Maternal health and children's socio-emotional and cognitive development:

New evidence from the Growing Up in New Zealand study

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Contents

List of figures

List of tables

Executive summary

Chronic illness and disability are long-term health conditions with wide-ranging outcomes beyond the individual, leading to outcomes that also affect other members of their family. This report examined how maternal chronic illness or disability during their child's infancy is associated with different socio-emotional and cognitive outcomes for children during early and mid-childhood. In addition, it examined how socio-economic and parenting factors can influence these outcomes.

This report used descriptive statistics and regression models to explain the association between maternal reports of living with a chronic illness or disability and child psychological outcomes during early and mid-childhood using the Growing Up in New Zealand cohort. These outcomes included maternal ratings of their child's socio-emotional development (as measured by the dimensions from the Strengths and Difficulties Questionnaire; SDQ) and maternal reports of their cognitive development, through measures of early English language skill and communication ability.

The findings from this report show that:

- The association between maternal chronic illness and disability is negligible at early ages (at ages two and five), particularly before starting school.
- At mid-childhood (at age eight), there are differences in socio-emotional outcomes between children with a mother who has experienced a long-term health condition and other children.
- Maternal chronic illness and disability are not associated with their children's early English language development.
- Family socio-economic resources and mothers' parenting styles have positive impacts on children's socio-emotional outcomes in families with maternal chronic illness and disability.

These findings suggest that maternal health status and disability present at their child's infancy is related to different children's socio-emotional outcomes at mid-childhood, after starting school, rather than at early ages. In addition, family factors such as greater socio-economic resources and more positive parenting is also related to better socio-emotional outcomes. Together, these results highlight the importance of providing relevant economic and support services for mothers with chronic illness or disability, thereby removing potential barriers to successful positive parenting.

Introduction

Chronic illnesses and disabilities can be long-lasting and affect various outcomes for adults and children. According to the 2013 New Zealand Disability Survey, approximately 24% of adults reported having a disability (Statistics New Zealand, 2014a). According to the 2020/21 New Zealand Health Survey, 10.3% of New Zealand adults reported having currently medicated high cholesterol and 16.7% reported having currently medicated high blood pressure (Ministry of Health, 2021). Evidence also suggests that rates of illness and disability that are non-fatal have remained stable since 1990 (Ministry of Health, 2020), suggesting that long-term health conditions persist in the population.

Adults living with a long-term health condition can also face social and financial stress associated with living with poorer health (Statistics New Zealand, 2014b). When a parent has a chronic illness or disability, their health status may also influence outcomes for their children, including children's psychological development (Francesconi & Heckman, 2016; Muhlenweg et al., 2016). Given the persistence and prevalence of these long-term conditions, it is important to understand the effects of chronic conditions and disabilities on family members, such as their co-residential children.

In this report, we examined how maternal chronic illness or disability during their child's infancy influenced their children's socio-emotional and cognitive development in early and mid-childhood. We focused on how associations between long-term maternal physical conditions and child psychological outcomes differ by socio-economic factors and parenting styles. To date, the association between parental chronic illness and child psychological outcomes has not been examined in the New Zealand population. In addition, we investigate cultural protective factors for Māori and Pacific families, again with a focus on mothers with a long-term health condition, and outcomes for children. Finally, we assess how chronic illness and disability may be associated with different rates of contact with government services that may ease challenges associated with long-term health conditions. Together, these findings expand our understanding of how maternal chronic illness and disability is associated with outcomes for New Zealand children and suggest areas in which public policy may help parents experiencing chronic illness and disability.

We used data from the Growing Up in New Zealand (GUiNZ) cohort, New Zealand's premier cohort study of approximately 7,000 children providing unique longitudinal information about child development in New Zealand (Growing Up in New Zealand, 2020). Although the longitudinal design of the study enables unique insights into child development over time, we note that the GUiNZ cohort may be a more socially and economically advantaged sub-set of the population compared with the general New Zealand population. The GUiNZ cohort reports a lower prevalence of chronic illness or disability compared to other cross-sectional studies of New Zealand health. For example, findings from the 2011 New

Zealand Health Study indicated a prevalence rate for chronic illnesses ranging from an estimated 2.5% of the population (for rheumatoid arthritis) to 16.2% (for chronic pain; Ministry of Health, 2021). Estimates of multimorbidity—living with multiple conditions—using Ministry of Health administrative data indicated prevalence rates between 7.9% (according to hospital discharge data) to 27.9% (according to pharmaceutical dispensing data; Stanley et al., 2018). In comparison, the prevalence in the overall GUiNZ cohort in 2011 was lower, where self-reported chronic illness prevalence rate was 10% for mothers and 8.1% for partners of the mother (Morton et al., 2012). We do not believe this undermines the insights to be gained from examining the GUiNZ data. Our focus here is not on assessing prevalence of chronic illness or disability in the general population, but rather on examining relationships between long-term health conditions of a parent and child outcomes. If such relationships are observed in GUiNZ, it suggests that these patterns may be even stronger in the general population where prevalence rates and levels of health disadvantage are higher. It also highlights areas of further examination with a view to developing policy or service interventions.

Literature review

The association between parental chronic illness and disability and child psychological outcomes in New Zealand is under-researched. The broad consensus from international research is that children with chronically ill parents have different psychological outcomes compared to children whose parents are not chronically ill. For example, children with chronically ill parents have higher scores on the Strengths and Difficulties Questionnaire (SDQ; dimensions of socio-emotional and behavioural characteristics indicating more sadness, worries, restlessness, or conflict), lower self-esteem, poorer emotional development, and lower social competence (Chen 2017; Morris et al., 2016).

Parental chronic illness may be associated with variations in children's cognitive outcomes as well. School-age children with a chronically ill parent have been reported to have poorer concentration and schoolwork completion—although these trends are likely linked to other family factors such as parental conflict (Visser et al., 2004). Research on parental disability finds similar results. Children with a parent with a disability trend towards poorer socio-emotional and behavioural development as well as delayed speech and language development relative to other children (e.g., Bogosian et al., 2010; Emerson & Brigham, 2014).

The limited past research in New Zealand has focused on mental illness rather than physical illness or disability. These studies have found that severe maternal postnatal psychological distress is associated with higher scores on the Strengths and Difficulties Questionnaire in early childhood (D'Souza et al., 2019a). In a study of Pacific Island families, Gao and colleagues (2007) report that at age two, Pacific children whose mothers reported better mental health

also reported their children as having lower internalising scores—had fewer worries and were less depressed—relative to other children.

Despite the wealth of research suggesting that children with chronically ill parents have poorer outcomes, a meta-analysis suggests that these effects, particularly for internalising and externalising scores (i.e., behaviours perceived as aggressive or hyperactive), are small (Sieh et al., 2010). Some research also contradicts past findings and has found that parental chronic illness and disability may be associated with *better* or *no differences* in outcomes (e.g., Collings & Llewellyn, 2012; Visser et al., 2004).

It is important to emphasise that the relationship between parental health and child psychological outcomes is not straightforward and is influenced by social and economic factors. Research has found that differences in child psychological outcomes are explained by economic or familial factors that are associated with managing chronic illness and disability in the family (e.g., Neely-Barnes et al., 2014). For example, the economic strain associated with managing a long-term health condition may magnify stress from living a chronic illness and disability itself. Research suggests that a chronically ill or disabled parent whose family has more financial resources to cope with chronic illness-related stress, has children with more positive socio-emotional and behavioural outcomes (Emerson & Brigham, 2014; Sieh et al., 2010) as well as better academic achievement (Chen & Fish, 2013).

In addition to socio-economic factors, parenting and parent-child relationships are important factors to consider in how long-term conditions amongst parents can impact child psychological outcomes. Positive parent-child relationships (Chen, 2017), positive communication (Howell et al., 2015), positive parenting styles (Armistead et al., 1995; Conrad & Hammen, 1993), and more parental support (Chen & Fish, 2013; Kotchik et al., 1997) are associated with better school functioning and socio-emotional outcomes for children. Similarly, less harsh and inconsistent parenting within families with parental chronic illness or disability may also be associated with better socio-emotional outcomes for children.

For Māori and Pacific families, cultural connectedness may function as a unique protective factor in the New Zealand context. Although cultural connectedness is likely beneficial for all families, it may be particularly pertinent for Māori and Pacific peoples experiencing systemic racism (e.g., Hickey & Wilson, 2017; Kapeli et al. 2020; Kidd et al., 2013). To counteract these experiences, strengths can be drawn from cultural and family connections when living with chronic illness and disability and these strengths can provide a form of scaffolding for the socio-emotional and cognitive development of Māori and Pacific children (Edwards et al., 2007). Indeed, research from the Pacific Islands Families Study suggests that Pacific children whose mothers identify with their own Pacific culture report their children as having less worry and sadness relative to those with lower identification with their Pacific culture (Paterson et

al., 2007). Similar positive outcomes have been seen for Māori youth. Cultural connectedness is associated with better mental health for Māori adolescents (Williams et al., 2018) and more effortful control for Māori children (Kukutai et al., 2020). However, research on Māori and Pacific families with chronic illness and disability and children's psychological development remains scarce.

Research questions, aims, and hypotheses

Our study used data from the GUiNZ cohort to examine how maternal chronic illness and disability are associated with the socio-emotional and cognitive development of New Zealand children. In addition, we examined how familial socio-economic and parenting factors as well as cultural connectedness can strengthen child socio-emotional development. For this report, we focused on socio-emotional development outcomes and English language and communication outcomes at early and mid-childhood.

We addressed the following questions:

1. How do maternal chronic illness and disability influence children's early and mid-childhood psychosocial and cognitive development?

2. Do socio-economic or family socio-emotional factors vary the associations between maternal chronic illness/disability and the socio-emotional/cognitive development of children, in particular for the most vulnerable children, who share important risk factors with the children supported by government services (including government payments and contact with Oranga Tamariki)?

3. How do maternal chronic illness and disability associate with the socio-emotional and cognitive development of Māori and Pacific children?

4. Does cultural identity and connectedness influence the associations between maternal chronic illness and disability and child development?

5. What are the demographic characteristics of families receiving government support (including payments and contact with government services), particularly for mothers with a chronic illness or disability? What are the potential reasons for the under-utilisation of government support for mothers with chronic illness or disability?

Method

Data

We used data from the Growing Up in New Zealand (GUiNZ) study, a child-focused longitudinal cohort of New Zealand families. The purpose of the study is to follow children and families from before birth and to understand the pathways leading to equitable and healthy child development in contemporary New Zealand. This study commenced in 2009/10 and families were recruited during the children's mothers' pregnancy (Growing Up in New Zealand, 2020). A cohort of 6,853 children were born into the study. At the time of this report, the study has collected data for their cohort up to eight years of age as well as a COVID-19-specific data collection wave.

We identify waves by the age of the child that corresponds with each data collection wave. We used data from five waves of the study, which included the antenatal wave and the waves in which the cohort is aged nine months, two years, five years (or 54 months), and eight years. At the nine-month wave, the GUiNZ cohort included 6,847 children and at the eight-year wave, the cohort included 5,004 children.

We focused on the health and disability of mothers rather than both parents as the mother is the parent that is consistently interviewed by the study across all years and in most cases, is the primary carer of the child in the New Zealand population (Statistics New Zealand, 2013). Although it would be useful to consider the impact of father's health on child development in future studies, this is dependent on the availability of suitable data and is beyond the scope of the current study.

Our indicator of maternal chronic illness comes from a survey undertaken when the child was aged nine months of age. The exact same question is not asked in subsequent surveys and thus we are unable to accurately assess the persistence of these conditions over time. We also have limited information on the severity of the chronic illness. Although the GUiNZ study asked about parents' perceptions of how their illness or disability affects their parenting, the number of responses to this question was limited and so we did not include this variable in our analyses. Future research drawing on other datasets, for example the New Zealand Health Survey or the Integrated Data Infrastructure, may be able to address some of these gaps.

Maternal chronic illness and disability

In line with most longitudinal research studies analysing individuals' health status, our measures of maternal chronic illness and disability are self-reported. Previous studies have found self-reported health status of adult populations are valid and reliable health indicators (e.g., Miilunpalo et al., 1997). We use the self-reported measures of maternal chronic illness and disability data collected

when the child was aged nine months, referred to subsequently as the nine-month wave. The nine-month wave is the only wave in which mothers were specifically asked about both chronic illness and disability status.

To identify mothers with a chronic illness, we used their responses to the question *"Do you currently have an illness that is long term, lasting 6 months or more?"* In the sample, 580 mothers reported having only a chronic illness.

To identify mothers with a disability, we used their responses to the question *"Do you currently have a disability that is long term, lasting 6 months or more?"*. In the sample, 266 mothers reported a disability (this group could include people who also had a chronic illness).

Of our sample, 82 mothers had both a chronic illness and a disability. A total of 846 of our sample had both or either a chronic illness or a disability.

Demographic characteristics of mothers included in our analyses are summarised in Appendix 1.

We also checked for overlap between chronic illness reports and pregnancy-related conditions as a data quality check. Only 13% of the sample reported a pregnancy-related condition and reported a chronic illness. This indicates that our measure of chronic illness is unlikely to be capturing a short-term pregnancy-related health issue. For full details of this, see Appendix 1.

Māori and Pacific families

Māori and Pacific families were identified as Māori or Pacific if either mother (asked at the antenatal wave) or child (asked of the parent at the nine-month wave) identified as being Māori or Pacific. Participants could identify with more than one ethnicity and thus some participants may be both Māori and Pacific. For analyses of Māori and Pacific families, the samples were restricted to families who identified as Māori or Pacific. There may be some overlap in participants from our approach as some mothers and children will identify with both Māori and Pacific ethnicities.

Focal psychological measures

Our outcome variables included child socio-emotional and cognitive outcomes, measured across several waves of the GUiNZ, starting at the nine-month wave until the eight-year wave. This allowed us to study the association between maternal chronic illness and disability on child psychological outcomes from early to mid-childhood. We report descriptive statistics on each outcome variable in Appendix 1. We also include a full list and details of all measures in Appendix 1. All measures in our analyses were reported by the mother.

Child psychological outcomes

For child socio-emotional outcomes we examined children's scores, based on mother's responses to items in the Strengths and Difficulties Questionnaire (SDQ), at the two-, five-, and eight-year waves. We examined the five separate dimensions of the SDQ: emotional problems, peer problems, hyperactivity/inattention, conduct problems, and prosociality.

For child cognitive outcomes, we examined mother's ratings of the child's early English language communication and vocabulary using the Communication and Symbolic Behaviour Scale (CSBS) and MacArthur CDI-I Words and Gestures (MacArthur CDI-I) at the nine-month wave, and MacArthur CDI-II Words and Sentences (MacArthur CDI-II) at the two-year wave.

