

# Growing Up in New Zealand

## Vulnerability Report 2: Transitions in exposure to vulnerability in the first 1000 days of life

2015





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

## Vulnerability Report 2: Transitions in exposure to vulnerability in the first 1000 days of life

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Further information on *Growing Up in New Zealand* is available at [www.growingup.co.nz](http://www.growingup.co.nz)



# Foreword

**Better decisions can be made for children when the conditions which cause them adverse effects and long-term harm are understood. This can inform public policies which aim to prevent, reverse, or mitigate these adverse effects.**

Having this comprehensive knowledge leads to public programmes that are both efficient in terms of value for money long-term, and what works.

This report on vulnerability is based on the information gathered in the first thousand days of the *Growing Up in New Zealand* longitudinal study which is following the lives of nearly 7000 babies born in 2009/10. This is the second in an evolving series of reports on vulnerability and resilience from this longitudinal study, and the sixth extensive report on the great variety of situations in which children are now growing up. We want those who develop policy to use these rich insights to have an increasingly robust knowledge base so they can establish and influence the type of policy settings that we need.

In future waves of the study there may be a need to enrich the information associated with particular conditions. Some conditions may become more important as we learn about their influence on vulnerability over time.

In this report, the accumulated knowledge of many international studies has been drawn on to select 12 risk factors against the conditions in which mothers have lived before and after the birth of their babies have been tested, separately and together. In general, about one in eight children are defined as in the highest level of vulnerability. These most vulnerable children are reporting positive in four or more of the associated conditions in each of the three measurement periods.

By assessing the likelihood of risk for the same children at different periods, we can see how deeply rooted some conditions can become, compared to risks that may appear and disappear in some perhaps as yet unexplained manner. We know for example that half of all cohort children were exposed to at least one risk factor either before their birth, or at nine months or at two years of age. Forty percent of those whose condition was classified before birth as high risk were no longer in that situation at nine months, these conditions were: financial stress, maternal physical wellbeing, maternal depression and unemployment. Of more concern, nearly one in twenty of the study population remained in the high risk group with four or more conditions over all three measurement periods.

This report tells us how particular conditions are spread across the population, and the impact felt when there are many conditions occurring at once. Some situations show how individuals are limited in establishing needed connections across autonomous services. This report provides evidence of the system discontinuity issue observed in the provision of primary care for mothers at an antenatal and postnatal state.

The odds of not being immunised increase with the number of vulnerable conditions. Similarly, the largest proportion of families accessing Whānau Ora or Parents as First Teachers were in the medium vulnerability risk group during late pregnancy. Less than 10% of those families using Parents as First Teachers were from the high vulnerability risk group. This is an area for further follow-up as the accessibility of such services is expected for families with high incidence of vulnerable conditions.

Perhaps two important conclusions can be immediately made from this report:

- a. Few programmes in New Zealand are evaluated to assess take-up rates once implemented. As a consequence, some of the information in this report provides a new window on the operation of the social service programmes that we trust to support the most vulnerable. Further study is needed but we have learned enough to expect more monitoring of even well-established programmes.
- b. The narrow focus of many service agencies is less of a problem than the apparent limited responsibility for managing the connections between services for those with several conditions. This lack of connection only creates more vulnerability.

To develop robust and enduring solutions to such problems, we will need to further mine the administrative databases of the New Zealand Government and the *Growing Up in New Zealand* study. It is clear that our current models of working are becoming increasingly ill-fitted for the population, and if we are to be the guardians of those still to be born in New Zealand, it is studies like these which will provide us with the much needed insight and evidence.



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

# Acknowledgements

*Growing Up in New Zealand* is a unique study that exists because of the ongoing contribution of approximately 7000 families and their children. These families provide our team at the University of Auckland with detailed information about themselves, to contribute to evidence that will build policies and programmes that can support all families in New Zealand. We recognise what a privilege it is to share your time and honesty. We also understand that your lives are not always easy, and that despite many potential challenges (that are sometimes described as ‘risks’ or ‘vulnerabilities’), on the whole you are supporting your children to develop so that they reach their full potential. While there is a focus in this report on risk factors, this information, along with work currently underway by the *Growing Up in New Zealand* team, also considers how you and your families are doing well, how your children are developing resilience, and how, where and when we can do more to improve outcomes for all. Thank you for your continued support.

The authors of this report are members of the *Growing Up in New Zealand* team: Senior Research Fellow (Dr Sarah Berry), Research Director (Associate Professor Susan Morton), Associate Directors (Dr Polly Atatoa Carr and Associate Professor Cameron Grant), Data Analytics Manager (Dr Jatender Mohal) and Biostatistician (Avinesh Pillai). In addition to these direct contributors to *Vulnerability Report 2: Transitions in exposure to vulnerability in the first 1000 days of life*, this report would not be possible without the efforts of all those involved in the wider *Growing Up in New Zealand* team. We particularly acknowledge: Peter Tricker (Project and Operations Manager), Rina Prasad (Lead Data Manager), Sabine Kruekel (Communications and Marketing Manager) and Cherie Lovell (Interview Manager), as well as our interviewers who have collected the invaluable information on which this report is based.

We acknowledge the key funders of *Growing Up in New Zealand*, who not only contribute to study sustainability, but also help to ensure that the information from our families informs the policy environment in New Zealand. We thank Superu (formerly the Families Commission) for their current management of the contract for *Growing Up in New Zealand* on behalf of the Crown and we acknowledge funding and support received from government agencies, who have also contributed specific review and comments on the content of this report through the *Growing Up in New Zealand* Policy Forum. These agencies (funding and advisory) include: the Ministry of Social Development (previous contract holders), the Ministry of Health and the Ministry of Education as well as Te Puni Kōkiri, and the Ministries of Justice, Business Innovation and Employment, Pacific Island Affairs, Corrections, the New Zealand Police, Women’s Affairs, Sport New Zealand and the Mental Health Commission. We also acknowledge previous and ongoing support of the Children’s Commission, Department of Labour, Housing New Zealand, Office of Ethnic Affairs, Statistics New Zealand and the Treasury.

*Growing Up in New Zealand* also recognises the continued support and advice provided by the Vice-Chancellor of the University of Auckland and the Chief Executive of Auckland UniServices, and the advisory and governance groups of our study which include: our Executive Board (chaired by Clare Ward); Policy Forum (chaired by Vasantha Krishnan); the national and international Executive Scientific Advisory Board (chaired by Professor Carlos Camargo Jr.); Kaitiaki Group (chaired by Professor Sir Mason Durie); and Data Access Committee (chaired by Professor Jane Harding). Further information regarding the team, governance, and design of this longitudinal study is available on our website: [www.growingup.co.nz](http://www.growingup.co.nz)



# 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.

This is the second report in the Vulnerability and Resilience series from the *Growing Up in New Zealand* team. This second report on early life vulnerability builds on the information delivered in the earlier *Vulnerability Report 1: Exploring the Definition of Vulnerability for Children in their First 1000 Days (2014)*. It similarly utilises information collected from the families at key time points during the first thousand days of their children's development (from conception until they are 2 years old). This report focuses on describing transitions in exposure to vulnerability risk factors for the children in the *Growing Up in New Zealand* cohort between the time of late pregnancy and their early postnatal lives. It also explores what family and environmental characteristics are associated with transitions in exposure to vulnerability over time. In addition to defining what family and environmental characteristics are associated with exposure to vulnerability, the report extends the exploration of what later health outcomes exposure is associated with to include behavioural outcomes (based on the well validated Strengths and Difficulties Questionnaire). This exploration of the downstream effects of early life vulnerability cannot yet provide complete evidence to address the important question, 'Vulnerable to what?' but it does provide further evidence that early and repeated exposure to adversity has impacts that affect multiple areas of child development, and that these impacts are already seen within the first 1000 days of a child's development.

This second vulnerability report describes some of the detailed analyses that sit behind the exploration of vulnerability transitions and their impact on early child development. These analyses are somewhat complex and are provided for completeness. We have provided diagrams to clarify what longitudinal data is being utilised in each section of the report as well as a summary of the

key messages that arise from each set of analyses to assist with the digestion of the information contained in this report. These are provided throughout the report rather than being collated in this foreword (as we have done previously). They are brought together in Section 7 which provides ideas regarding the utility of this information for shaping policy relevant to child vulnerability and improved early life outcomes. This final section in particular is designed to provoke further discussion with policy makers, and also highlights where this work might head in the future with further longitudinal exposure and later outcome measures available.

However, there are some findings that suggest we could already be doing better at targeting children who are most vulnerable from around the time of their birth. The longitudinal information from the first 1000 days of the children's lives and tracking of the transitions in exposure to vulnerability has already identified that some family and environmental characteristics are more likely to be associated with persistence of hardship. Some of these factors may be amenable to strategies to reduce their influence and impact from before or even during pregnancy. Other factors have been shown to be associated with an improvement in risk profile and it may be possible to develop strategies that can extend these factors to support vulnerable families that otherwise are not able to access them.

This report has again reinforced that risk factors for vulnerability tend to cluster, although not always. For example, being a teenage mother is highly likely to mean that children are also exposed to many other adverse environments. There may be merit in addressing the multiplicity of risk factors to support teenage mothers better, rather than trying to target according to only one risk factor. On the other hand, living in a high deprivation

area can often be the only risk factor that families experience. This measure of disadvantage is often used as a proxy for targeting of resources. This may not represent the most efficient way to identify risk based on these analyses.

Also of concern is that when access to services is compared for different vulnerability exposures, we note that for families experiencing the greatest disadvantage there does not seem to be an appropriate use or interaction with current support services. This leads us to question the applicability and accessibility of services that may well be geographically based. This may be problematic for our most vulnerable children, especially as they experience great residential mobility in their first 1000 days (Morton et al., 2014b).

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 being followed in this longitudinal study is comparable to that of the children being born in New Zealand today. Also the family and community environments they are growing up in reflect those of contemporary families with young children today.

We remain overwhelmingly grateful to the families and the children who are part of the *Growing Up in New Zealand* study. As always, we are privileged to be able to bring together the precious information that the families share with us over time. We remain hopeful that in doing so we may be able to provide an up-to-date picture of what it is like to be a child growing up in New Zealand today, so that we can provide evidence that can inform how we might best support our families, the communities, and influence the neighbourhoods and environments that all help to shape their wellbeing. 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.

Sincerely,



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

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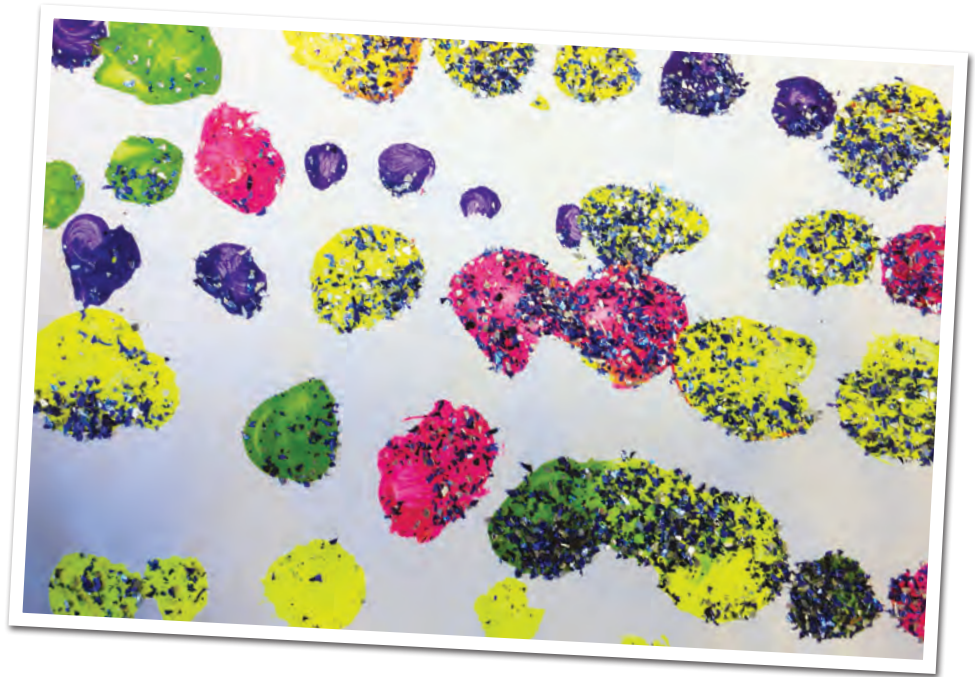
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# 1. About Growing Up in New Zealand





## 1.1 Growing Up in New Zealand overview

*Growing Up in New Zealand* is a longitudinal study that provides an up-to-date, population relevant picture of what it is like to be a child growing up in New Zealand in the 21st century. This study has recruited approximately 7000 children before they were born, and to date has collected information from mothers, their partners and the children themselves repeatedly throughout the first five years of life. *Growing Up in New Zealand* is unique in terms of its capacity to provide a comprehensive picture of contemporary child 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 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 both risk and protective factors, and to elucidate pathways of development across multiple domains of influence. This allows a comprehensive understanding of the complex interplay of all the factors that lead to child outcomes such as growth, health, behaviour and cognitive development.

Advantages of information collected from *Growing Up in New Zealand* as compared to routine data sources include: the depth and breadth of the detailed data collected regarding child development as well as the nature of parental and parent-child relationships, and the family context including how parents and children engage with their communities and environments; the strength of the data to determine associations between early exposures and later outcomes; the ability to measure these influences repeatedly for the same individuals over time, and therefore the ability to determine transitions in and out of states that influence child development; and the ability to link the longitudinal data to administrative data sources to add value and understanding across sectors. These critical aspects of the *Growing Up in New Zealand* data are evident in this exploration of transitions in exposure to vulnerability risk during early life in the New Zealand population.

## 1.2 The cohort

*Growing Up in New Zealand* recruited pregnant women who were due to have their babies between 25 April 2009 and 25 March 2010. The geographical area chosen for recruitment was the region of the North Island covered by the three contiguous District Health Boards (DHBs) of Auckland, Counties Manukau and Waikato. Given the lack of a register of pregnant women, specific challenges for this study included ensuring that: all eligible pregnant mothers living in the selected recruitment region received a timely invitation for their children to participate; the cohort recruited was of sufficient size to provide adequate statistical power for complex analyses of developmental trajectories over time across the whole cohort of children as well as within subgroups (including by ethnicity); and that the cohort was broadly generalisable to contemporary New Zealand children. These challenges were met. *Growing Up in New Zealand* recruited 6822 pregnant women and 4401 of their partners. An additional 200 families in a 'Leading Light: Roopu Piata' group were recruited in late 2008. Key characteristics of the recruited main cohort families are similar to those of all families having children in New Zealand today, especially with respect to their ethnic and socio-demographic diversity (Morton et al., 2010; Morton et al., 2012b; Morton et al., 2013a; Morton et al., 2014d).

## 1.3 Conceptual framework

*Growing Up in New Zealand*, with its longitudinal design, is multidisciplinary in nature and includes a translational dimension, with an explicit intent to relate to both the current policy context and inform future policy development. This study builds on the demonstrated value and lessons learnt from earlier New Zealand longitudinal studies, while reflecting the scientific and demographic changes that have occurred since the 1970s. The conceptual framework for *Growing Up in New Zealand* takes a life-course approach to child development and therefore seeks to facilitate an understanding of the dynamic interactions between children and their environments across a broad range of influences, from their immediate family environments to their wider societal context over time (Figure 1). The information collected from the cohort families from before birth and over time is centred on the child as the participant (as described in *Report 1: Before we are born; Report 2: Now we are born; Report 3: Now we are two: Describing*

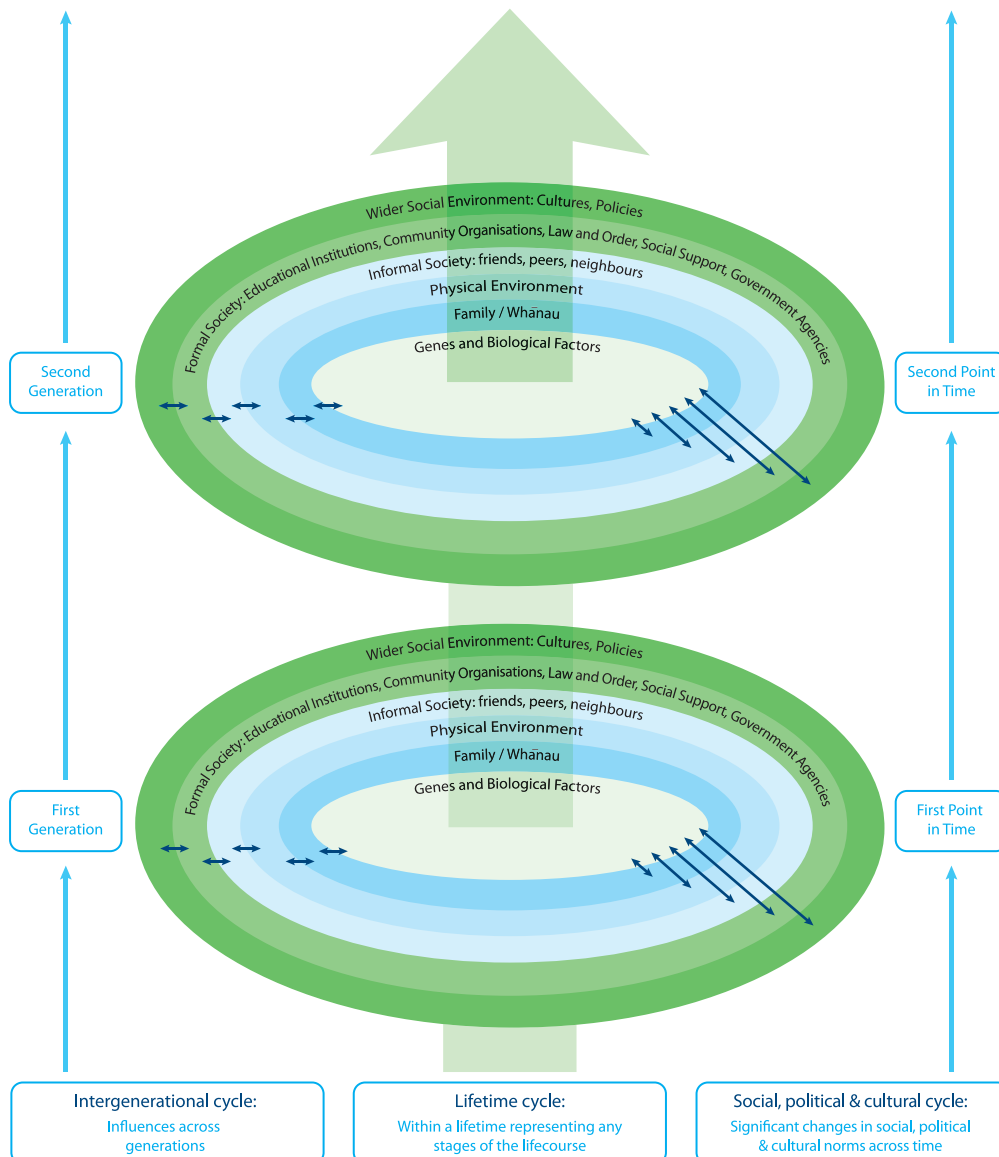


Figure 1: Conceptual framework of *Growing Up in New Zealand*

our first 1000 days; and other publications available at [www.growingup.co.nz](http://www.growingup.co.nz)). The conceptual model for the study incorporates the notion that the development of all children begins from before they are born (intergenerational) and that each life-course outcome is the result of a complex interplay over time between the individual's biology and environment (Figure 1).

## 1.4 Data collection waves

*Growing Up in New Zealand* was designed as a longitudinal study, with anticipated contact with the cohort up to the age of 21 years. Trajectories of early life development from before birth are recognised as critical for the ongoing health, wellbeing and resilience of children and their families.

The longitudinal information collected within the first five years of the children's lives includes that from face-to-face interviews (collected during the antenatal period, at nine months, two years and at four-and-a-half years), telephone interviews (collected at six weeks, 35 weeks, 16 months, and 23 months) and data linkage (between the *Growing Up in New Zealand* data and perinatal health records including the National Minimum Data Set and the National Immunisation Register). More detail about all these 'data collection waves' is described in previous *Growing Up in New Zealand* publications (for example, Morton et al., 2010 and Morton et al., 2014a). Each data collection wave seeks age-appropriate and policy relevant 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 (further information is available at [www.growingup.co.nz](http://www.growingup.co.nz)). Attention is given to ensuring that the methods utilised to collect domain-specific evidence acknowledge the diverse 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. The information presented here focuses on those specific and selected measures that describe likely risk factors for child vulnerability as well as child-specific health, wellbeing, and developmental outcomes.

