Growing Up in New Zealand

Residential Mobility Report 1: Moving house in the first 1000 days

2014

Growing Up
in New Zealand

Growing Up in New Zealand: A longitudinal study of New Zealand children and their families

Residential Mobility Report 1: Moving house in the first 1000 days

Susan M.B. Morton

Polly E. Atatoa Carr

Sarah D. Berry

Cameron C. Grant

Dinusha K. Bandara

Jatender Mohal

Peter J. Tricker

December 2014

Suggested citation: Morton, S. M. B., Atatoa Carr, P. E., Berry, S. D., Grant, C. C., Bandara, D.K., Mohal, J., Tricker, P. J. 2014. *Growing Up in New Zealand: A longitudinal study of New Zealand children and their families. Residential Mobility Report 1: Moving house in the first 1000 days.* Auckland: Growing Up in New Zealand

ISSN: 2253-251X (Online), ISSN: 2253-2501 (Print)

Contact details: Associate Professor Susan Morton, Director, *Growing Up in New Zealand*, PO Box 18288, Auckland 1743, Phone 0508 476 946 or +64 9 923 9972

Further information on *Growing Up in New Zealand* is available at www.growingup.co.nz

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND
Te Whare Wānanga o Tāmaki Makaurau

superu

Foreword

Public policies and their resulting programmes are often modelled, evaluated and operated using simplifying assumptions about eligibility and entitlement. Such assumptions reflect the limited capacity of social science and economics to identify and monitor the characteristics of people who may have common connections but whose circumstances differ greatly. However comprehensive an information source may be, it will only explain part of the variability between people.

To effectively target the services that are essential to childhood development it's important that we know the likely mobility (movement from home to home) of children, their mothers and families. This is increasingly being recognised as important in New Zealand where we can see that the mobility of households with children will have a detrimental effect on their access to services.

Knowing the extent and nature of the mobility of households may also help us rethink the most relevant way of assessing and managing entitlements to these services and ensuring equity of access especially when services are delivered by the public sector.

Ironically, this greater mobility is occurring at the same time as the provision of services becomes more targeted and the connections between people and service providers become fewer. The provision of community and regional services is usually funded based on population, which is often based on extrapolations of census night data. However census night estimates have reduced validity as time passes.

The solution is to look to longitudinal studies such as *Growing Up in New Zealand*, which adds great riches to our knowledge about family mobility. Most critically, the extent of residential mobility identified for the children and families in this study was unexpected, given previous findings from other sources.

This study identifies international research on impacts and causal influences of mobility. Many policies assume that there is continuity between the location of people targeted for services and their connections with those services. These policies may assume significantly less mobility in the population and underestimate the potential impact and cost of shifting to new service providers.

The absence of take-up rates for most programmes and the very limited operational evaluations on such programmes mean that the results in this report will challenge those whose understanding of policy effectiveness is based on the analysis of available records. For those involved in managing on-the-ground contact with the recipients of public services these results may corroborate and quantify their experience.

By drawing on longitudinal qualities and the research design of *Growing Up in New Zealand*, this report contributes to how we can measure mobility. Through such studies, the effectiveness of specific programmes can be evaluated and areas of improvement identified. We can also make judgements about the fundamentals of New Zealand's evolving approach to social welfare and the security of families and children.

This report will undoubtedly challenge some existing 'wisdom' about what is needed to effectively and evenly target services at families with children. There is further potential for *Growing Up in New Zealand* to extend understanding about the mobility of families and children, and further enrich understanding of the impact. The *Growing Up in New Zealand* team under Associate Professor Susan Morton is to be congratulated for taking up the challenge of this very serious issue.

Special thanks go to the families who remain committed to this study and its significant contribution to enriching our understanding of the experiences of children in our ever complex society.

Len Cook
Statistician, Advisor to the Social Policy and Evaluation Research Unit (Superu)

Acknowledgements

First and foremost, we acknowledge the ongoing commitment, time and honesty of the children and families who have provided us with their information since before the *Growing Up in New Zealand* cohort was born, and who continue to participate in this study. This report documents the high residential mobility of the *Growing Up in New Zealand* families, and also highlights some of the complexities of life with young children in New Zealand. We realise that through this mobility and complexity our families continue to keep in touch with us and to participate in this study, and for that we are truly grateful. We look forward to seeing all our children and families again soon.

We acknowledge the authors of *Residential Mobility Report 1: Moving house in the first 1000 days* who are members of the *Growing Up in New Zealand* research team: the Research Director (Associate Professor Susan Morton); Associate Directors (Associate Professor Cameron Grant and Dr Polly Atatoa Carr); Senior Research Fellow (Dr Sarah Berry); Data and Systems Manager (Peter Tricker); and Biostatisticians (Jatender Mohal and Dinusha Bandara). Other members of the *Growing Up in New Zealand* team have also been integral to the development of this report. We would particularly like to acknowledge Sabine Kruekel (Communications and Marketing Manager), Cherie Lovell (Interviewer Manager), Rina Prasad (Lead Data Manager), and all the wonderful interviewers who are essential not only for collecting the information from our participants, but also for keeping track of those families who have moved.

The content of this report is also informed by the experts in the specific research domains and themes for *Growing Up in New Zealand*. Information collected on residential mobility and neighbourhood has particularly been informed by our expert advisors in our Social Context, Neighbourhood and Environment Domain, specifically Dr Vivienne Ivory, and our advisors with this particular expertise on our Executive Scientific Advisory Group, specifically Professor Heather Joshi and Professor Tony Blakely. We also acknowledge Dr Len Cook for his advice and the foreword for this report.

We would also like to acknowledge the key funders of *Growing Up in New Zealand*, who not only help to sustain the study but also help to ensure that the information from our families contributes evidence to inform the policy environment in New Zealand. These include: the New Zealand Ministries of Social Development, Health, Education, Justice, Pacific Island Affairs, the Ministry of Business, Innovation and Employment and Te Puni Kōkiri; the Departments or Offices of Labour, Corrections, Ethnic Affairs, Women's Affairs, the Children's Commission, and the former Mental Health Commission; the New Zealand Police; Statistics New Zealand; Sport New Zealand and the Housing New Zealand Corporation.

These government agencies that have been involved in the development and implementation of *Growing Up in New Zealand* from the very beginning of this longitudinal study also form the Policy Forum for this project that has provided specific advice and review of the content of *Residential Mobility Report 1: Moving house in the first 1000 days*.

We acknowledge the ongoing advice and involvement of the Data Access Committee of *Growing Up in New Zealand* (chaired by Professor Jane Harding) and we thank the University of Auckland and Auckland UniServices Limited for their ongoing support, especially the Vice Chancellor (Professor Stuart McCutcheon), the Dean of the Faculty of Medical and Health Sciences (Professor John Fraser) and the Chief Executive of Auckland UniServices Limited (Dr Andy Shenk). Finally but importantly, we acknowledge the Social Policy Evaluation and Research Unit (Superu) for managing the *Growing Up in New Zealand* contract.

Director's Foreword

It is once again my great pleasure to present this report on behalf of all those involved in the *Growing Up in New Zealand* team.

Residential Mobility Report 1: Moving house in the first 1000 days is the fifth substantial report from *Growing Up in New Zealand*, and draws on the information collected from participating families during the first thousand days of their children's development (from conception until they are 2 years old). This report focusses on the residential mobility of the cohort families during the first two years of their children's lives. The topic of residential mobility was chosen because it was evident from the early work that *Growing Up in New Zealand* has provided on defining vulnerability (see Vulnerability Report 1, 2014) that residential mobility for families with young children in New Zealand was very common. The information available from the *Growing Up in New Zealand* families also allows a specific examination of residential mobility between late pregnancy and early infancy (up to nine months of age) as well as when the cohort children are between nine months and two years of age. Baseline information was collected from the families about their homes and households from before the cohort children were born. This provides a unique prospective consideration of the familial, household and neighbourhood factors that are associated with residential mobility during the very earliest period of children's development, in addition to what precipitates mobility as the children grow up.

A key strength of this report, as with the earlier reports from the *Growing Up in New Zealand* team, is that the diversity of the children and their families participating in this longitudinal study is comparable to that of the children being born in New Zealand today. Consequently, the environments they are growing up in, as well as the changes and pressures that the current housing market has been subject to in recent years are reflective of the environments and pressures that contemporary New Zealand families are experiencing in establishing a stable home base for themselves.

While it is relatively common to move house when family structure is undergoing changes, in this case where a new baby is due or recently born, the extent of residential mobility seen for the children and families in this contemporary longitudinal study was nevertheless unexpected. *Residential Mobility Report 1: Moving house in the first 1000 days* has explored whether the factors that were most likely to influence a child's chances of experiencing residential mobility between late pregnancy and during infancy were the same or different to those most influential for mobility during the second year of the children's lives. This longitudinal perspective, and an ability to compare determinants of change over different time periods in a child's life, is a key strength of birth cohort studies such as this one.

The high degree of residential mobility of families with very young children challenges the traditional way that the services designed to support these children and families are provided as they grow up. In particular the method of determining where to locate key health and early childhood education services, or other service hubs, according to where families live at any one point in time (e.g. according to residential location at the time of a population census) may need re-consideration. According to the longitudinal information available nearly half of the *Growing Up in New Zealand* children born in 2009 and 2010 moved at least once before their second birthday, and many children have moved house on several occasions. A census held every five or more years is not in a position to track these multiple changes. Nor can such a census inform in detail the delivery of services to families with pre-schoolers, and importantly describe the likely location of the families who may have the greatest need for access to those services.

The pattern of residential mobility observed for this cohort of children and their families does suggest that

the association of mobility with measures of deprivation is more mixed for New Zealand pre-schoolers than for children in other population contexts. Those children living in private rental accommodation during pregnancy or during infancy are the children most likely to experience mobility. We also know that the majority of those moving from one private rental property are moving to another private rental rather than into home ownership. This suggests that the residential mobility patterns we have seen during the first two years of these children's lives and the high rates of change are likely to continue throughout the children's early years, especially with the volatility of the current New Zealand housing market and the challenge for young families to maintain rental payments, or enter into mortgage agreements.

The extent of residential mobility for the *Growing Up in New Zealand* children and their families as they grow up will continue to be measured. Of particular interest are the effects that this mobility has on developmental trajectories as well as the capacity for our children to interact with key services in the pre-school and later periods, early childhood education and formal education services in particular.

We remain overwhelmingly grateful to the families and the children who are part of *Growing Up in New Zealand*. As always we are privileged to be able to bring together the precious information that the families share with us over time. In doing so, we provide an up to date picture of what it is like to be a child growing up in New Zealand today, and this evidence can inform how we might best support our families and their communities that all help to shape the wellbeing of all our children. Thank you also to the dedicated *Growing Up in New Zealand* research team who make these reports possible, and to the funders, the many advisory groups and the stakeholders who support us to do so.

Associate Professor Susan Morton
Director, *Growing Up in New Zealand*

Contents

List of Figures

List of Tables

1. Introduction

1.1 Residential mobility

Moving house is a common and central part of life for contemporary communities, particularly in Western countries. The rates of residential mobility in populations vary across these countries, with previous reports of age-standardised annual mobility for one year higher in New Zealand (19.6%) than that reported for the United States (17.5%), Australia (17.0%), Great Britain (10.6%), Sweden (9.5%) and Ireland (6.4%) (Long, 1992). The frequency of residential mobility is commonly determined from population-based census statistics and consequently may be underestimated, because of the mobility that may occur between census data collections. Further, certain population subgroups have higher residential mobility than the overall population. This is particularly true of families with children aged one to four years. There is extensive literature on residential mobility in the life-cycle of families since the mid 1950's, considering predictors of residential mobility in different environmental contexts, and determining relationships between residential mobility and social mobility (for examples of relevant literature see Rossi, 1955; Odland & Shumway, 1993; and Mulder & Wagner, 1993). In families, major life course events, particularly those that occur early in children's lives, are often related to residential mobility. Such events include the birth of children, disruption to parental labour force status, and the rearrangement of families and households. There is also a significant body of literature considering residential mobility and housing choice (for examples see Galster, 1987; Clark & Dieleman, 1996; DiPasquale & Wheaton, 1996; and Clark et al, 2006), and the relative role of house and neighbourhood in mobility.

Research on residential mobility has often utilised longitudinal data to improve the understanding of associations and predictors of mobility as well as the direction of influence between residential mobility and family/household events. These studies have shown that residential mobility is strongly related to household characteristics, such as housing tenure, area deprivation, income, unemployment and family structure (Long 1992; Astone & McLanahan 1994; Boheim & Taylor 2002) and that not all moves are alike. 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 circumstance.

The additional advantage of longitudinal analyses of residential mobility is the important opportunity to consider the potential impact of residential mobility on child outcomes. Once again the evidence is commonly mixed. Frequent childhood residential moves have been shown, particularly in the American context, to be related to childhood asthma, poorer self-reported health and wellbeing in adulthood and to increased drug use, smoking, and attempted suicide (Simpson, 1994; Hughes & Baumer, 1995; Austin & Russell, 1997; DeWit, 1998; Bures, 2003; Lee 2007; Qin et al, 2009; Oishi & Schimmack, 2010). There is limited evidence for causal relationships; the strongest link appears to be for an association between residential mobility and behavioural and emotional problems in school age children (for a review, see Jelleyman, 2008). Mediators of the effects of mobility on outcomes, the complications of mobility exacerbating pre-existing risk factors, and confounders of these relationships are likely. For example high levels of mobility can have implications for the effectiveness of social support networks (including friendships) as well as the interruption of service delivery and engagement, such as in health and education, which in turn can impact on child and later outcomes. Further, for any associations found between residential mobility and outcomes in childhood, adolescence or early adulthood, longitudinal analyses are required to determine the direction of such associations.

Recent comparative analyses have been conducted of the UK Millennium Cohort Study and the US Fragile Families Study. In these analyses, it was found that approximately half of the UK Millennium Cohort children had moved by age five years. Mobility was higher among those living in rental accommodation, and for those whose parents had experienced a change in their relationship or employment status (Gambaro & Joshi, 2014). Overall, this mobility in the UK was found to improve living circumstances, and mobility itself was not found to have an adverse effect on child behaviour outcomes. In the US Fragile Families Study, of 5000 children born between 1998 and 2000, 70% were found to have moved before the age of five years. Again, the most likely to move were those living in rental accommodation, those experiencing housing-related hardship and those for whom there had been a change in family structure (Buttaro et al., 2014). Further analyses within the Fragile Families will examine the possibility that residential mobility serves as a marker for risk of detrimental outcomes in child development, and also that residential mobility may be related to positive outcomes for some children.

In addition to providing evidence about the environment in which child development occurs, residential mobility is also an important consideration for the effective design, implementation and evaluation of programmes and policies for families and children. Many policies assume and rely on some continuity in the location of people in target populations and in their connections with services. These policies may currently underestimate the mobility of the population and the potential impact that crossing service boundaries may have on both service delivery and outcomes. For example, frequently mobile children in the UK were found to be less likely to be immunised against measles, mumps and rubella, suggesting that frequent moves could prevent the development of relationships with health professionals (Pearce et al., 2008). Further, an understanding of residential mobility predictors and effects is important for the development of policy concerning housing provisions, security and safety for families, as well as neighbourhood design and development.

In New Zealand, the frequency of residential mobility is thought to be significant although little is known about the residential mobility that occurs in the first 1000 days of a child's life. Importantly, the New Zealand household structure and housing tenure, along with our cultural, social and environmental context, provides different influences on the environment of residential mobility for children and their families. Further, residential mobility is an important focus in a number of policy areas in the current New Zealand environment. These include: service transience (including school absenteeism), early childhood education access and participation, housing quality, accessibility and affordability, child vulnerability and resilience, and supporting families that require multiple service intervention. Residential mobility is also a possible mediator of the pathway to the adverse and inequitable outcomes that are experienced by important subgroups of children in New Zealand, such as those described by ethnicity, poverty and socio-economic environment. If residential mobility during childhood in New Zealand is associated with ineffective engagement with health and education services, the opportunity for specific policies to target subpopulations to improve equitable outcomes may also be influenced by greater residential mobility. Eliminating such inequity is an important policy target.

Finally, community and regional service provision has also become more explicitly funded through population-based allocation processes in New Zealand. For policies and programmes to be appropriately developed and implemented requires an understanding of the population involved in such allocation, and the mobility of this population.

This report, *Residential Mobility Report 1: Moving house in the first 1000 days*, uses longitudinal evidence from the *Growing Up in New Zealand* study to provide information on the identifying

factors (risk and protective) associated with (and/or predictive of) residential mobility in the first two years of life. This information, and future work on residential mobility as a component of vulnerability and resilience in early life in New Zealand can guide agencies and policies to better target, better allocate, and improve support for families.

1.2 Overview of *Growing Up in New Zealand* study

Growing Up in New Zealand is a longitudinal study that provides a contemporary, population-relevant picture of what it is like to be a child growing up in New Zealand in the 21st century. The overarching objective of this study is to generate policy-relevant evidence to optimise children's developmental trajectories in multiple areas, including health, education, cultural identity, and social and cognitive functioning (Morton et al., 2012a).

