Health-related parenting behaviours across early childhood

Evidence from the *Growing Up in New Zealand* longitudinal survey

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Disclaimer

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Executive summary

Research aims

This study sought to understand how parenting behaviours that influence children's health, such as the food provided to children, their exposure to tobacco smoke, and the provision of their screen time and physical activity, cluster together and change across early childhood.

Early childhood is a particularly sensitive time for children's development and long-term health trajectories, and a period where broader population-level inequities in health first emerge. Thus, a better understanding of the more proximal determinants of health equity for children is potentially important for broader policy targets aimed at ameliorating these early socioeconomic and ethnic health inequities.

To shed light on the role of health-related parenting behaviours and children's early health, this study had three primary research questions:

1) What are the patterns of health-related parenting behaviours at different time points across the early childhood period?;
2) How do socioeconomic and ethnic disparities in health-related parenting behaviours narrow or widen over early childhood?; and,
3) Are these patterns of health-related parenting behaviours associated with inequities in children's health in ways that might explain persistent socioeconomic and ethnic disparities?

Data and sample

To address these aims, this study uses data from *Growing Up in New Zealand*- New Zealand's most recent longitudinal birth cohort study, representing a diverse sample of children born in 2009-2010 in the greater Auckland and Waikato regions. Data from the antenatal wave, along with waves when the children were 9-months, 2-years, and 4.5-years old were used, resulting in a sample of 5,795 children.

Key findings

A majority of parents were following through on more healthful behaviours that support their children's health, particularly early in the lifecourse

Most children were in clusters of parenting behaviours that were above the sample mean on more healthful behaviours (e.g., higher consumption of vegetables and fruit) and below average on behaviours associated with poorer health, such as screen time, fast food consumption, and tobacco smoke

exposure. This ranged from 76% of children at the 9-month wave to 40% of children at 2-years of age.

In comparison, a small proportion of the sample was identified as being exposed to clusters of parenting behaviours characterized by being above the mean on more unhealthful behaviours and below average on healthful behaviours. This ranged from 5% of children at the 9-month wave, peaking at 22% at the 4.5-year wave.

The percent of children being classified in clusters of parenting behaviours that were deemed most healthful declined as children aged. That is, following through on more healthful parenting behaviours became harder as children got older, indicating the potentially growing influence of more distal determinants of parenting behaviour and activities.

Parents, however, did not adhere to all healthy or all unhealthy behaviours at each wave. Instead there were five distinct "classes" of health behaviours at each wave, which tended to fall within a clear hierarchical pattern, with 'higher-tier' groups (one or two classes at each wave) of more healthful behaviours, 'mid-tier' groups (one or two classes at each wave) which tended to be around the sample mean on most behaviours, but had one or two distinguising features, such as being very high above the mean on screen time, for example. 'Lower-tier' groups (two classes at each wave) were typically above the mean across unhealthy behaviours and below on more healthful behaviours. Children's exposure to these different tier groups can and did change over time.

Socioeconomic and ethnic disparities in health-related parenting profiles appeared wider in the preschool years than earlier time points

There were clear inequities in the association between both socioeconomic status (measured by maternal educational attainment) and ethnicity, and health-related parenting classes across the early life course. Children with mothers with lower educational attainment, and tamariki Māori and Pacific and Asian children were at greater risk of being in lower-tier groups. Those risks appeared to be greater at later years (i.e., the 4.5-year wave vs. 9-month wave).

Point-in-time snapshots of health-related parenting were often not associated with child health, but cumulative exposure to more unhealthful parenting behaviours over time was associated with health outcomes

Despite inequities in health behaviours, these behaviours were not independently associated with children's health outcomes (e.g., acute illnesses, general health) when other factors, such as household income, were accounted for in the multivariate models. In fact, the inclusion of parenting behaviours in the multivariate models did little to change the association between maternal

education and child ethnicity and child health. This suggests that other structural factors may be more important for understanding persistent education and ethnic disparities in children's health, such as household income and neighbourhood-level deprivation.

Where health-related parenting behaviours did matter was when cumulative exposure was taken into account. Being consistently in the lower-tier groups across early childhood, or being in trajectories that started in higher-tier groups at antenatal and/or 9-month waves but trended down into lower-tier groups by the end of the study period, were associated with poorer rated health and greater risk of obesity.

Again, however, these associations appeared to explain little of the ethnic inequities in poorer health and child obesity risk.

Policy implications

Overall, there appear to be only a small minority of families who do not follow through on more healthful parenting behaviours to support their young children's health. Following through on these behaviours becomes harder, however, as children grow older. This finding suggests the need for more targeted and concentrated support during the earliest years, and even before birth, for more vulnerable populations, but also the extension of health services that provide universal care during the first year and throughout preschool, such as the Well Child Tamariki Ora programme. Importantly, interventions targeted at these behaviours should be informed by the research evidence of what works, with an understanding of the complexities of these co-existing behaviors.

The findings, however, confirm that policy interventions targeted just at modifying parenting behaviours alone will not ameliorate early childhood health inequities. Other factors, such as combating systemic racism, raising low-SES household incomes and ensuring high-deprivation communities have additional resources to thrive and promote healthful behaviours, are critical.

Future research should build on this study to further explore how these parenting behaviours are embedded within wider ecological contexts and, in turn, shape parents' ability to follow through on certain behaviours that may matter for population-level health, as well as equitable outcomes.

Introduction

Background

Like much of the developed world, there are strong and persistent ethnic and socioeconomic inequities in New Zealand children's health, emerging during the early years (Mills, Reid, and Vaithianathan 2012), growing larger over time, and contributing to life course outcomes such as inequities in life expectancy.

To achieve health equity in early life, we must ensure that families do not experience poverty, discrimination, powerlessness, and lack of access to quality employment, education and housing, safe environments, and healthcare. This requires all parts of government to work together to target the distal determinants of wellbeing and therefore have the most meaningful and effective impact on advancing health equity (World Health Organization 2008).

While these distal and structural determinents also shape behaviours, further understanding of more proximal determinants of health equity for children are also important policy targets, primarily because they are seen as more tractable intervention points. Because of the critical role of family in the lives of young children, and the amount of time that very young children spend with their parents or caregivers, health-related parenting behaviours are thought to be a proximate and malleable factor linked to children's health outcomes (Case and Paxson 2002; Philips, Sioen, Michels, Sleddens, and De Henauw 2014). For example, parents' decisions about what foods their children eat and whether parents smoke in the home and are associated with children's obesity status and frequency of respiratory illness, respectively (Best 2009; Lindsay, Sussner, Kim, and Gortmaker 2006). These early health issues go on to have repercussions for children's long-term health trajectories (Latham 2015).

Indeed, in New Zealand, there is clear evidence of the socioeconomic and ethnic disparities across many health-related parenting behaviours, particularly those related to early childhood nutrition, screen time, and tobacco smoke exposure. The *New Zealand Health Survey* found socioeconomic differences in nutrition-related behaviours, such as eating breakfast, and dietary intake for children aged 2–14 years. Children living in areas of high deprivation were less likely to have eaten breakfast at home regularly in the past week, and children from families experiencing socioeconomic deprivation were more likely to have eaten fast food or had three or more fizzy drinks in the past week and less likely to have met vegetable and fruit intake recommendations (Ministry of Health 2017).

These socioeconomic and ethnic disparities have also been found in studies examining screen time among young children, with European children and those living in areas of lower socioeconomic deprivation more likely to meet screen time guidelines than children of other ethnic groups and those living in areas of higher socioeconomic deprivation (Stewart, Duncan, Walker, Berry, and

Schofield 2019). In turn, not meeting screen time guidelines was associated with frequent illnesses and doctor visits.

Regarding tobacco smoke exposure, approximately 15% of New Zealand women of child-bearing age and 13% of pregnant women are regular tobacco smokers (Ministry of Health 2020a; Ministry of Health 2019). Women in the *Growing Up in New Zealand* longitudinal study were more likely to have been smokers prior to pregnancy if they lived in areas of higher socioeconomic deprivation, identified as Māori, were young, and were less educated. Among regular tobacco smokers, 51% of pregnant women continued smoking through pregnancy. These women were more likely to be living with other smokers in the household, identify as Māori, have low levels of education, smoke heavily and to have had an unplanned pregnancy (Shilling, Hedges, Atatoa Carr, and Morton 2018).

Parenting behaviours are multidimensional

There are few examples in the New Zealand literature that take a more collective and holistic examination of parenting behaviour trends, despite knowledge that they are complex and multifaceted. One parenting behaviour alone does not always predict health, and parenting behaviours can—and should—change to meet the developmental needs of children as they grow (Prickett and Augustine 2016). Examining one behaviour as a proxy for a range of parenting behaviours, misses that parenting behaviours both deemed 'bad' and 'good' for health coexist (e.g., supporting children's physical activity, such as providing access to swimming lessons, while also not meeting nutrition guidelines by drinking sugary drinks after the lesson), that the 'good' and 'bad' may correlate and that children may experience a combination of both (Augustine, Prickett, and Kimbro 2017). Moreover, it could also be that these behaviours may only matter for health cumulatively and under certain circumstances.

Socioeconomic and ethnic disparities in parenting behaviours

All parents want to do the right thing for their children. Conceptualizing parenting behaviours as 'good' or 'bad' ignores the structural factors that may be promoting healthy parenting practices or constraining parents from following through on behaviours they want to do. For example, providing a healthy, nutritious, and varied diet may be near impossible for parents in food poverty. For those with limited incomes, following nutritional guidelines are unrealistic, particularly at times when their children are less likely to try new foods, making the consequences of wasting food (and the hunger associated with that) more acute (Agrawal, Farrell, Wethington, and Devine 2019).

Mothers' educational attainment, specifically, is hypothesised to matter for children's development because of the human and social capital that comes through gaining university degrees. Educational attainment is tied to tangible resources such as higher incomes, but also human capital that can allow parents to better interpret and apply health information and navigate health systems.

Higher degrees also come with social capital that exposes them to other highly-educated parents which introduces them to (or creates pressure to display) health-promoting behaviours, such as the food that is acceptable for their children to been seen eating in front of others and having a slate of extracurricular activities (Augustine, Prickett, and Kimbro 2016).

In New Zealand, ethnicity is associated with inequities in child health, generally, and can be seen in disparities across health-related parenting behaviours, specifically. These parenting behaviour disparities, however, are shaped by broader structural forces related to colonialism and racism, social determinents of health, and cultural difference (Strickett and Moewaka-Barnes 2012). For example, colonisation stripped away tangible assests of land and rights, but also undermined cultural practices and language and set off waves of intergenerational trauma (Reid, Rout, Tau, and Smith 2017). For childrearing, play, care, and nuture within a broader whānau network in Aotearoa was central to raising tamariki and supporting their healthy development prior to European contact (Metge 1995; Salmond 1993). Centering Western parenting practices at the onset of colonialism introduced harsher disciplinary practices and, in the present, a focus on biological parents taking on the sole responsibility for raising children (Kiro 2017).

Centralising Western models of parenting creates tension for Māori and Pacific parents, specifically, who—because of the legacy or colonialism—and continued experiences of systemic racism—are more likely to lack the socioeconomic resources that predict good health and access to supports that promote health-related parenting behaviours. Minimising the role of whānau in supporting children's health, then, turns off a resource tap for those who might most need it. The ability to be supported and follow through on more healthful parenting behaviours is hampered still by ethnic stereotypes that both explicitly and implicitly become imbedded within the systems that are aimed at promoting children's health, generally, and parents' behaviour, specifically, such as interactions with health service providers (Ministry of Health 2020b; Ministry of Justice 2019).

In line with these critiques, it should be noted that parents are not solely responsible for health-related behaviours, and therefore misunderstandings regarding the context of such behaviour, and associated focus on informing and encouraging behaviour change can result in health promotion efforts being ineffective and even exacerbating inequities (Pickett, Luo, and Lauderdale 2005).

Stages of development as critical points for outsized impact

Finally, it's important to acknowledge that following through on certain behaviours may be harder or pose unique challenges at different ages (Prickett and Augustine 2016). For example, meeting all the well-child check-ups during infancy may be more cumbersome and, at the same time, more consequential than at later ages because of the number of immunisations and outsized

consequences of acute illnesses (Yoshinaga-Itano, Sedey, Coulter, and Mehl 1998). On the other hand, nutrition during the toddler years may be more important for healthy development than during infancy when there are fewer decisions to be made (e.g., solids vs. a milk-heavy diet). In this way, not only may health-related parenting gaps be wider at different ages because certain behaviours may be harder to follow through on, but the consequences of those gaps could represent important sources of inequalities for children's health.

The current study

Thus, this study asks three primary questions to inform policy and practitioners and the evidence-base for interventions targeting parenting behaviours to reduce child health inequities:

1) What are the patterns of health-related parenting behaviours at different time points across the early childhood period;
2) How do socioeconomic and ethnic disparities in health-related parenting behaviours narrow or widen over early childhood; and,
3) How are these patterns of health-related parenting behaviours associated with inequities in children's health in ways that might explain persistent socioeconomic and ethnic disparities in children's health?

Conceptual framework

Figure 1 presents the conceptual model guiding this study. In this model, we posit that socioeconomic status, measured through maternal education attainment, and ethnicity, influence health-related parenting behaviours (pathway a) which, in turn, are associated with children's health (measured by counts of children's general health, acute illnesses, and BMI status) (pathway b). We recognise that parenting behaviours are strongly influenced by structural and societal influences (pathway a), and that parents leverage those resources (e.g., social, financial, and human capital) in order to promote their children's healthy development, pointing to a source that may explain persistent socioeconomic and ethnic disparities in young children's health in New Zealand.

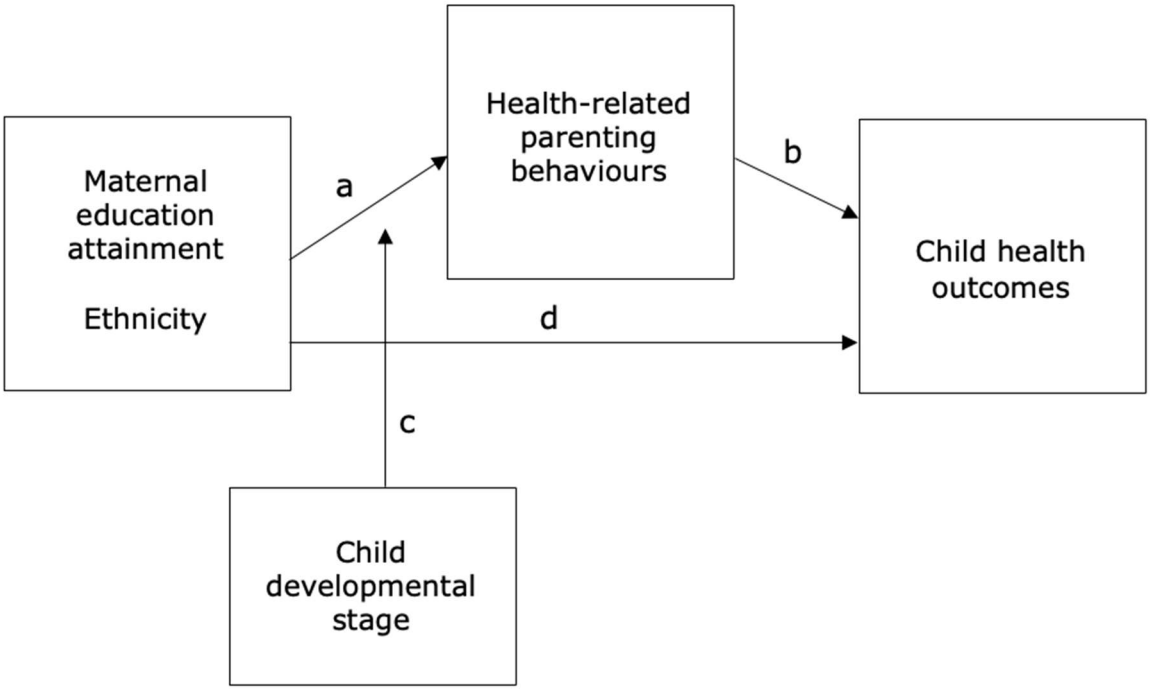
We also recognise that these structural and societal forces that operate through parents' ethnic identity and educational attainment and shape parenting behaviours also either impact child health directly (pathway d) or through other known and measureable (e.g., income, neighbourhood deprivation) and unknown or unmeasureable or hard-to-measure mechanisms (e.g., racist microaggressions; differences in treatment by health practitioners). These structural forces operate in ways that produce inequities both by producing additional disadvantages for those with less resources (e.g., food deserts or swamps in low-income neighbourhoods) while also accruing more advantages for those with more resources to begin with, such as the human and social capital well-resourced parents have to advocate for more health-promoting amenities in

their communities and schools (e.g., functioning and safe playgrounds, extracurricular enrichment activities).

Moreover, following through on certain behaviours may be more cumbersome or pose unique challenges at different ages. We argue that education and ethnicity will be more strongly associated with health-related parenting behaviours (e.g., gaps widest) at ages when following through on those behaviours takes more resources (e.g., financial, human and social capital) (pathway c).

In this way, not only may health-related parenting gaps be wider at different ages because certain behaviours may be harder or more costly to follow-through on (pathway c, Figure 1), but the consequences of those gaps could represent important sources of inequities in children's health.

Figure 1. Conceptual model



Building on Augustine, et al. (2016), a significant feature of this study is the measurement of health-related parenting behaviours, which takes a more holistic approach by capturing a variety of health-related behaviours simultaneously. Indeed, parenting behaviours do not happen in a vacuum. This study uses techniques (i.e., latent class analysis) that enable multidimensional measures of health-related behaviours.

Overall, this conceptual model informs the three key aims of the study. First, we identify how health-related parenting behaviours cluster together to create multidimensional 'profiles' of parenting at different time points across early childhood. Second, we examine income and ethnic disparities in these parenting profiles across early childhood. Third, we explore whether these profiles are

associated with both temporal (e.g., maternal-reported child health, acute illnesses) and chronic child health outcomes (Body Mass Index [BMI] status).

We examine both acute and chronic illnesses given the point-in-time and cumulative exposure to parenting behaviours may matter differently. For example, acute illnesses occur more suddenly, are of limited duration, and can be triggered by current conditions and environments. Chronic conditions are longer lasting andmore likely due to sustained exposure to less health conducive environments. It is important to note, however, that frequent and prolonged experiences of acute illness is tied to chronic conditions, such as obesity (Green 2015).

Method

Data and sample

This study uses data from *Growing Up in New Zealand* (GUiNZ). *Growing Up in New Zealand* is New Zealand's most recent birth cohort study, representing a diverse and representative longitudinal sample of around 6,000 children born in 2009-2010 in the greater Auckland and Waikato regions. The sample represented one in 11 births in the country in the same time period, and one in three births in the recruitment region, and is similar to the national population in terms of sex and singleton births, but was more ethnically diverse and had lower rates of preterm or low birthweight status (Morton et al. 2014).

We use the antenatal wave (collected in 2009-2010, most often during women's third trimester in the prenatal period) wave along with waves when children were 9-months (2010-11), 2-years (2011-12), and 4.5-years (2014-15) old. These waves represent interviews that were conducted face-to-face and a wider range of survey questions were asked.

Our study is unique in including the antenatal wave in the longitudinal trajectories of health-related parenting behaviours, but is in line with the extant literature that shows that maternal health, generally, and health-behaviours during the antenatal period, specifically, have implications for children's health (Baily and Byrom 2006 Cheng, et al. 2016; Lobel, et al. 2008).

Our final analytical sample included 5,795 children. Just over 15% (n = 1,058) of the baseline sample was excluded from the study due to attriting by the 54-month survey and for whom the primary caregiver, almost exclusively the mother in our analytical sample, changed. Table A1 in the appendix displays comparisons between those who attritted and those in the analytical sample based on antenatal/baseline characteristics. Those excluded from the study were more likely to have sociodemographic characteristics that would suggest they were disadvantaged, such as having lower incomes, lower levels of educational attainment, less likely to be in employment or in a two-parent family unit, and more likely to be an ethnic minority. In terms of health behaviours at the antenatal wave, those who attrited had higher rates of fast food consumption and tobacco smoke exposure and lower rates of exercise. These patterns have two key implications for the findings. First, we have lost those who were most likely to display more 'unhealthful' behaviours, meaning we may be underestimating the proportion of children being exposed to the most 'unhealthful' behaviours. Second, we may also be underestimating the SES and ethnic disparities in being exposed to more or less 'healthful' behaviours.

All children in the analytical sample had health-related parenting behaviour information for at least half (two of four) of the waves. Over 85% (n = 4,967) had no missing health-related parenting behaviour information at all four waves, 13.6% (n = 790) had non-missing information at three waves, and the

remaining 0.7% had non-missing information at two waves (*n* = 38). We elected to keep all children in the study who had not attrited but who may have been missing health-related parenting behaviour information at certain waves in order to limit potential bias from eliminating those who could still contribute data at some waves. Despite this concern, however, and because the large majority of the sample was not missing any health-related parenting information, excluding or including those who were missing data at some waves made little substantive difference to the overall findings.

Overall, 90.1% (*n* = 5,224) of the total analytical sample was included in the antenatal wave analyses, 99.4% (*n* = 5,758) of the sample in the 9-month wave analyses, 96.5% (*n* = 5,595) of the sample in the 2-year wave analyses, and 99.0% (*n* = 5,737) of the sample in the 4.5-year analyses. For the analyses examining trajectories of health profile experience over early childhood, those with health-related parenting behaviours at all four waves--85% of the analytical sample (*n* = 4,967)--were included.

Variables

Health-related parenting behaviours

To construct the health-related parenting behaviour profiles through latent class analysis, we included variables used across the four face-to-face study waves (i.e., antenatal, 9-months, 2-years, 4.5-years) in the preschool period in the areas of nutrition, physical/sedentary behaviour, and environmental exposure to tobacco smoke to create health-related parental classes at each of those waves.