Family support and parenting styles

We examined a range of parenting and family factors. These included measures of family support (measured in the antenatal wave), mother's interest in the baby (measured in the nine-month wave), confidence in parenting (measured in the two-year wave), parenting enjoyment (two-year wave), warm parenting (five- and eight-year waves), authoritarian parenting (five- and eight-year waves), hostile parenting (five- and eight-year waves), parenting efficacy (five- and eight-year waves).

Cultural connectedness

To examine cultural connectedness, we included measures of a mother's cultural identity and engagement. These included: belonging to a community (measured in the antenatal wave), the importance of their ethnicity (two-year wave), the strength of their ethnic identification (five-year wave) and cultural engagement (five-year wave)

Moderator variables

We examined maternal socio-economic status and positive parenting practices as potential moderators of the association between a mother's chronic illness or disability and child psychological outcomes.

We constructed a binary categorical variable to identify socio-economic disadvantage using measures of maternal education and household income. These data were collected at the nine-month wave. Families whose mothers' had secondary school level education or below as well as earning less than the national median household income were identified as 'lower education, lower income' in our sample. All other families were the reference category. We call this our index of socio-economic disadvantage.

We constructed the index for positive parenting for each wave, based on a weighted average of each of our parenting measures. This index is a composite measure of all parenting variables. All items were transformed to be positively

valenced (i.e., higher values indicating more positive parenting). For each wave of interest, a combined measure of all parenting measure data collected up until that wave were included in the index. For example, for the two-year wave, parenting measures from the antenatal wave up to the two-year wave were combined and weighted based on the number of measures included in the index. A list of all parenting variables included in our positive parenting index is in Appendix 1.

Government service engagement

We examined maternal engagement with government services and payments using two binary measures of contact with government organisations and receipt of government payments. Due to low counts in some questions that ask participants whether they receive government payments or have contact with service organisations, binary measures for contact with government organisations and government payment receipts were created. Any contact with any organisation was identified as having contact with a government organisation. Any receipt of any government payment was identified as receiving a government payment. For further information on how these variables were constructed, please see Appendix 1.

Analytical strategy

For our child psychological outcome variables, we focused on one cognitive area – early English language development (as measured by the CSBS and MacArthur CDI-I and CDI-II) and one set of measures of socio-emotional development (SDQ dimensions of emotional problems, peer problems, hyperactivity/inattention, conduct problems, and prosociality). We focus on the scores across individual dimensions rather than the 'Total Score' when assessing the SDQ. The 'Total Score' is used to determine the 'severity' of 'difficulties' across all measures of the SDQ. Although the SDQ is used for clinical diagnosis of socio-emotional difficulties, either through scores of the individual dimensions or through the Total Score, we focus on general associations between our focal variables and child psychological outcomes. We appreciate the clinical purpose of the measure, however we have chosen this approach to minimise stigmatising the socio-emotional development of children, particularly for Māori and Pacific families towards whom the SDQ may be biased (see Kersten, Dudley, et al., 2016).

We first conducted descriptive analyses of child socio-emotional and cognitive outcomes between children whose mothers have a chronic illness, a disability, or neither a chronic illness nor disability. For these analyses, t-tests were conducted to compare responses from mothers with neither a chronic illness nor disability against the chronic illness group and disability group. We are aware that descriptive statistics may be misleading as they do not take account of potential confounding associations between uncontrolled variables and the

outcomes of interest. However, we believe that descriptive statistics are useful to present a preliminary view of the variables under investigation.

We then examined how maternal chronic illness and disability is associated with child psychological outcomes using ordinary least squares regression analyses. In the regression analyses, for ease of interpretation, all outcome variables are standardised. In addition, due to small cases in the measures of maternal chronic illness and disability status, maternal health was assessed through a single binary measure. We combined all responses of chronic illness and disability into one variable in which we identified all mothers with either or both a chronic illness and/or disability. Regression analyses allow us to statistically adjust for maternal demographic characteristics, socio-economic and family factors that can influence child psychological outcomes. Our maternal demographic characteristics include the mother's age, education, pre-pregnancy body mass index (BMI), and whether the child lives in a rural or urban area. We also examine socio-economic factors such as household income and the 2006 New Zealand Deprivation Index (NZDep2006). Finally, we include family support and parenting style variables in our models.

For our analyses of Māori and Pacific families, we restrict the sample to Māori families or Pacific families. We estimate models with a reduced set of demographic and socio-economic variables due to higher rates of missing data for these sub-samples relative to the full sample. We only include mother's age, NZDep2006, and a binary measure of mother's education attainment (whether or not their highest level of education was an undergraduate degree or higher). We also incorporate measures of cultural identity and community engagement for our Māori and Pacific sub-samples.

To examine differences in contact with government organisations and receipt of government payments for families with parental chronic illness and/or disability, we examined cross-tabulations of frequencies as well as using logistic regressions. We used the mother's demographic characteristics, household income, belonging to a community, and receipt of government support as variables in these models. The full list of variables is presented in Appendix 1.

Indigenous data sovereignty approach

We recognise Māori data as *taonga* (treasure) and endeavoured to safeguard and protect the data belonging to Māori whānau in the Growing Up in New Zealand cohort. We acknowledge this is especially important as researchers based outside of New Zealand. We also extend this respect and protection to the data of Pacific families in New Zealand. To this end, we employed an Indigenous data sovereignty approach for our analyses of GUiNZ data with Māori and Pacific participants (Kukutai & Taylor, 2016). To achieve this, we worked in partnership with Māori and Pacific experts and researchers onshore in New Zealand. The analyses with Māori and Pacific participants were conducted by our Māori

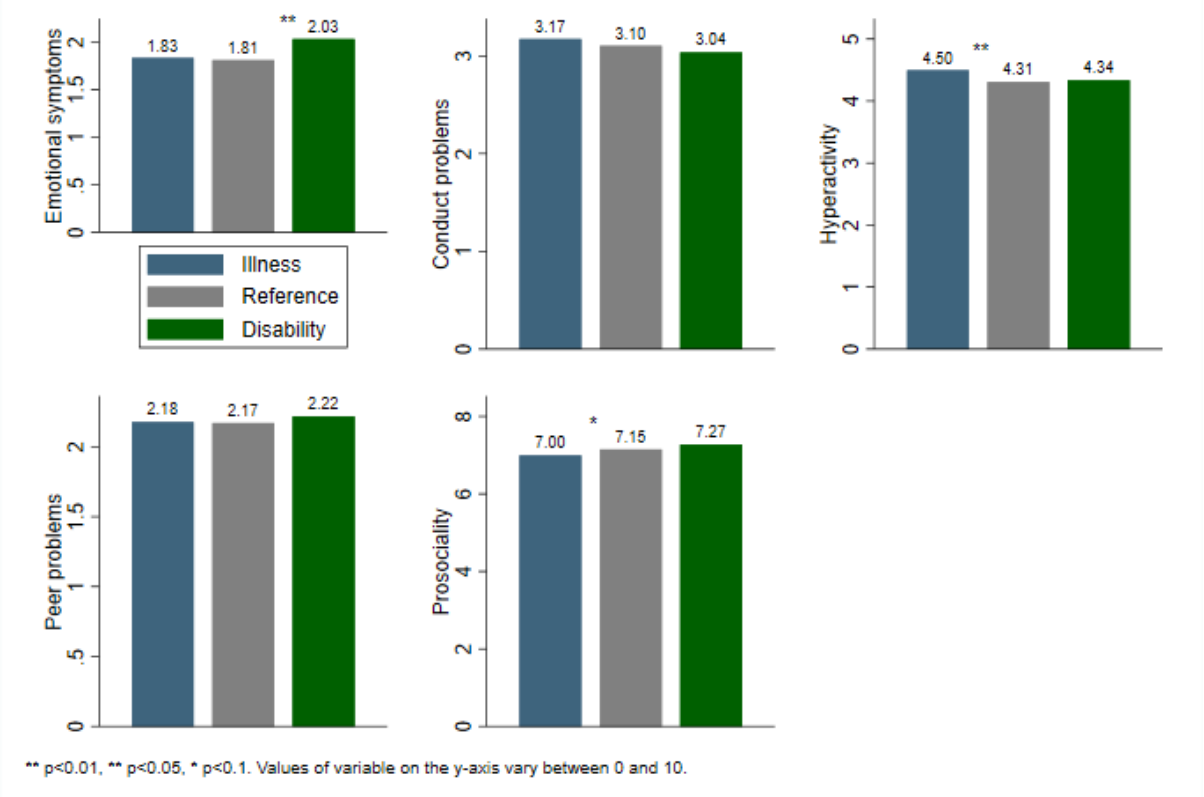
partners and the interpretation of the findings was guided by their knowledge and expertise.

Descriptive analyses

We focused on the SDQ and English language and communication development as the outcome variables for our descriptive analyses. In the following five sets of figures, we present results from t-tests in which we examined data for three groups of children for our descriptive analyses: children whose mothers have a chronic illness, children whose mothers have a disability (these mothers may also report having a chronic illness but are not included in the exclusively chronically ill group), and children whose mothers have no chronic illness or disability (reference group). We identify significant differences between these groups. A more detailed outline of the descriptive analyses features in Appendix 2. Please note, for our regression analyses, we combined the groups for chronic illness and disability.

Strengths and difficulties

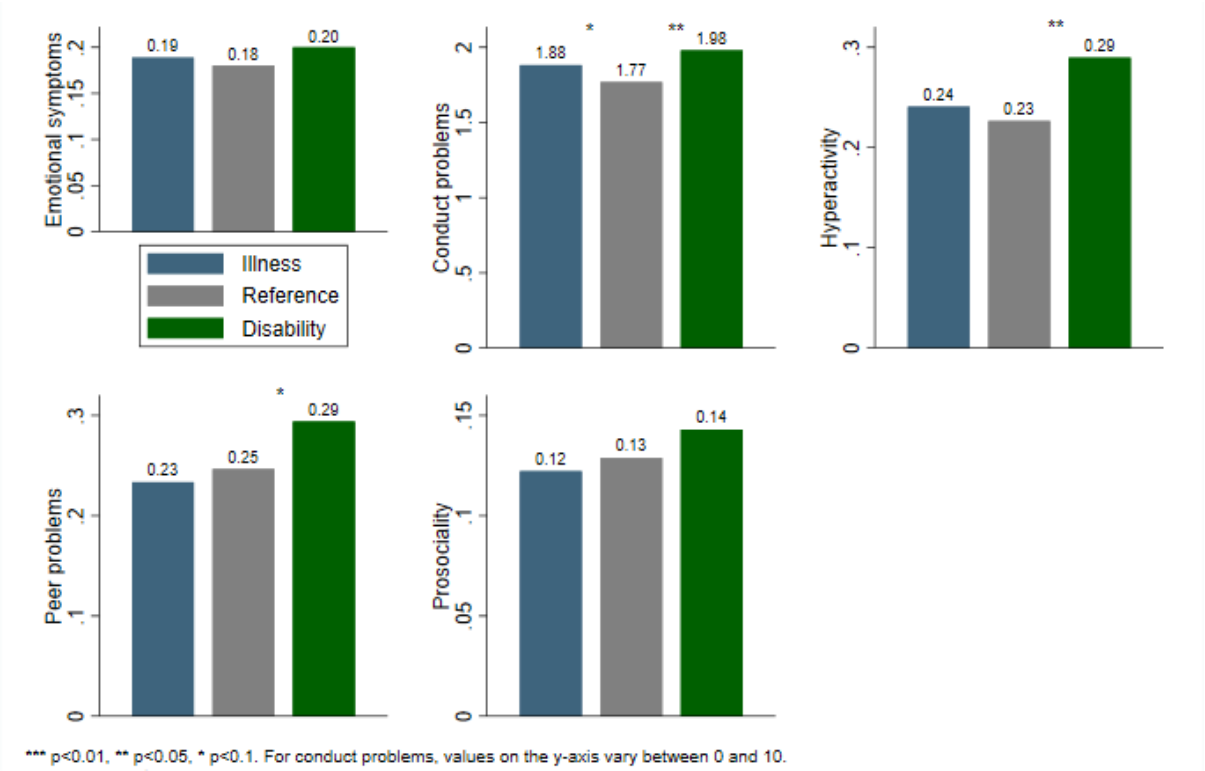
As shown in Figure 1, children aged two years whose mothers have a disability, had higher emotional difficulty scores relative to mothers without a chronic illness or disability. Children whose mothers have a chronic illness had higher scores of hyperactivity/inattention and lower prosociality scores relative to children whose mothers are not chronically ill. There were no statistically significant differences in children's outcomes related to the mother's chronic illness or disability for the other measures in Figure 1.



Stars indicate the statistical significance of the difference between each group and the reference group: *** p <0.01, ** p <0.05, * p<0.1; Reference category indicates children whose mothers have neither chronic illness nor disability.

Figure 1. Mother-rated child SDQ at two years by maternal health status

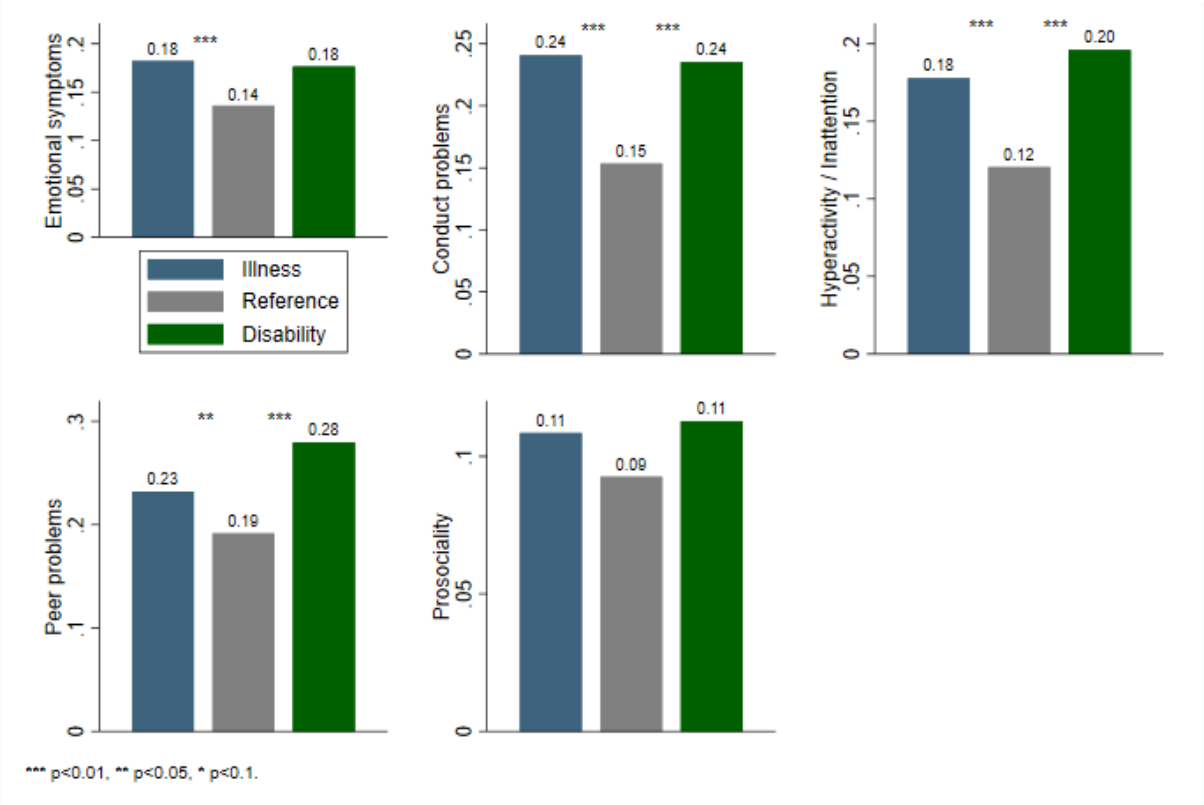
At five years (see Figure 2), children whose mothers have a chronic illness or a disability scored statistically significantly higher in conduct problems relative to children whose mothers did not report a chronic illness/disability. Furthermore, children whose mothers have a disability, scored higher on hyperactivity/inattention and peer problems relative to children with non-chronically ill mothers.