The *Growing Up in New Zealand* cohort consists of 6853 children, recruited before birth via their pregnant mothers (6,822 women) who agreed to their children's participation for up to 21 years and who completed an antenatal (pregnancy) interview. There were also 4401 partners of these pregnant women (predominantly the fathers of the *Growing Up in New Zealand* cohort) recruited (Morton et al., 2012b). The *Growing Up in New Zealand* cohort were expected to be born between April 2009 and March 2010, and key ethnic and socio-demographic characteristics of the recruited main cohort families are similar to those of families having children in New Zealand today (Morton et al., 2014a).

In recognition of the importance of the first 1000 days (from conception to age two years) in child development, *Growing Up in New Zealand* has undertaken several data collection waves during the children's first two years of life. The longitudinal information collected in this time period includes that from:

- Face-to-face interviews: the antenatal interviews (completed in June 2010) with the pregnant mother (most often in the last trimester of her pregnancy) and with her partner (almost always the biological father); the nine month interviews with the child's mother and her partner (completed in January 2011); and the two year interviews with the child's mother and her partner (completed in mid-2012). These two year interviews also involved direct observations, developmental and anthropometric assessments of the children themselves
- Telephone interviews with the mother when their children were six weeks, 35 weeks, 16 months, 23 months, 31 months and 45 months old
- Data linkage between the *Growing Up in New Zealand* data and routinely collected perinatal health records (completed in 2012).

Each data collection of *Growing Up in New Zealand* seeks age-appropriate information across six inter-connected domains: family and whānau, societal context and neighbourhood, education, health and wellbeing, psychological and cognitive development, and culture and identity. Attention is given to ensuring that the methods utilised to collect domain-specific evidence acknowledge the unique New Zealand population and environmental context, particularly the unique opportunity that *Growing Up in New Zealand* provides to examine the factors which contribute to the wellbeing of Māori whānau in New Zealand in the 21st century. Other key

issues that guide the development of methods and specific tools used for each data collection wave include the relevant constructs to be measured at specific time points and transitions, policy-relevance and the overarching longitudinal research questions and objectives (Morton et al., 2010; Morton et al., 2012c; Morton et al., 2014b).

Growing Up in New Zealand is unique in terms of its capacity to provide a comprehensive picture of child health and development across multiple domains of influence for children born in New Zealand, and for its inclusion of significant numbers of Māori, Pacific and Asian children as well as New Zealand European and the diversity of New Zealand children of other ethnicities. From its inception the *Growing Up in New Zealand* study has been explicitly designed to follow children from before birth until they are young adults, to understand 'what works' for children and families (rather than primarily focusing on negative outcomes) and to consider pathways of development across multiple domains of influence. This will allow up-to-date and robust understanding of the complex interplay of trajectories of child outcomes including growth, health, behaviour and cognitive development.

Further publications describing the features of design and development, objectives and research questions, recruitment and retention of the *Growing Up in New Zealand* cohort, and findings from the antenatal, nine month, and two year data collection waves can be accessed through www.growingup.co.nz

1.3 Focus of this report

Residential Mobility Report 1: Moving house in the first 1000 days continues a series of reports about the *Growing Up in New Zealand* children at two years of age and describes the frequency and distance of residential mobility for the *Growing Up in New Zealand* children in their first two years of life. In addition, this report identifies some of the demographic, family, household and neighbourhood characteristics that are associated with residential mobility in early life in New Zealand. The information used in *Residential Mobility Report 1: Moving house in the first 1000 days* is drawn from data collected at the *Growing Up in New Zealand* antenatal, nine month and two year interviews. Specifically:

- Section 2 of *Residential Mobility Report 1: Moving house in the first 1000 days* explains the methodology used in this report
- Section 3 describes the frequency of residential mobility for the children of *Growing Up in New Zealand* until the age of two years, along with information about the distance moved
- Section 4 analyses the characteristics associated with residential mobility over two time periods: from birth to nine months of age; and from nine months to two years of age. For each time point, univariate descriptive analysis is first used to look at the characteristics of those who were residentially mobile. A multivariable model of the key demographic, family and household characteristics of mobility is then provided, including assessment of the impact of a change in key family characteristics (parental relationship status and household income status)
- Section 5 of *Residential Mobility Report 1: Moving house in the first 1000 days* describes aspects of neighbourhood during the first two years of the children's lives. These include parental perceptions of neighbourhood, and measures of neighbourhood integration and belonging. This section also provides early information on the impact that residential

mobility may have on service access, with a specific example provided of mobility in and out of District Health Board regions

- Section 6 provides concluding comments on the analyses in *Residential Mobility Report 1: Moving house in the first 1000 days* and looks to opportunities for the future.

The aim of this report is to further our understanding of the determinants of residential mobility during the first two years of life in New Zealand. These analyses also form a foundation for later work on the *Growing Up in New Zealand* data that will further assess residential mobility, consider multiple moves as a dose effect and explore the relationship between residential mobility and child outcomes.

Adding a personal voice

"It has been a real challenge getting to grips with a new city, new job and new child care."

To give voice to the findings reported, quotations from *Growing Up in New Zealand* parents have been included (adapted so as not to identify individuals). These quotations refer to highlights and challenges associated with residential mobility during the first two years of their children's lives. The illustrations included in this report are provided by Arieta (aged 4.5 years), a *Growing Up in New Zealand* cohort member.

2. Methodology

2.1 Conceptual framework for *Growing Up in New Zealand*

The model of child development utilised within *Growing Up in New Zealand* is child centred, but never forgets that children develop in dynamic interactions with their families, communities, environments and societal contexts over time (Morton et al., 2012a). This conceptual approach to the study acknowledges the growth in our understanding of early child development in the last few decades, with an increasing recognition of the importance of the antenatal period and the first few years of life for shaping future developmental pathways for children.

The model is also explicitly longitudinal and takes a life course perspective in order to describe the cumulative impact of multiple, overlapping factors operating over time to: define the distribution of outcomes across the cohort population; consider critical influences (risk and protective) on developmental trajectories; and identify the critical time points where such risk and protective factors may be targeted for effective intervention.

2.2 Conceptual framework to consider residential mobility within *Growing Up in New Zealand*

As described by previous research on residential mobility in childhood (Gambaro & Joshi, 2014; Buttaro et al., 2014), a useful approach is to identify the possible precursors and consequences of residential mobility according to the potential associations that they have with one another, as depicted in the model described in Figure 1.

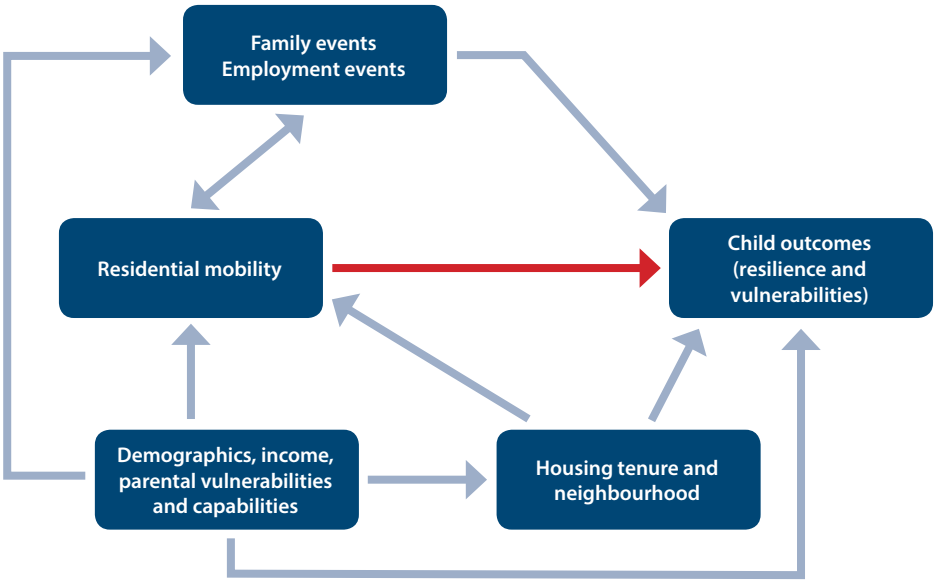

Figure 01: Conceptual model of precursors of residential mobility, and relationship with child outcomes (Gambaro & Joshi, 2014; Buttaro et al., 2014)

This model includes consideration of potential predictors for residential mobility, including family and employment events as well as parental demographic factors that may also be associated with family and employment events. It is also recognised in this model that there are relationships between housing tenure and neighbourhood arrangements, and both residential mobility and parental and family characteristics. These precursor relationships all need to be considered before meaningful understanding of the impact of residential mobility on child outcomes (the red arrow in Figure 1) is possible.

The focus of the analyses in *Residential Mobility Report 1: Moving house in the first 1000 days* is exploration of the potential precursors and predictors of residential mobility in the contemporary New Zealand child cohort (Figure 2). This analysis provides important insight into residential mobility in early childhood in New Zealand and will provide a useful foundation from which to explore the influence of residential mobility on child outcomes in the near future, also using *Growing Up in New Zealand* data.

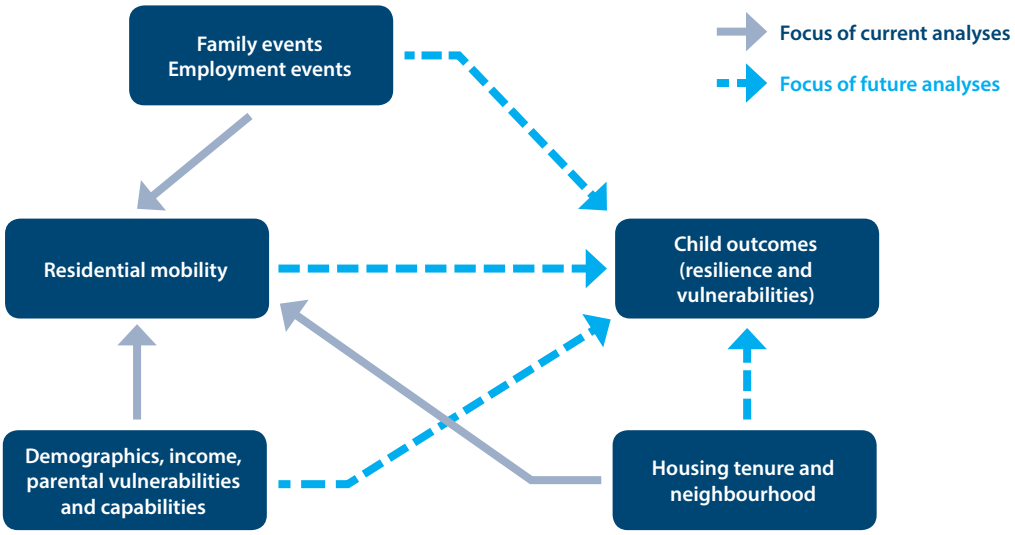

Figure 02: Conceptual model of precursors and consequences of residential mobility highlighting the focus of the analyses presented in this report (adapted from Gambaro & Joshi, 2014; Buttaro & Lennon, 2014)

2.3 Measures and data sources

Measures of residential mobility

For the purposes of this report, the following definitions of residential mobility were used:

- Self-reported change of residential address in the five years prior to pregnancy
- Moved residential address between the *Growing Up in New Zealand* antenatal interview and the nine month interview
- Moved residential address between the *Growing Up in New Zealand* nine month interview and the two year interview

The questions about residential mobility that were asked at the antenatal (pregnancy) interview, the nine month interview, or the two year data collection wave are listed in Table 1.

Table 01: Residential mobility questions within the *Growing Up in New Zealand* data collection waves in the first 1000 days of life

Question	Data collection	Participant(s)
How many times have you moved house in the past five years?	Antenatal	Mother and Partner
How long have you lived in your current residence?	Antenatal	Mother and Partner
How many times have you moved house since the last interview?	Nine month	Mother
How many times have you moved house since your child was nine months old?	Two year	Mother

Data regarding the distance moved is also included in *Residential Mobility Report 1: Moving house in the first 1000 days*. This is determined using address information which is recorded in a confidential manner for each *Growing Up in New Zealand* participant and updated at each data collection wave. The address information is processed through geocoding software to return the geographic coordinates of each dwelling (using the New Zealand Transverse Mercator 2000 Geodetic datum). Comparison of the geographical coordinates of each participant at the nine month data collection wave compared to the antenatal data collection wave, and of the two year data collection wave compared to the nine month data collection wave, using Pythagorean Theorem, allowed an approximation of lineal distance moved. To determine movement in and out of District Health Board regions the geocoding process at each data collection wave was used. The calculations for distance moved and for movement in and out of District Health Board regions assume the recorded participant address at each data collection wave, without considering interim moves.

There are a number of the *Growing Up in New Zealand* cohort who have moved internationally since recruitment; however, analyses in this report have been restricted to the cohort that has remained in New Zealand.

Exposure variables

The key parental, family and household variables used to explore residential mobility in the first two years of life in New Zealand in *Residential Mobility Report 1: Moving house in the first 1000 days* are described in this section. These variables were determined from the face-to-face interviews with the *Growing Up in New Zealand* parents at the pregnancy and nine month data collection waves, as described below. Detailed description of the exposure variables, including the reference groups used and the data collection wave at which each measure was collected, is included in Appendix 1. Further information about the variables used, their distribution in the *Growing Up in New Zealand* cohort population, and additional detail regarding the socio-demographic, developmental and health status of the *Growing Up in New Zealand* cohort and their families is available in previous *Growing Up in New Zealand* publications (for example, see Morton et al., 2010; Morton et al., 2012a; Morton et al., 2012c; Morton et al., 2014b).

Maternal characteristics

Maternal age at the time of pregnancy with the *Growing Up in New Zealand* cohort child was analysed in four age groups: less than 20 years; 20-29 years; 30-39 years; and 40 years and over.

Maternal ethnicity was self-identified and self-prioritised (participants were asked to identify all of their ethnicities, and then their main ethnicity as their self-prioritised ethnicity). For these analyses, the detailed ethnicity information was coded into Level 1 categories following the Statistics New Zealand coding criteria (Statistics New Zealand, 2005) which included European; Māori; Pacific Peoples; and Asian.

Maternal education was defined as the self-identified highest educational qualifications attained by the time of the antenatal *Growing Up in New Zealand* interview.

Maternal symptoms of depression were measured using the Edinburgh Postnatal Depression Scale (EPDS; Cox, Holden & Sagovsky, 1987), which consists of 10 self-report items focused on the cognitive and affective features of depression with a higher score indicating more features of depression. This analysis used the EPDS as a single continuous variable.

The measure of maternal physical wellbeing used for *Residential Mobility Report 1: Moving house in the first 1000 days* was the self-reported overall assessment of general current health with response categories ranging from 'Poor' to 'Excellent'.

Family characteristics

Family characteristics included in these analyses were: whether the cohort child was the first child or a subsequent child in the family, whether this pregnancy of the *Growing Up in New Zealand* cohort child was planned or unplanned, and parental relationship status.

The Family Stress scale used in this report consisted of a 4-point response (from *not at all stressful* to *highly stressful*) to questions about level of worry over six family-related items (a disabled or ill family member; current housing difficulties; balancing work and family life; money problems; family members not getting on; and another child's behaviour). The scale response was then used as a continuous variable for these analyses, with the higher scores indicating a greater level of family stress.

The External Support and Family Support measures for *Residential Mobility Report 1: Moving house in the first 1000 days* have been derived from the Sources of Support Scale (Dunst, Jenkins, & Trivette, 1984) modified for *Growing Up in New Zealand* to suit the New Zealand context. The 12 items on the scale are grouped into informal (partner, family, extended family, and peers) and formal sources (media, family doctor, professionals, child carers and early childhood educators, parenting support programmes). A 6-point response scale was used for each source of support, ranging from 1 for *not available*, then *not at all helpful, sometimes helpful, generally helpful, very helpful*, to 6 for *extremely helpful*. A higher score reflects higher expectations of parenting social support being available and helpful. The scores were used to create two measures: one of external support, and one of family support, both of which were then used as continuous variables in the logistic regression analyses.

Family cohesion was assessed using a Family Cohesion Scale developed for *Growing Up in New Zealand*, based on items from the Family Adaptation and Cohesion Scales (FACES III; Olson,

1985). Māori concepts of whānau (extended family) and reciprocity that more appropriately reflect the New Zealand context were included. Participants rated 9 items relating to family cohesion (e.g., "People in our family/whānau ask each other for help, when they need it"), on a 4-point scale from 1 (*never*) to 4 (*always*). A higher score reflects higher family cohesion and this measure was used as a continuous variable in the logistic regression analyses.

Home environment

Parental employment status was determined at the antenatal and the nine month data collection waves. Household employment status was then derived from whether: both mother and partner were employed; either mother or partner was employed; either mother or partner was unemployed; or both mother and partner were unemployed. This derived partnership employment status was only available where information had been collected from both partners.

Household income was self-reported within *Growing Up in New Zealand*, with the level of annual income then analysed for the purposes of this report within $10 000 - $50 000 income bands.

The categories of household structure within which the *Growing Up in New Zealand* cohort children live are defined as: one parent (with no other adults in the house); two parents (and no other adults in the house); extended family (one or two parents with additional adult family members); and non-kin (one or two parents with additional adults in the house who are not family members).

For the purposes of these analyses, household crowding was defined as: low crowding (<1 person per bedroom); medium crowding (≥1 to <2 people per bedroom); and high crowding (≥2 people per bedroom).