- *Nutrition:* Nutrition in the antenatal wave concerns mothers' nutritional intake and captures frequency of fruit and vegetable, fast food, sweets and lollies, and sugary drinks (i.e., juice and soft drinks) consumption. At the 9-month wave, this included children's fruit and vegetable, sugary drinks, and sweets and lollies consumption. The 2-year and 4.5-year waves included the same items as the 9-month wave but also included fast food consumption (which was not asked at the 9-month wave).
- *Physical/sedentary behaviour:* Physical and sedentary behaviour captured mothers' exercise at the antenatal wave, and physical activity of the child from the 2-year and 4.5-year waves. Screen time was captured at the 2-year and 4.5 year waves.
- *Environmental exposure to tobacco smoking:* Second hand tobacco smoke exposure of the child was captured at each wave, and measured whether any adult living in the same household as the child (or in pregnancy) smokes.

We focus on these three areas for practical, scientific, and policy reasons. First, nutrition, physical activity, and second hand tobacco smoke exposure are correlated with child health conditions, such as child obesity, acute illness, and

overall general health (Oberg et al. 2011; Grant et al. 2010). Large socioeconomic and ethnic inequities exist in these specific child health concerns (Mills et al. 2012), with public health programmes and policies aimed at intervening to reduce the burden of these diseases and target inequities. These programmes and policies often focus on early life, and on parenting and family education, messaging, and behavioural guidelines. Hence, these measures are of policy concern.

The variables used at each wave differ for two primary reasons. First, due to the availability of variables (e.g., practicality) across the different data collection waves of this longitudinal study. There is some relative consistency in measures of some items across waves (e.g., nutrition, smoke exposure), but not in others (e.g., screen time). Second, variables are required to be adapted in order to match the changes in health-related parenting behaviours over the early years to meet both children's health needs and developmental stages.

Where available, the *New Zealand Ministry of Health guidelines* were used to inform the coding schema (i.e., vegetable and fruit intake) (Ministry of Health 2012). Where there was less specific guidance or academic consensus on quantity (i.e., fast food, screen time), the sample distribution was used to inform the coding process. More detail on the construction of the health-related behaviours can be found in Table A2 in the appendix.

We note that parenting behaviours are reported by the mother. We acknowledge that parents, generally, and mothers, specifically, are not always sole responsible for the health-related behaviours their children are exposed to. Further discussion of this limitation can be found in the "Discussion" and "Limitations and future directions" sections.

Health outcomes

We examined three outcome measures—maternal-reported child health, experience of acute illnesses, and child overweight status.

Maternal-reported global child health was consistent across all three waves and represented by a scale ranging from *1* = poor through *5* = excellent in response to the question "In general, how would you say your [baby's/child's] current health is?"

Acute illness was measured at the 9-month, 2-year, and 4.5-year waves. At the 9-month and 2-year waves, acute illnesses was a scale score counting the number of chest infections (e.g., bronchitis, pneumonia, croup), bouts of gastroenteritis, and ear infections in the baby's life when the child was 9-months old (scale ranged from 0 through 8 instances) and in the past twelve months when the child was 2-years old (ranging from 0 through 11 instances).

Survey items differed at the 4.5-year wave, and parents were asked whether the child had at least one instance of certain acute illnesses such as a chest

infection, gastroenteritis, or ear infection.[1] Those same three types of illness were used to create a count ranging from *0* = experience none of those illnesses in the past twelve months through *3* = experienced at least one instance of all three types of those illnesses in the past twelve months.

Body Mass Index (BMI) status was measured at the 4.5-year wave. It was constructed in two ways—both, however, using New Zealand Ministry of Health guidelines for constructing BMI and BMI weight status cut-offs (Ministry of Health 2012). First, we created a binary indicator of whether the children's BMI placed them in the obese category or not. Second, we constructed a four-category measure indicating whether the child's BMI identified them as being underweight, healthy weight, overweight, or obese.

Although child obesity has been recognised as a significant public health challenge in New Zealand and ongoing policy concern (Chiavaroli, Gibbons, Cutfield, and Derraik 2019), we contextualise the use of such measurement in the broader research dialogue around the utility of BMI as a proxy for poor health (Gutin 2018; Tomiyama, Hunger, Nguyen-Cuu, and Wells 2016).

Covariates

Key independent variables

The two primary independent variables of interest are 1) socioeconomic status; and, 2) ethnicity. These two variables are two of the most prominent stratifiers in terms of population-level child health in New Zealand (Mills, Reid, and Vaithianathan 2012).

Maternal education was used as a proxy measure of socioeconomic status, where maternal education is one of the strongest predictors of parenting behaviours (Davis-Kean 2005). The importance of maternal education as a socioeconomic determinant is also in line with the existing literature examining health-related parenting behaviours (Augustine et al. 2017; Molburn, Lawrence, and Krueger 2020; Lawrence, Rogers, and Hummer 2019; Prickett and Augustine 2016). Educational attainment was broken into four dummy variables representing: 1) No formal school qualifications; 2) National Certificate for Educational Achievement (NCEA) levels 1-3 qualifications; 3) NCEA levels 4-6 qualifications; and, 4) undergraduate or postgraduate university degree.

Ethnicity was identified through mothers' reports of their children's ethnicity. Ethnic identification was provided at Level 1 Statistics New Zealand hierarchy, and where mothers identified their child within more than one ethnic group (32% of children), prioritisation was applied according to Statistics New Zealand guidelines and routine Ministry of Health processing. The final measure was a series of mutually-exclusive dummy variables indicating European (including predominantly NZ European/Pākehā), Māori, Pacific, Asian, or Other ethnicity.

[1] The number of illnesses was not captured in the 4.5-year survey.

Two primary reasons influenced the decision to use child ethnicity at each wave, including the antenatal wave, instead of maternal ethnicity. First, the study aims to inform our understanding of population-level inequities in child health, making a child-centered ethnicity classification appropriate. Second, the longitudinal analytical approach necessitated that ethnic and education groups remained consistent over time, ruling out combining maternal ethnicity at the antenatal wave with child ethnicity at subsequent waves.

A limitation of our approach to use child ethnicity (vs. maternal ethnicity) as a proxy for the families' ethnicity, however, lies in our conceptual theorisation of the pathways through which we think broader structural forces, such as colonialism and racism shape parents' behaviours in ways that translate into health inequities. For example, European mothers of tamariki Māori might accrue advantages because they themselves do not experience the same barriers to high quality health care access and exposure to racism and discrimination that, in turn, garners resources that supports them in following through on more healthful parenting behaviours. While we posit that our conceptual model still holds, the analytical application whereby child ethnicity is used as proxy over mothers' own ethnic identification may introduce statistical noise into the mediational pathway.

Despite the decision to prioritise child ethnicity over maternal ethnicity at the antenatal wave, there was high concordance between maternal and child ethnicity, where 85.5% of the children in the sample would have been coded with the same ethnicity had their mothers' ethnicity been used instead. Concordance was higher among the sample of children classified as European (95.8%) and Asian (93.2%), followed by Pacific children (82.2%), tamariki Māori (67.8%), and children of some other ethnicity (50.7%). Among tamariki Māori, 25.4% had a mother who was identified as European and further 5.3% as Pacific. Among Pacific children, 12.8% had a mother who identified as European, whereas 38.3% of children from some 'other' ethnicity had a mother identified as European.

Model covariates

An array of covariates were included in the models, and represent both time-invariant (e.g., maternal age at antenatal wave, child's low birthweight status) and time-variant measures (e.g., household income, family structure, residential mobility).

A full list of the covariates and their coding can be found in Table A3 in the appendix.

Analytical approach

Classes of health-related parenting behaviours

To begin, we conducted Latent Class Analysis (LCA) to construct 'classes' of health-related parenting behaviours at each wave (Aim 1). Latent class analysis is a statistical method for using data on observed characteristics or behaviours to group respondents into 'classes' that display similar types of characteristics or behaviours. For example, few parents are likely adhere to all healthy behaviours or all unhealthy behaviours. Instead, some parents might adhere to mostly healthy behaviours but also a few unhealthy behaviours, but overall, be considered a more healthful 'class.' Latent class analysis groups parents into 'classes' based on common or like combinations of these behaviours.

The most appropriate number of classes produced by the latent class analysis is determined through model fit statistics. We used several measures to test how well specific number of classes fit the data (e.g., AIC, BIC, log likelihood; presented in Table A4 in the appendix), with five classes determined to be the best fit at each wave.

While each class represented a unique set and pattern of clustering within and across each wave, the classes reflected both more or less 'healthful' behaviours in comparison to each other in terms of their association with child health, both in the literature and empirically through this analysis. In order to aid in interpretation and the construction of health-related parenting class 'trajectories' (see below), we devised a classification system at each wave to group more or less 'healthful' classes into groups. In some waves there was a clear hierarchical order to the classes in terms of healthfulness of the behaviors, however in others, there was not, and so classes were categorised as follows:

- Higher-tier: Classes that were clearly the most advantaged in terms of healthful behaviours, or in some waves one of two classes displaying more healthful behaviours;
- Mid-tier: Classes that were neither the most or least disadvantaged in terms of healthful behaviours.
- Lower-tier: Classes that were clearly the most disadvantaged in terms of healthful behaviours, or in some waves one of two classes displaying less healthful behaviours.

These categorisations are denoted in the presentation of the latent class analysis results in Tables 2a through 2d.

Trajectories of health-related parenting behaviours

These tier groups were then used to construct 'trajectories' of health behaviors across all four waves. We examined whether children remained in the same tier of behaviours, whether they transitioned into a 'higher-tier' health tiers or whether their moved into less healthful tiers. To construct these trajectories we examined every unique pattern of health-related tier exposure over the study

period, grouping them into 'like' experiences that considered both the stability in tier group experience, and the type (e.g., upward, downward, mixed) and timing (e.g., tier at antenatal vs. 4.5-year wave, upward shift at 9-month wave).[2]

Predictors of health-related parenting classes

Moving to the second Aim, multinomial logistic regressions were conducted at each wave to examine whether educational attainment and/or ethnicity was associated with differential risk of being members of more or less advantaged health behaviour classes.

Health-related parenting classes and child health

Finally, we examined whether these health-related parenting classes were associated with children's health (Aim 3). When examining the temporal health outcomes—acute illness count and maternal-reported global health scale—we estimated a series of Ordinary Least Squares (OLS) regressions at each wave. For examining children's overweight status, we estimated both logit (e.g., obese or not) and multinomial (e.g., underweight, healthy, overweight, obese) regressions, examining the association between health profiles at the 4.5 year wave and BMI status at the 4.5-year wave.

In addition to examining the associations between classes at each wave, we also explored the associations between the trajectory measures (i.e., health-profile experiences across all four waves), which captured the cumulative exposure to certain health profiles, and the child health measure, acute illness, and BMI status measured at the 4.5-year wave. A combination of OLS, logit, and multinomial regressions were used, dependent on the outcome measurement.

All analyses were conducted in Stata. Multiple imputation was used to impute item-level missing data on independent variables, producing 100 imputed datasets that were estimated using the suite of *mi estimate* commands. This technique has been shown to be more efficient and produce less bias in coefficients than traditional methods, such as listwise deletion (van Ginkel, Linting, Rippe, and van der Voort 2020). Differences in analytical sample sizes within waves using different dependent variables were the result of listwise deletion on the dependent variable.

[2] Unique patterns of health-related parenting tier membership that produced large enough cell sizes, such as those who were always in a higher-tier class at each wave, were coded as individual trajectories. Other unique patterns with small cell sizes were collapsed with other unique patterns that were similar, such as those who were always in the lower-tier class and those who were in the lower-tier class three of four waves.

Results

Table 1 presents a description of the sample, including the outcome variables, health-related parenting behaviours, and key independent variables. Table A5 in the appendix presents the sample descriptives for all variables used in the study.

Overall, in terms of health-related parenting behaviours, these behaviours appeared to change as children aged, becoming slightly less 'healthful'. This included children consuming more fast foods, sugary drinks, and sweets, and more time spent on screens at older ages. One exception to this pattern appeared to be second hand tobacco smoke exposure which was at its lowest rate in the antenatal period (19.6%), was highest at the 9-month wave (28.3%) and declined modestly at the 2-year (26.8%) and 4.5-year waves (24.7%).[3]

The proportions of children identified within the five main ethnic groups (European, Māori, Pacific, Asian and Other) remained similar at each wave. In addition, the key sociodemographic characteristic focused on for these analyses - maternal educational attainment also remained consistent across the waves, despite the analytical sample size changing slightly each wave.

Health-related parenting classes

To begin, we examine how health-related parenting behaviours clustered at each wave: antenatal, and when children were 9-months, 2-years, and 4.5-years old. Based on fit statistics from the latent class analyses (Table A4), five classes were determined to fit the data best at each wave.

Tables 2a-2d display 'heat maps' of the classes across the waves, highlighting the different health behaviors in each class compared to the total sample. Darker green shading denotes that parents in this class demonstrated more healthy behavior compared to the average for the sample as a whole, while darker red indicates that parents in this class demonstrated less healthy behavior relative to the average of the sample as a whole. Grey shading indicates average healthy behaviors.

Darker green shading identifies within-group averages representing more 'healthful' behaviour compared to the sample mean, whereas darker red suggest more 'unhealthful' behaviour. A grey shaded box, however, suggests the group's mean is broadly similar to the total sample mean.[4] To determine the magnitude of difference between the within-group averages and the total sample, we constructed z-scores for each behaviour within each wave. The z-score can be used to determine how far away from the sample mean the within-group mean is. For example, for screen time, an average z-score of 1 would indicate that that children in that particular class are watching one standard deviation more screen

[3] Chi^2 tests indicated that proportion of children exposed to tobacco smoke at each wave was statistically different from each other at at least $p < .05$.
[4] The shading schema broadly proxies Cohen's (1962) effect size classification.

time. Translated back to the raw screen time, that would be equal to about 2.34 more on the screen time scale, which is close to one and half hours more screen time per day at the 4-5-year wave.

Classes of the health behaviours at the antenatal wave

Beginning with the antenatal wave (Table 2a), the two higher-tier classes in terms of displaying more 'healthful' behaviour, represented close to half of all mothers in the sample, with a further 39.0% of pregnant women having average health behaviours but low on meeting the recommended servings of fruit and vegetables. Less than 5% of mothers fell into the lowest-tier class, however this class appeared particularly disadvantaged in terms of exceptionally high smoke exposure and reported very high rates of unhealthy behaviour compared with the vice versa of the higher-tier groups who were only moderately high on healthful behaviours. Overall, rates of exercise did not appear to be a distinguishing variable across the profiles.

Specifically, pregnant women with the most 'healthful' behaviours ("Low unhealthy food consumption and smoke exposure"; 9.0% of the sample) reported having below average consumption of unhealthy foods, such as fast food, sugary drinks, and sweets, and above average consumption of fruit and vegetables. This class also had lower rates of tobacco smoke exposure, with 12.4% of pregnant women reporting they or someone in their household smokes compared to 19.6% of the total sample.

The next 'higher-tier' class ("High vegetable/fruit consumption, low smoke exposure"; 40.2% of the sample) was average on unhealthy food consumption, but had the highest fruit and vegetable consumption and lowest rate of household smoke exposure (10.9%).

A third mid-tier class of pregnant women ("Average with low vegetable/fruit consumption"; 39.0% of the sample) was average across most indicators but was distinct for very low rates of vegetable and fruit consumption.

As an example of how different types of 'unhealthful' and 'healthful' behaviours coexist, a smaller fourth class of pregnant women ("Very low sweet consumption with high fast food, soft drinks, and vegetable/fruits consumption; 7.2%) had much lower sweets consumption and above average vegetable and fruit consumption than the total sample, but also reported more fast food and sugary drink consumption.

The lowest-tier class ("High unhealthy food consumption and smoke exposure"; 4.7%) had very high levels of fast food consumption and above average soft drink and sweets consumption. Close to three quarters of pregnant women in this tier (74.3%) also reported they or someone in their home smoked. Interestingly, this group also had above average vegetable and fruit consumption.

Table 1: Sample description

	Antenatal		9 months		2 years		4.5 years	
	n	*M*/%	*n*	*m*/%	*n*	*m*/%	*n*	*m*/%
Health outcomes								
Global health scale (1-5 scale)	..	..	5,758	4.45 (0.80)	5,594	4.34 (0.83)	5,737	4.34 (0.79)
Acute illness count*	..	..	5,751	0.80 (1.03)	5,575	1.68 (1.56)	5,736	0.67 (0.78)
Child obese status								
Not obese	..	..	..	..	..	..	4,961	91.70
Obese	..	..	..	..	..	..	449	8.30
Child BMI group								
Underweight	..	..	..	..	..	..	210	3.88
Healthy weight	..	..	..	..	..	..	3,678	67.99
Overweight	..	..	..	..	..	..	1,073	19.83
Obese	..	..	..	..	..	..	449	8.30
Health behaviours								
Vegetables/fruit (0-4 scale)	5,224	2.55 (1.14)	5,758	2.75 (0.57)	5,595	2.20 (1.06)	5,737	2.13 (1.11)
Fast food (0-4 scale)	5,224	1.24 (0.88)	..	..	5,595	1.11 (0.87)	5,737	1.23 (0.76)
Soft drinks and juice (0-4 scale)	5,224	2.89 (1.22)	5,758	0.73 (1.28)	5,595	2.13 (1.44)	5,737	2.09 (1.24)
Sweets (0-4 scale)	5,224	2.32 (1.26)	5,758	0.28 (0.70)	5,595	2.04 (1.13)	5,737	2.29 (0.96)
Exercise (0-3 scale)	5,224	1.38 (1.13)	…	..	5,595	3.21 (0.91)	5,737	3.09 (0.49)
Screen time (0-9 scale)	…	..	…	..	5,595	2.56 (2.38)	5,737	4.07 (2.34)
Smoke exposure								
No	4,198	80.36	4,128	71.69	4,095	73.19	4,318	75.27
Yes	1,026	19.64	1,630	28.31	1,500	26.81	1,419	24.73

Table 1 continued on next page

Table 1 continued

Educational attainment								
No secondary school qual.	277	5.31	333	5.80	315	5.64	329	5.75
NCEA 1-4	1,143	21.91	1,270	22.11	1,237	22.16	1,266	22.12
NCEA 5-6	1,588	30.44	1,747	31.41	1,711	30.65	1,740	30.40
Undergraduate/postgrad degree	2,208	42.33	2,395	41.69	2,319	41.54	2,388	41.73
Ethnicity								
European	2,426	46.47	2,645	45.95	2,585	46.23	2,641	46.06
Māori	1,226	23.48	1,354	23.52	1,311	23.44	1,345	23.46
Pacific	667	12.78	758	13.17	730	13.05	754	13.15
Asian	715	13.69	799	13.88	771	13.79	794	13.85
Other ethnicity	187	3.58	200	3.47	195	3.49	200	3.49
n	5,224		5,758		5,595		5,737	

M/m = mean; std. dev. = standard deviation for means; .. = Variable not available at this wave.

* Acute illness was a 0-11 scale at the 9-month and 2-year waves. It was a 0-3 scale at the 4.5-year wave.

Classes of the health behaviours at the 9-month wave

A slightly different pattern of health-related parenting behaviours emerged at the 9-month wave when survey questions were targeted at children's nutritional consumption (Table 2b).

For infants, the large majority of the sample (76.1%) were identified as having 'healthful' parenting behaviour, and the group with the least healthy behaviors represented just 1.4% of parents with infants. This small proportion of families with less 'healthful' parenting practices during infancy are not likely driving the broader population-level trends in early health outcomes at this critical age.

Groups were similar in terms of their infants' vegetable and fruit consumption, juice, soft drink and sweets consumption, and household smoke exposure. Instead, the class that could be deemed to be 'higher tier,' represented over three-quarters of the sample (76.1%) and was distinguished primarily by having slightly above average vegetable and fruit consumption.

The second class was average across most behaviours but was unique in their infants having below average vegetable and fruit consumption (12.3%). The third class had infants with very low vegetable and fruit consumption and higher rates of smoke exposure (5.3%).

The two classes in the lower-tier group were similar to each other in terms of their infants unhealthy food consumption and smoke exposure, except one reported above average vegetable and fruit consumption and second hand smoke exposure (4.9%) whereas the other was more 'unhealthful' across the behaviour variables: more likely to have lower rates of fruit and vegetable consumption; higher rates of consumption of less healthy food; and the highest rates of second hand smoke exposure at this data collection wave ("Disadvantaged across all behaviours; 1.4%).

Classes of health behaviours at the 2-year wave

The health behaviors at the 2-year analysis included the same items as the 9-month analysis, however it added measures of the child's fast food consumption, physical activity, and screen time (Table 2c).

Although 83% of the sample clustered into two groups, compared to the 9-month latent class groups, there appeared to be more variation in parenting behaviours and related exposures for children at this older age.

The class with the healthiest behavior (40.2% of the sample) reported lower child consumption of fast food, sugary drinks, and sweets, as well as less screen time. They also had the lowest rates of tobacco smoke exposure (14.2% vs. 26.8% in the total sample). They resembled the sample mean in terms of their children's consumption of vegetable and fruit, and their exercise level.

The largest class, consisting of 43.0% of children, reflected the sample mean on most indicators, however, was identified as having above average sugary drink consumption. A smaller mid-tier class (4.1%) was average on most indicators, however had below average rates of low sugary drink consumption but some of the highest rates of screen time.

An even smaller lower-tier class (1.7%) was above average on all food consumption, including vegetables and fruit, and these children also had higher rates of tobacco smoke exposure and lower rates of exercise.

A final lower-tier class consisting of 11.0% of the sample had more 'unhealthful' exposures across most indicators, including children with above average consumption of fast food, sugary drink, and sweets, above average screen time, and higher tobacco smoke exposure. However, they had average rates of vegetable and fruit consumption and exercise.

Classes and health behaviours at the 4.5-year wave

At the 4.5-year wave (Table 2d), the high-tier classes represented over half of all children. More children than prior waves, however, were exposed to the lower-tier classes, representing more diversity and potentially growing inequities in exposure to healthful versus unhealthful behaviours.