Stars indicate the statistical significance of the difference between each group and the reference group: *** p <0.01, ** p <0.05, * p<0.1; Reference category indicates children whose mothers have neither chronic illness nor disability. Values on the y-axis indicate the proportion of the sample which has the 20% highest values for each outcome (except conduct problems; see Growing Up in New Zealand [2020] and D'Souza et al. [2017] for more information on how the SDQ is measured in the GUiNZ study).

Figure 2. Mother-rated child SDQ at five years

At eight years (see Figure 3), children whose mothers have a chronic illness had higher emotional symptom scores, conduct problem scores, hyperactivity/inattention scores, and peer problem scores relative to children with non-chronically ill mothers. Moreover, compared to younger ages, the gaps between the two groups are large and statistically significant. Similarly, children whose mothers have a disability have higher conduct problem scores, hyperactivity/inattention scores, and peer problem scores relative to children with mothers without a chronic illness/disability.



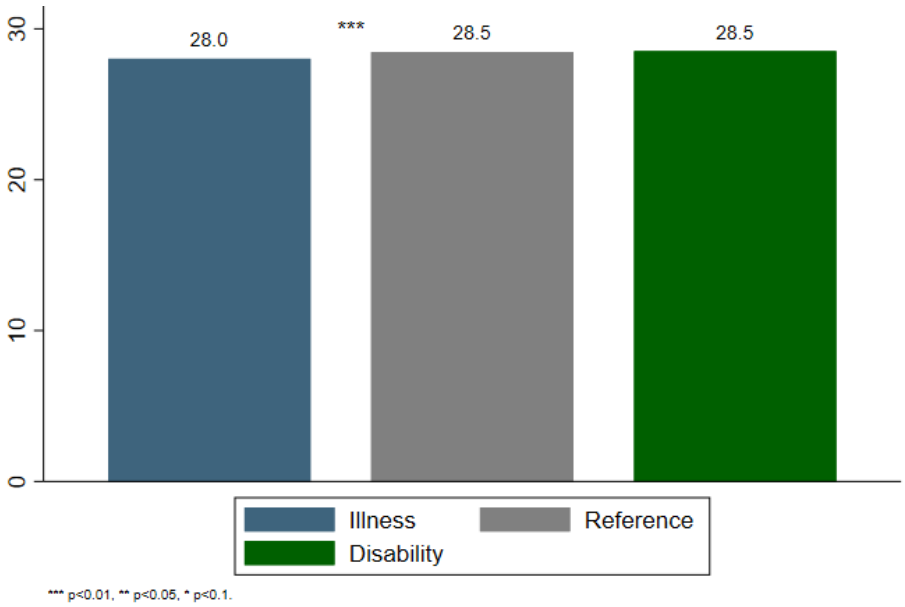
Stars indicate the statistical significance of the difference between each group and the reference group: *** p <0.01, ** p <0.05, * p<0.1; Reference category indicates children whose mothers have neither chronic illness nor disability. Values on the y-axis indicate the proportion of the sample which has the 20% highest values for each outcome (see Growing up in New Zealand [2020] and D'Souza et al. [2017] for more information on how the SDQ is measured in the GUiNZ study).

Figure 3. Mother-rated child SDQ at eight years

To summarise, children whose mothers have a chronic illness or disability had higher scores on emotional problems, conduct problems, hyperactivity/inattention, and peer problems at various ages relative to other children. These differences are small at ages two and five, and while larger at age eight remain generally small.

English language and communication

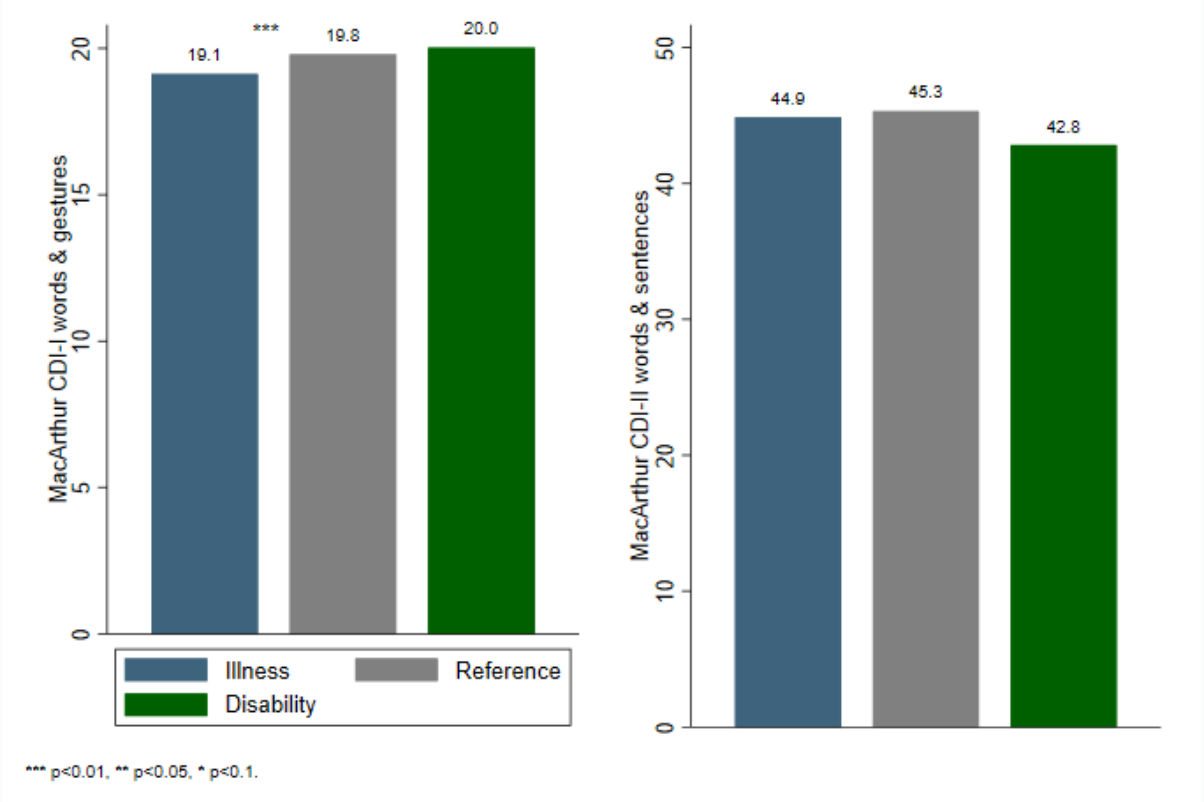
At nine months (see Figure 4), children whose mothers have a chronic illness scored lower on the Communication and Symbolic Behaviour measure (English language) relative to the reference group.



Stars indicate the statistical significance of the difference between each group and the reference group: *** p <0.01, ** p <0.05, * p<0.1; Reference category indicates children whose mothers have neither chronic illness nor disability.

Figure 4. Mother-rated Child Communication & Symbolic Behaviour Scale at nine months

In Figure 5, we show English vocabulary and gesture knowledge results at nine months and two years of age. As in the previous measure, children whose mothers have a chronic illness scored lower relative to the reference group. The gap is small, and no longer statistically significant at age two. There are no sizeable differences in these cognitive measures between children whose mothers have a disability and the reference group.



Stars indicate the statistical significance of the difference between each group and the reference group: *** p <0.01, ** p <0.05, * p<0.1; Reference category indicates children whose mothers have neither chronic illness nor disability.

Figure 5. Mother-rated child MacArthur test at nine months and two years (English language)

In summary, unlike the differences observed for SDQ, children with mothers who have a chronic illness (versus children with mothers without a chronic illness) had slightly worse English language skills, but these differences are very small. There are no differences in these outcomes for children whose mothers have a disability.

Regression results

For these analyses, we examined children's outcomes for those whose mothers have a chronic illness and/or disability with children whose mothers did not report a chronic illness or a disability. Unlike the descriptive analyses, we did not examine maternal disability independently due to small sample sizes. Instead, we examined how maternal chronic illness *and/or* disability is associated with child psychological outcomes.

As above, we focus our regression analyses on the SDQ as our socio-emotional development outcome. We also focus on measures of English language communication skills (Communication and Symbolic Behaviour Scale at age nine months, the MacArthur CDI-I at age nine months, the MacArthur CDI-II at age two years) as the main measures of cognitive development. The outcomes were all scored by the mother.

For easier reading, we summarise our findings in this section and present the full tables of our regression analyses in Appendix 2.

Strengths and difficulties

We found a small association between maternal chronic illness/disability and higher hyperactivity/inattention scores or children at age two years. However, when we controlled for socio-economic resources and parenting styles, there was no statistically significant association between maternal chronic illness/disability and other SDQ outcomes at this age.

We also found that having a lower-than-median household income is associated with reporting children as having higher emotional problems and peer problems scores. Higher positive parenting variable scores are also associated with reporting children as having lower scores on emotional problems, conduct problems, hyperactivity/inattention, peer problems, and higher prosociality scores.

For children's socio-emotional outcomes at age five, maternal chronic illness and/or disability during the child's infancy was associated with ratings of higher scores for children on the conduct problem dimension and higher scores on hyperactivity/inattention. However, when we controlled for socio-economic variables and parenting variables, there was no significant association between maternal chronic illness/disability and child socio-emotional outcomes – similar to our results at age two years.

Having a lower-than-median household income was associated with maternal ratings of children having higher scores for the dimensions of emotional problems, conduct problems, and peer problems. As with the results when children are aged two years, positive parenting styles are associated with lower scores on the dimensions of emotional problems, conduct problems,

hyperactivity/inattention, and peer problems as well as higher scores on prosociality.

When we examine SDQ scores at age eight, we found that maternal chronic illness and/or disability was associated with higher ratings of children's scores across all five measures. When we controlled for socio-economic and parenting variables, the significant association found for the outcomes of peer problems and prosociality were no longer statistically significant. However, children whose mothers reported a chronic illness or disability during their infancy were rated by their mothers as having higher scores on emotional problems, conduct problems, and hyperactivity/inattention. Importantly, these effect sizes are larger than at previous ages.

Having a higher household income was associated with maternal ratings of lower emotional problem scores. As with previous ages, more positive parenting is associated with lower scores on the SDQ dimensions.

English language and communication skills

Our regression analyses suggest that maternal chronic illness and disability is associated with lower scores on the communication and English language development scales when children are aged nine months. This association remained even when controlling for socio-economic and parenting variables.

When we specifically examined English language vocabulary, there was no significant association between maternal chronic illness and disability when children are aged nine months or two years. However, families with a higher household income and who practice more positive parenting styles scored higher in terms of English language skills at age two.

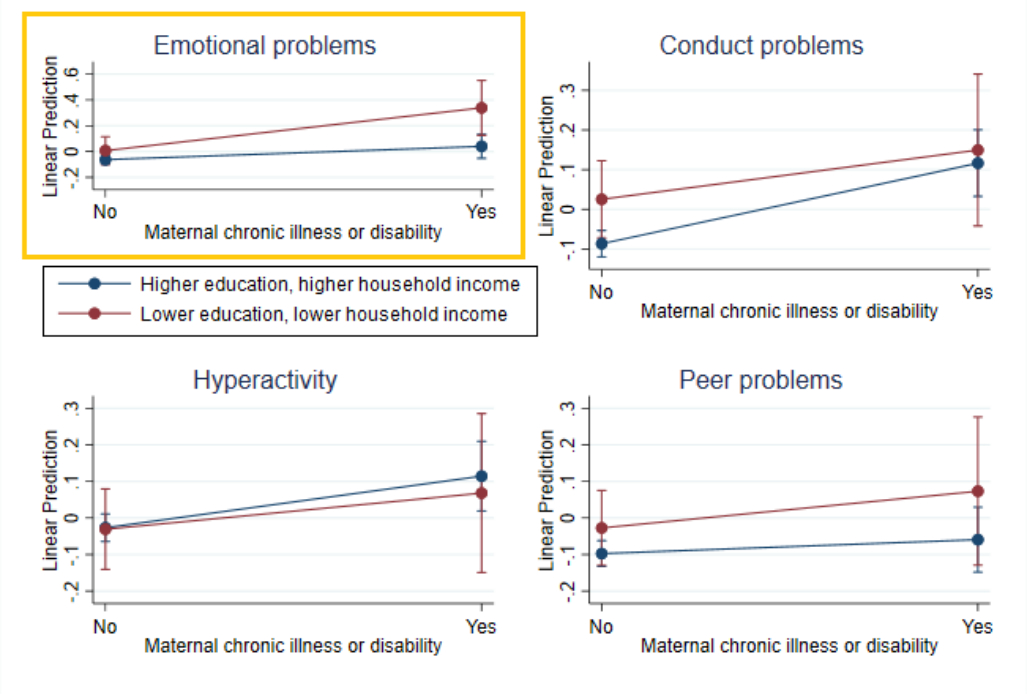
In summary, we find evidence that maternal chronic illness and disability is likely to influence children's socio-emotional outcomes but not English language development outcomes. The data suggests that the effect might be small in infancy and early childhood, but that it is larger in middle childhood. We also find that maternal characteristics, including indicators of socio-economic disadvantage and parenting influence on child development, could moderate the association between maternal chronic illness and child socio-emotional outcomes. In the next section, we report the results of our analyses examining the moderating role of socio-economic factors and parenting on the association between maternal character.

Moderation: Socio-economic and parenting factors

In this section, we present the results of our moderation analyses for SDQ at ages five and eight. We focus on these ages as the findings in the previous section identified that these were the only ages in which maternal chronic illness or disability was significantly associated with child psychological outcomes. We present a full account of our regression results in Appendix 2.