Participants were also asked about whether there was damp, mould or condensation in the room in which their baby slept in (at the nine month data collection wave).

Neighbourhood environment

Growing Up in New Zealand participants were asked about aspects of neighbourhood integration and neighbourhood belonging. The Neighbourhood Integration Scale (Turrell, Kavanagh, & Subramanian, 2006) was a set of 10 questions with a 5-point response scale ranging from *strongly disagree* to *strongly agree,* that included items such as "I have a lot in common with people in my neighbourhood". The scores were combined to create a single measure, used as a continuous variable for this analysis, with higher scores relating to stronger feelings of neighbourhood integration. Participants were also asked about how long they had spent living in the neighbourhood, how long they intended to stay in the neighbourhood, and about community participation, including whether they belonged to community groups.

The Neighbourhood Belonging Scale developed for *Growing Up in New Zealand* consisted of a set of six questions with a 4-point response scale ranging from *strongly disagree* to *strongly agree*, that included items such as "I feel like I belong to my community". The item scores were then combined to create a single measure, used as a continuous variable for this analysis, with higher scores relating to stronger feeling of community belonging.

Participants were also defined as living in rural or urban areas according to the urban rural

profile classification in the 2006 concordance file from Statistics New Zealand (2006). The study participants were linked to the Statistics New Zealand urban rural profile based on meshblock data.

Neighbourhood variables

In addition to the exposure variables used for modelling residential mobility, the description of neighbourhood and service engagement for the *Growing Up in New Zealand* cohort in this report provides further information relevant to residential mobility.

The neighbourhood mobility and belonging questions used in these analyses are provided in Table 2.

Table 02: Neighbourhood questions within *Growing Up in New Zealand*

Question	Data collection	Participant(s)
How long have you lived in this neighbourhood including the time living in another house if it was still in the same neighbourhood?	Antenatal	Mother and Partner
From today, how long do you intend to stay in this neighbourhood?	Antenatal and nine month	Mother and Partner
Have you moved neighbourhood in the last year?	Nine month	Mother
Why do you live in this neighbourhood?	Nine month	Mother and Partner
What would make this neighbourhood or local community a better place for you?	Antenatal	Mother and Partner
Feelings toward the local community/neighbourhood	Nine month	Mother and Partner
Belonging to social networks and groups or organisations within community/neighbourhood	Nine month	Mother and Partner

Participants were also asked about their reasons for living in their current neighbourhood, "what would make this neighbourhood or local community a better place for you", and the number and type of community groups that they belonged to.

2.4 Statistical analysis

Analyses such as contingency tables and univariate logistic regression first explored the association between key covariates with the outcome variables "moved residential address or didn't move residential address" between the antenatal interview and nine month interview, and "moved residential address or didn't move residential address" between the nine month interview and two year interview.

Based on univariate analyses findings, a multivariate logistic regression model was used to analyse the association between residential mobility to nine months and to two years and possible determinants, including maternal characteristics, family characteristics, home environment characteristics and neighbourhood environment characteristics. The temporal ordering of the variables was respected in the final model – that is, pre-pregnancy factors (maternal education, general health before pregnancy, employment) were first considered, followed by factors occurring earlier in the pregnancy (first or subsequent child, planned pregnancy, current relationship, family stress); and those occurring later in time (support

networks, family cohesion score, neighbourhood integration score). The final mutually adjusted model presented considers how the demographic, family, household and neighbourhood features predict residential mobility, including variables that were determined according to a change in relationship status or a change in household income over time. The modelling results presented in this report include the p-value of Wald chi-square statistic, adjusted odds ratios (OR) and 95% confidence intervals (CI) of odds ratio for each covariate in multivariate logistic regression model. The odds ratios investigate the association of covariates with outcome variables. A two-sided *p*-value of <.05 was considered statistically significant. Analyses were conducted using SAS software (version 9.3, SAS Institute, Cary, NC, US).

3. Residential mobility in the first 1000 days of life

3.1 Frequency of moving

During the *Growing Up in New Zealand* antenatal interview, the number of residential moves that had occurred in the previous five years was recorded. Overall, 85% (n = 5321) of the cohort had moved at least once in the past five years. Of those who had moved, 26% (n = 1389) had moved only once, while 74% (n = 3932) had moved twice or more. A small number (n = 107; 2% of those who had moved at least once) had moved 10 or more times in the past five years.

"When we move house so many times we have to constantly adapt to new circumstances."

Between pregnancy and the time the cohort child was nine months of age, 26% (n = 1539) of families had moved house at least once. Of these, the majority (84%; n = 1298) had moved one time only, while 12% (n = 186) moved two times, and 4% (n = 55) families moved three or more times during this period.

Between nine months and two years of age, similar patterns of mobility were observed, with 32% (n = 2001) of families moving at least once during this period. Of these, 80% (n = 1587) of families had moved one time once, while 16% (n = 324) had moved two times, and 4% (n = 90) had moved three or more times (Figure 3).

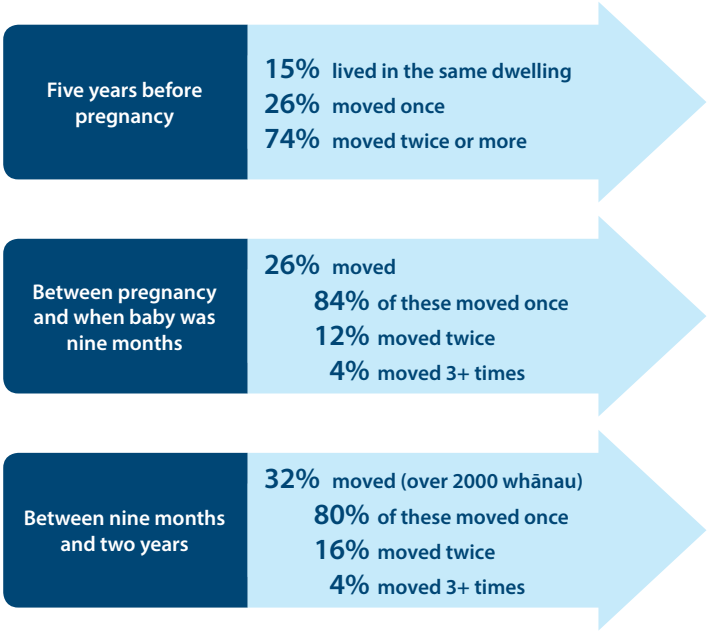

Figure 03: Residential mobility across each data collection wave of the *Growing Up in New Zealand* study

Overall, between birth and two years of age, 45.3% (n = 2796) of the *Growing Up in New Zealand* cohort had moved at least once (Figure 4).

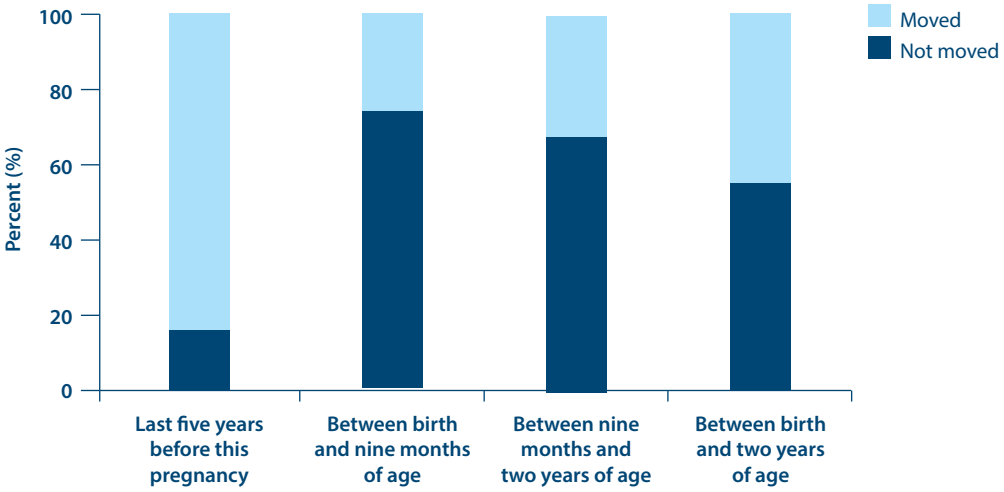

Figure 04: Proportion of the *Growing Up in New Zealand* cohort who experienced residential mobility

In these first two years of life, 1731 children moved once only (62% of those who had moved between birth and age two years), and 1062 children (38%) had moved twice or more (Table 3). The average number of moves between pregnancy and two years of age was 1.4 and the maximum number of moves was 8 (the situation for less than 10 children).

"We have moved three times in 12 months and that has been really unsettling for our kids."

Table 03: Frequency of residential mobility in the *Growing Up in New Zealand* cohort between pregnancy and two years of age

Total number of moves between birth and two years	Number of children*	Percentage of those who moved
0	3527	-
1	1731	62.0
2	708	25.3
3	239	8.6
4	74	2.6
5	22	0.8
6 or more	19	0.7

*__Note:__ The total number of children in Table 03 is the 6320 children for whom complete data on mobility is available to two years of age.

Of the children who had moved between birth and two years, 27% (n = 744) moved (at least once) between pregnancy and nine months of age, and again (at least once) between nine months and two years of age.

3.2 Distance moved

Considering those children who remained in New Zealand and moved house once only between pregnancy and nine months of age (because interim distance movement data was not available), the average distance moved was 28 km (standard deviation of 95 km), and the median distance moved was 4.7 km. Approximately 55% (n = 652) of children moved less than 5

km from their previous home, while approximately 9% (n = 109) moved more than 50 km from their previous home.

Similarly, for those children who moved house once between nine months and two years of age (n = 1336), the average distance moved was 37 km (standard deviation of 125 km), and the median distance moved was 4.4 km. Again, approximately half of these children (56%, n = 742) moved less than 5 km from their previous home, while approximately 10% (n = 140) moved more than 50 km from their previous home (Figure 5).

Of the children who had moved house between pregnancy and nine months of age, 77% (n = 1191) of their mothers stated that they had also moved neighbourhoods. Just under one quarter of these families (n = 346; 23%) had moved residence but stated that they did not move neighbourhood.

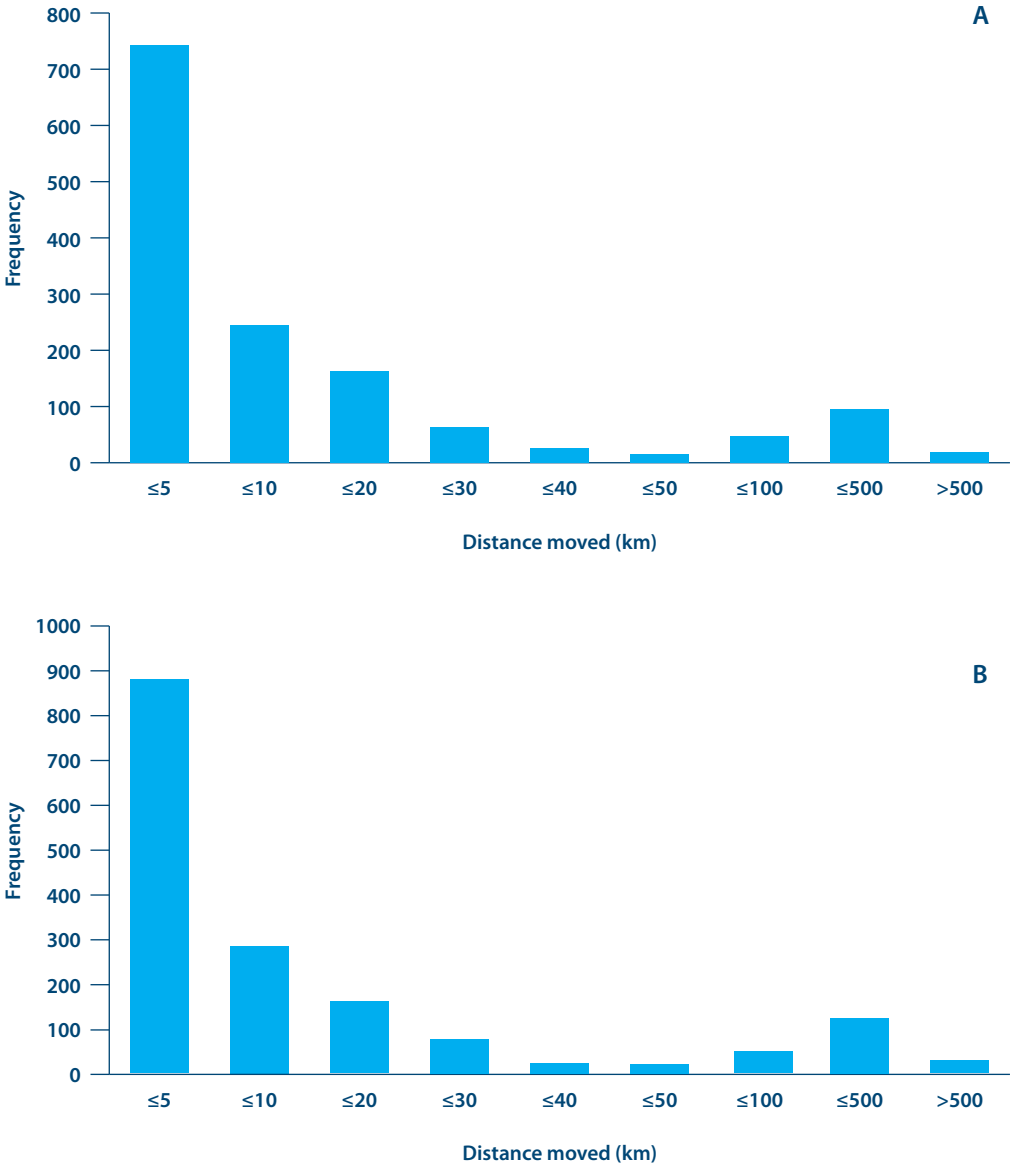

Figure 05: Distance moved by the *Growing Up in New Zealand* cohort between birth and nine months of age (A) and between nine months and two years of age (B)

4. Characteristics associated with residential mobility

This section of *Residential Mobility Report 1: Moving house in the first 1000 days* investigates the maternal, familial and socio-demographic characteristics associated with residential mobility in the first two years of life. Section 4.1 explores mobility between birth and nine months of age and then Section 4.2 explores mobility between nine months of age and two years. For each time period, a description of univariate relationships provides insight into which characteristics may describe those who moved residence (at least once) and those who did not. Given that many of these individual characteristics are known to be related to each other as well as to residential mobility, as described in Figure 1, these key inter-relationships are also explored within the *Growing Up in New Zealand* cohort. Finally, the maternal, socio-demographic, familial and neighbourhood characteristics are entered into a multivariate model to elucidate the most important predictors of residential mobility during the first two years of life for New Zealand children.

4.1 Characteristics associated with residential mobility between birth and nine months of age

Univariate relationships with residential mobility in infancy

Children who had experienced at least one move between birth and when they were nine months old tended to have younger mothers, with 49% of children with mothers less than 30 years of age during pregnancy experiencing at least one move, compared to 20% of children born to mothers 30-39 years old and 14% of children born to mothers more than 40 years old when they were pregnant with the *Growing Up in New Zealand* cohort children (Figure 6).

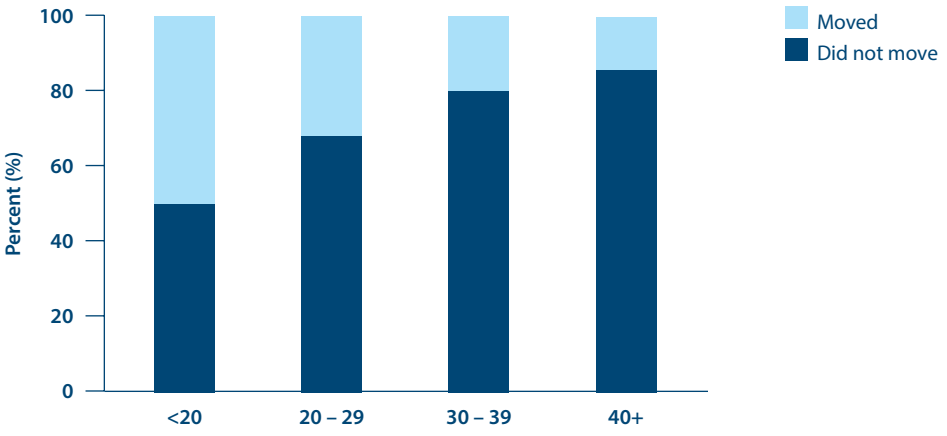

Figure 06: Residential mobility between birth and nine months of age according to maternal age during pregnancy

Children born to mothers who prioritised their own identity as Māori were more likely to experience residential mobility during infancy than children of European, Pacific or Asian mothers. Nearly one in three children born to Māori mothers (31%) experienced early life mobility compared to 25% of those born to European mothers, 25% of those born to Pacific mothers and 22% of those born to Asian mothers (Figure 7).

