

# Maternal intentions for human papillomavirus (HPV) vaccination of girls and boys in New Zealand

April 2022



**MINISTRY OF SOCIAL  
DEVELOPMENT**  
TE MANATŪ WHAKAHIATO ORA



**MEDICAL AND  
HEALTH SCIENCES**

This report has been produced for the Ministry of Social Development with funding from the Children and Families Research Fund [www.msd.govt.nz](http://www.msd.govt.nz)

### **Authors**

**Professor Cameron Grant**, Professor and Departmental Head, Department of Paediatrics: Child & Youth Health, University of Auckland; **Dr Caroline McElnay**, Director of Public Health, Population Health and Prevention Directorate, Ministry of Health; **Dr Carol Chelimo**, Senior Research Fellow, Department of Paediatrics: Child & Youth Health, University of Auckland

### **Acknowledgements**

We acknowledge Dr Alana Cavadino, Department of Epidemiology and Biostatistics, University of Auckland for providing review of the research design, methods, analysis and interpretation used for the preparation of this report.

We acknowledge Dr Peter Saxton, Department of Social and Community Health, University of Auckland for providing subject matter expertise review of this report.

We acknowledge the review by Dr McElnay of the policy relevance and applicability of the policy brief prepared from this report.

We acknowledge the review by Saraid Black of the communications content of this report.

This report is made possible with funding from the Ministry of Social Development using *Growing Up in New Zealand* (GUINZ) data collected by the University of Auckland. The data has been accessed and used in accordance with the GUINZ Data Access Protocol.

### **Disclaimer**

This work is licensed under the Creative Commons Attribution 3.0 New Zealand licence. In essence, you are free to copy, distribute and adapt the work, as long as you attribute the work to the Crown and abide by the other licence terms.

To view a copy of this licence, visit [creativecommons.org/licenses/by/3.0/nz/](http://creativecommons.org/licenses/by/3.0/nz/). Please note that no departmental or governmental emblem, logo or Coat of Arms may be used in any way which infringes any provision of the Flags, Emblems, and Names Protection Act 1981. Attribution to the Crown should be in written form and not by reproduction of any such emblem, logo or Coat of Arms.

### **Published**

25 November 2022

Ministry of Social Development  
PO Box 1556  
Wellington 6140  
New Zealand

### **ISBN**

978-1-99-110503-5

# Contents

|                                                                             |           |
|-----------------------------------------------------------------------------|-----------|
| <b>Executive summary</b> .....                                              | <b>1</b>  |
| Introduction.....                                                           | 1         |
| Methods.....                                                                | 1         |
| Results .....                                                               | 1         |
| Conclusions .....                                                           | 3         |
| <b>Introduction</b> .....                                                   | <b>4</b>  |
| Research aims and objectives .....                                          | 4         |
| Aims .....                                                                  | 4         |
| Objectives .....                                                            | 4         |
| Literature review .....                                                     | 4         |
| Policy content relevant to the research topic.....                          | 6         |
| Why this project was conducted .....                                        | 7         |
| <b>Methods</b> .....                                                        | <b>8</b>  |
| Design and methodology .....                                                | 8         |
| Research objectives.....                                                    | 8         |
| Data sources.....                                                           | 8         |
| Study procedures.....                                                       | 9         |
| Outcome measure (dependent variable) .....                                  | 9         |
| Independent variables of interest .....                                     | 10        |
| Stratification variables .....                                              | 10        |
| Analytical model .....                                                      | 10        |
| Statistical analysis .....                                                  | 11        |
| <b>Results</b> .....                                                        | <b>13</b> |
| Descriptive statistics .....                                                | 13        |
| Maternal responses regarding HPV vaccination intentions for 8-year-olds ..  | 13        |
| Characteristics of the study population .....                               | 15        |
| Factors associated with maternal HPV vaccination intentions for girls ..... | 20        |
| Univariable analysis.....                                                   | 20        |
| Multivariable analysis .....                                                | 31        |
| Factors associated with maternal HPV vaccination intentions for boys.....   | 32        |
| Univariable analysis.....                                                   | 32        |
| Multivariable analysis .....                                                | 34        |

|                                                                                                    |           |
|----------------------------------------------------------------------------------------------------|-----------|
| Analysis stratified by the child’s sex and ethnic group .....                                      | 43        |
| Maternal HPV vaccination intentions for girls and boys of Māori ethnicity...                       | 43        |
| Maternal HPV vaccination intentions for girls and boys of Pacific ethnicity..                      | 51        |
| <b>Discussion .....</b>                                                                            | <b>59</b> |
| Statement of principal findings .....                                                              | 59        |
| <b>Limitations and future directions .....</b>                                                     | <b>60</b> |
| Strengths and weaknesses of the study.....                                                         | 60        |
| Findings from this study in relation to other studies .....                                        | 61        |
| Meaning of the study: possible mechanisms and implications for clinicians or<br>policymakers ..... | 63        |
| Maternal responses regarding HPV vaccination intentions for 8-year-olds ..                         | 63        |
| Unanswered questions and future research.....                                                      | 65        |
| <b>Conclusions and recommendations .....</b>                                                       | <b>66</b> |
| <b>References .....</b>                                                                            | <b>67</b> |
| <b>Appendix 1: Te Anga o ngā Horopaki Māori:.....</b>                                              | <b>72</b> |
| <b>Appendix 2: Variables of interest .....</b>                                                     | <b>81</b> |
| 1.1 Child: 9-month data.....                                                                       | 81        |
| 1.2 Child: 2-year data .....                                                                       | 82        |
| 1.3 Child: 54-month data .....                                                                     | 83        |
| 1.4 Child: 8-year data .....                                                                       | 86        |
| 1.5 Mother: Antenatal data.....                                                                    | 87        |
| 1.6 Mother: 9-month data .....                                                                     | 92        |
| 1.7 Mother: 2-year data.....                                                                       | 93        |
| 1.8 Mother: 54-month data .....                                                                    | 97        |
| 1.9 Mother: 72-month data .....                                                                    | 99        |
| 1.10 Mother: 8-year data .....                                                                     | 102       |
| 1.11 Partner: Antenatal data .....                                                                 | 103       |
| 1.12 Partner: 9-month data.....                                                                    | 106       |
| 1.13 Partner: 2-year data .....                                                                    | 107       |

## List of figures

|                                                                                                            |    |
|------------------------------------------------------------------------------------------------------------|----|
| Figure 1 Selection of the study sample.....                                                                | 9  |
| Figure 2: Maternal responses regarding HPV vaccination intentions for girls and boys* .....                | 13 |
| Figure 3: Maternal responses regarding HPV vaccination intentions for girls, by child's ethnic group ..... | 14 |
| Figure 4: Maternal responses regarding HPV vaccination intentions of boys, by child's ethnic group .....   | 15 |

## List of tables

|                                                                                                                                             |    |
|---------------------------------------------------------------------------------------------------------------------------------------------|----|
| Table 1: Summary of categories of variables measured at each GUiNZ data-collection-wave of relevance to this proposal .....                 | 8  |
| Table 2: Maternal responses regarding HPV vaccination intentions for girls and boys, stratified by child's ethnic group .....               | 16 |
| Table 3: Characteristics of the study population .....                                                                                      | 17 |
| Table 4: Comparison of the analytical sample to the cohort at enrolment .....                                                               | 19 |
| Table 5A: Child factors potentially associated with maternal HPV vaccination intentions for GIRLS (unadjusted analysis) .....               | 23 |
| Table 5B: Maternal factors potentially associated with maternal HPV vaccination intentions for GIRLS (unadjusted analysis) .....            | 25 |
| Table 6: Multivariable analysis of factors associated with maternal HPV vaccination intentions for GIRLS .....                              | 28 |
| Table 7A: Child factors potentially associated with maternal HPV vaccination intentions for BOYS (unadjusted analysis) .....                | 36 |
| Table 7B: Maternal factors potentially associated with maternal HPV vaccination intentions for BOYS (unadjusted analysis) .....             | 38 |
| Table 8: Multivariable analysis of factors associated with maternal HPV vaccination intentions for BOYS .....                               | 41 |
| Table 9A: Child factors potentially associated with maternal HPV vaccination intentions for Māori GIRLS (unadjusted analysis).....          | 44 |
| Table 9B: Maternal factors potentially associated with maternal HPV vaccination intentions for Māori GIRLS (unadjusted analysis).....       | 45 |
| Table 10A: Child factors potentially associated with maternal HPV vaccination intentions for Māori BOYS (unadjusted analysis).....          | 47 |
| Table 10B: Maternal factors potentially associated with maternal HPV vaccination intentions for Māori BOYS (unadjusted analysis).....       | 48 |
| Table 11: Multivariable analysis of factors associated with maternal HPV vaccination intentions for girls and boys of Māori ethnicity ..... | 50 |
| Table 12A: Child factors potentially associated with maternal HPV vaccination intentions for Pacific GIRLS (unadjusted analysis).....       | 52 |
| Table 12B: Maternal factors potentially associated with maternal HPV vaccination intentions for Pacific GIRLS (unadjusted analysis).....    | 53 |

|                                                                                                                                               |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------|----|
| Table 13A: Child factors potentially associated with maternal HPV vaccination intentions for Pacific BOYS (unadjusted analysis).....          | 55 |
| Table 13B: Maternal factors potentially associated with maternal HPV vaccination intentions for Pacific BOYS (unadjusted analysis).....       | 56 |
| Table 14: Multivariable analysis of factors associated with maternal HPV vaccination intentions for girls and boys of Pacific ethnicity ..... | 58 |

# Executive summary

## Introduction

The New Zealand immunisation schedule includes free human papillomavirus (HPV) vaccination for 11- to 12-year old girls and boys. Parental vaccine hesitancy occurs with all vaccines. The HPV vaccine is specifically vulnerable to vaccine hesitancy because of the age when given, and because it prevents sexually transmitted infections.

The research objectives were to:

1. Describe the HPV vaccination intentions of mothers for their 8-year-old children.
2. Identify demographic factors, household characteristics, and social and behavioural factors associated with maternal intentions for HPV vaccination.
3. Identify healthcare factors associated with maternal intentions for HPV vaccination.
4. Describe the relationship of the child's past vaccination experiences with maternal intentions for HPV vaccination.

## Methods

At the *Growing Up in New Zealand* study's 8-year data-collection-wave, mothers were asked about their intentions regarding their child receiving the HPV vaccine.

The child's mother was asked:

*"Have you decided yet if you will have [child's-name] immunised with the HPV vaccine?"*

The response options were:

- Yes, I have decided I will have my child immunised
- Yes, I have decided I will not have my child immunised
- No, I have not yet decided
- I have never heard of the HPV vaccine

Associations of demographic factors, household characteristics, social and behavioural factors, healthcare factors and the child's past vaccination experiences with maternal HPV vaccination intentions were examined using multinomial logistic regression. Associations were described using adjusted odds ratios (aOR) and their 95% confidence intervals (CI).

## Results

Children whose mothers completed a child-proxy questionnaire at the 8-year follow-up (n=4,920) were eligible for this analysis. The analytic sample comprises 4,448 of 4,920 children (90%) who met the following criteria: 1)

mothers provided a valid response to the question regarding HPV vaccination intentions; and 2) New Zealand was identified as the child's usual country of residence at the 8-year follow-up.

The maternal intentions for HPV vaccination of their 8-year-old children differed significantly by their child's sex, with the proportion of mothers who stated they would vaccinate their 8-year-olds against HPV being higher for girls than boys, whereas the proportion of mothers who were undecided about HPV vaccination was higher for boys than girls.

For girls, maternal responses regarding HPV vaccination intentions differed by their daughter's ethnic group. Maternal age and maternal status at the 72-month follow-up and belonging to a church at the 9-month follow-up were associated with HPV vaccination intentions for girls but maternal parity, country of birth and area-level socioeconomic deprivation were not.

Mothers whose daughters were of Māori or Pacific ethnicity were less likely to have decided not to vaccinate their daughters against HPV and mothers whose daughters were of Pacific ethnicity were more likely to report that they had not heard about the HPV vaccine compared with mothers of non-Māori non-Pacific girls.

Mothers with lower educational status were more likely to have decided not to vaccinate their daughters, more likely to be undecided about HPV vaccination and more likely to report that they had not heard of the HPV vaccine. Mothers who were younger were more likely to have decided not to vaccinate their daughters against HPV and more likely to report that they had not heard of the HPV vaccine. Mothers who belonged to a church at the 9-month follow-up were more likely to have decided not to vaccinate their daughters against HPV.

For boys, maternal responses regarding HPV vaccination intentions differed by their son's ethnic group. Maternal parity, country of birth, education status at the 72-month follow-up, and frequency of maternal attendance at religious services at the 2-year follow-up were associated with HPV vaccination intentions for boys, but area-level socioeconomic deprivation was not.

Mothers whose sons were of Pacific ethnicity were less likely to have decided not to vaccinate their sons against HPV and less likely to be undecided about HPV vaccination compared with mothers of non-Māori non-Pacific boys. Mothers whose sons were of Māori ethnicity were more likely to report that they had not heard about the HPV vaccine compared with mothers of non-Māori non-Pacific boys.

Mothers whose sons were first-borns were more likely to be undecided about HPV vaccination for their sons, and more likely to report that they had not heard about the HPV vaccine. Mothers with lower educational status were more likely to have decided not to vaccinate their sons, and to report that they had not

heard of the HPV vaccine. Mothers who were not born in New Zealand were more likely to report that they had not heard of the HPV vaccine.

For girls but not for boys, maternal responses regarding HPV vaccination intentions differed significantly by their daughter's access to healthcare prior to the 2-year follow-up, but not for the 12 months prior to the 54-month follow-up.

For girls and boys, maternal HPV vaccination intentions differed significantly by their child uptake and timing of all doses of primary infant immunisation series and uptake of immunisations (full or partial) due at age 15 months and age 4 years.

## **Conclusions**

The maternal intentions for HPV vaccination of their 8-year-old children differed significantly by their child's sex, with the proportion of mothers who stated they would vaccinate their 8-year-olds against HPV being higher for girls than boys, whereas the proportion of mothers who were undecided about HPV vaccination was higher for boys than girls.

Mothers whose daughters were of Māori or Pacific ethnicity or whose sons were of Pacific ethnicity were less likely to have decided not to vaccinate their child against HPV.

While there are HPV specific factors associated with parental intent, there are also more general vaccine-related determinants which also apply to HPV vaccine. Addressing safety concerns regarding HPV vaccine appears necessary for caregivers to have greater confidence in the vaccine. Healthcare provider recommendations for and discussion about the HPV vaccine, along with increasing public awareness are key to improving uptake of the HPV vaccine in children. There appear to be deficits in the resources currently available to New Zealand parents about HPV vaccination for their children.

Before the birth of their child, parents in New Zealand have high intentions for immunisation of their children with only 2% of future mothers intending that their child will not be immunised. Experiences during childhood of difficulties in accessing primary care for their child are associated with an increased odds of parents deciding that their children will not receive the HPV vaccine.

# Introduction

## Research aims and objectives

### Aims

To describe the human papillomavirus vaccination (HPV) intentions of mothers for their 8-year-old daughters and sons and factors associated with these intentions and use this information to benefit the New Zealand (NZ) HPV immunisation programme.

### Objectives

1. Describe the HPV vaccination intentions of mothers for their 8-year-old children.
2. Identify demographic factors, household characteristics, and family social behaviours associated with maternal HPV vaccination intentions.
3. Identify healthcare factors associated with maternal HPV vaccination intentions.
4. Describe the relationship of the child's past vaccination experiences with maternal HPV vaccination intentions.