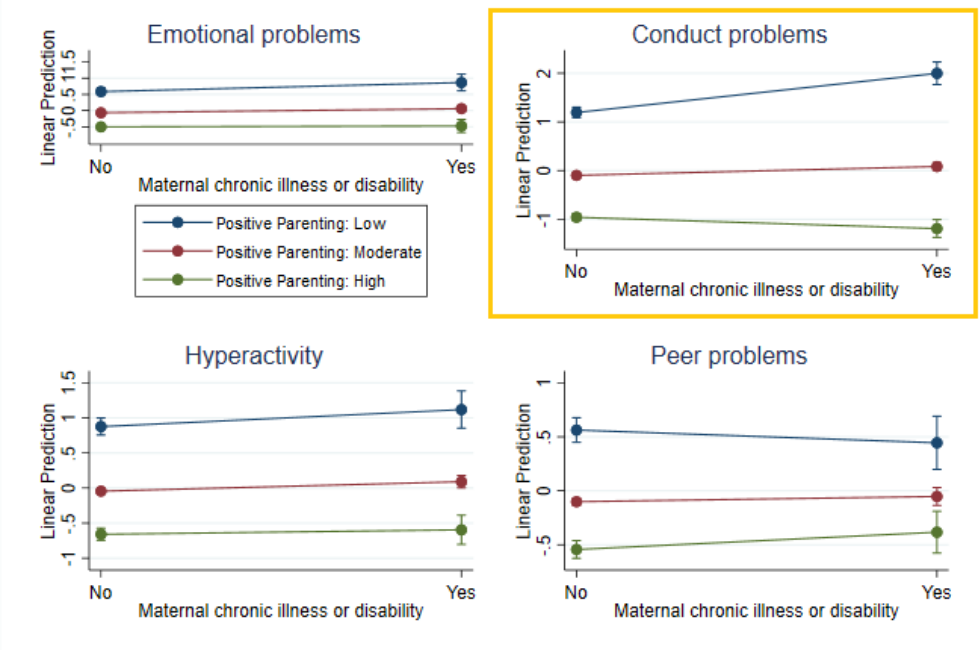
At age five, we found that a combination of having a mother with a chronic illness/disability and a lower socio-economic status was associated with higher conduct scores, relative to other children. In terms of the moderating role of positive parenting, we found that hyperactivity/inattention and peer problems scores of children whose mothers have a chronic illness or disability may be *increased* by positive parenting, which contradicts our expectations.

When we examined the outcomes for children at age eight, we found that low socio-economic status is associated with higher ratings in the emotional problems dimension (see Figure 6) and lower ratings in the prosociality dimension for children with a mother living with a chronic illness/disability. In terms of positive parenting, consistent with our expectations, we found that conduct problem dimension ratings of children whose mothers have a chronic illness or disability are *lower* when they receive *higher* levels of positive parenting (see Figure 7).



Note. The yellow box indicates a significant moderation. The blue line indicates higher maternal education, higher household income. The red line indicates lower maternal education, lower household income.

Figure 6. Predicted values of mother-rated SDQ scores at age eight years, moderated by socio-economic status



Note. The yellow box indicates a significant moderation. The blue line indicates lower levels of positive parenting. The red line indicates moderate levels of positive parenting. The green line indicates higher levels of positive parenting.

Figure 7. Predicted values of mother-rated SDQ scores at age eight years, moderated by positive parenting

To summarise, children with mothers with a chronic illness/disability in more socio-economically disadvantaged families have higher rated conduct and peer problem scores at age eight. The role of a positive parenting style paints a more complicated picture for children with mothers with a chronic illness or disability. Children's hyperactivity/inattention and peer problems scores are *higher* at age five with more positive parenting. In contrast, positive parenting is associated with *lower* conduct problem scores at age eight, for children with mothers living with long-term conditions.

Māori and Pacific children and families

Consistent with our full sample analyses, our analyses of Māori and Pacific families focused on outcomes measured using the SDQ at ages two, five, and eight years, as well as English language communication skills at age nine months and two years. We recognise that English may not be a language commonly used within Māori and Pacific families and that this measure may not accurately capture language and communication outcomes for children in Māori and Pacific families. We use English language communication skills for consistency across analyses and because of complexity and diversity in Pacific languages.

In this section, we summarise the findings for each outcome for Māori and Pacific children and families. We present a full account of our regression analyses in Appendix 2.

Strengths and difficulties

At age two, maternal chronic illness/disability was not significantly associated with SDQ scores, for either Māori or Pacific families, even when controlling for mother's demographics, parenting style and cultural connectedness.

The results for Māori children at age five indicated that maternal chronic illness/disability was not statistically significantly associated with most SDQ scores. Similar to the full sample analyses (which include Māori and Pacific families), higher positive parenting scores—parenting efficacy in particular—is associated with lower ratings across the SDQ dimensions. Mothers' sense of belonging to a community before their child's birth is associated with lower conduct problem scores.

For Pacific children, controlling for all other variables, maternal chronic illness/disability was not significantly related to most SDQ outcomes. Again, higher positive parenting scores were associated with lower ratings on the dimensions of emotional problems, conduct problems, hyperactivity/inattention, peer problems as well as lower scores on prosociality. Additionally, some cultural connectedness variables were significantly associated with SDQ scores. Mothers who engaged in more cultural activities with their children also rated their children as having more worries or sadness.

SDQ outcomes for Māori children at eight years of age were not statistically significantly associated with maternal chronic illness/disability when controlling for all other variables. Interestingly, mothers who engaged in more activities related to their culture also reported lower scores on the hyperactivity/inattention dimension for their child.

The results for Pacific children at age eight suggested that when controlling for all variables, maternal chronic illness/disability was largely unassociated with SDQ scores. Mothers who engaged in more cultural activities with their children also reported lower scores on the hyperactivity/inattention dimension for their children.

In summary, when accounting for demographic, parenting, and cultural factors, maternal chronic illness/disability was not significantly associated with most socio-emotional outcomes for Māori and Pacific children.

Language and communication skills

Maternal chronic illness and/or disability was not associated with variations in English language development outcomes for Māori children when controlling for the mother's demographics, parenting style, and cultural connectedness. As expected, the importance that mothers placed on their ethnic identity was associated with reporting fewer known words in English at age two.

When we assessed Pacific children, maternal chronic illness/disability was significantly associated with lower use of English words and communicative gestures at age nine months, controlling for demographic, parenting and cultural connectedness factors. However, maternal chronic illness/disability is not significantly associated with English vocabulary at age two years. Furthermore, children whose mothers belonged to a community during pregnancy and for whom ethnicity is important to their identity also had lower mother-reported English vocabulary scores.

Together, these results suggest that the association between maternal chronic illness/disability and communication outcomes of children are negligible and do not appear to be associated with English language ability past nine months for either Māori or Pacific infants. Unsurprisingly, for both Māori and Pacific families, mothers who reported higher cultural identity and connectedness also reported that their children had fewer known words in English—a foreign language.

Service use

In this section we explore how maternal chronic illness/disability is associated with rates of government support utilisation. We used cross-tabulations to examine patterns of contact with government organisations and receipt of government payments with maternal chronic illness/disability. We then examined patterns of government support receipt across maternal demographic characteristics.

Contact with any government organisation

First, we examined proportions of contact with government organisations between families reporting maternal chronic illness and/or disability when the child is aged nine months versus mothers with no illness or disability. As shown in Table 1, the proportion of mothers who reported chronic illness/disability who also had contact with a government organisation was higher than those who reported having no chronic illness/disability.

Table 1. Cross-tabulations of maternal illness/disability and contact with government organisations by age of the child

	2 years		5 years		8 years	
Contact	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**
	Percentage of the sample					
No chronic illness or disability	94.3	5.7	95.9	4.1	96.1	3.9
Yes chronic illness or disability	89.9	10.1	91.7	8.3	94.5	5.5

Receipt of any government payments

The proportion of families with maternal chronic illness/disability who reported receiving government payments was similar when the child is aged nine months. But a difference emerges from age two years onwards in payment receipt (see Table 2). A higher proportion of mothers with chronic illness/disability at nine months reported receiving government payments from two years onwards. This is in contrast to the smaller proportion reporting government payment receipt within families who did not report maternal chronic illness/disability at nine months.

Table 2. Cross-tabulations of maternal illness/disability and receiving a government payment across the age of the child

	9 months		2 years		45 months		5 years			
Payments	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**
	Percentage of the sample									
No chronic illness/disability	17.3	82.7	69.9	30.1	48.6	51.4	57.0	43.0	69.9	30.1
Yes chronic illness/disability	15.4	84.6	56.8	43.2	42.0	58.0	48.5	51.5	56.8	43.2

Next, we conducted logistic regression analyses to examine the demographic characteristics of mothers who received support from the government, with a particular interest in how maternal chronic illness/disability is associated with receiving support. We examined the probability of contact with an organisation and receiving government payments at the two-year and eight-year waves. We

summarise the results from these models below. The full analyses are reported in Appendix 2.

We found that maternal chronic illness/disability was associated with a higher probability of contact at the two-year wave but not at the eight-year wave. Maternal chronic illness/disability was associated with a higher probability of receiving government payments at the eight-year wave but not at the two-year wave.

Receiving a government payment at the two-year wave was associated with a higher probability of contact with an organisation at the same wave but not associated with a contact at the later wave. Contact with an organisation at the two-year wave was associated with a higher probability of receiving a government payment at both the two-and eight-year waves. Interestingly, women who felt that they belonged to some form of a community during pregnancy were less likely to be in contact with an organisation when their child was age two, relative to women who reported that they felt no belonging to any community. However, community belonging was associated with a higher probability of receiving payment at both the two-and eight-year waves.

Limitations

We acknowledge several limitations in our analysis.

Associations not causality

Our results report associations rather than causal connections between maternal chronic illness and disability and child psychological outcomes. Maternal health is not randomly assigned and there may be factors that influence both poor maternal health and child psychological outcomes. We tried to address this by controlling for several factors that influence both maternal health and child psychological outcomes, namely, socio-economic factors such as maternal education and household income. We nonetheless found an association between poor maternal health and child psychosocial development. We found a stronger association among low socio-economic status families than amongst high socio-economic status families. This implies that, above and beyond economic barriers that could influence maternal health and child outcomes, both maternal chronic illness or disability and child socio-emotional outcomes remain statistically significantly associated.

The need for effective policies that address the disadvantage of children whose mothers have a chronic illness does not necessarily depend on whether the association is causal. The design of effective policies should be guided by the evidence and the knowledge that a combination of different factors explains the association between maternal chronic illness and disability. Our analysis revealed that socio-economic factors and parenting styles moderated the association between maternal long-term health and child psychological outcomes, suggesting that improving parenting styles may improve child psychological outcomes. These findings are consistent with evidence from international studies, including randomised control trials, that have found positive parenting interventions in the general population (Britto et al., 2017) as well as for marginalised or disabled parents have benefits for child development (e.g., Kaplan et al., 2014; Nicholson et al., 2010; Visser et al., 2004).

A broad measure of chronic illness and disability

We used a self-reported, broad binary measure of maternal chronic illness and disability based on the mother's reports at only one point in time – at the nine-month wave. There are several limitations related to our measure of maternal health status. First, previous research has shown that self-reported measures of health are not equivalent to other, potentially more objective measures of health, for example one obtained through a medical diagnosis. At the same time, many studies have found that self-reported measures of health provide valid measurements of health status in adult populations (Miilunpalo et al., 1997).

Second, although we found associations between maternal chronic illness/disability reported during the child's infancy and children's psychological

outcomes later in childhood, it is difficult to establish whether the mothers' long-term health conditions persisted through the child's early and mid-childhood. We only have information about maternal chronic illness in one postnatal wave of GUiNZ. Although questions about functioning limitations have been included in the eight-year wave, the comparability of these two measures is limited.

In addition, given sample size considerations, the measure is broad and we do not have further details about the mother's chronic illness or disability. This is important to acknowledge as different conditions may lead to different kinds or levels of family stress, brought upon by condition severity or impact on daily functioning, which may change how a family manages both parenting and health conditions. Moreover, our measure is binary, and does not capture the severity of maternal chronic illness or disability, which could have an implication for child psychological outcomes.

Third, we did not account for maternal mental health distress and illness as these factors have been found in previous studies to be associated with child socio-emotional development in New Zealand (D'Souza et al., 2019a) as well as other international research (e.g., Morris et al., 2016).

These caveats associated with our measure of maternal health need to be considered when interpreting our findings and making policy recommendations. Ideally, future research should account for the persistence of long-term health conditions, severity, and their associations with parental mental health when examining their relationships with early and mid-childhood development.

Cognitive development measures, focused on Anglo-centric English language and socio-emotional outcomes

Our primary measures of cognitive development are focused on English language skills. English language skills cannot account for the full breadth of early cognitive development, limiting generalisability about cognitive development outcomes for children over time. One way to address this limitation is to extend our analysis to future waves of the GUiNZ study to include repeated measures of language development (such as literacy ability) as well as repeated measures of other cognitive outcomes such as self-regulation and memory, to have a more comprehensive set of measures of cognitive development.

We also did not account for the primary language spoken at home. English language was chosen for consistency across our analyses. However, future studies should look at the primary language within households as well as whether the household is a multi-lingual household. This is particularly important for analyses of language outcomes for Māori and Pacific families who are more likely to speak languages other than English at home, relative to Pākehā. Similarly, as highlighted above, the main outcome of the SDQ may be culturally biased (Kersten, Dudley, et al., 2016) and future research should consider drawing up on a range of measures that are responsive to non-'Western' cultural norms.

Another caveat of our measure of socio-emotional outcomes is that we focused on scores reported by mothers only. A systematic review of the psychometric properties of the SDQ suggests that the consistency of the ratings of a child between different people on these dimensions is low (Kersten, Czuba, et al., 2016). Children may appear or behave differently when they are with mothers compared to other people or they may be rated differently depending on the assessor. Indeed, the correlation between mother and father scores in the GUiNZ study are moderately correlated (r = .30) for children assessed at age two across all subscales (D'Souza et al., 2019b). In addition, particularly in the case of culturally diverse families in New Zealand, the scores of the SDQ can vary depending on cultural context and social environments (Kersten, Dudley, et al., 2016).

Along with the limited interpretability of SDQ scores in terms of rater and cultural generalisability, our results for SDQ have limited clinical application. This has resulted from opting to assess the SDQ as a scale and through their individual sub-dimensions as opposed to using clinical threshold cut-off criteria (see D'Souza et al., 2017 for cut-off criteria for the GUiNZ cohort) and the Total Score for the SDQ measure.

Finally, we can only report on child psychological outcomes up to eight years of age. The emerging picture is that the gap in socio-emotional development between children whose mothers have a chronic illness or disability and other children becomes large and consistent across measures at eight years of age. It is important to know how the gap evolves over time, such as when the children age into adolescence. We hope to extend our analysis to future waves of the GUiNZ study to address this question.

