well they achieved this task. Over 30% the children in cluster Type 4 were able to write their name recognisably. We also asked the children to count out loud up to ten; over half of children in this cluster were able to do so successfully.

## RESULTS



### Cluster comparisons

A result of excluding those with missing tenure data across the timepoints (see Appendix 2), meant there may be fewer significant differences between clusters than there might have been if there was not missing data for those more vulnerable or deprived families.

#### MATERNAL FACTORS

There were significant ( $P < 0.001$ ) differences in mothers' age, pre-pregnancy general health, education levels, ethnic groups and smoking behaviour between clusters, which is why these were included in our statistical models of child health and wellbeing outcomes. See cluster comparisons of maternal data in Appendix 5 (Table M).

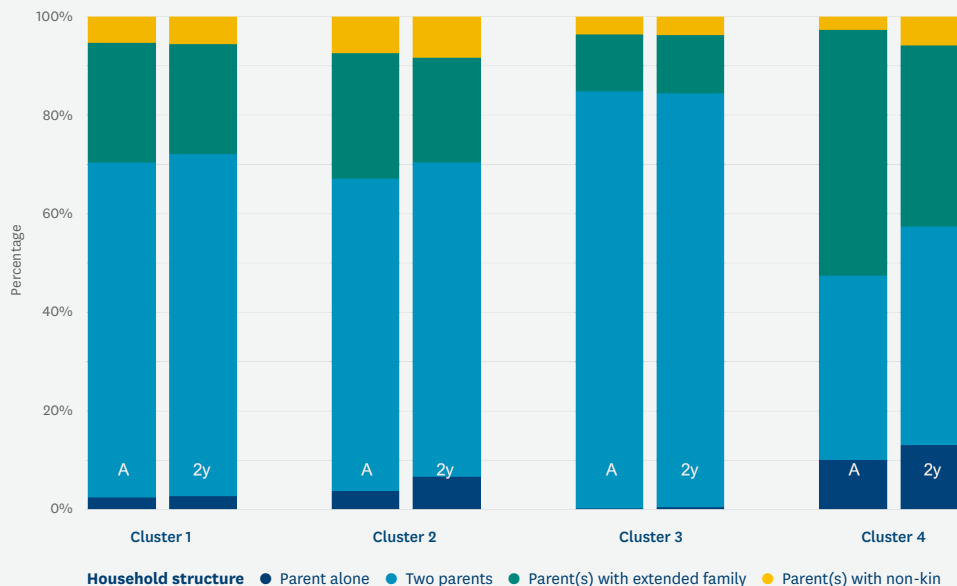
#### FAMILY FACTORS

At two timepoints in the study (Antenatal and 2 year) mothers were asked to report on their family structure. At both they were significantly different by cluster type (Antenatal:  $P < 0.001$ , 2 year:  $P < 0.001$ ). At the Antenatal ( $n=1184$ , 22.7%) and 2 year ( $n=1025$ , 19.7%) timepoints the proportion of families living with extended family was highest

in cluster Type 4 but had decreased between the Antenatal and 2 year timepoints (Antenatal  $n=163$ , 49.8% and 2 year  $n=118$ , 36.6%). The proportion of solo parents was higher in cluster Type 4 at both times (Antenatal  $n=33$ , 10.1% and 2 year  $n=42$ , 13%). At both timepoints the proportion of families living with non-family members was higher for cluster Type 2 compared to the other cluster types (Figure 13).

Level of material hardship was significantly different between clusters at both the 9 month ( $P < 0.001$ ) and 4 year ( $P < 0.001$ ) timepoints. At the 9 months over two out of five of the cohort families had not experienced any material hardship ( $n=2337$ , 44.8%). However, 656 families (12.6%) had experienced three or more hardships and this proportion was nearly half of cluster Type 4 ( $n=152$ , 46.5%) and nearly a fifth of cluster Type 2 ( $n=366$ , 18.2%) (Table 6). At the 4 year interview the overall proportion of mothers reporting no hardships had increased to  $n=3208$  (61.5%). The numbers of mothers reporting three or more hardships was one-in-ten (10.0%) however 13.9% ( $n=279$ ) of mothers in cluster Type 2 and 41.0% ( $n=134$ ) of mothers in cluster Type 4 reported three or more hardships (Table 6).

FIGURE 13. Family structure at the Antenatal and 2 year timepoints. Key: A=Antenatal, 2y=2 year interview





## RESULTS



TABLE 6. Number of hardships experienced at 9 month and 4 year interview.

Number of hardships	Type 1 (n=1391)	Type 2 (n=2016)	Type 3 (n=1481)	Type 4 (n=327)	Total (N=5215)
<b>9 month</b>					
0	574 (41.3%)	734 (36.4%)	957 (64.6%)	72 (22.0%)	2337 (44.8%)
1	514 (37.0%)	574 (28.5%)	404 (27.3%)	54 (16.5%)	1546 (29.7%)
2	183 (13.2%)	342 (17.0%)	101 (6.8%)	49 (15.0%)	675 (12.9%)
3+	119 (8.6%)	366 (18.2%)	19 (1.3%)	152 (46.5%)	656 (12.6%)
<b>4 year</b>					
0	856 (61.6%)	1048 (52.0%)	1229 (83.0%)	75 (22.9%)	3208 (61.5%)
1	320 (23.0%)	476 (23.6%)	192 (13.0%)	70 (21.4%)	1058 (20.3%)
2	125 (9.0%)	213 (10.6%)	43 (2.9%)	48 (14.7%)	429 (8.2%)
3+	89 (6.4%)	279 (13.9%)	17 (1.2%)	134 (41.0%)	519 (10.0%)

## HOUSEHOLD FACTORS

A third of mothers had not moved between the Antenatal and 4 year interview (n=1790, 34.3%). Cluster type was however significantly different for residential mobility (P<0.001). The proportions of mothers who had moved at least once between each interview was 34.2% (n=1783), and those that

had moved at least twice was 22.2% (n=1635). Less than 10% of families had moved between each timepoint (n=272, 9.1%). However, nearly 20% of families in cluster Type 2 (n=370, 18.4%) had moved at least three times between the Antenatal and the 4 year timepoint (Table 7).

TABLE 7. Residential mobility between the Antenatal and 4 year interview.

Residential mobility	Type 1 (n=1391)	Type 2 (n=2016)	Type 3 (n=1481)	Type 4 (n=327)	Total (N=5215)
Missing	3	7	3	2	15
Never moved	706 (50.8%)	318 (15.8%)	654 (44.2%)	112 (34.3%)	1790 (34.3%)
Moved once	464 (33.4%)	658 (32.6%)	556 (37.5%)	105 (32.1%)	1783 (34.2%)
Moved twice	178 (12.8%)	663 (32.9%)	236 (15.9%)	78 (23.9%)	1635 (22.2%)
Moved three times	40 (2.2%)	370 (18.4%)	32 (2.2%)	30 (9.2%)	272 (9.1%)

## RESULTS



Over three-quarters of families had not lived in a house with two or more people per bedroom across the four timepoints (Table 8). There were significant differences between clusters for levels of crowding however ( $P < 0.001$ ). About two-in-five ( $n=125$ , 41.7%) of the families in cluster Type 4 had experienced high crowding at one timepoint, and nearly a quarter of cluster Type 2 ( $n=467$ , 23.9%). While the proportion of children who lived in a highly crowded dwelling

( $\geq 2$  people per bedroom) for two or more timepoints was small (5.8%), this is still made up of 302 cohort children, as well as their siblings. Most of these children were in cluster Types 2 ( $n=219$ , 10.9%) and 4 ( $n=42$ , 12.8%).

**TABLE 8.** Cumulative crowding score calculated across the Antenatal to 4 year time period.

Crowding score	Type 1 (n=1391)	Type 2 (n=2016)	Type 3 (n=1481)	Type 4 (n=327)	Total (N=5215)
<b>Missing</b>	19	58	7	27	111
<b>0</b>	1105 (80.5%)	1272 (65.0%)	1377 (93.4%)	133 (44.3%)	3887 (76.2%)
<b>1</b>	236 (17.2%)	467 (23.9%)	87 (5.9%)	125 (41.7%)	915 (17.9%)
<b>2</b>	17 (1.2%)	126 (6.4%)	n<10 (0.6%)	13 (4.3%)	165 (3.2%)
<b>3</b>	n<10 (0.5%)	65 (3.3%)	n<10 (0.1%)	17 (5.7%)	90 (1.8%)
<b>4</b>	n<10 (0.5%)	28 (1.4%)	0 (0.0%)	12 (4.0%)	47 (0.9%)

## RESULTS



At nine months of age most of the cohort children lived in homes with low levels of dampness (n=4205, 81.1%; Table 9). This was significantly different between the clusters (P<0.001). Cluster Type 3 had the lowest proportion of dampness reported (n=1361, 92%) as compared to cluster Type 2 (n=506, 25.4%) and cluster Type 4 with two-in-five houses being reported to be damp quite often to always (n=134, 41.4%). Reported levels of condensation on the windows of the room the cohort child slept at night had

similar proportions to reported levels of dampness (Table 9) and again there were significantly different (P<0.001) patterns of proportions for all four cluster types. The majority of mothers reported no mould or mildew on the walls or ceiling, or that this was milder in the room where their child had slept recently (n= 46.3, 88.3%). Significant differences between cluster types was again seen (P<0.001) with higher proportions of mould or mildew reported in cluster Types 2 and 4 (Table 9).

TABLE 9. Housing condition at 9 month interview as reported by mothers.

Dampness	Type 1 (n=1391)	Type 2 (n=2016)	Type 3 (N=1481)	Type 4 (N=327)	Total (N=5215)
<b>Missing</b>	1	24	2	3	30
<b>Never to Not very often</b>	1168 (84.0%)	1486 (74.6%)	1361 (92.0%)	190 (58.6%)	4205 (81.1%)
<b>Quite often to Always</b>	222 (16.0%)	506 (25.4%)	118 (8.0%)	134 (41.4%)	980 (18.9%)
<b>Condensation</b>					
<b>Missing</b>	4	13	2	1	20
<b>Never to Not very often</b>	1126 (81.2%)	1494 (74.6%)	1333 (90.1%)	191 (58.6%)	4144 (79.8%)
<b>Quite often to Always</b>	261 (18.8%)	509 (25.4%)	146 (9.9%)	135 (41.4%)	1051 (20.2%)
<b>Mould and mildew</b>					
<b>Missing</b>	0	4	1	0	5
<b>No</b>	1274 (91.6%)	1703 (84.6%)	1394 (94.2%)	232 (70.9%)	4603 (88.3%)
<b>Yes</b>	117 (8.4%)	309 (15.4%)	86 (5.8%)	95 (29.1%)	607 (11.7%)

## RESULTS



At the 4 year interview most of the cohort mothers stated their dwelling was insulated (n=4013 85.7%) (Table 10). There were significant differences in the number of houses with insulation between clusters (P<0.001). Cluster Type 4 had the lowest proportion of houses that were insulated (n=175, 70%) and cluster Type 3 the highest (n=1366, 95.1%). When further investigating housing insulation the proportion

of houses with insulation in the walls, ceiling and under the floor was always greatest in cluster Type 3 (Table 10). Cluster Type 4 and 2 had lower levels of insulation in the ceiling and under the floor. Additionally, the proportion of houses with insulation in the walls was much lower in cluster Type 4 compared to the other clusters or the overall proportion (Table 10).

TABLE 10. Household insulation at 4 year interview.

Household insulation	Type 1 (n=1391)	Type 2 (n=2016)	Type 3 (N=1481)	Type 4 (N=327)	Total (N=5215)
<b>Missing</b>	93	319	44	77	533
<b>Yes</b>	1178 (90.8%)	1294 (76.3%)	1366 (95.1%)	175 (70.0%)	4013 (85.7%)
<b>No</b>	120 (9.2%)	403 (23.7%)	71 (4.9%)	75 (30.0%)	669 (14.3%)
<b>Insulation in the ceiling</b>					
<b>Yes</b>	1124 (86.6%)	1165 (68.7%)	1289 (89.7%)	148 (59.2%)	3726 (79.6%)
<b>No</b>	174 (13.4%)	532 (31.3%)	148 (10.3%)	102 (40.8%)	956 (20.4%)
<b>Insulation under the floor</b>					
<b>Yes</b>	674 (51.9%)	691 (40.7%)	855 (59.5%)	107 (42.8%)	2327 (49.7%)
<b>No</b>	624 (48.1%)	1006 (59.3%)	582 (40.5%)	143 (57.2%)	2355 (50.3%)
<b>Insulation in the walls</b>					
<b>Yes</b>	618 (47.6%)	633 (37.3)	854 (59.4%)	50 (20%)	2155 (46%)
<b>No</b>	680 (52.4)	1064 (62.7%)	583 (40.6%)	200 (80%)	2527 (54%)

## RESULTS



Also, at the 4 year timepoint mothers were asked if they used any heating when their house was cold during the most recent winter (Table 11). The proportion who answered always, most of the time or sometimes was 93% (n=4829). The proportion of the whole cohort that did not heat their homes, even if they were cold, was low at 2.8% (n=147). However, 17.1% (n=55) of cluster Type 4 was in this

category compared to just 0.5% (n<10) of cluster Type 3. Consequently, there was a significant difference between the cluster types for household heating ( $P<0.001$ ).

TABLE 11. Heating of the house at 4 year interview.

Heating	Type 1 (n=1391)	Type 2 (n=2016)	Type 3 (N=1481)	Type 4 (N=327)	Total (N=5215)
Missing	6	8	3	5	22
<b>Yes (always, most of the time, sometimes)</b>	1309 (94.5%)	1842 (91.7%)	1435 (97.1%)	243 (75.5%)	4829 (93.0%)
<b>No (even if the house was cold)</b>	22 (1.6%)	62 (3.1%)	n<10 (0.5%)	55 (17.1%)	147 (2.8%)
<b>No (as the house was not cold)</b>	54 (3.9%)	104 (5.2%)	35 (2.4%)	24 (7.5%)	217 (4.2%)

## RESULTS



## COMMUNITY FACTORS

Area level deprivation in Table 12 shows the proportions of the whole cohort for each of the deprivation groupings between the first 100 days timepoint and the 4 year interview. Half of the cohort was in the not high group for both time periods (n=2610, 50.1%), compared to one-quarter in the high deprivation group at both timepoints (n=1316, 25.2%). A small proportion moved from the not high to high deprivation group (n=275, 5.3%) and nearly

15% moved between the high deprivation group to not high (n=766, 14.7%). When reviewed by cluster type there was a significant difference in the proportions in the 'Any' versus 'None' groups (P<0.001). Over half of cluster Type 2 (n=1067, 53%) had experienced high deprivation at some timepoint and over 90% of cluster Type 4 (n=298, 91.1%). Conversely, the proportion of families that had not experienced high deprivation at any timepoint was over 80% for cluster Type 3 (n=1217, 82.2%) (Table 13).

TABLE 12. Frequency of families in high or not high groups between the first 1000 days and 4 year timepoints.

Deprivation based on the timepoints		
Groupings	Frequency	Percent
Missing	248	4.8
High dep, High dep	1316	25.2
High dep, Not high dep	766	14.7
Not high dep, High dep	275	5.3
Not high dep, Not high dep	2610	50.1

TABLE 13. Experience of deprivation by cluster type.

Experience of Deprivation	Type 1 (n=1391)	Type 2 (n=2016)	Type 3 (n=1481)	Type 4 (n=327)	Total (N=5215)
Missing	0	1	0	0	1
Any	549 (39.5%)	1067 (53.0%)	264 (17.8%)	298 (91.1%)	2178 (41.8%)
None	842 (60.5%)	948 (47.0%)	1217 (82.2%)	29 (8.9%)	3036 (58.2%)

At the 2 year timepoint mothers were asked to what extent they agreed or disagreed with a series of statements about their neighbourhoods. Over 70% of mothers agreed or strongly agreed that there were good parks, playgrounds, and play spaces in their neighbourhood with the proportions being over 80% in cluster Type 3 (n=1294, 87.4%). There was a significant difference by cluster type (P<0.001). When asked about access to close, affordable, regular public transport in their neighbourhood again over 70% of mothers agreed or strongly agreed with this statement and cluster Type 4

having the highest proportion (n=275, 74.1%). This was also significantly different by cluster type (P<0.001). Nearly 90% of mothers agreed or strongly agreed that there was access to basic shopping facilities in their neighbourhood but there were significant differences by cluster type (P=0.003) and over 80% of mothers agreed or strongly agreed that there was access to basic services such as banks and medical clinics in their neighbourhood but again this was significantly different by cluster type (P=0.007).

## RESULTS

**CHILD FACTORS**

There were n=2541 girls (48.7%) and n=2674 boys (51.3%) in the cohort and there were no significant differences in numbers of boys or girls between the cluster types (P=0.726). Child outcomes that were considered appropriate to both housing and health and wellbeing were tested univariately against cluster type (Table 14) and then subsequently tested in multivariate models (next section, from page 79). Details of child health, doctors' visits, asthma, other respiratory illnesses, skin infections and accidents and injuries across the clusters can be found in Table N (Appendix 5). Similarly, data relating to the children's socio-behavioural development including measures of self control and educational indicators across the clusters can be found in Tables O and P (Appendix 5).

TABLE 14. Univariate test of child outcomes and cluster type.

Four year child outcomes	P-value
<b>General health</b>	P=0.004
<b>Visited the GP</b>	P=0.004
<b>Asthma</b>	P<0.001
<b>Other respiratory illnesses</b>	P=0.321
<b>Skin infections</b>	P=0.010
<b>Number of accidents</b>	P=0.025
<b>Self control – Gift Wrap Task</b>	P<0.001
<b>SDQ – emotion problems</b>	P<0.001
<b>SDQ – hyperactivity inattention</b>	P<0.001
<b>SDQ – peer relationships</b>	P<0.001
<b>SDQ – prosocial behaviour</b>	P=0.419
<b>Writing task</b>	P<0.001
<b>Counting task</b>	P<0.001



## Child health and wellbeing outcomes for each cluster

A series of multivariable logistic regression models have been undertaken to determine if cluster type had an effect on child health, psychological development or education indicators measured at the four year interview. Input variables used in the models can be found in Table 15. The output variables used are in Table 16.



TABLE 15. Predictor variables for multivariable models.