### Literature review

#### *The human papillomavirus vaccine*

The human papillomavirus (HPV) vaccine provides protection against infection with HPV types that cause cervical, vaginal, vulvar, penile, anal, and oropharyngeal cancers.<sup>1</sup> Despite proven efficacy in cancer prevention for both men and women, and vaccine safety,<sup>1</sup> worldwide completion of recommended HPV vaccine schedules in females aged 10 to 20 years is low, estimated at 32% in developed countries up to 2014,<sup>2</sup> with an estimate for all age groups of 69% in 2018.<sup>3</sup>

In New Zealand, between 2008, when the national HPV vaccination programme started, and 2015 there was a 61% reduction in the rate of genital warts.<sup>4</sup> A population-based cohort study of women, published in 2020, described the impact of HPV vaccination on abnormal cervical cytology and histology rates in young New Zealand women.<sup>5</sup> The women studied (n=135,273) were born from 1990–1994, with a cervical cytology or histology registered with the National Cervical Screening Programme when aged 20–24 years between 01/01/2010 and 31/12/2015.<sup>5</sup> Vaccinated women (n=42,435, 41%) were those who received at least one HPV vaccine dose before age 18 years. In vaccinated compared to unvaccinated women, the incidence of high-grade cytology was 8.5 vs 11.3 per 1,000 person-years (incidence rate ratio [IRR] 0.75, 95% confidence interval [CI] 0.70-0.80), and high-grade histology was 6.0 vs 8.7 per 1,000 person-years (IRR 0.69, 95% CI 0.64-0.75).<sup>5</sup>

In New Zealand, Māori and Pacific women have higher cervical cancer incidence and mortality rates than European women.<sup>6</sup> Among women in New Zealand who have received at least one dose of HPV vaccine before age 18 years, the incidence of high-grade cervical histology does not differ between Māori and non-Māori.<sup>5</sup>

New Zealand was one of the first countries to have HPV vaccine on its schedule of recommended and funded vaccines for both females and males. The New Zealand immunisation schedule includes free HPV vaccination for 11–12-year-old girls and boys.

HPV vaccine is now in the national vaccination schedules for both females and males in a number of countries including Australia,<sup>7</sup> Canada,<sup>8</sup> the United Kingdom (UK),<sup>9</sup> and the United States (US).<sup>10</sup> By 2019 HPV vaccine had been introduced into 107 (55%) of the 194 WHO Member States, with 33 of these countries recommending it for both girls and boys.<sup>11</sup>

### ***Parental vaccine hesitancy and the HPV vaccine***

Vaccine hesitancy is defined as 'delay in acceptance or refusal of vaccination despite availability of vaccination services'.<sup>12</sup> Parental vaccine hesitancy has been evident since the concept of vaccination of humans was first demonstrated in the early 1800s.<sup>13</sup>

In addition to the parental hesitancy associated with all childhood vaccinations, HPV vaccination of children is specifically vulnerable because of the age when given and because the vaccine targets sexually transmitted infections. For example, in a 2017-18 national immunisation survey in the US about vaccines given during adolescence, lack of parental intent was the predominant reason for low HPV vaccine uptake.<sup>14</sup>

Parental vaccine hesitancy specific to the HPV vaccine is prevalent. In a nationally representative sample of parents in the US interviewed in 2014-2015, 28% reported refusing and 8% delaying the HPV vaccination of their child.<sup>15</sup> Parents who refused the HPV vaccine had specific concerns about the vaccine, whereas parents who delayed said they did so because they needed more information.<sup>15</sup> In the US, parental hesitancy about the HPV vaccine appears to be increasing with data from the 2012-2018 National Immunization Survey showing that while the proportion of unvaccinated adolescents who were recommended the HPV vaccine by their provider increased (from 27% in 2012 to 49% in 2018), parental lack of intent to initiate the HPV vaccine series for these adolescents also increased from 50% to 64% over the same time interval.<sup>16</sup>

In a survey of 769 parents whose daughter attended one of 14 socio-economically diverse schools in New Zealand in 2008, 67% of respondents said they wanted their daughter to receive the HPV vaccine. Parental intent to vaccinate was decreased for those having concerns about their child's reaction to previous vaccines received (odds ratio [OR] 0.47, 95% CI 0.37–0.59), and for

those who wanted more information before deciding on HPV vaccination for their daughter (OR=0.47, 95% CI 0.37–0.59).<sup>17</sup>

### ***Vaccination intentions and vaccine information received by parents in New Zealand***

In New Zealand, parental intentions for childhood vaccinations are an important determinant of the timeliness of the primary vaccination series given during infancy.<sup>18</sup> The vaccination intentions of mothers and fathers frequently differ, and each are independently associated with the timeliness of vaccinations of infants.<sup>18</sup>

Parents receive information that encourages and information that discourages them to have their child vaccinated. Receipt during pregnancy of discouraging information about vaccination is associated with delayed infant vaccinations regardless of whether encouraging information about vaccination was also received.<sup>19</sup> In contrast, receipt of encouraging information is not associated with the timeliness of infant vaccinations.<sup>19</sup>

In New Zealand, healthcare providers are the predominant source of information received during pregnancy about childhood vaccinations.<sup>19</sup> For most women (90%) this information encourages childhood vaccination, while 7% of pregnant women receive both encouraging and discouraging information, and 3% receive only discouraging information about vaccination from healthcare providers.<sup>19</sup> Receipt of a recommendation from a health care provider is associated with increased odds of parents initiating the HPV vaccine series.<sup>14</sup>

### **Policy content relevant to the research topic**

The policy relevance of parental intentions for HPV vaccination relates to the following issues

1. The relatively low uptake of HPV vaccine globally despite its proven efficacy in cancer prevention and its safety.<sup>1,2</sup>
2. Māori and Pacific women have higher cervical cancer incidence and mortality rates compared with European women.<sup>6</sup>
3. The limited international data on HPV vaccine intentions for boys, given that New Zealand was one of the first countries to recommend and fund HPV vaccines for both females and males.
4. The specific vulnerability of HPV vaccine to parental vaccine hesitancy.
5. The demonstrated contribution of parental vaccination intentions to the timely receipt of scheduled childhood vaccinations in New Zealand.
6. The central role that healthcare plays in vaccine delivery.
7. The recently increased profile of preventing disease with vaccines created by the COVID-19 pandemic.
8. The increase in disparities in childhood vaccine delivery that have become apparent since the beginning of the COVID-19 pandemic.

## **Why this project was conducted**

This project was conducted to answer the following two research questions.

1. What are the HPV vaccination intentions of mothers for their 8-year-old children, and do their intentions differ for daughters compared to sons?
2. Do HPV vaccination intentions of mothers vary by maternal demographics (e.g., ethnicity), household characteristics (e.g., deprivation), family characteristics (e.g., family social behaviours such as the child attending a religious school), children's past vaccination experiences, and preceding healthcare experiences of mothers and their children?

# Methods

## Design and methodology

This study was completed using external datasets from the *Growing Up in New Zealand* (GUiNZ) cohort study.<sup>20</sup> The GUiNZ cohort was created by the enrolment of 6,822 pregnant women and their partners. To be eligible, pregnant women had to be residing in the geographical region of New Zealand defined by the contiguous District Health Board regions of Auckland, Counties Manukau and Waikato, and have an estimated delivery date between 25 April 2009 and 25 March 2010.<sup>20</sup> The child cohort is ethnically and socioeconomically diverse, and broadly generalisable to the national birth cohort from 2007-2010.<sup>21</sup>

The study sample was limited to the 4,926 children for whom a child-proxy questionnaire was completed at the eight-year data-collection-wave.

## Research objectives

1. Describe the HPV vaccination intentions of mothers for their 8-year-old children.
2. Identify demographic factors, household characteristics, and family social behaviours associated with maternal HPV vaccination intentions.
3. Identify healthcare factors associated with maternal HPV vaccination intentions.
4. Describe the relationship of the child's past vaccination experiences with maternal HPV vaccination intentions.

## Data sources

The variable describing HPV vaccination intentions of mothers for their 8-year-old daughters and sons was obtained from the GUiNZ 8-year dataset. Factors that may be associated with vaccination intentions were identified from preceding datasets (Table 1).

**Table 1: Summary of categories of variables measured at each GUiNZ data-collection-wave of relevance to this proposal**

| Variable categories       | Data-collection-wave |                                         |    |    |    |    |
|---------------------------|----------------------|-----------------------------------------|----|----|----|----|
|                           | Antenatal            | Child's age at study follow-up (months) |    |    |    |    |
|                           |                      | 9                                       | 24 | 54 | 72 | 96 |
| Child demographics        |                      | ✓                                       | ✓  | ✓  | ✓  | ✓  |
| Maternal demographics     | ✓                    | ✓                                       | ✓  | ✓  | ✓  | ✓  |
| Household characteristics | ✓                    | ✓                                       | ✓  | ✓  | ✓  |    |
| Family social behaviours* | ✓                    | ✓                                       | ✓  | ✓  | ✓  |    |
| Healthcare factors        | ✓                    | ✓                                       | ✓  | ✓  |    |    |
| Immunisation experiences  | ✓                    | ✓                                       | ✓  | ✓  |    |    |

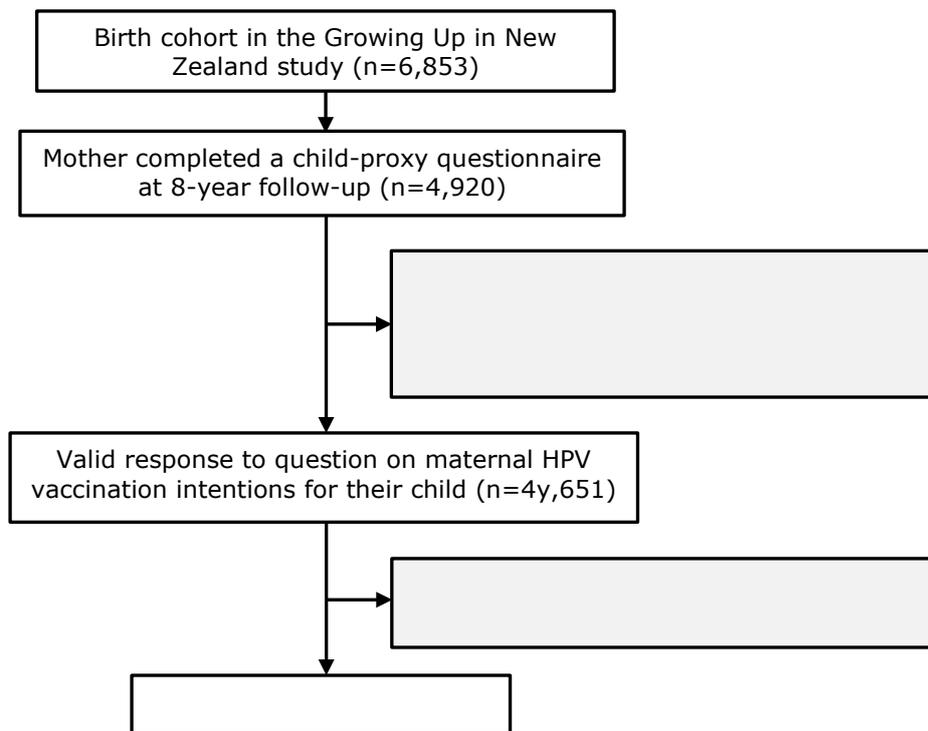
\* E.g., the child attending a religious school

## Study procedures

### *Selection of the analytic sample*

Figure 1 shows the exclusion procedure used to select the study sample for this analysis. Children whose mothers completed a child-proxy questionnaire at the 8-year follow-up (n=4,920) are eligible for this analysis. The analytic sample comprises 4,448 of 4,920 children (90%) who met the following criteria: 1) mothers provided a valid response to the question regarding HPV vaccination intentions; and 2) New Zealand was identified as the child's usual country of residence at the 8-year follow-up.

**Figure 1 Selection of the study sample**



### **Outcome measure (dependent variable)**

Maternal intentions to vaccinate girls and boys against HPV was assessed at the 8-year data-collection-wave. The child's mother was asked:

***"Have you decided yet if you will have [child's-name] immunised with the HPV vaccine?"***

Response options:

- Yes, I have decided I will have my child immunised
- Yes, I have decided I will not have my child immunised
- No, I have not yet decided
- I have never heard of the HPV vaccine

## **Limitations**

No further questions on the HPV vaccine were asked, including why mothers were for, against or undecided about HPV vaccination for 8-year-old girls or boys. Some mothers will only know the HPV vaccine by the brand name Gardasil. This might affect responses to option 4 "I have never heard of the HPV vaccine".

## **Independent variables of interest**

See Appendix 2 for the list of variables (as per the GUiNZ data dictionaries) and Appendix 1 for how the theoretical framework proposed, as shown in Appendix Figure 1, was applied using these variables.

## **Stratification variables**

1. Child's sex
2. Child's sex and ethnic group

## **Analytical model**

The Health Belief Model (HBM) has been used extensively to help explain why people choose to engage in a range of health behaviours, including in studies addressing parental acceptability of HPV vaccination for their children. The HBM has the following dimensions: perceived susceptibility; perceived severity; perceived benefits; perceived barriers; and cues to action.<sup>22-24</sup> *Perceived susceptibility* refers to the subjective perception of vulnerability to an illness. *Perceived severity* refers to feelings regarding the seriousness of an illness, including its consequences. *Perceived benefits* imply that choices made depend on one's beliefs in the effectiveness of choices available to reduce a health threat. *Perceived barriers* refer to factors that could hinder a person from undertaking a recommended health behavior.<sup>22,24</sup> Cues to action are stimuli (internal or external) that trigger the decision-making process, e.g. recommendations by health professionals to take specific actions.<sup>22</sup>

With the exception of one question on maternal HPV vaccination intentions for 8-year-old daughters/sons, the GUiNZ study has not collected data on HPV-specific knowledge, attitudes, beliefs, behaviours or experiences as at the 8-year follow-up. Therefore, behavioural models that require data specific to the study outcome (e.g. HBM, Theory of Reasoned Action) could not be applied to this project.

Given this limitation, we proposed to use a Māori model that has a better fit with the data available. *Te Anga o ngā Horopaki Māori: A conceptual framework for considering Māori lived realities* has been developed specifically for GUiNZ.<sup>25</sup> *Te Anga o ngā Horopaki Māori* was developed from the *Te Whare Tapa Whā* model,<sup>26</sup> with consideration also of other Māori models of health and wellbeing (the *Meihana*,<sup>27</sup> *Te Wheke*,<sup>28</sup> and *Ngā Pou Mana*<sup>29</sup> models). *Te Anga o ngā*

Horopaki Māori comprises six interconnected domains: Mahi Arataki (Policy and strategy); Te Ao Māori (Cultural identity); Whai rawa (Economic resources and capability); Taiao a hāpori (Environment and community); Whanaungatanga (Family and home); and Hauora (Health and wellbeing).