## 1.5 The focus of this report

*Transitions in exposure to vulnerability in the first 1000 days of life* is the second report within *Growing Up in New Zealand's* Vulnerability and Resilience series.

The impact of exposure to early life vulnerability continues to be an important area of policy focus in New Zealand as well as in the United Kingdom and Europe (Sabates & Dex 2012; 2015). The Green and White papers developed by the Minister of Social Development in 2011 (New Zealand Government, 2011a; 2011b), together with the subsequent Children's Action Plan in 2012 (New Zealand Government, 2012) are intended to reduce the impact of childhood vulnerability and ensure that every New Zealand child can 'thrive, belong and achieve'. Currently, there are important knowledge gaps in the New Zealand context. For example, it is first necessary to define what makes a child vulnerable, so that early identification of vulnerable children is possible. Secondly, it is necessary to understand how exposure to vulnerability changes during early childhood, to understand how transitions in and out of vulnerable states are shaped, and to determine how vulnerable states and their transitions impact later child and family outcomes.

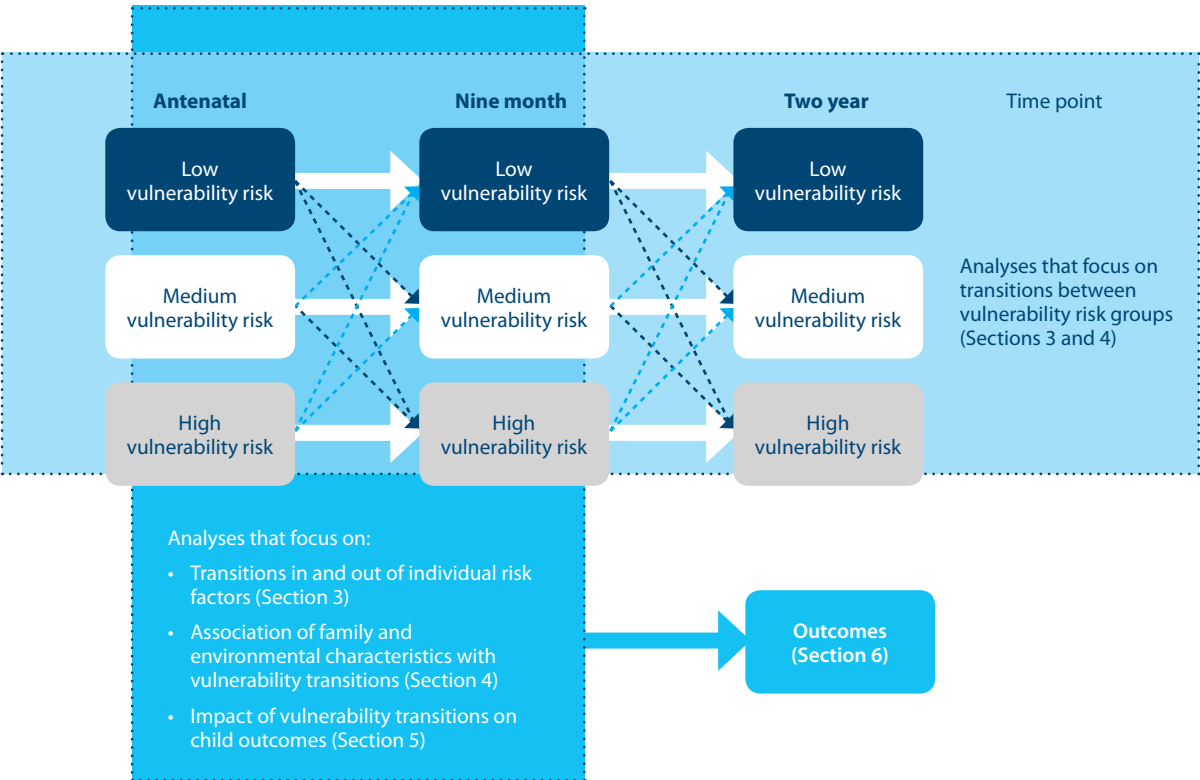
The first report within *Growing Up in New Zealand's* Vulnerability and Resilience series, *Exploring the Definition of Vulnerability for Children in their First 1000 Days* (Morton et al., 2014c), considered

the feasibility of using a set of 12 routinely available and consistently measured maternal and socio-demographic variables (or ‘risk factors’), relevant to the New Zealand context, to define early life vulnerability for contemporary New Zealand children. The availability of these 12 routinely measured risk factors determined the possibility of a checklist approach to enable identification of those children likely to be most vulnerable in early life, even from around the time of their birth.

A further focus of the first report was how the vulnerability risk factors combined and accumulated. The total number of risk factors experienced at each time point has been shown internationally to be a very strong proxy for measuring relative risk exposure across a population (Evans et al., 2013), and the vulnerability risk factors were also found to cluster often into one of three main groups. These clusters were: maternal characteristics and behaviours (including relationship status, receipt of an income tested benefit, smoking, maternal education, and maternal age); proximal home environment characteristics (including household crowding, tenure and deprivation index); and acute or pregnancy specific characteristics (including maternal physical wellbeing, maternal mental wellbeing, and financial stress).

These analyses indicated that exposure to multiple risk factors from before birth and during the first nine months of life increased the likelihood of experiencing poor health outcomes (such as chest infections, skin infections, and incomplete immunisations) at two years of age.

*Exploring the Definition of Vulnerability for Children in their First 1000 Days* (Morton et al., 2014c) also highlighted that exposure to individual risk factors for vulnerability during early life is dynamic, and a child’s profile of risk factor exposure may change significantly over time.



**Figure 2: Report structure and aims, depicting the transitions between vulnerability risk groups over time, and the analysis of the impact of transitions on outcomes at two years**

Exploring these transitions is a key focus of *Growing Up in New Zealand's* second Vulnerability and Resilience series report: *Transitions in exposure to vulnerability in the first 1000 days of life*. Like the first report, it utilises information collected from the cohort children and their families during the first 1000 days of life (from conception to age two years). The aim is to examine how exposure to vulnerability changes during early infancy, what maternal, family and neighbourhood characteristics are associated with vulnerable states and transitions, and how such transitions can impact child health and behaviour outcomes at two years of age (as illustrated in Figure 2).

*Transitions in exposure to vulnerability in the first 1000 days of life* builds on the first vulnerability report as illustrated in Figure 2 and summarised as follows:

- Further description of the prevalence of risk factors in the first 1000 days of life, focusing on exposure to a single risk factor, and exposure to more than four risk factors (Section 3)
- Focus on transitions in and out of low, medium and high vulnerability risk groups (Section 4)
- Analysis of how family and neighbourhood characteristics are associated with cumulative vulnerability exposure. This includes comparison of those children exposed to low risk or high risk that is stable ('stably low risk', 'stably high risk'), and children exposed to increasing or decreasing vulnerability risk (Section 5)
- Focus on how transitions in vulnerability exposure impact selected child outcomes at two years. This includes child behaviour in addition to health outcomes, and examines patterns of parental access to social services by vulnerability risk group. It focuses not only on the possibility of poor outcomes, but also on the question 'What works?' (Section 6).

## 1.6 Adding a personal voice

To give voice to the findings reported, quotations from *Growing Up in New Zealand* parents have also been included (adapted so as to not identify individuals). These quotations were provided by the parents (most often mothers) of the *Growing Up in New Zealand* cohort when their children were two years old. The quotes were in response to a question that asked parents to describe the biggest challenge with their cohort children in the past year.

"A real challenge is the uncertainty if you're doing the right job. Overcoming my own perceptions of parenting and being confident as a parent. I didn't get a manual."



## 2. Methods used to explore early life exposure to vulnerability



## 2.1 Information used in this report

The information used in *Transitions in exposure to vulnerability in the first 1000 days of life* is based on the complete dataset spanning the antenatal to two year time period of the *Growing Up in New Zealand* study. The 92% retention of the *Growing Up in New Zealand* child cohort from before birth to two years of age is described in *Now We Are Two: Describing our first 1000 days* (Morton et al., 2014a).

The preparation of the dataset for this report, including the strategy used to merge data between data collection waves, and the inclusion and exclusion criteria used, are summarised in Figure 3. Briefly, the antenatal dataset (from 6822 mothers, which resulted in a starting cohort size of 6853 children) and the nine month dataset (n = 6476 children) were merged into the two year dataset (n = 6327 children), to create a child-focused dataset for this report (n = 6327). This merged dataset was then restricted to exclude children for whom information was missing for five or more of the 12 vulnerability risk factors measured during the antenatal period that form the basis of the analyses presented in this report. This resulted in a dataset of n = 5737 children.

For an additional n = 158 children, there was missing information for the measured vulnerability risk factors at nine months of age. These children are included in the analyses, with footnotes provided in the relevant tables in this report describing this missing information if required.

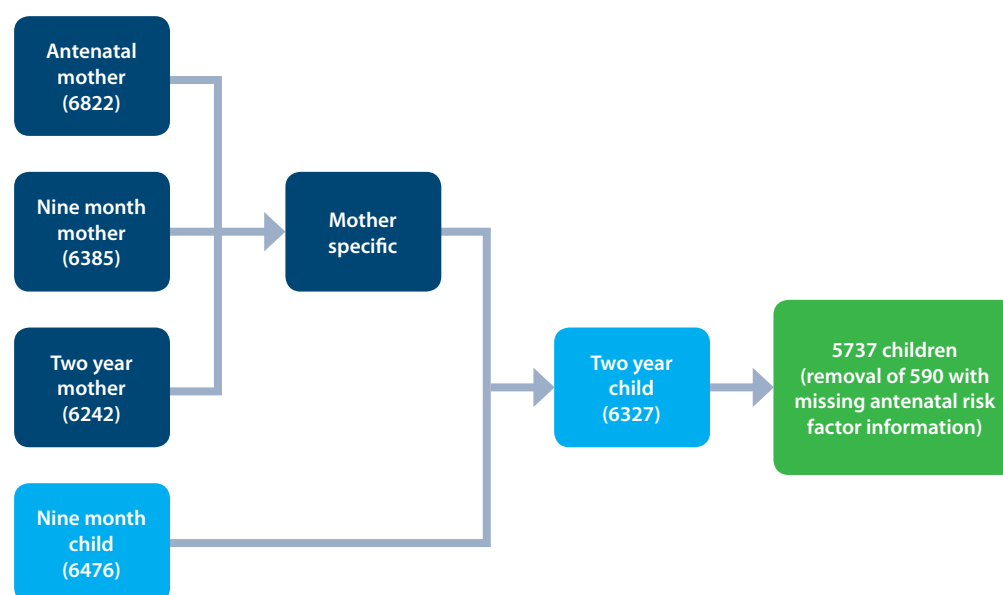


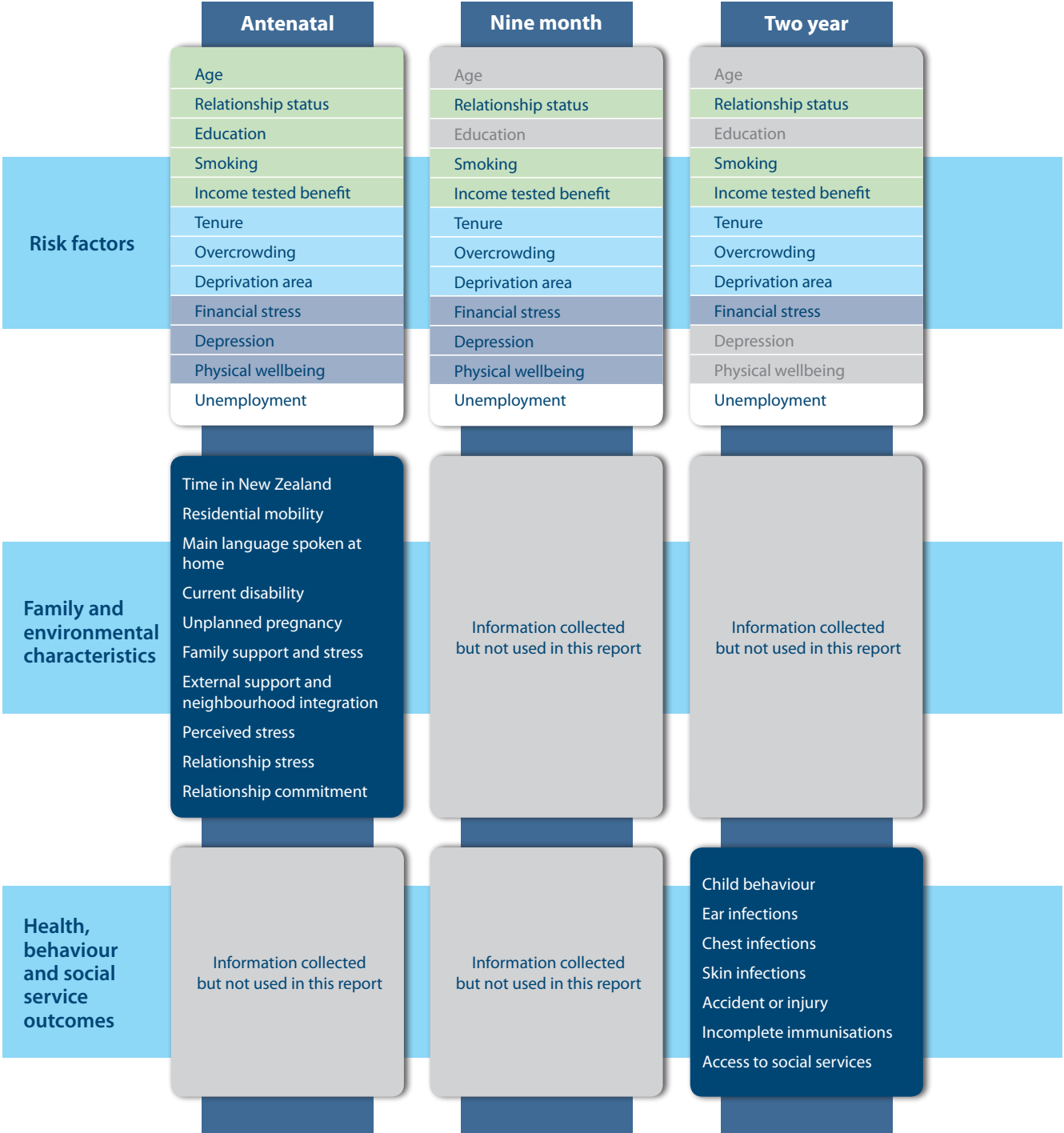
Figure 3: Dataset preparation and data merging strategy

*Transitions in exposure to vulnerability in the first 1000 days of life* utilises three groups of information from within this dataset:

- Twelve vulnerability risk factors, measured during the antenatal period, at nine months, and at two years of age
- Additional maternal, family and neighbourhood characteristics, measured during the antenatal period

- Outcome information relating to child health, child behaviour, and access to social services, measured at two years of age.

Detailed information about measures within each of these groups is provided in Sections 2.2, 2.4, and 2.5. The way in which this information is used in this report is summarised in Figure 4 and throughout the report to highlight the information focus of each section.



**Figure 4: Longitudinal information used for analyses**  
 Blue boxes indicate information that is used in this report, while grey boxes indicate information that is not used in this report.

## 2.2 Risk factors for vulnerability

The risk factors used to define child vulnerability in this report are the same as those that were used in the first report on vulnerability from the *Growing Up in New Zealand* study (Morton et al., 2014c, Table 1). These risk factors have also been previously utilised in international studies to define vulnerability, particularly as they have been associated with markers of disadvantage and poor outcomes throughout the life course. The risk factors include information about the proximal family environment, the distal family environment, and the home environment. Exposure to each risk factor has been dichotomised using the same definitions that were described in *Exploring the Definition of Vulnerability for Children in their First 1000 Days*.

**Table 1: Risk factors used to define child vulnerability, including the definition used at each time point to define ‘at risk’**

Category	Risk factor	Antenatal risk factor definition	Nine month risk factor definition	Two year risk factor definition
Proximal family variables	Maternal depression	Edinburgh Postnatal Depression Scale score of 13 or over indicating likely maternal depression	Edinburgh Postnatal Depression Scale score of 13 or over indicating likely maternal depression	N/A <sup>1</sup>
	Maternal physical wellbeing	Self-rated health in late pregnancy as poor or fair	Self-rated current health as poor or fair	N/A
	Maternal smoking	Continuing to smoke regularly/every day after the first trimester of pregnancy	Currently smoke regularly/every day	Currently smoke regularly/every day
	Maternal age	Teenage mother at time of pregnancy	Teenage mother at time of pregnancy	Teenage mother at time of pregnancy
Distal family variables	Relationship status	Mother with no current partner	Mother with no current partner	Mother with no current partner
	Maternal education	Mother with no formal secondary school qualifications	N/A	N/A
	Financial stress	Reporting highly stressful money problems	Reporting highly stressful money problems since the time baby was born	Reporting highly stressful money problems since the time baby was nine months old
Home environment	Deprivation area	Living in NZDep2006 area deciles 9 or 10	Living in NZDep2006 area deciles 9 or 10	Living in NZDep2006 area deciles 9 or 10
	Unemployment	Mother not on leave, actively seeking work but not currently working	Mother not on leave, actively seeking work but not currently working	Mother not on leave, actively seeking work but not currently working
	Tenure	Living in social housing	Living in social housing	Living in social housing
	Income tested benefit	In receipt of an income tested government benefit	In receipt of an income tested government benefit	In receipt of an income tested government benefit
	Overcrowding	Having 2 or more persons per bedroom	Having 2 or more persons per bedroom	Having 2 or more persons per bedroom

<sup>1</sup> N/A - This risk factor was not measured at this time point. In these cases, the information collected at the previous time point is assumed.

## 2.3 Definition of vulnerability risk groups

As described in the previous report, *Exploring the Definition of Vulnerability for Children in their First 1000 Days*, levels of exposure to risk factors are used to define vulnerability risk groups. These levels use the total number of vulnerability risk factors that children were exposed to at each time point (regardless of which risk factors these were). These cumulative risk scores (with a range of 0–12) were then grouped to form three levels of vulnerability risk exposure (low, medium and high risk) for each of the three time points (antenatal, nine months, two years), as described in Table 2.

Table 2: Definitions of vulnerability risk groups

Vulnerability risk group	Definition of risk group
Low risk	No exposure to vulnerability risk factors
Medium risk	Exposure to between one and three risk factors
High risk	Exposure to four or more risk factors

In addition to the vulnerability risk groups, this report also defines vulnerability transitions that occurred between late pregnancy and nine months. Four groups of vulnerability transitions are used in this report, to describe both change and stability in vulnerability exposure (Table 3).

Table 3: Definitions of vulnerability transition groups

Vulnerability transition group	Definition of transition group
Stably low vulnerability risk*	Low vulnerability risk at both the antenatal and nine month time points
Stably high vulnerability risk	High vulnerability risk at both the antenatal and nine month time points
Increased vulnerability risk	Increased vulnerability risk between the antenatal and nine month time points (from either low or medium risk)
Decreased vulnerability risk	Decreased vulnerability risk between the antenatal and nine month time points (from either medium or high risk)

\*The use of a reference group that was free of risk factors (i.e. a null group) was the most appropriate for comparisons in the transitions analyses and for determining the impact of transitions on child outcomes

## 2.4 Maternal, family and neighbourhood characteristics

The variables described in this section were used in Section 5 to analyse how maternal, family and neighbourhood characteristics are associated with the movement in and out of vulnerability risk groups (as described in Table 3). The variables are described in four groups: maternal characteristics, family environment, relationship environment, and additional demographic variables (used to adjust statistical models). Questionnaires are available at [www.growingup.co.nz](http://www.growingup.co.nz) and the statistical methods that were used are described in Section 2.6.



## Maternal characteristics

### Time in New Zealand

Mothers were asked during late pregnancy whether they had been born in New Zealand, and for how long they had been living here. Three categories were then derived: those who had been born in NZ, those who were born outside of NZ and had resided in NZ for more than five years, and those who were born outside of NZ and had resided in NZ for five years or fewer.

### Residential mobility

Mothers were asked during late pregnancy whether they had moved house in the past five years. Two categories resulted: those who had moved house at least once in the past five years, and those who had not moved house in the past five years.

### Main language spoken at home

Mothers were asked during late pregnancy which language they mainly spoke at home. Two categories resulted: those who mainly speak English at home, and those who mainly speak a language other than English at home.

### Current disability

Mothers were asked during late pregnancy whether they currently had a long term disability lasting six months or more. Two categories resulted: those who had a current disability lasting six months or more, and those who did not.

### Unplanned pregnancy

Mothers were asked during late pregnancy whether this pregnancy was planned. Two categories resulted: those who had planned their current pregnancy and those who had not.