Sample size

We acknowledge the small sample sizes for Māori and Pacific respondents. On the one hand, our results reinforce the need to consider the cultural diversity of the study population and the unique characteristics of Māori and Pacific families. But on the other hand, our sample size using the GUiNZ cohort for these groups is small, which limits the accuracy of the statistical analysis and conclusions. Specifically, small sample sizes increase the susceptibility of our analyses to Type II error. In other words, we may fail to detect 'real' effects that exist. Therefore, our results need to be interpreted with this caveat in mind.

Other

Finally, other aspects of the family environment may also influence how families deal with long-term health and disability conditions. For example, we do not account for other important—but related—factors, such as the conflict between parents (in two-parent households) and whether the child has co-residential siblings (Morris et al., 2016; Umberger, 2014). Additionally, we do not account for how different family structures may change these results (e.g., single-parent, blended families, versus two-parent households; Visser, 2004). Future research

should examine these factors and other important family-based mechanisms to better understand the needs of different family structures and outcomes for children in order to design more tailored interventions.

Discussion

International evidence suggests that children with mothers with long-term health conditions have different psychological outcomes compared to other children (Chen, 2017; Sieh et al., 2010). Our analysis sheds light on this issue among the New Zealand population with the Growing Up in New Zealand cohort. We examined the association between mothers' self-reported chronic illness and disability and differences in child development. We used measures of child socio-emotional and cognitive development assessed from infancy until mid-childhood.

We examined the following questions:

1. *How do maternal chronic illness and disability influence children's early and mid-childhood psychosocial and cognitive development?*

We found that maternal chronic illness and disability were associated with variations in children's socio-emotional outcomes. Our analyses revealed that the differences in socio-emotional outcomes between children whose mothers reported having a long-term condition and other children are likely to emerge in early childhood. These differences remained small in the first few years of life but widened after the children started school, at mid-childhood.

Our analysis has shown that at age eight, children whose mothers have a chronic illness or disability score higher on our measures of socio-emotional dimensions (as measured by the SDQ). For example, these children may be perceived as more worrisome, restless, and quarrelsome relative to other children. This association remained even after controlling for maternal demographics, socio-economic factors, and parenting styles. However, it is also important to note that despite this significant association, regardless of maternal health status, having more socio-economic resources and practicing positive parenting has a consistent association with children being perceived as less worrisome and uncooperative.

We found that children with a mother with a long-term condition had lower English language skills relative to other children at nine months of age. However, this difference was small and was no longer statistically significant at age two. Additionally, similar to SDQ scores, regardless of maternal health status, having more socio-economic resources and practicing positive parenting is consistently associated with higher English language skills in early childhood.

2. *Do socio-economic or family socio-emotional factors vary the associations between maternal chronic illness/disability and the socio-emotional/cognitive development of children, in particular for the most vulnerable children, who share important risk factors with the children supported by government services (including government payments and contact with Oranga Tamariki).*

The moderating roles of socio-economic status and positive parenting on SDQ scores were more substantial at age eight relative to earlier years. We found that the higher scores on the SDQ among children whose mothers have a chronic illness or disability are larger for those who live in socio-economically disadvantaged households. This suggests that economic resources help with stress associated with managing chronic illness or disability.

Further, although children with mothers with a long-term health condition were rated as having higher scores on the SDQ, if these mothers also reported employing more positive parenting styles, they also reported *lower* scores on the SDQ for their children (relative to other families). However, the moderating role of positive parenting is not clear-cut. Positive parenting is associated with *higher* scores on some of our socio-emotional dimensions at age five for children with mothers with chronic illness or disability.

3. *How do maternal chronic illness and disability associate with the socio-emotional and cognitive development of Māori and Pacific children?*
4. *Does cultural identity and connectedness influence the associations between maternal chronic illness and disability and child development?*

In addition to examining how maternal chronic illness and disability is associated with different psychological outcomes for children in the full sample, we also focused on psychological outcomes for Māori and Pacific whānau and families. This is important to investigate as Māori and Pacific family's experiences with the health system are markedly different from Pākehā and feature additional challenges rooted in a history of colonisation and systemic racism (e.g., Hickey & Wilson, 2017; Kapeli et al. 2020; Kidd et al., 2013).

We found that for Māori whānau and Pacific families, children with a mother with a chronic illness or disability were not different in their socio-emotional outcomes relative to other Māori and Pacific children. We also observed some associations between cultural connectedness variables and socio-emotional traits in children. One consistent finding, regardless of maternal health status, was that parent-child engagement in one's own cultural activities is associated with perceiving children as being less restless.

Although the significant variables associated with the SDQ are interesting to observe, we urge caution when interpreting the findings. Research has found that the SDQ in a multi-cultural context in New Zealand is culturally biased and is based on a Eurocentric standard of socio-emotional outcomes (Kersten, Dudley, et al., 2016). In this way, the SDQ has potential to mischaracterise socio-emotional traits as concerning but which are culturally normative and valued for non-European cultures.

We also assessed how maternal chronic illness or disability was associated with English language skills for Māori and Pacific whānau and families. We found that cultural connectedness variables were associated with lower English language skills. This makes sense given that whānau and families who are more connected

with their culture are, on average, more likely to speak languages other than English at home.

5. *What are the demographic characteristics of families receiving government support (including payments and contact with government services), particularly for mothers with a chronic illness or disability? What are the potential reasons for the under-utilisation of government support for mothers with chronic illness or disability?*

Finally, we examined factors that facilitate receiving government support. This is important to understand to help reach people who might be under-served by government services and payments, especially people who are living with long-term health conditions. However, due to data limitations, including the low numbers of families receiving various forms of government support, degrees of *under*-utilisation could not be directly assessed. Nonetheless, our findings provide insight into the rates of government support receipt for families with maternal chronic illness or disability. Mothers who reported having a chronic illness or disability were more likely to be in contact with a government organisation during their child's early years. However, by mid-childhood, maternal health status was no longer related to whether a mother was in contact with a government organisation.

In terms of receiving government payments, maternal chronic illness or disability status was not related to whether a mother was receiving government payments during their child's early years. However, by mid-childhood, mothers who had a chronic illness and disability were more likely to report receiving government payments.

Other important factors associated with government support receipt included contact with a government organisation in early childhood. This was related to a higher probability of receiving a government payment at mid-childhood, suggesting that early organisational contact is associated with receiving support payments at a later stage. In addition, mothers who felt that they belonged to a community were more likely to receive payments when their child was aged two and eight, suggesting that contact with support networks may help with knowledge of public systems to facilitate the access of these services (Pituch et al., 2020).

Future research using different data sources could build upon these findings. One possibility includes the use of the Integrated Data Infrastructure (IDI) to assess utilisation in more detail than what can be achieved with the GUiNZ study. For example, previous research using the IDI has revealed ethnic inequalities across profiles of disabled children and young people in terms of rates of contact with different sources of disability support (Bowden et al., 2020). Though this example does not strictly examine *under*-utilisation, it nonetheless highlights the capability of the IDI to explore differences in sociodemographic profiles between parents with long-term health conditions who

use government services and receive payments compared to their counterparts who are eligible but do not make use of services and payments.

The GUiNZ study nonetheless has many strengths, despite limitations in the measures that are available. These measures provide a more detailed picture of concepts that cannot be captured with other data sources such as administrative data (i.e., the IDI) or cross-sectional national surveys on general health (e.g., the New Zealand Health Survey). An existing demonstration of this is a study examining antenatal depression and antenatal anti-depressant dispensing using both the IDI and GUiNZ data. Svardal and colleagues (2021) found that demographic trends in anti-depressant intake captured through the IDI was discrepant from rates of antenatal depression indicated through a direct measure of antenatal depression in the GUiNZ study. In sum, although the GUiNZ data is unable to capture *under*-utilisation of government services, it nonetheless points to demographic trends—including longitudinal associations—associated with service use, including health status.

Policy implications

Our findings align with the learning and development dimension of the New Zealand Child Youth and Wellbeing Strategy (Department of the Prime Minister and Cabinet, 2019). This strategy includes a focus on improving the development of socio-emotional and self-management skills of children and young people in New Zealand. Our findings suggest that interventions to improve socio-emotional and self-management skills need to include family environments, schools, and community organisations. In fact, family factors such as challenges associated with maternal chronic illness/disability during a child's infancy may be associated with differences in scores across socio-emotional dimensions at mid-childhood. This highlights the need for *early* intervention and the importance of allocating resources to families with greater need. For children who are already at school and whose parent(s) are living with a long-term health or disability condition, their needs may also be partially met at school through providing appropriate resources to teachers in the classroom.

To address these concerns promptly, an integrated inter-agency approach would be ideal for families in need—addressing the needs of both parents and children, with early intervention if suitable. This approach is supported by a large body of international evidence which suggests that an integrated approach across government services, that is responsive to life stages, is the most effective in providing environments for healthy child growth and wellbeing (Britto et al., 2017). Our results suggest that differences in socio-emotional outcomes for children emerge at mid-childhood (with negligible differences at early childhood). This highlights how maternal health status is associated with differences after starting school. However, early intervention may help reduce differences amongst children at later ages. To do so, parents with health-related challenges for parenting could be identified through the primary health system, such as through regular visits as part of the Well Child Tamariki Ora programme. Changes made to the delivery of the Well Child Tamariki Ora programme could be to adapt advice to include helping parents living with long-term conditions.

One direction of putting these findings into practice includes adapting parenting resources supplied by government agencies at various stages of a child's early development. Although these resources provide information and support for positive parenting practices, these resources are also designed for a general audience. Future policy could consider how these resources could be adapted to parents who may have day-to-day health challenges or other restrictions associated with long-term health conditions.

In addition to adaptations made in light of parental health status, cultural considerations in terms of family and health should also be made when adapting services and policies. For Māori and Pacific whānau and families, resources and services across all government service sectors should be culturally relevant. This aligns with the priorities highlighted in the New Zealand Disability Strategy

2016–2026, including the importance of whānau-centred approaches to disability and acknowledging Pacific peoples' cultural diversity. Thus, services should ideally be Māori-centred and led as well as Pacific-centred and led. In this way, outcomes for Māori and Pacific children are fostered in a culturally relevant way, outside of Eurocentric standards of socio-emotional and language development.

Finally, we have not investigated fathers. The GUiNZ study, as is the case for many other child cohort studies, collects limited data on fathers. Nevertheless, research has identified the importance of paternal involvement for child cognitive outcomes (Cano et al. 2019). This points to the need for further research data and possible future new research directions on how parents shape child development.

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Appendix 1: Method

Maternal chronic illness and disability and pregnancy-related illness incidence

For rigour, we verified whether reports of chronic illness at the nine-month wave were related to pregnancy-related illness. We used data from the nine-month wave to check for simultaneous short-term pregnancy-related illness. Only 88 mothers who reported having a chronic illness at the nine-month wave also reported a pregnancy-related condition in the antenatal wave (13% of the sample of mothers with chronic illness). This small number suggests that our measure of chronic illness is not capturing short-term pregnancy-related health issues, but rather the long-term conditions we are focusing on.

Maternal demographic characteristics

We provide descriptive information on the sociodemographic characteristics of the mothers in the GUiNZ sample separately for mothers reporting a chronic illness, reporting a disability, and reporting neither (the reference group). At the nine-month wave, mothers were, on average, similar in age across the three groups.

Table 3. Mother age (at antenatal wave) by chronic illness and disability status (at nine-month wave)

Mother ages	*Mean*	*SD*	*Min*	*Max*	*N*
Sample					
Chronic illness	31.49	5.81	18	47	580
Disability	31.61	6.48	18	46	266
No illness or disability	30.97	5.88	18	47	5,612

Regarding educational attainment (see Table 3), the percentage of mothers who did not complete secondary school was generally low, but it was highest among those with disability (12.55% vs. 6.57% and 6.30% for mothers with chronic illness and mothers in the reference group, respectively). Mothers with chronic illness or disability were less likely to have university education relative to the reference group. Among mothers with chronic illness 21.97% have a bachelor's degree and 16.26% have a higher degree. Among mothers with disability, 18.63% have a bachelor's degree and 14.83% have a higher degree. In the reference group, 23.64% of mothers have a bachelor's degree and 16.14% have a higher degree.

Around 52.72% of children whose mothers had a chronic illness also live in households with an annual household income at or below the New Zealand

median household income for 2010 (at or below the $50,000-$70,000 category, assuming that the national median household income was $75,000 at the time of data collection; Ministry of Social Development, 2010). The proportion is larger among children whose mothers have a disability (61.04%) and smaller for children in the reference group (50.14%).

Turning to other demographic characteristics, the share of mothers with a BMI classified as 'normal' is smaller in the group of mothers with chronic illness and disability than in the reference group (50.58% and 47.06% vs. 56.23%, respectively). Mothers with chronic illness or disability are more likely to be above the 'normal' weight relative to mothers in the reference group. Finally, the very large majority of families (around 90% for all three groups) live in urban areas, which resulted from the initial recruitment strategy of mothers into the GUiNZ study.

Table 4. Mother educational attainment (at antenatal wave), household income and geographical location (at nine-month wave)

	Chronic illness	Disability	Reference group
	Percentage of the sample		
Education			
No secondary school	6.57	12.55	6.30
Secondary school	22.84	18.63	23.51
Diploma/Trade	32.35	35.36	30.42
Bachelor	21.97	18.63	23.64
Higher Degree	16.26	14.83	16.14
Household income			
Less than $20,000	3.11	4.76	4.79
$20,000-$30,000	8.95	11.69	5.81
$30,000-$50,000	16.73	23.38	18.30
$50,000-$70,000	23.93	21.21	21.24
$70,000-$100,000	21.98	19.48	23.15
$100,000-$150,000	16.54	12.12	16.86
More than $150,000	8.75	7.36	9.85
Pre-pregnancy BMI			
Underweight	2.31	5.88	4.32
Normal weight	50.58	47.06	56.23
Overweight	25.00	19.75	22.93
Obese	22.12	27.31	16.52
Lives in an urban area	91.37	89.80	91.78

Psychological measures

Our outcome variables include child socio-emotional and cognitive outcomes, measured across multiple waves of the GUiNZ, starting at the nine-month wave until the eight-year wave. We used these repeated measures to study the link between maternal chronic illness and disability and child psychological outcomes from early to mid-childhood. We report descriptive statistics on each outcome variable in the body of the report as well as in Appendix 2. All measures in our analyses were reported by the mother (unless otherwise specified).