### **Statistical analysis**

- Statistical analyses were performed using STATA software version 15 (StataCorp LLC) available on the GUINZ eResearch Platform.
- A 2-tailed P-value < .05 was considered statistically significant.
- Descriptive statistics were presented using counts and percentages for categorical variables, means and standard deviations for normally distributed data, and medians and interquartile ranges for non-normally distributed data. For the analytic sample stratified by child sex and ethnic group, figures were used to present descriptive data showing the nature and number of responses regarding maternal HPV vaccination intentions.
- An independent variable of interest was excluded if:
  - When cross-tabulated with the outcome measure and child sex, it results in small frequencies (cells count of  $n < 5$ ) in one or more categories such that it could not provide meaningful comparisons. This also applied to the analysis stratified by child sex and ethnic group.
  - If there was over 5% missing data for the variable.
- Univariable (unadjusted) analyses, comparisons of maternal HPV vaccination intentions for girls vs boys using chi-squared tests.
- Univariable (unadjusted) analyses, stratified by sex, explored associations between each factor of interest and maternal HPV vaccination intentions using chi-squared tests (for categorical variables), general linear models (for normally distributed variables) and Kruskal-Wallis tests (for non-normally distributed variables).
- Missing values were not reported in the tables because GUINZ requests that, for the purposes of anonymity, cells are not reported with values of <10.
- Factors of interest with a P-value of < .10 in the unadjusted analysis were considered in the multivariable analysis stratified by sex, whereas a P-value of < .20 was used as the cut-off for analyses stratified by sex and ethnic group, because of the smaller numbers and hence lower power in the stratified analyses.

### **Multivariable analysis**

- **Analysis stratified by sex:** Separately by child sex and using mothers who have decided to vaccinate girls/boys against HPV as the comparison group, multinomial logistic regression models were used to assess adjusted associations between factors of interest and maternal HPV vaccination intentions (4-level nominal variable; see Table 2). Results were summarised using three sets of adjusted odds ratios and their 95% confidence intervals.

- **Analysis stratified by sex and ethnic group:** This comprised separate analyses for girls of Māori ethnicity, girls of Pacific ethnicity, boys of Māori ethnicity, and boys of Pacific ethnicity. Table 2 shows that these four sub-groups have smaller cell counts (fewer responses) for the following outcome measure response options: “Yes, I have decided I will not have my child immunised” and “I have never heard of the HPV vaccine”. As such, multivariable logistic regression models assessed factors associated with mothers being undecided about HPV vaccination for their children with the comparison group being mothers who had decided to vaccinate girls/boys against HPV (dichotomous variable). Results were summarised using adjusted odds ratios and their 95% confidence intervals.
- **Application of Te Anga o ngā Horopaki Māori:** Variables were included in the multivariable model if they were considered essential in describing each domain within Te Anga o nga Horopaki Māori or if they were significant in published studies or when  $P < .10$ . The multivariable model was constructed hierarchically, beginning with the domain most distal to the mother and child (Mahi Arataki) and adding individual variables stepwise towards the most proximal (Hauora) domain (Appendix Figure 1). Variables were retained for subsequent analysis steps if  $P < .10$ . If no variables in a domain had  $P < .10$ , then the variable within each domain with the lowest  $P$ -value was retained for the remainder of the analyses. How the variables of interest have been assigned to domains in Te Anga o ngā Horopaki Māori is shown in Appendix 1 and Appendix Figure 1.

For clarity of reading, the presentation of variables in the tables in the results section has been organised into sections which group the variables that describe child factors and those that describe maternal factors.

- **Assessment for multicollinearity:** Multicollinearity was considered between the independent variables in the multivariable models. Multicollinearity was evident between different variables describing religion and different variables that described the relationship with healthcare. The independent variables selected for inclusion in the multivariate models for these two constructs (religion and relationship with healthcare) were chosen because they did not correlate with one another and because, due to the different variables describing religion and relationship with healthcare respectively, they had the strongest univariate associations with the dependent variable.

# Results

## Descriptive statistics

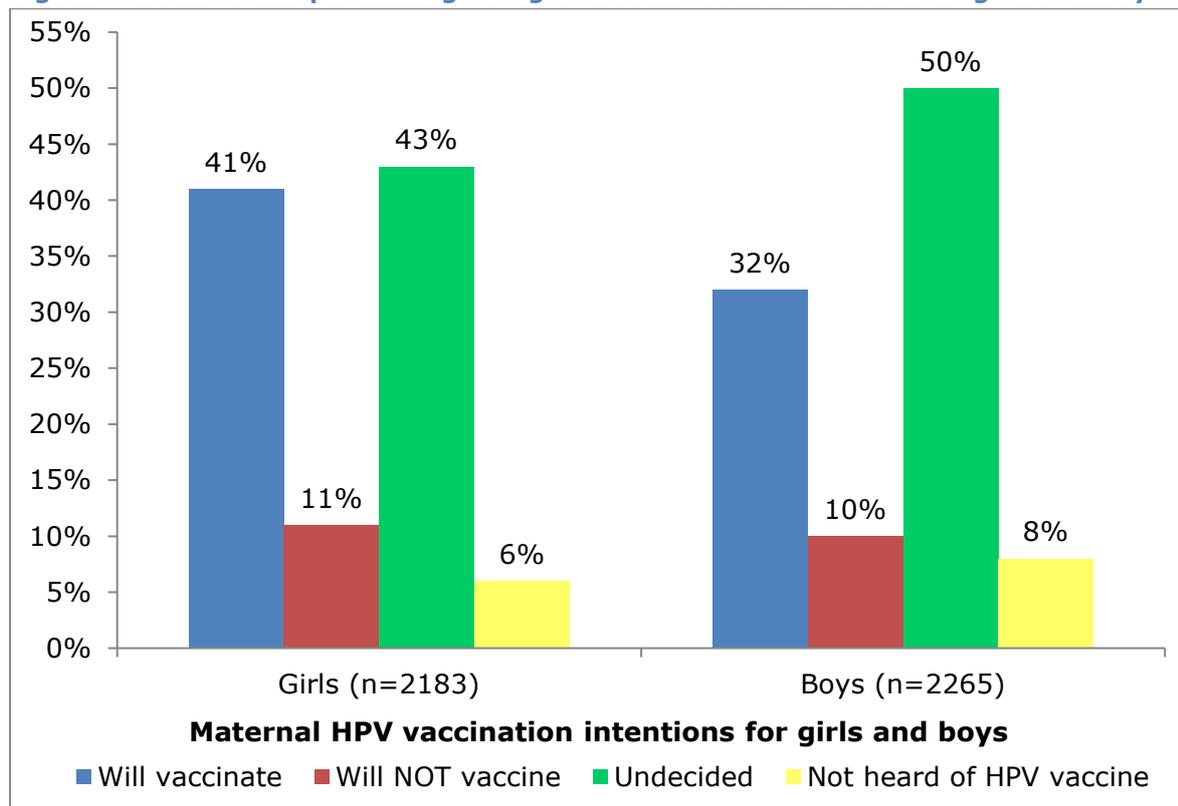
### Maternal responses regarding HPV vaccination intentions for 8-year-olds

The nature and number of responses regarding maternal HPV vaccination intentions for girls and boys, overall and stratified by ethnic group, are presented in Table 2.

#### By child's sex

Maternal responses regarding HPV vaccination intentions for 8-year-olds differed significantly by their child's sex ( $P < 0.001$ ) (**Figure 2, Table 2**). The proportion of mothers who stated they would vaccinate their 8-year-olds against HPV was higher for girls than boys (41% vs 32%), whereas the proportion of mothers who were undecided about HPV vaccination was higher for boys than girls (50% vs 43%).

**Figure 2: Maternal responses regarding HPV vaccination intentions for girls and boys\***

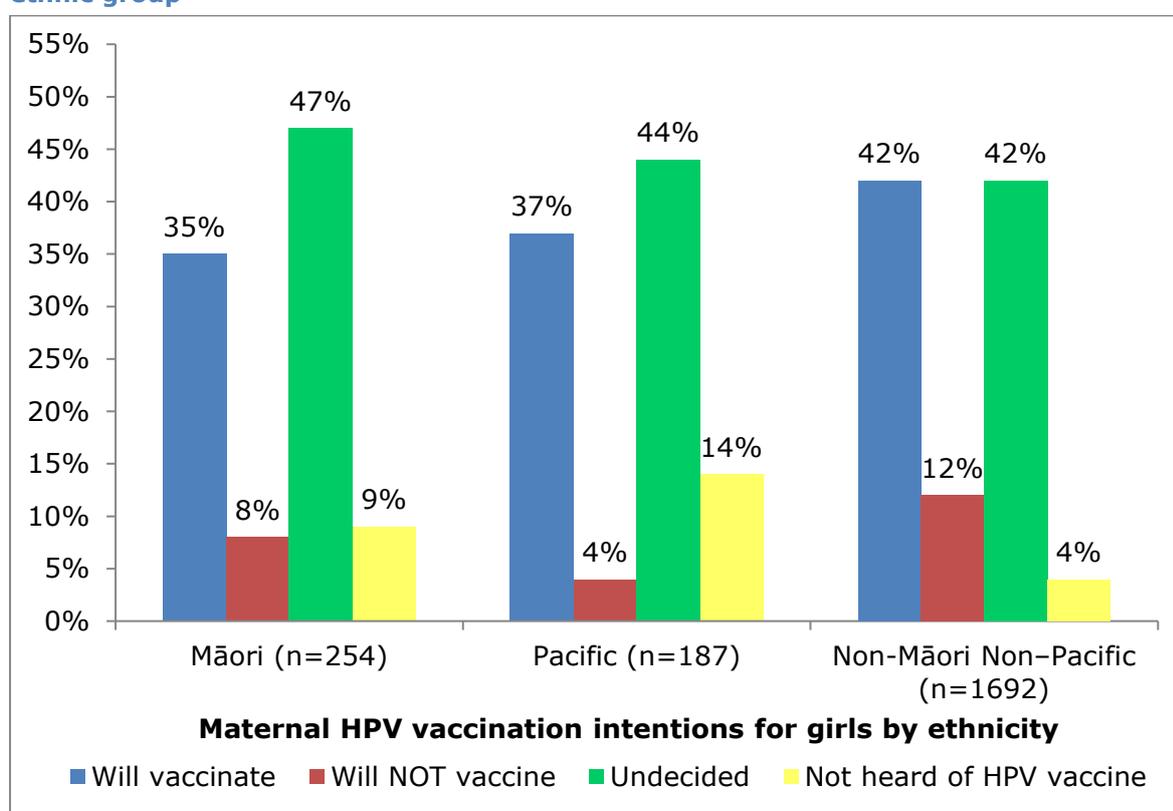


\* Percentages may not add up to 100% due to rounding

### By child's sex and ethnic group

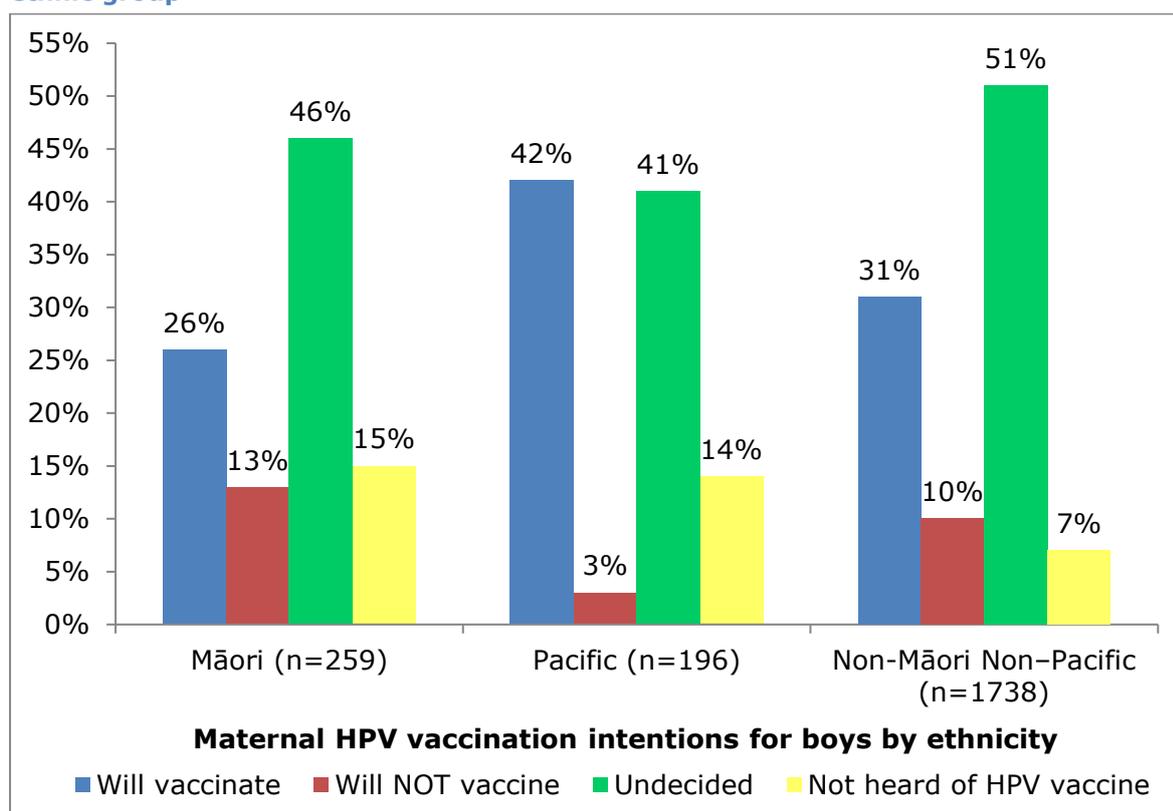
For girls, maternal responses regarding HPV vaccination intentions differed significantly by their daughter's ethnic group ( $P < 0.001$ ) (**Figure 3, Table 2**). The proportion of mothers who stated they would vaccinate their daughters against HPV was higher for non-Māori non-Pacific girls (41%) than Māori (35%) or Pacific (37%) girls. The proportion of mothers who had decided not to vaccinate their daughters against HPV was also higher for non-Māori non-Pacific girls (12%) than Māori (8%) or Pacific (4%) girls, whereas the proportion of mothers who had not heard of the HPV vaccine was higher for Pacific girls (14%) than Māori (9%) or non-Māori non-Pacific (4%) girls.

**Figure 3: Maternal responses regarding HPV vaccination intentions for girls, by child's ethnic group**



For boys, maternal responses regarding HPV vaccination intentions differed significantly by their son's ethnic group ( $P < 0.001$ ) (**Figure 4, Table 2**). The proportion of mothers who stated they would vaccinate their sons against HPV was higher for Pacific boys (42%) than Māori (26%) or non-Māori non-Pacific (31%) boys. In addition, the proportion of mothers who had not heard of the HPV vaccine was higher for Māori (15%) and Pacific (14%) boys than non-Māori non-Pacific (7%) boys. In contrast, the proportion of mothers who were undecided about HPV vaccination for their sons was higher for non-Māori non-Pacific boys (51%) than Māori (46%) or Pacific (41%) boys.

**Figure 4: Maternal responses regarding HPV vaccination intentions of boys, by child's ethnic group**



## Characteristics of the study population

### *By child's sex*

The boys (n=2,265) and girls (n=2,183) who comprised the analytic sample did not differ significantly with respect to their age at the 8-year follow-up, parity, ethnic group, area-level socioeconomic deprivation, or rurality (**Table 3**). In addition, they did not differ significantly based on their mother's age at the 8-year follow-up, highest education qualification at the 72-month follow-up and partner status at the 54-month follow-up, as well as whether their mother was born in New Zealand.

Both boys and girls had a median (IQR) age of 103 (98-107) months. Both groups also had the same proportion of children who were of Māori (12%) or Pacific (9%) ethnicities, were first-borns (43%), lived in households in the highest quintile of area-level deprivation (17%), and had mothers with a partner at 54-month follow-up (91%). Moreover, a comparable proportion of boys and girls had mothers who were under 35 years old at the 8-year follow-up (19% and 20%, respectively), had a less than a bachelor's degree at the 72-month follow-up (51% and 53%, respectively), or were born in New Zealand (72% and 71%, respectively).