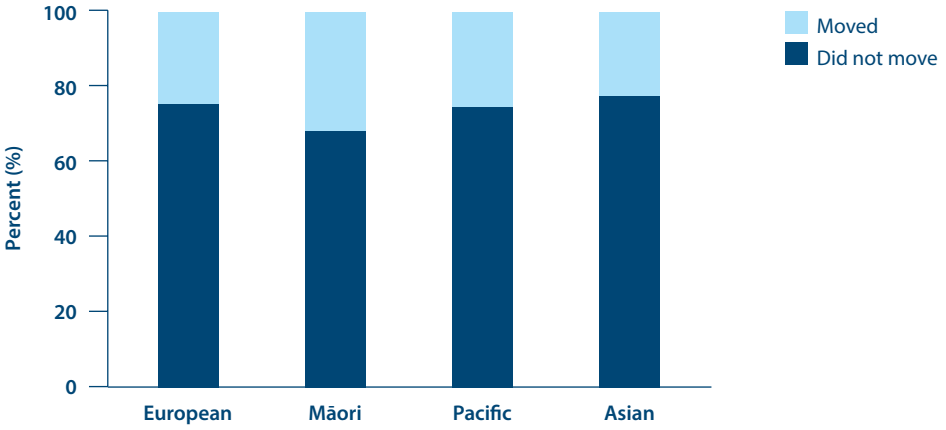

Figure 07: Residential mobility between birth and nine months of age according to maternal ethnicity

Children born into families with low levels of household income (as measured in pregnancy) were more likely to experience residential mobility during infancy than were children born into families with relatively high household incomes (Figure 8). Almost one in three children born into the most income-poor households experienced at least one residential move early in their lives, compared to approximately one in five children born into families with the highest household income group.

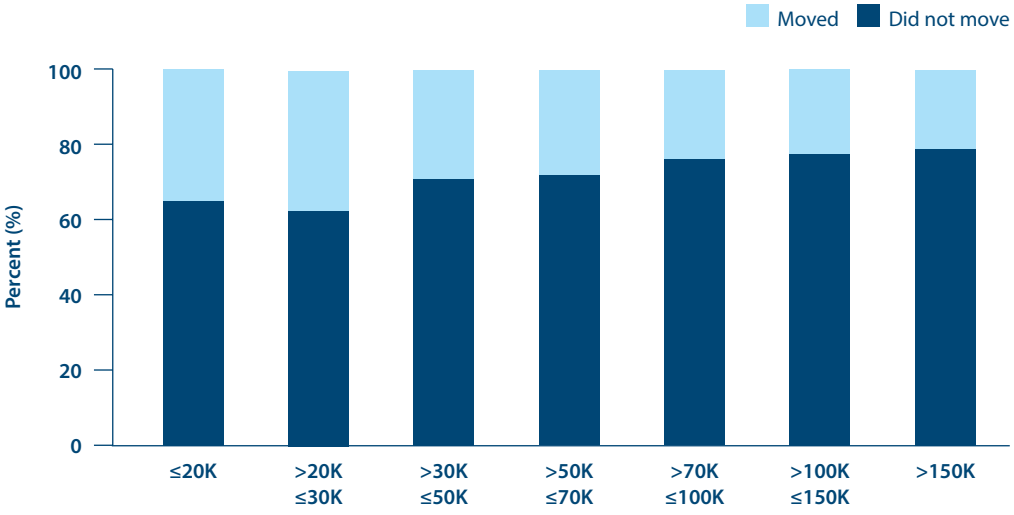

Figure 08: Residential mobility between birth and nine months of age according to household income group

Children born into families who were living in rental accommodation in pregnancy were more likely to experience at least one residential move between late pregnancy and nine months of age than were children born to families who owned their own house (Figure 9). Children born into families residing in private rental accommodation were the most likely to have experienced early mobility, with nearly one in two (49%) having moved at least once, compared to fewer than one in five experiencing mobility if their families were home owners. The majority (69%) of families who were living in a private rental home during late pregnancy, and who moved before

"Buying a new house is a real highlight."

their child was nine months of age, moved into another private rental home. Approximately one in four children born into families living in public rental accommodation experienced residential mobility in infancy.

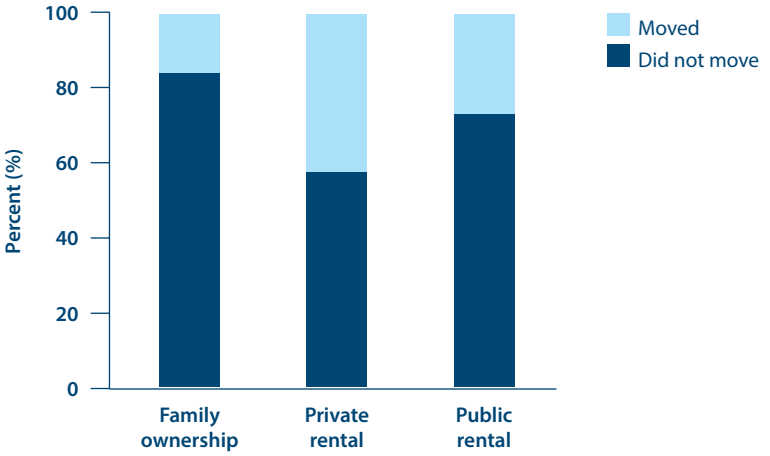

Figure 09: Residential mobility between birth and nine months of age according to housing tenure

Where children's family structures consisted of two parents, and no other adults in the house (as measured in pregnancy), they were less likely to experience residential mobility in their first nine months than were children living with either a sole parent or those living with extended family. Children most likely to experience at least one residential move in early life were those living in households with their parents as well as non-kin (Figure 10). Almost one in two children living in households with non-kin experienced residential mobility, compared to just over one in five of those living with two parents alone.

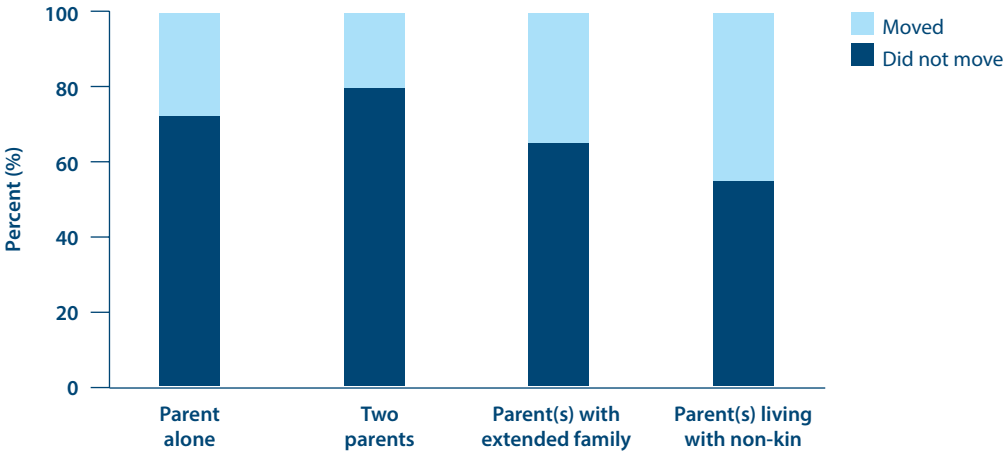

Figure 10: Residential mobility between birth and nine months of age according to household structure

Children living in areas of higher socio-economic deprivation in pregnancy were more likely to have moved than those living in areas of less deprivation, according to the New Zealand Deprivation Index (NZDep 2006; Salmond, Crampton, & Atkinson, 2006). The overall differences between the proportions of residentially mobile children living in the different deprivation areas was small (Figure 11).

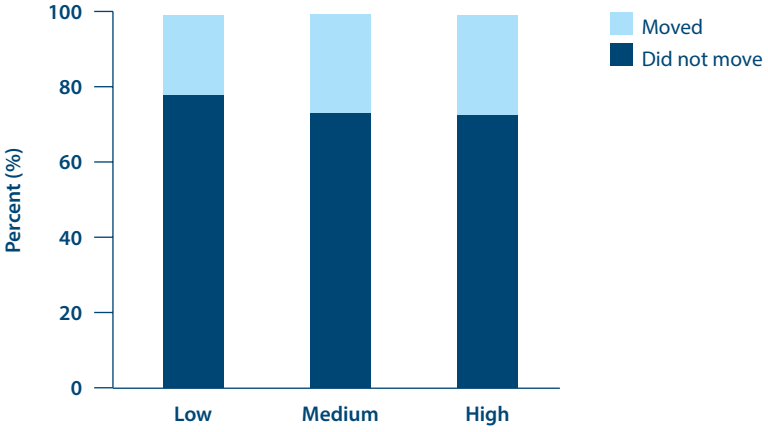

Figure 11: Residential mobility between birth and nine months of age according to area level deprivation in pregnancy (Low NZDep2006 deciles 1-3; Medium deciles 4-7; High deciles 8-10).

In summary, when looking at univariate associations between residential mobility and maternal and family characteristics, mobility in the first nine months of life is more associated with: younger maternal age; children of Māori mothers (compared to other ethnicities); low income households; children living in rental accommodation, with a sole parent, extended family adults or non-kin adults at home (compared to two parents); and those living in areas of higher deprivation.

While mobility is seen across the spectrum of diverse demographic and environmental circumstances for families in New Zealand, these univariate analyses indicate that there may be similarities between the characteristics that describe residential mobility in infancy and those that are most commonly associated with child vulnerability and increased risk of adverse outcomes (Morton et al., 2014c). Further understanding of these associations requires exploration of how these characteristics relate to each other (described next), and how they are associated with mobility once their relatedness is taken into account (described in the multivariate analyses of this section).

Relationships between the univariate characteristics that are associated with residential mobility

The single characteristics that have been shown to be associated with residential mobility in New Zealand in infancy, such as low maternal age, living in rental accommodation, and low household income, are not independent of each other.

For example, younger mothers in *Growing Up in New Zealand* are more likely than older mothers to be living in public rental accommodation. In addition, those living in public rental accommodation are more likely to be families with low household incomes. These inter-

relationships may partly explain the univariate associations between maternal age, housing tenure, income and mobility and therefore univariate associations alone cannot fully elucidate predictors of mobility.

This can be demonstrated by considering residential mobility in the first nine months of life according to household structure, stratified by maternal ethnicity (two inter-related factors that are each associated with mobility in the univariate analyses). Children born to parents living with extended family members or with adult non-kin experienced greater mobility in their first nine months of life when compared to children who experienced living with either a sole parent or two parents. However, the likelihood that children experienced these different household structures varied according to maternal ethnicity (Morton et al., 2014a). In particular, children born to Pacific or Asian mothers who were living with extended family were less likely to move than those living in this situation where mothers identified as either European or Māori. Only 26% of children living with Asian mothers in an extended family situation experienced early residential mobility compared to nearly half of all children born to European mothers living in the same household structure. The highest proportion of mobility was seen for children of Māori mothers living with non-kin adults (Figure 12).

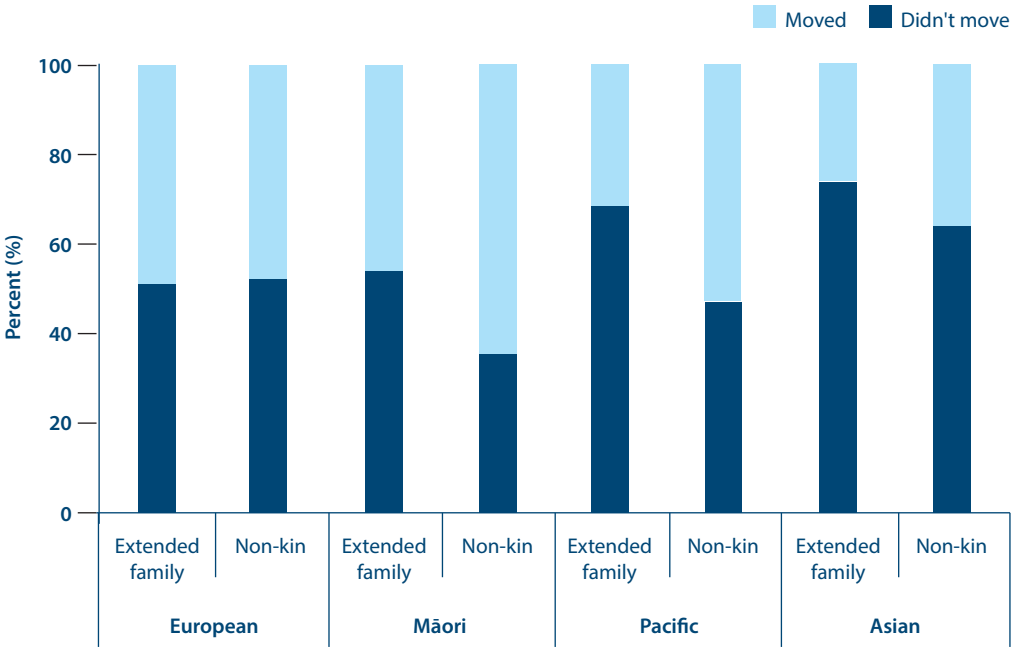

Figure 12: Residential mobility between late pregnancy and nine months of age according to household structure, stratified by maternal ethnicity

Because *Growing Up in New Zealand* has collected comprehensive information from families, it is possible to look at the collective impact of the inter-related individual, family, household and neighbourhood socio-demographic characteristics on residential mobility. The results of the multivariate analysis are presented in the following section.

Multivariate analysis of residential mobility between birth and nine months of age

For the purposes of *Residential Mobility Report 1: Moving house in the first 1000 days*, the inter-connected individual, family, household and neighbourhood characteristics have been explored in a multivariate model in order to determine whether they predict one or more residential moves between birth and nine months of age. The characteristics have been explored according to the temporal order in which they occurred to determine which factors were the main precipitator(s) of this early residential mobility in contemporary families in New Zealand. This model takes into account the associations that exist between the individual characteristics.

In addition to the ability to look at the inter-relationships between individual variables and residential mobility, another important advantage of using *Growing Up in New Zealand* data is the collection of this breadth of information over time. While *Residential Mobility Report 1: Moving house in the first 1000 days* focuses on data to two years of age, the longitudinal information collected within *Growing Up in New Zealand* allows for early analysis of the impact that a change in family circumstances may have on residential mobility. Therefore, change in parental relationship status and change in household income between birth and nine months of age have also been explored as possible influences on mobility in the multivariate model. Future reports and analyses of residential mobility within *Growing Up in New Zealand* will focus in more detail on the influence of other key changes in circumstances for children, as discussed in Section 6.

The maternal, familial, household and neighbourhood variables that continue to remain influential in terms of early life residential mobility in the mutually adjusted multivariate model are described in Table 4, and in this section. The full mutually adjusted model, including information about the univariate p values and the variables that became non-significant in the model is provided in Appendix 2.

Maternal characteristics associated with residential mobility:

- Maternal self-prioritised ethnicity remains a significant predictor of mobility in the multivariate model, with Māori, Pacific, Asian and other mothers all less likely to have moved between antenatal and nine months than European mothers (Table 4). Note that this is different from the univariate association which suggested that Māori mothers were more likely to move, implying that mobility is related to other characteristics more common in Māori mothers such as living in rental accommodation

- There were no overall significant effects of maternal education, antenatal maternal depression, or the self-assessment of maternal physical wellbeing in pregnancy (although these variables were significant in the univariate analyses). While maternal age group (significant in the univariate analyses) was also non-significant in the multivariate analyses, the confidence intervals indicate a possible decrease in likelihood of residential mobility in infancy with increasing maternal age group (Appendix 2). It will be interesting to investigate this possible relationship further as the amount of longitudinal data in *Growing Up in New Zealand* increases

Family characteristics associated with residential mobility:

- If the cohort child was a subsequent child, compared to the first child in their family, there was a decrease in the likelihood of residential mobility

- Increased levels of family cohesiveness were associated with a higher likelihood of moving, although the effect size was small (Table 4)
- Whether a pregnancy was planned or not, the current partnership status of the cohort child's parents, and the levels of family stress were not significantly associated with the likelihood of early residential mobility in the mutually adjusted model (despite their significance in the univariate analyses). The presence of external and family supports were also not significantly associated with the likelihood of early residential mobility (Appendix 2).

Aspects of the home environment associated with residential mobility:

"It has been such a challenge finding a job and getting a house."

- Parental employment status remained marginally significant in the multivariate model (highly significant in the univariate model), with families with two unemployed parents being more likely to have moved during the first nine months of their child's life compared to the reference group of two employed parents
- Household structure was significantly associated with residential mobility in the fully adjusted model, with those children living with extended family members, and those living with non-kin adults more likely to have moved in infancy, compared to those living with both parents (with or without other siblings)
- In relation to the household structure associations seen, a high level of household crowding around the time of the child's birth was also associated with a higher likelihood of mobility in the early postnatal period
- Household tenure during the antenatal period remained one of the most significant predictors of residential mobility between late pregnancy and when the children were nine months of age. Children born to families living in private rental accommodation were the most likely to experience early residential mobility (Table 4)

"We had to move house because the rental was sold. I'd rather not have to have my children move."

- Household income was non-significant in the multivariate model (although significant in the univariate analyses; Appendix 2).

Aspects of the neighbourhood environment associated with residential mobility:

- Being more integrated into a neighbourhood, and intentions to stay in a neighbourhood significantly reduced the likelihood of mobility in infancy (Table 4)
- Other neighbourhood features, including length of time in neighbourhood, belonging to communities and rurality were not significantly associated with this early mobility for children once all other factors were considered (Appendix 2)
- Aspects of neighbourhood are further discussed in Section 5.