The healthiest behaviours group (26.6%) represented just over one quarter of children and was characterised by lower consumption of fast food, sugary drinks and sweets, less screen time, and less tobacco smoke exposure (5.7% vs. 24.7% in the total sample). This group, however, also reported lower rates of vegetable and fruit consumption than the total sample.

The other healthiest behaviours class (26.6%) was average across most behaviours, but these children had high rates of vegetable and fruit consumption and below average screen time.

A mid-tier class (25.0%) was characterised by children with above average consumption of sugary drinks and below average vegetable and fruit consumption.

Finally, two lower-tier classes were identified, both with children twice as likely to be exposed to tobacco smoke compared to the sample mean (48.3-48.9% vs. 24.7%), and above average screen time. One group ("High food consumption, smoke exposure, and screen time"; 8.7%), however, had above average consumption of both vegetables and fruit and unhealthy foods. The children in the other group ("Low vegetable/fruit consumption, highest smoke exposure and screen time"; 13.1%) had below average vegetable and fruit consumption and above average fast food consumption.

Again, exercise did not appear to be a significant distinguishing factor in the determination of the class profiles.

Table 2a: Health-related parenting classes at the antenatal wave (n = 5,224)

Profile	Tier	*n*	%	Vegetables and Fruit z-score	Fast food z-score	Juice and soft drinks z-score	Sweets z-score	Exercise z-score	Smoke exposure %	Screen time z-score
Low unhealthy food consumption and smoke exposure	Higher	468	9.0	0.59	0.52	2.05				..
High vegetables/fruit consumption, low smoke exposure	Higher	2,101	40.2							..
Average with low vegetable/fruit consumption	Mid	2,035	39.0	-1.11	-0.14	-0.04	-0.05	0.10		..
Very low sweet consumption with high fast food, soft drinks, and vegetables/fruit consumption	Lower	375	7.2	0.70	-0.65	-0.47	1.74	-0.05	24.80	..
High unhealthy food consumption and smoke exposure	Lower	245	4.7	0.52	-1.73	-0.66	-0.74	0.23	74.29	..

.. Survey questions not asked at wave. Green indicates more 'healthful' behaviours or absence of less 'healthful' behaviours.
Z-scores for 'unhealthful' behaviours of fast food, juice and soft drinks, and sweets consumption and screen time have been reverse coded.

Red:	-0.80 of a standard deviation lower than the mean
Orange:	-0.60 to -0.79 of a standard deviation lower than the mean
Peach:	-0.40 to -0.59 of a standard deviation lower than the mean
	-0.39 to 0.39 of a standard deviation around the mean
Light green:	0.40 to 0.59 of a standard deviation higher than the mean
Medium green:	0.60 to 0.79 of a standard deviation higher than the mean
Dark green:	0.80 of a standard deviation and higher than the mean

For tobacco smoke exposure the same coding formula is applied, although dark red represents percent is 80% of the mean of higher, etc.

Table 2b: Health-related parenting classes at the 9-month wave (n = 5,758)

Profile	Tier	*n*	%	Vegetables and Fruit z-score	Fast food z-score	Juice and soft drinks z-score	Sweets z-score	Exercise z-score	Smoke exposure %	Screen time z-score
Above average vegetable/fruit consumption	Higher	4,381	76.1	0.44	..	0.14	0.25	..	23.31	..
Below average vegetable/fruit consumption	Mid	709	12.3	-1.33	..	-0.17	0.14	..	39.07	..
Very low vegetable/fruit consumption and high smoke exposure	Mid	304	5.3	-3.32	..	-0.26	-0.21	..	45.39	..
High food consumption and smoke exposure	Lower	281	4.9	0.44	..	-1.11	-3.15	..	51.25	..
Disadvantaged across all behaviours	Lower	83	1.4	-1.33	..	-1.07	-3.18	..	60.24	..

.. Survey questions not asked at wave. Green indicates more 'healthful' behaviours or absence of less 'healthful' behaviours.
Z-scores for 'unhealthful' behaviours of fast food, juice and soft drinks, and sweets consumption and screen time have been reverse coded.

Red:	-0.80 of a standard deviation lower than the mean
Orange:	-0.60 to -0.79 of a standard deviation lower than the mean
Peach:	-0.40 to -0.59 of a standard deviation lower than the mean
Grey	-0.39 to 0.39 of a standard deviation around the mean
Light green:	0.40 to 0.59 of a standard deviation higher than the mean
Medium green:	0.60 to 0.79 of a standard deviation higher than the mean
Dark green:	0.80 of a standard deviation and higher than the mean

For tobacco smoke exposure the same coding formula is applied, although dark red represents percent is 80% of the mean of higher, etc.

Table 2c: Health-related parenting classes at the 2-year wave (n = 5,595)

Profile	Tier	*n*	%	Vegetables and Fruit z-score	Fast food z-score	Juice and soft drinks z-score	Sweets z-score	Exercise z-score	Smoke exposure %	Screen time z-score
Low unhealthy food consumption, screen time, and smoke exposure	Higher	2,249	40.2	-0.03	0.46	0.95	0.45	-0.06	14.18	0.45
Average with high sugary drink consumption	Mid	2,406	43.0	-0.03	-0.15	-0.70	-0.24	-0.02	31.55	0.26
Average with high screen time and low sugary drink consumption	Mid	229	4.1	-0.07	0.03		0.16	0.15	34.06	-1.70
High food consumption, especially fast food	Lower	95	1.7	1.22	-2.94	-1.16	-1.32	0.45	48.42	-0.33
Disadvantaged across most behaviours	Lower	616	11.0	0.03	-0.62	-0.87	-0.57	0.16	48.38	-1.98

.. Survey questions not asked at wave. Green indicates more 'healthful' behaviours or absence of less 'healthful' behaviours.
Z-scores for 'unhealthful' behaviours of fast food, juice and soft drinks, and sweets consumption and screen time have been reverse coded.

Red:	-0.80 of a standard deviation lower than the mean
Orange:	-0.60 to -0.79 of a standard deviation lower than the mean
Peach:	-0.40 to -0.59 of a standard deviation lower than the mean
	-0.39 to 0.39 of a standard deviation around the mean
Light green:	0.40 to 0.59 of a standard deviation higher than the mean
Medium green:	0.60 to 0.79 of a standard deviation higher than the mean
Dark green:	0.80 of a standard deviation and higher than the mean

For tobacco smoke exposure the same coding formula is applied, although dark red represents percent is 80% of the mean of higher, etc.

Table 2d: Health-related parenting classes at the 4.5-year wave (n = 5,737)

Profile	Tier	*n*	%	Vegetables and Fruit z-score	Fast food z-score	Juice and soft drinks z-score	Sweets z-score	Exercise z-score	Smoke exposure %	Screen time z-score
Low unhealthy food consumption, screen time, and smoke exposure	Higher	1,524	26.6	-0.61	-0.55	-0.64	-0.43	-0.26	5.71	-0.56
Average with high sugary drink consumption	Higher	1,524	26.6	1.21	-0.28	-0.20	-0.18	0.18	17.65	-0.51
Average with high screen time and low sugary drink consumption	Mid	1,436	25.0	-0.67	0.38		0.36	0.06	31.55	-0.18
High food consumption, especially fast food	Lower	499	8.7	1.21	0.55	0.52	0.50	0.31	48.30	1.37
Disadvantaged across most behaviours	Lower	754	13.1	-0.73	0.58	0.30	0.21	-0.16	48.94	1.61

.. Survey questions not asked at wave. Green indicates more 'healthful' behaviours or absence of less 'healthful' behaviours.
Z-scores for 'unhealthful' behaviours of fast food, juice and soft drinks, and sweets consumption and screen time have been reverse coded.

Red:	-0.80 of a standard deviation lower than the mean
Orange:	-0.60 to -0.79 of a standard deviation lower than the mean
Peach:	-0.40 to -0.59 of a standard deviation lower than the mean
	-0.39 to 0.39 of a standard deviation around the mean
Light green:	0.40 to 0.59 of a standard deviation higher than the mean
Medium green:	0.60 to 0.79 of a standard deviation higher than the mean
Dark green:	0.80 of a standard deviation and higher than the mean

For tobacco smoke exposure the same coding formula is applied, although dark red represents percent is 80% of the mean of higher, etc.

Predictors of health-related parenting profiles

Aim 2 sought to examine the sociodemographic predictors of profile membership, with a particular focus on maternal education level and child ethnicity through multinomial logistic regressions.

In line with prior literature, we expect to see socioeconomic and ethnic disparities in class membership, where those with more resources are more likely to be in the higher-tier groups. We expect these patterns to persist even in the presence of other covariates such as neighbourhood deprivation (Grow, et al. 2010), parental work status (Hawkins, Cole, and Law 2007; Morrissey, Dunifon, and Kalil 2011), and urbanicity (Gibb et al. 2019; Johnson and Johnson 2015), which have been shown to matter for parenting behaviours and children's health.

The results of the regressions are presented in Table 3a (predicting parenting classes at the antenatal wave), Table 3b (predicting classes at the 9-month wave), Table 3c (predicting classes at the 2-year wave), and Table 3d (predicting classes at the 4.5-year wave). In each model, the reference category was the one deemed more 'healthful' in terms of behaviours and had a sufficiently large cell size. All covariates were included in the models.

Below we summarise the key findings across the four waves, followed by more detailed information on findings at each wave.

Key findings

- **Higher levels of maternal education attainment was associated with being in a higher-tier health-related parenting class at most waves**

  Overall, maternal educational attainment was statistically associated with differential risk of being exposed to different health-related parenting. That is, children with mothers with lower levels of education were typically at greater risk of being in lower-tier classes compared with higher-tier classes.

  At later child ages there were more consistent education-related disparities between higher-tier classes and both lower-tier and mid-tier classes, however disparities remained wider when examining the difference between higher- versus lower-tier classes compared with the difference between higher- and mid-tier classes.

- **European children were most likely to be in higher-tier health-related parenting classes**
  Similarly, ethnicity was also statistically associated with differential risk of health-related parenting behaviour class exposure, with European children consistently more likely to be in higher-tier classes than tamariki Māori and Pacific and Asian children. At the antenatal wave, however, this finding was only present when comparing the risk of being in the highest-

tier class with the lowest-tier classes. There were several notable differences between other ethnicies, such as Pacific infants (e.g., 9-month wave) at high risk of being in the "very low vegetable/fruit consumption and high smoke exposure" and "below average vegetable/fruit consumption" groups compared to tamariki Māori.

Similar again to the education findings, risk disparities between high-tier and mid-tier groups began to open up at later child ages.

- **Education and ethnic disparities widen at later child ages**

  Importantly, it appeared that education and ethnic risk disparities began to widen at later child ages, with the risk ratios greater at the 2-year and 4.5-year waves than they had been at the antenatal and 9-month waves, suggesting that following through on more health behaviours may be harder to do as child grow older.

Sociodemographic associations with health-related parenting classes at the antenatal wave

Table 3a presents the relative risk ratios of class membership using the "high vegetables/fruit consumption, low smoke exposure" profile as the reference group. We used this group as the reference category because it was deemed more 'healthful' in terms of behaviours and had a large cell size.

Pregnant women with lower educational attainment had a greater risk of being in the lower-tier group—"high unhealthy food consumption and smoke exposure"—than being in the higher-tier reference group. For example, those mothers with no secondary school qualifications were more than twice as likely (*Relative Risk Ratio [RRR]* = 2.24; $p < .01$) than those with a University degree to be in this lower-tier group compared to mothers in the reference group, with slightly lower risk among those with educational attainment of NCEA Levels 1-4 (*RRR* = 1.53; $p < .10$) and NCEA Levels 5-6 (*RRR* = 1.73; $p < .05$).

Interestingly, there were no differences in risk of being in the other lower-tier class—"very low sweet consumption with high fast food, soft drinks, and vegetable/fruit consumption"—by maternal educational attainment. Moreover, pregnant women with less education had lower risk than mothers with university degrees of being in the "average with low vegetable/fruit consumption" class (relative to the higher-tier classes).

When comparing classes by ethnic group identification, pregnant mothers of tamariki Māori, compared to European, were only at greater risk of being in the lower-tier "High unhealthy food consumption and smoke exposure" class (*RRR* = 1.48; $p < .05$) versus the higher-tier reference class. Despite being at greater risk of being in the "High unhealthy food consumption and smoke exposure", it is

important to note that this class represented less than 5% of all pregnant women.

Pregnant mothers of Pacific children had a similar risk of being in most classes compared to mothers of European children, except for the lower-tier class characterised by high fast food, sugary drinks, and vegetable and fruit consumption (*RRR* = 1.89; $p < .01$).

Mothers of Asian children were more likely than mothers of European children to be in the smaller, higher-tier class that was very low on unhealthy food consumption and smoke exposure (*RRR* = 1.76; $p < .001$) versus the class that was average on unhealthy food consumption but high on vegetable and fruit consumption. They were also less likely to be in the class characterised by low vegetable/fruit consumption (*RRR* = 0.71; $p < .01$) and unhealthy food consumption and tobacco smoke exposure (*RRR* = 0.52; $p < .05$). Mothers of Asian children, however, were at greater risk than European of being in the lower-tier class represented by high fast food and sugary drink consumption (*RRR* = 3.33; $p < .001$).

Table 3a: Multinomial regression predicting higher-tier health-related parenting class at the antenatal wave

	Ref: High vegetables/fruit consumption, low smoke exposure (Higher)			
Health behaviour class	vs. Low unhealthy food consumption and smoke exposure	vs. Average with low vegetable/fruit consumption	vs. Very low sweet consumption with high fast food, soft drinks, and vegetables/fruit consumption	vs. High unhealthy food consumption and smoke exposure
Tier	Higher	Mid	Lower	Lower
	RRR (std. err.)	RRR (std. err.)	RRR (std. err.)	RRR (std. err.)
Educational attainment (ref: Undergraduate/postgraduate degree)				
No secondary school quals	0.73	0.73+	1.06	2.24**
	(0.21)	(0.12)	(0.30)	(0.65)
NCEA 1-4	0.75+	0.86+	1.02	1.53+
	(0.12)	(0.08)	(0.17)	(0.36)
NCEA 5-6	0.80+	0.76***	1.00	1.73*
	(0.10)	(0.06)	(0.15)	(0.38)
Ethnicity (ref: European)				
Māori	0.85	0.87	0.93	1.48*
	(0.13)	(0.08)	(0.17)	(0.29)
Pacific	0.90	1.06	1.89**	1.35

	(0.19)	(0.13)	(0.39)	(0.32)
Asian	1.76***	0.71**	3.33***	0.52*
	(0.27)	(0.08)	(0.56)	(0.17)
Other ethnicity	0.94	0.71*	2.14**	0.32
	(0.26)	(0.12)	(0.57)	(0.24)
Maternal age (years)	1.08***	1.01	1.08***	0.96*
	(0.01)	(0.01)	(0.01)	(0.02)
Maternal employment (ref: Full-time work)				
Part-time work	1.39*	1.12	0.72+	0.64+
	(0.20)	(0.10)	(0.13)	(0.16)
Unemployed	1.00	0.93	1.00	0.93
	(0.24)	(0.13)	(0.23)	(0.24)
Not in the labour force	1.09	0.99	0.96	0.96
	(0.15)	(0.09)	(0.15)	(0.18)
Household income (1-7 scale)	0.90*	1.07*	0.87**	0.93
	(0.04)	(0.03)	(0.04)	(0.06)
Family structure (ref: Two-parent family, no other adults)				
Single-parent family, no other adults	1.23	0.71	0.86	0.86
	(0.36)	(0.16)	(0.28)	(0.34)
Parent(s), other kin adults	1.22	0.96	1.20	1.85***
	(0.17)	(0.09)	(0.18)	(0.32)
Parent(s), other non-kin adults	1.40	1.01	1.29	1.66+
	(0.31)	(0.15)	(0.31)	(0.47)
Siblings (0-6 scale)	1.04	1.00	1.06	1.03
	(0.05)	(0.03)	(0.05)	(0.06)
Rural area (ref: Urban area)	0.87	1.09	1.28	1.42
	(0.19)	(0.13)	(0.31)	(0.39)
Meshblock deprivation index (1-10 scale)	0.96+	0.96***	1.03	1.08*
	(0.02)	(0.01)	(0.02)	(0.03)
Constant	0.04***	0.90	0.02***	0.14**
	(0.02)	(0.25)	(0.01)	(0.09)
Pseudo R^2	0.05	0.05	0.05	0.05

n	5,224	5,224	5,224	5,224

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1. RRR = Relative risk ratios.

Sociodemographic associations with health-related parenting classes at the 9-month wave

The multinomial regression models predicting health-related parenting classes at the 9-month wave are presented in Table 3b. The higher-tier class—"Above average vegetable/fruit consumption"—was used as the reference group.

Lower levels of maternal education were statistically associated with greater risk of being in all mid- and lower-tier health classes. Moreover, these associations appeared to be stronger when examining the lower-tier (vs. mid-tier) classes. For example, having secondary school qualification versus a university degree was associated with having three times the risk (*RRR* = 2.96; $p < .05$) of being in the "disadvantaged across all behaviours" class instead of the higher-tier class. The risk dropped to 1.96 ($p < .05$), 2.41 ($p < .001$), and 1.97 ($p < .001$) times when examining the other lower-tier and mid-tier health profiles.

This pattern was similar by ethnicity. That is, infants identified as Māori, Pacific, and Asian were at greater risk of being in the lower-tier health classes compared with European children, and that association appeared to be stronger when examining the lowest-tier health class.

While Asian infants were consistently at greater risk than all other infants at being in lower- and mid-tier health class, there were some key differences between tamariki Māori and Pacific infants. Pacific infants had a higher risk of being in the "very low vegetable/fruit consumption and high smoke exposure" and "Below average vegetable/fruit consumption" classes compared to tamariki Māori. Tamariki Māori, however, had a higher risk of being in the "Disadvantaged across all behaviours" and "high food consumption and smoke exposure" classes than Pacific infants.

Table 3b: Multinomial regression predicting higher-tier health-related parenting class at the 9-month wave

	Ref: Above average vegetable/fruit consumption (Higher)			
Health behaviour class	vs. Very low vegetable/fruit consumption and high smoke exposure	vs. Below average vegetable/fruit consumption	vs. High food consumption and smoke exposure	vs. Disadvantaged across all behaviours
Tier	Mid	Mid	Lower	Lower
	RRR (std. err.)	RRR (std. err.)	RRR (std. err.)	RRR (std. err.)
Educational attainment (ref: Undergraduate/ postgraduate degree)				
No secondary school qualification	2.41***	1.97***	1.96*	2.96*

	(0.64)	(0.37)	(0.54)	(1.59)
NCEA 1-4	1.71**	1.39**	1.58*	2.44+
	(0.33)	(0.17)	(0.32)	(1.14)
NCEA 5-6	1.59*	1.30*	1.40+	2.16+
	(0.29)	(0.15)	(0.27)	(0.98)
Ethnicity (ref: European)				
Māori	1.83**	1.62***	2.20***	5.53***
	(0.36)	(0.20)	(0.45)	(2.55)
Pacific	2.88***	2.24***	1.81*	4.05**
	(0.62)	(0.32)	(0.43)	(2.09)
Asian	4.54***	2.89***	3.89***	9.47***
	(0.94)	(0.39)	(0.87)	(4.99)
Other ethnicity	1.87	2.09***	2.00+	2.73
	(0.74)	(0.46)	(0.81)	(2.99)
Maternal age (years)	0.96**	0.97***	0.93***	0.86***
	(0.01)	(0.01)	(0.01)	(0.03)
Maternal employment (ref: Full-time work)				
Part-time work	0.78	0.69*	1.06	1.12
	(0.17)	(0.10)	(0.25)	(0.58)
Unemployed	1.08	0.83	0.98	1.06
	(0.30)	(0.17)	(0.30)	(0.60)
Not in the labour force	0.79	0.93	0.92	1.10
	(0.17)	(0.13)	(0.21)	(0.52)
Household income (1-7 scale)	0.82***	0.86***	0.90*	0.95
	(0.05)	(0.03)	(0.05)	(0.10)
Family structure (ref: Two-parent family, no other adults)				
Single-parent family, no other adults	1.32	1.08	1.61+	1.57
	(0.30)	(0.19)	(0.43)	(0.72)
Parent(s), other kin adults	1.23	1.27*	2.23***	1.44
	(0.19)	(0.14)	(0.37)	(0.43)
Parent(s), other non-kin adults	1.17	1.19	1.49	1.73
	(0.33)	(0.24)	(0.47)	(0.84)
Residential moves between waves (0-5 scale)	1.10	1.05	1.09	1.26
	(0.11)	(0.08)	(0.11)	(0.19)
Siblings (0-6 scale)	1.32***	1.19***	1.20**	1.45***
	(0.07)	(0.04)	(0.07)	(0.13)
Rural area (ref: urban area)	0.85	0.98	0.63	1.86
	(0.25)	(0.17)	(0.22)	(0.89)
Meshblock deprivation index (1-10 scale)	1.07*	1.01	1.06*	1.17**

	(0.03)	(0.02)	(0.03)	(0.07)
Born at low birthweight (ref: No)	1.48	1.38+	0.93	0.99
	(0.38)	(0.25)	(0.29)	(0.54)
Child female (ref: Male)	1.31*	1.09	0.90	1.07
	(0.16)	(0.09)	(0.12)	(0.24)
Interview age deviations (months)	0.91	0.89*	1.47***	1.09
	(0.06)	(0.05)	(0.08)	(0.12)
Main child care provider (ref: None)				
Nanny/relative/friend care	1.22	1.11	0.70	0.68
	(0.25)	(0.16)	(0.16)	(0.29)
Centre-based, group care	0.91	1.20	0.91	0.44
	(0.22)	(0.18)	(0.21)	(0.26)
Constant	0.07***	0.29**	0.12***	0.03**
	(0.04)	(0.12)	(0.07)	(0.04)
Pseudo R^2	0.12	0.12	0.12	0.12
n	5,758	5,758	5,758	5,758

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1. RRR = Relative risk ratios.