**Table 2: Maternal responses regarding HPV vaccination intentions for girls and boys, stratified by child's ethnic group**

| "Have you decided yet if you will have [child's-name] immunised with the HPV vaccine?" | Girls        |                 |            |                       | Boys         |                 |            |                       |
|----------------------------------------------------------------------------------------|--------------|-----------------|------------|-----------------------|--------------|-----------------|------------|-----------------------|
|                                                                                        | Overall      | By ethnic group |            |                       | Overall      | By ethnic group |            |                       |
|                                                                                        |              | Māori           | Pacific    | Non-Māori Non-Pacific |              | Māori           | Pacific    | Non-Māori Non-Pacific |
| n (%)                                                                                  | n (%)        | n (%)           | n (%)      | n (%)                 | n (%)        | n (%)           | n (%)      |                       |
| Yes, I have decided I will have my child immunised                                     | 889 (41)     | 90 (35)         | 69 (37)    | 709 (42)              | 722 (32)     | 67 (26)         | 83 (42)    | 546 (31)              |
| Yes, I have decided I will not have my child immunised                                 | 234 (11)     | 21 (8)          | 8 (4)      | 203 (12)              | 227 (10)     | 34 (13)         | 5 (3)      | 179 (10)              |
| No, I have not yet decided                                                             | 928 (43)     | 120 (47)        | 83 (44)    | 709 (42)              | 1,124 (50)   | 118 (46)        | 80 (41)    | 893 (51)              |
| I have never heard of the HPV vaccine                                                  | 132 (6)      | 23 (9)          | 27 (14)    | 71 (4)                | 192 (8)      | 40 (15)         | 28 (14)    | 120 (7)               |
| <b>Total number of responses</b>                                                       | <b>2,183</b> | <b>254</b>      | <b>187</b> | <b>1,692</b>          | <b>2,265</b> | <b>259</b>      | <b>196</b> | <b>1,738</b>          |

**Table 3: Characteristics of the study population**

| Characteristic                                             | By sex (n=4,448)   |                    | P-value <sup>†</sup> | By child's ethnic group (n=4,326) |                    |                          | P-value <sup>†</sup> |
|------------------------------------------------------------|--------------------|--------------------|----------------------|-----------------------------------|--------------------|--------------------------|----------------------|
|                                                            | Boys               | Girls              |                      | Māori                             | Pacific            | Non-Māori<br>Non-Pacific |                      |
|                                                            | (n=2,265)          | (n=2,183)          |                      | (n=513)                           | (n=383)            | (n=3,430)                |                      |
|                                                            | n (%) <sup>*</sup> | n (%) <sup>*</sup> |                      | n (%) <sup>*</sup>                | n (%) <sup>*</sup> | n (%) <sup>a</sup>       |                      |
| Child's age (in months) at 8-year follow-up (median [IQR]) | 103<br>(98-107)    | 103<br>(98-107)    | 0.39                 | 103<br>(98-107)                   | 103<br>(99-108)    | 103<br>(98-107)          | 0.21                 |
| Parity                                                     |                    |                    |                      |                                   |                    |                          |                      |
| First-born                                                 | 959 (43)           | 931 (43)           | 0.95                 | 193 (39)                          | 121 (32)           | 1,529 (45)               | <0.001               |
| Subsequent child                                           | 1,282 (57)         | 1,240 (57)         |                      | 308 (61)                          | 260 (68)           | 1,882 (55)               |                      |
| Child's ethnicity                                          |                    |                    |                      |                                   |                    |                          |                      |
| Māori                                                      | 259 (12)           | 254 (12)           | 0.98                 | N/A                               | N/A                | N/A                      | N/A                  |
| Pacific                                                    | 196 (9)            | 187 (9)            |                      | N/A                               | N/A                | N/A                      |                      |
| Non-Māori Non-Pacific                                      | 1,738 (79)         | 1,692 (79)         |                      | N/A                               | N/A                | N/A                      |                      |
| Socioeconomic deprivation (NZDep2013)                      |                    |                    |                      |                                   |                    |                          |                      |
| Deciles 1 and 2 (low)                                      | 573 (25)           | 569 (26)           | 0.60                 | 52 (10)                           | 16 (4)             | 1,057 (31)               | <0.001               |
| Deciles 3 and 4                                            | 501 (22)           | 441 (20)           |                      | 57 (11)                           | 31 (8)             | 831 (24)                 |                      |
| Deciles 5 and 6                                            | 437 (19)           | 431 (20)           |                      | 83 (16)                           | 43 (11)            | 719 (21)                 |                      |
| Deciles 7 and 8                                            | 352 (16)           | 356 (16)           |                      | 117 (23)                          | 81 (21)            | 490 (14)                 |                      |
| Deciles 9 and 10 (high)                                    | 394 (17)           | 373 (17)           |                      | 201 (39)                          | 209 (55)           | 319 (9)                  |                      |
| Rurality (in 2013)                                         |                    |                    |                      |                                   |                    |                          |                      |
| Urban area                                                 | 1,986 (88)         | 1,875 (86)         | 0.11                 | 450 (88)                          | 375 (99)           | 2,915 (85)               | <0.001               |
| Rural area                                                 | 271 (12)           | 295 (14)           |                      | 60 (12)                           | 5 (1)              | 501 (15)                 |                      |
| Maternal age at 8-year follow-up                           |                    |                    |                      |                                   |                    |                          |                      |
| Less than 35 years                                         | 421 (19)           | 443 (20)           | 0.46                 | 194 (38)                          | 140 (37)           | 502 (15)                 | <0.001               |
| 35 to 39 years                                             | 598 (26)           | 581 (27)           |                      | 135 (26)                          | 111 (29)           | 895 (26)                 |                      |
| 40 to 44 years                                             | 771 (34)           | 728 (33)           |                      | 111 (22)                          | 85 (22)            | 1,270 (37)               |                      |
| 45 years or over                                           | 472 (21)           | 429 (20)           |                      | 73 (14)                           | 45 (12)            | 760 (22)                 |                      |

|                                                                             |            |            |      |          |          |            |        |
|-----------------------------------------------------------------------------|------------|------------|------|----------|----------|------------|--------|
| Mother's highest education qualification (antenatal and 72-month follow-up) |            |            |      |          |          |            |        |
| Less than a bachelor's degree                                               | 1,116 (51) | 1,109 (53) | 0.40 | 343 (70) | 294 (79) | 1,517 (46) | <0.001 |
| Bachelor's degree or higher                                                 | 1,058 (49) | 999 (47)   |      | 149 (30) | 80 (21)  | 1,784 (54) |        |
| Mother had partner at 54-month follow-up                                    |            |            |      |          |          |            |        |
| No                                                                          | 192 (9)    | 194 (9)    | 0.67 | 90 (18)  | 59 (15)  | 234 (7)    | <0.001 |
| Yes                                                                         | 2,029 (91) | 1,958 (91) |      | 418 (82) | 323 (85) | 3,182 (93) |        |
| Mother was born in New Zealand                                              |            |            |      |          |          |            |        |
| No                                                                          | 638 (28)   | 639 (29)   | 0.47 | 29 (6)   | 155 (41) | 1,043 (31) | <0.001 |
| Yes                                                                         | 1,604 (72) | 1,532 (71) |      | 472 (94) | 226 (59) | 2,369 (69) |        |

IQR=Interquartile Range; N/A=Not Applicable; NZDep2013=2013 New Zealand Deprivation Index

\* Percentages may not add up to 100% due to rounding

† Chi squared test

**Table 4: Comparison of the analytical sample to the cohort at enrolment**

| <b>Characteristic</b>                                 | <b>Cohort at enrolment*</b><br><b>n = 6,853, n (%)</b> | <b>Analytical sample</b><br><b>n = 4,448, n (%)</b> | <b>P value<sup>†</sup></b> |
|-------------------------------------------------------|--------------------------------------------------------|-----------------------------------------------------|----------------------------|
| Child sex                                             |                                                        |                                                     |                            |
| Male                                                  | 3,525 (52)                                             | 2,265 (51)                                          | 0.54                       |
| Female                                                | 3,318 (48)                                             | 2,183 (49)                                          |                            |
| Parity                                                |                                                        |                                                     |                            |
| First-born                                            | 2,852 (42)                                             | 1,890 (43)                                          | 0.30                       |
| Subsequent child                                      | 3,963 (58)                                             | 2,522 (57)                                          |                            |
| Child's ethnicity                                     |                                                        |                                                     |                            |
| Māori                                                 | 1,528 (24)                                             | 513 (12)                                            | < 0.001                    |
| Pacific                                               | 940 (15)                                               | 383 (9)                                             |                            |
| Non-Māori non-Pacific                                 | 3,913 (61)                                             | 3,430 (79)                                          |                            |
| Socioeconomic deprivation (NZDep2006 and NZDep2013)   |                                                        |                                                     |                            |
| Deciles 1 and 2 (low)                                 | 1,100 (16)                                             | 1,142 (26)                                          | < 0.001                    |
| Deciles 3 and 4                                       | 1,235 (18)                                             | 942 (21)                                            |                            |
| Deciles 5 and 6                                       | 1,168 (17)                                             | 868 (20)                                            |                            |
| Deciles 7 and 8                                       | 1,426 (21)                                             | 708 (16)                                            |                            |
| Deciles 9 and 10 (high)                               | 1,891 (28)                                             | 767 (17)                                            |                            |
| Rurality (in 2013)                                    |                                                        |                                                     |                            |
| Urban area                                            | 5,824 (85)                                             | 3,861 (87)                                          | 0.006                      |
| Rural area                                            | 998 (15)                                               | 566 (13)                                            |                            |
| Mother's highest education qualification <sup>‡</sup> |                                                        |                                                     |                            |
| Less than a bachelor's degree                         | 4,200 (62)                                             | 2,225 (52)                                          | < 0.001                    |
| Bachelor's degree or higher                           | 2,603 (38)                                             | 2,057 (48)                                          |                            |
| Mother was born in New Zealand                        |                                                        |                                                     |                            |
| No                                                    | 2,441 (36)                                             | 1,277 (29)                                          | < 0.001                    |
| Yes                                                   | 4,374 (64)                                             | 3,136 (71)                                          |                            |

\* Based upon data collected at the enrolment interview, the six-week postnatal interview (for child sex) and the nine-month mother interview (for child ethnic group)

† Chi squared test

‡ At enrolment versus at the 72-month follow-up

### ***By child's ethnic group***

Children of Māori (n=513), Pacific (n=383) and non-Māori non-Pacific (n=3,430) ethnicities did not differ significantly with respect to their age at the 8-year follow-up (median age: 103 months) (**Table 3**). However, there were significant differences by ethnic group with respect to parity, area-level socioeconomic deprivation, rurality, maternal age at the 8-year follow-up, maternal education at the 72-month follow-up, maternal partner status at the 54-month follow-up, and whether the mother was born in New Zealand. Compared with children of non-Māori non-Pacific ethnicities, a larger proportion of Māori or Pacific ethnicities were a subsequent child (respectively, 61% and 68% vs 55%) and lived in households in the highest quintile of area-level deprivation (respectively, 39% and 55% vs 9%). Furthermore, a larger proportion of children of Māori and Pacific ethnicities (than non-Māori non-Pacific) had mothers who were under 35 years old at the 8-year follow-up (respectively, 38% and 37% vs 15%), had less than a bachelor's degree at the 72-month follow-up (respectively, 70% and 79% vs 46%), and did not have a partner at the 54-month follow-up (respectively, 18% and 15% vs 7%). With respect to maternal country of birth, a larger proportion of Māori children had mothers who were born in New Zealand (94%) than children of Pacific (59%) or non-Māori non-Pacific (69%) ethnicities.

### ***In comparison to the cohort at enrolment***

In comparison to the cohort at enrolment, the analytical sample differed with respect to the child's ethnicity, area-level socioeconomic deprivation, rurality, maternal education, residential rurality and whether the mother was born in New Zealand (**Table 4**).

In comparison to the cohort at enrolment, the analytical sample included smaller proportions of children of Māori or Pacific ethnicity, smaller proportions of children living in areas of greater socioeconomic deprivation, a larger proportion living in urban areas, and a larger proportion whose mothers had a bachelor's degree or higher and a larger proportion whose mother was born in New Zealand (**Table 4**).

## **Factors associated with maternal HPV vaccination intentions for girls**

### **Univariable analysis**

#### ***Child factors***

In the unadjusted analysis, maternal HPV vaccination intentions for girls were associated with the child's: ethnicity; access to a GP or doctor 12 months prior to the 54-month and 2-year follow-ups; uptake of immunisations (full or partial) due at age 4 years and age 15 months; and uptake and timing of all doses of

the 6-week, 3-month and 5-month immunisations (**Table 5A**). However, maternal HPV vaccination intentions for girls were not associated with whether the child mostly saw their regular doctor when sick at the 2-year follow-up.

Compared with mothers who had decided to vaccinate their daughters against HPV, a larger proportion of mothers who had not heard of the HPV vaccine had daughters of Māori (19% vs 10%) or Pacific (22% vs 8%) ethnicities. In addition, a larger proportion of mothers who had not heard of the HPV vaccine had daughters who had not seen a GP or doctor when needed during the 12 months prior to the 54-month follow-up (7% vs 4%), as did mothers who were undecided about HPV vaccination (7% vs 4%).

Furthermore, compared with mothers who had decided to vaccinate their daughters against HPV, a larger proportion of mothers who had decided not to vaccinate their daughters against HPV had daughters who had: not received immunisations (full or partial) due at age 4 years (45% vs 8%) and age 15 months (33% vs 1%); not received all doses of the 6-week, 3-month and 5-month immunisations in full (43% vs 3%) and on time (59% vs 20%); and not seen a GP or doctor when needed during the 12 months prior to the 2-year follow-up (7% vs 3%).

### ***Maternal factors***

The following maternal factors were associated with maternal HPV vaccination intentions for girls in the unadjusted analysis: parity; country of birth (New Zealand vs other countries); area-level socioeconomic deprivation; age at the 8-year follow-up; education status at the 72-month follow-up; duration of being part of a religion at the 2-year follow-up; frequency of attending religious services at the 2-year follow-up; and belonging to a church at the 9-month follow-up (**Table 5B**). On the other hand, belonging to a religion or denomination at the 2-year follow-up and belonging to a Christian religion at the 2-year follow-up were not associated with maternal HPV vaccination intentions for girls. Partner status at the 54-month and 2-year follow-ups, taking the child to same GP or GP practice at the 2-year follow-up as when the child was 9 months old, and satisfaction with child's usual GP at 2-year follow-up were also not associated with maternal HPV vaccination intentions for girls.

Compared with mothers who had decided to vaccinate their daughters against HPV, a larger proportion of mothers who had not heard of the HPV vaccine were under 35 years old at the 8-year follow-up (31% vs 16%), and were mothers of girls who were first-borns (52% vs 40%) and lived in households in the three highest deciles of area-level deprivation (42% vs 22%).

Mothers who had decided not to vaccinate their daughters against HPV were largely born in New Zealand compared with mothers who had decided to vaccinate their daughters against HPV (91% vs 68%). In addition, a larger proportion of mothers who had decided not to vaccinate their daughters against HPV had less than a bachelor's degree at the 72-month follow-up (62% vs

46%), as were mothers who had not heard of the HPV vaccine (65% vs 46%) and mothers who were undecided about HPV vaccination (55% vs 46%).