Change in status from birth to nine months:

- A change in partnership status for the child's mother was associated with a higher chance of moving house between late pregnancy and nine months of age, even after considering all other factors. Residential mobility was most likely where there had been a partnership break up rather than where there had been a new partnership formed or no change in partner status
- Moving to a lower household income group was marginally associated with a greater likelihood of residential mobility in comparison to being in the same income group throughout the late pregnancy and early infancy period (Table 4).

Table 04: Multivariate model of residential mobility from pregnancy to nine months

	Multivariate *p* value	Multivariate odds ratio	Multivariate 95% confidence interval	
Maternal characteristics[1]				
Maternal ethnicity	<0.0001			
European (reference group)		1.0		
Māori		0.617	0.462	0.824
Pacific Peoples		0.496	0.349	0.703
Asian		0.479	0.355	0.648
Other		0.680	0.415	1.115
Family characteristics[2]				
Child order (cohort child)	0.0163			
First child (reference group)		1.0		
Subsequent child		0.776	0.631	0.954
Family cohesiveness	0.0017	1.036	1.013	1.059
Home environment[3]				
Parental employment	0.0118			
Mother and partner employed (reference group)		1.0		
Mother or Partner employed		1.009	0.829	1.227
Mother and Partner not employed		1.667	1.161	2.394
Mother or Partner not employed		0.855	0.623	1.174
Household structure	<0.0001			
Parent alone		0.719	0.337	1.536
Two parents alone (reference group)		1.0		
Parent(s) with extended family		1.914	1.503	2.439
Parent(s) with non-kin		2.243	1.57	3.203
Household tenure	<0.0001			
Family ownership (reference group)		1.0		
Private rental		3.931	3.24	4.77
Public/Other rental		1.28	0.802	2.044
Crowding	<0.0001			
Low crowding (<1 person per bedroom - reference group)		1.0		
Medium crowding (≥1 to <2 people per bedroom)		2.095	1.662	2.64
High crowding (≥2 people per bedroom)		2.871	2.005	4.112
Neighbourhood environment[4]				
Neighbourhood integration scale	0.0003	0.966	0.948	0.985
Intentions to stay in neighbourhood	<0.0001	0.979	0.972	0.986
Status change variables				
Change in partner status	0.0024			
No change (reference group)		1.0		
Newly partnered between antenatal and nine months		1.304	0.363	4.686
Newly partner-less between antenatal and nine months		2.346	1.447	3.802
Change in household income group	0.0111			
Same income group (reference group)		1.0		
Moved to higher income group between antenatal and nine months		1.029	0.789	1.341
Moved to lower income group between antenatal and nine months		1.335	1.1	1.62

Note that the variables which were non-significant in the fully adjusted model have been removed from Table 4, but are included in the full model in Appendix 2. These include:

[1]Non-significant maternal characteristics: age group, education, symptoms of depression in pregnancy, overall physical well-being

[2]Non-significant family characteristics: pregnancy planning, current partner status, external support, family support and family stress

[3]Non-significant household characteristics: household income

[4]Non-significant neighbourhood characteristics: length of time in neighbourhood, belonging to communities, rurality

Summary of main determinants of mobility between late pregnancy and nine months of age

The most important determinant of whether a child was likely to experience residential mobility in their first nine months of life was the housing tenure that their families were living in around the time of their birth. Those families living in private rental accommodation were the most likely to move in this period of the cohort child's life. Given that the overall rates of change in tenure between the antenatal period and nine months of age were minimal (39% of the *Growing Up in New Zealand* cohort in private rental during the antenatal period, compared to 38% at nine months; as seen in Morton et al., 2012c) it was unsurprising to observe that the majority (69%) of the residential moves out of private rental homes were to other private rental accommodation, rather than to home ownership.

Additionally, living in a household with adults other than parents (extended family or non-kin) increased the likelihood of early mobility, as did a partnership breaking up or moving to a lower household income band during the early months of a child's life. Maternal ethnicity was also a predictor of residential mobility from birth to nine months, with children of European mothers more likely to have moved than those of any other ethnicity.

4.2 Characteristics influencing residential mobility between the age of nine months and two years

This section investigates the maternal, familial, household and neighbourhood characteristics that are associated with residential mobility for cohort children between nine months and two years of age. Univariate relationships are described initially and then all the characteristics are entered into a multivariate model to consider the most important predictors of residential mobility during the second year of life for the *Growing Up in New Zealand* children.

Univariate associations with residential mobility during the second year of life

The children who had experienced at least one residential move in their second year of life also tended to have younger mothers, with over half of children born to teenage mothers experiencing mobility between the ages of nine months and two years. Slightly fewer children of mothers aged 20 to 29 years moved during this period (approximately 40%), but still a greater proportion of children living with mothers in this age group moved, compared to those children born to mothers aged 30 years or older (Figure 13).

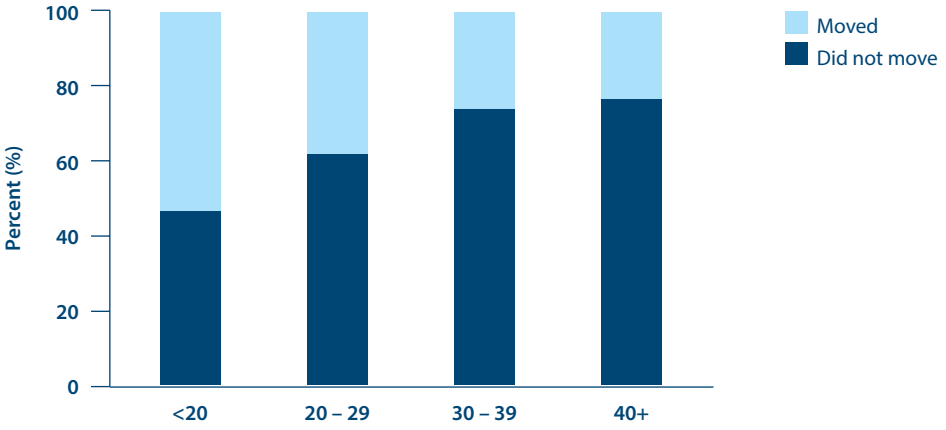

Figure 13: Residential mobility between nine months and two years of age according to maternal age during pregnancy

As seen for residential mobility in infancy, children born to mothers who prioritised their own identity as Māori were more likely to experience residential mobility during their second year of life compared to children of European, Pacific or Asian mothers. Nearly 40% of children born to Māori mothers experienced mobility between nine months of age and two years compared to approximately 30% of those children born to mothers that self-identified as European, Pacific or Asian ethnicity (Figure 14).

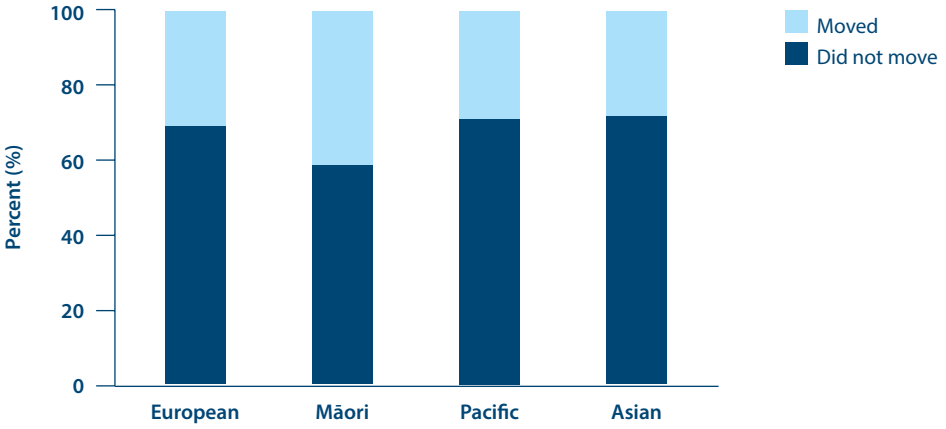

Figure 14: Residential mobility between nine months and two years of age according to maternal ethnicity

Children living in families with the lowest levels of household income were more likely to experience residential mobility during the second year of the children's lives compared to children born into families with higher household incomes (Figure 15). More than one in three children living in the most income-poor households experienced residential mobility between the ages of nine months and two years, compared to approximately one in five of children born into families with the highest household income group.

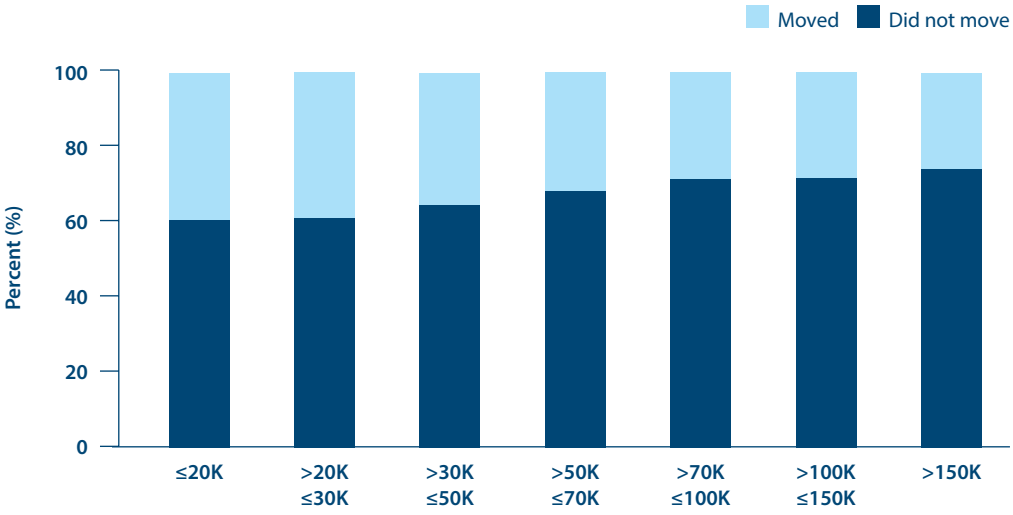

Figure 15: Residential mobility between nine months and two years of age according to household income

Children born to families living in private rental accommodation were most likely to experience at least one residential move between the age of nine months and two years compared to children living in public rental accommodation or in families who owned their own house (Figure 16). Approximately half of all children living in private rental dwellings at nine months moved at least once before their second birthday; for the majority of families (65%), this move was to another private rental home. The proportion of children living in public rental accommodation who moved during their second year of life was lower than the proportion in public rental accommodation who moved during the early postnatal period.

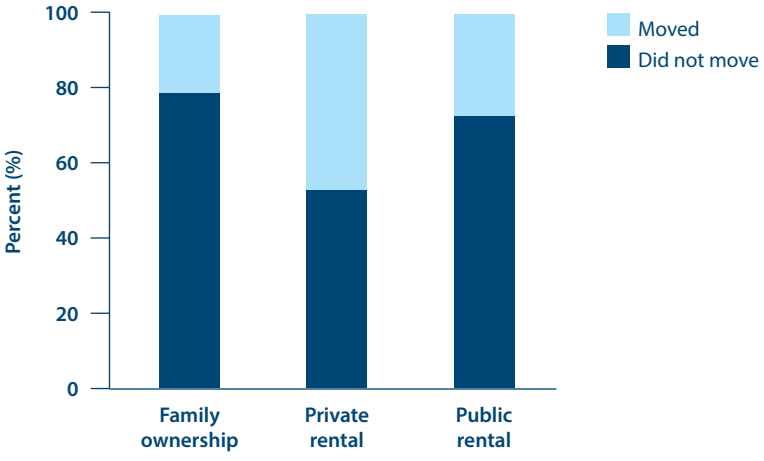

Figure 16: Residential mobility between nine months and two years of age according to housing tenure at nine months

Children living with two parents (and no other adults in the house) were less likely to experience residential mobility in their second year of life than were children living with either a sole parent or those living with extended family; however, the differences in mobility according to household structure in the second year of life were smaller than were those seen in the first nine months of life (Figure 17).

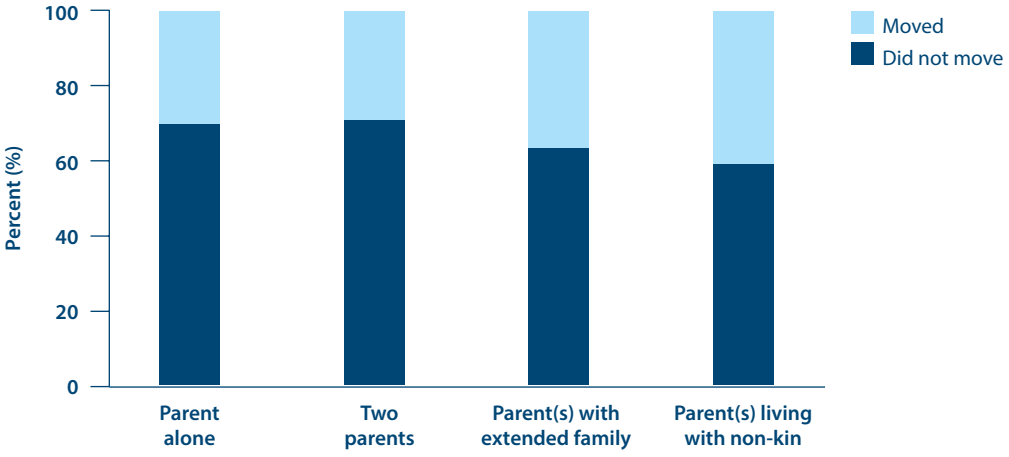

Figure 17: Residential mobility between nine months and two years of age according to household structure

There was only a very small variability in the proportions of children who had moved between nine months and two years according to area-level deprivation, with approximately 30% of children living in areas of high, medium and low socio-economic deprivation (as measured at nine months) moving between nine months and two years (Figure 18).

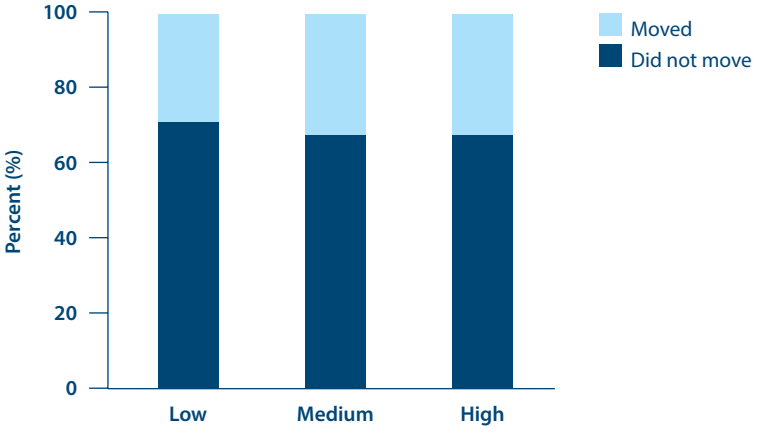

Figure 18: Residential mobility between nine months and two years of age according to area level deprivation at nine months (Low deprivation NZDep 2006 deciles 1-3; Medium deciles 4-7; High deciles 8-10).

In summary, when looking at associations between residential mobility and single maternal and family characteristics, mobility in the second year of life was associated with: younger maternal age; mothers identifying as Māori (compared to other ethnicities); living in low income households; living in rental accommodation; and living with either a sole parent, extended family adults or non-kin adults at home (compared to two parents). This group of factors associated with mobility from birth to nine months of age in the univariate analyses is very similar to those associated with earlier mobility, and again align closely to characteristics often associated with early vulnerability and later adverse outcomes. How these characteristics are associated with residential mobility once their inter-relatedness is taken account is now explored in the multivariate analysis.

Multivariate analysis of residential mobility between the age of nine months and two years

The mutually adjusted model in this section demonstrates the influence of the family, household, socio-demographic and neighbourhood characteristics on the likelihood of children in the *Growing Up in New Zealand* cohort experiencing at least one residential move between the ages of nine months and two years. The odds ratios shown are mutually adjusted for all other characteristics, given that there were as significant correlations between the familial and socio-demographic characteristics during this period of the child's life course as there were during the first nine months.

The variables that continue to remain influential in terms of predicting residential mobility for children in their second year of life in the mutually adjusted multivariate model are as described in Table 5, and in this section. The full mutually adjusted model, including information about the univariate *p* values, and the non-significant variables is provided in Appendix 3.

Maternal characteristics associated with residential mobility:

- Maternal age remained significantly associated with residential mobility in the multivariate model for children between the ages of nine months and two years of age, with teenage mothers and mothers aged 20 to 29 years more likely to have moved during the second year of their child's life compared to those over 30 years of age.
- Maternal ethnicity remained significant over this time period. Māori mothers were as likely to have moved during this period as European mothers, but children living with Pacific or Asian mothers were less likely to have moved during this time in the children's lives.
- There were no overall significant effects of maternal education or maternal symptoms of postnatal depression in the multivariate model, although these characteristics were significant in the univariate analyses (Appendix 3). Overall maternal physical wellbeing at nine months was not associated with residential mobility during the second year of a child's life.

Family characteristics associated with residential mobility:

- *Growing Up in New Zealand* children who were subsequent children in their families (compared to first children) were less likely to have moved in the second year of life, as was seen in the early postnatal period (Table 5).