## Family environment

### Family support and stress

Parents were asked during the last trimester of pregnancy to report on what sources of family support they expected to have available, and how helpful they expected each source to be, once their baby was born. These support sources (selected from the Family Support Scale; Dunst, Jenkins & Trivette, 1984) included partner, parents, partner's parents, extended family, partner's extended family and friends. A higher score reflected higher expected helpfulness (maximum score of 36).

Parents were asked during the last trimester of pregnancy to report to what extent items such as 'worry about a disabled or ill family member' or 'worry about current housing difficulties' were a source of stress. This 6-item Family Stress scale was specifically developed for *Growing Up in New Zealand*. Each item was scored from *not at all stressful* to *highly stressful*, with a higher score reflecting a higher level of family stress.

To form a combined scale that related to the level of support and stress within the home, individual scores on the Family Support scale and the Family Stress scale (reverse scored) were summed. This composite scale was used as a continuous measure with a lower score indicating a more difficult family environment.

### External support and neighbourhood integration

Parents were asked during the last trimester of pregnancy to report on what sources of external

(outside of family) support they expected to have available, and how helpful they expected each source to be, once their baby was born. These support sources included family doctor, professionals (such as Plunket nurse or kaiawhina), early parenting programmes (such as Parents as First Teachers), books and the internet. A higher score reflected higher expected helpfulness (maximum score of 36). These items were selected from the Family Support scale (Dunst et al., 1984)

In addition to these sources of external support, mothers were also asked to describe their level of neighbourhood integration using the Neighbourhood Integration scale (Turrell, Kavanagh & Subramanian, 2006). This is a set of 10 questions with a 5-point response scale ranging from *strongly disagree* to *strongly agree* (such as, 'I have a lot in common with people in my neighbourhood'). Higher scores relate to stronger feelings of neighbourhood integration.

To form a combined scale that related to the support found outside the home, individual scores for the external support items and the Neighbourhood Integration scale were summed. This composite scale was used as a continuous measure with a lower score indicating a more difficult external environment.

#### **Perceived stress**

Perceived maternal stress was assessed using the abbreviated (10-item) Perceived Stress Scale (Cohen et al., 1983) which has established reliability and validity (e.g., Roberti et al., 2006). The maximum score is 40, with higher scores indicating greater perceived stress.

## **Relationship environment**

#### **Relationship stress**

Mothers were asked to describe their relationship with their current partner. They were asked to think about a time during the past four weeks when they and their partners had spent time talking or doing things together and how they acted towards each other. The questions formed a 9-item Warmth and Hostility Scale (Melby et al., 1993) and a 6-item Conflict Scale (Pryor, 2004). Together these items comprised a continuous variable that describes the level of stress within the intimate relationship (maximum score of 105). A lower score indicated a more difficult relationship environment.

#### **Relationship commitment**

Based on work by Johnson and colleagues (1999), relationship stability was measured by asking mothers to describe their level of personal commitment (two items each rated 1 to 5) and relationship commitment (two items each rated 1 to 5). Higher scores reflected greater levels of personal and relationship commitment.

## **Additional demographic variables used to adjust models**

#### **Self-prioritised ethnicity**

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.

**Child gender**

Cohort child gender (recorded at six week interview).

**Parity**

Cohort child order (first child or subsequent child; maternal self-report during late pregnancy).

**Child general health**

Maternal self-reported measure of current child health at two years of age. Two categories were derived: those with poor or fair health, and those with good, very good or excellent health.

## 2.5 Outcome measures

All outcome measures used to analyse the impact of movement in and out of vulnerability risk groups were collected when the children were two years of age. Further details about the variables are provided in the *Growing Up in New Zealand* questionnaires (available through [www.growingup.co.nz](http://www.growingup.co.nz)) and the statistical methods that were used are described in Section 2.6.

The outcome measures chosen for this analysis were as follows:

### Child health outcomes

The child health outcomes used for analysis in this report include ear infections, skin infections, and respiratory infections. This information was self-reported by parents when their children were two years old. Parents were asked about ear and skin infections in the first two years of life that had been confirmed by a doctor, and respiratory infections requiring hospital admission. Information about child accident and injury was also included, from parental self-report of injury requiring medical attention up to the age of two years. In this report the occurrence of more than two injuries requiring medical attention was compared to having none or one. Immunisation information was also provided by parental self-report when the cohort children were aged two years.

### Child behaviour outcomes

Child behaviour at two years of age was measured using the Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997). This scale measures emotional symptoms, conduct problems, hyperactivity/ inattention, peer relationship problems and pro-social behaviour. The SDQ is used widely and internationally and is reliable, brief, comprehensive and simple to administer. It assesses positive and negative behaviours (Rothenberger & Woerner, 2004). The SDQ is also able to screen for behavioural difficulties (Warnick et al., 2008; Goodman & Scott, 1999) and has been validated for use in multiple countries including Australia, United Kingdom and the USA ([www.sdqinfo.com](http://www.sdqinfo.com)). It is also routinely used in NZ as a component of the Ministry of Health's B4 School Check. Three categories resulted for analysis: 'Low risk', 'Borderline' and 'Abnormal' behaviour.

## Contact with social services

Parents were asked when their children were aged two years about contact with Whānau Ora services, Child Youth and Family (CYF), Family Start and any other services during the first two years of their child's life.

The use of this more comprehensive set of outcomes at two years of age enables the analysis in this report to build on the first Vulnerability report by *Growing Up in New Zealand*, and to provide an early exploration of the question, 'Vulnerable to what?'

## 2.6 Statistical methods

This report utilises descriptive statistics, univariate and multivariable regression models.

Descriptive statistics in this report include counts ('n') and percentages ('%'); showing the number of participants who provided information for a given question, and with both row (horizontal) and column (vertical) percentages used to illustrate specific findings in tables.

Data in the report have been rounded to 1 decimal place, and therefore percentages in tables may not always add exactly to 100%.

Univariate logistic regression models have been used to explore the association between the different levels of vulnerability risk at each cross-sectional time point. These models have also explored the association between cumulative vulnerability risk exposure and later health and behavioural outcomes at two years of age.

Multivariable logistic regression models have been used to explore the association between maternal and family characteristics and stability in vulnerability risk exposure, or change in relative exposure to vulnerability over time. Utilising a life-course approach, the temporal ordering of the maternal and familial variables was respected in these models, with maternal characteristics entered first, followed by family characteristics, and finally relationship characteristics. The final model is presented in the report, but associations found at each step of the model development are described in Appendix 2.

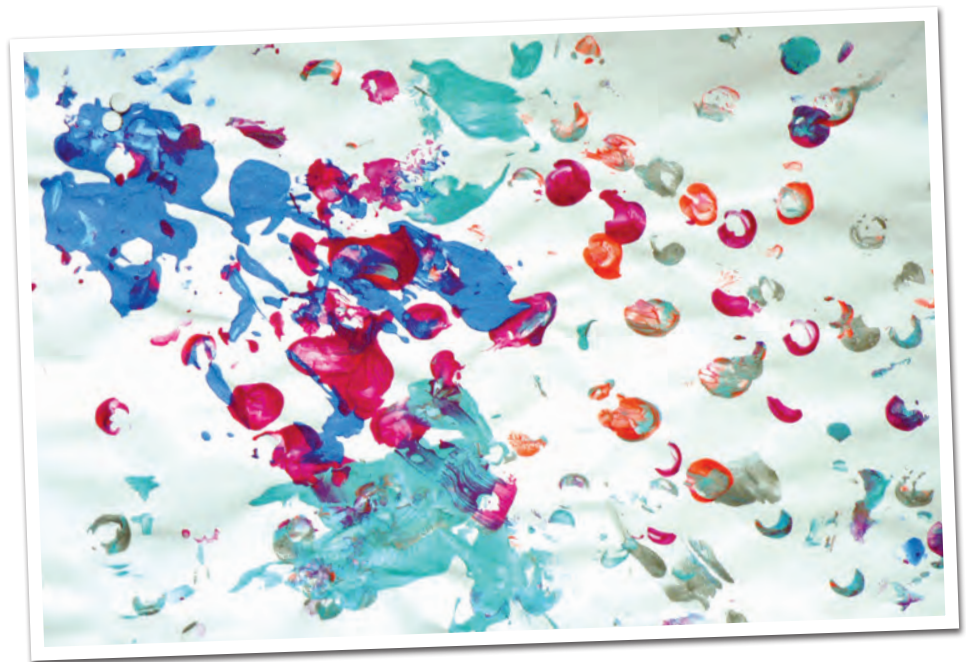
All multivariate models were also adjusted for maternal self-prioritised ethnicity, cohort child gender, and parity. The model that included the SDQ outcome variable was also adjusted for child general health.

The results from the logistic regressions are shown as odds ratios, 95% confidence intervals, and *p* values. A two-sided *p*-value of  $<.05$  was considered statistically significant.

Analyses were conducted using SAS software (version 9.4, SAS Institute, Cary, NC, US).



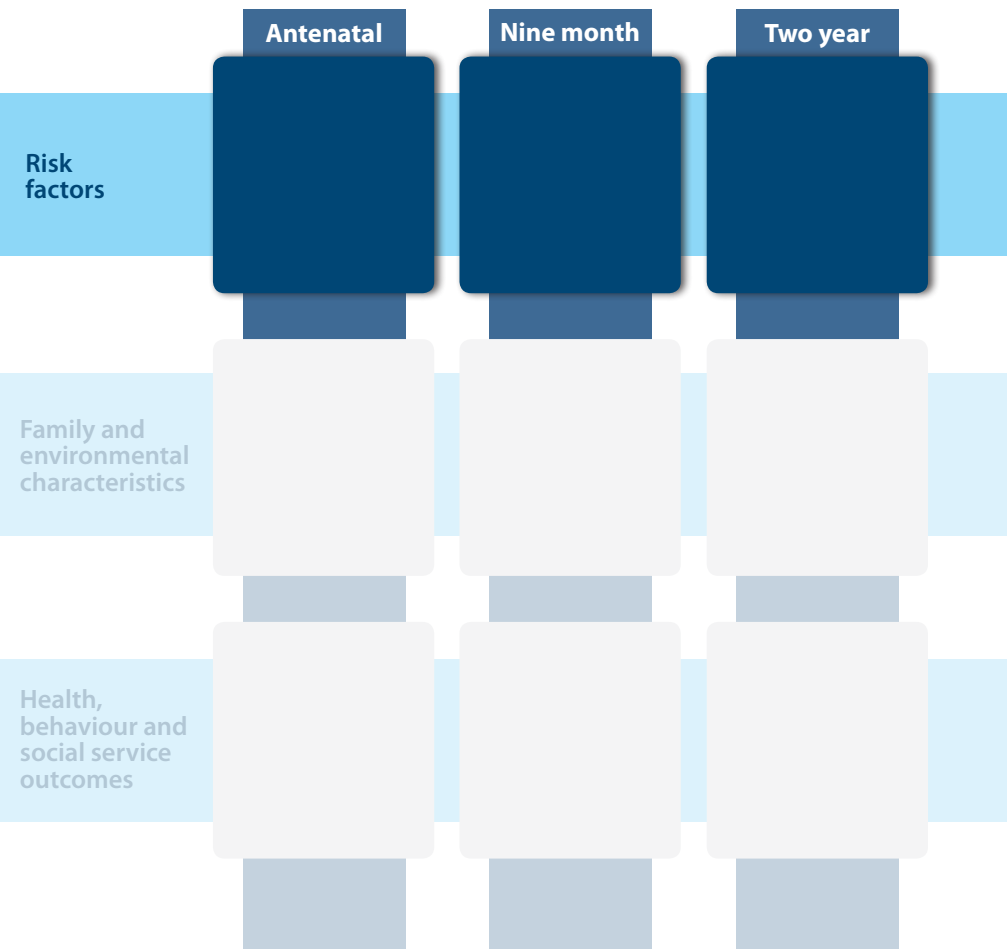
### 3. Vulnerability risk factors in the first 1000 days of life



The aim of this section is to review the prevalence of the 12 risk factors that were used to define child vulnerability in Report 1 and to examine the prevalence of individual risk factors amongst specific groups (those with a single risk factor, and those with four or more risk factors).

The data groups used in this section include risk factor information taken at the antenatal (AN), nine month (9M) and two year (2Y) time points, as summarised in Figure 5.

This section describes cumulative risk exposure and specific risk profiles at each time point within the first 1000 days.



**Figure 5: Information used in Section 3**  
Dark blue boxes indicate data used in this section, while grey boxes indicate data not used in this section.



## 3.1 Prevalence of vulnerability risk factors

### Individual risk factor prevalence

The prevalence of the 12 vulnerability risk factors (Morton et al., 2014c) in the first 1000 days of life is presented in Table 4.

The most prevalent risk factors during the antenatal period include deprivation area (n = 1475, 25.7%), financial stress (n = 979, 17.3%), and income tested benefit (n = 822, 14.3%).

Overcrowding showed the largest change in proportion of risk factor exposure across the cohort between late pregnancy and two years of age, increasing in prevalence from 12.8% at the antenatal time point to 20.4% at two years. Maternal smoking increased by approximately 4%, there was a 2% increase for receipt of an income tested benefit, and maternal depression decreased around 5% in overall prevalence.

*"The biggest challenge is struggling financially, and this makes it so hard to try to do the best for my son and support all his needs."*

**Table 4: Prevalence of risk factors during the first two years of life**

Risk factor	Antenatal*		Nine months		Two years	
	n	%	n	%	n	%
Deprivation area (NZDep2006 9 & 10)	1475	25.7	1394	25.0	1401	25.0
Financial stress (regular)	979	17.3	750	14.3	931	16.9
Income tested benefit	822	14.3	945	16.9	919	16.0
Overcrowding ( $\geq 2$ per bedroom)	734	12.8	1150	20.6	1141	20.4
Maternal depression (EPDS $\geq 13$ )***	692	12.1	439	7.9	–	–
Maternal smoking	583	10.2	761	13.6	772	13.5
Maternal physical wellbeing (poor/fair)***	550	9.6	522	9.4	–	–
Relationship status (no partner/single)	520	9.1	450	8.1	557	9.7
Unemployment	465	8.1	348	6.1	397	6.9
Tenure - public rental	395	6.9	367	6.6	343	6.1
Maternal education (no secondary school)**	347	6.1	–	–	–	–
Maternal age (<20 at late pregnancy)**	252	4.4	–	–	–	–

**Notes:**

\*Denominator for % is 5737, the number of participants who had complete information for the 12 vulnerability risk factors and who also completed the two year data collection wave.

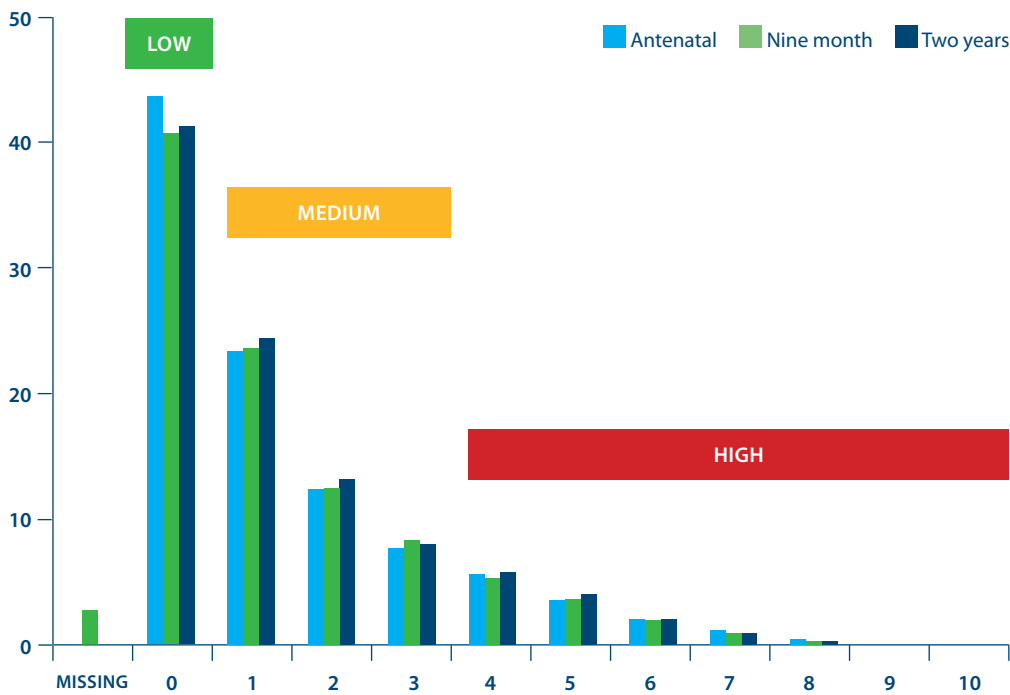
\*\* Not measured or updated at the nine month or two year time points.

\*\*\* Not measured at the two year time point.

### Cumulative risk exposure

The distribution of the number of risk factors present at antenatal, nine months and two years is shown in Figure 6.

The distribution of exposure to total number of risk factors (cumulative exposure) was similar at each of the three cross-sectional time points. Just over 40% of the cohort had zero risk factors (n = 2503, 43.6% at antenatal; n = 2334, 40.7% at nine months; and n = 2366, 41.2% at two years). This meant that more than half of the children were exposed to at least one vulnerability risk factor. Of these, a considerable proportion of children experienced exposure to a single risk factor (n = 1343, 41.5% at antenatal; n = 1353, 39.8% at nine months; and n = 1401, 41.6% at two years). Further, a small, but important, proportion of these children (n = 213, 6.6% at antenatal; n = 187, 5.5% at nine months; and n = 191, 5.7% at two years) experienced exposure to six or more risk factors at each time point.



**Figure 6: Distribution of number of risk factors at antenatal, nine month and two year time points**

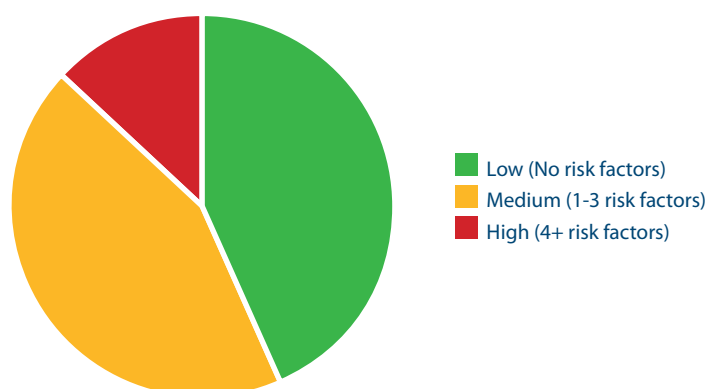
Note. The number of risk factors at the antenatal (light blue bars), nine month (green bars) and two years (dark blue bars) time points are shown. Data show percent of cohort with each number of risk factors.

## Distribution amongst vulnerability risk groups

The overall proportion of the cohort defined as low, medium or high vulnerability risk at the antenatal, nine month and two year time points is described in Table 5 and illustrated for the antenatal time point in Figure 7.

**Table 5: Distribution of participants across low, medium and high vulnerability risk at the antenatal, nine month and two year time points**

Vulnerability risk group	Antenatal n (%)	Nine months n (%)	Two years n (%)
Low (0 risk factors)	2503 (43.6)	2334 (41.8)	2366 (41.2)
Medium (1-3 risk factors)	2494 (43.5)	2546 (45.6)	2616 (45.6)
High (4 or more risk factors)	740 (12.9)	699 (12.5)	755 (13.2)



**Figure 7: Proportion of children exposed to low, medium and high vulnerability risk during the antenatal period**

## Clustering of risk factors

Figure 8 shows that there appears to be two main groups of risk factors: those that occur primarily with one or two risk factors in total (line graphs shown in dark blue), and those that primarily occur with three, four or five risk factors in total (line graphs shown in light blue). These groups of risk factors support and extend the findings of *Exploring the Definition of Vulnerability for Children in their First 1000 Days*, which demonstrated that the risk factors could be clustered into three main groups according to their characteristics. This new information shows that some risk factors are very unlikely to occur in isolation.

"Trying to find time for everything is so hard. I had to stop work because it was too much to try to manage the stress and get everything done by myself and still try to make sure my family is happy."