Compared with mothers who had decided to vaccinate their daughters against HPV, a larger proportion of mothers who had decided not to vaccinate their daughters against HPV attended religious services at least monthly at the 2-year follow-up (27% vs 20%) or belonged to a church at the 9-month follow-up (31% vs 21%). Similarly, a larger proportion of mothers who had not heard of the HPV vaccine attended religious services at least monthly at the 2-year follow-up (31% vs 20%) or belonged to a church at the 9-month follow-up (30% vs 21%).

**Table 5A: Child factors potentially associated with maternal HPV vaccination intentions for GIRLS (unadjusted analysis)**

| Variable                                                                                    | Whether mothers have decided to vaccinate daughters against HPV (n=2,183) |                               |                      |                                     | P-value <sup>†</sup> |
|---------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|-------------------------------|----------------------|-------------------------------------|----------------------|
|                                                                                             | Will vaccinate<br>(n=889)                                                 | Will NOT vaccinate<br>(n=234) | Undecided<br>(n=928) | Not heard of HPV vaccine<br>(n=132) |                      |
|                                                                                             | n (%) <sup>*</sup>                                                        | n (%) <sup>*</sup>            | n (%) <sup>*</sup>   | n (%) <sup>*</sup>                  |                      |
| Child's ethnicity (n=2133)                                                                  |                                                                           |                               |                      |                                     |                      |
| Māori                                                                                       | 90 (10)                                                                   | 21 (9)                        | 120 (13)             | 23 (19)                             | <0.001               |
| Pacific                                                                                     | 69 (8)                                                                    | 8 (3)                         | 83 (9)               | 27 (22)                             |                      |
| Non-Māori Non-Pacific                                                                       | 709 (82)                                                                  | 203 (88)                      | 709 (78)             | 71 (59)                             |                      |
| Child needed to see GP/doctor 12 months prior to 54-month follow, but not able to (n=2,157) |                                                                           |                               |                      |                                     |                      |
| Yes                                                                                         | 34 (4)                                                                    | 10 (4)                        | 62 (7)               | 9 (7)                               | 0.03                 |
| No                                                                                          | 845 (96)                                                                  | 223 (96)                      | 858 (93)             | 116 (93)                            |                      |
| Child received immunisations (full or partial) due at age 4 years (n=2,151)                 |                                                                           |                               |                      |                                     |                      |
| No                                                                                          | 70 (8)                                                                    | 106 (45)                      | 99 (11)              | 13 (10)                             | <0.001               |
| Yes                                                                                         | 808 (92)                                                                  | 128 (55)                      | 816 (89)             | 111 (90)                            |                      |
| Child mostly saw regular doctor when sick (2-year follow-up) (n=2,140)                      |                                                                           |                               |                      |                                     |                      |
| No                                                                                          | 240 (27)                                                                  | 70 (30)                       | 264 (29)             | 38 (30)                             | 0.73                 |
| Yes                                                                                         | 637 (73)                                                                  | 160 (70)                      | 643 (71)             | 88 (70)                             |                      |
| Child needed to see GP/doctor 12 months prior to 2-year follow, but not able to (n=2,151)   |                                                                           |                               |                      |                                     |                      |
| Yes                                                                                         | 25 (3)                                                                    | 16 (7)                        | 35 (4)               | 7 (6)                               | 0.03                 |
| No                                                                                          | 855 (97)                                                                  | 217 (93)                      | 877 (96)             | 119 (94)                            |                      |
| Child received immunisations (full or partial) due at age 15 months (n=2,149)               |                                                                           |                               |                      |                                     |                      |
| Yes                                                                                         | 871 (99)                                                                  | 155 (67)                      | 876 (96)             | 121 (96)                            | <0.001               |
| No                                                                                          | 8 (1)                                                                     | 77 (33)                       | 36 (4)               | 5 (4)                               |                      |

Child received all doses of the 6-week, 3-month and 5-month immunisations (n=2,134)

|                          |          |          |          |          |        |
|--------------------------|----------|----------|----------|----------|--------|
| Yes (all doses given)    | 845 (97) | 130 (57) | 827 (91) | 119 (92) | <0.001 |
| No (all doses not given) | 27 (3)   | 97 (43)  | 78 (9)   | 11 (8)   |        |

Child received all doses of the 6-week, 3-month and 5-month immunisations on time (n=2,134)

|                                  |          |          |          |         |        |
|----------------------------------|----------|----------|----------|---------|--------|
| Yes (all doses given on time)    | 698 (80) | 94 (41)  | 672 (74) | 99 (76) | <0.001 |
| No (not all doses given on time) | 174 (20) | 133 (59) | 233 (26) | 31 (24) |        |

---

GP=General Practitioner; HPV=Human Papillomavirus

\* Percentages may not add up to 100% due to rounding

† Chi squared test

**Table 5B: Maternal factors potentially associated with maternal HPV vaccination intentions for GIRLS (unadjusted analysis)**

| Variable                                                                              | Whether mothers have decided to vaccinate daughters against HPV (n=2183) |                               |                      |                                     | P-value <sup>†</sup> |
|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------|----------------------|-------------------------------------|----------------------|
|                                                                                       | Will vaccinate<br>(n=889)                                                | Will NOT vaccinate<br>(n=234) | Undecided<br>(n=928) | Not heard of HPV vaccine<br>(n=132) |                      |
|                                                                                       | n (%) <sup>*</sup>                                                       | n (%) <sup>*</sup>            | n (%) <sup>*</sup>   | n (%) <sup>*</sup>                  |                      |
| Parity (n=2,171)                                                                      |                                                                          |                               |                      |                                     |                      |
| First-born                                                                            | 356 (40)                                                                 | 81 (35)                       | 427 (46)             | 67 (52)                             | 0.001                |
| Subsequent child                                                                      | 529 (60)                                                                 | 153 (65)                      | 496 (54)             | 62 (48)                             |                      |
| Mother was born in New Zealand (n=2,171)                                              |                                                                          |                               |                      |                                     |                      |
| No                                                                                    | 287 (32)                                                                 | 44 (19)                       | 258 (28)             | 50 (39)                             | <0.001               |
| Yes                                                                                   | 598 (68)                                                                 | 190 (91)                      | 665 (72)             | 79 (61)                             |                      |
| Socioeconomic deprivation (NZDep2013) (n=2,170)                                       |                                                                          |                               |                      |                                     |                      |
| Low (deciles 1-3)                                                                     | 351 (40)                                                                 | 69 (30)                       | 330 (36)             | 31 (24)                             | <0.001               |
| Moderate (deciles 4-7)                                                                | 339 (38)                                                                 | 111 (48)                      | 343 (37)             | 45 (35)                             |                      |
| High (deciles 8-10)                                                                   | 196 (22)                                                                 | 53 (23)                       | 248 (27)             | 54 (42)                             |                      |
| Maternal age at 8-year follow-up (n=2,181)                                            |                                                                          |                               |                      |                                     |                      |
| Less than 35 years                                                                    | 146 (16)                                                                 | 54 (23)                       | 203 (22)             | 40 (31)                             | <0.001               |
| 35 to 39 years                                                                        | 219 (25)                                                                 | 61 (26)                       | 263 (28)             | 38 (29)                             |                      |
| 40 to 44 years                                                                        | 324 (36)                                                                 | 66 (28)                       | 301 (32)             | 37 (28)                             |                      |
| 45 years or over                                                                      | 200 (23)                                                                 | 53 (23)                       | 160 (17)             | 16 (12)                             |                      |
| Mother's highest education qualification (antenatal and 72-month follow-up) (n=2,108) |                                                                          |                               |                      |                                     |                      |
| Less than a bachelor's degree                                                         | 389 (46)                                                                 | 141 (62)                      | 498 (55)             | 81 (65)                             | <0.001               |
| Bachelor's degree or higher                                                           | 462 (54)                                                                 | 87 (38)                       | 406 (45)             | 44 (35)                             |                      |
| Mother had partner at 54-month follow-up (n=2,152)                                    |                                                                          |                               |                      |                                     |                      |
| No                                                                                    | 69 (8)                                                                   | 24 (10)                       | 88 (10)              | 13 (11)                             | 0.47                 |
| Yes                                                                                   | 807 (92)                                                                 | 210 (90)                      | 831 (90)             | 110 (8)                             |                      |
| Mother had partner at 2-year follow-up (n=2,145)                                      |                                                                          |                               |                      |                                     |                      |

|                                                                                                    |          |          |          |          |       |
|----------------------------------------------------------------------------------------------------|----------|----------|----------|----------|-------|
| No                                                                                                 | 70 (8)   | 19 (8)   | 67 (7)   | 11 (9)   | 0.92  |
| Yes                                                                                                | 808 (92) | 214 (92) | 843 (93) | 113 (91) |       |
| Takes child to same GP or GP practice at 2-year follow-up as when child was 9 months old (n=2,089) |          |          |          |          |       |
| No                                                                                                 | 94 (11)  | 32 (14)  | 111 (13) | 18 (15)  | 0.34  |
| Yes                                                                                                | 768 (89) | 189 (86) | 775 (87) | 102 (85) |       |
| Satisfaction with child's usual GP at 2-year follow-up (n=2,084)                                   |          |          |          |          |       |
| Less than satisfied                                                                                | 60 (7)   | 25 (11)  | 72 (8)   | 12 (10)  | 0.09  |
| Fairly satisfied                                                                                   | 199 (23) | 54 (24)  | 223 (25) | 29 (25)  |       |
| Very satisfied                                                                                     | 357 (42) | 77 (35)  | 386 (44) | 49 (42)  |       |
| Completely satisfied                                                                               | 244 (28) | 65 (29)  | 204 (23) | 28 (24)  |       |
| Belonged to religion/denomination at 2-year follow-up (n=2,143)                                    |          |          |          |          |       |
| No                                                                                                 | 496 (57) | 138 (59) | 551 (61) | 65 (52)  | 0.91  |
| Yes                                                                                                | 380 (43) | 95 (41)  | 359 (39) | 59 (48)  |       |
| Belonged to Christian religion at 2-year follow-up (n=2,138)                                       |          |          |          |          |       |
| No                                                                                                 | 577 (66) | 147 (64) | 609 (67) | 84 (68)  | 0.77  |
| Yes                                                                                                | 298 (34) | 84 (36)  | 299 (33) | 40 (32)  |       |
| Duration of being part of a religion at 2-year follow-up (n=2,143)                                 |          |          |          |          |       |
| Not religious                                                                                      | 496 (57) | 138 (59) | 551 (61) | 65 (52)  | 0.01  |
| All of the mother's life                                                                           | 305 (35) | 60 (26)  | 270 (30) | 46 (37)  |       |
| Less than mother's lifetime                                                                        | 75 (9)   | 35 (15)  | 89 (10)  | 13 (10)  |       |
| Frequency of attending religious services at 2-year follow-up (n=2,143)                            |          |          |          |          |       |
| Not religious                                                                                      | 496 (57) | 138 (59) | 551 (61) | 65 (52)  | 0.002 |
| Daily to monthly                                                                                   | 179 (20) | 62 (27)  | 184 (20) | 39 (31)  |       |
| Not often or never                                                                                 | 201 (23) | 33 (14)  | 175 (19) | 20 (16)  |       |
| Belongs to a church at 9-month follow-up (n=2,136)                                                 |          |          |          |          |       |
| No                                                                                                 | 685 (79) | 160 (69) | 726 (80) | 87 (70)  | 0.001 |

|                                                            |          |          |          |          |      |
|------------------------------------------------------------|----------|----------|----------|----------|------|
| Yes                                                        | 187 (21) | 72 (31)  | 182 (20) | 37 (30)  |      |
| Mother had partner at 9-month follow-up (n=2,136)          |          |          |          |          |      |
| No                                                         | 55 (6)   | 21 (9)   | 74 (8)   | 9 (7)    | 0.37 |
| Yes                                                        | 817 (94) | 211 (91) | 834 (92) | 115 (93) |      |
| Had family doctor or GP before becoming pregnant (n=2,171) |          |          |          |          |      |
| No                                                         | 85 (10)  | 22 (9)   | 95 (10)  | 16 (12)  | 0.76 |
| Yes                                                        | 800 (90) | 212 (91) | 828 (90) | 113 (88) |      |

---

GP=General Practitioner; HPV=Human Papillomavirus; NZDep2013=2013 New Zealand Deprivation Index

\* Percentages may not add up to 100% due to rounding

† Chi squared test

**Table 6: Multivariable analysis of factors associated with maternal HPV vaccination intentions for GIRLS**

| Variable                                                                          | Whether mothers have decided to vaccinate daughters against HPV (n=1,891) |          |                      |         |                                     |          |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------|----------|----------------------|---------|-------------------------------------|----------|
|                                                                                   | Will NOT vaccinate<br>(n=203)                                             |          | Undecided<br>(n=810) |         | Not heard of HPV vaccine<br>(n=102) |          |
|                                                                                   | Adjusted OR                                                               | P-value* | Adjusted OR          | P-value | Adjusted OR                         | P-value* |
|                                                                                   | (95% CI)*                                                                 |          | (95% CI)*            |         | (95% CI)*                           |          |
| <b>Child factors</b>                                                              |                                                                           |          |                      |         |                                     |          |
| Child's ethnicity                                                                 |                                                                           |          |                      |         |                                     |          |
| Māori                                                                             | 0.39 (0.21-0.75)                                                          | 0.005    | 1.11 (0.79-1.57)     | 0.55    | 1.58 (0.80-3.12)                    | 0.19     |
| Pacific                                                                           | 0.20 (0.08-0.48)                                                          | <0.001   | 0.95 (0.63-1.42)     | 0.79    | 2.54 (1.34-4.81)                    | 0.004    |
| Non-Māori Non-Pacific                                                             | Reference                                                                 |          | Reference            |         | Reference                           |          |
| Child needed to see GP/doctor 12 months prior to 54-month follow, but not able to |                                                                           |          |                      |         |                                     |          |
| Yes                                                                               | 0.68 (0.27-1.73)                                                          | 0.42     | 1.60 (1.00-2.55)     | 0.05    | 0.88 (0.32-2.41)                    | 0.80     |
| No                                                                                | Reference                                                                 |          | Reference            |         | Reference                           |          |
| Child needed to see GP/doctor 12 months prior to 2-year follow, but not able to   |                                                                           |          |                      |         |                                     |          |
| Yes                                                                               | 2.92 (1.32-6.47)                                                          | 0.01     | 1.41 (0.79-2.49)     | 0.24    | 2.17 (0.87-5.44)                    | 0.10     |
| No                                                                                | Reference                                                                 |          | Reference            |         | Reference                           |          |
| Child received immunisations (full or partial) due at age 4 years                 |                                                                           |          |                      |         |                                     |          |
| No                                                                                | 3.43 (2.16-5.45)                                                          | <0.001   | 1.09 (0.76-1.56)     | 0.64    | 1.39 (0.69-2.82)                    | 0.35     |
| Yes                                                                               | Reference                                                                 |          | Reference            |         | Reference                           |          |
| Child received immunisations (full or partial) due at age 15 months               |                                                                           |          |                      |         |                                     |          |
| Yes                                                                               | Reference                                                                 |          | Reference            |         | Reference                           |          |
| No                                                                                | 16.16 (6.67-39.18)                                                        | <0.001   | 3.96 (1.68-9.36)     | 0.002   | 4.83 (1.24-18.88)                   | 0.02     |
| Child received all doses of the 6-week, 3-month and 5-month immunisations on time |                                                                           |          |                      |         |                                     |          |
| Yes (all doses given on time)                                                     | Reference                                                                 |          | Reference            |         | Reference                           |          |
| No (not all doses given on time)                                                  | 2.04 (1.35-3.09)                                                          | 0.001    | 1.23 (0.95-1.59)     | 0.12    | 0.93 (0.53-1.65)                    | 0.81     |