"We lost our support network when we moved."

- Increased access to external support for families, and increased family stress were significantly associated with residential mobility in the second year of life in this multivariate model, although the effect size for these characteristics was very small.
- Whether a pregnancy was planned or not was not significantly associated with the likelihood of residential mobility between nine months and two years of age, nor was current partner status of the cohort children's parents (although these characteristics were significant in the univariate analyses).
- Increased levels of family support were not associated with residential mobility in the second year of life (Appendix 3).

Table 05: Multivariate model of residential mobility from nine months to two years of age

	Multivariate *p* value	Multivariate odds ratio	Multivariate 95% confidence interval	
Maternal characteristics[1]				
Maternal age group	<0.0001			
<20 years		2.092	1.301	3.363
20 – 29 years		1.453	1.235	1.708
30 – 39 years (reference group)		1.0		
40+ years		0.851	0.585	1.239
Maternal ethnicity	<0.0001			
European (reference group)		1.0		
Māori		0.994	0.793	1.245
Pacific Peoples		0.554	0.417	0.735
Asian		0.656	0.516	0.833
Other		0.929	0.63	1.37
Family characteristics[2]				
Child order (cohort child)	0.0461			
First child (reference group)		1.0		
Subsequent child		0.854	0.731	0.997
External support	0.0282	1.018	1.002	1.034
Family stress	0.0241	1.023	1.003	1.043
Home environment[3]				
Household income group	0.0056			
<=$20K		0.967	0.649	1.442
>$20K to <=$30K		0.83	0.59	1.116
>$30K to <=$50K		0.881	0.696	1.114
>$50K to <=$70K		0.938	0.761	1.156
>$70K to <= $100K (reference group)		1.0		
>$100K to <=$150K		1.421	1.137	1.775
> $150K		1.342	1.014	1.778
Household tenure	<0.0001			
Family ownership (reference group)		1.0		
Private rental		3.394	2.9	3.973
Public/Other rental		1.563	1.092	2.238
Crowding	0.0175			
Low crowding (<1 person per bedroom – reference group)		1.0		
Medium crowding (≥1 to <2 people per bedroom)		1.612	1.15	2.258
High crowding (≥2 people per bedroom)		1.709	1.158	2.522
Status change variables				
Change in partner status	<0.0001			
No change (reference group)		1.0		
Newly partnered		2.2	1.254	3.857
Partnership break up		2.03	1.408	2.926
Change in household income group	0.0036			
Same income group (reference group)		1.0		
Increase in household income group		1.311	1.114	1.543
Decrease in household income group		1.199	0.986	1.459

Note that the variables which were non-significant have been removed from Table 5, but are included in the full model in Appendix 3. These include:
[1]Non-significant maternal characteristics: education, symptoms of depression in pregnancy, overall physical well-being
[2]Non-significant family characteristics: pregnancy planning, current partner status, family support
[3]Non-significant home environment characteristics: parental employment status, household structure, housing quality: damp, condensation, mould
[4]Non-significant neighbourhood characteristics: belonging to communities, neighbourhood belonging, rurality.

"We have moved into a bigger home for our family."

Aspects of the home environment associated with residential mobility:

- The level of household income was significantly associated with childhood mobility in the second year of life, with those in the two highest income categories more likely to have moved between nine months and two years than those in the reference household income group of $70,000-$100,000.
- A highly significant predictor of residential mobility between nine months and two years was the type of housing tenure, with children living in private rental at nine months of age being the most likely to experience mobility during their second year of life.
- While household structure was not significantly associated with mobility at this time point, a high level of household crowding when the child was nine months old was associated with a higher likelihood of mobility during the second year of the child's life, although this effect appeared to be less than that seen around the time of birth.
- Parental employment status, significant in the univariate analyses, was not significant in the multivariate analysis of residential mobility from nine months to two years of age
- Housing quality measures at nine months (such as the presence of damp, condensation and mould) were not significantly associated with mobility during this time period (Appendix 3).

Aspects of the neighbourhood environment associated with residential mobility:

- Belonging to communities and neighbourhood belonging (significant in the univariate analyses) and rurality were not significantly associated with residential mobility in the second year of life in the multivariate model (Appendix 3).

Change in status from nine months to two years:

- A change in partnership status for the child's mother was significantly associated with a higher chance of moving house between nine months of age and two years, regardless of whether the change was becoming newly partnered or a partnership breaking up
- Moving to a higher household income group was associated with a greater likelihood of moving at least once in the child's second year of life.

Summary of main determinants of mobility between nine months and two years of age

The key determinant of whether a child was likely to experience residential mobility in their second year of life (between the ages of nine months and two years) was the housing tenure that their families were in when they were nine months of age. This was the same key association found for mobility between birth and nine months of age. As previously observed, those families living in private rental accommodation were the most likely to move in this period of the cohort child's life. Once again, the majority (66%) of these residential moves out of private rental homes were to another private rental home, rather than to home ownership.

Additionally, being born to a younger mother increased the likelihood of residential mobility during the second year of a child's life, as did: Māori and European maternal ethnicity; higher household income relative to the median; change in partnership status; and an increase in household income during this time.

There is some indication that the potential predictors of residential mobility during the second year are slightly different from those associated with mobility in the first nine months of a child's life. For example, in the first nine months of a child's life, moving to a lower household income was associated with residential mobility compared to moving to a higher household income in the second year of life. Understanding why we see these differences should become clearer as further longitudinal data is available to track mobility beyond the two year point. The later information will also allow a better assessment of the likely causal relationships between early life factors and mobility, and whether they predict greater or lesser stability of home environment over time.

5. Neighbourhood and service engagement

This section provides a description of neighbourhood perceptions, community participation and movement in and out of District Health Board regions for the *Growing Up in New Zealand* participants. It provides some early indication of how residential mobility may be related to these measures, but does not attempt to understand causal relationships. Exploration of these relationships will be the goal of future, more detailed analyses about the impact of residential mobility on community belonging, access to health and education services, and child health and developmental outcomes.

5.1 The neighbourhood of the *Growing Up in New Zealand* children in their first 1000 days

Time spent in current neighbourhood

At the antenatal interview, participants were asked about how long they had lived in their current neighbourhood as well as how long they intended to live in that neighbourhood. The average amount of time spent living in the current neighbourhood was 4.4 years (standard deviation 5.7 years) for the expectant mothers and 2.8 years (standard deviation 3.5 years) for their partners. On average, the number of years families intended to stay in their current neighbourhood was 10.5 years (standard deviation 15.9 years), reported by both expectant mothers and their partners.

The intended length of stay in the current neighbourhood in the antenatal period was shorter on average for those families who subsequently moved neighbourhood before the cohort child was nine months of age (n = 1191). For those who had moved neighbourhood by the time the cohort child was nine months of age, the average number of years participants said (at the antenatal interview) they intended to stay in the current neighbourhood was 4.3 years (standard deviation 11 years). For those who hadn't moved neighbourhood between pregnancy and nine months of age, the average number of years participants intended to stay in the current neighbourhood (as stated during the antenatal interview) was 12 years (standard deviation 16 years).

Perceptions of neighbourhood

Measures of neighbourhood integration were collected from families at the antenatal interview and again when the cohort children were nine months of age. During pregnancy, the average score for the Neighbourhood Integration Scale (as described in Section 2.3) was 34.5 (standard deviation of 4.9), with a maximum possible score of 50 (a higher score suggesting greater integration). When antenatal neighbourhood integration scores were compared for those who had subsequently moved neighbourhood by the time the cohort child was nine months of age, those who had moved neighbourhood had a lower neighbourhood integration score on average from the antenatal period (32.9 with standard deviation of 5.1) compared to those who had not subsequently moved neighbourhood (34.9 with standard deviation of 4.7). Maternal perception of neighbourhood integration was similar to paternal perception of neighbourhood integration overall.

The most common reasons stated as to why participants lived in their current neighbourhood in late pregnancy (Figure 19) were that it was a "good and safe neighbourhood" (44.5%), that "friends and/or family are nearby" (41%) and that it was "handy to shops and other amenities" (38%).

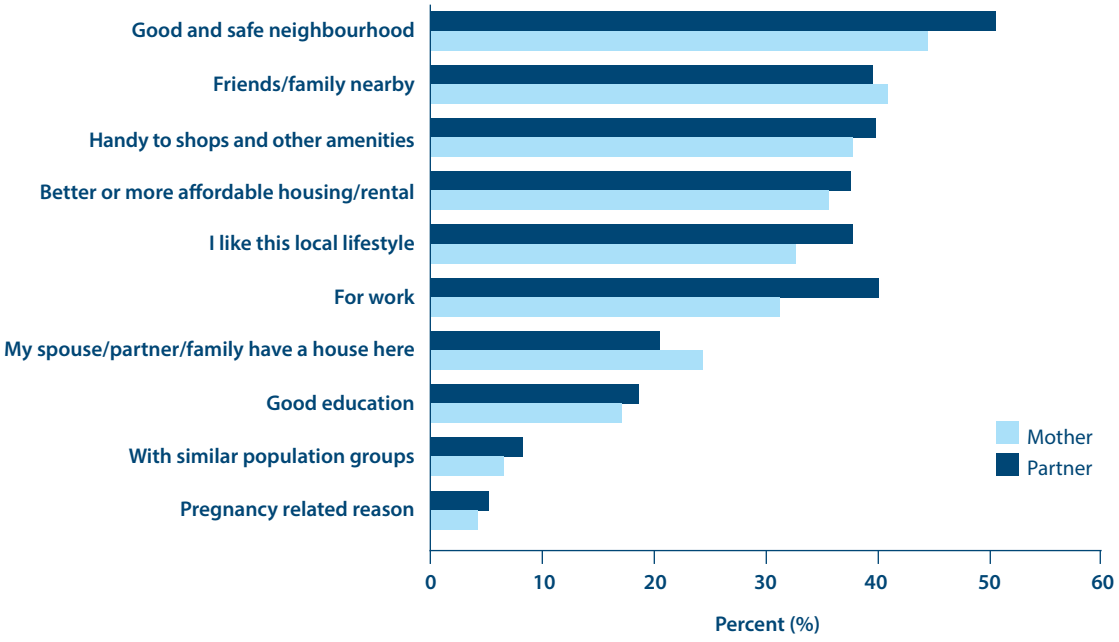

Figure 19: Reasons for living in neighbourhood

The most common reasons stated as to why participants lived in their neighbourhood in late pregnancy differed for those that were subsequently in the same neighbourhood at the nine month interview, compared to those that had subsequently moved neighbourhoods at the nine month interview (Figure 20).

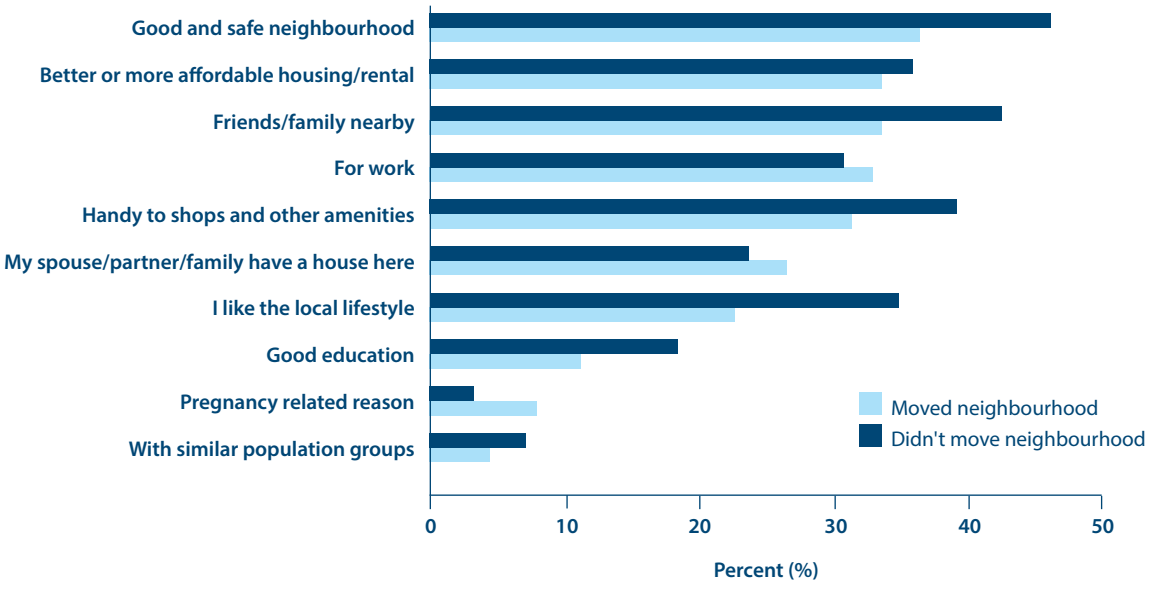

Figure 20: Reasons for living in neighbourhood according to neighbourhood mobility

Neighbourhood belonging

When asked "what would make this neighbourhood or local community a better place for you?" the most common characteristics mentioned were "no violence and crime" (36.4%, n = 2079), "more neighbourliness (being friendly, looking out for and respecting each other)" (27.5%, n = 1577) and "more neighbourhood get-togethers or community events" (25.1%, n = 1443). Many participants stated that they were happy with their neighbourhood as it was (32%, n = 1828). Other characteristics that were commonly stated were "safer roads and footpaths" (22.2%, n = 1266), and "community neighbourhood watch" (20.1%, n = 1145).

"We moved and changed communities when she was 19 months old and I had to reconnect with people and find groups to attend."

One aspect of community belonging relates to the number of community groups that people belong to (Figure 21). During pregnancy, approximately 64.7% (n = 3712) participants belonged to one or more community groups. Overall, 35.3% (n = 2020) didn't belong to any community groups, 14.9% (n = 853) belonged to one community group, 18.3% (n = 1047) belonged to two community groups, and 15.1% (n = 866) belonged to three community groups. The average number of community groups belonged to during pregnancy was 1.7.

At nine months, the proportion of people who belonged to one or more community groups had increased to 89.9% (n = 5537). Overall, 10.9% (n = 624) didn't belong to any community groups, 22% (n = 1258) belonged to one community group, 26.2% (n = 1500) belonged to two community groups, and 23.7% (n = 1358) belonged to three community groups. The average number of community groups belonged to at nine months was 2.4.

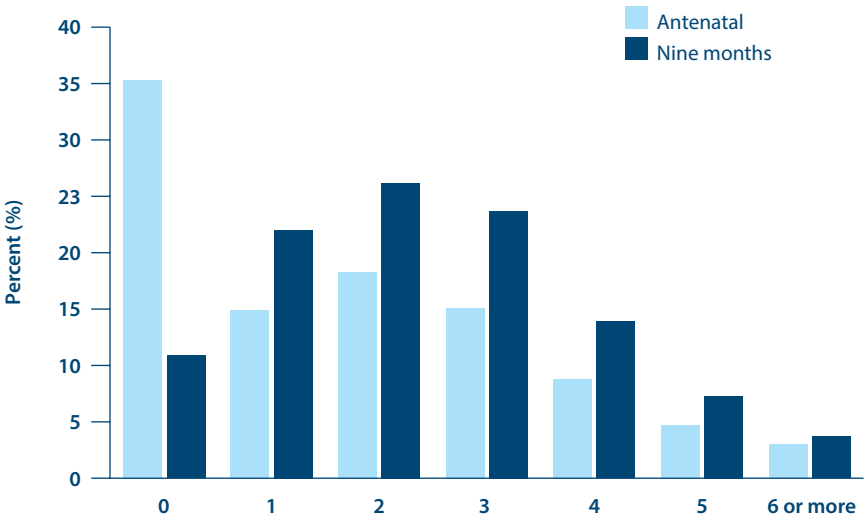

Figure 21: Number of community groups belonged to in pregnancy and when *Growing Up in New Zealand* children were nine months of age

5.2 Health service residence as an example of residential mobility and service delivery

It is not within the scope of this current report to consider in any detail the impact of residential mobility on the access to and effectiveness of the services with which the *Growing Up in New Zealand* cohort children engage. However, for the purposes of this report, and as an example of how residential mobility may influence health service engagement, an analysis of District Health Board residence over time has been conducted (Figure 22).