FACTORS INCLUDED AS PREDICTORS	
Variables	Description
<b>Sociodemographic</b>	
<b>Deprivation</b>	Longitudinal: Variable using exposure in first 1000 day or at four year interview vs. no exposure.
<b>Crowding</b>	Longitudinal: Cumulative score of crowding of $\geq 2$ people per bedroom = higher level crowding across time (0–4).
<b>Residential mobility</b>	Longitudinal: Cumulative score of numbers of moves between interviews (0–3).
<b>Cluster type</b>	Longitudinal: Sequence analysis cluster types (1–4).
<b>Maternal</b>	
<b>Maternal age</b>	Antenatal: Age in years: <20; 20–29, 30–34, 35 + years.
<b>Maternal education</b>	Antenatal: No secondary, secondary or diploma vs. Bachelor's degree or higher degree.
<b>Maternal health</b>	Antenatal: Health scale (poor, fair, good, very good, excellent).
<b>Maternal ethnicity</b>	Antenatal: European, Māori, Pasific, Asian, Other+ (includes MELAA, Other, New Zealander).
<b>Maternal smoking</b>	Longitudinal: Cumulative score of currently smoking across time (0–4).
<b>Child</b>	
<b>Child gender</b>	Perinatal data: Boy or girl



## RESULTS



TABLE 16. Child output variables.

Output variable	Description
<b>Child Health</b>	
<b>General health</b>	Binary variable – child health scale (poor + fair vs. good + very good + excellent)
<b>Diagnosis of asthma</b>	Binary: Yes = 1, no = 0
<b>Other respiratory infections</b>	Binary: Yes to any = 1, no to all = 0
<b>Skin infection</b>	Binary: Yes to any = 1, no to all = 0
<b>Injury (hospitalisations)</b>	Numerical: Number of injuries
<b>GP visits</b>	Binary: 0+1+2 visits in last 12 months=0, 3+ visits=1
<b>Socio-behavioural development</b>	
<b>Self control – Gift Wrap Task</b>	Binary: Child never peeked=1, child peeked 1 or more times=0
<b>SDQ (emotion)</b>	Binary: Normal=0, Borderline +Abnormal=1
<b>SDQ (prosocial)</b>	Binary: Normal=0, Borderline +Abnormal=1
<b>SDQ (peer relationships)</b>	Binary: Normal=0, Borderline +Abnormal=1
<b>SDQ (hyper and inattention)</b>	Binary: Normal=0, Borderline +Abnormal=1
<b>Education</b>	
<b>Name and Numbers – writing</b>	Binary: Recognisable name score 0+1+2=0, 3+4=1
<b>Name and Numbers – counting</b>	Binary: Counted out loud up to ten Yes=1, No=0

## RESULTS



## CHILD HEALTH

**General child health:** Cluster type was not significantly associated with child general health after multiple testing correction (Adj.Prob >0.05, Table 17). Numerically, belonging to cluster Type 1 or 2 was associated with an increased risk of poor general health compared to cluster Type 3. For cluster Type 3 this was nearly a doubling of the odds of having poor health (OR 1.99). Other factors in the model that were

numerically different (but did not pass the adjusted P-value threshold) included deprivation and ethnicity. Experiencing any deprivation was associated with a decreased risk of poor child general health compared to those who experienced no deprivation. Compared to children of European mothers, children of Pacific mothers were twice as likely (OR 2.05) to have poor general health.

TABLE 17. Binary logistic regression model for child health: general health.

Input variables	Coefficients	Estimate	SE	OR	Prob	Adj Prob	
<b>Deprivation</b>	Any	<b>-0.58</b>	<b>0.20</b>	<b>-1.78</b>	<b>0.004</b>	0.057	^
	None	REF					
<b>Residential mobility score</b>		0.13	0.11	1.14	0.230	1.000	
<b>Crowding score</b>		0.16	0.15	1.17	0.301	1.000	
<b>Maternal age</b>		0.01	0.02	1.02	0.390	1.000	
<b>Maternal education</b>	< Bachelor's degree	0.09	0.22	1.09	0.675	1.000	
	> Bachelor's degree	REF					
<b>Maternal general health</b>		0.17	0.10	1.19	0.078	1.000	
<b>Maternal self-prioritised ethnicity</b>	European	REF					
	Māori	0.15	0.28	1.17	0.577	1.000	
	Pacific	<b>0.72</b>	<b>0.37</b>	<b>2.05</b>	<b>0.050</b>	0.648	^
	Asian	0.18	0.29	1.19	0.543	1.000	
	Other+	-0.62	0.39	-1.87	0.108	1.000	
<b>Maternal smoking score</b>		0.10	0.07	1.10	0.191	1.000	
<b>Child gender</b>	Boy	REF					
	Girl	0.09	0.18	1.10	0.599	1.000	
<b>Cluster Type</b>	1	<b>-0.61</b>	<b>0.30</b>	<b>-1.83</b>	<b>0.040</b>	0.518	^
	2	<b>-0.69</b>	<b>0.30</b>	<b>-1.99</b>	<b>0.022</b>	0.281	^
	3	REF					
	4	-0.53	0.46	-1.69	0.257	1.000	

## RESULTS



**Asthma:** Cluster type was significantly associated with experiencing asthma, after multiple testing correction (Adj.Prob >0.05, Table 18). There was an increased risk of a child experiencing asthma for cluster Type 2 compared to cluster Type 3 (OR: -1.5). Additionally, compared to children

with European mothers, children of Māori mothers were more likely to experience asthma (OR: 1.67). Compared to boys, girls were less likely to experience asthma (OR: -1.58). Mothers' age and maternal Asian ethnicity approached significance.

TABLE 18. Binary logistic regression model for child health: asthma.

Input variables	Coefficients	Estimate	SE	OR	Prob	Adj Prob	
<b>Deprivation</b>	Any	0.13	0.10	1.14	0.199	1.000	
	None	REF					
<b>Residential mobility score</b>		0.03	0.05	1.03	0.524	1.000	
<b>Crowding score</b>		-0.01	0.06	-1.01	0.876	1.000	
<b>Maternal age</b>		-0.02	0.01	-1.02	0.026	0.333	^
<b>Maternal education</b>	< Bachelor's degree	0.09	0.1	1.10	0.355	1.000	
	> Bachelor's degree	REF				1.000	
<b>Maternal general health</b>		-0.05	0.05	-1.06	0.244	1.000	
<b>Maternal self-prioritised ethnicity</b>	European	REF					
	Māori	<b>0.51</b>	<b>0.13</b>	<b>1.67</b>	<b>&lt;0.001</b>	<b>0.001</b>	<b>***</b>
	Pacific	-0.16	0.16	-1.17	0.321	1.000	
	Asian	<b>-0.43</b>	<b>0.15</b>	-1.54	<b>0.004</b>	0.058	^
	Other+	0.14	0.23	1.15	0.532	1.000	
<b>Maternal smoking score</b>		-0.02	0.04	-1.02	0.534	1.000	
<b>Child gender</b>	Boy	REF					
	Girl	<b>-0.46</b>	<b>0.09</b>	<b>-1.58</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>***</b>
<b>Cluster Type</b>	1	0.24	0.13	1.28	0.058	0.76	
	2	<b>0.42</b>	<b>0.13</b>	<b>1.53</b>	<b>0.001</b>	<b>0.012</b>	<b>*</b>
	3	REF					
	4	0.36	0.21	1.43	0.09	1.000	

## RESULTS



**Other respiratory infections:** Cluster type was not significantly associated with experiencing respiratory infections in the last 12 months, after multiple testing correction (Adj.Prob >0.05, Table 19). There was a decreased risk of a child experiencing respiratory infection for cluster Type 1 compared to cluster Type 3 (OR: -1.2). Additionally, having a child that had a respiratory infection in the last 12 months was significantly negatively associated with

mothers' pre-pregnancy health (OR: -1.2). Children of Asian mothers were less likely to have experienced respiratory infection compared to children of European (OR: -1.6). Girls were less likely to have experienced respiratory infection compared to boys (OR: -1.2). There was no significant association between smoking, deprivation or crowding and child respiratory infection.

TABLE 19. Binary logistic regression model for child health: respiratory infections.

Input variables	Coefficients	Estimate	SE	OR	Prob	Adj Prob	
<b>Deprivation</b>	Any	0.02	0.07	1.02	0.791	1.000	
	None	REF					
<b>Residential mobility score</b>		0.05	0.04	1.05	0.182	1.000	
<b>Crowding score</b>		-0.03	0.05	-1.03	0.510	1.000	
<b>Maternal age</b>		0.01	0.01	1.01	0.126	1.000	
<b>Maternal education</b>	< Bachelor's degree	0.10	0.07	1.10	0.149	1.000	
	> Bachelor's degree	REF					
<b>Maternal general health</b>		<b>-0.11</b>	<b>0.03</b>	<b>-1.12</b>	<b>0.001</b>	<b>0.015</b>	*
<b>Maternal self-prioritised ethnicity</b>	European	REF					
	Māori	0.07	0.10	1.07	0.512	1.000	
	Pacific	-0.04	0.12	-1.04	0.741	1.000	
	Asian	<b>-0.49</b>	<b>0.10</b>	<b>-1.64</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	***
	Other+	-0.06	0.17	-1.07	0.708	1.000	
<b>Maternal smoking score</b>		-0.04	0.03	-1.04	0.206	1.000	
<b>Child gender</b>	Boy	REF					
	Girl	<b>-0.20</b>	<b>0.06</b>	<b>-1.22</b>	<b>0.001</b>	<b>0.012</b>	*
<b>Cluster Type</b>	1	0.05	0.09	1.05	0.595	1.000	
	2	0.11	0.09	1.11	0.218	1.000	
	3	REF					
	4	-0.14	0.16	1.15	0.392	1.000	

## RESULTS



**Skin infections:** Cluster type was not significantly associated with having a skin infection in the last 12 months after multiple testing correction (Adj.Prob >0.05, Table 20). Children of Māori or Pacific mothers were more likely to have experienced at least one skin infection in the last 12 months compared to children of European mothers (OR: Māori 1.71, Pacific 1.57). Mothers with a Bachelor's degree were more likely to have reported their child had a

skin infection in the last 12 months compared to mothers without a Bachelor's degree. Mothers' in poorer pre-pregnancy general health were significantly more likely to have had their child have a skin infection in the last 12 months. Deprivation and crowding were not significantly associated with skin infections.

TABLE 20. Binary logistic regression model for child health: skin infections.

Input variables	Coefficients	Estimate	SE	OR	Prob	Adj Prob	
<b>Deprivation</b>	Any	-0.06	0.07	-1.06	0.452	0.840	
	None	REF					
<b>Residential mobility score</b>		0	0.04	-1.00	0.924	1.000	
<b>Crowding score</b>		-0.01	0.05	-1.01	0.859	1.000	
<b>Maternal age</b>		-0.01	0.01	-1.01	0.09	1.000	
<b>Maternal education</b>	< Bachelor's degree	<b>0.23</b>	<b>0.07</b>	<b>1.26</b>	<b>0.001</b>	<b>0.014</b>	*
	> Bachelor's degree	REF					
<b>Maternal general health</b>		<b>-0.11</b>	<b>0.03</b>	<b>-1.11</b>	<b>0.002</b>	<b>0.022</b>	*
<b>Maternal self-prioritised ethnicity</b>	European	REF					
	Māori	<b>0.53</b>	<b>0.1</b>	<b>1.71</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	***
	Pacific	<b>0.45</b>	<b>0.12</b>	<b>1.57</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	***
	Asian	0.07	0.1	1.07	0.475	1.000	
	Other+	-0.11	0.18	-1.12	0.533	1.000	
<b>Maternal smoking score</b>		-0.01	0.03	-1.01	0.634	1.000	
<b>Child gender</b>	Boy	REF					
	Girl	0	0.06	1.00	0.982	1.000	
<b>Cluster Type</b>	1	0.15	0.09	1.16	0.098	1.000	
	2	0.1	0.09	1.11	0.245	1.000	
	3	REF					
	4	0	0.16	1.00	0.984	1.000	

## RESULTS



**Accidents and injuries:** Cluster type was not significantly associated with the number of accidents experienced after multiple testing correction (Adj.Prob >0.05, Table 21). The number of accidents the cohort child had across their lifetime where they needed to be taken to the doctor, dentist, health centre or hospital was significantly negatively

associated with the child being a girl or having a mother of Asian ethnicity compared to European. There was a positive trend for numbers of accidents or injuries in those children in cluster Type 2 (representing those in the private rental housing with medium to low income group).

TABLE 21. Numeric regression model for number of accidents or injuries.

Input variables	Coefficients	Estimate	SE	Prob	Adj Prob		
<b>Deprivation</b>	Any	-0.02	0.03	-1.02	0.630	1.000	
	None	REF					
<b>Residential mobility score</b>		0.00	0.02	1.00	0.798	1.000	
<b>Crowding score</b>		-0.01	0.02	-1.01	0.623	1.000	
<b>Maternal age</b>		0.00	0.00	1.00	0.389	1.000	
<b>Maternal education</b>	< Bachelor's degree	-0.01	0.03	-1.01	0.737	1.000	
	> Bachelor's degree	REF					
<b>Maternal general health</b>		-0.02	0.01	-1.02	0.270	1.000	
<b>Maternal self-prioritised ethnicity</b>	European	REF					
	Māori	-0.08	0.05	-1.08	0.080	1.000	
	Pacific	-0.08	0.05	-1.08	0.113	1.000	
	Asian	<b>-0.26</b>	<b>0.04</b>	<b>-1.30</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>***</b>
	Other+	-0.03	0.08	-1.03	0.652	1.000	
<b>Maternal smoking score</b>		0.00	0.01	1.00	0.998	1.000	
<b>Child gender</b>	Boy	REF					
	Girl	<b>-0.13</b>	<b>0.03</b>	<b>-1.14</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>***</b>
<b>Cluster Type</b>	1	0.03	0.04	1.03	0.490	1.000	
	2	0.08	0.04	1.08	0.045	0.582	^
	3	REF					
	4	0.09	0.07	1.09	0.196	1.000	

## RESULTS



**Number of doctor/GP visits:** Cluster type was not significantly associated with having three or more visits to the doctor/GP in the last 12 months after multiple testing correction (Adj.Prob >0.05, Table 22). Three or more visits to the doctor were significantly negatively associated with mothers with better pre-pregnancy health. Three or more

visits to the doctor for the cohort child was positively associated with having experienced any deprivation or having a mother of Asian ethnicity compared to European. A negative trend was observed for three or more doctors' visits and an increased crowding score or if the cohort child was a girl.

**TABLE 22.** Binary logistic regression model for number of doctors' visits.

Input variables	Coefficients	Estimate	SE	OR	Prob	Adj Prob	
<b>Deprivation</b>	Any	<b>0.15</b>	<b>0.07</b>	1.16	<b>0.035</b>	0.455	^
	None	REF					
<b>Residential mobility score</b>		-0.01	0.04	-1.01	0.815	1.000	
<b>Crowding score</b>		<b>-0.11</b>	<b>0.05</b>	-1.12	<b>0.016</b>	0.207	^
<b>Maternal age</b>		-0.01	0.01	-1.01	0.05	0.653	
<b>Maternal education</b>	< Bachelor's degree	-0.03	0.07	-1.03	0.617	1.000	
	> Bachelor's degree	REF					
<b>Maternal general health</b>		<b>-0.12</b>	<b>0.03</b>	<b>-1.13</b>	<b>&lt;0.001</b>	<b>0.005</b>	***
<b>Maternal self-prioritised ethnicity</b>	European	REF					
	Māori	0.17	0.1	1.19	0.095	1.000	
	Pacific	0.2	0.12	1.22	0.085	1.000	
	Asian	<b>0.19</b>	<b>0.09</b>	1.20	<b>0.048</b>	0.628	^
	Other+	0.03	0.16	1.03	0.852	1.000	
<b>Maternal smoking score</b>		-0.04	0.03	-1.04	0.204	1.000	
<b>Child gender</b>	Boy	REF					
	Girl	<b>-0.12</b>	<b>0.06</b>	-1.13	<b>0.037</b>	0.478	^
<b>Cluster Type</b>	1	0.05	0.08	1.05	0.546	1.000	
	2	0.03	0.08	1.03	0.685	1.000	
	3	REF					
	4	-0.03	0.16	-1.03	0.828	1.000	

## RESULTS



## CHILD SOCIO-BEHAVIOURAL DEVELOPMENT

**Self control Gift Wrap Task:** Cluster type was significantly associated with self control after multiple testing correction (Adj.Prob >0.05, Table 23). Children in cluster Type 1 were more likely to peek during the Gift Wrap Task (demonstrating

less self control) compared to children in cluster Type 3 (OR: 1.32). Additionally, children of Pacific or Asian mothers were more likely to peek (less self control) compared to those with European mothers (OR: Pacific 1.79, Asian 1.59). Girls were less likely to peek than boys (OR: -1.94).

TABLE 23. Binary logistic regression model for child self control.

Input variables	Coefficients	Estimate	SE	OR	Prob	Adj Prob	
<b>Deprivation</b>	Any	-0.02	0.08	-1.02	0.84	1.000	
	None	REF					
<b>Residential mobility score</b>		0.01	0.04	1.01	0.835	1.000	
<b>Crowding score</b>		-0.03	0.05	-1.03	0.555	1.000	
<b>Maternal age</b>		0.01	0.01	1.01	0.361	1.000	
<b>Maternal education</b>	< Bachelor's degree	0.06	0.08	1.07	0.402	1.000	
	> Bachelor's degree	REF					
<b>Maternal general health</b>		<b>-0.11</b>	<b>0.04</b>	-1.11	<b>0.004</b>	0.053	^
<b>Maternal self-prioritised ethnicity</b>	European	REF					
	Māori	0.3	0.11	1.36	0.006	0.083	^
	Pacific	<b>0.58</b>	<b>0.12</b>	<b>1.79</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>***</b>
	Asian	<b>0.46</b>	<b>0.1</b>	<b>1.59</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>***</b>
	Other+	0.22	0.19	1.25	0.238	1.000	
<b>Maternal smoking score</b>		-0.03	0.03	-1.03	0.295	1.000	
<b>Child gender</b>	Boy	REF					
	Girl	<b>-0.66</b>	<b>0.07</b>	<b>-1.94</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>***</b>
<b>Cluster Type</b>	1	<b>0.27</b>	<b>0.09</b>	<b>1.32</b>	<b>0.004</b>	<b>0.050</b>	<b>*</b>
	2	0.17	0.1	1.18	0.085	1.000	
	3	REF					
	4	0.19	0.17	1.21	0.248	1.000	



## RESULTS



**SDQ – Emotion:** Cluster type was not significantly associated with having an SDQ score indicative of borderline or abnormal emotion problems after multiple testing correction (Adj.Prob >0.05, Table 24). Children were more likely to have a borderline or abnormal emotion problems score if their mother identified as Māori (OR: 1.45), Pacific (OR: 3.62) or Asian (OR: 1.46) compared to European. Mothers of younger age had a slightly greater odds of having a child with borderline or abnormal emotion problem scores. There was a negative trend for maternal education less than

a Bachelor's degree and borderline or abnormal emotion problems. Poorer pre-pregnancy maternal health was also associated with increased odds of borderline or abnormal emotion problems. There was a positive trend for children in the borderline and abnormal range whose families were in cluster Type 2 (representing those in the private rental housing with medium to low income group) and 4 (representing those in the public housing low and middle income group).