Socio-emotional outcomes

Strengths and Difficulties Questionnaire (SDQ; two, five, and eight years). We constructed the subscales of the SDQ based on the original five dimensions: emotional problems, peer problems, hyperactivity/inattention, conduct problems, prosociality (Goodman, 1997). The items from the SDQ were measured on a three-point scale (Not true/Somewhat true/Certainly true) and summed to create each subscale. Categories of Normal/Borderline/Abnormal were derived from the summed scales based on distributions of scores within the cohort (see Growing Up in New Zealand [2020] and D'Souza et al. [2017] for more information on how the SDQ is measured in the GUiNZ study).

Cognitive outcomes

Communication and Symbolic Behaviour Scale (nine months). We constructed a measure of early communication skill (Wetherby & Prizant, 2001) in infancy using eleven items from this scale. The items from this measure were summed to create this scale.

MacArthur CDI-I Words and Gestures (nine months). We constructed a measure of early language and communication in English (CDI Advisory Board, 1992, 1993) at nine months of age with the sum of twelve binary items.

MacArthur CDI-II Words and Sentences (two years). We constructed a measure of early vocabulary and communication skills (Fenson et al., 2000) at age two with a list of 100 common words and phrases. The measure is a total number of words or phrases that the child says in English.

Parenting and family

Family support (antenatal). We constructed this measure using the sum of the mother's responses to nine items (Dunst et al., 1984). Examples included "When our family/whānau has an important activity such as a wedding or hui, everyone tries to be present" and "We ask each other for advice about important decisions in our family/whānau".

Interest in baby (nine months). We constructed this measure using the sum of the mother's responses to twelve items (Davies et al., 2002). Example items

included "I take an active interest in my baby" and "I talk to my baby in a warm and affectionate way".

Confidence in parenting (two years). This was measured using the mother's answer to the question "Overall, do you feel that as a parent you are: Not very good at being a parent, A person who has some trouble being a parent, An average parent, A better than average parent, A very good parent."

Parenting enjoyment (two years). We constructed this measure using the sum of four items (Martin, 2003), provided by the mother. Example items included "On the whole, I enjoy being a parent" and "Being a parent is very satisfying".

Warm parenting (five and eight years). We constructed this measure using the sum of eight items (Paterson & Sanson, 1999), responded to by the mother. Example items included "I give praise when he/she is good" and "I am responsive to his/her feelings and needs".

Authoritarian parenting (five and eight years). We constructed this measure using the sum of six items (Paterson & Sanson, 1999), provided by the mother. Example items included "There should be a clear line of authority within the family and no doubt about who decides" and "Children should not talk back to their parents".

Hostile parenting (five and eight years). We constructed this measure using the sum of eight items (Paterson & Sanson, 1999), provided by the mother. Example items included "I guide him/her by punishment more than by reason" and "I use physical punishment as a way of disciplining him/her".

Parenting efficacy (five and eight years). We constructed this measure using the sum of five items (Paterson & Sanson, 1999), provided by the mother. Example items included "I am afraid that disciplining my child for misbehaviour will cause him/her to not like me" and "I am unsure of how to solve his/her misbehaviour".

Cultural connectedness

Belonging to a community (antenatal). We used a single binary measure of the mother belonging to a community (e.g., family, school, church, club, etc).

Ethnicity importance (two years). We used a single item of maternal ethnicity importance: "How important is this as a sense of who you are: ethnicity", on a Likert scale measuring perceived importance.

Ethnic identification (five years). We constructed this measure of ethnic identification (Phinney, 1992) using twelve items, reported by the mother. Participants were asked to rate their agreement to Likert scales (1 Strongly Disagree to 5 Strongly Agree). Example items included "I have a strong sense of belonging to my own ethnic or cultural group" and "I am active in organisations

or social groups that mostly include members of my own ethnic or cultural group".

Cultural engagement (five years). We constructed this measure using three items, reported by the mother. Mothers were asked on a Likert scale how often they "read to {name} about {his/her} ethnicity or culture", "listen to your own ethnic or cultural music with {name}", and "attend your own ethnic or cultural celebrations with {name}?" (0 Never to 4 Very often).

Moderator variables

We examined whether the influence of maternal chronic illness or disability on child psychological outcomes is moderated by socio-economic status and positive parenting. In this section we outline in detail on how we constructed our moderating variables of socio-economic advantage and positive parenting.

Index for socio-economic advantage (nine months). We constructed an index of socio-economic advantage based on maternal education and household income. Specifically, we generated an indicator variable which takes the value "1" if the mother has low educational attainment (secondary school education or below) and low income (below the median national income), and "0" otherwise. Using this method, we classified 18.3% of the sample as low socio-economic status (low SES).

Index for positive parenting (antenatal, nine months, two years, five years, eight years). We also constructed an index for positive parenting for each wave, based on a weighted average of each of our parenting measures. For a full list of these variables, see Table 5 below.

Table 5. Parenting variables and items included in the positive parenting index

Variable (wave)	Item
Social support (antenatal)	People in our family/whānau ask each other for help, when they need it
	When someone does something good for our family, we try to do something back for that person
	There are times when our family enjoys doing activities that are just with our family/whānau
	People in our family/whānau would provide for each other even if there is very little to go around
	We feel very close to each other in our family/whānau
	People in our family/whānau support each other at difficult times
	When our family/whānau has an important activity such as a wedding or hui, everyone tries to be present
	We can easily think of things to do together as a family/whānau group
	We ask each other for advice about important decisions in our family/whānau
Time spent with child (9m)	I say nice things about my baby [babies]

	I take an active interest in my baby [babies]
	I am interested in the things my baby does [babies do]
	I praise my baby when he/she deserves it [babies when they deserve it]
	I enjoy having my baby [babies] around me
	I tell my baby how proud I am of him/her when he/she is good [babies how proud I am of them when they are good]
	I make my baby [babies] feel proud when he/she does [they do] well
	I talk to my baby [babies] in a warm and affectionate way
	I make my baby [babies] feel what he/she does [they do] is important
	I pay a lot of attention to my baby [babies]
	I try to make my baby [babies] happy
	I like to spend time with my baby [babies]
Parenting confidence (2y)	We would like to know how you feel about being a parent. Overall, do you feel that as a parent you are: (Not very good at being a parent; A person who has some trouble being a parent; An average parent; A better than average parent; A very good parent)
Parenting enjoyment (2y)	On the whole, I enjoy being a parent
	Being a parent is very satisfying
	On the whole, my child is/children are easy to parent
	On the whole, it's good to be a parent
Authoritarian parenting (5y)	Children should obey their parents?
	Parents should teach their children to behave properly?
	Children should not talk back to their parents?
	It is a child's responsibility to look after the parents when they need help?
	Parents always know what is best?
Hostile parenting (5y)	I guide {him/her} by punishment more than by reason
	I smack {him/her} when {he/she} is disobedient
	I grab {him/her} when {he/she} is being disobedient
	I use physical punishment as a way of disciplining {him/her}
	I argue with {him/her}
	I yell or shout when {he/she} misbehaves
	I explode with anger at {him/her}
	I disagree with {him/her}
Warm parenting (5y)	I encourage {him/her} to talk about {his/her} troubles
	I give praise when {he/she} is good
	I show sympathy if {he/she} is hurt or frustrated
	I give comfort and understanding when {he/she} is upset
	I am responsive to {his/her} feelings and needs
	I tell {him/her} that I appreciate what they try to accomplish express affection by hugging, kissing, and holding {him/her}
	I apologise to {him/her} when I make a mistake in parenting
Parenting efficacy (5y)	I find it difficult to discipline {him/her}
	I am afraid that disciplining my child for misbehaviour will cause {him/her} to not like me

	I threaten {him/her} with punishment more often than actually giving it
	I set strict, well-established rules for {him/her}
	I am unsure of how to solve {his/her} misbehaviour
Hostile parenting (8y)	I have lost my temper with {name}
	I have raised my voice and have shouted at {NAME}
	I have been angry with {name}
	When {name} cries, {he/she} gets on my nerves
Parenting efficacy (8y)	Does {name} behave in a manner different from the way you want {him/her} to?
	Do you think that {name}'s behaviour is more than you can handle?
	Do you feel that you are in control and on top of things when you are caring for {name}?
	Do you feel you are good at getting {name} to do what you want {him/her} to do?
Parenting consistency (8y)	When you give {name} an instruction or make a request to do something, how often do you make sure that {he/she} does it?
	How often does {name} get away with things that you feel should have been disciplined?
	If you tell {name} that {he/she} will be disciplined if {he/she} doesn't stop doing something, but {he/she} keeps doing it, how often will you discipline {him/her}?
	When you discipline {name}, how often does {he/she} ignore it?
	How often is {name} able to get out of discipline when {he/she} really sets {his/her} mind to it?
	How often do you think the level of discipline you give {name} depends on your mood?
Warm parenting (8y)	How often do you express affection by hugging, kissing, holding {name}?
	How often do you hug or hold {name} for no particular reason?
	How often do you have warm, close times together with {name}?
	How often do you feel close to {name} both when {he/she} is happy and upset?
	How often do you enjoy listening to {name} and doing things with {him/her}?
	How often do you tell {name} how happy {he/she} makes you?

Government service engagement

We examined family engagement with various government services as well as government payment frequencies with relation to maternal experience of chronic illness and disability. In this section we outline in detail on how we constructed our organisational contact and government payment variables.

Organisation contact (two, five, and eight years). A binary measure of any contact with government organisations was created for the data collection waves for which these data were collected (e.g., Whānau Ora, Child Youth and Family, Oranga Tamariki, etc.)

Government payment (nine months to eight years). A binary measure of receipt of any government payment or other forms of financial support was created for the data collection waves which these data were collected (e.g., Sole Parent Support, accommodation supplement, Family Tax Credits etc.)

Appendix 2: Results

Table 6. Descriptive statistics across outcome variables, by maternal chronic illness and disability status

	Chronic illness		Disability		No illness nor disability (Reference group)		Range		Missing data rates
	M	*SD*	*M*	*SD*	*M*	*SD*	*Min*	*Max*	%
Strengths and Difficulties (2y)									
Emotional problems	1.84	1.54	2.02	1.81	1.77	1.59	0	10	5.86
Peer problems	2.28	1.69	2.37	1.64	2.26	1.66	0	10	8.39
Hyperactivity/Inattention	4.50	2.11	4.34	2.23	4.31	2.13	0	10	7.58
Conduct problems	3.17	1.92	3.04	2.03	3.10	1.96	0	10	7.31
Prosociality	4.74	2.46	4.83	2.58	4.77	2.53	0	10	8.57
Strengths and Difficulties (5y)									
Emotional problems	0.28	0.62	0.29	0.61	0.28	0.63	0	2	0.02
Peer problems	0.35	0.67	0.48	0.79	0.36	0.70	0	2	0.02
Hyperactivity/Inattention	0.40	0.74	0.48	0.80	0.35	0.69	0	2	0.02
Conduct problems [a]	1.88	1.40	1.98	1.45	1.77	1.35	0	8	0.46
Prosociality	0.16	0.46	0.18	0.48	0.17	0.46	0	2	0.02
Strengths and Difficulties (8y)									
Emotional problems	0.32	0.68	0.30	0.66	0.23	0.58	0	2	11.59
Peer problems	0.40	0.73	0.46	0.75	0.34	0.68	0	2	11.59
Hyperactivity/Inattention	0.33	0.69	0.36	0.73	0.23	0.60	0	2	11.59
Conduct problems	0.41	0.73	0.38	0.70	0.25	0.59	0	2	11.59
Prosociality	0.16	0.47	0.19	0.53	0.14	0.44	0	2	11.59
Communication and Symbolic Behaviour (2y)	28.02	3.20	28.53	3.13	28.46	3.07	13	33	12.11
MacArthur CDI-I Words & Gestures	19.12	4.28	20.02	4.73	19.79	4.39	12	36	10.03
MacArthur CDI-II Words & Sentences	44.89	26.86	42.83	25.91	45.32	27.67	0	100	4.95

Note. All measures were standardised prior to regression analyses to allow comparisons in outcome variables between analyses.

[a] Conduct problems scale includes four items, rather than five in this data collection wave and constructed separately from the other scales.

Table 7. Regression results of maternal chronic illness/disability, mother demographics, household income, and parenting variables and mother-rated SDQ outcomes at the two-year wave

	B	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*
Variables (wave)	**Emotional problems**	**Conduct problems**	**Hyperactivity/Inattention**	**Peer problems**	**Pro-sociality**	**Emotional problems**	**Conduct problems**	**Hyperactivity/Inattention**	**Peer problems**	**Pro-sociality**
Maternal illness/disability (9m)	0.059	0.012	**0.075***	0.006	−0.040	0.062	−0.017	0.037	0.008	−0.023
Mother's age (9m)	**−0.058*****	**−0.102*****	**−0.107*****	**−0.103*****	0.005	−0.036	**−0.081*****	**−0.087*****	**−0.063****	0.006
Mother's age^2	**0.001***	**0.001*****	**0.001*****	**0.001*****	−0.000	0.000	**0.001****	**0.001*****	**0.001****	−0.000
Mother's education (Ref: Secondary)	–	–	–	–	–	–	–	–	–	–
No secondary school	**0.221*****	**0.418*****	0.107	**0.335*****	−0.072	0.117	**0.377*****	0.080	0.287***	−0.057
Diploma/Trade	**−0.063***	−0.023	0.037	0.018	0.047	**−0.084****	−0.010	0.049	0.049	0.042
Bachelor's degree	**−0.194*****	**−0.199*****	−0.061	**−0.192*****	0.003	**−0.167*****	**−0.170*****	−0.028	−0.109**	0.011
Higher degree	**−0.208*****	**−0.304*****	**−0.142*****	**−0.217*****	**0.063***	**−0.155*****	**−0.249*****	−0.112**	−0.116**	0.067*
Mother's BMI (Ref: 'Normal')	–	–	–	–	–	–	–	–	–	–
'Underweight'	**0.188*****	0.019	0.036	0.086	0.055	**0.148****	−0.011	0.030	**0.132***	0.047
'Overweight'	0.025	0.099***	0.051	0.001	−0.023	−0.003	**0.074****	0.050	−0.005	−0.009
'Obese'	**0.168*****	0.233***	**0.099*****	0.024	0.002	**0.102*****	**0.147*****	0.059	−0.047	0.032
Rurality (Ref: Urban)	**−0.240*****	−0.116**	−0.065	**−0.113****	−0.004	**−0.205*****	**−0.093****	−0.044	−0.050	−0.009
Household income bands (Ref: $50–70k)	–	–	–	–	–	–	–	–	–	–
<$20k	–	–	–	–	–	**0.226*****	**0.151****	−0.093	**0.371*****	0.037
$20–30k	–	–	–	–	–	**0.190*****	0.065	0.044	**0.125***	0.006
$30–50k	–	–	–	–	–	**0.128*****	0.057	0.009	**0.199*****	−0.023
$70–100k	–	–	–	–	–	−0.044	−0.033	−0.053	0.022	−0.002