Again, it is important to note that at 9 months of age, three-quarters of infants were in the higher-tier (more 'healthful' exposure) class. Therefore, while there were sociodemographic associations in differential risk of being in lower-tier health classes, those disparities apply to a minority of infants in our sample.

Sociodemographic associations with health-related parenting classes at the 2-year wave

Table 3c displays the results predicting health-related parenting class at the 2-year wave, with the higher-tier class—"Low unhealthy food consumption, screen time, and smoke exposure"—as the reference category.

Children of mothers with no secondary school qualifications had close to two and a half times the risk (*RRR* = 2.37; $p < .001$) than those with mothers with university degrees of being in the class that was disadvantaged across most behaviours. This was 2.12 times ($p < .001$) for children with mothers with NCEA Level 1-4 qualifications and 2.52 times ($p < .001$) for children with mothers with NCEA Level 5-6 qualifications. This pattern was similar albeit more linear when examining the risk of being in other classes, with the highest risk ratios among children of mothers with no secondary school qualifications, followed by those with NCEA Level 1-4 and NCEA 5-6.

A similar pattern emerged by ethnicity. Compared to European children, the risk of being disadvantaged across most behaviours was greatest for Pacific children, followed by Asian children, while narrower for tamariki Māori. Similar to the

education gradient, disparities in relative risk were larger when examining the higher-tier versus lower-tier classes and narrowed when examining the relative risk of being in the mid-tier health classes.

Table 3c: Multinomial regression predicting higher-tier health-related parenting class at the 2-year wave

	Ref: Low unhealthy food consumption, screen time, and smoke exposure (Higher)			
Health behaviour class Tier	vs. Average with high sugary drink consumption Mid RRR (std. err.)	vs. Average with high screen time and low sugary drink consumption Mid RRR (std. err.)	vs. High food consumption, especially fast food Lower RRR (std. err.)	vs. Disadvantaged across most behaviours Lower RRR (std. err.)
Educational attainment (ref: Undergraduate/ postgraduate degree)				
No secondary school qualification	1.52*	2.22*	4.21**	2.37***
	(0.26)	(0.70)	(1.95)	(0.57)
NCEA 1-4	1.42***	1.69*	1.85	2.12***
	(0.13)	(0.35)	(0.71)	(0.33)
NCEA 5-6	1.39***	1.63**	1.81	2.52***
	(0.11)	(0.30)	(0.66)	(0.36)
Ethnicity (ref: European)				
Māori	1.54***	2.30***	2.61*	3.23***
	(0.13)	(0.45)	(1.03)	(0.51)
Pacific	2.58***	2.72***	11.98***	6.13***
	(0.33)	(0.71)	(5.03)	(1.17)
Asian	1.81***	2.43***	2.98*	6.51***
	(0.19)	(0.56)	(1.50)	(1.11)
Other ethnicity	1.66**	1.40	3.19	4.42***
	(0.28)	(0.62)	(2.52)	(1.21)
Maternal age (years)	0.96***	0.99	0.95*	0.92***
	(0.01)	(0.01)	(0.02)	(0.01)
Maternal employment (ref: Full-time work)				
Part-time work	0.86+	0.81	0.62	0.79
	(0.08)	(0.19)	(0.24)	(0.13)
Unemployed	1.11	1.51	0.76	1.04
	(0.17)	(0.48)	(0.33)	(0.24)
Not in the labour force	0.99	1.18	0.63	0.93
	(0.09)	(0.27)	(0.21)	(0.15)
Household income (1-7 scale)	0.96	0.97	0.82*	0.95

	(0.03)	(0.06)	(0.07)	(0.04)
Family structure (ref: Two-parent family, no other adults)				
Single-parent family, no other adults	1.27	0.97	2.99**	1.85**
	(0.22)	(0.36)	(1.23)	(0.42)
Parent(s), other kin adults	1.30**	1.29	3.28***	1.42**
	(0.12)	(0.25)	(0.90)	(0.19)
Parent(s), other non-kin adults	1.27+	1.39	2.46*	1.23
	(0.17)	(0.40)	(1.11)	(0.26)
Residential moves between waves (0-5 scale)	0.99	1.08	1.00	1.13
	(0.05)	(0.12)	(0.17)	(0.09)
Siblings (0-6 scale)	1.14***	1.10	1.25*	1.17***
	(0.04)	(0.07)	(0.11)	(0.05)
Rural area (ref: urban area)	1.04	0.79	0.79	0.43*
	(0.14)	(0.31)	(0.82)	(0.17)
Meshblock deprivation index (1-10 scale)	1.04**	1.06*	1.10+	1.12***
	(0.01)	(0.03)	(0.06)	(0.02)
Born at low birthweight (ref: No)	0.91	0.93	1.49	1.26
	(0.14)	(0.31)	(0.66)	(0.28)
Child female (ref: Male)	0.98	1.21	1.30	0.90
	(0.06)	(0.17)	(0.29)	(0.09)
Interview age deviations (months)	1.12***	1.13***	0.99	1.16***
	(0.02)	(0.04)	(0.06)	(0.03)
Main child care provider (ref: None)				
Nanny/relative/friend care	1.29*	0.96	0.96	1.16
	(0.15)	(0.27)	(0.42)	(0.22)
Centre-based, group care	1.00	0.67*	0.68	0.55***
	(0.08)	(0.14)	(0.21)	(0.08)
Constant	1.79*	0.04***	0.04**	0.42+
	(0.53)	(0.03)	(0.04)	(0.21)
Pseudo R^2	0.11	0.11	0.11	0.11
N	5,595	5,595	5,595	5,595

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1. RRR = Relative risk ratios.

Sociodemographic associations with health-related parenting class at the 4.5-year wave

Table 3d presents the findings from multinomial regressions predicting health-related parenting classes at the 4.5-year wave. The higher-tier class—"Advantaged across all health behaviours except low vegetable/fruit consumption"—was used as the reference category.

Regarding maternal education, overall, the pattern of findings were similar to prior waves—higher educational attainment was associated with less risk of being in mid- or lower-tier parenting classes. The relative risk ratio was widest when comparing the lower-tier (typically least 'healthful') profile with the highest tier class—the reference group—versus mid-tier classes. Interestingly, however, there was no statistical difference between children of mothers with NCEA qualifications only and children of mothers with university degrees in the relative risk of being in the "High vegetable/fruit consumption and low screen time" class versus the higher-tier class reference group.

Again, a similar pattern emerged examining ethnic disparities in classes, with European children at lower relative risk of being in mid- and lower-tier classes compared with Māori, Pacific, and Asian children, with those disparities widest when examining lower-tier classes versus mid-tier parenting classes. Unlike prior waves, however, there were no significant difference in the relative risk disparity across the non-European ethnic groups.

Table 3d: Multinomial regression predicting higher-tier health-related parenting profile at the 4.5-year wave

	Ref: Advantaged across all health behaviours except low vegetable/fruit consumption (Higher)			
Health behaviour class	vs. High vegetable/fruit consumption and low screen time	vs. Low vegetable/fruit consumption and above average sugary drinks consumption	vs. Low vegetable/fruit consumption, highest smoke exposure and screen time	vs. High food consumption, smoke exposure, and screen time
Tier	Higher	Mid	Lower	Lower
	RRR (std. err.)	RRR (std. err.)	RRR (std. err.)	RRR (std. err.)
Educational attainment (ref: Undergraduate/ postgraduate degree)				
No secondary school qualification	2.28**	3.94***	5.41***	6.32***
	(0.62)	(1.04)	(1.54)	(1.92)
NCEA 1-4	1.05	1.39**	1.93***	2.48***
	(0.11)	(0.15)	(0.28)	(0.40)
NCEA 5-6	1.12	1.52***	2.22***	2.29***
	(0.10)	(0.15)	(0.29)	(0.35)
Ethnicity (ref: European)				
Māori	1.47***	2.16***	3.47***	2.38***
	(0.16)	(0.24)	(0.49)	(0.38)
Pacific	1.46*	2.77***	3.62***	3.10***
	(0.23)	(0.42)	(0.65)	(0.62)
Asian	0.95	1.73***	2.52***	2.45***
	(0.12)	(0.21)	(0.40)	(0.44)
Other ethnicity	1.01	1.30	1.55	2.61***
	(0.20)	(0.27)	(0.46)	(0.72)
Maternal age (years)	1.00	0.99+	0.97***	0.97**
	(0.01)	(0.01)	(0.01)	(0.01)
Maternal employment (ref: Full-time work)				
Part-time work	0.94	0.77**	0.84	0.99
	(0.09)	(0.07)	(0.11)	(0.15)
Unemployed	1.04	0.80	1.31+	1.31
	(0.14)	(0.11)	(0.21)	(0.23)
Not in the labour force	1.01	0.65***	0.93	0.92
	(0.11)	(0.07)	(0.13)	(0.15)

Table 3d continued on next page

Table 3d continued

Household income (1-7 scale)	0.91**	0.95	0.87*	0.87**
	(0.03)	(0.04)	(0.05)	(0.04)
Family structure (ref: Two-parent family, no other adults)				
Single-parent family, no other adults	1.16	1.06	0.79	0.93
	(0.19)	(0.18)	(0.16)	(0.20)
Parent(s), other kin adults	1.22	1.37*	2.10***	2.16***
	(0.16)	(0.17)	(0.29)	(0.33)
Parent(s), other non-kin adults	1.19	1.07	1.59+	1.14
	(0.23)	(0.22)	(0.40)	(0.35)
Residential moves between waves (0-5 scale)	0.99	1.03	1.07	1.10+
	(0.04)	(0.04)	(0.05)	(0.06)
Siblings (0-6 scale)	0.96	0.98	1.01	1.08
	(0.04)	(0.04)	(0.05)	(0.06)
Rural area (ref: urban area)	1.09	0.97	0.71+	0.93
	(0.13)	(0.13)	(0.14)	(0.19)
Meshblock deprivation index (1-10 scale)	0.97*	1.03+	1.11***	1.11***
	(0.02)	(0.02)	(0.02)	(0.03)
Born at low birthweight (ref: No)	1.04	1.30	1.96**	1.42
	(0.19)	(0.24)	(0.42)	(0.35)
Child female (ref: Male)	0.93	0.84*	0.64***	0.73**
	(0.07)	(0.06)	(0.06)	(0.08)
Interview age deviations (months)	1.04	1.05	1.10**	1.01
	(0.03)	(0.03)	(0.04)	(0.04)
Main child care provider (ref: None)				
Nanny/relative/friend care	0.68	0.67	1.38	1.58
	(0.23)	(0.23)	(0.52)	(0.65)
Centre-based, group care	0.71	0.76	0.67	0.71
	(0.19)	(0.21)	(0.19)	(0.22)
Constant	2.56*	1.28	0.78	0.42
	(1.09)	(0.57)	(0.44)	(0.25)
Pseudo R^2	0.08	0.08	0.08	0.08
N	5,737	5,737	5,737	5,737

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1. RRR = Relative risk ratios.

Health-related parenting profiles and child health

Aim 3 was to examine whether the health-related parenting profiles were associated with child health at each wave and, hence, may account for some of the socioeconomic and ethnic inequities in children's early health outcomes in New Zealand. These models represented a series of OLS and logit regressions (depending on the outcome), controlling for the same set of covariates applied to the models for Aim 2.

We examine both temporal child health outcomes at three waves (9-months, 2-years, and 4.5-years), such as materal-rated child health and children's acute illnesses, and child obesity status at the 4.5-year wave.

In addition, we constructed a measure of 'trajectories' of health-related parenting tier exposure to examine whether the cumulative exposure of being in a certain health-related parenting tier—or instability in exposure across the tiers—matters for children's health at the 4.5-year wave.

Below we summarise the key findings, with more detailed information on specific findings at each wave following after.

Key findings

- **Few associations between health-related parenting behaviours classes and children's health**

  Overall, there were few statistically significant associations between health-related parenting behaviours and children's health across multiple outcomes. When there were associations, these were attenuated to nonsignificant levels once the full set of covariates were included in the models.

  Where small disparities in the associations between health-related parenting behaviours did remain was at the 4.5-year wave, although the effect sizes were small.

- **Health-related parenting behaviours did not explain education and ethnic inequities in children's early health**

  While maternal educational attainment and child ethnicity was associated with differences in health-related parenting behaivours (per Aim 2), this association did little to explain the education-related and ethnic inequities in children's health.

- **Although most children were mostly exposed to more healthful parenting behaviours across the life course, there was diversity in exposure; only 5% of children were continuously or almost always exposed to the lower-tier profiles**

  There were ten distinct experiences of exposure to health-related parenting across the early life course, however 12.5% were always in a

higher-tier group across all four waves. Only 5.2% were mostly or always in a lower-tier group. The largest group, representing 23.3% of all children was one that was characterized by a shift from a mid-tier group at antenatal to higher-tier classes once the child was born. Similar to health-related parenting classes at each wave, there were education and ethnic disparities in trajectory experience.

- **Health-related parenting trajectories were associated with children's health at the 4.5-year wave, although these trajectories did not explain the persisten education and ethnic inequities in health**

  Unlike the point-in-time health-related parenting classes, the trajectories were associated with differences in children's health. Although once the full set of covariates were added to the models, the statistical significant associations that persisted were small in effect size. Moreover, the inclusion of the trajectories in the models did little to attenuate the ethnic and education-related disparities in obesity and other health measures.

Temporal child health outcomes

Health-related parenting profiles and child health at the 9-month wave

Table 4a presents the findings from the OLS regressions examining associations between the health-related parenting classes and maternal-report child health and counts of acute illnesses at the 9-month wave. Full model results can be found in Table A6 in the appendix. Three iterations of the models are presented: 1) with health-related parenting classes (and a control for child age in months) only; 2) with maternal education and child ethnicity only; 3) full model including covariates. The purpose of presenting all three models is to provide some preliminary evidence of potential mediation effects (although we do not formally test for mediation).

Examining the maternal-reported general child health scale, only one parenting profile—"Very low sweet consumption with high fast food, soft drinks, and vegetables/fruit consumption" was statistically associated with poorer overall health status when compared to the higher-tier class reference group. A small effect size was found for this association, the difference being -0.22 ($p > .05$) or 28% of a standard deviation.

In line with prior literature, tamariki Māori, and Pacific and Asian children had, on average, poorer rated health (Model 2). Maternal education, however, was not associated with differences in maternal-rated child health.

In the full model (Model 3) the statistical association between the disadvantaged parenting profile attenuated to be nonsignificant.

The associations between health-related parenting classes and the number of acute illnesses was stronger than that seen for maternal-reported overall child health. Being in a lower- or mid-tier class was associated with more acute illnesses compared to the two higher-tier classes. Two classes remained significant, however only at the $p < .10$ level, in the second controlled model. Education and ethnicity disparities did not experience any attenuation once parenting classes and other covariates were added to the models.

Table 4a: OLS regression predicting maternal-reported child health and acute illnesses at the 9-month wave

	General health			Acute illness		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Classes included in the models	X		X	X		X
Education and ethnicity in the models		X	X		X	X
Covariates in the models		X	X		X	X
	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)
Health behaviour class (ref: High vegetables/fruit consumption, low smoke exposure (Higher))						
Low unhealthy food consumption and smoke exposure (Higher)	-0.07		-0.00	0.08		-0.03
	(0.05)		(0.05)	(0.06)		(0.06)
Average with low vegetable/fruit consumption (Mid)	-0.22*		-0.11	0.39***		0.18
	(0.09)		(0.09)	(0.11)		(0.11)
Very low sweet consumption with high fast food, soft drinks, and vegetables/fruit consumption (Lower)	-0.07		0.01	0.25***		0.12+
	(0.05)		(0.05)	(0.06)		(0.06)
High unhealthy food consumption and smoke exposure (Lower)	-0.05+		0.00	0.14**		0.06
	(0.03)		(0.03)	(0.04)		(0.04)
Educational attainment (ref: Undergraduate/postgraduate degree)						
No secondary school qualification		0.05	0.05		0.17**	0.16*
		(0.05)	(0.05)		(0.06)	(0.06)
NCEA 1-4		0.02	0.02		0.02	0.02
		(0.03)	(0.03)		(0.04)	(0.04)
NCEA 5-6		0.03	0.03		0.07*	0.07*
		(0.03)	(0.03)		(0.03)	(0.03)
Ethnicity (ref: European)						

Māori		-0.10***	-0.10***		0.21***	0.21***
		(0.03)	(0.03)		(0.04)	(0.04)
Pacific		-0.03	-0.03		0.12*	0.12*
		(0.04)	(0.04)		(0.05)	(0.05)
Asian		-0.08*	-0.08*		-0.28***	-0.29***
		(0.03)	(0.03)		(0.04)	(0.04)
Other ethnicity		0.01	0.01		-0.02	-0.03
		(0.06)	(0.06)		(0.07)	(0.07)
Constant	4.47***	4.09***	4.09***	0.73***	1.05***	1.02***
	(0.01)	(0.10)	(0.10)	(0.02)	(0.12)	(0.12)
R^2	0.01	0.04	0.04	0.01	0.10	0.10
N	5,758	5,758	5,758	5,751	5,751	5,751

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Health-related parenting profiles and child health at the 2-year wave

At the 2-year wave (Table 4b; full results in Table A7 in the appendix), there were few significant statistical associations between health-related parenting profiles and maternal-reported overall child health and acute illness.

In line again with the literature, maternal education and child ethnicity was associated with general child health, whereas just ethnicity was statistically associated with differences in acute illnesses.

Health-related parenting profiles and child health at the 4.5-year wave

At the 4.5-year wave (Table 4c; full results in Table A8 in the appendix), health-related parenting behaviours were associated with differences in maternal-reported overall child health, with the mid- and low-tier classes associated with lower rated health than the two higher-tier groups. Once the maternal education, child ethnicity, and the full set of controls were included, the lower-tier class—"Low vegetable/fruit consumption, highest smoke exposure and screen time"—remained statistically associated with poorer rated health (B = -0.17 or 22% of a standard deviation; $p < .001$).

There was no significant association between the health-related parenting profiles and counts of acute illness in the full model, although maternal education and child ethnicity was associated with reports of more acute illness. It is important to recall that data on acute illness at the 4.5-year wave differed from earlier waves, and instead is more a measure of different types of acute illnesses experienced in the past year, versus counts of acute illness episodes. Hence, variability in this measure was lower than in prior waves.

Table 4b: OLS regression predicting maternal-reported child health and acute illnesses at the 2-year wave

	General health			Acute illness		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Classes included in the models	X		X	X		X
Education and ethnicity in the models		X	X		X	X
Covariates in the models		X	X		X	X
	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)
Health behaviour class (ref: Low unhealthy food consumption, screen time, and smoke exposure (Higher))						
Average with high sugary drink consumption (Mid)	-0.04+		-0.03	-0.02		0.01
	(0.02)		(0.03)	(0.05)		(0.05)
Average with high screen time and low sugary drink consumption (Mid)	0.01		0.00	-0.18+		-0.06
	(0.06)		(0.06)	(0.11)		(0.11)
High food consumption, especially fast food (Lower)	-0.01		-0.03	-0.17		-0.08
	(0.09)		(0.09)	(0.16)		(0.16)
Disadvantaged across most behaviours (Lower)	-0.07+		-0.06	-0.09		0.07
	(0.04)		(0.04)	(0.07)		(0.07)
Educational attainment (ref: Undergraduate/postgraduate degree)						
No secondary school qualification		0.10+	0.11*		-0.08	-0.08
		(0.05)	(0.05)		(0.10)	(0.10)
NCEA 1-4		0.07*	0.08*		-0.05	-0.05
		(0.03)	(0.03)		(0.06)	(0.06)
NCEA 5-6		0.05+	0.06*		0.04	0.03
		(0.03)	(0.03)		(0.05)	(0.05)
Ethnicity (ref: European)		s				

Māori		-0.07*	-0.07*		0.18**	0.18**
		(0.03)	(0.03)		(0.06)	(0.06)
Pacific		0.11**	0.12**		-0.14+	-0.14+
		(0.04)	(0.04)		(0.07)	(0.08)
Asian		-0.08*	-0.07+		-0.69***	-0.70***
		(0.04)	(0.04)		(0.07)	(0.07)
Other ethnicity		0.06	0.06		-0.16	-0.17
		(0.06)	(0.06)		(0.11)	(0.11)
Constant	4.36***	3.86***	3.89***	1.70***	1.78***	1.76***
	(0.02)	(0.10)	(0.11)	(0.03)	(0.19)	(0.19)
R^2	0.01	0.03	0.03	0.01	0.10	0.10
n	5,595	5,595	5,595	5,575	5,575	5,575

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table 4c: OLS regression predicting maternal-reported child health and acute illnesses at the 4.5-year wave

	General health			Acute illness		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Classes included in the models	X		X	X		X
Education and ethnicity in the models		X	X		X	X
Covariates in the models		X	X		X	X
	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)
Health behaviour class (ref: Advantaged across all health behaviours except low vegetable/fruit consumption (Higher))						
High vegetable/fruit consumption and low screen time (Higher)	0.00		0.02	1.02		1.03
	(0.03)		(0.03)	(0.03)		(0.03)
Low vegetable/fruit consumption and above average sugary drinks consumption (Mid)	-0.10***		-0.05+	0.99		1.04
	(0.03)		(0.03)	(0.03)		(0.03)
High food consumption, smoke exposure, and screen time (Lower)	-0.14***		-0.05	0.98		1.07
	(0.04)		(0.04)	(0.04)		(0.04)
Low vegetable/fruit consumption, highest smoke exposure and screen time (Lower)	-0.26***		-0.17***	0.93*		1.01
	(0.04)		(0.04)	(0.03)		(0.04)
Educational attainment (ref: Undergraduate/postgraduate degree)						
No secondary school qualification		0.01	0.03		0.92	0.91+
		(0.05)	(0.05)		(0.05)	(0.05)
NCEA 1-4		0.04	0.05+		0.94*	0.93*
		(0.03)	(0.03)		(0.03)	(0.03)
NCEA 5-6		0.00	0.02		1.00	1.00
		(0.03)	(0.03)		(0.03)	(0.03)
Ethnicity (ref: European)						

Māori		-0.05+	-0.03		0.95+	0.94*
		(0.03)	(0.03)		(0.03)	(0.03)
Pacific		-0.01	0.01		0.85***	0.85***
		(0.04)	(0.04)		(0.03)	(0.03)
Asian		-0.22***	-0.20***		0.70***	0.69***
		(0.03)	(0.03)		(0.02)	(0.02)
Other ethnicity		-0.08	-0.07		0.89*	0.89*
		(0.06)	(0.06)		(0.05)	(0.05)
Constant	4.36***	3.86***	3.89***	1.70***	1.78***	1.76***
	(0.02)	(0.10)	(0.11)	(0.03)	(0.19)	(0.19)
R^2	0.01	0.04	0.05	0.01	0.04	0.04
n	5,737	5,737	5,737	5,737	5,737	5,737

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Health-related parenting profiles and BMI at the 4.5-year wave

Table 4d presents the results of examining whether parenting profiles at the 4.5-year wave were associated with child BMI status at the 4.5-year wave (full results presented in Table A9 in the appendix). BMI status was modelled in two ways: 1) Obese or not using logit regressions; and, 2) Underweight, healthy weight, overweight, and obese using multinomial regressions.