| <b>Maternal factors</b>                                                     |                  |       |                  |       |                  |      |
|-----------------------------------------------------------------------------|------------------|-------|------------------|-------|------------------|------|
| Parity                                                                      |                  |       |                  |       |                  |      |
| First-born                                                                  | 0.97 (0.66-1.43) | 0.88  | 1.23 (0.99-1.53) | 0.06  | 1.55 (0.97-2.46) | 0.06 |
| Subsequent child                                                            | Reference        |       | Reference        |       | Reference        |      |
| Mother was born in New Zealand                                              |                  |       |                  |       |                  |      |
| No                                                                          | 0.74 (0.48-1.15) | 0.19  | 0.92 (0.73-1.17) | 0.51  | 1.56 (0.97-2.52) | 0.07 |
| Yes                                                                         | Reference        |       | Reference        |       | Reference        |      |
| Socioeconomic deprivation (NZDep2013)                                       |                  |       |                  |       |                  |      |
| Low (deciles 1-3)                                                           | Reference        |       | Reference        |       | Reference        |      |
| Moderate (deciles 4-7)                                                      | 1.35 (0.90-2.04) | 0.15  | 0.97 (0.77-1.23) | 0.80  | 1.15 (0.67-1.98) | 0.61 |
| High (deciles 8-10)                                                         | 1.31 (0.78-2.19) | 0.31  | 1.06 (0.79-1.43) | 0.69  | 1.27 (0.68-2.36) | 0.45 |
| Maternal age at 8-year follow-up                                            |                  |       |                  |       |                  |      |
| Less than 35 years                                                          | 2.27 (1.26-4.08) | 0.01  | 1.42 (1.00-2.04) | 0.05  | 2.43 (1.10-5.37) | 0.03 |
| 35 to 39 years                                                              | 1.37 (0.81-2.33) | 0.24  | 1.31 (0.97-1.78) | 0.08  | 1.76 (0.83-3.77) | 0.14 |
| 40 to 44 years                                                              | 1.11 (0.67-1.84) | 0.68  | 1.11 (0.83-1.47) | 0.48  | 1.78 (0.86-3.69) | 0.12 |
| 45 years or over                                                            | Reference        |       | Reference        |       | Reference        |      |
| Mother's highest education qualification (antenatal and 72-month follow-up) |                  |       |                  |       |                  |      |
| Less than a bachelor's degree                                               | 1.94 (1.33-2.83) | 0.001 | 1.42 (1.15-1.76) | 0.001 | 1.80 (1.12-2.90) | 0.02 |
| Bachelor's degree or higher                                                 | Reference        |       | Reference        |       | Reference        |      |
| Satisfaction with child's usual GP at 2-year follow-up                      |                  |       |                  |       |                  |      |
| Less than satisfied                                                         | 1.03 (0.53-2.00) | 0.94  | 1.17 (0.77-1.79) | 0.47  | 1.75 (0.80-3.83) | 0.16 |
| Fairly satisfied                                                            | 0.77 (0.48-1.25) | 0.30  | 1.25 (0.94-1.66) | 0.13  | 1.13 (0.61-2.08) | 0.70 |
| Very satisfied                                                              | 0.75 (0.49-1.15) | 0.18  | 1.24 (0.97-1.59) | 0.09  | 1.08 (0.63-1.86) | 0.78 |
| Completely satisfied                                                        | Reference        |       | Reference        |       | Reference        |      |
| Frequency of attending religious services at 2-year follow-up               |                  |       |                  |       |                  |      |
| Not religious                                                               | Reference        |       | Reference        |       | Reference        |      |
| Daily to monthly                                                            | 0.98 (0.51-1.86) | 0.94  | 0.93 (0.64-1.34) | 0.70  | 1.54 (0.77-3.06) | 0.22 |

|                                          |                  |      |                  |      |                  |      |
|------------------------------------------|------------------|------|------------------|------|------------------|------|
| Not often or never                       | 0.60 (0.36-1.01) | 0.06 | 0.79 (0.60-1.02) | 0.08 | 0.74 (0.40-1.38) | 0.35 |
| Belongs to a church at 9-month follow-up |                  |      |                  |      |                  |      |
| No                                       | Reference        |      | Reference        |      | Reference        |      |
| Yes                                      | 1.96 (1.08-3.54) | 0.03 | 0.96 (0.68-1.35) | 0.80 | 0.96 (0.51-1.82) | 0.91 |

CI=Confidence Interval; GP=General Practitioner; HPV=Human Papillomavirus; NZDep2013=2013 New Zealand Deprivation Index; OR=Odds Ratio

\* Multinomial logistic regression models with mothers who have decided to vaccinate GIRLS against HPV (n=776) as the reference/baseline group.

## Multivariable analysis

In the multivariable analysis, after adjustment for other child and for maternal factors, maternal HPV vaccination intentions for girls were associated with the child's: ethnicity; access to a GP or doctor 12 months prior to 2-year follow-up; uptake of immunisations (full or partial) due at age 4 years and age 15 months; and uptake and timing of all doses of the 6-week, 3-month and 5-month immunisations (**Table 6**). On the other hand, maternal HPV vaccination intentions for girls were not associated with the child's access to a GP or doctor 12 months prior to the 54-month follow-up.

In the multivariable analysis, after adjustment for child and other maternal factors, maternal age at the 8-year follow-up, education status at the 72-month follow-up, and belonging to a church at the 9-month follow-up were associated with HPV vaccination intentions for girls in the multivariable analysis (**Table 6**). However, maternal HPV vaccination intentions for girls were not associated with the following factors: parity; country of birth (New Zealand vs other countries); area-level socioeconomic deprivation; satisfaction with child's usual GP at 2-year follow-up; and frequency of attending religious services at the 2-year follow-up.

### ***Mothers who had decided not to vaccinate girls against HPV compared with mothers who had decided to vaccinate girls against HPV***

In the adjusted analysis, mothers whose daughters were of Māori ethnicity (aOR, 0.39; 95% CI, 0.21-0.75;  $P = 0.005$ ) or Pacific ethnicity (aOR, 0.20; 95% CI, 0.08-0.48;  $P < 0.001$ ) were less likely to have decided not to vaccinate their daughters against HPV compared with mothers of non-Māori non-Pacific girls (**Table 6**). Furthermore, the likelihood of mothers deciding not to vaccinate their daughters against HPV was greater if their daughters had: not received immunisations (full or partial) due at age 4 years (aOR, 3.43; 95% CI, 2.16-5.45;  $P < 0.001$ ) and age 15 months (aOR, 16.16; 95% CI, 6.67-39.18;  $P < 0.001$ ); not received all doses of the 6-week, 3-month and 5-month immunisations on time (aOR, 2.04; 95% CI, 1.35-3.09;  $P = 0.001$ ); and not seen a GP or doctor when needed during the 12 months prior to the 2-year follow-up (aOR, 2.92; 95% CI, 1.32-6.47;  $P = 0.01$ ).

In the adjusted analysis, mothers with less than a bachelor's degree at the 72-month follow-up (aOR, 1.94; 95% CI, 1.33-2.83;  $P = 0.001$ ) were also more likely to have decided not to vaccinate their daughters against HPV, as were mothers aged under 35 years at the 8-year follow-up (aOR, 2.27; 95% CI, 1.26-4.08;  $P = 0.01$ ) compared with mothers aged 45 years or over. In addition, the likelihood of mothers deciding not to vaccinate their daughters against HPV was greater if they belonged to a church at the 9-month follow-up (aOR, 1.96; 95% CI, 1.08-3.54;  $P = 0.03$ ).

### ***Mothers who were undecided about HPV vaccination for girls compared with mothers who had decided to vaccinate girls against HPV***

In the adjusted analysis, the likelihood of mothers being undecided about HPV vaccination for girls was greater if their daughters had not received immunisations (full or partial) due at age 15 months (aOR, 3.96; 95% CI, 1.68-9.36; P = 0.002), or if mothers had less than a bachelor's degree at the 72-month follow-up (aOR, 1.42; 95% CI, 1.15-1.76; P = 0.001) (**Table 6**).

### ***Mothers who had not heard about the HPV vaccine compared with mothers who had decided to vaccinate girls against HPV***

In the adjusted analysis, mothers whose daughters were of Pacific ethnicity (aOR, 2.54; 95% CI, 1.34-4.81; P = 0.004) were more likely to report that they had not heard about the HPV vaccine compared with mothers of non-Māori non-Pacific girls (**Table 6**). In addition, the likelihood of mothers stating that they had not heard about the HPV vaccine was greater if their daughters had not received immunisations (full or partial) due at age 15 months (aOR, 4.83; 95% CI, 1.24-18.88; P = 0.02). Mothers with less than a bachelor's degree at the 72-month follow-up (aOR, 1.80; 95% CI, 1.12-2.90; P = 0.02) were also more likely to report that they had not heard of the HPV vaccine, as were mothers aged under 35 years at the 8-year follow-up (aOR, 2.43; 95% CI, 1.10-5.37; P = 0.03) compared with mothers aged 45 years or over.

## **Factors associated with maternal HPV vaccination intentions for boys**

### **Univariable analysis**

#### ***Child factors***

In the unadjusted analysis, maternal HPV vaccination intentions for boys were associated with the child's: ethnicity; uptake of immunisations (full or partial) due at age 4 years and age 15 months; and uptake and timing of all doses of the 6-week, 3-month and 5-month immunisations (**Table 7A**). However, maternal HPV vaccination intentions for boys were not associated with the child's access to a GP or doctor 12 months prior to the 54-month and 2-year follow-ups, as well as whether the child mostly saw their regular doctor when sick at the 2-year follow-up.

Compared with mothers who had decided to vaccinate their sons against HPV, a larger proportion of mothers who had not heard of the HPV vaccine had sons of Māori ethnicity (21% vs 10%), as did mothers who had decided not to vaccinate their sons against HPV (16% vs 10%). In contrast, compared with mothers who had decided to vaccinate their sons against HPV, a smaller proportion of mothers who decided not to vaccinate their sons against HPV had sons of Pacific ethnicity

(2% vs 12%), as did mothers who were undecided about HPV vaccination (7% vs 12%).

In addition, compared with mothers who had decided to vaccinate their sons against HPV, a larger proportion of mothers who had decided not to vaccinate their sons against HPV had sons who had not received immunisations (full or partial) due at age 4 years (43% vs 8%) and age 15 months (29 % vs 1%), as well as all doses of the 6-week, 3-month and 5-month immunisations in full (38% vs 6%) and on time (56% vs 21%).

### ***Maternal factors***

The following maternal factors were associated with maternal HPV vaccination intentions for boys in the unadjusted analysis: parity; country of birth (New Zealand vs other countries); area-level socioeconomic deprivation; education status at the 72-month follow-up; partner status at the 2-year and 9-month follow-ups; and access to a family doctor or GP before becoming pregnant (**9b**).

Furthermore, maternal HPV vaccination intentions for boys were associated with: belonging to a religion or denomination at the 2-year follow-up; belonging to a Christian religion at the 2-year follow-up; duration of being part of a religion at the 2-year follow-up; frequency of attending religious services at the 2-year follow-up; and belonging to a church at the 9-month follow-up. However, maternal age at the 8-year follow-up and partner status at the 54-month follow-up were not associated with their HPV vaccination intentions for boys. Taking the child to same GP or GP practice at the 2-year follow-up as when the child was 9 months old and satisfaction with child's usual GP at the 2-year follow-up were also not associated with maternal HPV vaccination intentions for boys.

Compared with mothers who had decided to vaccinate their sons against HPV, a larger proportion of those who had not heard of the HPV vaccine were mothers of boys who were first-borns (50% vs 39%) or lived in households in the three highest deciles of area-level deprivation (33% vs 26%). In addition, compared with mothers who had decided to vaccinate their sons against HPV, a larger proportion of mothers who had not heard of the HPV vaccine had less than a bachelor's degree at the 72-month follow-up (64% vs 47%), as did mothers who had decided not to vaccinate their sons against HPV (57% vs 47%).

Furthermore, a larger proportion of mothers who had not heard of the HPV vaccine had a partner at the 2-year follow-up (12% vs 8%), as did mothers who had decided not to vaccinate their sons against HPV (11% vs 8%). Comparably, a larger proportion of mothers who had not heard of the HPV vaccine had a partner at the 9-month follow-up compared with mothers who had decided to vaccinate their sons against HPV (10% vs 7%)

With respect to maternal country of birth, the proportion of those who were born in New Zealand was larger among mothers who had decided not to vaccinate their sons against HPV compared with mothers who had decided to vaccinate

their sons against HPV (79% vs 69%), but was smaller among mothers who had not heard of the HPV vaccine (59% vs 69%).

Compared with mothers who had decided to vaccinate their sons against HPV, a larger proportion of mothers who had decided not to vaccinate their sons against HPV attended religious services at least monthly at the 2-year follow-up (34% vs 25%), belonged to a Christian religion at the 2-year follow-up (46% vs 38%), or belonged to a church at the 9-month follow-up (29% vs 25%). In contrast, compared with mothers who had decided to vaccinate their sons against HPV, a larger proportion of mothers who were undecided about HPV vaccination for their sons were non-religious at the 2-year follow-up (61% vs 53%) or did not belong to a church at the 9-month follow-up (80% vs 75%).

With respect to maternal access to healthcare before pregnancy, the proportion of those who did not have a family doctor or GP before becoming pregnant was larger among mothers who had not heard of the HPV vaccine compared with mothers who had decided to vaccinate their sons against HPV (14% vs 8%), as well as among mothers who had decided not to vaccinate their sons against HPV (12% vs 8%).

### **Multivariable analysis**

In the multivariable analysis, after adjustment for other child and maternal factors, maternal HPV vaccination intentions for boys were associated with the child's: ethnicity; uptake of immunisations (full or partial) due at age 4 years and age 15 months; and uptake and timing of all doses of the 6-week, 3-month and 5-month immunisations (**Table 8**).

With respect to maternal factors, after adjustment for child and other maternal factors, the following were associated with their HPV vaccination intentions for boys in the multivariable analysis: parity; country of birth (New Zealand vs other countries); education status at the 72-month follow-up; and frequency of attending religious services at the 2-year follow-up (**Table 8**). However, maternal HPV vaccination intentions for boys were not associated with area-level socioeconomic deprivation or maternal access to a family doctor or GP before becoming pregnant.

### ***Mothers who had decided not to vaccinate boys against HPV compared with mothers who had decided to vaccinate boys against HPV***

In the adjusted analysis, mothers whose sons were of Pacific ethnicity (aOR, 0.15; 95% CI, 0.06-0.40; P <0.001) were less likely to have decided not to vaccinate their sons against HPV compared with mothers of non-Māori non-Pacific boys (**Table 8**). In addition, the likelihood of mothers deciding not to vaccinate their sons against HPV was greater if their sons had not received immunisations (full or partial) due at age 4 years (aOR, 3.26; 95% CI, 2.05-5.17; P <0.001) and age 15 months (aOR, 8.52; 95% CI, 3.64-19.94; P <0.001), as well as all doses of the 6-week, 3-month and 5-month

immunisations on time (aOR, 2.09; 95% CI, 1.39-3.13;  $P < 0.001$ ). Furthermore, mothers with less than a bachelor's degree at the 72-month follow-up (aOR, 1.46; 95% CI, 1.02-2.09;  $P = 0.04$ ) were more likely to have decided not to vaccinate their sons against HPV, as were mothers who attended religious services at least monthly at the 2-year follow-up (aOR, 2.09; 95% CI, 1.36-3.21;  $P = 0.001$ ) compared with non-religious mothers.