**TABLE 24.** Binary logistic regression model for child emotion problems.

Input variables	Coefficients	Estimate	SE	OR	Prob	Adj Prob	
<b>Deprivation</b>	Any	0.16	0.09	1.18	0.077	1.000	
	None	REF					
<b>Residential mobility score</b>		0.07	0.05	1.07	0.135	1.000	
<b>Crowding score</b>		0.03	0.05	1.04	0.519	1.000	
<b>Maternal age</b>		<b>-0.03</b>	<b>0.01</b>	<b>-1.03</b>	<b>&lt;0.001</b>	<b>0.002</b>	<b>***</b>
<b>Maternal education</b>	< Bachelor's degree	<b>-0.2</b>	<b>0.09</b>	-1.23	<b>0.031</b>	0.397	<b>^</b>
	> Bachelor's degree	REF					
<b>Maternal general health</b>		<b>-0.12</b>	<b>0.04</b>	-1.13	<b>0.004</b>	0.052	<b>^</b>
<b>Maternal self-prioritised ethnicity</b>	European	REF					
	Māori	<b>0.37</b>	<b>0.12</b>	<b>1.45</b>	<b>0.003</b>	<b>0.034</b>	<b>*</b>
	Pacific	<b>1.29</b>	<b>0.13</b>	<b>3.62</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>***</b>
	Asian	<b>0.38</b>	<b>0.12</b>	<b>1.46</b>	<b>0.002</b>	<b>0.023</b>	<b>*</b>
	Other+	-0.06	0.25	-1.06	0.81	1.000	
<b>Maternal smoking score</b>		-0.02	0.03	-1.02	0.57	1.000	
<b>Child gender</b>	Boy	REF					
	Girl	0.05	0.08	1.05	0.523	1.000	
<b>Cluster Type</b>	1	0.03	0.12	1.04	0.778	1.000	
	2	<b>0.24</b>	<b>0.12</b>	1.27	<b>0.043</b>	0.556	<b>^</b>
	3	REF					
	4	<b>0.36</b>	<b>0.18</b>	1.43	<b>0.042</b>	0.547	<b>^</b>

## RESULTS



**SDQ – Hyperactivity and inattention:** Cluster type was not significantly associated with having an SDQ score indicative of borderline or abnormal hyperactivity or inattention after multiple testing correction (Adj.Prob >0.05, Table 25). Girls were less likely than boys to have an abnormal or borderline score for hyperactivity and inattention (OR: -1.55). Compared to children of European mothers, children of Pacific mothers were more likely to have a borderline or abnormal score for hyperactivity and inattention (OR: 1.49). There were

increased odds of a child having an abnormal or borderline score for hyperactivity or inattention if they experienced residential mobility (OR: 1.14) or if their mother did not have a Bachelor's degree (OR: -1.60). There was also a small but significant effect of maternal age and maternal smoking on the odds of having an abnormal or borderline score for hyperactivity or inattention.

TABLE 25. Binary logistic regression model for child hyperactivity and inattention.

Input variables	Coefficients	Estimate	SE	OR	Prob	Adj Prob	
<b>Deprivation</b>	Any	0.11	0.08	1.12	0.183	1.000	
	None	REF					
<b>Residential mobility score</b>		<b>0.13</b>	<b>0.04</b>	<b>1.14</b>	<b>0.001</b>	<b>0.016</b>	*
<b>Crowding score</b>		-0.09	0.05	-1.10	0.083	1.000	
<b>Maternal age</b>		<b>-0.02</b>	<b>0.01</b>	<b>-1.02</b>	<b>0.001</b>	<b>0.013</b>	*
<b>Maternal education</b>	< Bachelor's degree	<b>-0.47</b>	<b>0.08</b>	<b>-1.60</b>	<b>2.31E-08</b>	<b>&lt;0.001</b>	<b>***</b>
	> Bachelor's degree	REF					
<b>Maternal general health</b>		<b>-0.15</b>	<b>0.04</b>	<b>-1.17</b>	<b>&lt;0.001</b>	<b>0.001</b>	<b>***</b>
<b>Maternal self-prioritised ethnicity</b>	European	REF					
	Māori	0.11	0.11	1.12	0.309	1.000	
	Pacific	<b>0.4</b>	<b>0.12</b>	<b>1.49</b>	<b>0.001</b>	<b>0.015</b>	*
	Asian	0.04	0.11	1.04	0.709	1.000	
	Other+	0.06	0.2	1.06	0.756	1.000	
<b>Maternal smoking score</b>		<b>-0.13</b>	<b>0.03</b>	<b>-1.13</b>	<b>&lt;0.001</b>	<b>0.001</b>	<b>***</b>
<b>Child gender</b>	Boy	REF					
	Girl	<b>-0.44</b>	<b>0.07</b>	<b>-1.55</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>***</b>
<b>Cluster Type</b>	1	0.01	0.11	1.01	0.922	1.000	
	2	0.17	0.11	1.18	0.11	1.000	
	3	REF					
	4	0.23	0.17	1.26	0.175	1.000	

## RESULTS



**SDQ – Peer relationships:** Cluster type was significantly associated with having an SDQ score indicative of borderline or abnormal peer relationships after multiple testing correction (Adj.Prob >0.05, Table 26). Children in cluster Types 1,2 and 4 had greater odds of having a borderline or abnormal peer relationships score compared to cluster Type 3. Children of mothers who identify as Māori, Pacific or Asian ethnicity had greater odds of having a borderline or abnormal peer relationships score compared to children of

European mothers. Children who experienced deprivation had greater odds of having an abnormal or borderline peer relationships score compared to those who did not experience deprivation (OR: 1.3). There were decreased odds of their child having a borderline or abnormal peer relationship score for mothers with a Bachelor's degree and for mothers who smoked. With increasing mother age there was decreased odds of having a child with a borderline or abnormal peer relationship score.

**TABLE 26.** Binary logistic regression model for child peer relationships.

Input variables	Coefficients	Estimate	OR	SE	Prob	Adj Prob	
<b>Deprivation</b>	Any	<b>0.26</b>	<b>0.08</b>	<b>1.30</b>	<b>0.001</b>	<b>0.016</b>	**
	None	REF					
<b>Residential mobility score</b>		0	0.04	1.00	0.944	1.000	
<b>Crowding score</b>		0.06	0.05	1.06	0.261	1.000	
<b>Maternal age</b>		<b>-0.02</b>	<b>0.01</b>	-1.02	<b>0.006</b>	0.072	^
<b>Maternal education</b>	< Bachelor's degree	<b>-0.25</b>	<b>0.08</b>	<b>-1.28</b>	<b>0.004</b>	<b>0.048</b>	*
	> Bachelor's degree	REF					
<b>Maternal general health</b>		<b>-0.13</b>	<b>0.04</b>	<b>-1.14</b>	<b>0.001</b>	<b>0.012</b>	*
<b>Maternal self-prioritised ethnicity</b>	European	REF					
	Māori	<b>0.61</b>	<b>0.11</b>	<b>1.85</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	***
	Pacific	<b>1.18</b>	<b>0.12</b>	<b>3.25</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	***
	Asian	<b>1</b>	<b>0.1</b>	<b>2.71</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	***
	Other+	-0.16	0.23	-1.18	0.476	1.000	
<b>Maternal smoking score</b>		<b>-0.13</b>	<b>0.03</b>	<b>-1.14</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	***
<b>Child gender</b>	Boy	REF					
	Girl	<b>-0.2</b>	<b>0.07</b>	<b>-1.23</b>	<b>0.004</b>	<b>0.050</b>	*
<b>Cluster Type</b>	1	<b>0.37</b>	<b>0.11</b>	<b>1.45</b>	<b>0.001</b>	<b>0.011</b>	*
	2	<b>0.49</b>	<b>0.11</b>	<b>1.64</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	***
	3	REF					
	4	<b>0.63</b>	<b>0.17</b>	<b>1.89</b>	<b>&lt;0.001</b>	<b>0.002</b>	***

## RESULTS



**SDQ – Prosocial behaviour:** Cluster type was not significantly associated with having an SDQ score indicative of borderline or abnormal prosocial behaviour after multiple testing correction (Adj.Prob >0.05, Table 27). Compared to boys, girls had greater odds of having an SDQ score that was

indicative of borderline or abnormal prosocial behaviour. Children of mothers with a Bachelor's degree had greater odds of having a borderline or abnormal prosocial behaviour score.

TABLE 27. Binary logistic regression model for child prosocial behaviour.

Input variables	Coefficients	Estimate	SE	OR	Prob	Adj Prob	
<b>Deprivation</b>	Any	<b>0.21</b>	<b>0.1</b>	1.24	<b>0.034</b>	0.436	^
	None	REF					
<b>Residential mobility score</b>		-0.03	0.05	-1.03	0.572	1.000	
<b>Crowding score</b>		0.09	0.07	1.09	0.184	1.000	
<b>Maternal age</b>		<b>0.02</b>	<b>0.01</b>	1.02	<b>0.01</b>	0.130	^
<b>Maternal education</b>	< Bachelor's degree	<b>0.3</b>	<b>0.1</b>	<b>1.34</b>	<b>0.002</b>	<b>0.028</b>	*
	> Bachelor's degree	REF					
<b>Maternal general health</b>		<b>-0.12</b>	<b>0.05</b>	-1.13	<b>0.01</b>	0.127	^
<b>Maternal self-prioritised ethnicity</b>	European	REF					
	Māori	-0.09	0.15	-1.10	0.526	1.000	
	Pacific	-0.13	0.16	-1.14	0.414	1.000	
	Asian	-0.11	0.13	-1.11	0.429	1.000	
	Other+	-0.44	0.27	-1.56	0.104	1.000	
<b>Maternal smoking score</b>		-0.05	0.04	-1.05	0.232	1.000	
<b>Child gender</b>	Boy	REF					
	Girl	<b>-0.75</b>	<b>0.09</b>	<b>-2.12</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	***
<b>Cluster Type</b>	1	0.17	0.12	1.18	0.153	1.000	
	2	0.09	0.12	1.09	0.464	1.000	
	3	REF					
	4	0.22	0.21	1.25	0.297	1.000	

## RESULTS



## EDUCATIONAL INDICATORS

**Name and Numbers – Writing their name:** Cluster type was significantly associated with children being able to write their name after multiple testing correction (Adj.Prob >0.05, Table 28). Children in cluster Type 2 and 4 were less likely to be able to write their name than those in cluster Type 3. Girls were more likely to be able to write their name than boys (OR: 2.6) and children of mothers with a Bachelor's

degree were more likely to be able to write their name (OR: 1.3). Children who had experienced deprivation were less likely to be able to write their name (OR: -1.43). Children with mothers who identified as Asian were more likely to be able to write their name whereas those with Māori or Pacific mothers were less likely to be able to write their name compared to children with European mothers.

TABLE 28. Binary logistic regression model for Name and Numbers task – Writing.

Input variables	Coefficients	Estimate	SE	OR	Prob	Adj Prob	
<b>Deprivation</b>	Any	<b>-0.35</b>	<b>0.07</b>	<b>-1.43</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>***</b>
	None	REF					
<b>Residential mobility score</b>		0.04	0.04	1.05	0.244	1.000	
<b>Crowding score</b>		<b>-0.12</b>	<b>0.05</b>	-1.12	<b>0.023</b>	0.294	^
<b>Maternal age</b>		-0.01	0.01	-1.01	0.047	0.614	
<b>Maternal education</b>	< Bachelor's degree	<b>0.27</b>	<b>0.07</b>	<b>1.31</b>	<b>&lt;0.001</b>	<b>0.002</b>	<b>***</b>
	> Bachelor's degree	REF					
<b>Maternal general health</b>		<b>0.08</b>	<b>0.04</b>	1.08	<b>0.025</b>	0.323	^
<b>Maternal self-prioritised ethnicity</b>	European	REF					
	Māori	<b>-0.49</b>	<b>0.11</b>	<b>-1.63</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>***</b>
	Pacific	<b>-0.36</b>	<b>0.12</b>	<b>-1.44</b>	<b>0.003</b>	<b>0.036</b>	<b>*</b>
	Asian	<b>0.42</b>	<b>0.11</b>	<b>1.53</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>***</b>
	Other+	-0.13	0.18	-1.13	0.475	1.000	
<b>Maternal smoking score</b>		<b>0.14</b>	<b>0.03</b>	<b>1.15</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>***</b>
<b>Child gender</b>	Boy	REF					
	Girl	<b>0.96</b>	<b>0.06</b>	<b>2.60</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>***</b>
<b>Cluster Type</b>	1	<b>-0.18</b>	<b>0.09</b>	-1.20	<b>0.045</b>	0.581	^
	2	<b>-0.33</b>	<b>0.09</b>	<b>-1.40</b>	<b>&lt;0.001</b>	<b>0.004</b>	<b>***</b>
	3	REF					
	4	<b>-0.52</b>	<b>0.17</b>	<b>-1.69</b>	<b>0.002</b>	<b>0.023</b>	<b>*</b>

## RESULTS



**Name and Numbers – Counting to ten:** Cluster type was significantly associated with children being able to count to ten after multiple testing correction (Adj.Prob >0.05, Table 29). Children in cluster Type 1,2 and 4 were less likely to be able to count to ten than those in cluster Type 3. Girls were

more likely than boys to be able to count to ten (OR: 1.36). Children who experienced deprivation had decreased odds of being able to count to ten (OR: -1.35). Children of mothers who identified as Māori or Pacific were less likely to be able to count to ten than those of European mothers.

TABLE 29. Binary logistic regression model for Name and Numbers task – Counting.

Input variables	Coefficients	Estimate	SE	OR	Prob	Adj Prob	
<b>Deprivation</b>	Any	-0.3	0.09	-1.35	0.001	0.008	***
	None	REF					
<b>Residential mobility score</b>		0.01	0.05	1.01	0.837	1.000	
<b>Crowding score</b>		-0.05	0.05	-1.06	0.322	1.000	
<b>Maternal age</b>		0	0.01	1.00	0.894	1.000	
<b>Maternal education</b>	< Bachelor's degree	0.26	0.09	1.29	0.004	0.056	^
	> Bachelor's degree	REF					
<b>Maternal general health</b>		0.13	0.04	1.14	0.002	0.020	*
<b>Maternal self-prioritised ethnicity</b>	European	REF					
	Māori	-0.4	0.12	-1.48	<0.001	0.009	***
	Pacific	-0.57	0.13	-1.77	<0.001	<0.001	***
	Asian	0.06	0.13	1.07	0.613	1.000	
	Other+	-0.19	0.21	-1.21	0.374	1.000	
<b>Maternal smoking score</b>		0.12	0.03	1.12	<0.001	0.005	***
<b>Child gender</b>	Boy	REF					
	Girl	0.31	0.08	1.36	<0.001	0.001	***
<b>Cluster Type</b>	1	-0.34	0.11	-1.41	0.003	0.037	*
	2	-0.39	0.12	-1.48	0.001	0.010	**
	3	REF					
	4	-0.57	0.18	-1.76	0.001	0.016	*



# Discussion

All children, whatever their family background, should have the opportunity to thrive and enjoy the fullness of life to which they are entitled as citizens of this bounteous land.

— Solutions to Child Poverty in New Zealand evidence for action.

One of the Government's priorities is to improve the wellbeing of all children and young people. The Child and Youth Wellbeing Strategy is the overarching framework for central government policy development to achieve this. One of the key aims is to remove barriers to wellbeing, including ensuring that children and young people live in stable housing that is affordable, warm and dry<sup>7</sup>.

Looking ahead, it is likely there will be increasing numbers of families renting their home for the long term. It is also possible home ownership opportunities could increase particularly for low to medium income families through an increase in supply of affordable homes, pathway to home ownership options, and subsidy/grant schemes. Whether a child lives in a home that is rented or owned should not determine their level of wellbeing or outcomes. We have explored the *Growing Up in New Zealand* longitudinal data to gain insight into whether the experiences of families and young children in different tenures and income levels differ. Below we will discuss our results, and compare findings to relevant literature. Interpretation of the results in the Discussion and Policy Implications section rests with the authors, who take full responsibility for any errors or omissions.

## Changes in housing tenure and income are common for families

Moving between housing tenure types was a common experience for families in the *Growing Up in New Zealand* cohort. Although the overall proportion of families living

in the different tenure type – home ownership, private rental, public housing, changed very little across the four timepoints, 30% of families changed housing tenure at least once in the preschool period. This occurred most often for families moving between private rental and homeownership, with a small number of families shifting between private rental and public housing. Although the proportion of public housing families in the cohort was relatively small at just over 300 families, it was noteworthy that almost half (n=145) of these families changed housing tenure at least once during the four years. Total household income also fluctuated for families in the preschool period and the distribution of household income differed by housing tenure. The proportion of families with high income was greatest for those in the home ownership group compared to families renting or living in public housing. Homeowners generally have higher personal and family incomes than non-home owners<sup>10</sup>. Income fluctuation after the arrival of a child is not unexpected; however those of high income may be more able to buffer the loss of income compared to those with lower incomes and in less stable tenure types. Income levels in New Zealand are known to be inequitable, with lower income levels seen in Māori and Pacific households compared to non-Māori and non-Pacific<sup>8</sup>. Strain on household incomes for some communities may also be further strained by aspirations and expectations of caregivers to be able to be at home with new babies. Research by The Southern Initiative and Social Wellbeing Agency has also highlighted the different cultural expectations for some families around the time of birth<sup>25</sup>.

<sup>7</sup> <https://childyouthwellbeing.govt.nz/resources/current-programme-action.html>

<sup>8</sup> <http://archive.stats.govt.nz/Census/2013-census.aspx>

## DISCUSSION



Cohort families experienced a high degree of movement between housing tenure types and income bands during their child's first four years of life. This was clearly demonstrated by the complexity of sequences present in the sequence state analysis (SSA) of the housing tenure/income band states. Home ownership with high ( $\geq$ \$100K per year) household income was the state least likely to have changed across the four timepoints, while families in the private rental market and those in public housing experienced a much greater number of different housing and income journeys i.e. changes in states, over four years. When looking at the average amount of time spent in each state, public housing states had the lowest average time, followed by private rental-high income. Although tenure type changes were seen in the cohort, the majority of journey changes were due to families experiencing changes in their household income through the period. Although research often shows long periods of low income for families to be more detrimental to the health and wellbeing of children than short periods<sup>26</sup> there is less known about the effects of income instability over time on children's outcomes more broadly.