Mid- and lower-tier classes were associated with higher odds of children having a BMI that classified them as obese versus not obese when no covariates were included in the model (Model 1). The class characterised by low vegetable/fruit consumption coupled with highest smoke exposure and screen time were at over four times more at risk (*Odds Ratio [OR]* = 4.13; $p < .001$) of being identified as obese (vs. not) compared to the higher-tier reference class. This dropped to just over two times more at risk among those who were higher on all food consumption coupled with higher smoke exposure and screen time (*OR* = 2.30; $p < .001$) and the class with low vegetable/fruit consumption but above average sugar drink consumption (*OR* = 2.17; $p < .001$). Those in the "high vegetable/ fruit consumption and low screen time" class were 1.51 times more likely to be identified as obese than those in the higher-tier class reference group.

In line with prior literature, there were some educational and ethnic differences in risk of obesity (Model 2), whereby children with mothers with lower educational attainment and tamariki Māori and Pacific children were at greater risk of being identified as obese.

Interestingly, when both health-related parenting behaviour classes and covariates were included in the full model (Model 3), the associations between health-related behaviour classes and obesity attenuated significantly for most of the classes, however the associations between education and ethnicity and obesity risk attenuated only slightly. This suggests both that differences in class membership by maternal education attainment and ethnicity explain little of the association between these factors and obesity risk, and that, instead, other factors such as household income and community-level deprivation explain the association between health-related parenting behaviours and obesity risk (see Table A8 in the appendix for full model results).

As a test of the robustness of these findings, Table 4d also presents the results of a multinomial regression predicting BMI status groups: underweight; healthy weight; overweight; and, obese. In line with the prior findings, it appears the findings were driven by differences in risk of being obese (vs. healthy weight), and not by differences in risk of being overweight versus health weight.

Table 4d: Logit and multinomial regression predicting child BMI status at the 4.5-year wave

	Obese status (ref: All else)			BMI status (ref: Healthy weight)		
				Underweight	Overweight	Obese
	Model 1	Model 2	Model 3	Model 3	Model 3	Model 3
Classes included in the models	X		X	X	X	X
Education and ethnicity in the models		X	X	X	X	X
Covariates in the models		X	X	X	X	X
	OR (std. err.)	OR (std. err.)	OR (std. err.)	RRR (std. err.)	RRR (std. err.)	RRR (std. err.)
Health behaviour class (ref: Advantaged across all health behaviours except low vegetable/fruit consumption (Higher))						
High vegetable/fruit consumption and low screen time (Higher)	1.51*		1.34+	0.65*	1.13	1.36+
	(0.25)		(0.23)	(0.13)	(0.11)	(0.24)
Low vegetable/fruit consumption, highest smoke exposure and screen time (Lower)	4.13***		2.36***	1.04	1.14	2.44***
	(0.68)		(0.43)	(0.26)	(0.15)	(0.45)
Low vegetable/fruit consumption and above average sugary drinks consumption (Mid)	2.17***		1.58**	0.77	1.16	1.62**
	(0.35)		(0.26)	(0.15)	(0.12)	(0.27)
High food consumption, smoke exposure, and screen time (Lower)	2.30***		1.30	0.88	1.12	1.32
	(0.46)		(0.28)	(0.26)	(0.16)	(0.29)
Educational attainment (ref: Undergraduate/postgraduate degree)						
No secondary school qualification		1.25	1.14	1.10	1.22	1.22
		(0.29)	(0.27)	(0.55)	(0.20)	(0.29)
NCEA 1-4		1.67***	1.61**	1.38	1.11	1.68**
		(0.26)	(0.25)	(0.28)	(0.12)	(0.27)
NCEA 5-6		1.54**	1.46**	1.29	1.06	1.49**
		(0.22)	(0.21)	(0.23)	(0.10)	(0.22)
Ethnicity (ref: European)						

Māori		1.84***	1.66***	0.78	1.31**	1.75***
		(0.27)	(0.25)	(0.20)	(0.13)	(0.27)
Pacific		3.21***	2.93***	0.69	2.08***	3.63***
		(0.53)	(0.49)	(0.26)	(0.26)	(0.62)
Asian		0.73	0.68+	3.33***	0.49***	0.67+
		(0.16)	(0.15)	(0.62)	(0.07)	(0.15)
Other ethnicity		1.50	1.47	0.97	0.90	1.43
		(0.44)	(0.43)	(0.42)	(0.19)	(0.42)
Constant	0.05***	0.03***	0.02***	0.03***	0.12***	0.02***
	(0.01)	(0.02)	(0.01)	(0.03)	(0.05)	(0.01)
Pseudo R^2	0.04	0.10	0.10	0.07	0.07	0.07
N	5,410	5,410	5,410	5,410	5,410	5,410

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Health-related parenting trajectories

These health-related parenting profiles do not happen in a time void and, instead, may matter more when viewed cumulatively across the early life course. To shed light on the different 'trajectories' of health-related profiles across all four waves, we examined every unique pattern of health-related profiles, including movements into and out of higher- and lower-tier health-related parenting groups.

Table 5 presents these results. Overall, there appeared to be ten distinct experiences across the early life course:

1) Always higher tier;
2) Mostly higher tier, but mid-tier at antenatal;
3) Higher tier at antenatal, but only mostly higher tier thereafter;
4) Mostly mid-tier;
5) Higher tier to lower tier;
6) Lower tier at antenatal, always or mostly higher tier thereafter
7) Lower tier at antenatal, higher tier at 9-months, but downward thereafter;
8) Always or mostly lower tier;
9) Mixed, unstable trajectory; and,
10) Lower tier to higher tier.

Overall, 12.5% of the sample were in the 'always higher tier' trajectory versus 5.2% of the sample that were always or mostly (three of four waves) always in the lower-tier class (note: less than 1.0% of the sample were always in the lower-tier parenting classes). The largest group (23.3% of the sample) were those who were more likely to be in a mid-tier class at antenatal but shifted into always or mostly being in the higher-tier classes after the child was born. A further 17% were in the higher-tier class in antenatal and mostly in the higher-tier classes thereafter but experienced a period in a mid- or lower-tier class. A further 13.5% were fairly stable in mid-tier classes throughout the study period, while 11.6% experienced a downward trajectory from being in a higher-tier class at antenatal to a lower-tier class by the 4.5-year wave. Another 10.3% had a mixed trajectory, where they typically experienced time in all different tiers with no clear pattern or trajectory.

Overall, there was a diversity of experiences, although a larger portion of the sample was consistently in higher-tier classes over the early life course.

Table 5: Trajectories of health-related parenting class membership across early childhood (n = 4,967)

	Total *N*	Always higher tier %	Mostly higher tier, but mid-tier at antenatal %	Higher tier at antenatal, but only mostly higher tier thereafter %	Mostly mid-tier %	Higher tier to lower tier %
Total	4,967	12.52	23.31	16.95	13.47	11.60
Educational attainment						
No secondary school qualification	254	*n* < 10	7.09	11.02	17.32	19.69
NCEA 1-4	1,103	7.98	15.59	16.59	15.78	15.05
NCEA 5-6	1,507	9.75	18.31	18.18	14.00	15.53
Undergraduate/ postgraduate degree	2,103	18.16	32.91	16.98	11.41	5.99
Ethnicity						
European	2,327	18.95	33.95	18.01	10.66	6.15
Māori	1,161	7.67	16.80	16.62	14.38	15.07
Pacific	631	2.22	9.03	13.47	19.33	20.13
Asian	669	8.22	11.51	16.44	16.59	15.99
Other ethnicity	179	12.85	21.79	19.55	11.73	13.41

Table 5 continued on next page

Table 5 continued

	Total *n*	Lower tier at antenatal, always or mostly higher tier thereafter %	Low tier at antenatal, higher tier at 9-months, but downward thereafter %	Always or mostly lower tier %	Mixed, unstable trajectory %	Lower tier to higher tier %
Total	4,967	2.19	3.50	5.19	10.25	1.01
Educational attainment						
No secondary school qualification	254	*n* < 10	7.48	17.32	14.96	*n* < 10
NCEA 1-4	1,103	1.36	4.08	8.16	14.32	1.09
NCEA 5-6	1,507	2.12	4.38	5.84	10.68	1.19
Undergraduate/ postgraduate degree	2,103	2.71	2.09	1.71	7.23	0.81
Ethnicity						
European	2,327	2.66	1.33	1.03	6.83	0.43
Māori	1,161	1.64	4.48	9.73	12.40	1.21
Pacific	631	*n* < 10	8.08	10.30	15.37	*n* < 10
Asian	669	2.84	4.78	7.03	14.20	2.39
Other ethnicity	179	*n* < 10	*n* < 10	*n* < 10	7.82	*n* < 10

Note. *n* < 10 = percent supressed where cell size is less than 10.

Similar to patterns at individual waves, there were education and ethnic differences in trajectory experiences. Children with mothers with undergraduate/postgraduate degrees were more likely to be in the 'always higher tier' trajectory, with 18.2% of children with university-educated mothers in this group, compared to 9.8% of those with mothers with NCEA levels 5-6, 8.0% of those with mothers with NCEA levels 1-3, and less than 4.0% of those with mothers had no formal qualifications. Children with higher-educated mothers were also more likely to be in the "mostly higher tier, but mid-tier at antenatal" trajectory (32.9% vs. 18.3% with mothers with NCEA 5-6, 15.6% with mothers with NCEA 1-3, and 7.1% with mothers with no qualifications).

Other education-related disparities in trajectory membership included children of mothers with an undergraduate/postgraduate degree being less likely to be in the "always or mostly lower tier," "mixed, unstable," and "higher tier to lower tier" trajectories.

Ethnic disparities were also found, with 19.0% of European children being in the "always higher tier" trajectory, versus 7.7% of tamariki Māori, 2.2% of Pacific children, and 8.2% of Asian children. European children were also more likely to be in the "mostly higher tier, but mid-tier at antenatal" trajectory than other ethnicities. Similar patterns emerged in ethnic disparities in the other lower- and mid-tier trajectories.

Health-related parenting trajectories and child health

We next examined whether these trajectories were associated with children's health outcomes at the 4.5-year wave. Table 6 displays the OLS regression results predicting maternal-reported general child health and counts of acute illness (full model results presented in Table A10 in the appendix). The findings provide some evidence that the cumulative health-related parenting trajectories may have a stronger association with child health than point-in-time measures of parenting behaviours, with more significant differences even in the presence of the full set of covariates (Model 3).

There was no statistical difference in maternal-reported overall child health between the "always higher tier" trajectory and the "mostly higher tier, but mid-tier at antenatal" trajectory. Interestingly, there was no statistical difference between the "always lower tier" trajectory and the "lower tier at antenatal, always or mostly higher tier thereafter" and "lower tier to higher tier" trajectories. We note, however, smaller cell sizes among some trajectories may limit statistical power.

Table 6: OLS regression predicting the association between health-related parenting trajectories and child health at the 4.5-year wave

	General health			Acute illness		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Trajectories included in the models	X		X	X		X
Education and ethnicity in the models		X	X		X	X
Covariates in the models		X	X		X	X
	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)
Health profile trajectory (ref: Always higher tier)						
Mostly higher tier, but mid-tier at antenatal	-0.03		-0.03	0.02		0.01
	(0.04)		(0.04)	(0.04)		(0.04)
Higher tier at antenatal, but only mostly higher tier thereafter	-0.12**		-0.08+	-0.06		-0.03
	(0.04)		(0.04)	(0.04)		(0.04)
Mostly mid-tier	-0.14**		-0.07+	-0.12**		-0.05
	(0.04)		(0.04)	(0.04)		(0.04)
Higher tier to lower tier	-0.26***		-0.15**	-0.11*		-0.03
	(0.05)		(0.05)	(0.05)		(0.05)
Lower tier at antenatal, always or mostly higher tier thereafter	0.01		0.06	-0.13		-0.10
	(0.08)		(0.08)	(0.08)		(0.08)
Low tier at antenatal, higher tier at 9-months, but downward thereafter	-0.21**		-0.11	-0.23***		-0.14*
	(0.07)		(0.07)	(0.07)		(0.07)
Always or mostly lower tier	-0.36***		-0.24***	-0.15*		-0.04
	(0.06)		(0.06)	(0.06)		(0.06)

Table 6 continued on next page

Table 6 continued

Mixed, unstable trajectory	-0.18***		-0.10*	-0.18***		-0.09+
	(0.05)		(0.05)	(0.05)		(0.05)
Lower tier to higher tier	-0.09		0.04	-0.25*		-0.13
	(0.12)		(0.12)	(0.11)		(0.11)
Educational attainment (ref: Undergraduate/postgraduate degree)						
No secondary school qualification		0.01	0.04		-0.08	-0.06
		(0.06)	(0.06)		(0.05)	(0.06)
NCEA 1-4		0.05	0.06*		-0.06*	-0.07*
		(0.03)	(0.03)		(0.03)	(0.03)
NCEA 5-6		-0.00	0.01		-0.00	0.02
		(0.03)	(0.03)		(0.03)	(0.03)
Ethnicity (ref: European)						
Māori		-0.07*	-0.06+		-0.06+	-0.03
		(0.03)	(0.03)		(0.03)	(0.03)
Pacific		0.02	0.04		-0.16***	-0.14***
		(0.04)	(0.04)		(0.04)	(0.04)
Asian		-0.22***	-0.20***		-0.36***	-0.34***
		(0.04)	(0.04)		(0.03)	(0.04)
Other ethnicity		-0.05	-0.03		-0.11*	-0.12*
		(0.06)	(0.06)		(0.06)	(0.06)
Constant	4.47***	3.89***	3.95***	0.75***	0.58***	0.60***
	(0.03)	(0.13)	(0.13)	(0.03)	(0.12)	(0.13)
R^2	0.02	0.04	0.05	0.01	0.04	0.04
n	4,967	4,967	4,967	4,967	4,967	4,967

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table 7: Logit and multinomial regressions predicting the association between health-related parenting trajectories and child BMI status at the 4.5-year wave

	Predicting obese status (ref: all else)			Predicting BMI status (ref: healthy weight)		
				Underweight	Overweight	Obese
	Model 1	Model 2	Model 3	Model 3	Model 3	Model 3
Trajectories included in the models	X		X	X	X	X
Education and ethnicity in the models		X	X	X	X	X
Covariates in the models		X	X	X	X	X
	OR (std. err.)	OR (std. err.)	OR (std. err.)	RRR (std. err.)	RRR (std. err.)	RRR (std. err.)
Health profile trajectory (ref: Always higher tier)						
Mostly higher tier, but mid-tier at antenatal	1.56+		1.44	0.88	0.98	1.42
	(0.40)		(0.38)	(0.23)	(0.13)	(0.38)
Higher tier at antenatal, but only mostly higher tier thereafter	1.88*		1.32	0.70	1.06	1.32
	(0.50)		(0.36)	(0.20)	(0.15)	(0.36)
Mostly mid-tier	2.38**		1.38	0.77	0.99	1.36
	(0.63)		(0.38)	(0.24)	(0.16)	(0.38)
Higher tier to lower tier	4.50***		2.27**	0.95	0.97	2.23**
	(1.15)		(0.62)	(0.30)	(0.17)	(0.62)
Lower tier at antenatal, always or mostly higher tier thereafter	1.03		0.89	1.10	1.11	0.92
	(0.57)		(0.50)	(0.53)	(0.31)	(0.52)
Low tier at antenatal, higher tier at 9-months, but downward thereafter	4.16***		1.79+	1.11	1.37	2.01*
	(1.32)		(0.61)	(0.52)	(0.32)	(0.70)
Always or mostly lower tier	4.43***		1.86*	0.91	0.95	1.81+
	(1.27)		(0.58)	(0.40)	(0.20)	(0.58)

Table 7 continued on next page

Table 7 continued

Mixed, unstable trajectory	3.22***		1.70+	1.00	1.14	1.75*
	(0.86)		(0.48)	(0.32)	(0.19)	(0.50)
Lower tier to higher tier	1.07		0.59	0.78	1.70	0.70
	(0.81)		(0.45)	(0.61)	(0.62)	(0.55)
Educational attainment (ref: Undergraduate/postgraduate degree)						
No secondary school qualification		1.41	1.30	0.85	1.24	1.39
		(0.36)	(0.33)	(0.53)	(0.23)	(0.36)
NCEA 1-4		1.54**	1.45*	1.38	1.11	1.50*
		(0.26)	(0.25)	(0.30)	(0.12)	(0.26)
NCEA 5-6		1.41*	1.34+	1.32	1.08	1.37*
		(0.22)	(0.21)	(0.25)	(0.11)	(0.22)
Ethnicity (ref: European)						
Māori		1.83***	1.72***	0.73	1.30*	1.80***
		(0.29)	(0.28)	(0.20)	(0.14)	(0.30)
Pacific		3.34***	3.06***	0.89	2.10***	3.81***
		(0.59)	(0.55)	(0.35)	(0.28)	(0.71)
Asian		0.71	0.65+	3.46***	0.41***	0.62*
		(0.17)	(0.16)	(0.71)	(0.07)	(0.15)
Other ethnicity		1.17	1.10	0.87	0.92	1.08
		(0.41)	(0.39)	(0.41)	(0.20)	(0.38)
Constant	0.04***	0.03***	0.02***	0.03***	0.12***	0.02***
	(0.01)	(0.02)	(0.01)	(0.03)	(0.06)	(0.01)
Pseudo R^2	0.04	0.11	0.11	0.07	0.07	0.07
n	4,687	4,687	4,687	4,687	4,687	4,687

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

The largest disparity in general health was between the stable higher-tier and stable lower-tier trajectories (B = -0.24; p < .001), followed by the disparity with those in the "higher tier to lower tier" trajectory (B = -0.15; p < .01), and "mixed, unstable" trajectory (B = -0.10; p < .05). Despite these persistent disparities, effect sizes were small, at around less than 25% of a standard deviation.

When examining the full model predicting acute illnesses, there was only one remaining statistical difference (at traditional levels), between the "always higher tier" and "lower tier at antenatal, higher tier at 9-months, but downward thereafter" trajectories.

Table 7 examines whether these trajectories were associated with child BMI status at the 4.5-year wave (full model results can be found in Tables A11 and A12 in the appendix). The findings were similar to children's general health: those in lower tier trajectories were at greater risk of obesity. Moreover, similar to the findings from parenting behaviour classes predicting obese status at the 4.5-year wave, modeling the parenting trajectories with the full set of covariates attenuated the association between parenting behaviour trajectories and risk of child obesity, but did little to the strength of the associations between maternal education and child ethnicity and risk of obesity. Again, this suggests that other factors may be more important, such as income and community-level deprivation, in terms of a mediational pathway through parenting behaviours that, in turn, are associated with child health.

Discussion

The aim of this study was to examine how proximal determinants of health and health equity, particularly health-related parenting behaviours, are patterned over early childhood in a cohort of New Zealand children. Instead of examining one behaviour at one time point, we provide a more holistic and realistic picture of parenting behaviours over multiple domains simultaneously from the antenatal period and across early childhood. The purpose of providing such comprehensive trajectories was to examine the role these health-related parenting behaviours might play in establishing and exacerbating existing socioeconomic and ethnic inequities in children's early childhood health. We therefore aim to highlight particularly critical or sensitive developmental periods where inequities may be wider.

To meet these aims, we used unique longitudinal data from *Growing Up in New Zealand*, starting with maternal health-related behaviours in pregnancy, a period increasingly being recognised as important for early child health outcomes. We then examined parenting behaviours in the infant, toddler, and preschool years. Several important findings emerged.

A majority of parents were following through on more healthful behaviours for their children

At each wave (i.e., antenatal, 9 months, 2 years, 4.5 years), more parents were classified as having healthy behaviors than were identified as having unhealthy or medium healthy behaviors. Children in these families with healthy behaviors were less likely to be given sugary drinks and foods, more likely to be given the recommended servings of vegetables and fruits, and more likely to live in tobacco smoke-free homes. In the antenatal period 49% of mothers were classified as having healthy behaviors, when the child was nine months old 76% of mothers were classified as having healthy bevaiors. The number dropped as children aged so that when the child was 2 years old, 40% of parents were classified as having healthy behaviors. At the time the child was 4.5 years old, the number rebounded to 53%.

Although there was a clear hierarchical order where some groups were enacting more 'healthful' behaviours than others, there was no group of parents that emerged at any wave where the group average on health behaviours exceeded that of the total sample mean across all the behaviours being examined. This finding demonstrates the complexity of providing a consistently 'healthful' behaviour environment in early childhood.

Indeed, there was not one group of parents who were exceptionally good or bad at following through on more or less healthful behaviours. Instead, a majority of parents were doing some combination of health-promoting behaviours, and it is likely the combination of these behaviours that matter more than homing in on

any one behaviour. This is an important insight for policy makers, practitioners, and those who study child health because targeting one behaviour or targeting a population based on the highest prevalence of certain behaviour may be missing that it is the sum of certain behaviours that are particularly problematic. It also misses sources of resilience and chances to reinforce efficacy and empowerment among more vulnerable whānau and families that are doing alright in other health-related areas.