***Mothers who were undecided about HPV vaccination for boys compared with mothers who had decided to vaccinate boys against HPV***

In the adjusted analysis, mothers whose sons were of Pacific ethnicity (aOR, 0.63; 95% CI, 0.42-0.92;  $P = 0.02$ ) were less likely to be undecided about HPV vaccination compared with mothers of non-Māori non-Pacific boys, whereas mothers whose sons were first-borns (aOR, 1.31; 95% CI, 1.06-1.61;  $P = 0.01$ ) were more likely to be undecided about HPV vaccination for their sons (**Table 8**). Moreover, the likelihood of mothers being undecided about HPV vaccination for boys was greater if their sons had not received immunisations (full or partial) due at age 15 months (aOR, 3.04; 95% CI, 1.37-6.77;  $P = 0.01$ ), as well as all doses of the 6-week, 3-month and 5-month immunisations on time (aOR, 1.33; 95% CI, 1.04-1.72;  $P = 0.03$ ).

***Mothers who had not heard about the HPV vaccine compared with mothers who had decided to vaccinate boys against HPV***

In the adjusted analysis, mothers whose sons were of Māori ethnicity (aOR, 2.50; 95% CI, 1.48-4.23;  $P = 0.001$ ) were more likely to report that they had not heard about the HPV vaccine compared with mothers of non-Māori non-Pacific boys, as were mothers whose sons were first-borns (aOR, 1.81; 95% CI, 1.27-2.58;  $P = 0.001$ ) (**Table 8**). The likelihood of mothers stating that they had not heard about the HPV vaccine was also greater if their sons had not received immunisations (full or partial) due at age 15 months (aOR, 3.12; 95% CI, 1.02-9.54;  $P = 0.04$ ). In addition, mothers who were not born in New Zealand (aOR, 1.85; 95% CI, 1.26-2.71;  $P = 0.002$ ) were more likely to report that they had not heard of the HPV vaccine, as were mothers with less than a bachelor's degree at the 72-month follow-up (aOR, 2.02; 95% CI, 1.40-2.93;  $P < 0.001$ ).

**Table 7A: Child factors potentially associated with maternal HPV vaccination intentions for BOYS (unadjusted analysis)**

| Variable                                                                                    | Whether mothers have decided to vaccinate sons against HPV (n=2,265) |                            |                     |                                  | P-value <sup>†</sup> |
|---------------------------------------------------------------------------------------------|----------------------------------------------------------------------|----------------------------|---------------------|----------------------------------|----------------------|
|                                                                                             | Will vaccinate (n=722)                                               | Will NOT vaccinate (n=227) | Undecided (n=1,124) | Not heard of HPV vaccine (n=192) |                      |
|                                                                                             | n (%) <sup>*</sup>                                                   | n (%) <sup>*</sup>         | n (%) <sup>*</sup>  | n (%) <sup>*</sup>               |                      |
| Child's ethnicity (n=2193)                                                                  |                                                                      |                            |                     |                                  |                      |
| Māori                                                                                       | 67 (10)                                                              | 34 (16)                    | 118 (11)            | 40 (21)                          | <0.001               |
| Pacific                                                                                     | 83 (12)                                                              | 5 (2)                      | 80 (7)              | 28 (15)                          |                      |
| Non-Māori Non-Pacific                                                                       | 546 (78)                                                             | 179 (82)                   | 893 (82)            | 120 (64)                         |                      |
| Child needed to see GP/doctor 12 months prior to 54-month follow, but not able to (n=2,234) |                                                                      |                            |                     |                                  |                      |
| Yes                                                                                         | 33 (5)                                                               | 7 (3)                      | 63 (6)              | 7 (4)                            | 0.30                 |
| No                                                                                          | 675 (95)                                                             | 218 (97)                   | 1,048 (94)          | 183 (96)                         |                      |
| Child received immunisations (full or partial) due at age 4 years (n=2,229)                 |                                                                      |                            |                     |                                  |                      |
| No                                                                                          | 58 (8)                                                               | 97 (43)                    | 117 (11)            | 19 (10)                          | <0.001               |
| Yes                                                                                         | 648 (92)                                                             | 128 (57)                   | 994 (89)            | 168 (90)                         |                      |
| Child's vaccination status at age 4 years (n=2,228)                                         |                                                                      |                            |                     |                                  |                      |
| Fully vaccinated at age 4 years                                                             | 644 (91)                                                             | 120 (53)                   | 984 (89)            | 163 (87)                         | <0.001               |
| Not fully vaccinated, but mother intends to organise it                                     | 42 (6)                                                               | 26 (12)                    | 73 (7)              | 11 (6)                           |                      |
| Not fully vaccinated and mother has no intention to                                         | 20 (3)                                                               | 79 (35)                    | 53 (5)              | 13 (7)                           |                      |
| Child mostly saw regular doctor when sick (2-year follow-up) (n=2,224)                      |                                                                      |                            |                     |                                  |                      |
| No                                                                                          | 204 (29)                                                             | 72 (33)                    | 324 (29)            | 50 (26)                          | 0.50                 |
| Yes                                                                                         | 506 (71)                                                             | 146 (67)                   | 782 (71)            | 140 (74)                         |                      |
| Child needed to see GP/doctor 12 months prior to 2-year follow, but not able to (n=2,239)   |                                                                      |                            |                     |                                  |                      |
| Yes                                                                                         | 31 (4)                                                               | 12 (5)                     | 57 (5)              | 13 (7)                           | 0.57                 |

|                                                                                             |          |          |            |          |        |
|---------------------------------------------------------------------------------------------|----------|----------|------------|----------|--------|
| No                                                                                          | 682 (96) | 212 (95) | 1,054 (95) | 178 (93) |        |
| Child received immunisations (full or partial) due at age 15 months (n=2,240)               |          |          |            |          |        |
| Yes                                                                                         | 706 (99) | 160 (71) | 1,065 (96) | 183 (96) | <0.001 |
| No                                                                                          | 8 (1)    | 64 (29)  | 46 (4)     | 8 (4)    |        |
| Child received all doses of the 6-week, 3-month and 5-month immunisations (n=2,217)         |          |          |            |          |        |
| Yes (all doses given)                                                                       | 666 (94) | 136 (62) | 997 (91)   | 172 (91) | <0.001 |
| No (all doses not given)                                                                    | 44 (6)   | 83 (38)  | 101 (9)    | 18 (9)   |        |
| Child received all doses of the 6-week, 3-month and 5-month immunisations on time (n=2,217) |          |          |            |          |        |
| Yes (all doses given on time)                                                               | 564 (79) | 96 (44)  | 808 (74)   | 148 (78) | <0.001 |
| No (not all doses given on time)                                                            | 146 (21) | 123 (56) | 290 (26)   | 42 (22)  |        |

GP=General Practitioner; HPV=Human Papillomavirus

\* Percentages may not add up to 100% due to rounding

† Chi squared test

**Table 7B: Maternal factors potentially associated with maternal HPV vaccination intentions for BOYS (unadjusted analysis)**

| Variable                                                                              | Whether mothers have decided to vaccinate sons against HPV (n=2,265) |                               |                         |                                     | P-value <sup>†</sup> |
|---------------------------------------------------------------------------------------|----------------------------------------------------------------------|-------------------------------|-------------------------|-------------------------------------|----------------------|
|                                                                                       | Will vaccinate<br>(n=722)                                            | Will NOT vaccinate<br>(n=227) | Un-decided<br>(n=1,124) | Not heard of HPV vaccine<br>(n=192) |                      |
|                                                                                       | n (%) <sup>*</sup>                                                   | n (%) <sup>*</sup>            | n (%) <sup>*</sup>      | n (%) <sup>*</sup>                  |                      |
| Parity (n=2,241)                                                                      |                                                                      |                               |                         |                                     |                      |
| First-born                                                                            | 281 (39)                                                             | 72 (32)                       | 513 (46)                | 93 (50)                             | <0.001               |
| Subsequent child                                                                      | 432 (61)                                                             | 152 (68)                      | 604 (54)                | 94 (50)                             |                      |
| Mother was born in New Zealand (n=2,242)                                              |                                                                      |                               |                         |                                     |                      |
| No                                                                                    | 222 (31)                                                             | 47 (21)                       | 293 (26)                | 76 (41)                             | <0.001               |
| Yes                                                                                   | 492 (69)                                                             | 177 (79)                      | 824 (74)                | 111 (59)                            |                      |
| Socioeconomic deprivation (NZDep2013) (n=2,257)                                       |                                                                      |                               |                         |                                     |                      |
| Low (deciles 1-3)                                                                     | 282 (39)                                                             | 87 (38)                       | 415 (37)                | 55 (29)                             | 0.02                 |
| Moderate (deciles 4-7)                                                                | 250 (35)                                                             | 79 (35)                       | 452 (40)                | 73 (38)                             |                      |
| High (deciles 8-10)                                                                   | 185 (26)                                                             | 61 (27)                       | 256 (23)                | 62 (33)                             |                      |
| Maternal age at 8-year follow-up (n=2,262)                                            |                                                                      |                               |                         |                                     |                      |
| Less than 35 years                                                                    | 130 (18)                                                             | 42 (19)                       | 202 (18)                | 47 (24)                             | 0.11                 |
| 35 to 39 years                                                                        | 178 (25)                                                             | 71 (31)                       | 302 (27)                | 47 (24)                             |                      |
| 40 to 44 years                                                                        | 246 (34)                                                             | 67 (30)                       | 403 (36)                | 55 (29)                             |                      |
| 45 years or over                                                                      | 166 (23)                                                             | 47 (21)                       | 216 (19)                | 43 (22)                             |                      |
| Mother's highest education qualification (antenatal and 72-month follow-up) (n=2,172) |                                                                      |                               |                         |                                     |                      |
| Less than a bachelor's degree                                                         | 323 (47)                                                             | 124 (57)                      | 550 (51)                | 119 (64)                            | <0.001               |
| Bachelor's degree or higher                                                           | 369 (53)                                                             | 93 (43)                       | 530 (49)                | 66 (36)                             |                      |
| Mother had partner at 54-month follow-up (n=2,221)                                    |                                                                      |                               |                         |                                     |                      |
| No                                                                                    | 67 (10)                                                              | 15 (7)                        | 88 (8)                  | 22 (12)                             | 0.19                 |
| Yes                                                                                   | 635 (90)                                                             | 208 (93)                      | 1,021 (92)              | 165 (88)                            |                      |
| Mother had partner at 2-year follow-up (n=2,222)                                      |                                                                      |                               |                         |                                     |                      |

|                                                                                                    |          |          |            |          |        |
|----------------------------------------------------------------------------------------------------|----------|----------|------------|----------|--------|
| No                                                                                                 | 58 (8)   | 25 (11)  | 78 (7)     | 23 (12)  | 0.03   |
| Yes                                                                                                | 650 (92) | 197 (89) | 1,028 (93) | 163 (88) |        |
| Takes child to same GP or GP practice at 2-year follow-up as when child was 9 months old (n=2,170) |          |          |            |          |        |
| No                                                                                                 | 91 (13)  | 27 (12)  | 139 (13)   | 25 (14)  | 0.98   |
| Yes                                                                                                | 600 (87) | 190 (88) | 940 (87)   | 158 (86) |        |
| Satisfaction with child's usual GP at 2-year follow-up (n=2,167)                                   |          |          |            |          |        |
| Less than satisfied                                                                                | 61 (9)   | 28 (13)  | 91 (8)     | 18 (10)  | 0.47   |
| Fairly satisfied                                                                                   | 157 (23) | 46 (21)  | 269 (25)   | 49 (27)  |        |
| Very satisfied                                                                                     | 264 (38) | 88 (41)  | 420 (39)   | 64 (35)  |        |
| Completely satisfied                                                                               | 207 (30) | 55 (25)  | 298 (28)   | 52 (28)  |        |
| Belonged to religion/denomination at 2-year follow-up (n=2,219)                                    |          |          |            |          |        |
| No                                                                                                 | 372 (53) | 109 (49) | 679 (61)   | 99 (53)  | <0.001 |
| Yes                                                                                                | 334 (47) | 113 (51) | 426 (39)   | 87 (47)  |        |
| Belonged to Christian religion at 2-year follow-up (n=2,215)                                       |          |          |            |          |        |
| No                                                                                                 | 435 (62) | 119 (54) | 749 (68)   | 124 (67) | <0.001 |
| Yes                                                                                                | 269 (38) | 103 (46) | 354 (32)   | 62 (33)  |        |
| Duration of being part of a religion at 2-year follow-up (n=2,218)                                 |          |          |            |          |        |
| Not religious                                                                                      | 372 (53) | 109 (49) | 679 (61)   | 99 (53)  | <0.001 |
| All of the mother's life                                                                           | 253 (36) | 72 (32)  | 329 (30)   | 65 (35)  |        |
| Less than mother's lifetime                                                                        | 80 (11)  | 41 (18)  | 97 (9)     | 22 (12)  |        |
| Frequency of attending religious services at 2-year follow-up (n=2,217)                            |          |          |            |          |        |
| Not religious                                                                                      | 372 (53) | 109 (49) | 679 (61)   | 99 (53)  | <0.001 |
| Daily to monthly                                                                                   | 175 (25) | 75 (34)  | 208 (19)   | 51 (28)  |        |
| Not often or never                                                                                 | 158 (22) | 38 (17)  | 218 (20)   | 35 (19)  |        |
| Belongs to a church at 9-month follow-up (n=2,201)                                                 |          |          |            |          |        |
| No                                                                                                 | 525 (75) | 158 (71) | 879 (80)   | 134 (74) | 0.004  |

|                                                            |          |          |            |          |      |
|------------------------------------------------------------|----------|----------|------------|----------|------|
| Yes                                                        | 176 (25) | 65 (29)  | 218 (20)   | 46 (26)  |      |
| Mother had partner at 9-month follow-up (n=2,200)          |          |          |            |          |      |
| No                                                         | 46 (7)   | 21 (9)   | 61 (6)     | 18 (10)  | 0.04 |
| Yes                                                        | 655 (93) | 202 (91) | 1,035 (94) | 162 (90) |      |
| Had family doctor or GP before becoming pregnant (n=2,240) |          |          |            |          |      |
| No                                                         | 60 (8)   | 26 (12)  | 97 (9)     | 27 (14)  | 0.04 |
| Yes                                                        | 652 (92) | 198 (88) | 1,020 (91) | 160 (86) |      |

---

GP=General Practitioner; HPV=Human Papillomavirus; NZDep2013=2013 New Zealand Deprivation Index