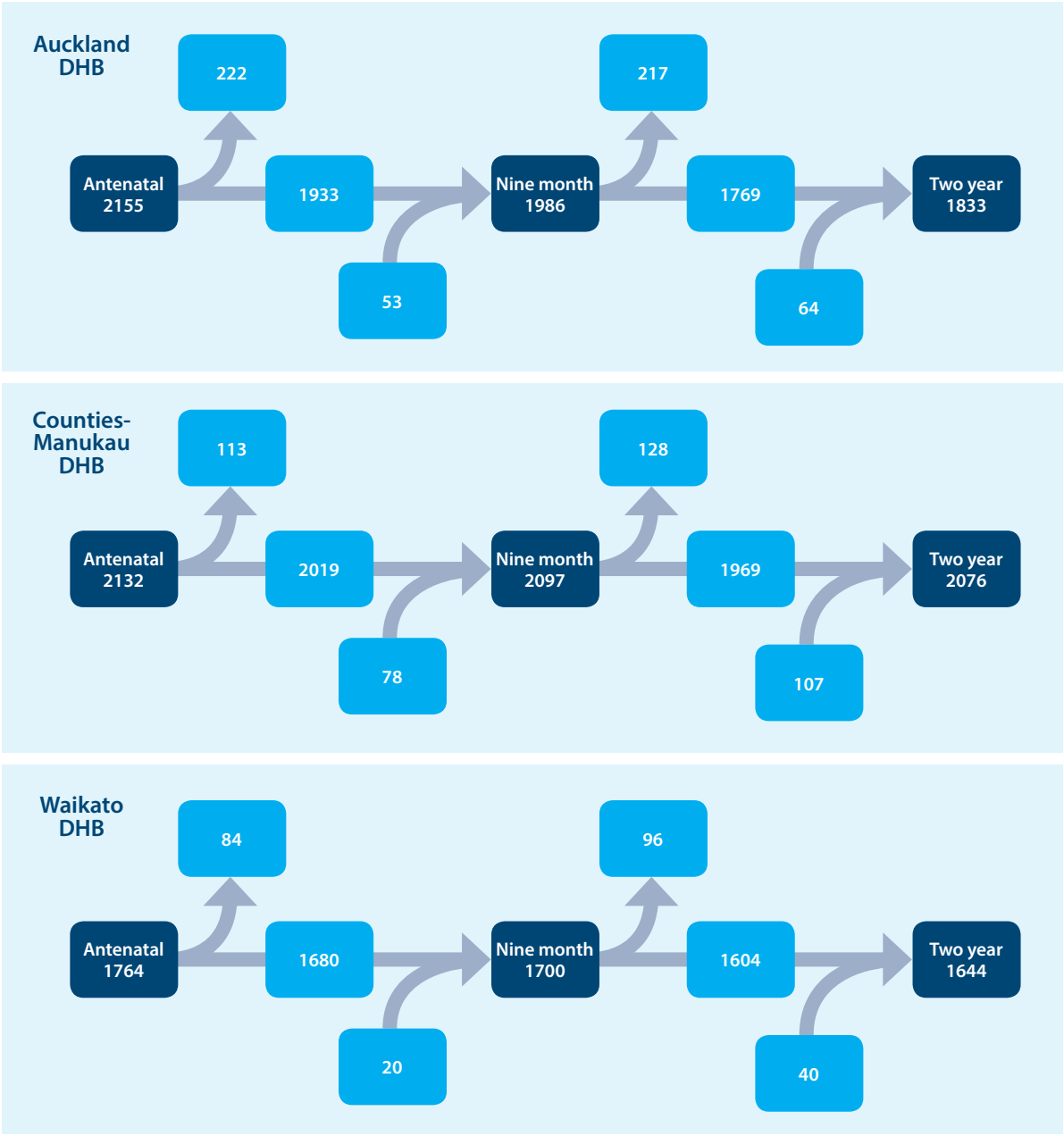

Figure 22: Movement in and out of the residential area of the three main District Health Board regions from which the *Growing Up in New Zealand* cohort was recruited

The largest number (over 2000 children) of the *Growing Up in New Zealand* cohort was recruited from the Auckland District Health Board region. Over time, approximately 450 children who were originally recruited in this residential area moved out of the Auckland DHB: 222 children moved out of this area between the pregnancy and nine month interviews; and 217 between nine months and two years of age. Of those moving out of the Auckland DHB region, the two DHBs that the largest number of children had moved to at the two year time point were Waitemata DHB (34% of those who had moved) and Counties Manukau DHB (32% of those who had moved). Over the first two years of data collection in *Growing Up in New Zealand*, just over 100 children had moved into the Auckland DHB region.

Over the same time period, just over 240 children who were originally recruited in the Counties Manukau DHB residential area moved out of this area. Of these, the two DHBs that the largest number of children had moved to at the two year time point were Auckland (28% of those who had moved) and Waikato (16% of those who had moved). Over the first two years of data collection in *Growing Up in New Zealand*, just under 200 children moved into the Counties Manukau DHB region.

With respect to movement in and out of the Waikato DHB region over the same time period, just under 200 children who were originally recruited in the Waikato DHB residential area moved out of this area. Of these, the two DHBs that the largest number of children had moved to at the two year time point were Lakes DHB (13% of those who had moved) and Counties Manukau DHB (12% of those who had moved). Over the first two years of data collection in *Growing Up in New Zealand*, 60 children moved into the Waikato DHB region.

6. Concluding remarks and looking to the future

The New Zealand context of residential mobility is diverse and complex. This report has explored the likelihood of experiencing residential mobility over the first 1000 days for contemporary New Zealand children, and particularly focused on assessing the individual, familial, household and neighbourhood characteristics that are associated with residential mobility in early life in New Zealand.

This analysis of *Growing Up in New Zealand* data has provided the following key conclusions (Figure 23):

- Moving house is a frequent event in the lives of New Zealand families. In fact, the level of residential mobility described in the *Growing Up in New Zealand* cohort is greater than that demonstrated in other comparable cohorts (such as that of the Millennium Cohort in the UK).
- Residential mobility during the first two years is associated with aspects of parental demographics, employment, housing tenure and structure, and neighbourhood level characteristics for New Zealand children.
- Univariate analyses indicate similarities between the characteristics that are associated with residential mobility and those that are most commonly associated with child vulnerability and increased risk of adverse outcomes.
- When relationships between the characteristics associated with residential mobility are taken into account in multivariate analyses, a more complex picture of predictors of residential mobility is seen.
- The key determinant of mobility between birth and the age of nine months, and between nine months and two years of age for the *Growing Up in New Zealand* cohort is the housing tenure that families are living in. Families living in private rental accommodation are the most likely to move in this early period of life. Variation in the proportion of families in different housing tenure types in New Zealand compared to other countries may in part explain the differing rates of residential mobility seen. Improving the security of housing tenure in New Zealand, particularly in the private rental market, may protect families from undesired moves.
- In the first 1000 days of life in New Zealand, residential mobility is also higher for those cohort children who are a first child, and those children who are living in less traditional household structure types (with their parent(s) as well as additional adults such as extended family members or non-kin). In the univariate analyses it appeared that children born to Māori mothers experienced greater residential mobility than those born to mothers identifying with other ethnicities. However, once characteristics associated with maternal ethnicity (such as maternal age and tenure) had been taken into account in the multivariate analysis, children of European mothers are the most likely to move in early life.
- The longitudinal data which allows change in status to be used in the model demonstrates that those children who had parents whose partnership ended, or whose households moved to a lower household income during the early months of their child's life were more likely to have moved. Those children in families who increased their income during the second year of a child's life, or who had experienced a change in partner status, were more likely to have moved during that time period than those children in families whose household income had not changed.

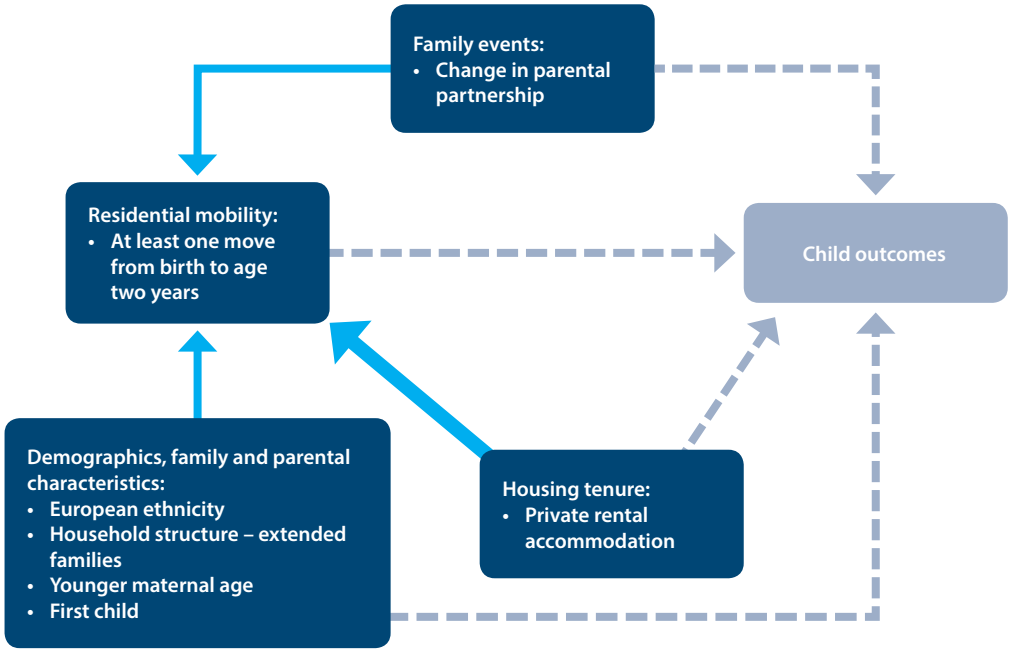

Figure 23. Examples of the key findings of *Residential Mobility Report 1: Moving house in the first 1000 days* with respect to the precursors of mobility

Although challenging to define and measure, residential mobility is an important feature of life for pre-school New Zealanders and as such it will continue to play an important part in future analyses of the *Growing Up in New Zealand* cohort to determine what influences child developmental trajectories (Figure 24). Examples of ongoing and future work within this cohort study regarding residential mobility include:

- Analysis of the characteristics of those families who are frequently mobile (moved twice or more) compared to those who have moved only once before their child turns two;
- Further analyses on the direction and strength of associations with residential mobility to two years and beyond including exploration of the specific reasons for moving (where available), analyses of the frequency of mobility (and investigation of dose-effect relationships), and the attributes of neighbourhoods moved to or from;
- Research on the impact of different patterns of residential mobility on early trajectories of child health and developmental wellbeing and other child outcomes including early childhood education participation and school transience;
- Research on the impact of different patterns of residential mobility within population subgroups, and across the diversity of families, to better understand the impact of mobility on equity of outcomes for children;
- Research elucidating and understanding the difference between and reasons underlying desired and undesired residential mobility;
- Comparison of longitudinal data to other national data sources such as that provided by the Census and other Statistics New Zealand survey data;

- Evaluation of how changes in housing affordability and changes in the state housing sector influence residential mobility;
- Evaluation of the impact of policy and programme effectiveness given the extent of residential mobility, especially those that are geographically or locally planned and based;
- Understanding the impact of mobility on child vulnerability and how this may contribute to both positive and negative outcomes;
- Research examining how mobility is associated with resilience, and what features of families, neighbourhoods and society enable mobility to act as a buffer against adverse outcomes;
- Research examining the importance and relevance of period effects (for example the economic recession) in comparison to influences on other generations and other cohorts.

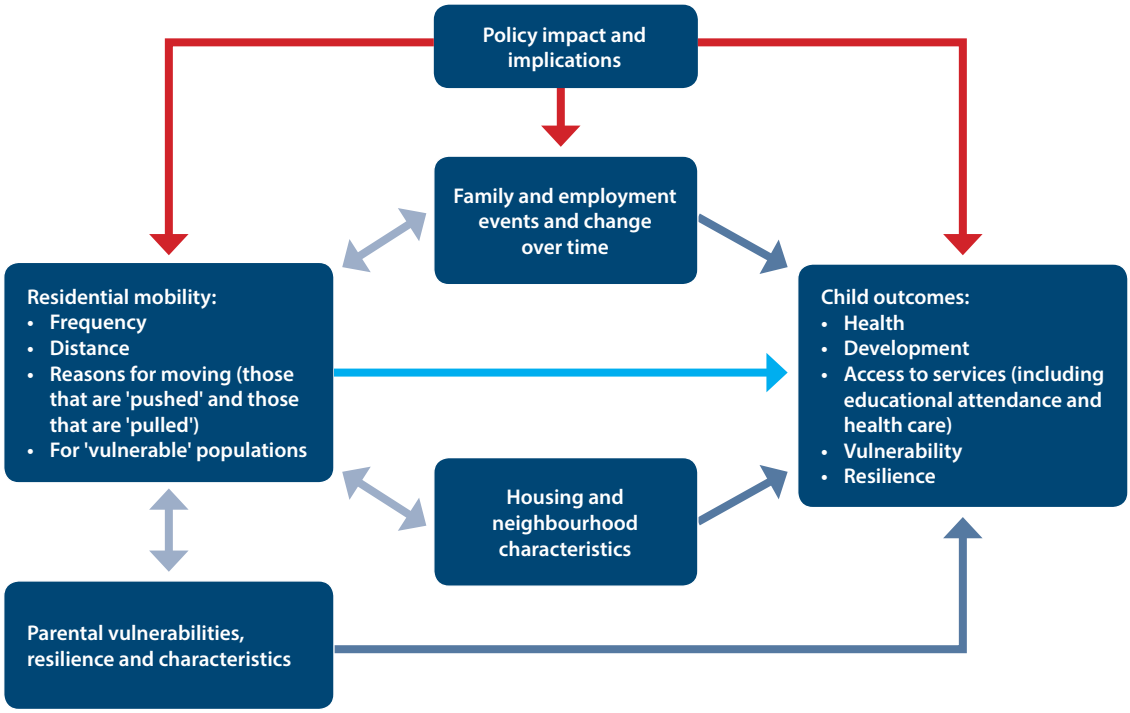

Figure 24. Examples of areas of future focus regarding residential mobility and child outcomes within *Growing Up in New Zealand*

In addition, with the completion of the field collection of the pre-school data from the *Growing Up in New Zealand* children and families at the end of 2014, exploration of the associations between reasons for moving, rates of mobility and outcomes in the immediate pre-school period will be possible. This will enable a better appreciation of the potential impact of residential mobility on family life during the whole pre-school period and the capacity of current policies and programmes to support those families who are highly mobile. For example, preliminary exploration of data for families that moved two or more times during the first two years of their child's life suggests that frequent residential mobility may be associated

with reduced perception of neighbourhood belonging. More detailed analysis will help to understand whether that is a cause or a consequence of residential mobility, and what are the precursors and/or effects of cumulative mobility.

In some populations, residential mobility serves as a marker for reduced continuity of access to key services, health care in particular, and also for adverse child outcomes later on. It will be possible within *Growing Up in New Zealand* to understand whether this is a pattern that we see repeated in the New Zealand context once more pre-school health outcomes are available. Further, the ability to explore associations between residential mobility and other issues, such as social exclusion, poor behavioural and educational outcomes will also be possible.

This further exploration of the effect of mobility on some of the key social issues that have been shown to be associated with later life poor outcomes across multiple domains will provide valuable contemporary New Zealand specific evidence to inform the design of services that are accessible and appropriate for contemporary children, where mobility is rapidly becoming the norm. In this way, the *Growing Up in New Zealand* longitudinal data can contribute further to understanding what shapes contemporary children's development, and how we can best support children's development at the family, community, neighbourhood and societal level to ensure that all children growing up in New Zealand today can reach their full potential.

References

Astone NM, McLanahan SS. (1994) Family structure, residential mobility, and school dropout: a research note. *Demography*, 31, 575-84.

Austin JB, Russell G. (1997) Wheeze, cough, atopy, and indoor environment in the Scottish Highlands. *Arch Dis Child* 1997, 76, 22-6.

Boheim R, Taylor MP. (2002) Tied down or room to move? Investigating the relationships between housing tenure, employment status, and residential mobility in Britain. *Scottish J Political Econ*, 49, 369–92.

Bures RM. (2003) Childhood residential stability and health at midlife. *Am J Public Health*, 93, 1144-8.

Buttaro A, Lennon M, Joshi H, Gambaro L. (2014) Housing conditions, moves and child wellbeing in the first five years of life: Fragile Families Study USA. Society for Longitudinal and Life Course Studies International Conference, Lausanne, Switzerland.

Clark WAV & Dieleman F (1996). Households and Housing: Choice and Outcomes in the Housing Market. New Jersey: Rutgers University, Center for Urban Policy Research.

Clark W, Deurloo M & Dieleman F. (2006) Residential Mobility and Neighbourhood Outcomes, *Housing Studies*, 21(3), 323-342.

Cox JL, Holden JM & Sagovsky R. (1987) Detection of postnatal depression: Development of the 10-item Edinburgh Postnatal Depression Scale. *British Journal of Psychiatry*, 150, 782-786.

DeWit DJ. (1998) Frequent childhood geographic relocation: Its impact on drug use initiation and the development of alcohol and other drug-related problems among adolescents and young adults. *Addict Behav*, 23, 623-34.

DiPasquale D & Wheaton W. (1996) Urban Economics and Real Estate Markets. Englewood Cliffs, New Jersey: Prentice Hall.

Dunst CJ, Jenkins V & Trivette CM. (1984) The family support scale: reliability and validity. *Journal of Individual, Family & Community Wellness*, 1(4), 45-52.

Galster G. (1987) Homeowners and Neighbourhood Reinvestment. Durham: Duke University Press.

Gambaro L & Joshi H. (2014) Housing conditions, moves and child wellbeing in the first five years of life: Millenium Cohort Study UK. Symposium presented at the Society for Lifecourse and Longitudinal Studies International Conference, Lausanne, Switzerland.

Gasper J, DeLuca S, Estacion A. (2010) Coming and going: explaining the effects of residential and school mobility on adolescent delinquency. *Soc Sci Res*, 39, 459-76.

Hughes CH, Baumer JH. (1995) Moving house: a risk factor for the development of childhood asthma. *BMJ*, 311, 1069-70.