### What are the experiences of families with young children living in different housing tenure types with different income levels in New Zealand today and does this experience differ for those living in public or social housing?

Household tenure and income journeys for families were broadly categorised into four main types or clusters which differed in terms of the complexity of the journey as well as the states experienced. Each of these cluster groups had both distinct journeys as well as distinct characteristics in terms of the families who lived these experiences, and the characteristics of their housing and neighbourhood environment. The most common state experienced by families belonging to cluster Type 1 and 3 was home ownership. The difference between these two clusters of families was the time spent with medium household income (most common for cluster Type 1) compared to high household income (most common for cluster Type 3). These two clusters also differed in terms of the overall complexity or stability of state, with families in cluster Type 3 more commonly experiencing more stable state over time (i.e. less change), compared to cluster Type 1.

The most common states experienced in cluster Types 2 and 4 were those in the private rental and public housing groups. Compared to cluster Types 1 and 3, cluster Type 2 and 4 had less stability of states and therefore more complex journeys. Overall, home ownership in combination with high or medium income was associated with the greatest stability for families whereas those predominately living in public or private rental homes had the least stability. This suggests that home ownership and higher incomes may provide a buffer to housing tenure/household income changes for families during the early years of their child's life.

### Moving house is a common experience for cohort families

Residential mobility is commonly experienced by families in the *Growing Up in New Zealand* cohort<sup>3</sup>, with around half of the families moving house at least once in four years. However, the proportion experiencing residential mobility differed between household tenure type and income journey cluster groups. Three quarters of cluster Type 2 families had experienced residential mobility at least once during their child's first four years, with nearly 20% moving three or more times. Cluster Type 2 are those families that spend the majority of their housing tenure journey in private rentals. In contrast, it was much less common for families in cluster Type 1 or 3 (those spending most of the housing tenure journey in home ownership) to experience residential mobility. Instead, for cluster Type 4 (predominately public rentals) it was less common to move house compared to cluster Type 2, but more common compared to cluster Types 1 and 3. These results are consistent with literature on residential mobility for New Zealanders generally. Stats NZ's 2018 General Social Survey showed 59% of renters had been in their current property less than three years, whereas this was the case for only 22% of home-owners<sup>27</sup>. Additionally, the BRANZ 2015 House Condition Survey found the frequency of moving house was higher in the rental sector, with just under 40% having lived in their home for more than seven years compared to nearly 75% of owner-occupiers<sup>28</sup>.

Families shift house for all sorts of reasons; however for those families living in rental accommodation, moving house is not always a choice. Having the choice and control over housing options, termed 'Security of tenure'; has been declining in both private and public rental housing in New Zealand<sup>2</sup>. The Stocktake of Housing Report<sup>9</sup> noted factors contributing to insecurity included: a tightening of public housing eligibility rules in 2013, reviewable tenancies within



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public housing for those tenants paying market or close to market rent, conditions within the housing market including rent increases resulting in high housing costs for families, general house price increases and opportunity for investors to realise capital gains. Additionally, the short-term nature of tenancy agreements whether periodic or fixed term may also be a contributing factor. The average private rental housing tenancy duration is two-years with the most common tenancy type being a 12-month fixed term contract, many becoming periodic agreements at the end of the fixed term. A place-based survey of South Auckland schools found that low income households in private rentals experienced the most residential mobility and that these families were either subject to insecure renting arrangements or were moving to reduce accommodation costs<sup>29</sup>.

In families, major life events, particularly those that occur early in children's lives, are often related to residential mobility, for example, the birth of children, disruption to parental labour force status, and the rearrangement of families and households<sup>3</sup>. Research has demonstrated that changing address is common during pregnancy (17% percent of mothers across New Zealand), but that for whānau in South Auckland landlords especially did not want to take on single mothers, resulting in multiple moves to insecure temporary accommodation<sup>25</sup>. It is important to note however that not all moves are alike, and for some, moving is a stressful experience coupled with other adverse family events. For others, mobility can be the result of (or can result in) improved family circumstances.

### Household composition differed by housing tenure and income cluster

The composition of the family household including the number of people living in the house and the number of people sharing bedrooms differed between the housing tenure and income journey clusters. Overall, living in a household with two parents is the most common experience for the cohort regardless of cluster type. However, there are differences in the proportion of participants living in two parent households when comparing between the clusters. Specifically, cluster Type 3 families were more likely to live in two parent households compared to cluster Types 1 and 2 and two parent households were least common for cluster Type 4 families who were more likely to be living with extended family compared to the other clusters. Cluster Type 4 also included the highest proportion of sole-parents. There appears to be little difference in the overall proportions

for family structure over the first two years for clusters Type 1 and 3, cluster Type 2 sole parent families increased in number, and in cluster Type 4 there were fewer families living with extended family and an increase in families with two parents. This may mean sole-parents who are more likely to have financial challenges are accessing public housing. This may be a positive situation for families as the literature shows sole-parents often face difficulties in tenure stability in private rental housing<sup>30</sup>.

Overall, most families in the cohort did not experience household crowding; however, the proportion of families experiencing crowding differed by household tenure and income journey cluster. For cluster Type 1 and 3 (predominately home ownership) the majority of families did not experience crowding. However for cluster Types 2 and 4 experience of crowding was more common with the greatest proportion of crowding for cluster Type 4 families (those predominately living in public rentals). In addition, a greater proportion of children in cluster Type 2 and 4 were sharing a bed with their parents at three years of age.

At the 2013 population census, crowding was much higher for households with children and for complex households such as multiple families or families with additional people<sup>31</sup>. Our results are consistent with this report, with families in cluster Type 4 having a higher proportion of crowding and households living with extended family. Although it is important to note, that over time, less of these families were living with extended family.

Crowding occurs for a variety of reasons and as such the solutions to crowding are similarly varied. For example, structural crowding occurs where there are not enough bedrooms for the number of occupants, and this report has used a simple measure of structural crowding to consider this experience for families. Additionally, crowding can often be fluid, changing as household members move in and out of a home for a variety of reasons.

Structural crowding is reported to be influenced by the cost of housing or difficulties in securing a home<sup>31</sup>. For example, large families requiring larger homes face increased difficulties as larger homes can be more expensive (to buy or rent) and harder to find in the rental market<sup>31</sup>. Additionally, structural crowding can occur where households unable to access housing move in with others. Pacific peoples are known to have the highest prevalence of crowding, with 40% of Pacific people living in crowded conditions according to 2013 Census data<sup>9</sup> and Pacific children most likely to be living in crowded homes<sup>32</sup>.

<sup>9</sup> <https://www.stats.govt.nz/news/crowded-housing-highest-among-pacific-peoples>

## DISCUSSION



## Most homes are insulated and heated during winter

Overall, for most homes, mothers reported that their home was insulated and that they were able to heat their home when needed. However, these proportions differed when comparing between the housing tenure and income clusters. Families in cluster Type 1 and 3 (both predominately home ownership) more commonly reported that their home was insulated and that they heated their home when it was cold. In contrast, cluster Type 2 (mostly private rental) and 4 (mostly public rental) most commonly reported experiences of damp, condensation and mould in their homes compared to cluster Types 1 and 3. These results are consistent with the 2015 New Zealand Housing Conditions Survey which reported that rental houses were typically in poor condition compared to owner occupied houses and were often heated using less effective and efficient methods<sup>28</sup>.

Around two-thirds of homes in cluster Types 1 and 3 had alterations made to improve the health of the home – ranging from insulation, heat pump or other heating source, ventilation system or double glazing. This compares to just under a third of homes in cluster Types 2 and 4. Across the clusters, of those homes with either added insulation or a heat pump, over a quarter had used the Warm Up NZ subsidy or similar. Some families may not be aware their home has insulation, whether alterations to their current house had been made over the past 12 months, and/or whether a subsidy had been used. This might be a particular limitation for families renting their homes. Additionally where families may be aware their home has insulation, the quality of the insulation present is also important. The BRANZ 2015 HCS analysis concluded that 53% of housing had suboptimal roof insulation and/or subfloor insulation and would benefit from an insulation retrofit<sup>28</sup>.

There were families across all four clusters who had experienced dampness, condensation and mould/mildew in the room where the children slept quite often/always or almost always (asked when children were nine months old). However, frequent experiences of dampness, condensation and mould/mildew were higher for cluster Type 4 followed by cluster Type 2. Damp and mould are key indicators of a poor-quality indoor environment<sup>28</sup>. The BRANZ 2015 survey found rental houses compared to owner-occupied houses were twice as likely to smell damp, nearly three times as likely to feel damp, and mould was slightly more common.

It is important to also consider how families use their homes and the appliances within for heating and ventilation. This is a key factor in maintaining a healthy indoor environment<sup>28</sup>. If heating is not used during the winter months, then the interior of homes is less likely to reach the WHO's recommended indoor room temperature of 18°C<sup>28</sup>. Use of the home can range from opening windows, use of curtains to allow in or retain heat, mechanical ventilation systems particularly in the kitchen and bathroom, as well as a heating appliance. Factors influencing this behaviour may include worries around energy costs, perceived effectiveness of thermal systems and whether they make a difference to the indoor environment, and knowledge on how to make the indoor environment warmer and drier in a cost-efficient way.

## Experience of material hardship

Families experiencing material hardship occurred across all cluster types; however the proportion of families experiencing material hardship differed markedly by cluster type. The level of material hardship experienced was greatest for Cluster Type 4, followed by 2, 1 and 3 at both timepoints. In 2014, 16% of New Zealand children were experiencing material hardship (score of six or more on the DEP-17 index<sup>34</sup>). Persistent deprivation has also been shown in NZ children using an individual deprivation score (NZiDep)<sup>35</sup>. Rates of material hardship have been reported to differ by household type. For example, sole-parent households with dependent children had the greatest proportion of people experiencing material hardship<sup>10</sup>. Additionally, it is more common for children in social housing to experience material hardship compared to those in private rental or home ownership<sup>11</sup>. Material hardship has become increasingly recognised as an important area to study alongside income-based measures when measuring levels of deprivation and especially for children when assessing the implications of poverty.

## Most families have good access to amenities in their neighbourhood

Overall, most mothers reported that they had good access to amenities in their neighbourhoods. This included access to good parks, playgrounds, and play spaces, good public transport, shopping facilities and services such as banks and medical clinics. However, there were some small differences

<sup>10</sup> <http://socialreport.msd.govt.nz/economic-standard-of-living/material-hardship.html>

<sup>11</sup> Measuring and monitoring material hardship for New Zealand children: MSD research and analysis used in advice for the Budget 2015 child hardship package.

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in proportions when comparing the different housing tenure and income cluster groups. Although there was a high proportion of mothers reporting good access to amenities across all cluster groups, those families in cluster Type 3 (predominately home ownership and a higher income) more commonly reported good access to amenities compared to the other three cluster groups. However, the difference between cluster Type 3 and the other clusters was relatively small and under 10% for all amenities reported. Having very few differences in good access to service and social amenities and social infrastructure between clusters is encouraging, particularly given that over 90% of cluster Type 4 families and just over half of cluster Type 2 families had experienced living in a high deprivation area. These results generally align with the General Social Survey data from 2018<sup>27</sup>.

The relative importance of the different reasons for living within a neighbourhood differed across the housing tenure and income clusters. The exception to this was living nearby to family and friends. Overall, a similar proportion (two in five) within each cluster valued being close to friends and family. For cluster Types 1, 2 and 3, the most commonly reported reason for living in their neighbourhood was because it was a good safe neighbourhood. However, this was much less commonly reported for cluster Type 4 (predominantly public rental) who most commonly reported affordable housing as the reason they lived within their neighbourhood. While public housing applicants can select areas they would prefer to live in, with limited public housing stock if a house becomes available and is offered then the choice is often to accept the house, or continue to wait, and thus remaining in their current housing situation. In a recent New Zealand study of an affordable housing development, the opportunity to access secure and affordable housing was the primary motivation for moving to the development area for both households in community rental housing and those moving towards home ownership<sup>36</sup>.

Feeling safe, being connected socially, and having family support are important considerations for families when choosing where to live. Being connected to the community through family, schooling and strong local networks can contribute to a sense of satisfaction and belonging<sup>33</sup>.

These are important considerations for future urban development and renewal particularly the disciplines of master planning, urban design, placemaking and community

development. It is important that as housing moves towards higher densities, and communities change, access to parks, playgrounds and other social infrastructure and amenities is protected or enhanced.

### Are these differences in experience related to child outcomes?

Household tenure and income journeys were associated with differences in health and wellbeing outcomes for children. Specifically, there were differences in the odds of experiencing specific health diagnoses, socio-behavioural development problems and educational outcomes between the cluster groups even after accounting for factors well known to be linked to these outcomes (such as ethnicity, sex and deprivation).

When adjusting for other variables, cluster type was significantly associated with child diagnosis of asthma. There was also a trend with general health status and increased accidents and injuries. Children's socio-behavioural development was also shown to be influenced by cluster type – including child self control, hyperactivity and inattention and peer relationships. Additionally, early educational indicators including writing and counting were significantly associated with cluster type.

The early education indicators measured at four years old were significantly predicted by cluster type and area level deprivation with those children in cluster Type 2 and 4 less able to complete the tasks compared to those in cluster Type 3. These indicators can be seen as a way to assess being ready for school. This finding is supported by literature that has shown socio-demographic differences in early learning skills are present before formal schooling commences<sup>38,39</sup>. Research by Hart and Risley<sup>40</sup> also estimated that children from higher income homes were exposed to 30 million more words in the first four years of life than children from low-income homes. This '30-million-word gap' has significant implications for children's language development. Additionally research by *Growing Up in New Zealand* has demonstrated that gaps in word knowledge between children from more deprived and less deprived areas are already evident at age two years<sup>41</sup>. New Zealand children who do not have early language and literacy skills inevitably read more slowly and fall farther and farther behind by adolescence<sup>42</sup>.

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Child social development (peer relationship) and measures of self control were also significantly predicted by cluster type and deprivation. Retrospective studies have found that children with high self control in their early years have better educational achievement, less involvement with the criminal justice system, and better physical and mental health throughout life<sup>43,44</sup>. Consequently, understanding of self control could be an effective way to address societal issues resulting in growing interest in self control from government agencies, educators, and the general public

Additionally, although a relatively large number of studies try to estimate the effect of socioeconomic status on children's health, surprisingly few studies estimate the effect of parental income on children's health. This is partly because surveys that include extensive information on income often do not ask about child health, and surveys that focus on child health include weak measures of parental income<sup>26</sup>.

Many of the child health outcomes including respiratory infections (other than asthma) and number of skin infections were not significantly affected by cluster type after adjusting for other variables. Housing tenure and income journeys may not be the direct cause of some of these outcome differences and it is likely the characteristics associated with these journeys (that were not included in the multivariate modelling) may provide a more direct link between the experience of these journeys and health and wellbeing outcomes for children. For example, when comparing the characteristics of the different housing tenure and income clusters we identified specific factors that may underlie some of these results. For example, housing quality, insulation and heating all differed by cluster group. These factors all contribute to the home environment and therefore could contribute to the differences in outcomes for children in different cluster groups.

The relationship between housing condition and occupants' wellbeing has been well researched. Previous research has clearly demonstrated the negative impacts of poor quality housing on physical and mental health including respiratory infections<sup>45</sup> and close contact infectious diseases<sup>45</sup> and psychological distress<sup>46</sup>. Improvements to condition of housing including insulation, heating and ventilation have achieved positive outcomes of improved perceived health, lower rates of hospitalisation for respiratory illnesses, fewer days of work/school, and fewer GP visits, and lower heating costs<sup>6,47</sup>. Other contributing factors to risks of physical and mental health include, individual hardship, fuel poverty, housing affordability and crowding<sup>46</sup>.

Other factors that are reported to influence child health outcomes either directly or indirectly include residential mobility and crowding. These two factors both differed by cluster type. Frequent housing mobility and insecurity of tenure can have negative impacts on children and families as increased mobility may mean families are less likely to be affiliated with a primary health care provider<sup>2</sup>. Additionally, there is an increased risk of emergency admissions for potentially preventable hospitalisation in early childhood, when children move house within the first twelve months of life<sup>2</sup>. Residential mobility has also been associated with increased socioemotional and behavioural difficulties in preschool children<sup>48</sup>. As low income households in private rental homes experience high residential mobility, often resulting in frequent changes of schools for children<sup>49</sup> there is also an association with poor education performance<sup>49</sup>.

Stabilising mobility and providing families with more control on where they live and for how long – whether they own or rent their home can have many positive effects. A synthesis of evidence bulletin by AHURI concludes that a lack of control over a person's living environment has been identified as a potentially 'chronic' source of stress but that having security of tenure can lead to improved health and wellbeing by providing a degree of ontological security through people having a home, and reducing stress associated with insecure housing and frequent mobility. Reduced stress can assist with the ability for parents and children to focus on longer term goals such as personal relationships and education. Additionally, partial and indirect evidence suggests that security of tenure contributes positively to social cohesion through better residential stability and increased length of residence<sup>49</sup>.

Overall, the housing tenure and income journeys of families appears to be associated with children's health and wellbeing outcomes. The potential for these factors to have a detrimental effect on children's lives may have life-long consequences for New Zealand as a whole. The potential impacts on families experiencing these housing and income fluctuations, as well as some of the poorer housing quality effects may be able to be mediated through additional social interventions and policies targeted to those more vulnerable families. These results therefore highlight the need and importance of wrapping support around families who experience journeys associated with poor health and wellbeing outcomes.

## DISCUSSION



### What are the housing factors that help children to thrive?

Overall, the children in our families regardless of cluster type, environmental influences or housing quality were in good health. Over 80% of mothers reported their child health as excellent or very good across all four clusters and over 70% had no or only a little worry about their child's health at aged four. Over 80% of the children had had all of their four year immunisations across the four cluster types, therefore over 98% of the cohort children had never had any of the MMR vaccine preventable illnesses. Other illnesses such as meningitis, rheumatic fever and scarlet fever also had very low occurrence in the cohort at less than 1% across all four clusters.

Although not a direct housing factor, there was also a high degree of quality parental involvement with the cohort children. The importance of parental involvement has been highlighted by research; for example the frequency with which parents read to young children is a strong and unique predictor of their later language development<sup>55</sup>.

Additionally, most mothers felt their neighbourhoods had good amenities, they lived in areas near family and friends and did not feel unsafe in their neighbourhoods. Feeling safe, being connected socially, and having family support are important considerations for families when choosing where to live. Being connected to the community through family, schooling and strong local networks can contribute to a sense of satisfaction and belonging<sup>33</sup>.