$100–150k	–	–	–	–	–	–0.062	–0.054	–0.055	–0.011	–0.014
>$150k	–	–	–	–	–	–0.100*	–0.022	–0.002	–0.063	–0.045
NZDep2006 Index	–	–	–	–	–	**0.019*** **	**0.026*** **	**0.011***	**0.031*** **	–0.005
Family support (antenatal)	–	–	–	–	–	**0.009*** **	**0.008****	0.000	**–0.007****	**0.007*** **
Interest in the baby (9m)	–	–	–	–	–	**–0.026*** **	**–0.027*** **	**–0.022*** **	**–0.021*** **	**0.016*** **
Parenting enjoyment (2y)	–	–	–	–	–	**–0.046*** **	**–0.099*** **	**–0.092*** **	**–0.039*** **	**0.065*** **
Parenting confidence (2y)	–	–	–	–	–	0.011	**–0.060*** **	**–0.096*** **	**–0.034***	**0.072*** **

Note. Values in each column are unstandardised linear regression coefficients.
Outcome variables have been standardised. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 8. Regression results of maternal chronic illness/disability, mother demographics, household income, and parenting variables and mother-rated SDQ outcomes at the five-year wave

	B	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*
Variables (wave)	**Emotional problems**	**Conduct problems**	**Hyperactivity/Inattention**	**Peer problems**	**Pro-sociality**	**Emotional problems**	**Conduct problems**	**Hyperactivity/Inattention**	**Peer problems**	**Pro-sociality**
Maternal illness/disability (9m)	0.032	**0.105*** **	**0.084** **	0.018	0.018	0.037	0.057	0.060	−0.001	−0.003
Mother's age (9m)	**−0.059** **	−0.037	**−0.090*** **	**−0.106*** **	0.018	−0.006	0.035	−0.043	−0.043	0.036
Mother's age^2	**0.001***	0.000	**0.001*** **	**0.001*** **	−0.000	−0.000	−0.000	0.000	0.001	−0.000
Mother's education (Ref: Secondary)	–	–	–	–	–	–	–	–	–	–
No secondary school	**0.114***	**0.204*** **	**0.226*** **	**0.176** **	0.083	0.050	0.019	0.127	−0.003	0.030
Diploma/Trade	0.007	−0.035	−0.011	−0.031	−0.036	0.013	−0.026	−0.020	−0.020	−0.024
Bachelor's degree	**−0.121*** **	**−0.188*** **	**−0.176*** **	**−0.156*** **	0.057	**−0.067***	**−0.142*** **	**−0.139*** **	**−0.077***	0.075
Higher degree	−0.047	**−0.226*** **	**−0.160*** **	**−0.162*** **	0.024	0.030	**−0.149*** **	**−0.107** **	−0.053	0.064
Mother's BMI (Ref: 'Normal')	–	–	–	–	–	–	–	–	–	–
'Underweight'	0.022	−0.035	−0.090	0.093	0.065	0.041	−0.022	−0.078	0.120	0.096
'Overweight'	0.020	0.031	**0.098*** **	0.009	**−0.078** **	−0.027	−0.039	**0.071** **	−0.021	**−0.075** **
'Obese'	**0.155*** **	**0.143*** **	**0.155*** **	**0.184*** **	−0.045	0.053	0.029	0.064	**0.086** **	**−0.091** **
Rurality (Ref: Urban)	**−0.180*** **	−0.056	0.000	**−0.108** **	−0.052	**−0.142*** **	−0.056	0.012	−0.028	−0.074
Household income bands (Ref: $50–70k)	–	–	–	–	–	–	–	–	–	–
<$20k	–	–	–	–	–	**0.280*** **	**0.145***	0.095	**0.446*** **	−0.007
$20–30k	–	–	–	–	–	**0.240*** **	0.034	0.079	**0.132** **	0.030
$30–50k	–	–	–	–	–	**0.097** **	**0.084***	**0.117** **	**0.105** **	0.049
$70–100k	–	–	–	–	–	0.027	−0.011	**0.092** **	−0.059	−0.042

$100–150k	–	–	–	–	–	0.032	−0.057	0.036	**−0.087****	−0.064
>$150k	–	–	–	–	–	0.014	−0.014	0.049	−0.028	−0.027
NZDep2006 Index	–	–	–	–	–	**0.010****	0.003	**0.010***	**0.034*****	0.006
Family support (antenatal)	–	–	–	–	–	0.004	−0.002	−0.003	−0.003	**−0.008****
Interest in the baby (9m)	–	–	–	–	–	−0.006	**−0.011****	0.003	−0.006	**−0.017*****
Parenting enjoyment (2y)	–	–	–	–	–	**−0.019****	**−0.029*****	**−0.026*****	−0.011	**−0.030*****
Parenting confidence (2y)	–	–	–	–	–	0.009	0.012	−0.017	−0.009	**−0.046****
Warm parenting (5y)	–	–	–	–	–	**0.011****	**−0.010****	0.004	−0.003	**−0.031*****
Parenting efficacy (5y)	–	–	–	–	–	**−0.044*****	**−0.089*****	**−0.052*****	**−0.043*****	**−0.031*****
Authoritarian parenting (5y)	–	–	–	–	–	**0.008***	0.000	0.002	**0.012*****	−0.001
Hostile parenting (5y)	–	–	–	–	–	**0.022*****	**0.065*****	**0.034*****	**0.007***	0.003

Note. Values in each column are unstandardised linear regression coefficients. Outcome variables have been standardised.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 9. Regression results of maternal chronic illness/disability, mother demographics, household income, and parenting variables and mother-rated SDQ outcomes at the eight-year wave

	B	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*
Variables (wave)	**Emotional problems**	**Conduct problems**	**Hyperactivity/Inattention**	**Peer problems**	**Pro-sociality**	**Emotional problems**	**Conduct problems**	**Hyperactivity/Inattention**	**Peer problems**	**Pro-sociality**
Maternal illness/disability (9m)	**0.124*** **	**0.250*** **	**0.174*** **	**0.073***	**0.082***	**0.141*** **	**0.179*** **	**0.116*** **	0.025	0.027
Mother's age (9m)	−0.034	−0.054	−0.020	**−0.138*** **	−0.027	−0.052	−0.025	−0.017	**−0.091** **	−0.006
Mother's age^2	0.000	0.001	0.000	**0.002*** **	0.000	0.001	0.000	0.000	**0.001** **	0.000
Mother's education (Ref: Secondary)	–	–	–	–	–	–	–	–	–	–
No secondary school	−0.091	0.012	−0.059	0.096	0.109	−0.042	0.026	−0.114	0.084	0.074
Diploma/Trade	−0.075	−0.045	0.033	0.053	−0.025	−0.056	−0.036	0.036	0.046	−0.020
Bachelor's degree	**−0.120** **	−0.060	−0.045	**−0.107** **	0.046	**−0.089***	−0.030	−0.071	**−0.092***	0.061
Higher degree	**−0.113** **	**−0.106** **	−0.063	−0.067	0.067	−0.076	−0.060	−0.072	−0.031	**0.099***
Mother's BMI (Ref: 'Normal')	–	–	–	–	–	–	–	–	–	–
'Underweight'	−0.056	0.085	0.038	0.008	−0.023	−0.081	0.043	0.106	−0.018	−0.001
'Overweight'	0.016	**0.063***	0.002	0.023	0.008	0.044	**0.079** **	0.007	0.048	−0.008
'Obese'	**0.115** **	**0.154*** **	**0.082***	**0.322*** **	0.010	0.070	**0.101** **	0.072	**0.225*** **	−0.022
Rurality (Ref: Urban)	−0.028	−0.003	**−0.095***	−0.005	−0.053	−0.053	−0.021	−0.084	0.003	−0.021
Household income bands (Ref: $50–70k)	–	–	–	–	–	–	–	–	–	–
<$20k	–	–	–	–	–	−0.116	0.139	−0.022	0.163	0.107
$20–30k	–	–	–	–	–	−0.021	−0.008	−0.111	**0.340*** **	0.088
$30–50k	–	–	–	–	–	−0.066	−0.013	−0.089	**0.119** **	−0.032
$70–100k	–	–	–	–	–	**−0.144*** **	−0.058	−0.000	0.021	−0.027
$100–150k	–	–	–	–	–	**−0.114** **	−0.061	−0.034	−0.010	−0.002
>$150k	–	–	–	–	–	**−0.114***	0.045	−0.029	0.035	0.041
NZDep2006 Index	–	–	–	–	–	−0.008	−0.005	−0.005	0.007	0.003
Family support (antenatal)	–	–	–	–	–	−0.004	**−0.007***	−0.003	−0.002	−0.006

Interest in the baby (9m)	–	–	–	–	–	−0.001	−0.004	−0.004	−0.006	0.003
Parenting enjoyment (2y)	–	–	–	–	–	−0.009	0.008	−0.001	**−0.018***	−0.005
Parenting confidence (2y)	–	–	–	–	–	0.001	0.017	−0.016	−0.028	−0.015
Warm parenting (5y)	–	–	–	–	–	**0.015*****	0.007	0.003	0.007	0.001
Parenting efficacy (5y)	–	–	–	–	–	**−0.026*****	**−0.013****	−0.008	**−0.019*****	−0.006
Authoritarian parenting (5y)	–	–	–	–	–	−0.005	−0.006	−0.005	0.006	−0.001
Hostile parenting (5y)	–	–	–	–	–	**−0.014****	**0.018*****	**0.010***	0.003	−0.005
Warm parenting (8y)	–	–	–	–	–	−0.007	**−0.011***	0.005	**−0.014****	**−0.038*****
Parenting efficacy (8y)	–	–	–	–	–	**0.016****	**−0.012***	0.002	0.002	**−0.023*****
Authoritarian parenting (8y)	–	–	–	–	–	**−0.091*****	**−0.156*****	**−0.120*****	**−0.081*****	**−0.085*****
Hostile parenting (8y)	–	–	–	–	–	**0.018****	**0.029*****	**0.021****	−0.010	0.007

Note. Values in each column are unstandardised linear regression coefficients. Outcome variables have been standardised.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 10. Regression results of maternal chronic illness/disability, mother demographics, household income, and parenting variables and mother-rated English language and communication skills at the nine-month and two-year waves

	B	*B*	*B*	*B*	*B*	*B*
Variables (wave)	**Communication and Symbolic Behaviour**	**MacArthur CDI-I Words & Gestures**	**MacArthur CDI-II Words & Sentences**	**Communication and Symbolic Behaviour**	**MacArthur CDI-I Words & Gestures**	**MacArthur CDI-II Words & Sentences**
Maternal illness/disability (9m)	**−0.078***	−0.064	−0.050	**−0.083***	−0.052	−0.035
Mother's age (9m)	0.009	**−0.068*****	**0.047****	0.039	−0.035	0.011
Mother's age^2	−0.000	**0.001****	**−0.001***	**−0.001****	0.000	−0.000
Mother's education (Ref: Secondary)	–	–	–	–	–	–
No secondary school	0.081	**0.172****	−0.016	0.014	0.094	0.128
Diploma/Trade	0.053	0.021	**0.066***	0.063	0.043	0.022
Bachelor's degree	**−0.073***	**−0.205*****	**0.244*****	−0.052	**−0.164*****	**0.146*****
Higher degree	−0.006	**−0.185*****	**0.302*****	0.047	**−0.114****	**0.175*****
Mother's BMI (Ref: 'Normal')	–	–	–	–	–	–
'Underweight'	**0.198*****	**0.187*****	**−0.136***	**0.229*****	**0.182****	−0.098
'Overweight'	0.022	0.049	−0.050	−0.014	0.019	−0.044
'Obese'	0.052	**0.147*****	**−0.164*****	0.019	**0.081****	**−0.081****
Rurality (Ref: Urban)	−0.078	**−0.136*****	**0.150*****	−0.012	**−0.080***	**0.084***
Household income bands (Ref: $50–70k)	–	–	–	–	–	–
<$20k	–	–	–	**0.444*****	**0.410*****	−0.039
$20–30k	–	–	–	**0.169****	**0.126***	**−0.226*****
$30–50k	–	–	–	0.077	**0.113****	**−0.109****
$70–100k	–	–	–	0.045	0.016	**0.166*****
$100–150k	–	–	–	−0.047	−0.028	**0.205*****
>$150k	–	–	–	0.020	0.025	**0.241*****
NZDep2006 Index	–	–	–	**0.021*****	**0.023*****	**−0.033*****
Family support (antenatal)	–	–	–	**0.026*****	**0.024*****	−0.001

Interest in the baby (9m)	–	–	–	**0.054*** **	**0.031*** **	**0.031*** **
Parenting enjoyment (2y)	–	–	–	–	–	**0.017** **
Parenting confidence (2y)	–	–	–	–	–	**0.044** **

Note. Values in each column are unstandardised linear regression coefficients. Outcome variables have been standardised.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 11. Regression results of maternal chronic illness/disability and the moderating roles of socio-economic status and positive parenting for mother-rated SDQ scores at the five- and eight-year waves

	5 years					8 years				
	B	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*
Variables (wave)	**Emotional problems**	**Conduct problems**	**Hyperactivity/Inattention**	**Peer problems**	**Pro-sociality**	**Emotional problems**	**Conduct problems**	**Hyperactivity/Inattention**	**Peer problems**	**Pro-sociality**
Maternal illness/disability (9m)	−0.104	0.083	−0.541	**−0.683***	−0.601	0.452	**1.644*****	0.391	−0.348	**0.704****
SES (Ref: All other SES)	–	–	–	–	–	–	–	–	–	–
Lower education and lower household income	**0.094****	0.071	**0.118****	**0.142*****	0.040	0.070	**0.112****	−0.004	0.070	0.084
Illness × SES	−0.056	**0.207****	−0.056	0.118	−0.023	**0.228***	−0.079	−0.042	0.063	**−0.237***
Illness × Positive parenting index (5y)	0.247	−0.011	**0.951***	**1.011***	0.931	−0.503	**−2.074*****	−0.359	0.556	**−0.932***
Positive parenting index (5y)	**−2.057*****	**−5.278*****	**−2.938*****	**−1.981*****	**−2.269*****	**−2.178*****	**−4.304*****	**−3.068*****	**−2.212*****	**−2.860*****
Mother's age (9m)	−0.041	−0.032	**−0.087*****	**−0.082*****	0.036	−0.051	−0.029	−0.018	**−0.157*****	−0.000
Mother's age^2	0.000	0.000	**0.001*****	**0.001*****	−0.000	0.001	0.000	0.000	**0.002*****	0.000
Mother's BMI (Ref: 'Normal')	–	–	–	–	–	–	–	–	–	–
'Underweight'	0.073	0.003	−0.077	**0.142***	0.078	−0.063	0.029	0.081	−0.037	0.002
'Overweight'	−0.018	0.004	**0.089****	−0.017	**−0.089****	0.024	**0.065***	0.005	0.037	−0.037
'Obese'	**0.093****	**0.099*****	**0.119*****	**0.105*****	**−0.094****	0.077	**0.118*****	**0.092***	**0.263*****	−0.047