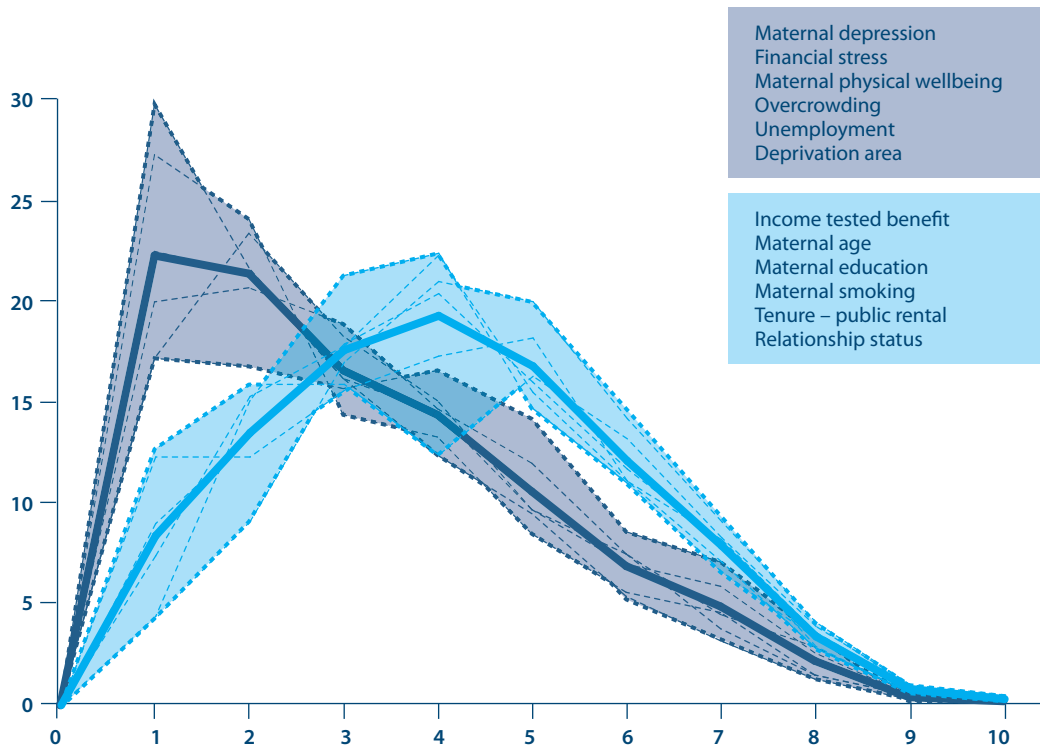


Figure 8: Total number of risk factors that occur with each individual risk factor, as measured during the antenatal period

Note. Where the X-axis is 1, the risk factor occurs in isolation, where the X-axis is 2, the risk factor occurs with one other risk factor, etc. The bold, solid line in each group represents the average for that group, whilst the dotted lines represent each of the 12 risk factors. The Y-axis shows the proportion of the cohort who experience each number of total risk factors.

## 3.2 Prevalence of risk factors amongst specific risk profiles

### Risk factor prevalence amongst children exposed to a single risk factor

"Being a parent it feels good but it's hard too. The hardest thing to cope with is the financial stuff."

As described in Section 3.1, approximately one quarter of the cohort are exposed to a single vulnerability risk factor at any of the three time points. The prevalence of these singly occurring risk factors is shown in Table 6.

The most common singly occurring risk factor is deprivation area (NZDep2006 9 & 10), with 381 children (28.4%) of the 1343 children exposed to a single risk factor during the antenatal period experiencing this risk factor. This was also the most common singly occurring risk factor at the nine month time point (n = 362, 24.6%) and at the two year time point (n = 318, 23.4%).

Regular financial stress, maternal depression and poor maternal physical wellbeing were also among the more common singly occurring risk factors, particularly during the antenatal period. Interestingly, the first Vulnerability report, *Exploring the Definition of Vulnerability for Children in their First 1000 Days*, showed that these three risk factors formed a cluster that was described as acute or pregnancy specific conditions.

On the other hand, the risk factors of maternal age (teen parent), living in a public rental home, having no partner and having no secondary school education, very rarely occurred without other risk factors also being present (Table 6).

As noted in the first Vulnerability report, although the proportion of the cohort exposed to specific risk factors at each time point is similar (Table 4), there is considerable individual movement in and out of exposure to specific risk factors. For example, of the 1343 children exposed to a single risk factor during the antenatal time point, only 571 (43%) of these were still exposed to a single risk factor at nine months, while 393 (29%) were exposed to no risk factors at nine months and 356 (27%) were exposed to two or more risk factors at nine months. These changes in exposure at the individual level are explored further in Section 4.

*"Being a solo parent and balancing work and health and money and all that sort of thing is really tough."*

**Table 6: Prevalence of risk factors amongst people with one risk factor only**

Risk factor	Antenatal*		Nine months		Two years	
	n	%	n	%	n	%
Deprivation area (NZDep2006 9 &10)	381	28.4	331	24.5	318	23.4
Financial stress (regular)	267	20.1	189	14.7	268	19.9
Maternal depression (EPDS $\geq$ 13)	156	11.6	86	6.4		
Overcrowding ( $\geq$ 2 per bedroom)	147	11.0	280	20.7	260	19.1
Maternal physical wellbeing (poor/fair)	82	6.1	157	11.6		
Unemployment	80	6.0	61	4.5	80	5.7
Maternal smoking	72	5.4	111	8.2	86	6.2
Income tested benefit	61	4.5	65	4.8	53	3.8
Maternal education (no secondary school qualifications)	26	1.9				
Relationship status (no partner/single)	47	3.5	22	1.6	46	3.3
Tenure - public rental	17	1.3	11	0.8	<10*	<1.0
Maternal age (<20)	<10*	<1.0				
<b>Total people with a single risk factor at each time point</b>	<b>1343</b>		<b>1353</b>		<b>1401</b>	

\*Frequencies less than 10 not reported

## Risk factor prevalence amongst children exposed to four or more risk factors

The prevalence of risk factors amongst the high risk vulnerability group is described in Table 7. The most prevalent risk factors amongst this group during the antenatal period were deprivation area (NZDep2006 9 &10), which was a risk factor that 528 children (71.4%) were exposed to within the high risk group, income tested benefit (n = 489, 66.1%), and maternal smoking (n = 348, 47%). The most significant change after the antenatal period was an increase in the proportion of children exposed to overcrowding (n = 393, 56.2% at nine months; n = 401, 54.9% at two years).

Table 7: Prevalence of risk factors amongst the high risk group

Risk factor	Antenatal		Nine months		Two years	
	n	%	n	%	n	%
Deprivation area (NZDep2006 9 &10)	528	71.4	512	73.3	516	68.6
Income tested benefit	489	66.1	513	73.5	558	73.9
Maternal smoking	348	47.0	398	56.9	412	54.6
Financial stress (regular)	335	45.3	263	39.2	336	45.6
Relationship status (no partner/single)	311	42.0	260	37.2	325	43.1
Overcrowding (≥2 per bedroom)	296	40.0	393	56.2	401	54.9
Maternal depression (EPDS ≥13)	276	37.3	190	27.2	–	–
Tenure - public rental	275	37.2	245	35.6	235	32.3
Maternal physical wellbeing (poor/fair)	250	33.8	180	25.8	–	–
Unemployment	234	31.6	159	22.8	192	25.4
Maternal education (no secondary school qualifications)	227	30.7	–	–	–	–
Maternal age (<20)	160	21.6	–	–	–	–
Total people in high risk at each time point	740		699		755	

### Distribution of individual risk factors between the medium and high risk groups

Table 8 describes how each of the 12 risk factors are distributed between the medium and high vulnerability risk groups. The risk factors of public rental, maternal age, and maternal education occurred at a higher proportion in the high risk group, while the risk factors of financial stress, deprivation area and maternal depression occurred at a higher proportion in the medium risk group (Table 8).

"I got very depressed and lonely and I've had to stop work."



**Table 8: Distribution of risk factors between the medium risk and high risk groups at the antenatal time point only**

Risk factor	Medium risk n	High risk n	Total n	% in medium	% in high
Financial stress (regular)	644	335	979	65.8	34.2
Deprivation area (NZDep2006 9 &10)	947	528	1475	64.2	35.8
Maternal depression (EPDS $\geq 13$ )	416	276	692	60.1	39.9
Overcrowding ( $\geq 2$ per bedroom)	438	296	734	59.7	40.3
Maternal physical wellbeing (poor/fair)	300	250	550	54.5	45.5
Unemployment	231	234	465	49.7	50.3
Income tested benefit	333	489	822	40.5	59.5
Maternal smoking	235	348	583	40.3	59.7
Relationship status (no partner/single)	209	311	520	40.2	59.8
Maternal age (<20)	92	160	252	36.5	63.5
Maternal education (no secondary school)	120	227	347	34.6	65.4
Tenure - public rental	120	275	395	30.4	69.6

### 3.3 Key points

- Living in an area of high deprivation was the most common risk factor for children in early life
- Having a mother who was experiencing financial stress or on an income tested benefit, or experiencing overcrowding, were the next most common risk factors for children in early life
- Over half of all cohort children were exposed to at least one risk factor either before their birth, or at nine months or at two years of age
- Some risk factors tend to occur on their own, or with just one other risk factor. Experiencing financial stress, maternal depression and poor maternal physical wellbeing commonly occurred alone
- Approximately 1 in 10 of the cohort children were exposed to four or more risk factors either before their birth, or at nine months or at two years of age
- Those risk factors that were more likely to occur together were maternal age (teen parent), maternal smoking, being on an income tested benefit, living in a public rental home, having no partner and having no secondary school education.

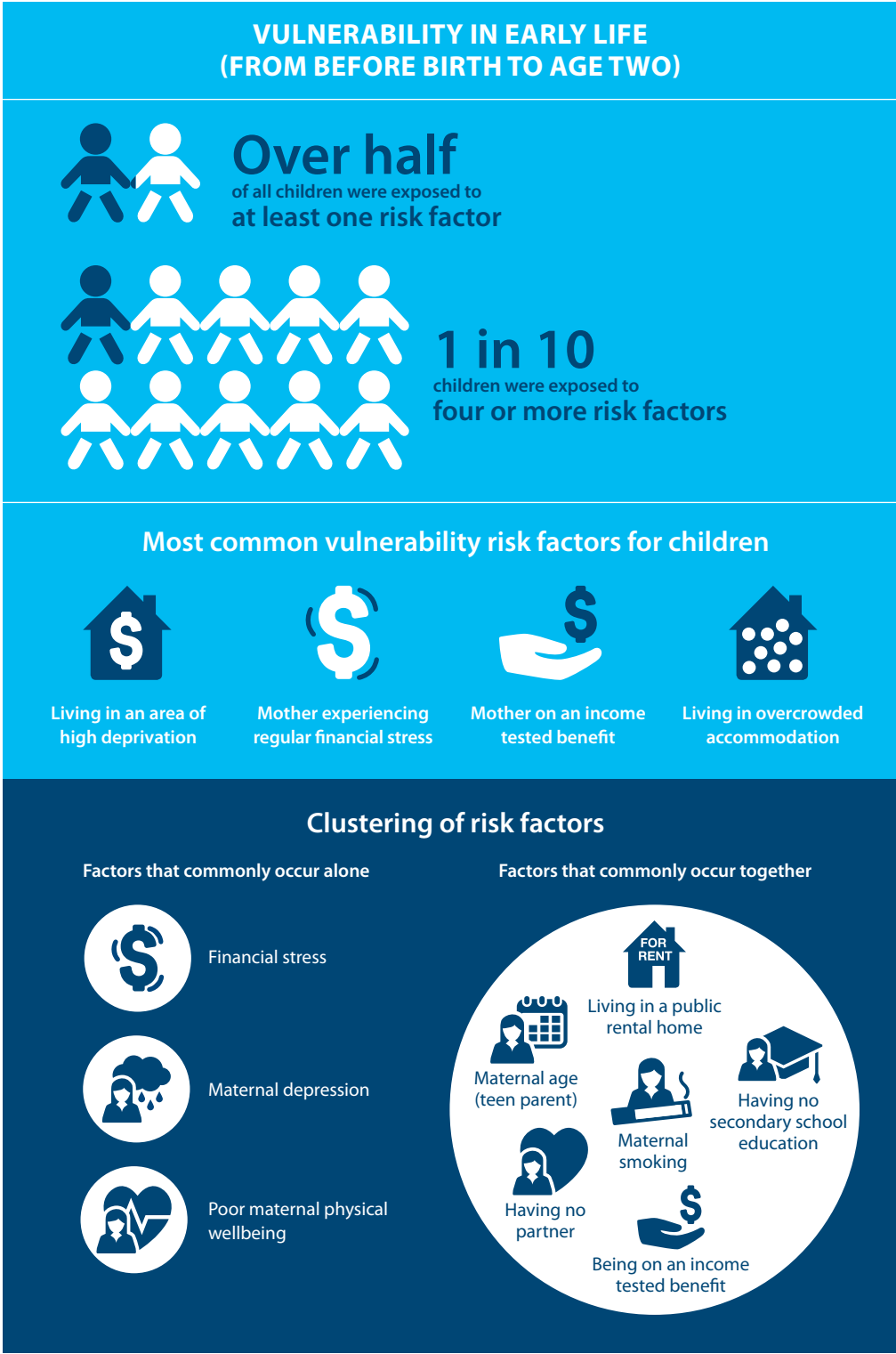


Figure 9: Key points from Chapter 3 – Vulnerability risk factors in the first 1000 days of life

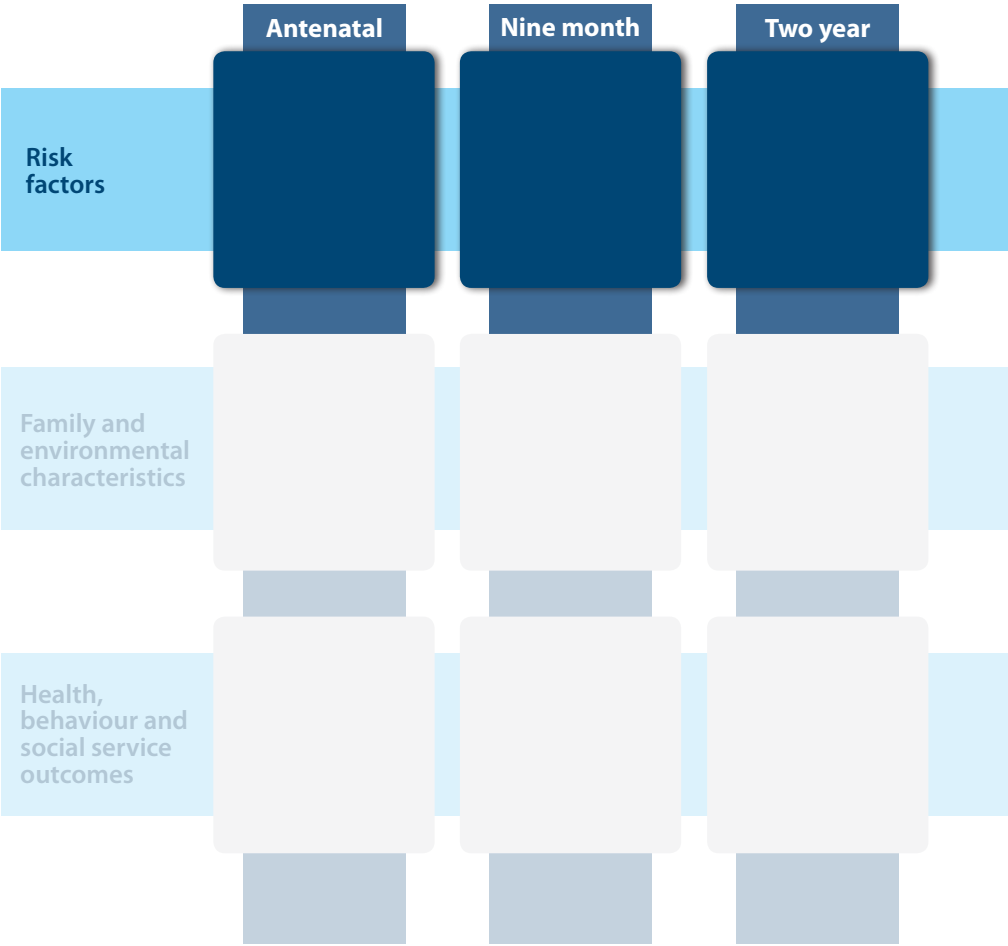


## 4. Transitions between vulnerable states over time



This section takes a longitudinal approach by examining how exposure to vulnerability changes in the first 1000 days of life. The aim is to examine transitions in exposure to individual vulnerability risk factors and transitions in exposure to cumulative vulnerability. Firstly, moving in and out of vulnerability risk factors between late pregnancy and age nine months is described, followed by a description of transitions that occur during the first 1000 days of life. There is a specific focus on transitions in and out of extreme vulnerability groups (that is, those moving in and out of the low risk or high risk groups between these time periods).

The information used in this section includes risk factor information from the antenatal, nine month and two year time points, as summarised in Figure 10.



**Figure 10: Information used in Section 4**  
Dark blue boxes indicate data used in this section, while grey boxes indicate data not used in this section.

# 4.1 Movement in and out of individual risk factors between late pregnancy and nine months

The movement in and out of individual risk factors between late pregnancy and when the *Growing Up in New Zealand* cohort children were nine months old is summarised in Figure 11. While some risk factors were highly stable over this time period, other risk factors, such as unemployment, were dynamic. For example the overall proportions of the cohort experiencing unemployment at the antenatal period and at nine months were similar, but only 13.8% (n = 64) of those who were experiencing unemployment during the antenatal period were also experiencing

"The biggest challenge has been the changes – splitting up with my partner and moving out on my own."

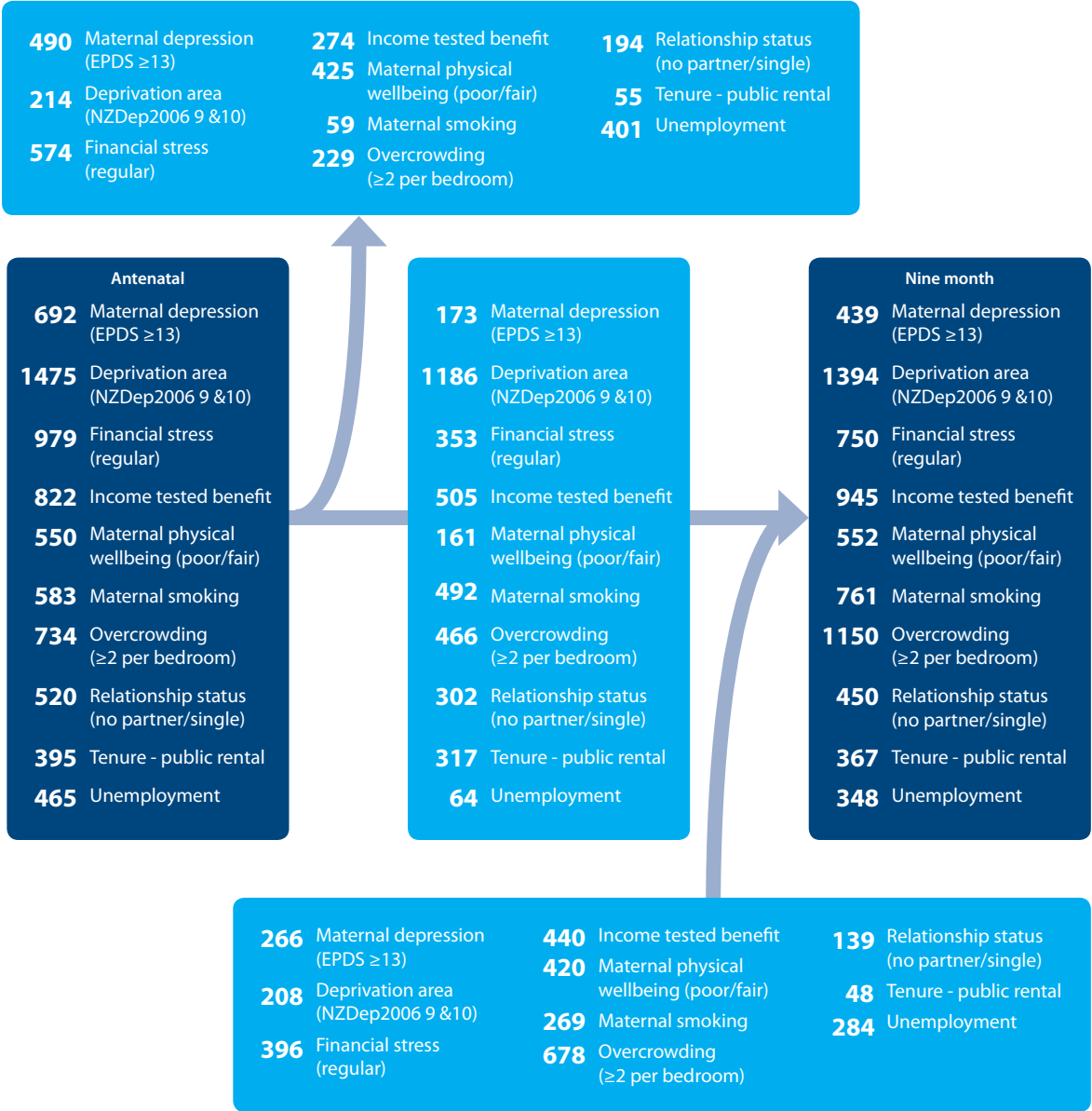
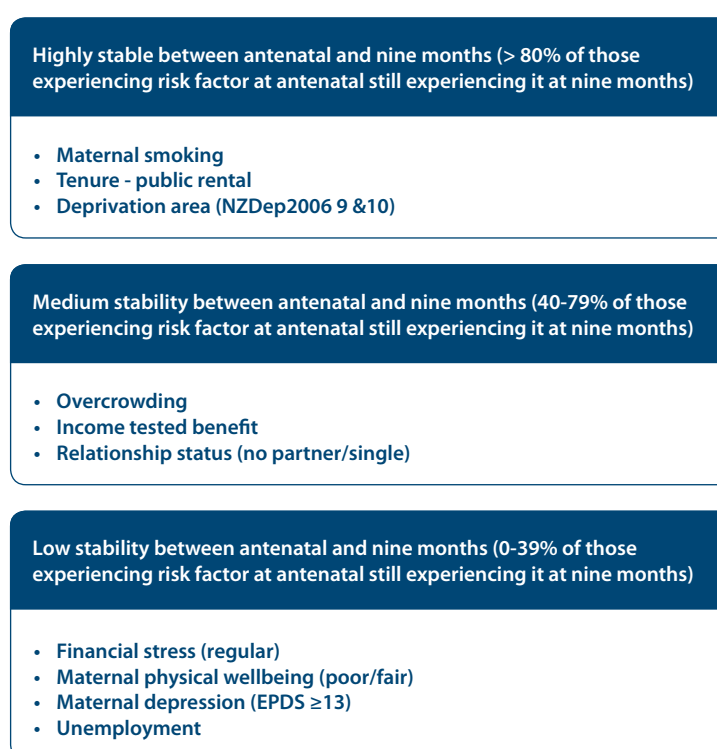


Figure 11: Movement out of individual risk factors between antenatal and nine months

unemployment at nine months. Conversely, 80.3% of those living in a public rental during the antenatal period were still living in this tenure type at nine months.