A high proportion of houses were insulated across the cluster types and almost all had some form of heating. Poor housing quality and living conditions have been clearly demonstrated to have negative outcomes for child health and changes to housing quality including adding insulation and heating have been shown to improve child outcomes<sup>5, 47, 56</sup>. Over a third of homes across the cluster types had, in the last year, had some form of renovation done in order to improve the quality of the home. This will continue to mitigate the effects of poor housing quality and will hopefully only increase with more recently implemented housing policy regulations.

The factors highlighted above can all act as agents of resilience. Resilience being the capacity to achieve developmental milestones, such as education and employment, in spite of adversity in childhood. Resilience is based on the complex interactions between risk (adversity)

and protective factors and is better thought of as a process, rather than an event or trait. It also evolves over time, with adversity often leading to responses (e.g. mental health issues or alcohol and drug use) that lead to further adverse outcomes<sup>57</sup>. Research undertaken at SUPERU showed the importance of relationships that served to promote positive attitudes and determination, to provide self-belief and support. Sometimes this support came through agencies, but often it was from extended family or community or schools. Where the response to the initial adverse event had been positive, the impact in terms of negative behaviours could be reduced<sup>57</sup>. Where there are positive resilience factors for families the impacts of housing stability and quality may be able to be diminished.



## LIMITATIONS

Our study has investigated household tenure and income journeys for families; however the methodology we applied did not incorporate equivalised income. This means we have not accounted for differences in household size or composition when reporting total household income. Additionally, we have 9–14% of missing income data across the four timepoints and this may mean the full picture of income differences between families cannot be fully accounted for, however by not excluding these families from the analyses and incorporating them into the SSA we feel we have allowed those families' journeys to be represented.

The crowding measure used here is based on the number of bedrooms versus the number of occupants of the dwelling. Analysis of Te Kupenga 2013, a survey of New Zealand Māori, compared a crowding measure with respondents' perception as to whether their house was too small<sup>58</sup>. The authors noted a key limitation was a focus on the number of bedrooms, rather than the size of the house overall, or how big other spaces in the house were. They also noted that manaakitanga can mean that there are often frequent guests in these homes that are not considered 'usually resident'. This analysis found that responses in terms of whether the house was 'too small' were associated with reported levels of whānau wellbeing, while the objective crowding measure that compared bedrooms to occupants was not associated. This does not undermine our understanding of crowding as a risk factor for infectious disease, but rather adds to our understanding that crowding needs to be understood in the context of the household living there.

Additionally, as there were only just over 300 families in public housing in the study and although these families seemed to show poorer general outcomes, the reason this was not more evident in the analyses may simply be due to sample size effects. We also do not have all the environmental and housing quality data for families and their neighbourhood for each timepoint, so although the analysis is longitudinal in nature, not all the variables are and thus temporality and change for our families cannot always be accurately described or assessed. Access to services such as public transport and medical clinics within the neighbourhood did not differ by cluster and therefore this suggests this is not something underlying the differences seen in cluster groups. However, we note that this may be more about a family's ability to access these services (which we did not look at) rather than the services being available in the neighbourhood.

For analysis purposes we have simplified tenure into three categories but recognise there will be a minority of the cohort that do not fit neatly into these categories. As this is a childcentric study we have used the term family even when those in the household are potentially not mother or father or even a relative. Household income was also referred to as family income. We believe this describes the child's experience of tenure and income, however we appreciate that this may merge the concepts of family and household as defined and used by others

Additionally, attrition bias by excluding those with missing tenure data across the timepoint, as described in the Methods and seen in **Appendix 2 (Table H)**, meant it is likely that if those more vulnerable or deprived families data had been available it may have resulted in more significant differences by cluster type.

Finally the authors would like to acknowledge the broad scope of the research questions we asked and that this has meant we have not been able to drill down into causes of some of the outcomes seen. There is however, the potential to narrow the focus in the future using *Growing Up in New Zealand* data (e.g. drivers of income change over time) to evaluate the effects of policy in more detail and also to use future data collection waves.



## POLICY IMPLICATIONS

Our study used the *Growing Up in New Zealand* longitudinal data to look at the outcomes of children living in homes with different tenures and levels of household income, to understand their lived experiences and to see who is doing well and how does it differ. Children's outcomes have been at the forefront of the Government's agenda in recent years. Achieving improved wellbeing for all children and reducing exposure to poverty, along with measurement of progress, has recently been mandated through new and revised legislation.

The Government's Child and Youth Wellbeing Strategy, released in 2019, recognises the importance of a child's home, that it impacts across many dimensions of wellbeing. One of the six outcomes in the Strategy "Children have what they need" incorporates living in stable housing that is affordable, warm and dry. Progress indicators include housing affordability and housing quality. The associated Action Plan within the Strategy sets out a range of housing-related actions, policies and legislation changes currently being implemented or planned which aim to achieve this outcome.

From our findings emerged four key themes for policy makers to consider. For each theme we have identified current policies, legislation and public sector activity that support our themes, along with recommended actions to achieve greater impact.

### **Supporting families through income and housing tenure journeys during the first few years, enhancing positive change and, reducing negative change.**

Most cohort families experienced a degree of movement and fluctuation between income types and housing tenure types during the first four years of their child's life, with changes in income being more frequent than housing tenure changes. Families renting their home experienced more journey fluctuation compared to families who owned their home.

We saw in our analysis that those who changed housing tenure (~30% of our cohort) were relatively evenly split between families moving from private rental into homeownership, or families moving from home ownership into private rental. A much smaller proportion (3.4%) shifted between private and public rental homes.

Policies providing financial or subsidy support for families during the preschool years could alleviate or 'smooth out' these journeys. Financial assistance may also lessen a need for housing tenure change where necessitated from decreased income. Home ownership subsidies and affordable housing options may enable families with young children, even with income fluctuations, to be able to move into home ownership.

### **CONTRIBUTION THROUGH CURRENT POLICY AND PUBLIC SECTOR ACTIVITY:**

- Continuation of, and greater promotion of family and child support policies that provide subsidies or income assistance, that alleviate the loss of income. Including, Paid Parental Leave, Best Start, Working for Families and Flexible Working arrangements.
- Continuation of current home ownership schemes such as KiwiSaver Home Start and the Progressive Homeownership scheme, combined with an increase in affordable housing supply over the short to medium term may see more families with young children be able to change tenure from renting to home ownership.
- Increased supply of affordable and public housing through the Government's housing and urban development programme may reduce housing cost/rents and provide more housing options.
- Opportunities to contribute to the Child and Youth Wellbeing Strategy.

### **ADDITIONAL RECOMMENDATIONS:**

- + Policy to support low-income families' income stability in the first year of children's lives i.e. amendment to Paid Parental Leave policy to allow parents to return to work on a gradual basis while still receiving a subsidy as rental homes in the low and medium income groups showed far less income stability across the four timepoints, thus receipt of a subsidy for a longer period would likely improve stability.
- + For those not eligible for the Accommodation Supplement, provision of short-term financial support for families to cover rent increases or interest increases for mortgage payments that may occur during the period from birth to early childhood when incomes are most affected. Ensure families know if they are eligible for the Accommodation Supplement e.g. information pack provided through Lead Maternity Carers or GP.

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- + Provision of a wider range of affordable housing options to assist an increased level of subsidy, to enable families in lower income groups to move from rental to private home ownership tenure. Options could include shared ownership, or rent-to-buy, as our study has shown homeownership was a more favourable outcome for families.
- + Improved security of tenure for families through provision of government owned rental housing options for low-medium income families who do not qualify for public housing but can afford to pay market rent. This may be particularly beneficial for families where renting is a long term housing solution, and provide more control over rent increases during the tenancy.
- Kāinga Ora's social obligations include assisting neighbourhoods and communities to flourish. This will be achieved through urban design and community engagement and community development activity, creating more connected communities and enhancing a 'sense of place'.
- Public housing tenancy reviews now exclude families with children under 18 years of age unless their income exceeds eligibility criteria.
- Increased affordable housing supply through the government's build programme as well as the home ownership financial support schemes – making home ownership a more accessible housing option.

### **Improve security of tenure for families renting, enable them to create a place to call home, facilitate residential stability and promote connected communities.**

*Growing Up in New Zealand* families experienced a high degree of residential mobility, particularly those living in private sector rental homes. Research has shown people who rent shift home more frequently than those who own their home. Income, housing cost, and tenure security are key factors that contribute to residential stability.

Over 70% of families across all four clusters had good access to amenities and playgrounds. It will be important for current and future public and affordable housing developments to continue to retain and enhance these connections.

#### **CONTRIBUTION THROUGH CURRENT POLICY AND PUBLIC SECTOR ACTIVITY:**

- Residential Tenancies Amendment Act included provisions that will include security of tenure for tenants, manage housing cost through rent review restrictions, and allows tenants to make minor changes to help create a 'home'.
- Healthy Homes Guarantee Act and Standards will ensure rental homes are warm, dry and safe. This will reduce the need for families to have to move due to poor quality housing.
- A Sustaining Tenancies approach by Kāinga Ora provides greater support for tenants at risk of losing their home, enabling them to address issues putting their tenancy at risk.
- The Sustaining Tenancies service implemented by the Te Tūāpapa Kura Kāinga – Ministry of Housing and Urban Development to assist individuals, families and whānau at risk of losing their tenancy.

#### **ADDITIONAL RECOMMENDATIONS:**

- + Increased tenancy protection for families in rental homes with young children to try to improve stability and reduce both mobility and stresses associated with repeated changes in housing. Nearly 20% of families renting (low/medium income) had moved three or more times in four/five years.
- + Provision of more affordable housing options such as rent-to-buy, shared ownership, or government owned affordable rentals aimed specifically at families who do not qualify for public housing but face high housing costs in the private rental sector. This will provide greater security of tenure.
- + Ability for families renting to sign medium to long term rental agreements, and for longer notification periods when landlords want to sell.
- + Residential stability could lead to stronger community connection and empowerment. Consider developing policy or legislation to empower communities – ensuring more engagement on matters impacting a community, and their voice is heard in decision-making. An example is the Community Empowerment Act 2015 and subsequent policy development by the Scottish Government to strengthen community engagement and empower them to have more say and control over matters that affect them (<https://www.gov.scot/policies/community-empowerment>).
- + Deep dive research into the reasons families move, providing a clearer understanding of drivers, barriers to staying, analysis of the different or similar drivers between private rental mobility public housing mobility and what affects security of tenure within each sector. An understanding of the reason for moves would aid in identifying support solutions. For example positive reasons could include for family support, bigger house, and strategic e.g. better school, employment reasons, while negative reasons may include where families had no choice, e.g. landlord selling property or housing costs become unaffordable (mortgage payment or rent).



## DISCUSSION



**Our results support current policy and legislation aimed at ensuring rental homes are warm, dry, and safe. Maintain focus on reducing crowding through families accessing housing that meets their needs.**

Our results are in line with wider research findings that rental houses in New Zealand are in poorer condition than owner-occupied homes. Houses should be fit for purpose whether rented or owned, which includes being dry and safe and able to be heated efficiently and cost-effectively to achieve WHO recommended indoor room temperature of 18°C. These conditions are critical to improving the warmth and dryness of our children's homes to give them the best start in life. It is through regulation that this will be achieved; however incentives, assistance through subsidies, and better education on making your home warm and dry will also all contribute to healthier home environments for children.

There a number of regulatory and educational mechanisms currently in progress aimed at improving the quality of housing. Housing quality measurement over the short to medium term should demonstrate success of these mechanisms, with indicators being included in the Government's Child Wellbeing Strategy, national population wellbeing approaches such as the Living Standards Framework and Indicators Aotearoa New Zealand. Regular surveys including BRANZ House Condition Survey, and Census (if the house condition questions are repeated), along with organisational evaluation and monitoring such as that by the Ministry for Housing and Urban Development and Kāinga Ora, will also demonstrate progress in improving the condition of homes children are living in.

Past and current initiatives with a cross-agency, collaborative approach have shown success at addressing housing condition and crowding amongst other challenges, e.g. the Healthy Housing Programme, and more recently the Healthy Homes Initiative. Both initiatives have resulted in positive outcomes experienced by the participating families.

**CONTRIBUTION THROUGH CURRENT POLICY AND PUBLIC SECTOR ACTIVITY:**

- Residential Tenancies Act and the Healthy Homes Standards provide a set of standards for heating, insulation, ventilation, moisture and draught stopping that all rental properties must comply with. Landlords have until 2024 to ensure their properties fully comply.
- Warmer Kiwi Homes Programme providing grants for heater and insulation installation to low income home owners.

- Winter Energy Payment – support payment for energy costs to help families afford to heat their homes.
- Kāinga Ora's housing standards will result in all new homes meeting HomeStar6 rating, ensuring they are warm, dry, safe and cost-efficient to heat.
- Kāinga Ora will be rolling out a significant urban renewal programme which will deliver new built homes but also improve the condition of existing public rental housing. The programme includes a mix of small and large-scale projects redevelopment projects to deliver new affordable and public housing. Renewal and upgrade of existing public houses (those not being redeveloped) will be undertaken through Retrofit and Health Homes Programmes. New supply of housing will contribute towards alleviating crowding.
- Healthy Homes Initiative: participants included families in crowded housing. The housing assessment and action plan will look at what is needed to address crowding and to make the home warm and dry, and then implement necessary solutions through cross-agency collaboration.
- Emergency Housing and Transitional Housing: these two programmes overseen by the Ministry for Social Development, Te Tūāpapa Kura Kāinga – Ministry of Housing and Urban Development could help prevent higher rates of crowding by providing urgent temporary homes for those with a critical and urgent housing need.
- Provision of educational material and advice by Crown agencies on how to improve the condition of a home in terms of keeping it warm and dry.

**ADDITIONAL RECOMMENDATIONS:**

- + Continuation and expansion of initiatives such as the Healthy Housing Initiative and Rheumatic Fever Prevention Programme, that focus specifically on families with critical needs around housing condition and crowding. These initiatives allow the fast-tracking of solutions and can also identify and provide support for other challenges families may be facing.
- + Explore options to encourage early or speedier compliance with the Healthy Homes Standards. This could also potentially reduce compliance costs and any associated stress for renting families, e.g. low-interest loans for landlords to undertake required works.
- + Widen perspective/concept of Health Homes Standards to all residential property and provide low-interest loans for all home owners to bring their homes up to standard. This would ensure all children live in warm, dry and safe homes.

## DISCUSSION



- + Ensure educational campaigns on required housing standards and support services are wide-reaching and appropriately designed for all types of families and whanau renting, as well as landlords.
- + Re-establish the Rheumatic Fever Prevention Programme: involving District Health Boards, Kāinga Ora and other government agencies, the programme identifies and refers children and their families living in crowded conditions and at risk of Rheumatic Fever for housing assessments. Plans are developed and implemented addressing underlying factors such as housing need, condition of the home and health needs.
- + Create a safe and positive environment where families experiencing severe crowding feel they can speak out about it without risk of adverse consequences e.g. risking their tenancy.
- + Heating poverty – review of policy to help families on lower incomes to be able to afford to heat their homes when needed. Look to options that will be cost-effective over the medium to long term, rather than short-term focus, or winter by winter. Long term option could include regulation of electricity prices.
- + New housing supply must provide a mix of housing typologies built to accommodate large families and small families appropriately. For existing homes, consideration should be given to initiatives for adding bedroom extensions, or adding separate self-contained small dwellings on site to provide the right number of bedrooms required, or accommodate extended family members.

This study has highlighted that for many, housing and income state is not something that stays static after the birth of a child and has the potential to negatively impact families over the course of years. This research emphasises why it is important to have the appropriate safety nets to support families during this time.

**Enable environments that contribute to optimal cognitive and educational outcomes for children whether their families rent or own their home. Supporting opportunities for quality time between parents and their children.**

Our results indicate differences exist for educational indicators, social development (peer relationship) and self control among children living in low to medium income renting households compared to medium to high income home owning households. It is concerning if these differences remain as children enter and progress through school both for educational achievement and positive social relationships.

However, we also saw a high proportion of parents across the different housing tenure and income groups spend time with their children on educational activities along with singing, playing music and telling stories. Likewise a majority of families indicated they had good access to parks and playgrounds in their neighbourhood. Ensuring children spend quality time with their families, have opportunities to build knowledge and skills, as well as play are identified in the outcomes being sought through the Child and Youth Wellbeing Strategy outcomes.

**CONTRIBUTION THROUGH CURRENT POLICY AND PUBLIC SECTOR ACTIVITY:**

- Existing programmes in communities for parents/ caregivers and young children i.e. Public Libraries reading and music programmes.
- Paid Parental Leave – allows parents to have time at home with their young children.
- Flexible working arrangements.
- Improved condition of rental housing, energy subsidies and reducing crowding – families no longer need to move in together, or they can access a home with the right number of bedrooms.
- Master planning for urban development activity will encompass assessment of community and neighbourhood social amenity spaces including provision of greenspace, cycleways, and playgrounds.

## DISCUSSION

**ADDITIONAL RECOMMENDATIONS:**

- + Consider opportunities to increase funding/enable more community-based programmes for families with preschool aged children.
- + Develop a social support policy for families in public housing specifically for mothers with young children with a focus on mothers' health and wellbeing.
- + Focus needed on early indicators of cognitive development issues (specifically peer relationships) for under five year old's growing up in lower income households – creation/strengthening of support services for families.
- + A universal screening tool to evaluate whether children are “ready to learn” alongside targeted support structures, to help reduce associated inequities in outcomes for children who have already experienced considerable housing insecurity by the time they start school.
- + Additional support for families to facilitate high-quality ECE attendance may help to ensure more children are starting school with the requisite skills.
- + Policy focus on building/ensuring family/whānau support in neighbourhoods and communities to facilitate social support.

Ensuring children spend quality time with their families, have opportunities to build knowledge and skills, as well as play are identified in the outcomes being sought through the Child and Youth Wellbeing Strategy outcomes. Exposure to these experiences and ability to participate should not be determined or negatively impacted by housing tenure or income level.

**FUTURE DIRECTIONS FOR RESEARCH**

We have the potential to continue the sequence analyses for these families and extend the research using the data from future data collections and evaluate not only if the patterns seen in this report are still evident but also whether some of the policy interventions and legislation that have subsequently been introduced (i.e. the Healthy Homes Standards) as well as public sector programmes such as Kāinga Ora's build and renewal programme have had any effect on children's health and wellbeing. Given level of residential mobility found in this report and that observed in

the *Growing Up in New Zealand* cohort<sup>3</sup>, now that the children have started school, and that school is cited as a reason for mobility, it will be interesting to look at the influence of continued housing mobility on outcomes for children and also if the patterns of income stability and tenure have altered over time. This will also allow us to see if differences in educational outcomes persist and whether, or not chronic health outcomes emerge once younger childhood illnesses have largely passed.