Rurality (Ref: Urban)	**–0.163*** **	–0.069	0.016	–0.028	–0.060	–0.048	–0.020	–0.075	0.040	–0.023
NZDep2006 Index	**0.014*** **	**0.008***	**0.016*** **	**0.039*** **	0.004	–0.007	–0.004	–0.003	**0.012***	0.004

Note. Values in each column are unstandardised linear regression coefficients. Outcome variables have been standardised.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 12. Regression results of maternal chronic illness/disability, mother demographics, parenting, and cultural connectedness variables and mother-rated SDQ scores at the two-year wave for Māori and Pacific children

	Māori					Pacific				
	B	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*
Variables (wave)	**Emotional problems (2y)**	**Conduct problems (2y)**	**Hyperactivity/Inattention (2y)**	**Peer problems (2y)**	**Pro-sociality (2y)**	**Emotional problems (2y)**	**Conduct problems (2y)**	**Hyperactivity/Inattention (2y)**	**Peer problems (2y)**	**Pro-sociality (2y)**
Maternal illness/disability (9m)	0.034	−0.066	0.001	−0.035	−0.028	0.094	−0.015	0.088	−0.015	0.064
Mother's age (9m)	−0.052	−0.042	**−0.131*** **	**−0.162*** **	−0.005	−0.043	−0.051	**−0.085** **	**−0.108** **	−0.027
Mother's age^2	0.001	0.000	**0.002*** **	**0.002*** **	−0.000	0.001	0.000	0.001	**0.002** **	0.000
University education (Ref: Below university)	**−0.250*** **	**−0.385*** **	−0.099	**−0.239*** **	0.054	**−0.418*** **	**−0.307*** **	−0.084	**−0.231** **	0.027
NZDep2006 Index	**0.051*** **	**0.060*** **	0.014	**0.057*** **	**−0.015** **	**0.050*** **	**0.046*** **	**0.022***	**0.060*** **	**−0.024*** **
Family support (antenatal)	0.009	**0.012***	−0.002	**−0.015** **	0.007	0.008	0.006	−0.010	0.011	−0.000
Interest in the baby (9m)	**−0.027*** **	**−0.031*** **	**−0.029*** **	**−0.017***	**0.013** **	**−0.027*** **	**−0.017***	**−0.018** **	−0.012	**0.015** **
Parenting enjoyment (2y)	**−0.048*** **	**−0.106*** **	**−0.084*** **	**−0.054*** **	**0.082*** **	**−0.026**	**−0.067*** **	**−0.098*** **	**−0.064*** **	**0.068*** **
Parenting confidence (2y)	−0.005	**−0.078** **	**−0.068** **	−0.008	0.034	**0.086** **	−0.058	0.001	0.001	0.036

Belonging to a community (antenatal; Ref: None)	**–0.167*** **	–0.068	0.010	–0.071	–0.019	–0.044	–0.014	–0.023	**–0.116***	–0.016
Ethnic importance (2y)	**0.133*** **	0.045	–0.011	0.037	0.036	0.053	0.002	0.047	0.015	–0.005

Note. Values in each column are unstandardised linear regression coefficients. Outcome variables have been standardised.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 13. Regression results of maternal chronic illness/disability, mother demographics, parenting, and cultural connectedness variables and mother-rated SDQ scores at the five- and eight-year waves for Māori children

Māori	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*
Variables (wave)	**Emotional problems (5y)**	**Conduct problems (5y)**	**Hyperactivity/Inattention (5y)**	**Peer problems (5y)**	**Pro-sociality (5y)**	**Emotional problems (8y)**	**Conduct problems (8y)**	**Hyperactivity/Inattention (8y)**	**Peer problems (8y)**	**Pro-sociality (8y)**
Maternal illness/disability (9m)	−0.028	**0.153****	0.028	0.040	0.037	0.142	0.135	0.072	0.081	0.043
Mother's age (9m)	**−0.114*****	−0.008	−0.041	**−0.164*****	0.021	−0.039	−0.028	−0.019	−0.061	−0.078
Mother's age^2	**0.002****	0.000	0.000	**0.002*****	−0.000	0.000	0.000	0.000	0.001	0.001
University education (Ref: Below university)	−0.102	**−0.136****	**−0.144***	**−0.143****	0.006	−0.001	−0.123	−0.145	−0.007	**0.202*****
NZDep2006 Index	**0.021****	**0.025****	0.015	**0.066*****	**0.022***	−0.006	0.009	0.003	**0.026****	**0.022***
Family support (antenatal)	−0.010	−0.006	−0.002	−0.009	0.002	0.004	0.012	0.002	−0.000	−0.007
Interest in the baby (9m)	**−0.020****	−0.011	−0.013	0.005	**−0.022****	0.012	0.002	−0.000	0.010	**0.022***
Parenting enjoyment (2y)	0.002	**−0.028***	−0.019	−0.006	**−0.043****	−0.005	0.010	−0.006	−0.026	−0.006
Parenting confidence (2y)	−0.008	0.041	0.029	−0.050	0.031	0.035	−0.017	0.006	−0.071	0.003
Warm parenting (5y)	**0.026*****	**−0.015***	−0.006	0.002	**−0.037*****	0.018	0.005	−0.012	**0.022***	0.013
Parenting efficacy (5y)	**−0.057*****	**−0.079*****	**−0.048*****	**−0.055*****	**−0.021****	**−0.037*****	−0.002	−0.016	**−0.037*****	0.009
Authoritarian parenting (5y)	0.005	−0.002	0.000	0.002	0.006	−0.009	−0.001	−0.003	−0.012	−0.000
Hostile parenting (5y)	**0.034*****	**0.064*****	**0.041*****	**0.019****	−0.011	−0.014	**0.023****	**0.019***	0.006	−0.002
Warm parenting (8y)	–	–	–	–	–	−0.008	−0.001	0.008	**−0.024***	**−0.026****
Parenting efficacy (8y)	–	–	–	–	–	0.016	**−0.027***	−0.009	−0.022	**−0.037*****

Authoritarian parenting (8y)	–	–	–	–	–	**– 0.108*** **	**– 0.203*** **	**– 0.154*** **	**– 0.097*** **	**– 0.101*** **
Hostile parenting (8y)	–	–	–	–	–	0.019	0.026	0.003	–0.008	0.006
Belonging to a community (antenatal; Ref: None)	–0.096	**–0.119****	0.018	**–0.137****	**–0.122***	0.011	–0.064	0.127	–0.058	–0.038
Ethnic importance (2y)	–0.017	–0.058	0.031	0.017	–0.052	–0.085	0.010	–0.025	**–0.121***	–0.026
Ethnic identification (5y)	0.054	0.005	**–0.109****	0.077	–0.048	0.008	–0.040	–0.042	**0.124****	**–0.092***
Cultural engagement (5y)	0.001	0.043	0.010	–0.046	–0.038	0.011	–0.059	**–0.079***	–0.045	–0.013

Note. Values in each column are unstandardised linear regression coefficients. Outcome variables have been standardised.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 14. Regression results of maternal chronic illness/disability, mother demographics, parenting, and cultural connectedness variables and mother-rated SDQ scores at the five- and eight-year waves for Pacific children

Pacific	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*
Variables (wave)	**Emotional problems (5y)**	**Conduct problems (5y)**	**Hyperactivity/Inattention (5y)**	**Peer problems (5y)**	**Pro-sociality (5y)**	**Emotional problems (8y)**	**Conduct problems (8y)**	**Hyperactivity/Inattention (8y)**	**Peer problems (8y)**	**Pro-sociality (8y)**
Maternal illness/disability (9m)	**−0.247***	0.129	0.096	0.127	0.057	−0.137	−0.039	**0.315****	0.024	0.166
Mother's age (9m)	**−0.114***	−0.010	−0.087	**−0.102***	0.009	−0.137	0.011	0.019	−0.136	0.024
Mother's age^2	**0.002***	0.000	0.001	**0.001***	0.000	0.002	−0.000	−0.000	0.002	−0.000
University education (Ref: Below university)	**−0.188***	0.012	−0.070	**−0.291*****	0.090	**−0.187***	−0.111	−0.072	−0.167	−0.054
NZDep2006 Index	**0.074*****	**0.029****	0.002	**0.081*****	**0.029****	−0.004	**0.032***	**0.038****	**0.057*****	0.015
Family support (antenatal)	0.006	−0.002	0.008	0.005	0.007	−0.010	−0.005	0.003	0.014	−0.003
Interest in the baby (9m)	**−0.020***	**−0.030*****	0.008	**−0.025****	**−0.026*****	−0.009	−0.002	−0.021	−0.001	−0.004
Parenting enjoyment (2y)	−0.009	−0.018	−0.015	−0.017	−0.018	0.028	0.018	−0.020	−0.027	−0.007
Parenting confidence (2y)	**0.090***	0.038	−0.029	0.028	0.009	0.065	0.004	0.037	−0.043	0.051
Warm parenting (5y)	**0.031*****	−0.006	−0.000	0.009	−0.014	−0.019	−0.001	−0.001	0.023	−0.006
Parenting efficacy (5y)	**−0.090*****	**−0.085*****	**−0.054*****	**−0.050*****	**−0.020***	**−0.044*****	−0.016	−0.002	**−0.038****	−0.018
Authoritarian parenting (5y)	**0.044*****	0.005	−0.009	0.003	**−0.018***	−0.002	−0.014	**−0.043*****	0.000	−0.000
Hostile parenting (5y)	**0.026*****	**0.046*****	**0.038*****	**0.024*****	0.004	−0.013	0.013	0.019	0.009	−0.005
Warm parenting (8y)	–	–	–	–	–	0.003	−0.000	0.003	−0.013	−0.003
Parenting efficacy (8y)	–	–	–	–	–	−0.019	**−0.047****	0.015	**−0.039***	−0.020
Authoritarian parenting (8y)	–	–	–	–	–	**−0.070*****	**−0.128*****	**−0.043***	**−0.070*****	**−0.048****
Hostile parenting (8y)	–	–	–	–	–	0.026	**0.055****	**0.073*****	0.023	0.005

Belonging to a community (antenatal; Ref: None)	−0.024	−0.085	−0.047	−0.063	0.021	0.133	−0.079	0.074	−0.066	0.015
Ethnic importance (2y)	−0.012	−0.042	−0.005	0.026	0.107	−0.072	−0.029	0.049	−0.037	**−0.168****
Ethnic identification (5y)	−0.036	0.054	−0.053	−0.097	**−0.127****	**0.124***	0.016	−0.051	−0.009	0.002
Cultural engagement (5y)	**0.095****	0.036	−0.031	0.097**	−0.024	−0.015	0.045	**−0.139****	0.053	−0.018

Note. Values in each column are unstandardised linear regression coefficients. Outcome variables have been standardised.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 15. Regression results for maternal chronic illness/disability, mother demographics, parenting, cultural connectedness variables and mother-rated English language and communication skills at the nine-month and two-year waves for Māori and Pacific children

	Māori			Pacific		
	B	*B*	*B*	*B*	*B*	*B*
Variables (wave)	**Communication and Symbolic Behaviour**	**MacArthur CDI-I Words & Gestures**	**MacArthur CDI-II Words & Sentences**	**Communication and Symbolic Behaviour**	**MacArthur CDI-I Words & Gestures**	**MacArthur CDI-II Words & Sentences**
Maternal illness/disability (9m)	0.027	0.032	−0.033	−0.146	**−0.199****	−0.065
Mother's age (9m)	0.004	**−0.056***	0.024	0.019	**−0.081****	−0.018
Mother's age^2	−0.000	0.001	−0.000	−0.000	**0.001***	0.000
University education (Ref: Below university)	**−0.154****	**−0.350*****	0.070	**−0.184****	**−0.267*****	**0.273*****
NZDep2006 Index	0.011	**0.037*****	**−0.046*****	0.009	**0.035*****	**−0.064*****
Family support (antenatal)	**0.026*****	**0.020*****	**0.012****	**0.020*****	**0.021*****	0.004
Interest in the baby (9m)	**0.050*****	**0.035*****	**0.018****	**0.035*****	−0.003	**0.024*****
Parenting enjoyment (2y)	−0.063	−0.030	0.002	**−0.140****	0.032	**0.049*****
Parenting confidence (2y)	–	–	**0.052***	–	–	**−0.077****
Belonging to a community (antenatal; Ref: None)	–	–	−0.014	–	–	**−0.193*****
Ethnic importance (2y)	–	–	**−0.124*****	–	–	**−0.284*****

Note. Values in each column are unstandardised linear regression coefficients. Outcome variables have been standardised.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 16. Logistic regression results for maternal chronic illness/disability, mother demographics, community belonging, and government support, examining likelihood of receiving government support at the two- and eight-year waves

	B	*B*	*B*	*B*
Variables (wave)	**Contact (2y)**	**Payment (2y)**	**Contact (8y)**	**Payment (8y)**
Maternal illness/disability (9m)	**0.557*** **	0.151	0.044	**0.443*** **
Mother's age (9m)	**−0.211** **	**−0.394*** **	−0.050	**−0.381*** **
Mother's age^2	**0.003** **	**0.005*** **	0.001	**0.004*** **
Mother's education (Ref: Secondary)	–	–	–	–
No secondary school	**0.471***	**0.476***	−0.053	**0.781*** **
Diploma/Trade	**0.370** **	−0.151	−0.098	**0.186***
Bachelor's degree	**0.383***	**−0.327*** **	**−0.990*** **	−0.152
Higher degree	**0.468***	**−0.414*** **	**−1.087*** **	**−0.245***
Household income bands (Ref: $50–70k)	–	–	–	–
<$20k	**1.026*** **	**0.603*** **	0.270	**0.406***
$20–30k	**0.847*** **	**1.105*** **	**0.684** **	**1.200*** **
$30–50k	0.275	**0.547*** **	0.129	**0.578*** **
$70–100k	−0.076	**−0.993*** **	**−0.548***	**−0.566*** **
$100–150k	−0.027	**−1.719*** **	**−1.091** **	**−0.900*** **
>$150k	−0.344	**−1.947*** **	−0.538	**−0.866*** **
Rurality	−0.386	**0.457*** **	−0.316	**0.340*** **
NZDep2006	**0.053** **	**0.072*** **	–	–
NZDep2013	–	–	**0.128*** **	**0.113*** **
Belonging to a community (antenatal; Ref: no)	**−0.260***	**0.336*** **	0.107	**0.204** **
Payment (2y; Ref: no)	**0.991*** **	–	0.299	–
Contact (2y; Ref: no)	–	**0.993*** **	–	**0.717*** **

Note. Values in the columns are unstandardised logistic regression coefficients.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix 3: Additional references

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