A small minority of children were exposed to consistently unhealthful behaviours

At each wave there was a group who were well-below average across multiple healthful behaviour domains: children who may not be receiving support for their nutritional and physical activity needs, and are being exposed to second-hand smoke in the home.

Importantly, however, the proportion of children in these groups was small. At the antenatal wave, the group with the least healthy behaviors included 4.7% of pregnant women, and 5.3% of 9-month old infants were in this group (with just 1.4% in the group with the least healthy behaviors). By the two-year wave this increased to 12.7% of children and 21.8% at the 4.5-year wave.

The families of these infants and children therefore represent a relatively small, but important, potential target for early health-related interventions.

Patterns of behaviour exposure change over time

While a majority of parents are supporting a more healthful behavioural environment in infancy, this appears harder to achieve in later years, when children are spending more time in other contexts, enacting more agency over their own food preferences, and when screen time becomes more normative. These findings point to the need for continued support for parents, families, and whānau as they transition through developmental stages, such as the toddler and preschool years. This support needs to counter the potentially stronger role of more distal forces on parental behaviour and children's nutrition, such as food marketing (Lobstein, et al. 2015; Signal et al., 2017), disproportionate access to calorie-dense foods in high-deprivation areas (Cooksey-Stowers, Schwartz, and Brownell 2017; Sushil, Vandevijvere, Exeter, and Swinburn 2017; Woodham 2011), food insecurity, and poverty.

There are socioeconomic and ethnic disparities in health-related parenting classes which widen over the early life course

Clear inequities in health-related parenting classes were determined, with children with mothers with lower educational attainment, and Māori, Pacific, or

Asian children at greater risk of being in lower-tier profiles, compared to a higher-tier (more 'healthful') behaviour profile. Those risks were greater at later years (i.e., greater at the 4.5-year wave than at the 9-month wave). Although comparisons of risk ratios across the years should be interpreted with caution given differences in profiles across waves (see the 'Limitations and future directions' section), these findings provide preliminary support that patterns in health-related behaviours become more dispersed across early childhood and that these appear to be correlated with socioeconomic status and ethnicity.

This is important because it suggests that to decrease inequities before children enter formal school settings, with the potential benefits of more structured access to physical activity and play and, for children at low decile schools, school breakfast and lunch programmes that provide healthy food, requires promoting healthful parenting behaviours in early childhood. It also highlights that almost all parents start out with healthy behaviours and may want to, with appropriate support, continue those behaviours as children transition into the toddler and preschool years.

Point-in-time snapshots of health-related parenting classes were not strongly correlated with most child health outcomes, and did not explain socioeconomic and ethnic child health inequities

While the parenting behaviours examined in these analyses have been associated with children's health in prior literature, in this New Zealand cohort these point-in-time health-related parenting profiles only appear correlated with child obesity at the 4.5-year wave (i.e., the low-tier "low vegetable/fruit consumption, highest smoke exposure and screen time" group), and not maternal reports of overall health status and acute illnesses once the full set of covariates were entered into the models. For example, although the parenting behaviour profiles were typically associated with differences in the child health outcomes in models without covariates, once covariates were added to the models, those associations attenuated to statistically insignificant levels.

Importantly, the attenuation did not appear to be compensated in the maternal education and child ethnicity coefficients, point to other structural forces shaping child health outcomes. That is, the inclusion of health-related behaviours in the model did not affect the education and ethnicity coefficients in a way that would suggest a mediation effect, whereby children with less educated mothers or who were non-European were less likely to be in higher-tier health-related parenting profiles and, in turn, had poorer health.

Taken together, it suggests that while these health-related behaviours may be important for child health outcomes, this is because these behaviours are themselves influenced by other covariates, such as household income, that are associated with parents' education and ethnicity. These findings point to both

structural and policy malleable levers for change, such as family income, that can support parents' ability to follow through on healthier parenting behaviours.

Cumulative exposure to certain health-related parenting classes, however, matters

There did, however, seem to be a stronger association between parenting behaviour profiles and outcomes when the cumulative exposure to health-related parenting behaviours across the early life course was taken into account. In particular, children were most consistently associated with poorer health and greater risk of obesity at the 4.5-year wave when they were in the following trajectories: always or mostly exposed to lower-tier parenting profiles across the early life course; in mixed or unstable trajectories; or experienced a downward trajectory from higher- to lower-tier profiles. This is an important finding for potentially understanding child health inequities given tamariki Māori and Pacific children were more likely to experience these trajectories.

There are two potential, and complementary, reasons for this pattern discussed here. First, and most intuitively, cumulative exposure to more healthful or unhealthful behaviours over time is more likely to impact child health. This explanation provides impetus for effective, non-discriminatory and non-judgmental interventions aimed at ameliorating child health disparities through supporting families and whānau into more pro-health behaviours, within a context that supports these behaviours. Such interventions may allow for periods where parents may not be able to follow recommended nutritional practices for their children to be "recovered" from in terms of the impact those behaviours might have on their children's long-term health.

Second, it could reflect the fact that there was a lot of movement into and out of higher- and lower-tier health-related parenting profiles across the life course. This means that, if the cumulative exposure to certain parenting profiles matters for child health outcomes, then point-in-time measures of health-related parenting profiles mask what might be more typical of the child's overall exposure to certain parenting contexts. As an example, less than one-third (31.2%) of children were in the more stable trajectories of either 'always higher-tier,' 'mostly mid-tier,' or 'always and mostly lower-tier.' This drops to only 14% of the sample if trajectories were limited to 'always' being within a specific profile tier over the early life course. Indeed, 94% of children were in a higher-tier profile at some point during the preschool period for this cohort, 80% were in a mid-tier profile, and 36% experienced time in a lower-tier profile.

In short, it is likely important for all those supporting families to consider not only current health-related parenting behaviours, but whether things have changed recently, become more challenging, and why, in order to support parents more effectively manage healthful parenting activities behaviours they have previously delivered.

Implications for policy and practice

These findings point to both structural and on-the-ground implications to support children's wellbeing and health equity, and also again highlight the complexity of measuring, monitoring and enhancing the environment in the critical early years for children and their families.

While a small proportion of infants experience "unhealthy" behaviors, this proportion grows over time. Cumulative exposure to parenting behaviour profiles matter, and the distal determinants of socioeconomic and ethnic inequities in health outcomes are likely to be mediated by parental behaviour. It therefore becomes increasingly important to provide effective health, and health-related services to support families, and to provide these services early (including in the antenatal period) and consistently over the preschool period. It also highlights the importance access to high quality child care where children are protected from second-hand tobacco smoke, not exposed to screens, and provided healthy meals. These services must be racism-free and non-judgmental, strengths-based, and developed in partnership with the communities that need them the most.

Existing services that have the opportunity to deliver strengthened universal, and targeted, care to families with young children include antenatal care delivery (Ratima and Crengle, 2013), Early Childhood Education and Care services (Canterbury District health Board 2018), and the Well Child Tamariki Ora programme (Ministry of Health, 2020b). This research has not only again highlighted the importance of these opportunities to strengthen infant and child wellbeing, as well as the complexity and dynamic nature of the 'behavioural' or 'lifestyle' environments for families at this age – important for agencies to understand when they are discussing best practice guidelines, counselling parents, and monitoring point-in-time experiences. Indeed, policy design and implementation should be informed by evaluative evidence of impact and best practices.

Effective, and comprehensive health promotion, including Māori and Pacific community development, is also required to counter the influences that can 'undo' parental and whānau intentions to support healthy outcomes for their infants and children, with Kaupapa Māori approaches shown to be associated with child health preventative care and use of services aimed at supporting parents' health, too (Cram et al. 2018).

Finally, policy intervention at the structural and systems level are necessary for fulfilling obligations under Tiriti o Waitangi towards the protection and promotion of Māori health, and the eliminations of health inequities. Actions towards the elimination of child poverty and material deprivation, and ensuring that tamariki Māori, whānau and Kaupapa Māori services, such as Whānau Ora, are meaningfully resourced and empowered are necessary steps for wellbeing.

Limitations and future directions

This study is not without limitations. First, while *Growing Up in New Zealand* is the most comprehensive and contemporary data source in New Zealand for examining health-related parenting behaviours over the early life course, differences in what items were measured in each wave may have influenced some of the findings. For example, the 9-month wave, where a large majority of children were identified as being the most 'healthful' tier, did not measure fast food consumption and screen time. There were also less information on the amount of other foods, such as sugary drinks and vegetables and fruits, that were consumed daily compared to measures at later waves. It is unlikely that no children under the age of one were watching television or consuming fast food, and that these factors, if measured, might have provided further diversity in the profiles of health-related behaviours. As another example, the finding that exercise was not a distinguishing factor between health-related parenting profiles may have less to do with true differences in children's physical activity levels, and more to do with how exercise was measured for this cohort: getting outdoors for play and participation in common childhood activities, such as playing chasing games or with balls.

The lack of association between early health behaviour profiles and health outcomes could also be because of lack of variation in both parenting behaviours (at the 9-month wave) and the health outcomes, with a large majority of mothers reporting their infants and toddlers being in excellent health, compared to a smaller majority by the 4.5-year wave.

Future data collection efforts on children's health contexts should consider collecting information on screen time and fast food consumption at the earliest ages and further develop measures on physical activity that are collected from parents or utilise other more objective technologies, such as accelerometers to understand children's physical activity that may be more strongly correlated with children's health (Elmesmari, Martin, Reilly, and Paton 2018).

Second, by empirical necessity we focus on *mothers' reports* of parenting behaviours, such as their reports of what their children eat. This is a challenge for understanding children's exposure to different nutritional contexts for multiple reasons. First, mothers may not know what types of foods or activities children are exposed to when not in their care. This issue may be even more acute as children grow older and are more likely to be in non-parental care. Further, relying on maternal-reported accounts places the responsibility (and potentially blame) for feeding on mothers. The findings and potential policy implications should be interpreted with the understanding that children's lives, and health outcomes, are embedded within broader family, cultural, political and ecological contexts often outside of their immediate parents' control, generally, and their mothers', specifically.

Third, tidy comparisons of latent class profiles across the waves were not possible, as the types of profiles and items used to construct the profiles changed across waves. While we were able to group profiles into hierarchical 'tiers' and examine trajectories across time, this approach did not allow for a more thorough analytical approach, such as a fixed-effects model, that could better inform causality and compare the relative size of socioeconomic and ethnic gaps across waves. Future research could leverage a latent construct approach that incorporates both the relative importance of specific health behaviours for predicting health outcomes and also can be standardized across waves so more rigorous comparisons can be made. Doing so would also increase the utility of the findings for policy and practice by identifying certain behaviours as potential intervention points.

Fourth, as noted on page 16 and highlighted in Table A1 in the appendix, 15% of the original GUiNZ cohort was excluded from this study due to having left the study by the 54-month interview. These families had sociodemographic characteristics that suggested they were more disadvantaged, such as having lower incomes and not being in the labour force. They were also more likely to exhibit health behaviours at the antenatal wave that less healthful, such as higher rates of tobacco smoke exposure and fast food consumption and less exercise. In this way, our findings are likely more conservative in that we are underestimating the proportion of children being exposed to 'unheathful' behaviors and likely, too, the SES and ethnic disparities in being exposed to to them. Future research should explore ways to account for these potential selection effects, such as inverse probability weighting, propensity score matching, or another weighting approach that accounts for the differential rates of attrition across key sociodemographic characteristics.

Fifth, an original tenet of the current study was to examine the role that the Well-Child Tamariki Ora programme (e.g., early life health prevention visits with a General Practice service, Community provider, Plunket nurse, or other health care provider) might play in narrowing socioeconomic and ethnic gaps in higher- and lower-tier parenting profile membership. While the current measures in *Growing Up in New Zealand* would not allow for a thorough examination of the potential role of health service interaction on parenting behaviours and child health, future research could leverage linked health records for a more precise examination of the role healthcare interactions play in ameliorating gaps in both health-related parenting behaviours and children's health.

Sixth, although we found that the health-related behaviours did not explain the persistent education and ethnic child health inequities, that is not to say that the behaviours themselves do not matter differentially for children with more or less resources. For example, in the presence of higher socioeconomic deprivation we might expect that if children are receiving nutritious food and getting access to the outdoors, that this might matter more in the context of not having access to other health-promoting resources or being exposed to more daily stresses.

Future research should further unpack whether these behaviours matter in different ways for various groups of children under different circumstances.

Finally, this study can only point to correlation, not causation. We recognise the constellation of factors that were both not measured and potentially unmeasurable that might influence the parenting behaviours we examined, the potential impact of those behaviours on children's health, the potential impact of children's health on parental behaviours, and the complex associations between socioeconomic status and ethnicity, parenting behaviours, and children's health. Indeed, future research should examine why and how parents health-related parenting behaviours change to shed light on the ways both structural and individual forces causally play a role in influencing children's early health.

Overall, we believe this study provides a comprehensive descriptive picture of the health-related parenting contexts that New Zealand children experience over the early life course, pointing to policy-relevant levers for intervention, opportunities for future research exploration, and areas of inequities while also highlighting how structural context shapes family processes.

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Appendix A: Appendix tables

Table A1. Characteristics at antenatal wave for analytical sample vs. those excluded from the analytical sample

	Analytical sample		Attrited sample	
	n	*M*/% (std. dev.)	*n*	*M*/% (std. dev.)
Health behaviours				
Vegetable/fruit (0-4 scale)	5,224	2.55	947	2.50
		(1.14)		(1.17)
Fast food (0-4 scale)	5,224	1.24	948	1.36*
		(0.88)		(1.10)
Soft drinks and juice (0-4 scale)	5,224	2.89	946	2.95
		(1.22)		(1.31)
Sweets (0-4 scale)	5,224	2.32	943	1.97*
		(1.26)		(1.49)
Exercise (0-3 scale)	5,224	1.38	948	1.28*
		(1.13)		(1.17)
Smoke exposure				
No	4,198	80.36	703	68.45*
Yes	1,026	19.64	324	31.55*
Educational attainment				
No secondary school qual.	277	5.31	154	14.64*
NCEA 1-4	1,143	21.91	349	33.17*
NCEA 5-6	1,588	30.44	334	31.75
Undergraduate/postgrad degree	2,208	42.33	215	20.44*
Ethnicity				
European	2,426	46.47	668	17.51*
Māori	1,226	23.48	181	27.10*
Pacific	667	12.78	190	28.44*
Asian	715	13.69	153	22.90*
Other ethnicity	187	3.58	27	4.04
Maternal age at antenatal (years)	5,224	30.44	1,057	27.87*
		(5.66)		(6.14)
Maternal employment				
Full-time work	2,289	43.83	298	31.43*
Part-time work	1,029	19.70	79	8.33*
Unemployed	374	7.16	160	16.88*
Not in the labour force	1,531	29.31	411	43.35*
Household income	4,532	4.87	680	3.79*
		(1.57)		(1.62)
Family structure				
Two-parent family, no other adults	3,614	69.18	506	47.87*
Single-parent family, no other adults	145	2.78	53	5.01*
Parent(s), other kin adults	1,179	22.57	435	41.15*

Parent(s), other non-kin adults	286	5.47	63	5.96
Siblings	5,224	1.11	950	1.36*
		(1.28)		(1.60)
Rural area				
No	4,806	92.00	1,024	96.88*
Yes	418	8.00	33	3.12*
Meshblock deprivation index	5,222	5.78	1,057	7.35*
		(2.89)		(2.71)
n	5,224		1,058	

M/m = mean; std. dev. = standard deviation for means
* T-test/Chi2 tests indicated statistically different at at least $p < .05$ from analytical sample

Table A2. Health-related parenting behaviours variable construction

	Antenatal	9 months	2 years	4.5 years
Nutrition				
Vegetable and fruit intake	1 = none	0 = Hasn't tried, or eats fruit and/or vegetables less than weekly	0 = Hardly ever eats fruit or vegetables	0 = Hardly ever eats fruit or vegetables
	2 = Some fruit or vegetables, but not every day	1 = Eats fruit and vegetables, but not every day	1 = Eats fruit or vegetables, but not every day	1 = Eats fruit or vegetables, but not every day
	3 = Fruit or vegetables every day, but not the recommended servings	2 = Eats either fruit or vegetables every day	2 = Eats either fruit or vegetables every day	2 = Eats either fruit or vegetables every day
	4 = Fruit *and* vegetables every day, but not the recommended intake of both	3 = Eats fruit *and* vegetables every day	3 = Eats fruit *and* vegetables every day, but not the recommended servings of both	3 = Eats fruit *and* vegetables every day, but not the recommended servings of both
	5 = The recommended servings of fruit *and* vegetables every day		4 = Eats the recommended servings of both fruit *and* vegetables every day	4 = Eats the recommended servings of both fruit *and* vegetables every day
Fast food	0 = Never	Not measured.	0 = Never	0 = Never
	1 = Less than once per week		1 = Less than once per week	1 = Less than once per week
	2 = 1-2 times per week		2 = 1-2 times per week	2 = 1-2 times per week
	3 = 3-6 times per week		3 = 3-6 times per week	3 = 3-6 times per week
	4 = Daily		4 = Daily	4 = Daily

Juice and soda/ soft drinks	0 = Never 1 = Less than once per week 2 = 1-2 times per week 3 = 3-6 times per week 4 = Daily	0 = Hasn't tried, or tried but no longer eats these things 1 = Less than weekly 2 = 1-2 times per week 3 = 3-6 times per week 4 = daily	0 = Never 1 = Less than once per week 2 = 1-2 times per week 3 = 3-6 times per week 4 = Daily	0 = Never 1 = Less than once per week 2 = 1-2 times per week 3 = 3-6 times per week 4 = Daily
Sweets	0 = Never 1 = Less than once per week 2 = 1-2 times per week 3 = 3-6 times per week 4 = Daily	0 = Hasn't tried, or tried but no longer eats these things 1 = Less than weekly 2 = 1-2 times per week 3 = 3-6 times per week 4 = daily	0 = Never 1 = Less than once per week 2 = 1-2 times per week 3 = 3-6 times per week 4 = Daily	0 = Never 1 = Less than once per week 2 = 1-2 times per week 3 = 3-6 times per week 4 = Daily
Physical/ sedentary behaviour				
Physical activity	0 = No exercise, on average 1 = 1-2 days per week 2 = 3-4 days per week	Not measured.	0 = Child does not spend time outdoors on a week day 1 = One hour on average outdoors on a week day 2 = Two hours on average outdoors on a week day	Average of six scales (*alpha* = 0.60) where 0 = never and 5 = every day for participating in the following activities: -climbs tress/frames/wall bars - plays with a ball

	3 = 5-7 days per week		3 = Three hours on average outdoors on a week day 4 = Four or more hours on average outdoors on a week day	- plays chasing/ running games - rides a bike - dances - takes part of physical exercise as a family
Screen time	Not measured.	Not measured.	Continuous scale ranging from 0 = does not have screen time through 9 = four hours or more. Screen time includes time spent watching television and on devices.	Continuous scale ranging from 0 = does not have screen time through 9 = four hours or more. Screen time includes time spent watching television and on devices.
Second-hand smoke exposure				
Second-hand smoke exposure	0 = Neither mother nor partner (if present) smokes, nor does anyone smoke in the same room as mother	0 = Neither mother nor partner (if present) smokes at least once a day, nor anyone in the household	0 = Neither mother smokes at least once a day, nor anyone in the household	0 = Neither mother, nor anyone in the household

	1 = Mother or partner (if present) smokes, and/or others smoke in the same room as mother	1 = Mother or partner (present) smokes at least once per day, and/or others who live in the home smoke regularly	1 = Mother smokes at least once per day, and/or others who live in the home smoke regularly	1 = Mother smokes at least once per day, and/or others who live in the home smoke regularly

Note. "Recommended servings" comes from the New Zealand Ministry of Health guidelines (Ministry of Health 2012).

Table A3. Covariate coding

	Time variant /invariant	Measured the same across waves	Measurement
Maternal characteristics			
Maternal age	Invariant	Yes	Continuous in years; ranging from 18 (bottom-coded by GUiNZ), through 41 (top-coded by GUiNZ).
Maternal work status	Variant	Yes	Four dummy variables: full-time (30 hours or more per week); part-time (1-29 hours per week); unemployed; not in the labour force.
Child characteristics			
Born low birthweight	Invariant	Yes; but not measured at antenatal.	Binary variable: 0 = birthweight 2,500 grams or more; 1 = birthweight less than 2,500 grams.
Sex	Invariant	Yes; but not measured at antenatal.	Binary variable: 0 = male; 1 = female.
Age deviation from interview age in months	Variant	Yes; but not measured at antenatal.	Child's age deviation in months from intended interview age, continuous variable ranging from -5 (5-months younger than intended interview age), through 15 (15-months older than intended interview age).
Main child care	Variant	Yes; but not measured at antenatal.	Three dummy variables: Not in any child care; main child care is a nanny/relative/friend care; main child care is a group care setting (e.g., preschool, kindergarten, kohunga reo)
Family characteristics			
Household income	Variant	Yes	Continuous scale ranging from 1 = $20,000 or less per annum through 7 = over $150,000 per annum.

Family structure	Variant	Yes	Four dummy variables (coded by GUiNZ): two-parent family, no other adults; single-parent family, no other adults; parent(s), other kin adult; parent(s), other non-kin adults.
Siblings	Variant	Yes	Continuous variable ranging from 0 = no siblings in the home, through 6 = six or more siblings in the home.
Residential mobility	Variant	Yes; but not measured at antenatal.	Continuous scale ranging from 0 = no residential moves since last interview, through 4 = four or more residential moves since last interview.
Geographic characterstics			
Urbanicity	Variant	Yes	Binary variable: 0 = lives in urban area; 1 = lives in rural area.
Meshblock deprivation index	Variant	Yes	Continuous NZDep measure ranging from 0 = least deprived decile, through 10 = most deprived decile.