Figure 12 summarises the risk factors into high stability, medium stability and low stability, according to the proportion of the cohort that were experiencing these individual risk factors both at late pregnancy and at nine months of age.



**Figure 12: Summary of individual risk factor stability between antenatal and nine months**

This figure summarises only those risk factors for which a measure of change between the antenatal and nine month time points was available

## 4.2 Movement in and out of risk factor groups between late pregnancy and nine months

When considering the vulnerability risk groups (low, medium and high), overall 28% of the cohort changed vulnerability risk group between antenatal and nine months (Table 9). More than 15% of the cohort increased their vulnerability risk group between antenatal and nine months data collection. Almost 13% decreased their vulnerability risk group between antenatal and nine months. A larger proportion of participants in the high vulnerability risk group during the antenatal period changed their vulnerability risk group by nine months than did those who were in the low vulnerability risk group during the antenatal period.

Table 9: Overall stability, increase and decrease in exposure to vulnerability risk between the antenatal period and nine months of age

Movement between antenatal and nine months	Antenatal vulnerability risk			
	Whole cohort n (%)	Low n (%)	Medium n (%)	High n (%)
No change in risk	4023 (72.1)	1849 (75.2)	1716 (70.5)	458 (66.6)
Increased risk	844 (15.1)	608 (24.8)	236 (9.7)	N/A
Decreased risk	712 (12.8)	N/A	482 (19.8)	230 (33.4)

## 4.3 Movement in and out of vulnerability risk groups between late pregnancy and two years

The movement in and out of each vulnerability risk group at each time point is summarised in Figure 13.

### Low risk vulnerability group

Of the 2503 children who were in the low vulnerability risk group (without any of the 12 risk factors) at the antenatal time point, 1849 (75%) of these remained in this group at nine months of age. Of the children who moved out of the low risk vulnerability group between the antenatal and nine month time points (and with complete information), 99% (n = 603) gained one to three risk factors and therefore entered the medium vulnerability risk group. Approximately 1% of these children (n<10) gained four or more risk factors and therefore entered the high risk group.

Between nine months and two years, 83% (n = 1942) of those children who were in the low risk vulnerability group at nine months remained in that group at two years. There were 389 children who moved out of the low risk group to the medium risk group, and <10 who moved into the high risk group between nine months and two years of age. There were 1601 children (64% of the 2503 children in the low vulnerability risk during the antenatal period) who were in the low risk vulnerability group at all three time points.

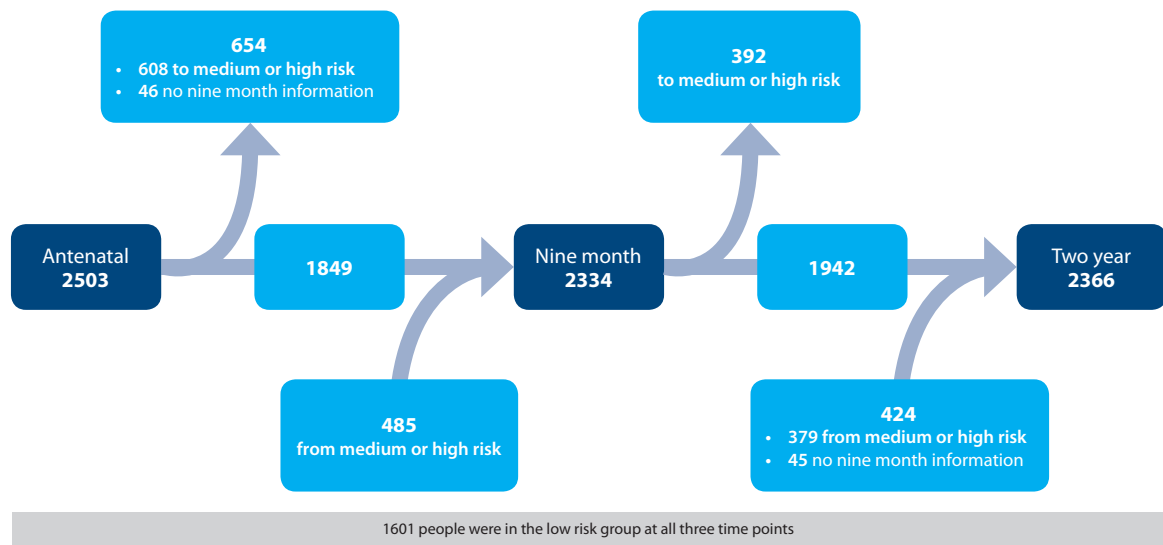
### Medium risk vulnerability group

Of the 2494 children in the medium risk group at the antenatal time point, 69% of these remained in the medium risk group at nine months of age. Of the children who moved out of the medium risk group at nine months, 67% (n = 482) moved to the low risk group (by losing all their vulnerability risk factors), and the remaining third moved to the high risk group at nine months of age, by gaining risk factors. There were 830 children who moved into the medium risk group at nine months of age. Of these, 603 (73%) were in the low risk group in late pregnancy, and 227 (27%) were in the high risk group in late pregnancy.

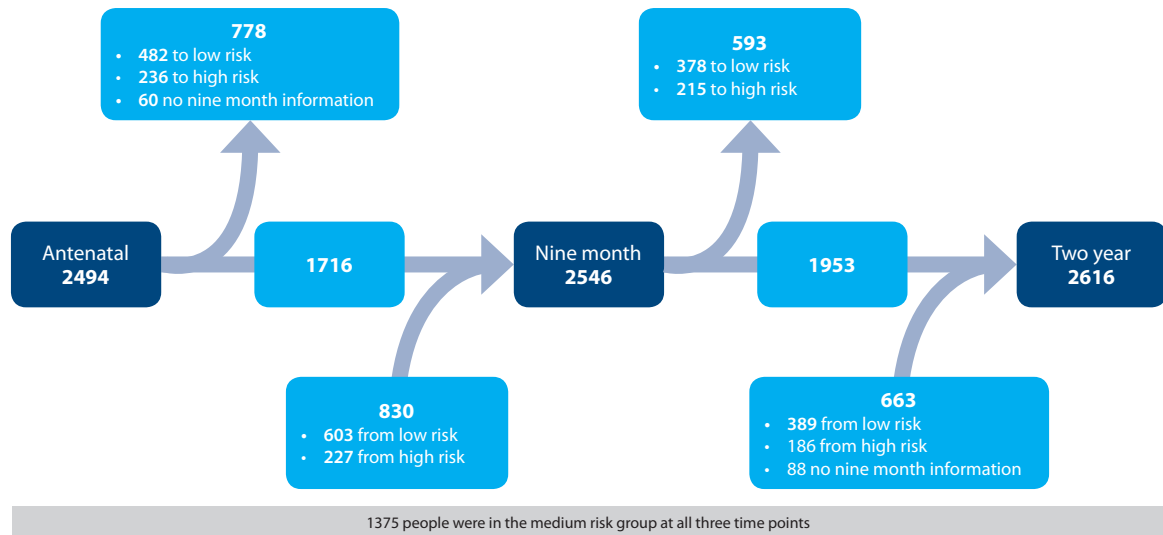
Between nine months and two years of age, there were 378 children (15% of those in the medium risk group at nine months of age) who moved out of the medium risk group and into the low risk group (by losing all their vulnerability risk factors) and 215 (8% of those in

*"It has been such a challenge coping with going backwards and forwards – getting her settled after her father left and trying to support her only on my own income."*

### 1. Movement in and out of the low vulnerability risk group



### 2. Movement in and out of the medium vulnerability risk group



### Movement in and out of the high vulnerability risk group

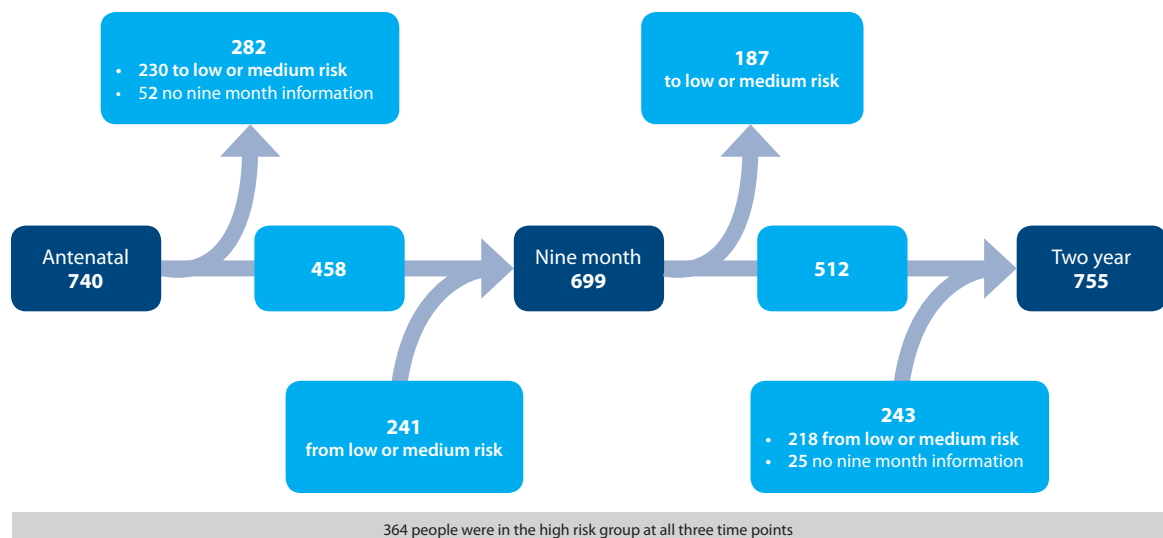


Figure 13: Movement in and out of low, medium and high vulnerability risk groups between late pregnancy and two years of age

the medium risk group at nine months of age) who moved to the high risk group, by gaining risk factors. There were 1953 children who remained in the medium risk group between nine months and two years. There were 663 children who moved into the medium risk group between nine months and two years of age. Of these, 59% ( $n = 389$ ) were from the low risk group. There were 1375 children in the medium risk vulnerability group at all three time points (55% of the 2494 children in the medium vulnerability risk group during the antenatal period).

### High risk vulnerability group

There were 740 children exposed to the high risk vulnerability group of factors at the antenatal time point. By the age of nine months, 458 (62%) of these remained in the high risk vulnerability group while the remaining 282 (38%) had moved out of the high risk group, 80% ( $n = 227$ ) to the medium risk group. There were 241 children who moved into the high risk vulnerability group between antenatal and nine months of age (236 from medium risk, 5 from low risk).

Between nine months and two years of age, there were 512 children who remained in the high risk vulnerability group (73% of those who had been in the high vulnerability risk group at nine months of age). There were 187 children who moved out of this risk group, almost all of whom ( $n = 186$ ) moved to the medium risk group. There were 243 children who moved into the high risk group between nine months and two years of age (240 from the medium and 3 from the low risk group). There were 364 children who remained in the high risk group at all three time points (49% of those in the high vulnerability risk group during the antenatal period).

## 4.4 Focus: movement in and out of the low vulnerability risk group in the first nine months of life

### Increased risk

Of the 603 children who moved out of the low risk group between the antenatal and nine month time points, there were 491 (81%) who gained one risk factor, 90 (15%) who gained two risk factors and 22 (4%) who gained three risk factors. The relative proportions of risk factors gained by these children between the antenatal and nine month time points are shown in Table 10. Overcrowding was the most commonly gained risk factor (for 28% of the children, likely in part to reflect the addition of a child to the family during this time period). The next most commonly gained risk factors between late pregnancy and nine months of age were financial stress and poor maternal health.

*"We have such a big family at home, high levels of anxiety and insomnia, and this has led to depression which meant parts of my life had completely shut down."*

**Table 10: Prevalence of risk factors gained at nine months, for those who had been in the low vulnerability risk group during the antenatal period and moved into the medium or high risk groups at nine months**

	n	%
Overcrowding	171	28.1
Financial stress (regular)	139	24.1
Maternal physical wellbeing (poor/fair)	134	22
Maternal depression (EPDS $\geq 13$ )	79	13
Unemployment	66	10.9
Income tested benefit	57	9.4
Maternal smoking	52	8.6
Deprivation area (NZDep2006 9 & 10)	43	7.1
Relationship status (no partner/single)	18	3
Tenure - public rental	0	0
<b>Total people who were low risk at antenatal and medium or high risk at nine months</b>	<b>608</b>	

*"The biggest challenge for us has been splitting up with her father and living separately, but now we are back together."*

## Decreased risk

There were 485 children who moved into the low risk vulnerability group at the nine month time point, and therefore lost all their risk factors. Of these, 482 moved from the medium risk group and <10 were in the high risk group in late pregnancy. The prevalence of risk factors amongst these participants at the antenatal time point (i.e. the risk factors that were lost between antenatal and nine months) are described in Table 11.

**Table 11: Prevalence of risk factors subsequently lost between late pregnancy and nine months of age, for those who had been in the medium or high vulnerability risk group at antenatal and moved into medium or high risk at nine months**

	n	%
Financial stress (regular)	156	32.4
Maternal depression (EPDS $\geq 13$ )	114	23.5
Maternal physical wellbeing (poor/fair)	65	13.4
Unemployment	64	13.2
Overcrowding	63	13
Deprivation area (NZDep2006 9 & 10)	58	12
Income tested benefit	49	10.1
Relationship status (no partner/single)	12	2.5
Maternal smoking	10	2.1
Tenure - public rental	<10*	<2.0
<b>Total people who were medium or high risk at antenatal and moved to low risk at nine months</b>	<b>485</b>	

\*Frequencies less than 10 not reported



Financial stress and maternal symptoms of depression were the risk factors most commonly lost between late pregnancy and nine months of age. Living in public rental accommodation, maternal smoking, and being without a current partner were the risk factors least commonly lost over this same time period.

## 4.5 Focus: movement in and out of the high vulnerability risk group in the first nine months of life

The number of risk factors gained or lost in or out of the high risk vulnerability group between late pregnancy and nine months of age is described in Figure 14.

### Increased risk

For the children who moved into the high risk vulnerability group between antenatal and nine months (i.e. increased their total number of risk factors), 26% (n = 84) gained just one risk factor, 30% (n = 95) gained two risk factors, and 28% (n = 89) gained three risk factors. There were 49 children (16%) who gained four or more risk factors during this same time period.

*"Some of the changes in my life have been a real highlight for our family – I have got a job, and have a new partner."*

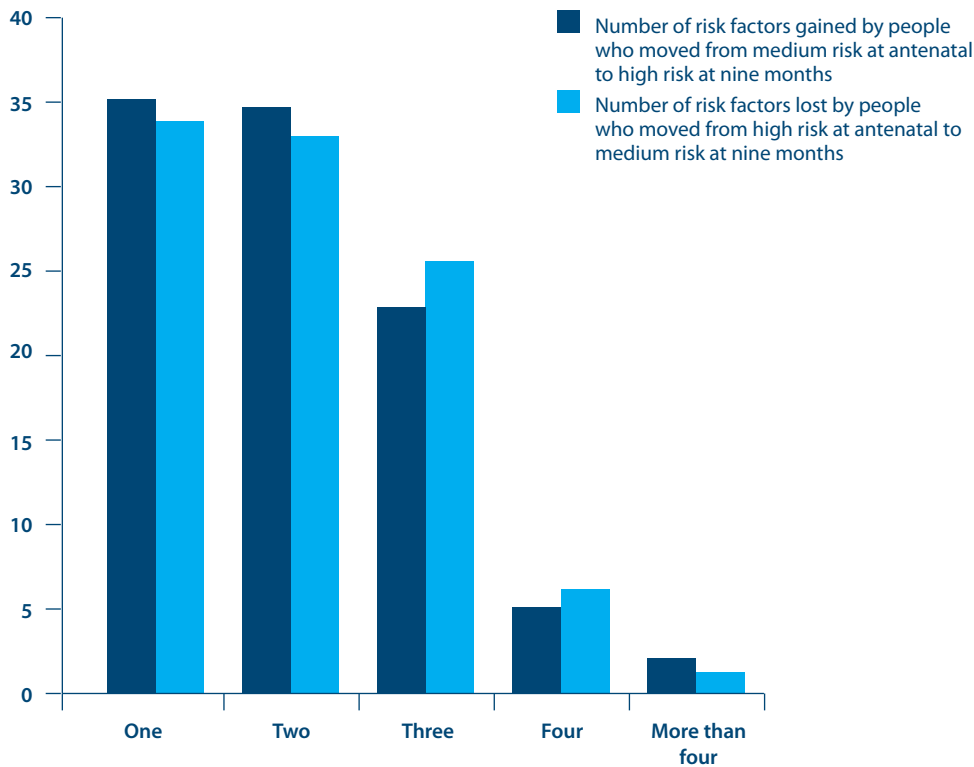


Figure 14: Number of risk factors gained or lost during movement in and out of the high risk vulnerability group (percent of those who moved in or out of high risk between antenatal and nine months)

Decreased risk

"I wasn't working before so I couldn't provide some things that she needed. Now I can."

One third of the children who moved out of the high risk vulnerability group between antenatal and nine months of age (n = 77) lost one risk factor, another 33% (n = 75) lost two risk factors, 26% (n = 58) lost three risk factors, and 17 children (7.5%) lost four or more risk factors between antenatal and nine months.

Being on an income tested benefit, overcrowding, and experiencing financial stress were the risk factors that were most commonly gained by children moving into the high risk vulnerability group between antenatal and nine months of age. Experiencing less financial stress, better maternal physical wellbeing and fewer symptoms of maternal depression were the factors most commonly moving children out of the high risk vulnerability group between late pregnancy and nine months of age (Figure 15).