# Conclusion

This study has described the living experiences or journeys in different housing tenure types and with different income levels of New Zealand children during their early years. In doing so we have increased our understanding of how housing changes over time for New Zealand families, and identified some of the key demographic, family, household and neighbourhood/community characteristics that are associated with these residential situations and their relationship with early life child outcomes in New Zealand. This study has highlighted that for many, housing and income state is not something that stays static after the birth of a child and has the potential to negatively impact families over the course of years.

While the report demonstrates associations between housing and income, and specific measures of wellbeing, causality has not been addressed. However, these results highlight the need and importance of wrapping support around families who experience journeys associated with poorer health and wellbeing outcomes.

Household tenure and income journeys differed by family, housing and sociodemographic factors and were associated with differences in health and wellbeing outcomes for children. These analyses point to the complexity of the pathways to wellbeing for many children in New Zealand.

Our ability to describe housing-related pathways, and their associations with child outcomes across early years, therefore provides new evidence on the factors that may also promote wellbeing for Māori and Pacific families, and support improved health equity. We note that we have not analysed our data specifically by ethnic group, as ethnicity is who the mothers and children are, rather than a housing experience, or an outcome. However, we can see that tamariki Māori and Pacific children made up a bigger group in cluster Type 4, and to some extent cluster Type 2, than cluster Types 1 and 3. Our results therefore can help to emphasise the importance of Government agencies working with Iwi, hapū and rūpu Māori, as well as Pacific communities to ensure that the policies noted above will be effective at meeting the needs of the households these children are a part of. It also highlights the importance of involving these communities in the development of any programmes that are targeted toward renters – public or private.

One of the strengths of using *Growing Up in New Zealand's* multidisciplinary, longitudinal information of children, their families and their environments has enabled us to more holistically answer our research questions. We have shown that families with young children in different tenure types and with different incomes do have different experiences and that these experiences are not the same for families living in public housing. These differences have also been shown to be associated with early childhood health and wellbeing and that some of our population's children are thriving more so than others.



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# Appendix 1:

## Questions used as input variables in analyses

**TABLE A:** Housing tenure questions

Question	Timepoint	Response options
Do you, or anyone else who lives here, own this dwelling (with or without mortgage)?	Antenatal	1. Freehold, 2. Own paying mortgage, 3. Family trust, 4. Private rental, 5. Public rental, 6. Free rental, 7. Own – don't know, 8. Other
Have you moved since the last interview?	9 month	1. Yes, 2. No, 99. Don't know, 98. Prefer not to say
Do you, or anyone else who lives here, own this dwelling (with or without mortgage)?	9 month	1. Yes, 2. No, 99. Don't know, 98. Prefer not to say
If nobody who lives here owns this dwelling, who owns it?	9 month	1. Private person, trust, or business, 2. Family trust, 4. Housing New Zealand, 5. Other state-owned corporation or state-owned enterprise, or government department or ministry, 99. Don't know, 98. Prefer not to say
Do you, or anyone else who lives here, pay rent to an owner or to an agent for this house/flat?	9 month	1. Yes, 2. No, 99. Don't know, 98. Prefer not to say
Do you, or anyone else who lives here, make mortgage payments for this house/flat?	9 month	1. Yes, 2. No, 99. Don't know, 98. Prefer not to say
Have you moved house since your child/children was 9 months old?	2 year	1. Yes, 2. No, 99. Don't know, 98. Prefer not to say
Do you, or anyone else who lives there, own or partly own the house/flat you live in (with or without a mortgage)?	2 year	1. Yes, 2. No, 99. Don't know, 98. Prefer not to say
If nobody who lives here owns the house/flat you live in, who owns it?	2 year	1. Private Person, Trust, Or Business, 2. Family Trust, 3. Local Authority/City Council, 4. Housing New Zealand, 5. Other State-Owned, 99. Don't know, 98. Prefer not to say.
Do you, or anyone else who lives with you, pay rent to an owner or to an agent for this house/flat you live in?	2 year	1. Yes, 2. No, 99. Don't know, 98. Prefer not to say
Do you, or anyone else who lives with you, make mortgage payments for the house/flat you live in?	2 year	1. Yes, 2. No, 99. Don't know, 98. Prefer not to say
How many times have you moved house since your child was/children were two years old?	4 year	0. None, 1. One, 2. Two, 3. Three, 4. Four or more, 99. Don't know, 98. Prefer not to say
Do you or anyone else who lives there, own or partly own the house/flat you live in (with or without a mortgage)?	4 year	0. No, 1. Yes, 99. Don't know, 98. Prefer not to say
Do you, or anyone else who lives with you, make mortgage payments for the house/flat you live in?	4 year	0. No, 1. Yes, 99. Don't know, 98. Prefer not to say
If nobody who lives here owns the house/flat you live in, who owns it?	4 year	1. Private Person, Trust, Or Business, 2. Family Trust, 3. Local Authority/City Council, 4. Housing New Zealand, 5. Other State-Owned, 97. Other (please specify), 99. Don't know, 98. Prefer not to say
Do you, or anyone else who lives with you, pay rent to an owner or to an agent for this house/flat you live in?	4 year	0. No, 1. Yes, 99. Don't know, 98. Prefer not to say



## APPENDIX 1



TABLE B: Household income questions

Question	Timepoint	Response options
Household income groups – categorised	Antenatal, 9 month	1. <=20K, 2. >20K <=30K, 3. >30K <=50K, 4. >50K <=70K, 5. >70K <=100K, 6. >100K <=150K, 7. >150K
What was your household's total income, before tax or anything else was taken out of it? Please include your personal income in this total.	2 year	1. Loss/Zero Income/\$1-\$5,000 (\$1-\$84 per week after tax), 2. \$5,001-\$10,000 (\$84-\$168 per week after tax), 3. \$10,001-\$15,000 (\$168-\$250 per week after tax), 4. \$15,001-\$20,000 (\$250-\$327 per week after tax), 5. \$20,001-\$25,000 (\$327-\$400 per week after tax), 6. \$25,001-\$30,000 (\$400-\$480 per week after tax), 7. \$30,001-\$40,000 (\$480-\$630 per week after tax), 8. \$40,001-\$50,000 (\$630-\$777 per week after tax), 9. \$50,001-\$70,000 (\$777-\$1000 per week after tax), 10. \$70,001-\$100,000 (\$1000-\$1400 per week after tax), 11. \$100,001-\$150,000 (\$1400-\$2000 per week after tax), 12. \$150,001 Or More (\$2000+ per week after tax), 99. Don't know, 98. Prefer not to say
What was your household's total income? (categorised)	4 year	1. NA, 1. <=20K, 2. >20K <=30K, 3. >30K <=50K, 4. >50K <=70K, 5. >70K <=100K, 6. >100K <=150K, 7. >150K

TABLE C: Maternal questions

Question	Timepoint	Response options
Mother age (years) – derived and re-categorised	Antenatal	<=18, 19-40, >=41
Thinking about before you became pregnant, in general would you say your health was...	Antenatal	0. Poor, 1. Fair, 2. Good, 3. Very good, 4. Excellent, 9. Don't know and Prefer not to say
Highest education – re-classified	Antenatal	0. No secondary school qualification, 1. Secondary school/ NCEA 1-4, 2. Diploma/Trade certificate/NCEA 5-6, 3. Bachelor's degree, 4. Higher degree
Are you currently smoking?	Antenatal	1. Yes, 2. No, 9. Don't know and Prefer not to say
Do you currently smoke regularly, at least one cigarette a day?	9 month	1. Yes, 2. No, 99. Don't know, 98. Prefer not to say
Do you currently smoke regularly, at least one cigarette a day?	2 year	1. Yes, 2. No, 99. Don't know, 98. Prefer not to say
Do you currently smoke regularly, at least one cigarette a day?	4 year	0. No, 1. Yes, 99. Don't know, 98. Prefer not to say
Self-prioritised ethnicity – re-classified	Antenatal	1. European, 2. Māori, 3. Pacific, 4. Asian, 5. MELAA, 6. Other, 8. New Zealander, 9. Don't know and Prefer not to say

## APPENDIX 1



TABLE D: Child focused questions

Question	Timepoint	Response options
In general, how would you say child's current health is?	9 month, 2 year, 4 year	1. Excellent, 2. Very good, 3. Good, 4. Fair, 5. Poor, 99. Don't know, 98. Prefer not to say
In general, over the last year, how much worry or concern did (name)'s health cause you?	4 year	1. No worry or concern, 2. A little worry or concern, 3. Some worry or concern, 4. Quite a bit of worry or concern, 5. A lot of worry or concern, 99. Don't know, 98. Prefer not to say
In the past 12 months, how many times has (name) seen a GP or family doctor? (categorised)	4 year	0. Never, 1-24, 25+ times
Which, if any of these other childhood illnesses, has (name) ever had... <ul style="list-style-type: none"> <li>· Measles including German measles (Rubella)?</li> <li>· Chicken pox?</li> <li>· Mumps?</li> <li>· Meningitis?</li> <li>· Whooping cough or pertussis?</li> <li>· Rheumatic fever?</li> <li>· Scarlet fever?</li> <li>· None of the above?</li> <li>· Don't know</li> <li>· Prefer not to say</li> </ul>	4 year	0. No, 1. Yes
Which, if any, of these common childhood illnesses has child had in the last 12 months? <ul style="list-style-type: none"> <li>· Non-food allergies</li> <li>· Hay-fever</li> <li>· Ear infections</li> <li>· Asthma</li> <li>· Whooping cough or pertussis</li> <li>· Other respiratory disorders including chest infections, bronchiolitis, bronchitis, pneumonia</li> <li>· Cough lasting more than four weeks</li> <li>· Wheezing in the chest</li> <li>· Gastroenteritis (this is 3 or more watery or looser-than-normal bowel movements or diarrhoea within a 24 hour period)</li> <li>· Eczema or dermatitis</li> <li>· Throat infection or tonsillitis</li> <li>· Skin infections (where the skin is red or warm or painful or swollen, or there are pustules or boils, or crusting or oozing)</li> <li>· Rheumatic fever</li> <li>· Measles including German measles (Rubella)</li> <li>· Chicken pox</li> <li>· Mumps</li> <li>· Meningitis</li> <li>· Scarlet Fever</li> <li>· None of the above</li> <li>· Don't know</li> <li>· Prefer not to say</li> </ul>	4 year	0. No, 1. Yes
How many courses of antibiotics has child had in the last 12 months?	4 year	0. None, 1. One to two courses, 2. Three to four courses, 3. Five to six courses, 4. Seven or more courses, 99. Don't know, 98. Prefer not to say
Most children have accidents or injuries at some time. Since child was two, has he/she ever had an accident or injury for which he/she was taken to the doctor, dentist, health centre, or hospital?	4 year	0. No, 1. Yes, 99. Don't know, 98. Prefer not to say

## APPENDIX 1



TABLE D: Child focused questions

Question	Timepoint	Response options
How many accidents or injuries (number of accidents)?	4 year	1. Number of accidents, 99. Don't know, 98. Prefer not to say
Thinking about the most severe (or only) accident or injury since child was two, what sort of accident or injury was this?	4 year	1. Loss of consciousness/knocked out, 2. Bang on the head/injury to head without being knocked out, 3. Broken bone, fracture or dislocation, 4. Near drowning, 5. Swallowed household cleaner/other poison/pills, 6. Swallowed object, 7. Cut needing stitches or glue, 8. Injury to mouth or tooth, 9. Burn or scald, 10. Fall, 11. Motor vehicle related crash (occupant or pedestrian), 97. Other (Please specify), 99. Don't know, 98. Prefer not to say
Gift Wrap task – time elapsed before first peek	4 years	1. Child never peeked during 1–min timing, 2. Time
Gift Wrap task – how many times did the child peek?	4 years	1. Child peeked once, 2. Child peeked more than once, 3. Child peeked once or more and then remained peeking for the remainder of the timing, 4. Child peeked (one or more times) and touched the gift.
How often do you read books with child?	4 years	1. Seldom or never, 2. Once a week, 3. Several times a week, 4. Once a day, 5. Several times a day, 99. Don't know, 98. Prefer not to say
How often do you tell stories to child? Do not include reading books	4 years	1. Seldom or never, 2. Once a week, 3. Several times a week, 4. Once a day, 5. Several times a day, 99. Don't know, 98. Prefer not to say
How often do you sing songs or play music with child?	4 years	1. Seldom or never, 2. Once a week, 3. Several times a week, 4. Once a day, 5. Several times a day, 99. Don't know, 98. Prefer not to say
How often do you encourage child to print letters, words, or numbers?	4 years	1. Seldom or never, 2. Once a week, 3. Several times a week, 4. Once a day, 5. Several times a day, 99. Don't know, 98. Prefer not to say
How often do you encourage child to read words?	4 years	1. Seldom or never, 2. Once a week, 3. Several times a week, 4. Once a day, 5. Several times a day, 99. Don't know, 98. Prefer not to say
How often do you encourage child to count?	4 years	1. Seldom or never, 2. Once a week, 3. Several times a week, 4. Once a day, 5. Several times a day, 99. Don't know, 98. Prefer not to say
How often do you encourage child to recognise numbers?	4 years	1. Seldom or never, 2. Once a week, 3. Several times a week, 4. Once a day, 5. Several times a day, 99. Don't know, 98. Prefer not to say
SDQ – What is the level of emotional symptoms that child has at 54 month?	4 years	0. Normal, 1. Borderline, 2. Abnormal
SDQ – What is the level of hyperactivity inattention that child has at 54 month?	4 years	0. Normal, 1. Borderline, 2. Abnormal
SDQ – What is the level of peer problems that child has at 54 month?	4 years	0. Normal, 1. Borderline, 2. Abnormal
SDQ – What is the level of prosocial behaviour that child has at 54 month?	4 years	0. Normal, 1. Borderline, 2. Abnormal
Name & Numbers – Writing	4 years	Raw data – see Table K for scoring protocol
Name & Numbers – Counting	4 years	Raw data – 0–10 score

## APPENDIX 1



TABLE E: Family related questions

Question	Timepoint	Response options
Household structure (re-categorised)	Antenatal, 2 year	1. Parent alone, 2. Two parents, 3. Parent(s) with extended family, 4. Parent(s) living with non-kin (and extended family if applicable)
How many siblings does child have? (re-categorised)	4 year	1-10, 10+, 99. Don't know, 98. Prefer not to say
In the last 12 months have you personally: <ul style="list-style-type: none"> <li>· been forced to buy cheaper food so that you could pay for other things you needed?</li> <li>· put up with feeling cold to save heating costs?</li> <li>· made use of special food grants or food banks because you did not have enough money for food?</li> <li>· continued wearing shoes with holes because you could not afford replacements?</li> <li>· gone without fresh fruit and vegetables often, so that you could pay for other things you needed?</li> <li>· received help in the form of food, clothes or money from a community organisation (like the Salvation Army)?</li> </ul>	9 month, 4 year	9 month labels: 1. Yes, 2. No, 99. Don't know, 98. Prefer not to say  4 year labels: 0. No, 1. Yes, 99. Don't know, 98. Prefer not to say

TABLE F: Household questions

Question	Timepoint	Response options
How many bedrooms are there in this dwelling? (re-categorised)	Antenatal	1. None or 1, 2-6, 7+
How many people are in the household, not counting yourself? (re-categorised)	Antenatal	1-11+
How many bedrooms are there in this house? (re-categorised)	9 months	1-6+, 99. Don't know, 98. Prefer not to say
How many people aged 18 years or over live in the household? (re-categorised)	9 months	1-6+, 99. Don't know, 98. Prefer not to say
How many people aged under 18 years live in the household? (re-categorised)	9 months	1-6+, 99. Don't know, 98. Prefer not to say
Number of people and age in the house?	23 month phone call	Categorised into the household grid
How many bedrooms are there in the house you live in?	2 year	1. None or 1, 2-7, 8+
How many bedrooms are in the house where child lives? (re-categorised)	4 year	1-7, 8+, Don't know, 98. Prefer not to say
How many adults (aged 18 and over) live in the same house as child? (re-categorised)	4 year	1-8, 9+, Don't know, 98. Prefer not to say
How many boys (aged under 18 years) live in the same house as child? (re-categorised)	4 year	1-6+, 99. Don't know, 98. Prefer not to say
How many girls (aged under 18 years) live in the same house as child? (re-categorised)	4 year	1-6+, 99. Don't know, 98. Prefer not to say

## APPENDIX 1



TABLE F: Household questions

Question	Timepoint	Response options
<p>What is the current sleeping arrangement you have for your child most of the time in your home:</p> <ul style="list-style-type: none"> <li>· In a separate room alone?</li> <li>· In a separate bed in a shared room with sibling(s)/ other children?</li> <li>· In a shared bed with other sibling(s)/other children?</li> <li>· In a separate bed in a shared room with parents?</li> <li>· In a shared bed with parents?</li> <li>· In a separate bed in shared room with other adults?</li> <li>· In a shared bed in a room with other adults?</li> <li>· Other?</li> </ul>	45 month phone call	0. No, 1. Yes, Don't know, 98. Prefer not to say
How many times have you moved house since the last interview?	9 month	1-3, 4+, 88. Not moved, 99. Don't know, 98. Prefer not to say
Have you moved house since your child was 9 months old?	2 year	1. Yes, 2. No, 99. Don't know, 98. Prefer not to say
How many times have you moved house since your child was two years old?	4 year	0. None, 1. One, 2. Two, 3. Three, 4. Four or more, 99. Don't know, 98. Prefer not to say
How many times have you moved house since your <i>Growing Up in New Zealand</i> child/children were 4.5 years old?	72 month online questionnaire	0. None, 1-6, 7+, 99. Don't know, 98. Prefer not to say
What is most important reason why you have moved house since your <i>Growing Up in New Zealand</i> child/ children were 4.5 years old?	72 month online questionnaire	<p>1. We need to move for employment/work/business reasons, 2. To have more family support nearby, 3. To be closer to a particular school for your study child/children, 4. To be closer to a particular school for other children in the family, 5. We moved for financial reasons, 6. We wanted to move to a different neighbourhood, 7. We bought our own house, 8. We lived in a rental property and it was sold, 9. We lived in a rental property and the rent was increased, 10. Our lease on our rental property expired or we were given notice by our landlord (for reason other than the rental property being sold), 11. We wanted to move into a warmer, drier and/or safer house, 12. We wanted to move into a bigger property/house, 14. Because of the breakdown of a marriage or relationship, 15. Because of a new marriage or relationship, 16. We moved in with family, 97. Other, 99. Don't know, 98. Prefer not to say</p> <p>Note: Option 13. We wanted to move into a smaller property/house was merged with 97. Other due to small numbers.</p>
What type of dwelling is this?	2 year – Interviewer observation	1. Separate house, 2. Semi-detached house/row or terrace house/townhouse etc., 3. Flat/unit/apartment, 4. Caravan/cabin, 5. House or flat attached to shop, office etc., 6. Farm, 9. Converted garage/sleepout, 95. Not sighted, 97. Other
What is the external condition of this dwelling?	2 year – Interviewer observation	1. Badly deteriorated, 2. Poor condition with peeling paint and need of repair, 3. Fair condition, 4. Well-kept with good repair and exterior surface, 6. No chance to observe, 7. Don't know
<p>Is your house/flat insulated:</p> <ul style="list-style-type: none"> <li>· In the ceiling?</li> <li>· Under the floor?</li> <li>· In the walls?</li> </ul>	4 year	0. No, 1. Yes, 99. Don't know, 98. Prefer not to say