Table A4. Latent Class Analysis model fit statistics

Classes	AIC	BIC	LL
Antenatal wave			
2	84176.99	84295.08	-42070.50
3	83211.69	83375.70	-41580.84
4	82934.90	83144.84	-41435.45
5	82127.25	82383.11	-41024.62
6	82064.46	82366.25	-40986.23
7	80870.36	81218.07	-40382.18
9-month wave			
2	57238.38	57338.25	-28604.19
3	47126.80	47266.63	-23542.40
4	28670.47	28816.96	
5	27037.15	27216.93	-13491.58
6	30047.37	30307.04	-14984.68
7	34586.48	34886.11	-17248.24
2-year wave			
2	112428.41	112567.63	-56193.21
3	111100.10	111292.36	-55521.05
4	110656.71	110902.01	-55291.36
5	110228.60	110526.94	-55069.30
6	109980.72	110332.09	-54937.36
7	109287.91	109692.32	-54582.96
4.5-year wave			
2	103951.13	104090.88	-51954.57
3	c	c	c
4	102897.98	103144.21	-51411.99
5	101415.63	101715.09	-50662.82
6	101288.41	101641.11	-50591.21
7	100836.78	101242.72	-50357.39

AIC = Akaike information criterion; BIC = Bayesian information criterion; LL = Log Likelihood. c = model could not converge.

In general, lower AIC, BIC, and LL statistics indicate better model fit. However, model fit statistics are also assessed on whether adding an additional class produces a substantial improvement in the model fit. Based on this criteria, five classes was deemed the best fit across all waves (as opposed to seven classes, for example, which often has the lowest AIC, BIC, and LL) because it produced a substantively bigger improvement than the four-class solution and this improvement was not replicated when moving to model fits with a larger number of classes.

Table A5. Full sample description

	Antenatal		9 months		2 years		4.5 years	
	n	*M*/%	*n*	*m*/%	*n*	*m*/%	*n*	*m*/%
Health outcomes								
Global health scale (1-5 scale)	..	..	5,758	4.45 (0.80)	5,594	4.34 (0.83)	5,737	4.34 (0.79)
Acute illness count*	..	..	5,751	0.80 (1.03)	5,575	1.68 (1.56)	5,736	0.67 (0.78)
Child obese status								
Not obese	..	..	..	..	..	..	4,961	91.70
Obese	..	..	..	..	..	..	449	8.30
Child BMI group								
Underweight	..	..	..	..	..	..	210	3.88
Healthy weight	..	..	..	..	..	..	3,678	67.99
Overweight	..	..	..	..	..	..	1,073	19.83
Obese	..	..	..	..	..	..	449	8.30
Health behaviours								
Vegetable/fruit (0-4 scale)	5,224	2.55 (1.14)	5,758	2.75 (0.57)	5,595	2.20 (1.06)	5,737	2.13 (1.11)
Fast food (0-4 scale)	5,224	1.24 (0.88)	..	..	5,595	1.11 (0.87)	5,737	1.23 (0.76)
Soft drinks and juice (0-4 scale)	5,224	2.89 (1.22)	5,758	0.73 (1.28)	5,595	2.13 (1.44)	5,737	2.09 (1.24)
Sweets (0-4 scale)	5,224	2.32 (1.26)	5,758	0.28 (0.70)	5,595	2.04 (1.13)	5,737	2.29 (0.96)
Exercise (0-3 scale)	5,224	1.38 (1.13)	…	..	5,595	3.21 (0.91)	5,737	3.09 (0.49)
Screen time (0-9 scale)					5,595	2.56 (2.38)	5,737	4.07 (2.34)
Smoke exposure								
No	4,198	80.36	4,128	71.69	4,095	73.19	4,318	75.27
Yes	1,026	19.64	1,630	28.31	1,500	26.81	1,419	24.73

Educational attainment								
No secondary school qual.	277	5.31	333	5.80	315	5.64	329	5.75
NCEA 1-4	1,143	21.91	1,270	22.11	1,237	22.16	1,266	22.12
NCEA 5-6	1,588	30.44	1,747	31.41	1,711	30.65	1,740	30.40
Undergraduate/postgrad degree	2,208	42.33	2,395	41.69	2,319	41.54	2,388	41.73
Ethnicity								
European	2,426	46.47	2,645	45.95	2,585	46.23	2,641	46.06
Māori	1,226	23.48	1,354	23.52	1,311	23.44	1,345	23.46
Pacific	667	12.78	758	13.17	730	13.05	754	13.15
Asian	715	13.69	799	13.88	771	13.79	794	13.85
Other ethnicity	187	3.58	200	3.47	195	3.49	200	3.49
Maternal age at antenatal (years)	5,224	30.44 (5.66)	5,758	30.47 (5.72)	5,595	30.49 (5.72)	5,737	30.49 (5.70)
Maternal employment								
Full-time work	2,289	43.83	954	17.03	1,487	27.89	2,152	37.94
Part-time work	1,029	19.70	1,220	21.78	1,326	24.87	1,611	28.40
Unemployed	374	7.16	338	6.03	372	6.98	794	14.00
Not in the labour force	1,531	29.31	3,089	55.15	2,146	40.26	1,115	19.66
Household income	4,532	4.87 (1.57)	5,028	4.49 (1.55)	5,170	4.68 (1.61)	4,926	5.10 (1.49)
Family structure								
Two-parent family, no other adults	3,614	69.18	3,534	7.17	265	4.76	4,069	72.47
Single-parent family, no other adults	145	2.78	384	65.98	3,888	69.84	422	7.52
Parent(s), other kin adults	1,179	22.57	1,169	21.83	1,083	19.45	916	16.31
Parent(s), other non-kin adults	286	5.47	269	5.02	331	5.95	208	3.70
Siblings	5,224	1.11 (1.28)	5,223	1.11 (1.29)	5,548	1.10 (1.22)	5,064	1.66 (1.01)
Rural area								
No	4,806	92.00	5,296	91.98	3,153	90.32	4,943	90.28
Yes	418	8.00	462	8.02	338	9.68	532	9.72
Meshblock deprivation index	5,222	5.78 (2.89)	5,756	5.77 (2.92)	5,501	5.69 (2.93)	5,475	5.53 (3.00)

Residential moves	…	…	5,682	0.30	5,576	0.38	5,736	0.81
				(0.59)		(0.65)		(1.04)
Main child care								
None	…	…	3,720	70.33	2,434	47.64	174	3.05
Nanny/relative/friend care	…	…	776	14.67	647	12.66	188	3.29
Centre-based, group case	…	…	793	14.99	2,028	39.69	5,347	93.66
Baby born low birthweight								
No	…	…	5,480	95.22	5,324	95.21	5,457	95.17
Yes	…	…	275	4.78	268	4.79	277	4.83
Baby sex								
Male	…	…	2,962	51.44	2,880	51.47	2,953	51.47
Female	…	…	2,796	48.56	2,715	48.53	2,784	48.53
Age deviation from interview age in months	…	…	5,758	0.38	5,595	0.21	5,737	-0.10
				(0.88)		(1.84)		(1.49)
n	5,224		5,758		5,595		5,737	

M/m = mean; std. dev. = standard deviation for means; .. = variable not available at this wave.
* Acute illness is a 0-11 scale at the 9-month and 2-year waves. It is a 0-3 count at the 4.5-year wave.

Table A6. OLS regression predicting maternal-reported health and acute illnesses at the 9-month wave

	General health			Acute illness		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Classes included in the models	X		X	X		X
Education and ethnicity in the models		X	X		X	X
Covariates in the models		X	X		X	X
	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)
Health behaviour profile (ref: High vegetables/fruit consumption, low smoke exposure))						
Low unhealthy food consumption and smoke exposure	-0.07		-0.00	0.08		-0.03
	(0.05)		(0.05)	(0.06)		(0.06)
Very low sweet consumption with high fast food, soft drinks, and vegetables/fruit consumption	-0.22*		-0.11	0.39***		0.18
	(0.09)		(0.09)	(0.11)		(0.11)
Average with low vegetable/fruit consumption	-0.07		0.01	0.25***		0.12+
	(0.05)		(0.05)	(0.06)		(0.06)
High unhealthy food consumption and smoke exposure	-0.05+		0.00	0.14**		0.06
	(0.03)		(0.03)	(0.04)		(0.04)
Educational attainment (ref: Undergraduate/postgraduate degree)						
No secondary school qualification		0.05	0.05		0.17**	0.16*
		(0.05)	(0.05)		(0.06)	(0.06)
NCEA 1-4		0.02	0.02		0.02	0.02
		(0.03)	(0.03)		(0.04)	(0.04)
NCEA 5-6		0.03	0.03		0.07*	0.07*
		(0.03)	(0.03)		(0.03)	(0.03)
Ethnicity (ref: European)						
Māori		-0.10***	-0.10***		0.21***	0.21***

	(0.03)	(0.03)	(0.04)	(0.04)
Pacific	-0.03	-0.03	0.12*	0.12*
	(0.04)	(0.04)	(0.05)	(0.05)
Asian	-0.08*	-0.08*	-0.28***	-0.29***
	(0.03)	(0.03)	(0.04)	(0.04)
Other ethnicity	0.01	0.01	-0.02	-0.03
	(0.06)	(0.06)	(0.07)	(0.07)
Maternal age (years)	0.01***	0.01***	-0.02***	-0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
Maternal employment (ref: Full-time work)				
Part-time work	0.03	0.03	0.00	0.00
	(0.04)	(0.04)	(0.04)	(0.04)
Unemployed	-0.02	-0.02	0.10	0.10
	(0.05)	(0.05)	(0.07)	(0.07)
Not in the labour force	-0.01	-0.01	-0.01	-0.01
	(0.04)	(0.04)	(0.05)	(0.05)
Household income (1-7 scale)	0.03**	0.03**	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Family structure (ref: Two-parent family, no other adults)				
Single-parent family, no other adults	-0.07	-0.07	0.22***	0.22***
	(0.04)	(0.04)	(0.06)	(0.06)
Parent(s), other kin adults	0.05+	0.05+	0.04	0.03
	(0.03)	(0.03)	(0.04)	(0.04)
Parent(s), other non-kin adults	0.05	0.05	-0.10	-0.10
	(0.05)	(0.05)	(0.06)	(0.06)
Residential moves between waves (0-5 scale)	-0.02	-0.02	0.05*	0.05*
	(0.02)	(0.02)	(0.02)	(0.02)
Siblings (0-6 scale)	-0.05***	-0.05***	0.08***	0.08***
	(0.01)	(0.01)	(0.01)	(0.01)
Rural area (ref: Urban area)	-0.01	-0.01	-0.10*	-0.10*

		(0.04)	(0.04)		(0.05)	(0.05)
Meshblock deprivation index (1-10 scale)		0.00	0.00		0.00	0.00
		(0.00)	(0.00)		(0.01)	(0.01)
Child born at low birthweight		-0.08	-0.08		0.11+	0.11+
		(0.05)	(0.05)		(0.06)	(0.06)
Child female (ref: Male)		0.09***	0.09***		-0.19***	-0.19***
		(0.02)	(0.02)		(0.03)	(0.03)
Child age deviation in months	-0.02+	-0.01	-0.01	0.08***	0.05**	0.05**
	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)
Main child care provider (ref: None)						
Nanny/relative/friend care		-0.11**	-0.11**		0.11*	0.12**
		(0.04)	(0.04)		(0.04)	(0.04)
Centre-based, group care		-0.28***	-0.28***		0.44***	0.44***
		(0.04)	(0.04)		(0.05)	(0.05)
Constant	4.47***	4.09***	4.09***	0.73***	1.05***	1.02***
	(0.01)	(0.10)	(0.10)	(0.02)	(0.12)	(0.12)
R^2	0.01	0.04	0.04	0.01	0.10	0.10
n	5,758	5,758	5,758	5,751	5,751	5,751

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table A7. OLS regression predicting maternal-reported health and acute illness at the 2-year wave

	General health			Acute illness		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Classes included in the models	X		X	X		X
Education and ethnicity in the models		X	X		X	X
Covariates in the models		X	X		X	X
	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)
Health behaviour profile (ref: Low unhealthy food consumption, screen time, and smoke exposure)						
High food consumption, especially fast food	-0.01		-0.03	-0.17		-0.08
	(0.09)		(0.09)	(0.16)		(0.16)
Disadvantaged across most behaviours	-0.07+		-0.06	-0.09		0.07
	(0.04)		(0.04)	(0.07)		(0.07)
Average with high sugary drink consumption	-0.04+		-0.03	-0.02		0.01
	(0.02)		(0.03)	(0.05)		(0.05)
Average with high screen time and low sugary drink consumption	0.01		0.00	-0.18+		-0.06
	(0.06)		(0.06)	(0.11)		(0.11)
Educational attainment (ref: Undergraduate/ postgraduate degree)						
No secondary school qualification		0.10+	0.11*		-0.08	-0.08
		(0.05)	(0.05)		(0.10)	(0.10)
NCEA 1-4		0.07*	0.08*		-0.05	-0.05
		(0.03)	(0.03)		(0.06)	(0.06)
NCEA 5-6		0.05+	0.06*		0.04	0.03
		(0.03)	(0.03)		(0.05)	(0.05)
Ethnicity (ref: European)						
Māori		-0.07*	-0.07*		0.18**	0.18**

	(0.03)	(0.03)	(0.06)	(0.06)
Pacific	0.11**	0.12**	-0.14+	-0.14+
	(0.04)	(0.04)	(0.07)	(0.08)
Asian	-0.08*	-0.07+	-0.69***	-0.70***
	(0.04)	(0.04)	(0.07)	(0.07)
Other ethnicity	0.06	0.06	-0.16	-0.17
	(0.06)	(0.06)	(0.11)	(0.11)
Maternal age (years)	0.01**	0.01**	-0.02***	-0.02***
	(0.00)	(0.00)	(0.00)	(0.00)
Maternal employment (ref: Full-time work)				
Part-time work	0.06+	0.06+	-0.01	-0.01
	(0.03)	(0.03)	(0.06)	(0.06)
Unemployed	0.04	0.04	0.26**	0.26**
	(0.05)	(0.05)	(0.09)	(0.09)
Not in the labour force	0.07+	0.07+	-0.08	-0.08
	(0.03)	(0.03)	(0.06)	(0.06)
Household income (1-7 scale)	0.04***	0.04***	0.06***	0.06***
	(0.01)	(0.01)	(0.02)	(0.02)
Family structure (ref: Two-parent family, no other adults)				
Single-parent family, no other adults	0.05	0.06	0.14	0.14
	(0.05)	(0.06)	(0.10)	(0.10)
Parent(s), other kin adults	-0.01	-0.01	0.07	0.07
	(0.03)	(0.03)	(0.06)	(0.06)
Parent(s), other non-kin adults	0.04	0.05	0.05	0.05
	(0.05)	(0.05)	(0.09)	(0.09)
Residential moves between waves (0-5 scale)	0.01	0.01	-0.03	-0.03
	(0.02)	(0.02)	(0.03)	(0.03)

Siblings (0-6 scale)		-0.02*	-0.02*		0.11***	0.11***
		(0.01)	(0.01)		(0.02)	(0.02)
Rural area (ref: Urban area)		0.10*	0.10*		-0.08	-0.08
		(0.05)	(0.05)		(0.08)	(0.08)
Meshblock deprivation index (1-10 scale)		0.01	0.01		-0.00	-0.00
		(0.00)	(0.00)		(0.01)	(0.01)
Child born at low birthweight		-0.16**	-0.16**		0.42***	0.41***
		(0.05)	(0.05)		(0.09)	(0.09)
Child female (ref: Male)		0.05*	0.04*		-0.26***	-0.25***
		(0.02)	(0.02)		(0.04)	(0.04)
Child age deviation in months	0.00	0.00	0.01	0.03**	0.03**	0.03**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Main child care provider (ref: None)						
Centre-based, group care		-0.02	-0.02		0.14+	0.13+
		(0.04)	(0.04)		(0.07)	(0.07)
Nanny/relative/friend care		-0.16***	-0.16***		0.60***	0.61***
		(0.03)	(0.03)		(0.05)	(0.05)
Constant	4.36***	3.86***	3.89***	1.70***	1.78***	1.76***
	(0.02)	(0.10)	(0.11)	(0.03)	(0.19)	(0.19)
R^2	0.01	0.04	0.05	0.01	0.04	0.04
n	5,595	5,595	5,595	5,575	5,575	5,575

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table A8. OLS regression predicting maternal-reported health and acute illness at the 4.5-year wave

	General health			Acute illness		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Classes included in the models	X		X	X		X
Education and ethnicity in the models		X	X		X	X
Covariates in the models		X	X		X	X
	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)
Health behaviour profile (ref: Advantaged across all health behaviours except low vegetable/fruit consumption (Higher))						
High vegetable/fruit consumption and low screen time (Higher)	0.00		0.02	1.02		1.03
	(0.03)		(0.03)	(0.03)		(0.03)
Low vegetable/fruit consumption and above average sugary drinks consumption (Mid)	-0.10***		-0.05+	0.99		1.04
	(0.03)		(0.03)	(0.03)		(0.03)
High food consumption, smoke exposure, and screen time (Lower)	-0.14***		-0.05	0.98		1.07
	(0.04)		(0.04)	(0.04)		(0.04)
Low vegetable/fruit consumption, highest smoke exposure and screen time (Lower)	-0.26***		-0.17***	0.93*		1.01
	(0.04)		(0.04)	(0.03)		(0.04)
Educational attainment (ref: Undergraduate/postgraduate degree)						
No secondary school qualification		0.01	0.03		0.92	0.91+
		(0.05)	(0.05)		(0.05)	(0.05)
NCEA 1-4		0.04	0.05+		0.94*	0.93*
		(0.03)	(0.03)		(0.03)	(0.03)
NCEA 5-6		0.00	0.02		1.00	1.00

	(0.03)	(0.03)	(0.03)	(0.03)
Ethnicity (ref: European)				
Māori	-0.05+	-0.03	0.95+	0.94*
	(0.03)	(0.03)	(0.03)	(0.03)
Pacific	-0.01	0.01	0.85***	0.85***
	(0.04)	(0.04)	(0.03)	(0.03)
Asian	-0.22***	-0.20***	0.70***	0.69***
	(0.03)	(0.03)	(0.02)	(0.02)
Other ethnicity	-0.08	-0.07	0.89*	0.89*
	(0.06)	(0.06)	(0.05)	(0.05)
Maternal age (years)	0.01***	0.01***	1.00	1.00
	(0.00)	(0.00)	(0.00)	(0.00)
Maternal employment (ref: Full-time work)				
Part-time work	0.06*	0.06*	1.03	1.03
	(0.03)	(0.03)	(0.03)	(0.03)
Unemployed	0.02	0.02	1.03	1.03
	(0.04)	(0.04)	(0.04)	(0.04)
Not in the labour force	0.04	0.04	0.99	1.00
	(0.03)	(0.03)	(0.03)	(0.03)
Household income (1-7 scale)	0.05***	0.05***	1.01	1.01
	(0.01)	(0.01)	(0.01)	(0.01)
Family structure (ref: Two-parent family, no other adults)				
Single-parent family, no other adults	-0.03	-0.04	1.15**	1.15**
	(0.04)	(0.04)	(0.05)	(0.05)
Parent(s), other kin adults	-0.01	0.00	1.00	1.00
	(0.03)	(0.03)	(0.03)	(0.03)
Parent(s), other non-kin adults	-0.05	-0.04	1.04	1.04

		(0.06)	(0.06)		(0.06)	(0.06)
Residential moves between waves (0-5 scale)		0.00	0.00		1.01	1.01
		(0.01)	(0.01)		(0.01)	(0.01)
Siblings (0-6 scale)		0.02+	0.02+		0.97*	0.97*
		(0.01)	(0.01)		(0.01)	(0.01)
Rural area (ref: Urban area)		0.03	0.03		0.97	0.97
		(0.04)	(0.04)		(0.03)	(0.03)
Meshblock deprivation index (1-10 scale)		-0.00	-0.00		1.00	1.00
		(0.00)	(0.00)		(0.00)	(0.00)
Child born at low birthweight		-0.10*	-0.09+		1.10*	1.10*
		(0.05)	(0.05)		(0.05)	(0.05)
Child female (ref: Male)		0.07**	0.06**		0.98	0.98
		(0.02)	(0.02)		(0.02)	(0.02)
Child age deviation in months	0.00	0.00	0.01	1.00	1.01+	1.01+
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Main child care provider (ref: None)						
Centre-based, group care		-0.13	-0.12		1.33***	1.33***
		(0.08)	(0.08)		(0.11)	(0.11)
Nanny/relative/friend care		-0.13*	-0.14*		1.20**	1.20**
		(0.06)	(0.06)		(0.07)	(0.07)
Constant	4.41***	3.86***	3.89***	1.97***	1.78***	1.74***
	(0.02)	(0.12)	(0.12)	(0.04)	(0.21)	(0.20)
R^2	0.01	0.04	0.05	0.01	0.04	0.04
n	5,737	5,737	5,737	5,737	5,737	5,737

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table A9. Logit and multinomial regressions predicting child BMI status at 4.5 years

	Obese status (ref: All else)			BMI status (ref: Healthy weight)		
				Underweight	Overweight	Obese
	Model 1	Model 2	Model 3	Model 3	Model 3	Model 3
Classes included in the models	X		X	X	X	X
Education and ethnicity in the models		X	X	X	X	X
Covariates in the models		X	X	X	X	X
	OR (std. err.)	OR (std. err.)	OR (std. err.)	RRR (std. err.)	RRR (std. err.)	RRR (std. err.)
Health behaviour profile (ref: Advantaged across all health behaviours except low vegetable/fruit consumption)						
High vegetable/fruit consumption and low screen time	1.51*		1.34+	0.65*	1.13	1.36+
	(0.25)		(0.23)	(0.13)	(0.11)	(0.24)
Low vegetable/fruit consumption and above average sugary drinks consumption	2.17***		1.58**	0.77	1.16	1.62**
	(0.35)		(0.26)	(0.15)	(0.12)	(0.27)
High food consumption, smoke exposure, and screen time	2.30***		1.30	0.88	1.12	1.32
	(0.46)		(0.28)	(0.26)	(0.16)	(0.29)
Low vegetable/fruit consumption, highest smoke exposure and screen time	4.13***		2.36***	1.04	1.14	2.44***
	(0.68)		(0.43)	(0.26)	(0.15)	(0.45)
Educational attainment (ref: Undergraduate/postgraduate degree)						
No secondary school qualification		1.25	1.14	1.10	1.22	1.22
		(0.29)	(0.27)	(0.55)	(0.20)	(0.29)
NCEA 1-4		1.67***	1.61**	1.38	1.11	1.68**
		(0.26)	(0.25)	(0.28)	(0.12)	(0.27)
NCEA 5-6		1.54**	1.46**	1.29	1.06	1.49**
		(0.22)	(0.21)	(0.23)	(0.10)	(0.22)
Ethnicity (ref: European)						