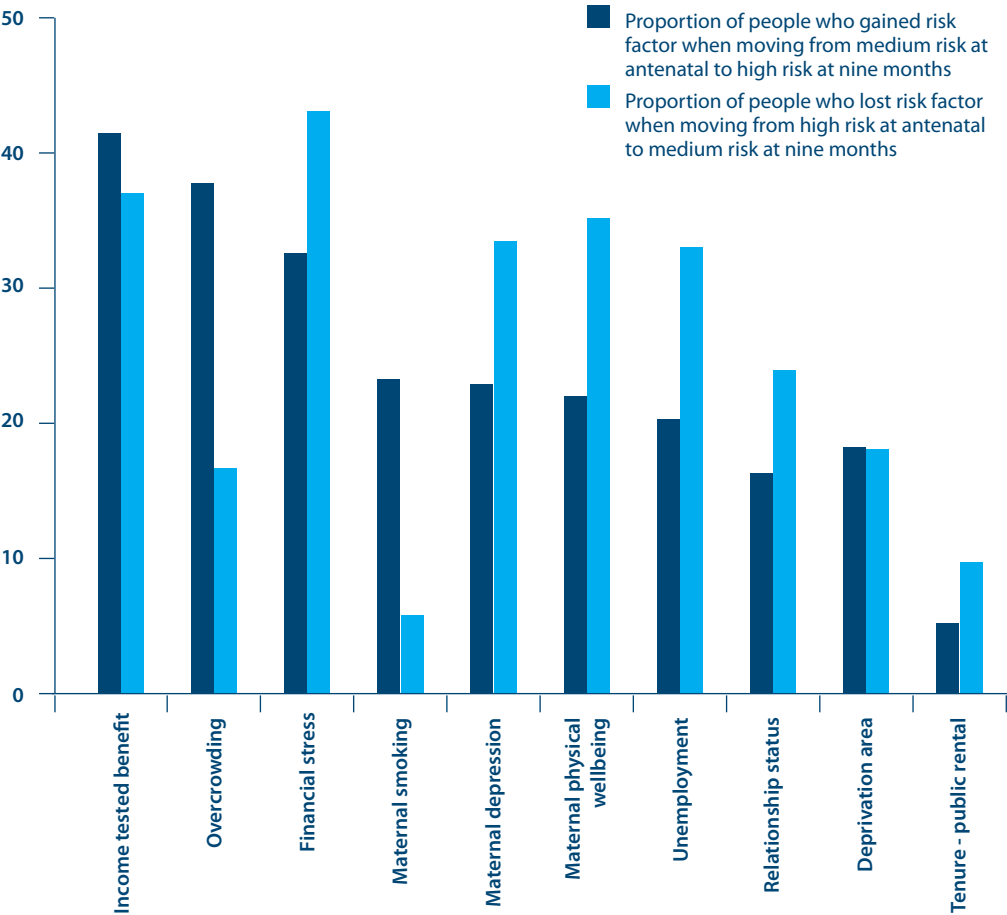


Figure 15: Gain and loss of risk factors associated with movement in and out of the high risk vulnerability group (percent of those who moved in or out of high risk between antenatal and nine months). Percent adds up to greater than 100 because more than one risk factor could be gained or lost.

## 4.6 Key points

- Approximately 28% of children experienced changed vulnerability risk groups between the antenatal period and nine months of age
- Maternal smoking and living in public rental accommodation (or social housing) were the risk factors least likely to have changed between the antenatal period and nine months of age
- Experiencing financial stress, poor maternal health (mental and physical) and being unemployed were the risk factors most likely to have changed between pregnancy and nine months of age.

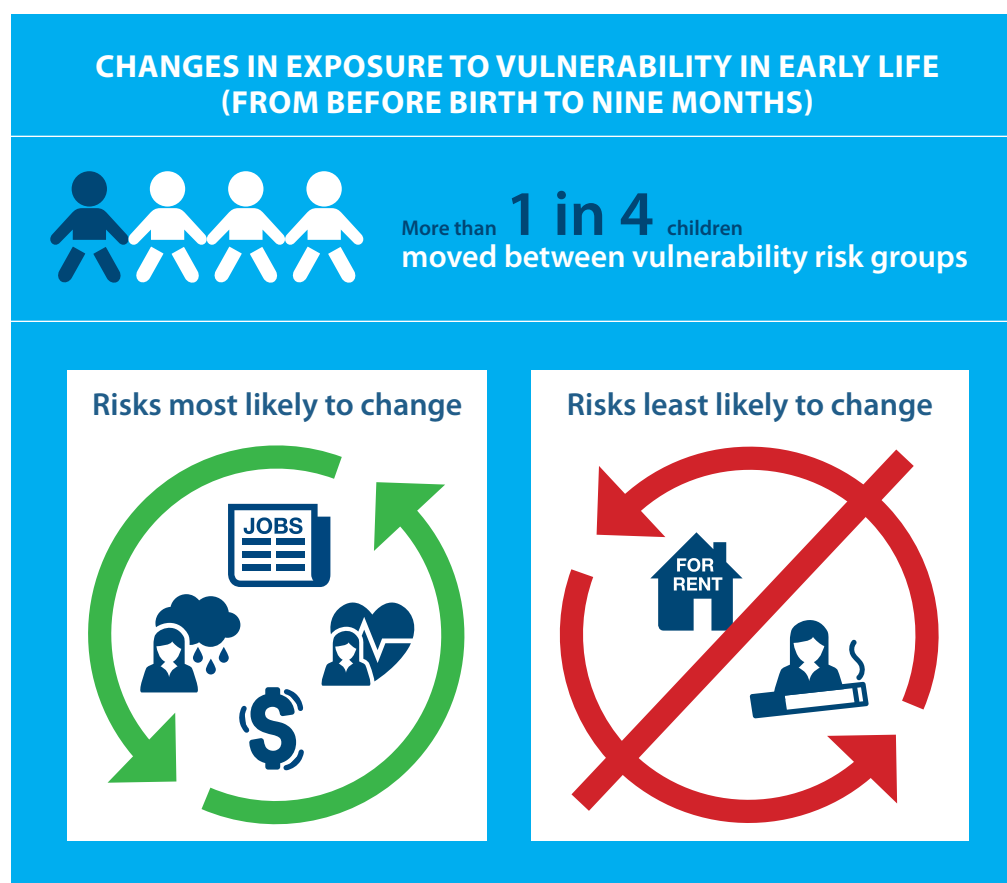


Figure 16: Key points from Chapter 4 – Transitions between vulnerable states over time

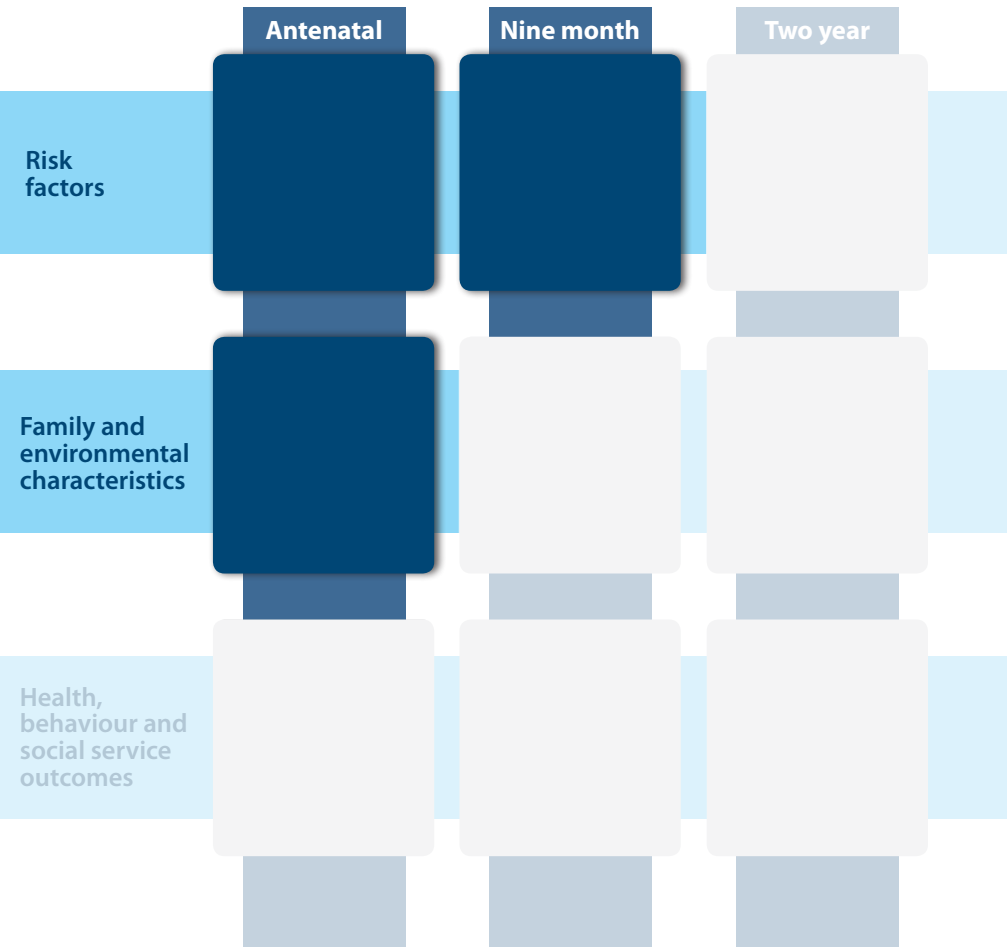


## 5. Association of maternal, family and neighbourhood characteristics with vulnerability risk group transitions



The aim of this section is to describe how maternal, family and neighbourhood characteristics may be associated with vulnerability transitions, with a focus on the transitions that occur between late pregnancy and nine months of age.

The information used here (summarised in Figure 17) includes risk factor information measured at the antenatal and nine month time points, along with the maternal, family and neighbourhood characteristics measured during the antenatal period.



**Figure 17: Information used in Section 5**  
Dark blue boxes indicate data used in this section, while grey boxes indicate data not used in this section.

This section takes a longitudinal approach and explores (using a multivariate model) whether the interconnected maternal, relationship, family, and neighbourhood characteristics that are present during late pregnancy are associated with vulnerability states, including transitions between vulnerability groups, over the first nine months of life. The characteristics have been explored according to the temporal order in which they occurred. Models were also corrected for maternal self-prioritised ethnicity, cohort child gender and cohort child order (maternal parity).

Three vulnerability states are compared in this section: stably high vulnerability risk compared to stably low vulnerability risk; increased vulnerability risk compared to stably low vulnerability risk; and decreased vulnerability risk compared to stably high vulnerability risk.

The results from the adjusted multivariate model are described in Table 12, and in this section. The results from the temporally ordered approach used for the models are provided in Appendix 2.

### Maternal characteristics associated with transitions in vulnerability risk between late pregnancy and nine months of age

- Between late pregnancy and nine months of age, those children who were the result of a pregnancy that was not planned were:
  - more likely to be in the stably high vulnerability risk group, or
  - more likely to have experienced an increase in vulnerability risk, compared to the stably low vulnerability risk group, or
  - less likely to have experienced a decrease in vulnerability risk, compared to the stably high risk group.
- The children of mothers with higher perceived stress were more likely:
  - to be in the stably high vulnerability risk group compared to the stably low vulnerability risk group, or
  - to have experienced an increase in vulnerability risk, compared to the stably low vulnerability risk group.
- The children of mothers with a current disability were more likely:
  - to be in the stably high vulnerability risk group compared to the stably low vulnerability risk group, or
  - to have experienced a decrease in vulnerability compared to the stably high risk group.
- The children of mothers who were born outside NZ and who have lived in NZ for fewer than five years were more likely to have experienced an increase in vulnerability risk, compared to the stably low vulnerability risk group.
- The children of mothers who were born outside NZ and who have lived in NZ for more than five years were more likely:
  - to be in the stably high vulnerability risk group compared to the stably low vulnerability risk group, or
  - to have experienced an increase in vulnerability risk, compared to the stably low vulnerability risk group.

*"My own health is a real challenge for us now. I physically can't keep up with him."*

*"Being far away from my family, and the lack of any support is the hardest thing."*

*"The hardest thing is managing the children on my own with no external support."*

**Table 12: Univariate and multivariate models of characteristics associated with transitions in vulnerability exposure**

	Univariate model		Multivariable model				
	OR	P-value	OR	SE	95% CI lower	95% CI upper	P-value
Stably high vulnerability risk compared to stably low vulnerability risk							
Not born in NZ, lived in NZ less than five years	2.12	0.7637	3.37	0.35	1.06	10.70	0.0388
Not born in NZ, lived in NZ five or more years	3.69	0.0012	5.34	0.28	2.19	13.02	0.0002
Residential mobility – moved	0.80	0.2532	0.67	0.17	0.35	1.31	0.2453
English language not main language used at home	0.71	0.2664	0.50	0.25	0.19	1.31	0.1594
Current disability	3.84	<.0001	2.94	0.22	6.67	1.12	0.0202
Unplanned pregnancy	22.77	<.0001	16.47	0.13	9.93	27.33	<.0001
External environment – less support	1.08	<.0001	1.02	0.02	0.99	1.06	0.159
Higher perceived stress	0.78	<.0001	0.83	0.02	0.79	0.87	<.0001
Family environment – more family stress	1.22	<.0001	1.07	0.02	1.03	1.12	0.0007
More relationship stress	1.10	<.0001	1.02	0.01	0.99	1.05	0.1526
Less personal commitment	2.13	<.0001	1.37	0.13	1.06	1.78	0.0184
Less relationship commitment	2.10	<.0001	1.40	0.13	1.09	1.82	0.0096
Increased vulnerability risk compared to stably low vulnerability risk							
Not born in NZ, lived in NZ less than five years	0.76	0.0138	0.75	0.10	0.54	1.04	0.0796
Not born in NZ, lived in NZ five or more years	1.14	0.0302	1.22	0.09	0.93	1.61	0.1545
Residential mobility – moved	0.87	0.2832	0.96	0.07	0.74	1.26	0.7835
English language not main language used at home	0.73	0.0615	0.92	0.09	0.64	1.34	0.6704
Current disability	1.61	0.0088	1.45	0.10	2.12	0.99	0.0563
Unplanned pregnancy	2.87	<.0001	2.41	0.05	1.94	2.98	<.0001
External environment – less support	1.03	<.0001	1.02	0.01	1.00	1.03	0.0172
Higher perceived stress	0.91	<.0001	0.92	0.01	0.91	0.94	<.0001
Family environment – more family stress	1.07	<.0001	1.03	0.01	1.02	1.05	0.0002
More relationship stress	1.02	<.0001	0.99	0.01	0.98	1.01	0.2339
Less personal commitment	1.25	<.0001	1.12	0.06	0.99	1.27	0.0668
Less relationship commitment	1.22	<.0001	1.05	0.06	0.93	1.18	0.4561
Decreased vulnerability risk compared to stably high vulnerability risk							
Not born in NZ, lived in NZ less than five years	0.41	0.0732	0.425	0.231	0.198	0.909	0.0275
Not born in NZ, lived in NZ five or more years	0.429	0.066	0.459	0.1763	0.26	0.81	0.0072
Residential mobility – moved	0.844	0.3513	0.963	0.1157	0.612	1.516	0.8699
English language not main language used at home	0.643	0.0415	0.928	0.1517	0.512	1.683	0.8065
Current disability	0.521	0.0052	0.430	0.1547	0.789	0.216	0.0065
Unplanned pregnancy	0.241	<.0001	0.287	0.0926	0.2	0.413	<.0001
External environment – less support	0.972	0.0014	0.976	0.0111	0.955	0.997	0.0257
Higher perceived stress	1.056	<.0001	1.018	0.0142	0.99	1.047	0.2125
Family environment – more family stress	0.948	<.0001	0.991	0.0125	0.967	1.016	0.4837
More relationship stress	0.968	<.0001	0.984	0.00803	0.968	0.999	0.0408
Less personal commitment	0.749	<.0001	0.91	0.0783	0.781	1.061	0.2305
Less relationship commitment	0.72	<.0001	0.875	0.0839	0.743	1.032	0.1122



### Family characteristics associated with transitions in vulnerability risk between late pregnancy and nine months of age

- The children of those mothers who had less family support and more family stress were more likely:
  - to be in the stably high vulnerability risk group compared to the stably low vulnerability risk group, or
  - to have experienced an increase in vulnerability risk, compared to the stably low vulnerability risk group.

*"We work together as a family or team and everyone has a role. That's a highlight for us."*

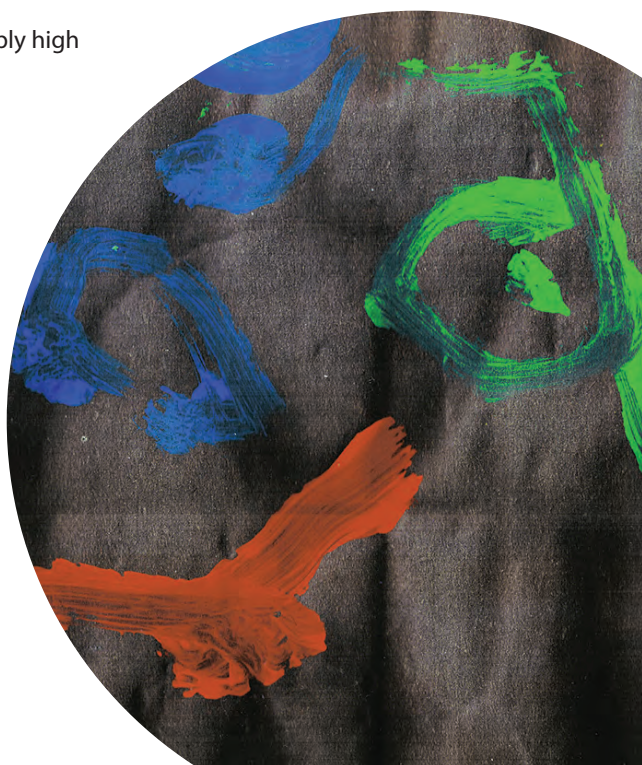
### Relationship characteristics associated with transitions in vulnerability risk between late pregnancy and nine months of age

- The children of those mothers who had less personal commitment and less relationship commitment were more likely to be in the stably high vulnerability risk group, compared to the stably low vulnerability risk group.
- The children of those mothers who had more relationship stress were more likely:
  - to have experienced an increase in vulnerability risk, compared to the stably high vulnerability risk group, or
  - to have experienced a decrease in vulnerability risk, compared to the stably low vulnerability risk group.

*"It is really important that we have people in our lives that understand our situation and are on the same page – people in our family."*

### Neighbourhood characteristics associated with transitions in vulnerability risk between late pregnancy and nine months of age

- The children of those mothers who expressed less neighbourhood integration, and less support outside the family home were more likely to have:
  - experienced an increase in vulnerability risk, compared to the stably low vulnerability risk group, or
  - experienced a decrease in vulnerability risk, compared to the stably high vulnerability risk group.



## 5.1 Key points

*"The biggest challenge is ensuring she's settled between moves. Maintaining stability and contact with her extended family during all these changes."*

- Transitions in vulnerability risk were associated with maternal, family, and neighbourhood characteristics
- Having more perceived stress, a current disability, an unplanned pregnancy, and being born outside New Zealand were maternal characteristics associated with persistently high vulnerability, or with increased vulnerability exposure
- Having less family support and more family stress were family characteristics associated with persistently high vulnerability, or with increased vulnerability exposure
- Having more relationship stress was associated with persistently high vulnerability, or with increased vulnerability exposure
- Feeling less integrated into the neighbourhood, and having less support (outside of family support) were associated with persistently high vulnerability, or with increased vulnerability exposure.