## APPENDIX 1



TABLE F: Household questions

Question	Timepoint	Response options
<p>Since you have been living in this house has it undergone any of these major changes:</p> <ul style="list-style-type: none"> <li>• Insulation installed?</li> <li>• Heat pump installed?</li> <li>• Installation of any other heating system?</li> <li>• HRV/DVS or similar ventilation system installed?</li> <li>• Double glazing?</li> <li>• No changes?</li> </ul>	4 year	0. No, 1. Yes, 99. Don't know, 98. Prefer not to say
Was your insulation or your heat pump installation subsidised through the Warm Up New Zealand scheme or similar?	4 year	0. No, 1. Yes, 99. Don't know, 98. Prefer not to say
Did you use any heating when your house was cold during the most recent winter?	4 year	1. Yes, always, 2. Yes, most of the time, 3. Yes, sometimes, 4. No I did not use any heating even though the house was cold, 5. No I did not use any heating because my house was not cold, 99. Don't know, 98. Prefer not to say
How often would you say the house where 'baby' lives most was damp?	9 month	1. Never/hardly ever, 2. Not very often, 3. Quite often, 4. Always/almost always, 99. Don't know, 98. Prefer not to say
How often was there heavy condensation in the room where your baby sleeps at night, that is, water trickling down the inside of the windows or wall, or a puddle of water at the bottom of the window or wall?	9 month	1. Never/hardly ever, 2. Not very often, 3. Quite often, 4. Always/almost always, 99. Don't know, 98. Prefer not to say
Thinking about the past two weeks, has there been mould or mildew on the walls or ceilings in the room where your baby sleeps at night?	9 month	1. Yes, 2. No, 99. Don't know, 98. Prefer not to say

## APPENDIX 1



TABLE G: Community/neighbourhood related questions

Question	Timepoint	Response options
New Zealand Deprivation Index Classification (2006)	Antenatal, 9 month, 2 year	1. NZDep=1, 2. NZDep=2, 3. NZDep=3, 4. NZDep=4, 5. NZDep=5, 6. NZDep=6, 7. NZDep=7, 8. NZDep=8, 9. NZDep=9, 10. NZDep=10
New Zealand Deprivation Index Classification (2013)	4 year	1. NZDep=1, 2. NZDep=2, 3. NZDep=3, 4. NZDep=4, 5. NZDep=5, 6. NZDep=6, 7. NZDep=7, 8. NZDep=8, 9. NZDep=9, 10. NZDep=10
How would you rate the general condition of most of the buildings nearby, say within 100 metres of the respondent's house?	2 year – Interviewer observation	1. Badly deteriorated, 2. Poor condition with peeling paint and need of repair, 3. Fair condition, 4. Well-kept with good repair and exterior surface, 5. No other dwellings nearby, 6. No chance to observe, 7. Don't know
Why do you live in this neighbourhood: <ul style="list-style-type: none"> <li>• Work?</li> <li>• Good education?</li> <li>• Friends/family nearby?</li> <li>• Better or more affordable housing/rental?</li> <li>• With similar population groups?</li> <li>• Good and safe neighbourhood?</li> <li>• Handy to shops and other amenities?</li> <li>• Pregnancy related reason?</li> <li>• I like the local lifestyle?</li> <li>• My spouse/partner/family have a house here?</li> <li>• Other?</li> </ul>	Antenatal	0. No, 1. Yes, 99. Don't know/Prefer not to say
To what extent do you agree or disagree with these statements about your neighbourhood: <ul style="list-style-type: none"> <li>• there are good parks, playgrounds, and play spaces in this neighbourhood?</li> <li>• there is access to close, affordable, regular public transport in this neighbourhood?</li> <li>• there is access to basic shopping facilities in this neighbourhood?</li> <li>• there is access to basic services such as banks, medical clinics, etc., in this neighbourhood?</li> </ul>	2 year	1. Strongly disagree, 2. Disagree, 3. Agree, 4. Strongly agree, 99. Don't know, 98. Prefer not to say



# Appendix 2:

## The research cohort and missingness

Overall from the baseline cohort (n=6853) there is only 24% missing in total due to there being missing data at any one of the four timepoints used in the study. Showing the % of missing using the denominator of total missing allows a better comparison of missing between the categories of each variable. For example for gender we see that the % of missing is similar for both male and female (male 52.4% vs. female 47.6%). Additionally, when comparing tenure you can see that for public rentals, as a row % this would be 34% of data is missing but this implies that this data is only missing at the Antenatal interview. The reality is that 10.1% is missing from any one of four timepoints used in the study. What can also be seen from Table H is that where the percentages are greater in the missing participants compared to the

n=5215 that there is some bias in the data we have used. Clearly shown is that when we were missing data on housing tenure across all the interviews we were more likely to be missing information from Māori, Pacific, Asian and MELAA mothers as well as those in high deprivation neighbourhoods (NZDep2006 deciles 8–10;<sup>17</sup>) or if the mother was 24 years or younger at the Antenatal interview. Additionally, mothers with fewer educational qualifications, those in public housing and having a household annual income of \$30,000 or less were more likely to be missing in the cohort we have used in this research. The impact of this attrition bias (the risk of imbalanced results due to non-participation of study participants) will be considered in the Discussion.

**TABLE H:** Cross sectional description of participants used in this research and those missing from the cohort.

Timepoint	Included in study (n=5215)		Excluded due to missing data (n=1638)		Baseline cohort (N=6853)
	n	%	n	%	n
<b>Mother ethnicity</b>					
European	3091	59.3	554	33.8	3645
Māori	663	12.7	287	17.5	950
Pacific	594	11.4	403	24.6	997
Asian	690	13.2	312	19	1002
MELAA	94	1.8	50	3.1	144
Other	77	1.5	18	1.1	95
Missing information	6	0.1	14	0.9	20
<b>Child birth gender</b>					
Male	2674	51.3	858	52.4	3532
Female	2541	48.7	780	47.6	3321
<b>NZDep2006 (Antenatal)</b>					
1	439	8.4	83	5.1	522
2	469	9	117	7.1	586
3	501	9.6	99	6	600
4	547	10.5	98	6	645



## APPENDIX 2



TABLE H: Cross sectional description of participants used in this research and those missing from the cohort.

Timepoint	Included in study (n=5215)		Excluded due to missing data (n=1638)		Baseline cohort (N=6853)
	n	%	n	%	n
<b>NZDep2006 (Antenatal)</b>					
<b>5</b>	428	8.2	101	6.2	529
<b>6</b>	516	9.9	131	8	647
<b>7</b>	516	9.9	168	10.3	684
<b>8</b>	539	10.3	214	13.1	753
<b>9</b>	634	12.2	261	15.9	895
<b>10</b>	624	12	365	22.3	989
<b>Missing information</b>	2	0	1	0.1	3
<b>Mother age group at pregnancy</b>					
<b>&lt; 20 years</b>	199	3.8	128	7.8	327
<b>20 –24 years</b>	674	12.9	321	19.6	995
<b>25–29 years</b>	1262	24.2	410	25	1672
<b>30–34 years</b>	1723	33	404	24.7	2127
<b>35–39 y ears</b>	1140	21.9	299	18.3	1439
<b>40+ years</b>	121	2.3	49	3	170
<b>Missing information</b>	96	1.8	27	1.6	123
<b>Mother education</b>					
<b>No secondary school qualification</b>	284	5.4	205	12.5	489
<b>Secondary school/NCEA 1–4</b>	1137	21.8	490	29.9	1627
<b>Diploma or Trade certificate</b>	1593	30.5	502	30.6	2095
<b>Bachelor's degree</b>	1277	24.5	275	16.8	1552
<b>Higher degree</b>	916	17.6	154	9.4	1070
<b>Missing information</b>	8	0.2	12	0.7	20

## APPENDIX 2



TABLE H: Cross sectional description of participants used in this research and those missing from the cohort.

Variable	Included in study (n=5215)		Excluded due to missing data (n=1638)		Baseline cohort (N=6853)
	n	%	n	%	n
<b>Household Tenure</b>					
<b>Family ownership</b>	2924	56.1	313	19.1	3237
<b>Private rental</b>	1970	37.8	461	28.1	2431
<b>Public rental</b>	321	6.2	165	10.1	486
<b>Other</b>	0	0	51	3.1	51
<b>Missing information</b>	0	0	648	39.6	648
<b>Household Income</b>					
<b>Less than 20,001</b>	157	3	63	3.9	220
<b>20,001 to 30,000</b>	212	4.1	79	4.8	291
<b>30,001 to 50,000</b>	566	10.9	165	10	731
<b>50,001 to 70,000</b>	728	14	133	8	861
<b>70,001 to 100,000</b>	1067	20.5	146	9	1213
<b>100,001 to 150,000</b>	1080	20.7	82	5	1162
<b>More than 150,000</b>	703	13.5	50	3.1	753
<b>Missing information</b>	702	13.5	920	56.2	1622

Note the baseline cohort in this context is the original recruited cohort of 6853 which includes children who have been formally opted out of the study and those who have died since birth. Mother ethnicity is self-prioritised from total response ethnicity collected at the Antenatal interview. Percentages are column %. Table H is made up of data available for each of the variables from four timepoints.



# Appendix 3:

## Sequence State Analysis – initial analyses

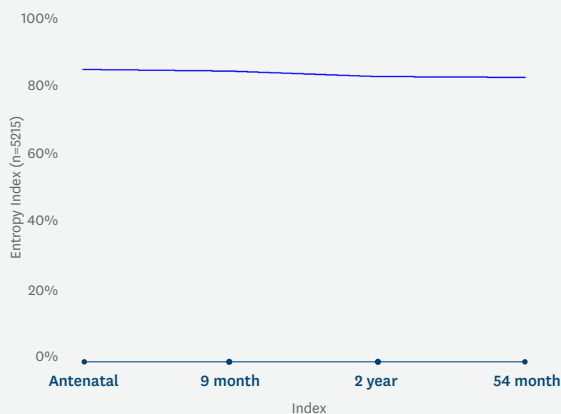
### Sequence state analysis (SSA)

Initial SSA analyses determined the diversity of states at each timepoint, the flux of states across a sequence (turbulence), similarities and distances between sequences (clustering methodology) and the sequence complexity of each cluster. These are described below for completeness of reporting for the technical reader.

### Diversity of states

The diversity of states at each timepoint represents the relative proportions of families that belong to each state (e.g. private home ownership with high income) at each time. Diversity of state is presented in Figure A as an entropy of state index. The entropy would be 0 if all families were categorised as the same state (no diversity) and maximal (1) when the same proportion of families are in each state. Diversity (and therefore entropy indices) was relatively similar across all four timepoints (85%, 84%, 82%, 82%). This means the relative proportions of families in each state was similar regardless of the timepoint analysed.

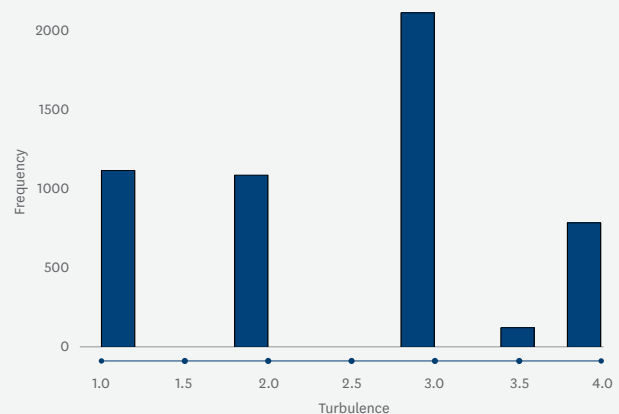
**FIGURE A.** Diversity of state, represented as entropy index at each timepoint



### Sequence complexity

The complexity of each family's journey (sequence) refers to the movement from one state to another over time. Sequence complexity is determined by calculating the sequence turbulence. A sequence that has many distinct states and state changes between timepoints is more turbulent than a series with fewer unique states and state changes. Turbulence also considers the amount of time spent in a state and the variation in duration of time spent in a state. Turbulence also increases when the average number of states before a repetition of a previous state increases. If a state is never repeated or if each timepoint has a unique state, then turbulence is considered maximal. Turbulence is presented in Figure B. The mean turbulence was 2.48, the median 2.81 with a minimum value of 1 and a maximum value of 4. From Figure B we can see just over 1000 families had the least complex journey (sequence), while about 750 had the most complex sequence with likely many moves between different states. Approximately 2000 families had the most common level of turbulence, which was closer to more complex, rather than less complex in terms of their sequences from state to state over the different timepoints.

**FIGURE B.** Sequence turbulence. Elzingas turbulence for each sequence in the sequence dataset



## APPENDIX 3



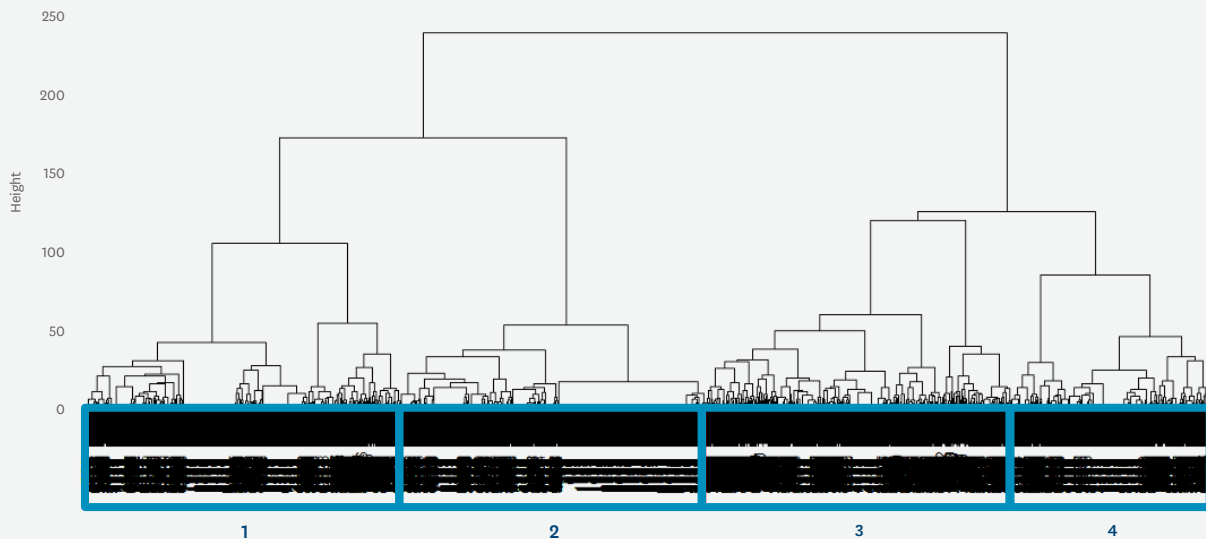
### Similarities and distances between sequences

To determine groups of common sequence journeys, the similarities and distances between sequences were determined by computing the distance between all possible pairs of sequences in the dataset. Clustering was then used to aggregate the sequences into a reduced number of groups. Substitution costs used for optimal matching distances were derived from the observed transition rates (TRATE). Lastly, distance matrix clustering was completed using the Ward method. The outcome of this analysis gave four distinct cluster types (Figure C).

### Turbulence of each cluster

The average sequence complexity also differed between clusters. Cluster Type 2 had the greatest sequence complexity (mean = 3.25), followed by Cluster Type 4 (mean = 2.96) and Cluster Type 1 (mean = 2.85). Cluster Type 3 had the lowest sequence complexity (mean = 2.25).

**FIGURE C.** Dendrogram of distance matrix clustering (Ward Hierarchical clustering of sequences). Proportional clusters highlighted and numbered in blue





# Appendix 4:

## Child output variables used at four years

### Child health questions

TABLE I: Child health questions used at 4 year timepoint to derive the output variables for regression models.

Question	Response options
<b>General health:</b> In general, how would you say child's current health is?	1. Excellent, 2. Very good, 3. Good, 4. Fair, 5. Poor, 99. Don't know, 98. Prefer not to say
<b>Respiratory infections:</b> Which, if any, of these common childhood illnesses has child had in the last 12 months?	5. Whooping cough or pertussis, 6. Other respiratory disorders including chest infections, bronchiolitis, bronchitis, pneumonia, 7. Cough lasting more than four weeks, 8. Wheezing in the chest, 96. None of the above 99. Don't know, 98. Prefer not to say
<b>Asthma:</b> Which, if any, of these common childhood illnesses has child had in the last 12 months?	4. Asthma, 96. None of the above 99. Don't know, 98. Prefer not to say
<b>Skin infections:</b> Which, if any, of these common childhood illnesses has child had in the last 12 months?	12. Skin infections (where the skin is red or warm or painful or swollen, or there are pustules or boils, or crusting or oozing), 96. None of the above 99. Don't know, 98. Prefer not to say
<b>Accidents &amp; injury:</b> Most children have accidents or injuries at some time. Since child was two, has he/she ever had an accident or injury for which he/she was taken to the doctor, dentist, health centre, or hospital?	0. No, 1. Yes, 99. Don't know, 98. Prefer not to say
<b>Accidents &amp; injury:</b> How many accidents or injuries?	1. Number of accidents ___ (range 1 – 10+), 99. Don't know, 98. Prefer not to say
<b>GP &amp; Dr. visits:</b> In the past 12 months, how many times has child seen a GP or family doctor?	0. Never, 1. Number of times ___ (range 1 –25+), 99. Don't know, 98. Prefer not to say

## APPENDIX 4



## Child socio-behavioural development tools development tools

### THE GIFT WRAP TASK (GWT)

**Background:** The GWT was used at the 4 year interview to get an observational measure of the ability to control arousing behaviour prior to entering school<sup>22</sup>. It is a measure of delayed gratification and can be a measure of hot cognition<sup>59</sup>. The ability to delay gratification has been found to be predictive of multiple life outcomes, including prevention of developmental and mental health problems and greater scholastic achievement<sup>60</sup>. This tool has been widely used in research and in several longitudinal studies (e.g. Project on Human Development in Chicago Neighbourhoods; <https://www.icpsr.umich.edu/web/pages/NACJD/about.html>).