Jelleyman T, Spencer N. (2008) Residential mobility in childhood and health outcomes: a systematic review. *J Epidemiol Community Health*, 62, 584-92.

Lee D. (2007) Residential mobility and gateway drug use among Hispanic adolescents in the US: evidence from a national survey. *Am J Drug Alcohol Abuse*, 33, 799-806.

Long LH. (1992) Changing residence: comparative perspectives on its relationship to age, sex and marital status. *Popul Studies*, 46, 141–58.

Long LH. (1992) International perspectives on the residential mobility of America's children. *J Marriage Fam*, 54, 861–9.

Morton SMB., Atatoa Carr PE, Bandara DK, Grant CC, Ivory VC, Kingi TR, Liang R, Perese LM, Peterson E, Pryor JE, Reese E, Robinson EM, Schmidt JM, Waldie KE. (2010) *Growing Up in New Zealand*: A longitudinal study of New Zealand children and their families. Report 1: Before we are Born. Auckland, *Growing Up in New Zealand*. ISBN: 978-0-473-17889-5 (electronic), ISBN: 978-0-473-17974-8 (print).

Morton SMB, Atatoa Carr P, Grant CC, Robinson EM, Bandara DK, Bird A, Ivory VC, Kingi TK, Liang R, Marks EJ, Perese LM, Peterson ER, Pryor JE, Reese E, Schmidt JM, Waldie KE, Wall C. (2012a) Cohort Profile: *Growing Up in New Zealand*. *International Journal of Epidemiology*, 42(1), 65-75.

Morton SMB, Atatoa Carr P, Grant CC, Robinson ER, Bird A, Waayer D. (2012b) How do you recruit and retain a pre-birth cohort? Lessons learnt from *Growing Up in New Zealand. Evaluation and the Health Professions*. DOI: 10.1177/0163278712462717.

Morton SMB, Atatoa Carr P, Grant CC, Lee A, Bandara DK, Mohal J, Kinloch J, Schmidt J, Hedges M, Ivory V, Kingi TK, Liang R, Perese L, Peterson E, Pryor J, Reese E, Robinson E, Waldie K, Wall C. (2012c) *Growing Up in New Zealand*: A longitudinal study of New Zealand children and their families. Report 2: Now we are Born. Auckland, University of Auckland.

Morton SMB, Ramke J, Kinloch J, Grant CC, Atatoa Carr P, Leeson H, Lee AC, Robinson E. (2014a) *Growing Up in New Zealand* cohort alignment with all New Zealand births. *Australian and New Zealand Journal of Public Health*.

Morton SMB, Atatoa Carr PE, Grant CC, Berry SD, Bandara DK, Mohal J, Tricker PJ, Ivory VC, Kingi TR, Liang R, Perese LM, Peterson E, Pryor JE, Reese E, Waldie KE, Wall CR. (2014b) *Growing Up in New Zealand*: A longitudinal study of New Zealand children and their families. Now we are Two: Describing our first 1000 days. Auckland: *Growing Up in New Zealand*.

Morton SMB, Atatoa Carr PE, Grant CC, Berry SD, Marks EJ, Chen XM-H, Lee AC. (2014c) *Growing Up in New Zealand*: A longitudinal study of New Zealand children and their families. Vulnerability Report 1: Exploring the Definition of Vulnerability for Children in their First 1000 Days. Auckland: *Growing Up in New Zealand*.

Mulder CH & Wagner M. (1993) Migration and marriage in the life course: a method for studying synchronized events. *European Journal of Population*, 9.1, 55-76

Odland J, Shumway JM. (1993) Interdependencies in the timing of migration and mobility events. *Papers in Regional Science*, 72.3, 221-237

Oishi S & Schimmack U. (2010) Residential mobility, well-being, and mortality. *J Pers Soc Psychol*, 98, 980-94.

Pearce A, Elliman D, Bedford H, Law C. (2008) Residential Mobility and Uptake of Childhood Immunisations: Findings from the UK Millennium Cohort Study, *Vaccine*, 26, 1675–1680.

Qin P, Mortensen PB, Pedersen CB. (2009) Frequent change of residence and risk of attempted and completed suicide among children and adolescents. *Arch Gen Psychiatry*, 66, 628-32.

Rossi PH. (1955) Why families move; a study in the social psychology of urban residential mobility. Glencoe, Illinois: Free Press

Salmond C, Crampton P & Atkinson J. (2006) NZDep2006 index of deprivation users manual. University of Otago, Wellington.

Simpson GA, Fowler MG. (1994) Geographic mobility and children's emotional/behavioural adjustment and school functioning. *Pediatrics*, 93, 303-9.

South SJ, Deane GD. (1993) Race and residential mobility: individual determinants and structural constraints. *Soc Forc*, 72, 147-67.

Statistics New Zealand. (2005) Statistical Standard for Ethnicity. Wellington: Statistics New Zealand.

Statistics New Zealand. (2006) Census Questionnaires. Christchurch: Information Centre, Statistics New Zealand.

Statistics New Zealand. (2008) General Social Survey. Wellington: Statistics New Zealand, Wellington, Social Conditions Business Unit, Statistics New Zealand.

Tucker CJ, Marx J, Long L. (1998) "Moving on": residential mobility and children's school lives. *Sociol Educ*, 71, 111-29.

Turrell G, Kavanagh A & Subramanian SV. (2006) Area variation in mortality in Tasmania (Australia): the contributions of socioeconomic disadvantage, social capital and geographic remoteness. *Health & Place*, 12(3), 291-305.

Appendices

APPENDIX 1: Exposure variables used to model residential mobility

	Antenatal	Nine month
Maternal characteristics		
Maternal age group in pregnancy	Yes	-
<20 years		
20 – 29 years		
30 – 39 years (reference group)		
40+ years		
Maternal ethnicity	Yes	-
European (reference group)		
Māori		
Pacific Peoples		
Asian		
Other		
Maternal highest education level attained	Yes	-
No secondary school education		
Secondary school/NCEA Level 1-4		
Trade or diploma or NCEA Level 5-6		
Bachelor's degree (reference group)		
Higher degree		
Maternal symptoms of depression (Edinburgh Postnatal Depression Scale)	Yes	Yes
Continuous variable		
Maternal self-assessment of overall physical wellbeing	Yes	Yes
Poor/ Fair		
Good		
Very good (reference group)		
Excellent		
Family characteristics		
Pregnancy planning	Yes	-
Planned (reference group)		
Unplanned		
Child order information for cohort child	Yes	-
First child (reference group)		
Subsequent child		
Relationship status	Yes	Yes
Current partner (reference group)		
No current partner		
External support (SPE)	Yes	Yes
Family support (SPF)	Yes	Yes
Family cohesiveness (COH)	Yes	Yes
Home environment		
Parental employment status	Yes	Yes
Mother and Partner employed (reference group)		
Mother or Partner employed		
Mother and Partner not employed		
Mother or Partner not employed		

Household income band	Yes	Yes
<=$20K		
>$20K to <=$30K		
>$30K to <=$50K		
>$50K to <=$70K		
>$70K to <= $100K (reference group)		
>$100K to <=$150K		
> $150K		
Household structure	Yes	Yes
Parent alone (One parent in the house with no other adults)		
Two parents alone (Two parents in the house and no other adults – reference group)		
Parent(s) with extended family (One or two parents and extended family adults)		
Parent(s) with non-kin (One or two parents with other non-kin adults in the house)		
Household tenure	Yes	Yes
Family ownership (reference group)		
Private rental		
Public/Other rental		
Household crowding measure	Yes	Yes
Low crowding (<1 person per bedroom – reference group)		
Medium crowding (≥1 to <2 people per bedroom)		
High crowding (≥2 people per bedroom)		
Dampness of house baby lives in	N/A	Yes
Never/hardly ever (reference group)		
Not very often		
Quite often		
Always/almost always		
Heavy condensation in room where baby sleeps	N/A	Yes
Never/hardly ever (reference group)		
Not very often		
Quite often		
Always/almost always		
In last 2 weeks, mould or mildew in room where baby sleeps at nightat night ives in	N/A	Yes
Yes (reference group)		
No		
Neighbourhood environment		
Neighbourhood integration scale	Yes	No
Length of time spent living in neighbourhood	Yes	No
Length of time intended to stay in neighbourhood	Yes	Yes*
Do you belong to any communities	Yes	Yes
Yes (reference group)		
No		
Belonging scale	No	Yes
Rurality	Yes	Yes
Urban (reference group)		
Rural		

Notes:
- Indicates item was not measured in the nine month DCW, antenatal measure used for the modelling
N/A: Not applicable for this time point
* Asked only of those who had moved neighbourhood at this time point

APPENDIX 2: Full multivariate model of residential mobility from birth to nine months

	Reference group	Univariate *p* value	Multivariate *p* value	Multivariate odds ratio	Multivariate 95% confidence interval	
Maternal characteristics						
Maternal age group		<.0001	0.1578			
<20 years				1.896	0.949	3.79
20 – 29 years				1.188	0.975	1.447
30 – 39 years	Reference			1.0		
40+ years				0.969	0.609	1.54
Maternal ethnicity		<0.0001	<0.0001			
European	Reference			1.0		
Māori				0.617	0.462	0.824
Pacific Peoples				0.496	0.349	0.703
Asian				0.479	0.355	0.648
Other				0.68	0.415	1.115
Maternal education		<0.0001	0.1546			
No secondary school education				1.238	0.773	1.981
Sec school/NCEA 1-4				1.121	0.859	1.461
Diploma/Trade cert/NCEA 5-6				1.081	0.852	1.371
Bachelor's degree	Reference			1.0		
Higher degree				1.388	1.071	1.798
Maternal depression		<0.0001	0.1202	1.015	0.996	1.034
Maternal physical wellbeing		<0.0001	0.7966			
Poor/ Fair				0.934	0.671	1.301
Good				1.079	0.874	1.331
Very good	Reference			1.0		
Excellent				1.004	0.797	1.265
Family characteristics						
Pregnancy planning		<0.0001	0.1762			
Planned	Reference			1.0		
Unplanned				1.148	0.94	1.402
Child order information		<0.0001	0.0163			
First child	Reference			1.0		
Subsequent child				0.776	0.631	0.954
Current partner status		<0.0001	0.1027			
Current partner	Reference			1.0		
No current partner				1.688	0.9	3.166
External support		0.0332	0.5810	1.005	0.987	1.023
Family support		0.7346	0.5542	1.006	0.987	1.025
Family cohesiveness		0.7382	0.0017	1.036	1.013	1.059
Family stress		<.0001	0.2024	1.015	0.992	1.038
Home environment						
Parental employment		<0.0001	0.0118			
Mother and partner employed	Reference			1.0		
Mother or partner employed				1.009	0.829	1.227
Mother and partner not employed				1.667	1.161	2.394
Mother or partner not employed				0.855	0.623	1.174

Household income		<0.0001	0.4285			
<=$20K				1.126	0.624	2.034
>$20K to <=$30K				1.173	0.735	1.87
>$30K to <=$50K				1.009	0.736	1.384
>$50K to <=$70K				1.1	0.84	1.441
>$70K to <= $100K	Reference			1.0		
>$100K to <=$150K				1.041	0.807	1.343
> $150K				1.395	1.028	1.893
Household structure		<0.0001	<0.0001			
Parent alone				0.719	0.337	1.536
Two parents alone				1.0		
Parent(s) with extended family				1.914	1.503	2.439
Parent(s) with non-kin				2.243	1.57	3.203
Household tenure		<0.0001	<0.0001			
Family ownership	Reference			1.0		
Private rental				3.931	3.24	4.77
Public/Other rental				1.28	0.802	2.044
Crowding		<0.0001	<0.0001			
Low crowding (<1 person per bedroom)	Reference			1.0		
Medium crowding (≥1 to <2 people per bedroom)				2.095	1.662	2.64
High crowding (≥2 people per bedroom)				2.871	2.005	4.112
Neighbourhood environment						
Neighbourhood integration scale		<0.0001	<0.0001	0.965	0.947	0.983
Length of time in neighbourhood		<0.0001	0.0924	0.985	0.967	1.003
Intention to stay in neighbourhood		<0.0001	<0.0001	0.978	0.971	0.985
Belonging to communities		<0.0001	0.4013			
Yes	Reference			1.0		
No				1.082	0.9	1.301
Rurality		0.7152	0.2912			
Urban	Reference			1.0		
Rural				0.844	0.615	1.157
Status change variables between antenatal and nine months						
Change in partner status		<0.0001	0.0024			
No change	Reference			1.0		
Newly partnered				1.304	0.363	4.686
Loss of partner				2.346	1.447	3.802
Change in household income group		<0.0001	0.0024			
Same income group	Reference			1.0		
Moved to higher income group				1.029	0.789	1.341
Moved to lower income group				1.335	1.1	1.62

APPENDIX 3: Full multivariate model of residential mobility from nine months to two years

	Reference group	Univariate *p* value	Multivariate *p* value	Multivariate odds ratio	Multivariate 95% confidence interval	
Maternal characteristics						
Maternal age group		<0.0001	<0.0001			
<20 years				2.092	1.301	3.363
20 – 29 years				1.453	1.235	1.708
30 – 39 years	Reference			1.0		
40+ years				0.851	0.585	1.239
Maternal ethnicity		<0.0001	<0.0001			
European	Reference			1.0		
Māori				0.994	0.793	1.245
Pacific Peoples				0.554	0.417	0.735
Asian				0.656	0.516	0.833
Other				0.929	0.63	1.37
Maternal education		<0.0001	0.881			
No secondary school education				0.886	0.6	1.309
Sec school/NCEA 1-4				0.988	0.797	1.224
Diploma/Trade cert/NCEA 5-6				1.04	0.859	1.259
Bachelor's degree	Reference			1.0		
Higher degree				1.067	0.863	1.317
Maternal depression		<0.0001	0.3179	1.009	0.992	1.026
Maternal physical wellbeing		0.0533	0.2379			
Poor/ Fair				1.076	0.836	1.386
Good				1.12	0.941	1.333
Very good	Reference			1.0		
Excellent				1.195	0.998	1.431
Family characteristics						
Pregnancy planning		<0.0001	0.6564			
Planned	Reference			1.0		
Unplanned				0.964	0.819	1.134
Child order for chort child		<0.0001	0.0461			
First child	Reference					
Subsequent child				0.854	0.731	0.997
Current partner status		<0.0001	0.5452			
Current partner	Reference			1.0		
No current partner				0.887	0.603	1.307
External support		0.6867	0.0282	1.018	1.002	1.034
Family support		0.8809	0.9392	0.999	0.986	1.013
Family stress		<0.0001	0.0241	1.023	1.003	1.043
Home environment						
Parental employment		<0.0001	0.4115			
Mother and partner employed	Reference			1.0		
Mother or partner employed				1.094	0.935	1.279
Mother and partner not employed				1.209	0.756	1.932
Mother or partner not employed				1.213	0.954	1.544
Household income group		<0.0001	0.0056			
<=$20K				0.967	0.649	1.442
>$20K to <=$30K				0.83	0.59	1.166

>$30K to <=$50K				0.881	0.696	1.114
>$50K to <=$70K				0.938	0.761	1.156
>$70K to <= $100K	Reference			1.0		
>$100K to <=$150K				1.421	1.137	1.775
> $150K				1.342	1.014	1.778
Household structure		<0.0001	0.3029			
Parent alone				0.924	0.598	1.426
Two parents alone				1.0		
Parent(s) with extended family				1.176	0.97	1.426
Parent(s) with non-kin				1.158	0.843	1.592
Household tenure		<0.0001	<0.0001			
Family ownership	Reference			1.0		
Private rental				3.394	2.9	3.973
Public/Other rental				1.563	1.092	2.238
Crowding		<0.0001	0.0175			
Low crowding (<1 person per bedroom)	Reference			1.0		
Medium crowding (≥1 to <2 people per bedroom)				1.612	1.15	2.258
High crowding (≥2 people per bedroom)				1.709	1.158	2.522
Dampness of house baby lives in		0.1076	0.2224			
Never/hardly ever	Reference			1.0		
Not very often				0.892	0.75	1.06
Quite often				0.78	0.612	0.994
Always/almost always				0.91	0.61	1.357
Heavy condensation in room where baby sleeps		0.2053	0.2171			
Never/hardly ever	Reference			1.0		
Not very often				1.2	1.009	1.428
Quite often				1.115	0.884	1.406
Always/almost always				1.029	0.694	1.526
Neighbourhood variables						
Belonging to communities		<0.0001	0.0924			
Yes	Reference			1.0		
No				1.227	0.967	1.557
Neighbourhood belonging scale		0.0024	0.9364	1.001	0.976	1.027
Rurality		0.5507	0.1986			
Urban	Reference			1.0		
Rural				1.18	0.917	1.519
Change variables from nine months to two years						
Change in partner status		<0.0001	<0.0001			
No change	Reference			1.0		
Newly partnered				2.2	1.254	3.857
Loss of partnership				2.03	1.408	2.926
Change in household income group		<0.0001	0.0036			
Same income group	Reference			1.0		
Moved to higher income group				1.311	1.114	1.543
Moved to lower income group				1.199	0.986	1.459

Growing Up
in New Zealand

www.growingup.co.nz

www.auckland.ac.nz