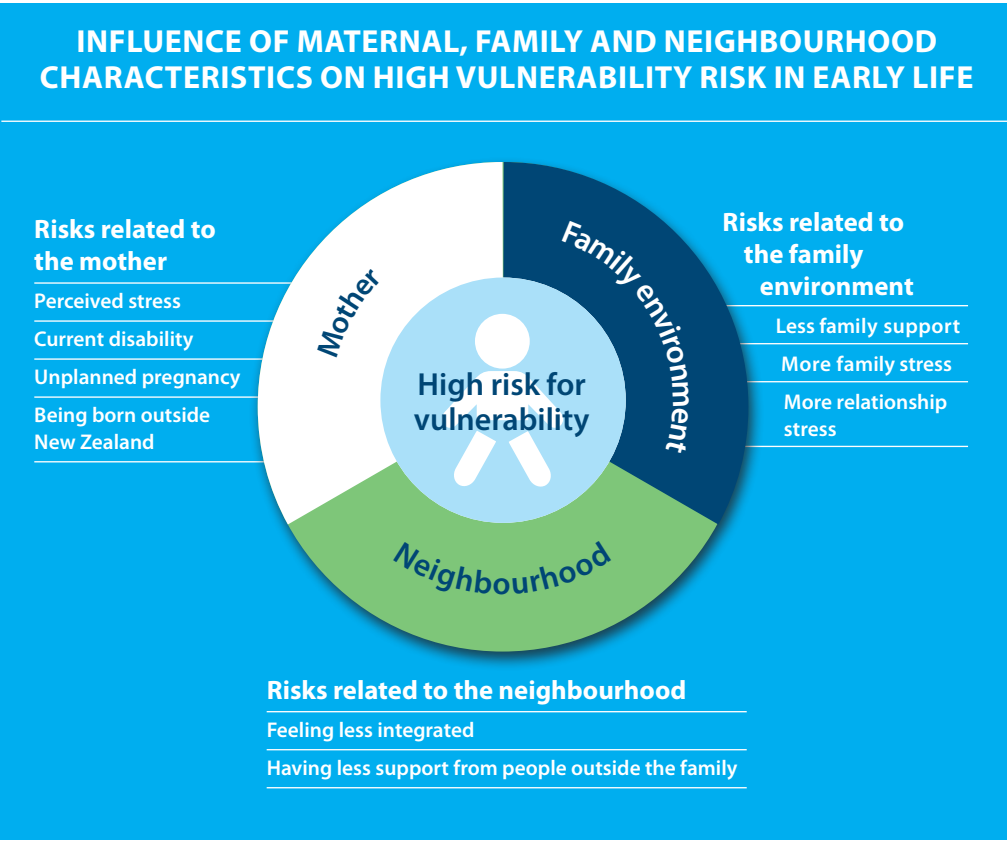


Figure 18: Key points from Chapter 5 – Association of maternal, family and neighbourhood characteristics with vulnerability risk group transitions

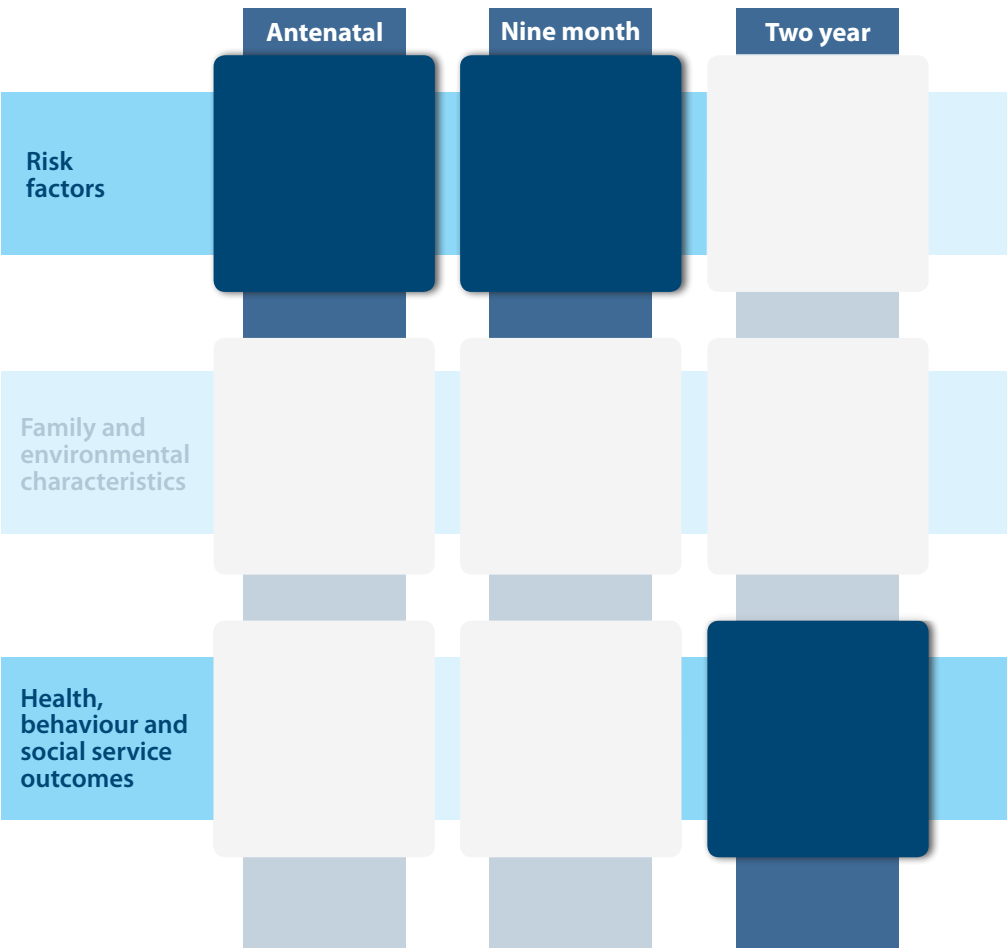
## 6. Impact of vulnerability transitions on outcomes at two years of age



The focus of this section is to examine how exposure to vulnerability in the early months of life can impact on key child behaviour and health outcomes at two years of age, as well as access to social services in the first two years of life. The health outcomes presented are the key health outcomes that were found to be affected by early life vulnerability in the first report within *Growing Up in New Zealand’s Vulnerability and Resilience series: Exploring the Definition of Vulnerability for Children in their First 1000 Days* (Morton et al., 2014c).

This section extends these previous findings by describing how transitions in vulnerability may impact child health outcomes. It also describes how cumulative vulnerability exposure and vulnerability transitions impact child behaviour, as measured by the Strengths and Difficulties Questionnaire (SDQ), a commonly used and well-validated child behaviour questionnaire. Finally, a description of social service use, according to vulnerability risk group, is provided.

The information used in this section is summarised in Figure 19.



**Figure 19: Information used in Section 6**  
Dark blue boxes indicate data used in this section, while grey boxes indicate data not used in this section.

## 6.1 Health outcomes

*Exploring the Definition of Vulnerability for Children in their First 1000 Days* (Morton et al., 2014c) demonstrated that vulnerability risk group was associated with child health outcomes to two years of age including ear infections, chest infections, skin infections, accidents and injury, and incomplete immunisations. In Table 13, the association of vulnerability group transitions (stably high risk compared to stably low risk, increased risk compared to stably low risk, and decreased risk compared to stably high risk) with ear infection, chest infection, skin infection, accident or injury, and incomplete immunisations is described. Similar to the findings of the first report (Morton et al., 2014c), we found no statistically significant association of vulnerability risk transitions with doctor diagnosed ear infections. However, for those children who were consistently exposed to a high level of vulnerability risk over time (stably high risk), there was an increased likelihood of chest infection (requiring hospitalisation) and incomplete immunisations, in comparison to those children who were consistently in the lowest vulnerability risk group. For those children whose exposure to vulnerability risk increased between the antenatal period and nine months of age, there was an increased likelihood of having a doctor diagnosed skin infection and incomplete immunisations at two years of age. There was no effect of vulnerability risk group transitions on the likelihood of sustaining an accident or injury.

"I think dealing with everything and all his health issues with his chest – that is the biggest worry."

**Table 13: Association of the antenatal to nine month vulnerability risk groups of stably high, stably low and increased vulnerability with key health outcomes at two years**

Variable	Odds ratio	95% CI lower	95% CI upper	P-value
<b>Doctor diagnosed ear infection</b>				
Stably high vs stably low	0.89	0.70	1.14	0.369
Increased vs stably low	1.01	0.86	1.19	0.901
Decreased vs stably high	1.25	0.96	1.63	0.093
<b>Chest infection requiring hospitalisation</b>				
Stably high vs stably low	1.37	1.07	1.75	0.013
Increased vs stably low	1.10	0.94	1.30	0.243
Decreased vs stably high	0.94	0.72	1.23	0.657
<b>Doctor diagnosed skin infection</b>				
Stably high vs stably low	1.28	0.93	1.77	0.132
Increased vs stably low	1.26	1.00	1.59	0.052
Decreased vs stably high	0.94	0.66	1.33	0.712
<b>Two or more accidents or injuries requiring medical attention</b>				
Stably high vs stably low	1.20	0.92	1.57	0.173
Increased vs stably low	1.04	0.88	1.24	0.641
Decreased vs stably high	0.91	0.69	1.22	0.537
<b>Incomplete immunisation</b>				
Stably high vs stably low	1.53	1.07	2.19	0.021
Increased vs stably low	1.29	1.00	1.66	0.050
Decreased vs stably high	0.77	0.52	1.14	0.194

Note that the reference group for health outcomes is "Yes"

## 6.2 Behaviour outcomes

To determine whether there was an association of vulnerability risk transitions with behavioural outcomes at two years of age using the Strengths and Difficulties Questionnaire (SDQ), the distribution of SDQ outcomes amongst the antenatal vulnerability risk groups was first described (Table 14). Within the low vulnerability risk group, there were 2270 children (79.4%) who were considered low risk of negative behavioural outcomes, and 238 children (8.3%) who were considered to have 'abnormal' SDQ scores. In contrast, within the high vulnerability risk group, a higher proportion of the children (43.9%,  $n = 325$ ) were considered to have 'abnormal' SDQ scores and 273 children (36.9%) were considered at low risk of negative behavioural outcomes. This suggests that vulnerability risk experienced during the antenatal period may have lasting impact through to child behavioural development at two years of age.

**Table 14: Distribution of SDQ outcomes at two years amongst the antenatal vulnerability risk groups**

Total SDQ category	Vulnerability risk group - antenatal		
	Low n (%)	Medium n (%)	High n (%)
Low risk	2270 (79.4)	1706 (62.8)	273 (36.9)
Borderline	351 (12.2)	486 (17.9)	141 (19.1)
Abnormal	238 (8.3)	523 (19.2)	325 (43.9)

Secondly, statistical analysis of the association between SDQ scores at age two years and vulnerability risk group measured during the antenatal period (Table 15) and at the nine month time point (Table 16) was conducted. Compared to those in the low risk vulnerability group, children within the high risk vulnerability group were more likely to have an abnormal SDQ score at two years of age. The odds ratio of an abnormal SDQ score for those in the high risk group in the antenatal period was 7, and the odds ratio of an abnormal SDQ score for those in the high risk group at nine months of age was 8. In addition, compared to the low risk vulnerability group, children within the medium risk vulnerability group were over two times more likely (if they were in the medium risk group at either antenatal or nine month time periods) to have an abnormal SDQ score at two years of age.

**Table 15: Association of antenatal vulnerability risk groups with SDQ outcomes at two years**

Variable	OR	95 % CI lower	95 % CI upper	P-value
Medium vs low	2.317	2.059	2.608	<.0001
High vs low	7.224	6.135	8.506	<.0001

Note that the reference group for SDQ is 'Low risk of negative behaviour outcomes'

**Table 16: Association of nine month vulnerability risk groups with SDQ outcomes at two years**

Variable	OR	95 % CI lower	95 % CI upper	P-value
Medium vs low	2.556	2.255	2.897	<.0001
High vs low	8.415	7.13	9.933	<.0001

Note that the reference group for SDQ is 'Low risk of negative behaviour outcomes'

Thirdly, to examine the association between vulnerability transitions at the antenatal and nine month time periods with SDQ outcomes at age two years, the distribution of SDQ outcomes scores amongst these vulnerability states was determined (Table 17).

Compared to those in the stably low vulnerability group (no risk factors at either the antenatal or the nine month time period), a greater proportion of children within the stably high vulnerability group (high risk at antenatal and high risk at nine months) was considered to have 'abnormal' SDQ scores. Likewise, in comparison to the stably low vulnerability group, a greater proportion of children exposed to the increased vulnerability risk group was considered to have 'abnormal' SDQ scores at age two years.

*"I have found it challenging to mix a stressful full time job with being a parent, especially when trying to manage her behaviour when we don't have the same ideas about discipline and telling her off."*

**Table 17: Distribution of SDQ outcomes at two years amongst the antenatal to nine month vulnerability risk groups of stably high, stably low and increased vulnerability**

Total SDQ category	Stably low n (%)	Stably high n (%)	Increased risk group n (%)
Low risk	1710 (83.0)	144 (31.4)	651 (61.0)
Borderline	208 (10.1)	97 (21.2)	209 (19.6)
Abnormal	142 (6.9)	217 (47.4)	207 (19.4)

Finally, these longitudinal vulnerability risk states were modelled with SDQ outcomes at age two years to determine whether they were significantly associated with SDQ scores (Table 18). This analysis showed that children were more likely to fall into the 'abnormal' behaviour category if they were consistently exposed to high vulnerability risk in the early months of life, and if they increased their vulnerability risk in the first nine months. Interestingly, children who decreased their vulnerability risk between the antenatal period and the first nine months of life were less likely to fall into the 'abnormal' behaviour category than were those consistently exposed to high vulnerability risk.

**Table 18: Association of the antenatal to nine month vulnerability risk groups of stably high, stably low and increased vulnerability with SDQ outcomes at two years**

Variable	OR	Standard error	95% CI lower	95% CI upper	P-value
<b>SDQ score</b>					
Stably high vs stably low	8.24	0.16	5.99	11.34	<.0001
Increased vs stably low	2.67	0.13	2.07	3.43	<.0001
Decreased vs stably high	0.28	0.16	0.21	0.39	<.0001

Note that the reference group for SDQ is 'Low risk of negative behaviour outcomes'

## 6.3 Contact with social services

Families were asked at two years of age whether they were in contact with specific social services, and they were also provided with the opportunity to self-report on services they were in contact with during the first two years of their child's life. Table 19 describes the number and proportions of families accessing CYF, Whānau Ora, Family Start, Parents as First Teachers, and other services. These are grouped by antenatal vulnerability risk group. The greatest proportion of families accessing CYF and Family Start services are in the high vulnerability risk group.



"Parenting in isolation is the hardest, and the worries and concerns that go with that especially when I'm away from any services, family, friends, and support."

The greatest proportion of families using Whānau Ora, Parents as First Teachers, and other services are in the medium vulnerability risk group.

Table 19: Access of social services by families with two-year-old children

Service accessed	Low vulnerability risk during late pregnancy			Medium vulnerability risk during late pregnancy			High vulnerability risk during late pregnancy		
	n	Row %	Column %	n	Row %	Column %	n	Row %	Column %
Whānau Ora	16	15.5	0.6	48	46.6	1.8	39	37.9	5.3
CYF	<10*	7.5	<1.0	30	37.5	1.1	44	55.0	6.0
Other services (all mentioned)	77	27.2	2.7	123	43.5	4.6	83	29.3	11.3
Family Start	<10*	3.7	<1.0	33	40.7	1.2	45	55.6	6.1
Parents as First Teachers	20	37.0	<1.0	30	55.6	1.1	<10*	7.4	<1.0

\*Frequencies less than 10 not reported

## 6.4 Key points

- Those children who were exposed to persistently high vulnerability risk were more likely to have experienced chest infections, and to have incomplete immunisations by the age of two years
- Ear infections did not seem to be related to differential exposure to risk factors
- There was a small, but not significant, protective effect on other two year health outcomes when moving out of stably high vulnerability risk
- Those children exposed to high vulnerability risk during the antenatal period, or at nine months, were more likely to fall into the 'abnormal' SDQ category
- Those children who experienced persistently high vulnerability risk, and those who experienced an increase in vulnerability risk were more likely to fall into the 'abnormal' SDQ category when compared to those who were in the stably low vulnerability risk group
- The majority of families who had accessed CYF or Family Start by age two years had been in the high vulnerability risk group during late pregnancy, however there was a small proportion of families using these services who had no vulnerability risk factors during late pregnancy
- The largest proportion of families accessing Whānau Ora, or Parents as First Teachers, were in the medium vulnerability risk group during late pregnancy. Less than 10% of those families using Parents as First Teachers were from the high vulnerability risk group.



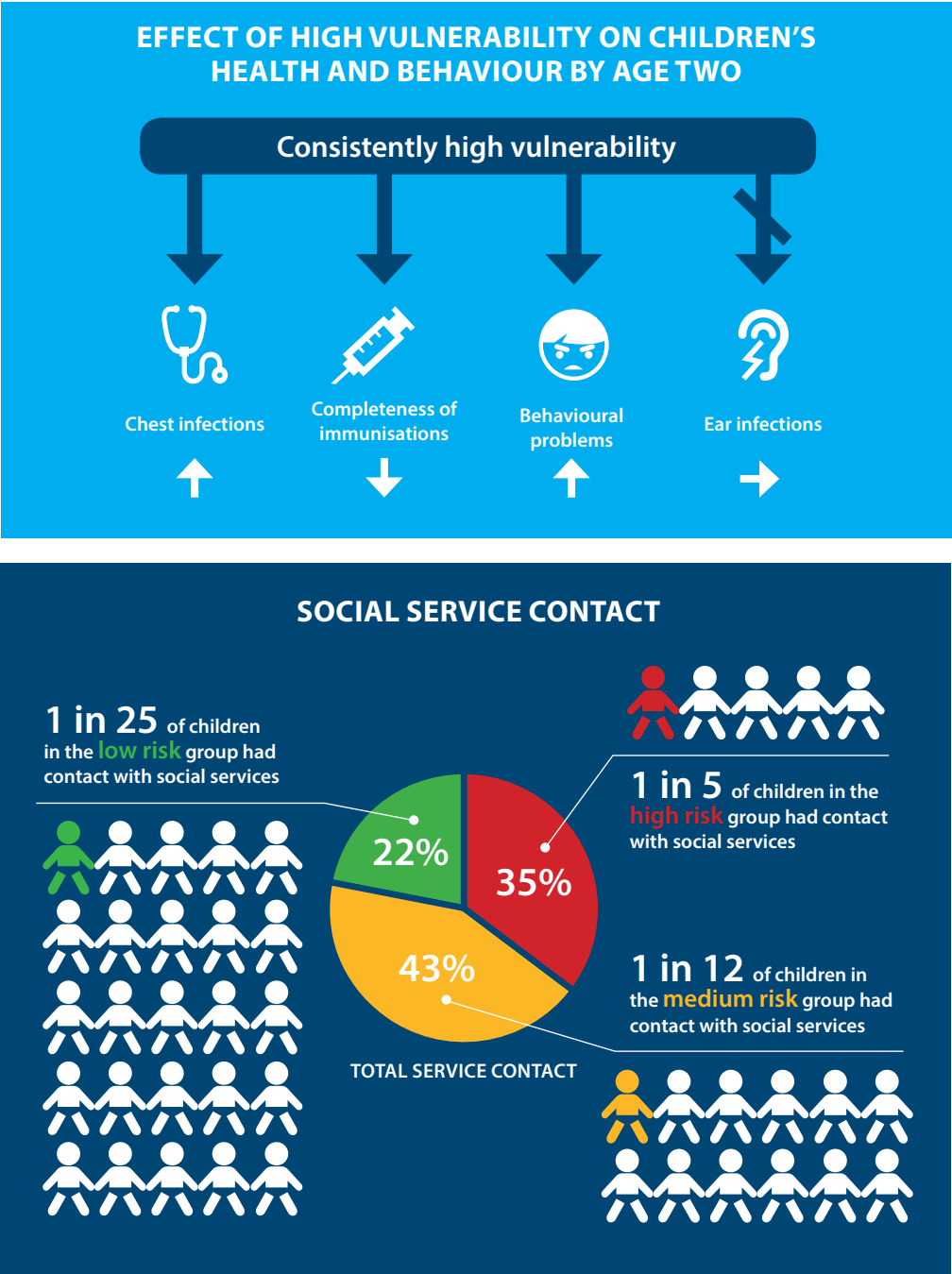


Figure 20: Key points from Chapter 6 – Impact of vulnerability transitions on outcomes at two years of age



## 7. Insights from exploring transitions in vulnerability



*Transitions in exposure to vulnerability in the first 1000 days of life*, the second report in *Growing Up in New Zealand's Vulnerability and Resilience* series has explored transitions (and stability) in exposure to risk factors for vulnerability over time. It has explored both what shapes these transitions and what these different patterns of relative exposure mean for health and behavioural outcomes for the cohort children within their first 1000 days of development, when early trajectories of later life wellbeing and development are already being set.

The reason for focusing on early life vulnerability is primarily because it remains an important area of policy focus in the New Zealand context. Many strategies are currently either being developed, implemented or evaluated to ensure policy interventions and support are accurately targeted at the most vulnerable children. Well targeted strategies from as early as possible in children's lives will potentially provide the most cost-efficient way to reduce the downstream effects of vulnerability and give all children the best possible start in life.

The policy focus to reduce children's exposure to vulnerability as well as to reduce the downstream effects of cumulative exposure is justified given the graded relationship seen between greater cumulative exposure to vulnerability and both poor child health (also described in Morton et al. 2014c) and abnormal child behavioural and developmental SDQ scores. In particular, exposure to early vulnerability in pregnancy and throughout infancy is associated with marked differences in the likelihood that children will have SDQ scores that classify them as high risk for abnormal behaviour even at two years of age. There is also evidence that duration of exposure to risk matters (as described in Section 6).

This second report has explored transitions in exposure to vulnerability utilising the same set of 12 routinely available maternal and socio-demographic variables (or 'risk factors') used to describe vulnerability in the first report: '*Exploring the Definition of Vulnerability for Children in their First 1000 Days*' (Morton et al. 2014c). Cumulative exposure is again measured by summing the absolute number of the 12 risk factors that the children are exposed to at any one time point as well as over multiple time points. This method has been shown internationally to be a very strong proxy for determining relative exposure to vulnerability at a population level (Evans et al., 2013).