Methodology and how the tool was used and if specifically adapted for use in *Growing Up in New Zealand*: The child was told “Now I have a surprise to show you, but I don’t want you to see it. I want to wrap it first. Please turn around so you won’t see it. Please don’t look or peek while I wrap it. I’ll tell you when I’m done”.

A timer is set for 1 minute. The interviewer takes out wrapping materials and pre-wrapped gift (being careful not to let the child see that gift is already wrapped). The interviewer noisily pretends to wrap while watching child’s behaviour. After 1 minute they say “Ok, I’m all done, you can turn around now”.

The interviewer records the time of the child’s first peek. They also record each time the child turns around or peeks and they say “Remember, no peeking. I’ll tell you when I’m done”. The interviewer also codes how many times the child peeked.

**The outcome variables are:** Time to first peek and how many times the child peeked. Four response options were possible.

1. Child peeked once
2. Child peeked more than once
3. Child peeked once or more and then remained peeking for the remainder of the timing
4. Child peeked (one or more times) and touched the gift

For more information on this tool please refer to the Reference and Process User Guide (<https://www.growingup.co.nz/sites/growingup.co.nz/files/2019-12/Available%20Data%20PDFs/DCW5%20Data%20User%20Guide%2029052017.pdf>).

**Key reference:** Kochanska et al. (2000). Effortful control in early childhood: continuity and change, antecedents, and implications for social development. *Developmental Psychology*, 36(2): 220–232.

## APPENDIX 4



### STRENGTH AND DIFFICULTIES QUESTIONNAIRE (SDQ)

**Background:** Young children differ in their emotional and behavioural adjustment and their behaviour continues to change especially across childhood and adolescence. To measure this, we have used the Strength and Difficulties Questionnaire (SDQ)<sup>23</sup>. This scale measures emotional symptoms, hyperactivity/ inattention, peer relationship problems and prosocial behaviour. The SDQ used at the 4 year interview has been found to have good structural validity and internal consistency<sup>61</sup>. Additionally, the SDQ is used widely and internationally. It also has norms for use in multiple countries including Australia, United Kingdom, and the USA (see [www.sdqinfo.com](http://www.sdqinfo.com)). Cutpoints

for categories have been based on population data such that 80% of children scored 'normal', 10% 'borderline' and 10% 'abnormal'.

**Methodology:** The questions related to the four sub-scales of the SDQ we have used, and the scoring methodology can be found in Tables I and J. Each of the sub-scales in Table I have scores that range from 0–10 and can be summed for categorisation into the three bands (as seen in Table J). Note the reverse coding of some questions (\*). For further information on the SDQ please refer to the Reference and Process User Guide (<https://www.growingup.co.nz/sites/growingup.co.nz/files/2019-12/Available%20Data%20PDFs/DCW5%20Data%20User%20Guide%2029052017.pdf>).

TABLE J: Scoring for SDQ subscales.

Parent completed SDQ	Three band categorisations		
	Normal	Borderline	Abnormal
Emotional problems score	0–3	4	5–10
Hyperactivity score	0–5	6	7–10
Peer problems score	0–2	3	4–10
Prosocial score	6–10	5	0–4

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TABLE K: SDQ questions and scoring for each of the four subscales.

Question	Not true	Somewhat true	Certainly true
<b>Emotional symptoms subscale score</b>			
Often complains of headaches, stomach-aches, or sickness	0	1	<b>2</b>
Many worries or often seems worried	0	1	<b>2</b>
Often unhappy, down-hearted or tearful	0	1	<b>2</b>
Nervous or clingy in new situations, easily loses confidence	0	1	<b>2</b>
Many fears, easily scared	0	1	<b>2</b>
<b>Peer relationship problems subscale score</b>			
Rather solitary, prefers to play alone	0	1	<b>2</b>
Has at least one good friend*	<b>2</b>	1	0
Generally liked by other children*	<b>2</b>	1	0
Picked on or bullied by other children	0	1	<b>2</b>
Gets along better with adults than with other children	0	1	<b>2</b>
<b>Hyperactivity/inattention subscale score</b>			
Restless, overactive, cannot stay still for long	0	1	<b>2</b>
Constantly fidgeting or squirming	0	1	<b>2</b>
Easily distracted, concentration wanders	0	1	<b>2</b>
Thinks things out before acting*	<b>2</b>	1	0
Good attention span, sees work through to the end*	<b>2</b>	1	0
<b>Prosocial behaviour subscale score</b>			
Considerate of other people's feelings	0	1	<b>2</b>
Shares readily with other children, for example toys, treats, pencils	0	1	<b>2</b>
Helpful if someone is hurt, upset, or feeling ill	0	1	<b>2</b>
Kind to younger children	0	1	<b>2</b>
Often volunteers to help others (parents, teachers, other children)	0	1	<b>2</b>

**Key reference:** Goodman R. (1997). The Strengths and Difficulties Questionnaire: A Research Note. *Journal of Child Psychology*, 38: 581–5986.



## APPENDIX 4



## Educational measures used

### NAME AND NUMBERS TASK

**Background:** The Name and Numbers task is part of the ‘Who am I?’ Developmental Assessment<sup>62</sup> and is an indicator of school readiness designed for pre school and the first two years of school. The test includes a series of writing and copying tasks designed to assess children’s understanding and use of conventional symbols. ‘Who Am I?’ has been used by the Longitudinal Study of Australian Children (LSAC, <https://growingupinaustralia.gov.au/>) and was used under licence from The Australian Council for Educational Research Ltd. It has also been used across cultures. It is quick to administer and has a standardised scoring procedure. Two numbers tasks were added: counting up to 10 and counting down from 10.

**Methodology:** The ‘Who Am I?’ Developmental Assessment includes tasks in which children are asked to write their name, copy shapes, and write numbers, letters and words.

*Growing Up in New Zealand* only used the Name and Numbers task plus the two counting tasks. The tasks were administered as follows:

The children were provided with an A4 Name and Numbers Worksheet, and a pencil/ pen. The sheet had large spaces on it for writing.

**Interviewer:** [Pointing to the space provided]. “Write your name here.” Any response, even if only a scribble was praised. Worksheet was collected back from the child.

**Interviewer:** “Please can you count up from 1 to 10?” Interviewer wrote down the child’s responses.

Coding for the Name and Numbers task was carried out by trained researchers according to a scoring protocol. Response items for the Name task were coded according to the standard scoring manual whereby each response is assessed on a four-point scale (Table L;<sup>64</sup>). All scores were double checked by a second researcher.

TABLE L: Writing name task scoring.

Task	Score				
	0	1	2	3	4
My name is...	No response	Scribble, or no recognisable letters from the name	Some recognisable letters from the name. Permitted: letters formed poorly; an incomplete name	Recognisable name. Permitted: letters formed poorly, name written in reverse/mirror writing	Recognisable name: letters generally clear. Permitted: some letters reversed

The counting tasks were coded according to the number of correct numbers in the longest number sequence given by the child (the inclusion of other words (i.e. not numbers) or interruptions in the sequence was permitted).

**Key reference:** de Lemos M. & Doig B. (1999). *Who Am I?: Developmental Assessment*: Melbourne. ACER.



# Appendix 5:

## Maternal and child cluster comparison data

TABLE M: Maternal variables across the cluster types.

Maternal variables	Type 1 (n=1391)	Type 2 (n=2016)	Type 3 (N=1481)	Type 4 (N=327)	Total (N=5215)
<b>Mean age (P&lt;0.001)</b>	30.68	28.49	33.39	28.09	30.16
<b>General health (P&lt;0.001)</b>					
<b>Excellent</b>	275 (19.8%)	318 (15.8%)	469 (31.7%)	44 (13.5%)	1106 (21.2%)
<b>Very Good</b>	521 (37.5%)	700 (34.7%)	657 (44.4%)	71 (21.7%)	1949 (37.4%)
<b>Good</b>	467 (33.6%)	769 (38.1%)	313 (21.1%)	137 (41.9%)	1686 (32.3%)
<b>Fair</b>	101 (7.3%)	185 (9.2%)	31 (2.1%)	56 (17.1%)	373 (7.2%)
<b>Poor</b>	26 (1.9%)	42 (2.1%)	10 (0.7%)	19 (5.8%)	97 (1.9%)
<b>Highest education (P&lt;0.001)</b>					
<b>No secondary school qualification</b>	37 (2.7%)	173 (8.6%)	10 (0.7%)	64 (19.6%)	284 (5.4%)
<b>Sec school/NCEA 1–4</b>	336 (24.2%)	511 (25.3%)	169 (11.4%)	121 (37.0%)	1137 (21.8%)
<b>Diploma/Trade cert/NCEA 5–6</b>	473 (34.0%)	702 (34.8%)	300 (20.3%)	118 (36.1%)	1593 (30.5%)
<b>Bachelor's degree</b>	351 (25.2%)	405 (20.1%)	509 (34.4%)	12 (3.7%)	1277 (24.5%)
<b>Higher degree</b>	193 (13.9%)	223 (11.1%)	492 (33.2%)	n<10 (2.4%)	916 (17.6%)
<b>Self-prioritised ethnicity (P&lt;0.001)</b>					
<b>European</b>	872 (62.9%)	991 (49.2%)	1180 (79.7%)	48 (14.7%)	3091 (59.3%)
<b>Māori</b>	126 (9.1%)	372 (18.5%)	79 (5.3%)	86 (26.3%)	663 (12.7%)
<b>Pacific</b>	110 (7.9%)	257 (12.8%)	54 (3.6%)	173 (52.9%)	594 (11.4%)
<b>Asian</b>	239 (17.2%)	316 (15.7%)	125 (8.4%)	10 (3.1%)	690 (13.2%)
<b>MELAA</b>	13 (0.9%)	55 (2.7%)	18 (1.2%)	n<10 (2.4%)	94 (1.8%)
<b>Other</b>	n<10 (0.1%)	n<10 (0.2%)	n<10 (0.3%)	0 (0.0%)	11 (0.2%)
<b>New Zealander</b>	25 (1.8%)	18 (0.9%)	21 (1.4%)	n<10 (0.6%)	66 (1.3%)
<b>Smoking score (P&lt;0.001)</b>					
<b>0</b>	1207 (86.8%)	1527 (75.7%)	1407 (95.0%)	173 (52.9%)	4314 (82.7%)
<b>1</b>	56 (4.0%)	96 (4.8%)	27 (1.8%)	26 (8.0%)	205 (3.9%)
<b>2</b>	34 (2.4%)	89 (4.4%)	13 (0.9%)	20 (6.1%)	156 (3.0%)
<b>3</b>	50 (3.6%)	116 (5.8%)	17 (1.1%)	45 (13.8%)	228 (4.4%)
<b>4</b>	44 (3.2%)	188 (9.3%)	17 (1.1%)	63 (19.3%)	312 (6.0%)

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TABLE N: Child health across cluster types.

General health	Type 1 (n=1391)	Type 2 (n=2016)	Type 3 (N=1481)	Type 4 (N=327)	Total (N=5215)
<b>Missing</b>	1	0	0	0	1
Excellent	697 (50.1%)	936 (46.4%)	871 (58.8%)	173 (52.9%)	2677 (51.3%)
Very good	485 (34.9%)	743 (36.9%)	479 (32.3%)	98 (30.0%)	1805 (34.6%)
Good	168 (12.1%)	274 (13.6%)	112 (7.6%)	45 (13.8%)	599 (11.5%)
Fair	39 (2.8%)	53 (2.6%)	17 (1.1%)	10 (3.1%)	119 (2.3%)
Poor	1 (0.1%)	9 (0.4%)	2 (0.1%)	1 (0.3%)	13 (0.2%)
<b>Visited the GP</b>					
<b>Missing</b>	1	0	0	0	1
No	74 (5.3%)	104 (5.2%)	96 (6.5%)	19 (5.8%)	293 (5.6%)
Yes	1309 (94.2%)	1902 (94.3%)	1383 (93.4%)	302 (92.4%)	4896 (93.9%)
<b>Illnesses - respiratory (chest infections, bronchiolitis, bronchitis, pneumonia)</b>					
<b>Missing</b>	1	1	1	0	3
No	1193 (85.8%)	1728 (85.8%)	1277 (86.3%)	295 (90.2%)	4493 (86.2%)
Yes	197 (14.2%)	287 (14.2%)	203 (13.7%)	32 (9.8%)	719 (13.8%)
<b>Cough lasting more than four weeks</b>					
<b>Missing</b>	1	1	1	0	3
No	1198 (86.2%)	1730 (85.9%)	1262 (85.3%)	296 (90.5%)	4486 (86.1%)
Yes	192 (13.8%)	285 (14.1%)	218 (14.7%)	31 (9.5%)	726 (13.9%)
<b>Wheezing in the chest</b>					
<b>Missing</b>	1	1	1	0	3
No	1217 (87.6%)	1707 (84.7%)	1328 (89.7%)	272 (83.2%)	4524 (86.8%)
Yes	173 (12.4%)	308 (15.3%)	152 (10.3%)	55 (16.8%)	688 (13.2%)
<b>Asthma</b>					
<b>Missing</b>	1	1	1	0	3
No	1221 (87.8%)	1691 (83.9%)	1344 (90.8%)	276 (84.4%)	4532 (86.9%)
Yes	169 (12.2%)	324 (16.1%)	136 (9.2%)	51 (15.6%)	680 (13.0%)
<b>Skin infections</b>					
<b>Missing</b>	1	1	1	0	3
No	1235 (88.8%)	1762 (87.4%)	1342 (90.7%)	264 (80.7%)	4603 (88.3%)
Yes	155 (11.2%)	253 (12.6%)	138 (9.3%)	63 (19.3%)	609 (11.7%)
<b>Number of accidents</b>					
<b>Missing</b>	6	5	2	2	15
None	930 (66.9%)	1314 (65.2%)	966 (65.2%)	231 (70.6%)	3441 (66.0%)
One	325 (23.4%)	503 (25.0%)	381 (25.7%)	63 (19.3%)	1272 (24.4%)
Two	86 (6.2%)	129 (6.4%)	93 (6.3%)	12 (3.7%)	320 (6.1%)
Three plus	44 (3.2%)	65 (3.2%)	39 (2.6%)	19 (5.8%)	167 (3.2%)

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TABLE O: Child socio-behavioural development across the cluster types.

Self control – Gift Wrap Task	Type 1 (n=1391)	Type 2 (n=2016)	Type 3 (N=1481)	Type 4 (N=327)	Total (N=5215)
<b>Missing</b>	86	173	70	18	347
Never	920 (70.5%)	1319 (71.6%)	1086 (77.0%)	201 (65.0%)	3526 (67.6%)
Child peeked once	175 (13.4%)	239 (13.0%)	149 (10.6%)	50 (16.2%)	613 (11.8%)
Child peeked more than once	169 (13.0%)	223 (12.1%)	143 (10.1%)	49 (15.9%)	584 (11.2%)
Child peeked once or more and then remained peeking for the remainder of the timing	41 (3.1%)	61 (3.3%)	31 (2.2%)	n<10 (2.9%)	142 (2.7%)
Child peeked (one or more times) and touched the gift	0 (0.0%)	n<10 (0.1%)	n<10 (0.1%)	n<10 (0.0%)	n<10 (0.1%)
<b>SDQ – emotion development</b>					
Normal	1185 (85.2%)	1569 (77.8%)	1329 (89.7%)	203 (62.1%)	4286 (82.2%)
Borderline	99 (7.1%)	216 (10.7%)	80 (5.4%)	36 (11.0%)	431 (8.3%)
Abnormal	107 (7.7%)	231 (11.5%)	72 (4.9%)	88 (26.9%)	498 (9.5%)
<b>SDQ – hyperactivity inattention</b>					
Normal	1116 (80.2%)	1458 (72.3%)	1255 (84.7%)	204 (62.4%)	4033 (77.3%)
Borderline	108 (7.8%)	242 (12.0%)	107 (7.2%)	51 (15.6%)	508 (9.7%)
Abnormal	167 (12.0%)	316 (15.7%)	119 (8.0%)	72 (22.0%)	674 (12.9%)
<b>SDQ – peer relationships</b>					
Normal	1070 (76.9%)	1399 (69.4%)	1302 (87.9%)	166 (50.8%)	3937 (75.5%)
Borderline	171 (12.3%)	291 (14.4%)	97 (6.5%)	62 (19.0%)	621 (11.9%)
Abnormal	150 (10.8%)	326 (16.2%)	82 (5.5%)	99 (30.3%)	657 (12.6%)
<b>SDQ – prosocial behaviour</b>					
Normal	1199 (86.2%)	1761 (87.4%)	1296 (87.5%)	277 (84.7%)	4533 (86.9%)
Borderline	135 (9.7%)	174 (8.6%)	135 (9.1%)	36 (11.0%)	480 (9.2%)
Abnormal	57 (4.1%)	81 (4.0%)	50 (3.4%)	14 (4.3%)	202 (3.9%)

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TABLE P: Educational indicators across the cluster types.

Educational indicators	Type 1 (n=1391)	Type 2 (n=2016)	Type 3 (N=1481)	Type 4 (N=327)	Total (N=5215)
<b>Missing</b>	91	197	76	31	395
<b>Writing task</b>					
No response	35 (2.5%)	33 (1.6%)	20 (1.4%)	20 (6.1%)	108 (2.1%)
Scribble/no recognisable letters	83 (6.0%)	186 (9.2%)	72 (4.9%)	60 (18.3%)	401 (7.7%)
Some recognisable letters from the name	396 (28.5%)	630 (31.3%)	346 (23.4%)	116 (35.5%)	1488 (28.5%)
Recognisable name/letters formed poorly	252 (18.1%)	312 (15.5%)	273 (18.4%)	34 (10.4%)	871 (16.7%)
Recognisable name letters generally clear	534 (38.4%)	658 (32.6%)	694 (46.9%)	66 (20.2%)	1952 (37.4%)
<b>Counting task</b>					
Incomplete (0–9)	262 (18.8%)	448 (22.2%)	170 (11.5%)	122 (37.3%)	1002 (19.2)
Complete (0–10)	1038 (74.6%)	1371 (68.0)	1235 (83.4%)	174 (53.2)	3818 (73.2)

**Social and Community Health**

**School of Population Health**

M&HS Bldg 507.1115,  
Level 1, 28 Park Avenue,  
Auckland, New Zealand

**t** +64 9 373 7599 ext 86723

**e** [e.marks@auckland.ac.nz](mailto:e.marks@auckland.ac.nz)

**The University of Auckland**

Private Bag 92019, Auckland 1142  
New Zealand



**MEDICAL AND  
HEALTH SCIENCES**  
SCHOOL OF POPULATION HEALTH