Māori	1.84***	1.66***	0.78	1.31**	1.75***
	(0.27)	(0.25)	(0.20)	(0.13)	(0.27)
Pacific	3.21***	2.93***	0.69	2.08***	3.63***
	(0.53)	(0.49)	(0.26)	(0.26)	(0.62)
Asian	0.73	0.68+	3.33***	0.49***	0.67+
	(0.16)	(0.15)	(0.62)	(0.07)	(0.15)
Other ethnicity	1.50	1.47	0.97	0.90	1.43
	(0.44)	(0.43)	(0.42)	(0.19)	(0.42)
Maternal age (years)	1.02+	1.02*	1.01	0.99	1.02+
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
Maternal employment (ref: Full-time work)					
Part-time work	0.76+	0.78+	1.20	1.00	0.78
	(0.11)	(0.12)	(0.22)	(0.09)	(0.12)
Unemployed	0.92	0.90	0.80	0.83	0.85
	(0.15)	(0.15)	(0.23)	(0.10)	(0.14)
Not in the labour force	1.02	1.04	1.10	0.88	1.00
	(0.15)	(0.16)	(0.24)	(0.09)	(0.15)
Household income (1-7 scale)	0.90*	0.91*	1.07	1.01	0.91*
	(0.04)	(0.04)	(0.08)	(0.03)	(0.04)
Family structure (ref: Two-parent family, no other adults)					
Single-parent family, no other adults	0.90	0.92	0.51	1.16	0.95
	(0.18)	(0.18)	(0.22)	(0.16)	(0.19)
Parent(s), other kin adults	1.20	1.14	0.95	1.08	1.17
	(0.16)	(0.15)	(0.20)	(0.12)	(0.16)
Parent(s), other non-kin adults	0.98	0.94	0.75	0.96	0.92
	(0.29)	(0.28)	(0.32)	(0.19)	(0.28)
Residential moves between waves (0-5 scale)	0.95	0.95	1.04	1.06+	0.96
	(0.05)	(0.05)	(0.08)	(0.04)	(0.05)
Siblings (0-6 scale)	0.91*	0.91*	0.81*	1.07*	0.93
	(0.04)	(0.04)	(0.07)	(0.04)	(0.04)
Rural area (ref: Urban area)	0.92	0.94	0.94	0.93	0.92

		(0.19)	(0.20)	(0.26)	(0.12)	(0.19)
Meshblock deprivation index (1-10 scale)		1.08***	1.07**	1.00	1.04**	1.09***
		(0.02)	(0.02)	(0.03)	(0.02)	(0.02)
Child born at low birthweight		0.38**	0.35**	1.67*	0.61**	0.32**
		(0.13)	(0.12)	(0.44)	(0.11)	(0.11)
Child female (ref: Male)		1.23*	1.27*	0.93	1.28***	1.35**
		(0.13)	(0.13)	(0.13)	(0.09)	(0.14)
Child age deviation in months	1.15***	1.10**	1.09**	1.05	1.04	1.11**
	(0.03)	(0.03)	(0.03)	(0.05)	(0.03)	(0.03)
Main child care provider (ref: None)						
Centre-based, group care		1.38	1.37	1.34	1.23	1.49
		(0.54)	(0.54)	(0.84)	(0.38)	(0.60)
Nanny/relative/friend care		1.12	1.14	0.98	1.41	1.26
		(0.30)	(0.31)	(0.52)	(0.31)	(0.36)
Constant	0.05***	0.03***	0.02***	0.03***	0.12***	0.02***
	(0.01)	(0.02)	(0.01)	(0.03)	(0.05)	(0.01)
Pseudo R^2	0.01	0.04	0.05	0.01	0.04	0.04
n	5,410	5,410	5,410	5,410	5,410	5,410

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table A10. OLS regressions with health behaviour trajectories predicting maternal-reported child health and acute illnesses at the 4.5-year wave

	General health			Acute illness		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Classes included in the models	X		X	X		X
Education and ethnicity in the models		X	X		X	X
Covariates in the models		X	X		X	X
	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)	Coeff. (std. err.)
Health profile trajectory (ref: Always higher tier)						
Mostly higher tier, but mid-tier at antenatal	-0.03		-0.03	0.02		0.01
	(0.04)		(0.04)	(0.04)		(0.04)
Higher tier at antenatal, but only mostly higher tier thereafter	-0.12**		-0.08+	-0.06		-0.03
	(0.04)		(0.04)	(0.04)		(0.04)
Mostly mid-tier	-0.14**		-0.07+	-0.12**		-0.05
	(0.04)		(0.04)	(0.04)		(0.04)
Higher tier to lower tier	-0.26***		-0.15**	-0.11*		-0.03
	(0.05)		(0.05)	(0.05)		(0.05)
Lower tier at antenatal, always or mostly higher tier thereafter	0.01		0.06	-0.13		-0.10
	(0.08)		(0.08)	(0.08)		(0.08)
Low tier at antenatal, higher tier at 9-months, but downward thereafter	-0.21**		-0.11	-0.23***		-0.14*
	(0.07)		(0.07)	(0.07)		(0.07)
Always or mostly lower tier	-0.36***		-0.24***	-0.15*		-0.04
	(0.06)		(0.06)	(0.06)		(0.06)
Mixed, unstable trajectory	-0.18***		-0.10*	-0.18***		-0.09+
	(0.05)		(0.05)	(0.05)		(0.05)

Lower tier to higher tier	-0.09		0.04	-0.25*		-0.13
	(0.12)		(0.12)	(0.11)		(0.11)
Educational attainment (ref: Undergraduate/postgraduate degree)						
No secondary school qualification		0.01	0.04		-0.08	-0.06
		(0.06)	(0.06)		(0.05)	(0.06)
NCEA 1-4		0.05	0.06*		-0.06*	-0.07*
		(0.03)	(0.03)		(0.03)	(0.03)
NCEA 5-6		-0.00	0.01		-0.00	0.02
		(0.03)	(0.03)		(0.03)	(0.03)
Ethnicity (ref: European)						
Māori		-0.07*	-0.06+		-0.06+	-0.03
		(0.03)	(0.03)		(0.03)	(0.03)
Pacific		0.02	0.04		-0.16***	-0.14***
		(0.04)	(0.04)		(0.04)	(0.04)
Asian		-0.22***	-0.20***		-0.36***	-0.34***
		(0.04)	(0.04)		(0.03)	(0.04)
Other ethnicity		-0.05	-0.03		-0.11*	-0.12*
		(0.06)	(0.06)		(0.06)	(0.06)
Maternal age (years)		0.01***	0.01***		0.00	0.00
		(0.00)	(0.00)		(0.00)	(0.00)
Maternal employment (ref: Full-time work)						
Part-time work		0.06*	0.06+		0.03	0.03
		(0.03)	(0.03)		(0.03)	(0.03)
Unemployed		0.04	0.05		0.03	0.04
		(0.04)	(0.04)		(0.03)	(0.04)
Not in the labour force		0.03	0.03		-0.01	-0.02
		(0.03)	(0.03)		(0.03)	(0.03)

Household income (1-7 scale)		0.05***	0.05***		0.01	0.01
		(0.01)	(0.01)		(0.01)	(0.01)
Family structure (ref: Two-parent family, no other adults)						
Single-parent family, no other adults		-0.04	-0.03		0.14**	0.11*
		(0.05)	(0.05)		(0.04)	(0.05)
Parent(s), other kin adults		-0.02	0.00		-0.00	-0.02
		(0.03)	(0.03)		(0.03)	(0.03)
Parent(s), other non-kin adults		0.01	0.02		0.04	0.06
		(0.06)	(0.06)		(0.05)	(0.06)
Residential moves between waves (0-5 scale)		-0.00	0.00		0.01	0.01
		(0.01)	(0.01)		(0.01)	(0.01)
Siblings (0-6 scale)		0.02*	0.03*		-0.03*	-0.03**
		(0.01)	(0.01)		(0.01)	(0.01)
Rural area (ref: Urban area)		0.03	0.02		-0.03	-0.03
		(0.04)	(0.04)		(0.04)	(0.04)
Meshblock deprivation index (1-10 scale)		-0.01	-0.00		-0.00	-0.00
		(0.00)	(0.00)		(0.00)	(0.00)
Child born at low birthweight		0.06**	0.06*		-0.02	-0.03
		(0.02)	(0.02)		(0.02)	(0.02)
Child female (ref: Male)		-0.09+	-0.07		0.10*	0.08
		(0.05)	(0.05)		(0.05)	(0.05)
Child age deviation in months	-0.00	-0.00	-0.00	0.01	0.01+	0.01+
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Main child care provider (ref: None)						
Centre-based, group care		-0.15	-0.15		0.28***	0.30***

		(0.09)	(0.09)		(0.08)	(0.09)
Nanny/relative/friend care		-0.14*	-0.14*		0.18**	0.17**
		(0.07)	(0.07)		(0.06)	(0.07)
Constant	4.47***	3.89***	3.95***	0.75***	0.58***	0.60***
	(0.03)	(0.13)	(0.13)	(0.03)	(0.12)	(0.13)
R^2	0.02	0.04	0.05	0.01	0.04	0.04
n	4,967	4,967	4,967	4,967	4,967	4,967

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table A11. Logit regressions with health behaviour trajectories predicting maternal-reported child BMI obese status at the 4.5-year wave

	Predicting obese status (ref: all else)		
	Model 1	Model 2	Model 3
Classes included in the models	X		X
Education and ethnicity in the models		X	X
Covariates in the models		X	X
	OR (std. err.)	OR (std. err.)	OR (std. err.)
Health profile trajectory (ref: Always higher tier)			
Mostly higher tier, but mid-tier at antenatal	1.56+		1.44
	(0.40)		(0.38)
Higher tier at antenatal, but only mostly higher tier thereafter	1.88*		1.32
	(0.50)		(0.36)
Mostly mid-tier	2.38**		1.38
	(0.63)		(0.38)
Higher tier to lower tier	4.50***		2.27**
	(1.15)		(0.62)
Lower tier at antenatal, always or mostly higher tier thereafter	1.03		0.89
	(0.57)		(0.50)
Low tier at antenatal, higher tier at 9-months, but downward thereafter	4.16***		1.79+
	(1.32)		(0.61)
Always or mostly lower tier	4.43***		1.86*
	(1.27)		(0.58)
Mixed, unstable trajectory	3.22***		1.70+
	(0.86)		(0.48)
Lower tier to higher tier	1.07		0.59
	(0.81)		(0.45)
Educational attainment (ref: Undergraduate/postgraduate degree)			
No secondary school qualification		1.41	1.30
		(0.36)	(0.33)
NCEA 1-4		1.54**	1.45*
		(0.26)	(0.25)
NCEA 5-6		1.41*	1.34+
		(0.22)	(0.21)
Ethnicity (ref: European)			
Māori		1.83***	1.72***
		(0.29)	(0.28)
Pacific		3.34***	3.06***
		(0.59)	(0.55)
Asian		0.71	0.65+
		(0.17)	(0.16)
Other ethnicity		1.17	1.10

		(0.41)	(0.39)
Maternal age (years)		1.01	1.02
		(0.01)	(0.01)
Maternal employment (ref: Full-time work)			
Part-time work		0.72*	0.72*
		(0.12)	(0.12)
Unemployed		0.84	0.82
		(0.15)	(0.15)
Not in the labour force		0.93	0.93
		(0.15)	(0.15)
Household income (1-7 scale)		0.89*	0.90*
		(0.04)	(0.04)
Family structure (ref: Two-parent family, no other adults)			
Single-parent family, no other adults		0.81	0.82
		(0.18)	(0.18)
Parent(s), other kin adults		1.31+	1.24
		(0.19)	(0.18)
Parent(s), other non-kin adults		1.31	1.28
		(0.40)	(0.40)
Residential moves between waves (0-5		0.87*	0.87*
		(0.05)	(0.05)
Siblings (0-6 scale)		0.95	0.94
		(0.05)	(0.05)
Rural area (ref: Urban area)		0.92	0.93
		(0.20)	(0.20)
Meshblock deprivation index (1-10 scale)		1.10***	1.09***
		(0.03)	(0.03)
Child born at low birthweight		1.24+	1.26*
		(0.14)	(0.14)
Child female (ref: Male)		0.43*	0.41*
		(0.16)	(0.15)
Child age deviation in months	1.14***	1.10**	1.09**
	(0.03)	(0.04)	(0.04)
Main child care provider (ref: None)			
Centre-based, group care		1.49	1.47
		(0.64)	(0.63)
Nanny/relative/friend care		1.18	1.20
		(0.35)	(0.36)
Constant	0.04***	0.03***	0.02***
	(0.01)	(0.02)	(0.01)
Pseudo R^2	0.04	0.11	0.11
n	4,687	4,687	4,687

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table A12. Multinomial regressions with health behaviour trajectories predicting maternal-reported child BMI status at the 4.5-year wave

Model 1: Trajectories only			
	Predicting BMI status (ref: healthy weight)		
	Underweight RRR (std. err.)	Overweight RRR (std. err.)	Obese RRR (std. err.)
Health profile trajectory (ref: Always higher tier)			
Mostly higher tier, but mid-tier at antenatal	0.83	1.02	1.55+
	(0.21)	(0.14)	(0.40)
Higher tier at antenatal, but only mostly higher tier thereafter	0.73	1.21	1.92*
	(0.21)	(0.17)	(0.51)
Mostly mid-tier	0.84	1.26	2.47***
	(0.25)	(0.19)	(0.66)
Higher tier to lower tier	1.08	1.27	4.74***
	(0.32)	(0.20)	(1.22)
Lower tier at antenatal, always or mostly higher tier thereafter	1.27	1.10	1.06
	(0.60)	(0.30)	(0.60)
Low tier at antenatal, higher tier at 9-months, but downward thereafter	1.22	1.88**	4.89***
	(0.54)	(0.41)	(1.58)
Always or mostly lower tier	0.99	1.48*	4.82***
	(0.39)	(0.29)	(1.41)
Mixed, unstable trajectory	1.14	1.45*	3.51***
	(0.35)	(0.23)	(0.95)
Lower tier to higher tier	1.06	1.89+	1.26
	(0.80)	(0.65)	(0.96)
Constant	0.06***	0.24***	0.05***
	(0.01)	(0.03)	(0.01)
Pseudo R^2	0.02	0.02	0.02
Model 2: Education and ethnicity			
Educational attainment (ref: Undergraduate/postgraduate degree)			
No secondary school qualification	0.86	1.25	1.51
	(0.54)	(0.23)	(0.39)
NCEA 1-4	1.36	1.11	1.60**
	(0.30)	(0.12)	(0.27)
NCEA 5-6	1.32	1.09	1.45*
	(0.25)	(0.11)	(0.23)
Ethnicity (ref: European)			
Māori	0.72	1.31**	1.92***
	(0.20)	(0.14)	(0.31)
Pacific	0.89	2.14***	4.19***
	(0.34)	(0.28)	(0.76)

Asian	3.46***	0.42***	0.68
	(0.68)	(0.07)	(0.16)
Other ethnicity	0.87	0.93	1.14
	(0.41)	(0.20)	(0.40)
Maternal age (years)	1.02	0.99	1.01
	(0.02)	(0.01)	(0.01)
Maternal employment (ref: Full-time work)			
Part-time work	1.16	1.04	0.73+
	(0.23)	(0.10)	(0.12)
Unemployed	0.85	0.89	0.81
	(0.26)	(0.12)	(0.15)
Not in the labour force	0.94	0.89	0.90
	(0.23)	(0.10)	(0.15)
Household income (1-7 scale)	1.08	1.02	0.90*
	(0.08)	(0.04)	(0.05)
Family structure (ref: Two-parent family, no other adults)			
Single-parent family, no other adults	0.59	1.23	0.86
	(0.26)	(0.18)	(0.20)
Parent(s), other kin adults	0.91	1.14	1.36*
	(0.21)	(0.13)	(0.20)
Parent(s), other non-kin adults	0.58	0.99	1.29
	(0.30)	(0.21)	(0.40)
Residential moves between waves (0-5 scale)	1.10	1.05	0.89+
	(0.09)	(0.04)	(0.05)
Siblings (0-6 scale)	0.84+	1.07+	0.96
	(0.08)	(0.04)	(0.05)
Rural area (ref: Urban area)	0.96	0.98	0.91
	(0.28)	(0.13)	(0.20)
Meshblock deprivation index (1-10 scale)	1.00	1.05**	1.11***
	(0.03)	(0.02)	(0.03)
Child born at low birthweight	0.89	1.32***	1.34*
	(0.14)	(0.10)	(0.15)
Child female (ref: Male)	1.33	0.61*	0.39*
	(0.41)	(0.13)	(0.15)
Child age deviation in months	1.07	1.05+	1.12**
	(0.05)	(0.03)	(0.04)
Main child care provider (ref: None)			
Centre-based, group care	1.21	1.16	1.61
	(0.77)	(0.39)	(0.71)
Nanny/relative/friend care	0.82	1.42	1.32
	(0.44)	(0.34)	(0.41)
Constant	0.02***	0.12***	0.03***
	(0.02)	(0.06)	(0.02)

Pseudo R^2	0.07	0.07	0.07
Model 3: Full model			
Health profile trajectory (ref: Always higher tier)			
Mostly higher tier, but mid-tier at antenatal	0.88	0.98	1.42
	(0.23)	(0.13)	(0.38)
Higher tier at antenatal, but only mostly higher tier thereafter	0.70	1.06	1.32
	(0.20)	(0.15)	(0.36)
Mostly mid-tier	0.77	0.99	1.36
	(0.24)	(0.16)	(0.38)
Higher tier to lower tier	0.95	0.97	2.23**
	(0.30)	(0.17)	(0.62)
Lower tier at antenatal, always or mostly higher tier thereafter	1.10	1.11	0.92
	(0.53)	(0.31)	(0.52)
Low tier at antenatal, higher tier at 9-months, but downward thereafter	1.11	1.37	2.01*
	(0.52)	(0.32)	(0.70)
Always or mostly lower tier	0.91	0.95	1.81+
	(0.40)	(0.20)	(0.58)
Mixed, unstable trajectory	1.00	1.14	1.75*
	(0.32)	(0.19)	(0.50)
Lower tier to higher tier	0.78	1.70	0.70
	(0.61)	(0.62)	(0.55)
Educational attainment (ref: Undergraduate/postgraduate degree)			
No secondary school qualification	0.85	1.24	1.39
	(0.53)	(0.23)	(0.36)
NCEA 1-4	1.38	1.11	1.50*
	(0.30)	(0.12)	(0.26)
NCEA 5-6	1.32	1.08	1.37*
	(0.25)	(0.11)	(0.22)
Ethnicity (ref: European)			
Māori	0.73	1.30*	1.80***
	(0.20)	(0.14)	(0.30)
Pacific	0.89	2.10***	3.81***
	(0.35)	(0.28)	(0.71)
Asian	3.46***	0.41***	0.62*
	(0.71)	(0.07)	(0.15)
Other ethnicity	0.87	0.92	1.08
	(0.41)	(0.20)	(0.38)
Maternal age (years)	1.02	0.99	1.01
	(0.02)	(0.01)	(0.01)
Maternal employment (ref: Full-time work)			
Part-time work	1.16	1.05	0.73+
	(0.23)	(0.10)	(0.12)
Unemployed	0.85	0.88	0.79
	(0.26)	(0.12)	(0.14)
Not in the labour force	0.93	0.90	0.90
	(0.23)	(0.11)	(0.15)
Household income (1-7 scale)	1.08	1.02	0.90*

	(0.09)	(0.04)	(0.05)
Family structure (ref: Two-parent family, no other adults)			
Single-parent family, no other adults	0.59	1.23	0.86
	(0.26)	(0.18)	(0.20)
Parent(s), other kin adults	0.89	1.14	1.29+
	(0.20)	(0.13)	(0.19)
Parent(s), other non-kin adults	0.58	0.99	1.25
	(0.30)	(0.21)	(0.39)
Residential moves between waves (0-5 scale)	1.10	1.05	0.89*
	(0.09)	(0.04)	(0.05)
Siblings (0-6 scale)	0.84+	1.07+	0.96
	(0.08)	(0.04)	(0.05)
Rural area (ref: Urban area)	0.96	0.98	0.92
	(0.28)	(0.13)	(0.20)
Meshblock deprivation index (1-10 scale)	0.99	1.04**	1.10***
	(0.03)	(0.02)	(0.03)
Child born at low birthweight	0.90	1.33***	1.36**
	(0.14)	(0.10)	(0.15)
Child female (ref: Male)	1.32	0.61*	0.36**
	(0.41)	(0.13)	(0.14)
Child age deviation in months	1.07	1.05+	1.11**
	(0.05)	(0.03)	(0.04)
Main child care provider (ref: None)			
Centre-based, group care	1.18	1.18	1.59
	(0.76)	(0.40)	(0.70)
Nanny/relative/friend care	0.83	1.43	1.33
	(0.45)	(0.34)	(0.41)
Constant	0.03***	0.12***	0.02***
	(0.03)	(0.06)	(0.01)
Pseudo R^2	0.07	0.07	0.07
n	4,687	4,687	4,687

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1