## 7.1 Focus on transitions in exposure to the 12 vulnerability risk factors

*Transitions in exposure to vulnerability in the first 1000 days of life* has provided a more detailed exploration of how the 12 risk factors cluster at different time points as well as how risk factors tend to commonly co-occur, or do not, in early life. In particular the analyses explored which of the 12 risk factors were most likely to be associated with exposure to extremes of vulnerability risk as well as with movement into and out of these risk categories. This information is used here to consider how to better target strategies to the most vulnerable children.

### Area level deprivation

The most common of the 12 risk factors experienced by children at any measurement point during their first 1000 days was that they were living in an area of high deprivation. While this is measured as a single risk factor it is worthwhile noting that area level deprivation is of course a composite measure of multiple socio-demographic variables, and because of the way it is

derived, 20% of the New Zealand population would be expected to live in each NZDep2006 quintile. In general, families with young children in New Zealand, as well as in the cohort specifically, are known to be over-represented in the most deprived quintile (Morton et al., 2012a). So it is not surprising that exposure to this risk factor is common at each of the early life time points. Living in a high deprivation area was also the most likely risk factor to occur as a single risk (with none of the other 11 risk factors for vulnerability) for children at the lowest end of the medium risk category, at each of the antenatal, nine month and two year time points. This most probably reflects the heterogeneity of families living in any defined deprivation area, with individual families having differing levels of need for support. From a policy perspective this finding suggests that traditional targeting of support by deprivation area to reduce downstream effects of exposure to vulnerability may not be accurately targeted. It is true that approximately four out of five of the cohort children living in NZDep2006 deciles 9 or 10 did experience additional risk factors for vulnerability, but for approximately 20% of the families with children in the cohort, this additional targeted support may well be unnecessary.

### Acute pregnancy specific risks

Further risk factors that tended to occur singly in pregnancy were those defined as 'acute pregnancy specific conditions' in Report 1 (Morton et al., 2014c). Maternal poor physical or mental wellbeing were two of these risks that were frequently observed occurring as the single risk factor a child was exposed to. At an individual child level, these pregnancy specific maternal wellbeing risk factors frequently resolved between late pregnancy and the postnatal period, thereby reducing some children's exposure to vulnerability. However, many mothers also experienced poor health in the postnatal period when they had previously reported good health in pregnancy, meaning there was considerable flux in the exposure of individual children to these risk factors. While overall the proportion of children in the cohort exposed to poor maternal wellbeing in the postnatal period, compared to the antenatal period, reduced for maternal depression and remained similar for poor or fair maternal wellbeing, the individual children exposed changed considerably. In terms of reducing the impact of these acute pregnancy risks, we could look to the unique lead maternity care system that exists in the New Zealand context, designed to care for all pregnant women. Generally this system is working effectively to deliver high quality perinatal care (Bartholomew et al., 2015), but the system does lead to discontinuity in the provision of primary care for mothers during pregnancy as well as for mothers and their babies postnatally (beyond the first few weeks). Ensuring there is appropriate and affordable access to health services for all new mothers, as well as adequate checks to recognise poor maternal health early, should not be compromised because mothers almost always change primary carers at this vulnerable time for themselves and their infants.

### Exposure to financial stress

A further risk factor that occurred frequently as a single risk factor was acute financial stress. Late pregnancy and early postnatal life are times when families report a reduction in household income and, as described in *Now we are born* (Morton et al., 2012a), when the majority of families are reliant on multiple sources of income to support their families. Recent 2015 changes to the Paid Parental Leave legislation may have helped to alleviate some of the acute stress that families reported facing around the time of their child's birth in 2009/10. This legislative change has better aligned the paid parental leave provisions with parents' reported wishes to take longer periods of leave with higher levels of payment.

As well as being associated with increasing exposure to vulnerability in the postnatal period, financial stress was also a risk factor associated with decreasing exposure to vulnerability for children after birth. Understanding why this risk factor was associated with increasing as well as decreasing exposure to vulnerability will require further longitudinal information from families and more detailed analysis when this information becomes available.

## Teenage motherhood

Other risk factors tended to occur with others more frequently than they occurred in isolation. Approximately 1 in 10 of the cohort children were exposed to four or more risk factors at each time point during early life and there was evidence of common clustering of some specific risk factors (as described in Report 1; Morton et al., 2014c). The most common clusters of risk factors included a combination of maternal characteristics and characteristics of the home environment. In particular, having a mother who was a teenage parent commonly co-occurred with having no partner, living in a public rental and having incomplete secondary school education.

From a policy perspective, strategies aimed at preventing teenage pregnancy are often prioritised, given New Zealand's high rate of teenage pregnancy compared to most other OECD countries. However, not all teenage pregnancies are unplanned or are inevitably linked to poor child outcomes. In addition to ongoing preventive strategies, the common co-occurrence of risk factors experienced by children of teenage mothers provides the impetus for moves towards greater co-ordination of the multiple social services agencies that currently support young mothers and their babies in the perinatal and postnatal period. Being exposed to four or more risk factors means that children born to young mothers are likely to be in the high vulnerability risk group. Currently it appears that this group is not accessing social services at the level that we might expect (Section 6.3). Perhaps providing all young mothers with a single case worker, who could ensure that they have access to support across multiple domains, for example access to advice about their own and their baby's health and wellbeing (especially if there is no partner) as well as access to affordable, safe housing and access to ongoing educational or training opportunities with appropriate and affordable child care could provide a more efficient way to provide services to meet specific need. This would represent a more proactive approach than either requiring young mothers to interact with multiple agencies themselves or to wait until they have experienced problems before they receive this co-ordinated support.

## 7.2 Focus on transitions in vulnerability risk groups over time

To more usefully explore transitions in exposure to vulnerability, risk was categorised into three groups for this report: low vulnerability risk (no risk factors); medium vulnerability risk (1-3 risk factors); and high vulnerability risk (4 or more risk factors). This categorisation differs slightly from that used in Report 1 which focused on explaining the impact of cumulative exposure on early health outcomes. This change was made to ensure that the low risk group had no risk factors so stability of exposure and transitions in and out of this group at one point and over time could be better explored with a null reference group.

Across the cohort the majority of the children (72%) remained in the same grouped risk category between the antenatal period and when they were nine months of age, meaning that they experienced approximately the same absolute number of risk factors throughout

this perinatal period. That stability of relative exposure to vulnerability was the most common experience for the cohort children. This provides further impetus to consider how to reduce exposure to all 12 risk factors during pregnancy – or even before – rather than waiting for problems to develop in the postnatal period before providing support.

Most change in the number of risk factors experienced by individual children was the result of the gain or loss of just one risk factor, in terms of only total number of risks experienced. At the transition points of risk categorisation this meant that children moving from low (no risk factors) to medium risk between the antenatal and nine month time period most commonly gained just one risk factor. Similarly movement out of the high risk category was usually associated with a change in the number of risk factors experienced from four to three for the majority of children who experienced a change in their risk group. The gain or loss of a sufficient number of risk factors to move children from the low to the high risk group in this perinatal period or in the opposite direction was experienced by only a few children.

However while the absolute number of risk factors experienced by the children from before their births and throughout their early months tended to be relatively stable, the specific risk factors experienced at the individual level often varied even if the total number of risk factors experienced did not change.

## Public rental and maternal smoking

In addition to area level deprivation (noted in Section 7.1), type of household tenure and maternal smoking were highly stable individual risk factors experienced by children in the cohort between late pregnancy and the postnatal period. Families who were living in public rental during pregnancy were highly likely to be in public rental after the birth of their child, and children in these families were amongst the most vulnerable. Therefore ensuring that public rental properties provide affordable, safe and warm home environments for young children is especially important.

At an individual level maternal smoking behaviour was also unlikely to change from late pregnancy to the postnatal period. Mothers who were smoking in late pregnancy almost always continued to smoke in the postnatal period. A further small group of previous smokers did return to smoking after the birth of their child, although overall rates of maternal smoking remained lower in the postnatal period compared to pre-pregnancy rates. This suggests further that the optimal time to support efforts to reduce maternal smoking is either prior to pregnancy or in early pregnancy to support mothers to quit during their pregnancy.

## Overcrowding

Overcrowding is a risk factor that was associated with medium stability of exposure to risk between the antenatal and postnatal periods. It was also one risk factor that was frequently newly added to an individual child's exposure profile after birth. This risk factor requires careful interpretation around this time. Overcrowding is a known risk factor for poor child health outcomes, but it is not yet clear whether new exposure postnatally carries a similar risk to persistence of exposure where the overcrowding preceded the cohort child's birth. The effect of persistence will be able to be compared to the effects of new or limited exposure to overcrowding as more longitudinal exposure and child outcome information becomes available.

## 7.3 Focus on other familial and environmental factors associated with risk transitions

As well as the 12 risk factors used to define vulnerability in this report, we also explore what other familial and wider environmental factors are associated with either persistence of exposure to vulnerability or with a change in risk exposure. The primary purpose of these analyses is to ascertain whether these wider factors might be amenable to intervention to potentially reduce exposure to vulnerability or mitigate the effects of exposure in early life.

Two key factors that were associated with a greater likelihood of persistence of exposure to vulnerability in early life, as well as with a tendency for exposure to vulnerability to increase over this time period, were firstly whether a pregnancy was planned or not, and secondly the nature and level of support at a family level.

### Unplanned pregnancy

The pregnancy characteristic most likely to be associated with children experiencing clusters of risk factors and being in higher risk groups for vulnerability was whether the pregnancy itself was planned or unplanned. The likelihood of children being exposed to stably high vulnerability risks compared to stably low (between pregnancy and infancy) was greater for this characteristic than any other. Other familial factors that might be expected to be associated with an unplanned pregnancy (including relationship status and family stress) only explained a small fraction of the association in multivariate analyses (Table 12).

Unplanned pregnancies were common, with approximately 40% of the *Growing Up in New Zealand* cohort pregnancies reportedly being unplanned (Morton et al., 2012a). It is difficult to imagine that this rate will ever reduce completely and it is important to note that unplanned does not mean unwanted. However it may often mean unprepared and therefore this prompts a more general consideration of how support is provided for all pregnant mothers and families so that being unprepared does not expose children to such a high likelihood of experiencing significant vulnerability from the time of their birth. Policies across sectors that support appropriate durations of paid parental leave; support parents to continue to participate in the workforce; support the provision of affordable and accessible child care; and support opportunities for families to find safe and secure housing would all contribute to this. This multi-sectoral approach supports the call for children's needs to be considered in all policy evaluation and development (New Zealand Government, 2011a).

### Level and nature of family support

Other familial and environmental factors that were associated with children's likelihood of exposure to early life vulnerability concerned the nature of the familial relationships and the level of support internal to and external to the children's families. For example, the less committed parents reported being to each other and the more stress they perceived in their relationship and family, the more likely their child was to experience high levels of vulnerability. Perceived stress can be challenging to disentangle in a temporal and causal sense from exposure to vulnerability, as it may either be a result of, or an inevitable co-factor of, experiencing disadvantage, rather than a catalyst for increasing exposure to vulnerability.



Regardless, providing good support for all families with young children (as suggested above) could assist with reducing perceived stress and support all families better to provide an environment that enables their children to flourish.

This broad support is potentially of even more importance for children born to parents who have migrated to New Zealand since their own birth. These families make up almost a third of all *Growing Up in New Zealand* cohort families. This type of support may also assist the several hundred parents of cohort children who report living with a chronic disability. Children born to migrant parents had a higher likelihood of experiencing early vulnerability and often have fewer resources to draw on in terms of extended family and wider community support. Similarly a child born to a parent with a chronic disability is more likely to be exposed to higher levels of vulnerability and the parent may require more support to care for their children.

It is again salient to note that families of children experiencing the highest vulnerability risk group during pregnancy reported levels of engagement with current services designed to support them well below what might be expected given their perceived need (Table 20).

## 7.4 Looking ahead – where to next?

This second report in the Vulnerability and Resilience series has focused on transitions in and out of vulnerability. Already the analyses of the early longitudinal information collected from three time points over the first 1000 days of the children's lives have identified that some specific risk factors from the 12 used to define vulnerability are more likely than others to contribute to children being exposed to cumulative vulnerability. The early longitudinal information has also identified some wider familial and environmental characteristics that are associated with a greater likelihood of either persistent or increasing vulnerability exposure. In this final section this information has been integrated to suggest possible policy approaches to reduce either the exposure or the impact of vulnerability for children from before their birth. These suggestions are designed to inform policy discussions across sectors rather than being an end in themselves.

The analyses in this report extend the exploration of vulnerability begun in Report 1 in this series, but they are only the beginning of where analyses will head as further longitudinal exposures and child outcome measures become available from the pre-school period and beyond. In particular this report has not explored what shapes resilience for children in the face of adverse early environments in any detail. This will be a key focus of a future report when further longitudinal information is available to measure this important area to inform 'what works' to support the healthy development of vulnerable children in New Zealand today.



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# 9. Appendices

## Appendix 1

Support measures contrasted between stably low and stably high vulnerability risk groups (raw scores from questionnaire scales; arbitrary units presented). Information shown is the mean score for each questionnaire scale, along with the difference between mean scores and the percent difference between mean scores.

	Maximum score	Stably low n = 1849	Stably high n = 457	Difference	Percent difference
External environment	86	58.6	56.0	-2.6	-4.6
Perceived stress score	40	10.1	18.2	8.1	44.5
Family environment	66	41.0	33.7	-7.3	-21.7
Relationship stress	105	88.8	78.5	-10.3	-13.1
Personal commitment	15	9.8	8.6	-1.2	-14.0
Relationship commitment	15	9.7	8.7	-1.0	-11.5

Support measures for those in stably low risk group and those who had increased their risk group (raw scores from questionnaire scales; arbitrary units presented). Information shown is the mean score for each questionnaire scale, along with the difference between mean scores and the percent difference between mean scores.

	Maximum score	Stably low n = 1849	Stably high n = 457	Difference	Percent difference
External environment	86	58.6	57.1	-1.5	-2.6
Perceived stress score	40	10.1	13.3	3.2	24.1
Family environment	66	41.0	38.4	-2.6	-6.8
Relationship stress	105	88.8	86.6	-2.2	-2.5
Personal commitment	15	9.8	9.6	-0.2	-2.1
Relationship commitment	15	9.7	9.5	-0.2	-2.1

Support measures for those in stably high risk group and those who had decreased their risk group (raw scores from questionnaire scales; arbitrary units presented). Information shown is the mean score for each questionnaire scale, along with the difference between mean scores and the percent difference between mean scores.

	Maximum score	Stably low n = 1849	Stably high n = 457	Difference	Percent difference
External environment	86	56	57.1	-1.5	1.9
Perceived stress score	40	18.2	15.1	3.2	-20.5
Family environment	66	33.7	36.6	-2.6	7.9
Relationship stress	105	78.5	85.5	-2.2	8.2
Personal commitment	15	8.6	9.5	-0.2	9.5
Relationship commitment	15	8.7	9.4	-0.2	7.4

## Appendix 2

### Statistical model development: Multivariable logistic regression model to explore the odds of experiencing stably high vulnerability compared to the stably low vulnerability group

**Model 1:** shows the associations of pre-existing and early pregnancy characteristics with vulnerability outcome, adjusted for maternal self-prioritised ethnicity, gender, and parity

	Odds of being in stably high vulnerability group compared to the stably low vulnerability group				
	OR	SE	95% CI lower	95% CI upper	P-value
Not born in NZ, lived in NZ less than five years	3.251	0.4431	1.364	7.748	0.0078
Not born in NZ, lived in NZ five or more years	4.782	0.3430	2.441	9.366	<.0001
Residential mobility – moved	0.521	0.2569	0.315	0.862	0.0112
English language not main language used at home	0.368	0.4232	0.167	0.81	0.013
Current disability	6.815	0.3005	0.123	0.4	<.0001
Unplanned pregnancy	25.114	0.1942	17.165	36.744	<.0001

**Model 2:** shows the associations of pre-existing and early pregnancy and later pregnancy characteristics with vulnerability outcome, adjusted for maternal self-prioritised ethnicity, gender, and parity

	Odds of being in stably high vulnerability group compared to the stably low vulnerability group				
	OR	SE	95% CI lower	95% CI upper	P-value
Not born in NZ, lived in NZ less than five years	5.86	0.5468	2.007	17.113	0.0012
Not born in NZ, lived in NZ five or more years	6.35	0.4333	2.716	14.848	<.0001
Residential mobility – moved	0.624	0.3034	0.344	1.131	0.1205
English language not main language used at home	0.563	0.4628	0.227	1.395	0.2149
Current disability	3.521	0.3872	0.133	0.606	0.0011
Unplanned pregnancy	21.332	0.2367	13.414	33.923	<.0001
External environment – less support	1.03	0.0197	1.001	1.06	0.0416
Higher perceived stress	0.82	0.0206	0.787	0.854	<.0001
Family environment – more family stress	1.131	0.0181	1.092	1.172	<.0001

## Statistical model development: Multivariable logistic regression model to explore the odds of experiencing increased vulnerability compared to the stably low vulnerability group

**Model 1:** shows the associations of pre-existing and early pregnancy characteristics with vulnerability outcome, adjusted for maternal self-prioritised ethnicity, gender, and parity

	Odds of experiencing increased vulnerability group compared to the stably low vulnerability group				
	OR	SE	95% CI lower	95% CI upper	P-value
Not born in NZ, lived in NZ less than five years	0.754	0.1606	0.551	1.033	0.0791
Not born in NZ, lived in NZ five or more years	1.178	0.1357	0.903	1.536	0.2283
Residential mobility – moved	0.935	0.1299	0.725	1.206	0.6057
English language not main language used at home	0.793	0.1827	0.554	1.135	0.2048
Current disability	1.615	0.1866	0.43	0.893	0.0102
Unplanned pregnancy	2.893	0.1027	2.365	3.538	<.0001

**Model 2:** shows the associations of pre-existing and early pregnancy and later pregnancy characteristics with vulnerability outcome, adjusted for maternal self-prioritised ethnicity, gender, and parity

	Odds of experiencing increased vulnerability group compared to the stably low vulnerability group				
	OR	SE	95% CI lower	95% CI upper	P-value
Not born in NZ, lived in NZ less than five years	0.773	0.1647	0.559	1.067	0.1175
Not born in NZ, lived in NZ five or more years	1.252	0.1414	0.949	1.651	0.1123
Residential mobility – moved	0.952	0.1340	0.732	1.239	0.7163
English language not main language used at home	0.924	0.1881	0.639	1.336	0.6744
Current disability	0.699	0.1932	0.478	1.021	0.0636
Unplanned pregnancy	2.631	0.1070	2.134	3.245	<.0001
External environment – less support	1.019	0.0071	1.005	1.033	0.0093
Higher perceived stress	0.923	0.0092	0.906	0.94	<.0001
Family environment – more family stress	1.038	0.0085	1.021	1.055	<.0001

## Statistical model development: Multivariable logistic regression model to explore the odds of experiencing decreased vulnerability compared to the stably low vulnerability group

**Model 1:** shows the associations of pre-existing and early pregnancy characteristics with vulnerability outcome, adjusted for maternal self-prioritised ethnicity, gender, and parity

	Odds of experiencing decreased vulnerability group compared to the stably high vulnerability group				
	OR	SE	95% CI lower	95% CI upper	P-value
Not born in NZ, lived in NZ less than five years	0.483	0.3263	0.255	0.915	0.0257
Not born in NZ, lived in NZ five or more years	0.514	0.2490	0.316	0.838	0.0076
Residential mobility – moved	1.056	0.1961	0.719	1.551	0.7814
English language not main language used at home	1.049	0.2667	0.622	1.77	0.8569
Current disability	0.474	0.2498	1.293	3.442	0.0028
Unplanned pregnancy	0.246	0.1594	0.18	0.337	<.0001

**Model 2:** shows the associations of pre-existing and early pregnancy and later pregnancy characteristics with vulnerability outcome, adjusted for maternal self-prioritised ethnicity, gender, and parity

	Odds of experiencing decreased vulnerability group compared to the stably high vulnerability group				
	OR	SE	95% CI lower	95% CI upper	P-value
Not born in NZ, lived in NZ less than five years	0.433	0.3341	0.225	0.834	0.0124
Not born in NZ, lived in NZ five or more years	0.492	0.2551	0.299	0.812	0.0055
Residential mobility – moved	0.947	0.2011	0.639	1.405	0.7873
English language not main language used at home	1.026	0.2711	0.603	1.746	0.9234
Current disability	1.950	0.2588	1.174	3.239	0.0099
Unplanned pregnancy	0.275	0.1637	0.199	0.378	<.0001
External environment – less support	0.98	0.0095	0.962	0.998	0.0302
Higher perceived stress	1.039	0.0115	1.015	1.062	0.001
Family environment – more family stress	0.966	0.0103	0.947	0.986	0.0008