\* Percentages may not add up to 100% due to rounding

† Chi squared test

**Table 8: Multivariable analysis of factors associated with maternal HPV vaccination intentions for BOYS**

| Variable                                                                          | Whether mothers have decided to vaccinate sons against HPV (n=2,026) |         |                          |         |                                     |          |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------|---------|--------------------------|---------|-------------------------------------|----------|
|                                                                                   | Will NOT vaccinate<br>(n=197)                                        |         | Undecided<br>(n=1,014)   |         | Not heard of HPV vaccine<br>(n=175) |          |
|                                                                                   | Adjusted OR<br>(95% CI)*                                             | P-value | Adjusted OR<br>(95% CI)* | P-value | Adjusted OR<br>(95% CI)*            | P-value* |
| <b>Child factors</b>                                                              |                                                                      |         |                          |         |                                     |          |
| Child's ethnicity                                                                 |                                                                      |         |                          |         |                                     |          |
| Māori                                                                             | 1.12 (0.65-1.92)                                                     | 0.69    | 1.07 (0.75-1.52)         | 0.73    | 2.50 (1.48-4.23)                    | 0.001    |
| Pacific                                                                           | 0.15 (0.06-0.40)                                                     | <0.001  | 0.63 (0.42-0.92)         | 0.02    | 1.36 (0.77-2.39)                    | 0.29     |
| Non-Māori Non-Pacific                                                             | Reference                                                            |         | Reference                |         | Reference                           |          |
| Child received immunisations (full or partial) due at age 4 years                 |                                                                      |         |                          |         |                                     |          |
| No                                                                                | 3.26 (2.05-5.17)                                                     | <0.001  | 0.93 (0.65-1.34)         | 0.69    | 1.06 (0.58-1.92)                    | 0.85     |
| Yes                                                                               | Reference                                                            |         | Reference                |         | Reference                           |          |
| Child received immunisations (full or partial) due at age 15 months               |                                                                      |         |                          |         |                                     |          |
| Yes                                                                               | Reference                                                            |         | Reference                |         | Reference                           |          |
| No                                                                                | 8.52 (3.64-19.94)                                                    | <0.001  | 3.04 (1.37-6.77)         | 0.01    | 3.12 (1.02-9.54)                    | 0.04     |
| Child received all doses of the 6-week, 3-month and 5-month immunisations on time |                                                                      |         |                          |         |                                     |          |
| Yes (all doses given on time)                                                     | Reference                                                            |         | Reference                |         | Reference                           |          |
| No (not all doses given on time)                                                  | 2.09 (1.39-3.13)                                                     | <0.001  | 1.33 (1.04-1.72)         | 0.03    | 1.05 (0.68-1.64)                    | 0.81     |
| <b>Maternal factors</b>                                                           |                                                                      |         |                          |         |                                     |          |
| Parity                                                                            |                                                                      |         |                          |         |                                     |          |
| First-born                                                                        | 0.97 (0.67-1.42)                                                     | 0.89    | 1.31 (1.06-1.61)         | 0.01    | 1.81 (1.27-2.58)                    | 0.001    |
| Subsequent child                                                                  | Reference                                                            |         | Reference                |         | Reference                           |          |
| Mother was born in New Zealand                                                    |                                                                      |         |                          |         |                                     |          |
| No                                                                                | 0.71 (0.46-1.10)                                                     | 0.12    | 0.88 (0.70-1.12)         | 0.30    | 1.85 (1.26-2.71)                    | 0.002    |

|                                                                             |                  |       |                  |      |                  |        |
|-----------------------------------------------------------------------------|------------------|-------|------------------|------|------------------|--------|
| Yes                                                                         | Reference        |       | Reference        |      | Reference        |        |
| Socioeconomic deprivation (NZDep2013)                                       |                  |       |                  |      |                  |        |
| Low (deciles 1-3)                                                           | Reference        |       | Reference        |      | Reference        |        |
| Moderate (deciles 4-7)                                                      | 0.90 (0.60-1.37) | 0.63  | 1.19 (0.94-1.50) | 0.15 | 1.33 (0.87-2.02) | 0.18   |
| High (deciles 8-10)                                                         | 1.06 (0.65-1.73) | 0.81  | 0.98 (0.73-1.32) | 0.89 | 1.10 (0.67-1.81) | 0.72   |
| Mother's highest education qualification (antenatal and 72-month follow-up) |                  |       |                  |      |                  |        |
| Less than a bachelor's degree                                               | 1.46 (1.02-2.09) | 0.04  | 1.21 (0.98-1.50) | 0.07 | 2.02 (1.40-2.93) | <0.001 |
| Bachelor's degree or higher                                                 | Reference        |       | Reference        |      | Reference        |        |
| Frequency of attending religious services at 2-year follow-up               |                  |       |                  |      |                  |        |
| Not religious                                                               | Reference        |       | Reference        |      | Reference        |        |
| Daily to monthly                                                            | 2.09 (1.36-3.21) | 0.001 | 0.79 (0.60-1.03) | 0.09 | 1.13 (0.72-1.76) | 0.60   |
| Not often or never                                                          | 1.10 (0.69-1.75) | 0.69  | 0.80 (0.62-1.04) | 0.09 | 0.91 (0.57-1.43) | 0.68   |
| Had family doctor or GP before becoming pregnant                            |                  |       |                  |      |                  |        |
| No                                                                          | 1.36 (0.75-2.47) | 0.31  | 1.00 (0.70-1.45) | 0.98 | 1.60 (0.94-2.72) | 0.08   |
| Yes                                                                         | Reference        |       | Reference        |      | Reference        |        |

CI=Confidence Interval; GP=General Practitioner; HPV=Human Papillomavirus; NZDep2013=2013 New Zealand Deprivation Index; OR=Odds Ratio

\* Multinomial logistic regression models with mothers who have decided to vaccinate BOYS against HPV (n=640) as the reference/baseline group.

## **Analysis stratified by the child's sex and ethnic group**

### **Maternal HPV vaccination intentions for girls and boys of Māori ethnicity**

#### ***Girls of Māori ethnicity***

Among girls of Māori ethnicity, the univariable analysis showed no significant associations of child and maternal factors with maternal HPV vaccination intentions for their daughters (**Table 9A** and **Table 9B**). In addition, none of the factors examined in the multivariable analysis were associated with maternal HPV vaccination intentions for girls of Māori ethnicity (**Table 11**).

#### ***Boys of Māori ethnicity***

Except for parity, the univariable analysis showed no significant associations of child and maternal factors with maternal HPV vaccination intentions for boys of Māori ethnicity (**Table 10A** and **Table 10B**). Compared with mothers who had decided to vaccinate Māori boys against HPV, a larger proportion of those who were undecided about HPV vaccination were mothers of Māori boys who were first-borns (39% vs 23%). However, none of the factors examined in the multivariable analysis were associated with maternal HPV vaccination intentions for boys of Māori ethnicity (**Table 11**).

**Table 9A: Child factors potentially associated with maternal HPV vaccination intentions for Māori GIRLS (unadjusted analysis)**

| Variable                                                                                  | Whether mothers have decided to vaccinate daughters against HPV (n=210) |                    | P-value <sup>†</sup> |
|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|--------------------|----------------------|
|                                                                                           | Will vaccinate (n=90)                                                   | Undecided (n=120)  |                      |
|                                                                                           | n (%) <sup>*</sup>                                                      | n (%) <sup>*</sup> |                      |
| Child needed to see GP/doctor 12 months prior to 54-month follow, but not able to (n=210) |                                                                         |                    |                      |
| Yes                                                                                       | 5 (6)                                                                   | 11 (9)             | 0.33                 |
| No                                                                                        | 85 (94)                                                                 | 109 (91)           |                      |
| Child received immunisations (full or partial) due at age 4 years (n=209)                 |                                                                         |                    |                      |
| No                                                                                        | 13 (14)                                                                 | 19 (16)            | 0.76                 |
| Yes                                                                                       | 77 (86)                                                                 | 100 (84)           |                      |
| Child mostly saw regular doctor when sick (2-year follow-up) (n=207)                      |                                                                         |                    |                      |
| No                                                                                        | 40 (44)                                                                 | 37 (32)            | 0.06                 |
| Yes                                                                                       | 50 (56)                                                                 | 80 (68)            |                      |
| Child needed to see GP/doctor 12 months prior to 2-year follow, but not able to (n=207)   |                                                                         |                    |                      |
| Yes                                                                                       | 5 (6)                                                                   | 6 (5)              | 0.87                 |
| No                                                                                        | 84 (94)                                                                 | 112 (95)           |                      |
| Child received all doses of the 6-week, 3-month and 5-month immunisations (n=205)         |                                                                         |                    |                      |
| Yes (all doses given)                                                                     | 84 (94)                                                                 | 106 (91)           | 0.41                 |
| No (all doses not given)                                                                  | 5 (6)                                                                   | 10 (9)             |                      |
| Child received all doses of the 6-week, 3-month and 5-month immunisations on time (n=205) |                                                                         |                    |                      |
| Yes (all doses given on time)                                                             | 57 (64)                                                                 | 81 (70)            | 0.38                 |
| No (not all doses given on time)                                                          | 32 (36)                                                                 | 35 (30)            |                      |

GP=General Practitioner; HPV=Human Papillomavirus

\* Percentages may not add up to 100% due to rounding

† Chi squared test

**Table 9B: Maternal factors potentially associated with maternal HPV vaccination intentions for Māori GIRLS (unadjusted analysis)**

| Variable                                                                                         | Whether mothers have decided to vaccinate daughters against HPV (n=210) |                    | P-value <sup>†</sup> |
|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|--------------------|----------------------|
|                                                                                                  | Will vaccinate (n=90)                                                   | Undecided (n=120)  |                      |
|                                                                                                  | n (%) <sup>*</sup>                                                      | n (%) <sup>*</sup> |                      |
| Parity (n=206)                                                                                   |                                                                         |                    |                      |
| First-born                                                                                       | 31 (36)                                                                 | 56 (47)            | 0.10                 |
| Subsequent child                                                                                 | 56 (64)                                                                 | 63 (53)            |                      |
| Socioeconomic deprivation (NZDep2013) (n=210)                                                    |                                                                         |                    |                      |
| Low (deciles 1-3)                                                                                | 21 (23)                                                                 | 20 (17)            | 0.38                 |
| Moderate (deciles 4-7)                                                                           | 24 (27)                                                                 | 40 (33)            |                      |
| High (deciles 8-10)                                                                              | 45 (50)                                                                 | 60 (50)            |                      |
| Maternal age at 8-year follow-up (n=210)                                                         |                                                                         |                    |                      |
| Less than 35 years                                                                               | 34 (38)                                                                 | 49 (41)            | 0.18                 |
| 35 to 39 years                                                                                   | 21 (23)                                                                 | 37 (31)            |                      |
| 40 to 44 years                                                                                   | 19 (21)                                                                 | 24 (20)            |                      |
| 45 years or over                                                                                 | 16 (18)                                                                 | 10 (8)             |                      |
| Mother's highest education qualification (antenatal and 72-month follow-up) (n=202)              |                                                                         |                    |                      |
| Less than a bachelor's degree                                                                    | 54 (64)                                                                 | 90 (76)            | 0.06                 |
| Bachelor's degree or higher                                                                      | 30 (36)                                                                 | 28 (24)            |                      |
| Mother had partner at 54-month follow-up (n=208)                                                 |                                                                         |                    |                      |
| No                                                                                               | 11 (13)                                                                 | 21 (18)            | 0.32                 |
| Yes                                                                                              | 77 (88)                                                                 | 99 (83)            |                      |
| Mother had partner at 2-year follow-up (n=206)                                                   |                                                                         |                    |                      |
| No                                                                                               | 14 (16)                                                                 | 14 (12)            | 0.40                 |
| Yes                                                                                              | 74 (84)                                                                 | 104 (88)           |                      |
| Takes child to same GP or GP practice at 2-year follow-up as when child was 9 months old (n=200) |                                                                         |                    |                      |
| No                                                                                               | 12 (14)                                                                 | 17 (15)            | 0.90                 |
| Yes                                                                                              | 73 (86)                                                                 | 98 (85)            |                      |
| Satisfaction with child's usual GP at 2-year follow-up (n=200)                                   |                                                                         |                    |                      |
| Less than satisfied                                                                              | 12 (14)                                                                 | 14 (12)            | 0.44                 |
| Fairly satisfied                                                                                 | 18 (21)                                                                 | 34 (30)            |                      |
| Very satisfied                                                                                   | 35 (41)                                                                 | 48 (42)            |                      |
| Completely satisfied                                                                             | 20 (24)                                                                 | 19 (17)            |                      |
| Belonged to religion/denomination at 2-year follow-up (n=205)                                    |                                                                         |                    |                      |
| No                                                                                               | 52 (60)                                                                 | 77 (65)            | 0.42                 |

|                                                                       |         |          |      |
|-----------------------------------------------------------------------|---------|----------|------|
| Yes                                                                   | 35 (40) | 41 (35)  |      |
| Belonged to Christian religion at 2-year follow-up (n=203)            |         |          |      |
| No                                                                    | 55 (63) | 82 (71)  | 0.26 |
| Yes                                                                   | 32 (37) | 34 (29)  |      |
| Duration of being part of a religion at 2-year follow-up (n=205)      |         |          |      |
| Not religious                                                         | 52 (60) | 77 (65)  | 0.55 |
| All of the mother's life                                              | 22 (25) | 29 (25)  |      |
| Less than mother's lifetime                                           | 13 (15) | 12 (10)  |      |
| Frequency of attending religious services at 2-year follow-up (n=205) |         |          |      |
| Not religious                                                         | 52 (60) | 77 (65)  | 0.71 |
| Daily to monthly                                                      | 17 (20) | 19 (16)  |      |
| Not often or never                                                    | 18 (21) | 22 (19)  |      |
| Belongs to a church at 9-month follow-up (n=203)                      |         |          |      |
| No                                                                    | 74 (86) | 97 (83)  | 0.54 |
| Yes                                                                   | 12 (14) | 20 (17)  |      |
| Mother had partner at 9-month follow-up (n=203)                       |         |          |      |
| No                                                                    | 10 (12) | 17 (15)  | 0.55 |
| Yes                                                                   | 76 (88) | 100 (85) |      |
| Had family doctor or GP before becoming pregnant (n=206)              |         |          |      |
| No                                                                    | 11 (13) | 9 (8)    | 0.22 |
| Yes                                                                   | 76 (87) | 110 (92) |      |

GP=General Practitioner; HPV=Human Papillomavirus; NZDep2013=2013 New Zealand Deprivation Index

\* Percentages may not add up to 100% due to rounding

† Chi squared test

**Table 10A: Child factors potentially associated with maternal HPV vaccination intentions for Māori BOYS (unadjusted analysis)**

| Variable                                                                                  | Whether mothers have decided to vaccinate sons against HPV (n=185) |                    | P-value <sup>†</sup> |
|-------------------------------------------------------------------------------------------|--------------------------------------------------------------------|--------------------|----------------------|
|                                                                                           | Will vaccinate (n=67)                                              | Undecided (n=118)  |                      |
|                                                                                           | n (%) <sup>*</sup>                                                 | n (%) <sup>*</sup> |                      |
| Child needed to see GP/doctor 12 months prior to 54-month follow, but not able to (n=185) |                                                                    |                    |                      |
| Yes                                                                                       | 6 (9)                                                              | 12 (10)            | 0.79                 |
| No                                                                                        | 61 (91)                                                            | 106 (90)           |                      |
| Child received immunisations (full or partial) due at age 4 years (n=185)                 |                                                                    |                    |                      |
| No                                                                                        | 8 (12)                                                             | 20 (17)            | 0.36                 |
| Yes                                                                                       | 59 (88)                                                            | 98 (83)            |                      |
| Child mostly saw regular doctor when sick (2-year follow-up) (n=182)                      |                                                                    |                    |                      |
| No                                                                                        | 15 (23)                                                            | 31 (26)            | 0.67                 |
| Yes                                                                                       | 49 (77)                                                            | 87 (74)            |                      |
| Child received all doses of the 6-week, 3-month and 5-month immunisations (n=183)         |                                                                    |                    |                      |
| Yes (all doses given)                                                                     | 60 (91)                                                            | 100 (85)           | 0.29                 |
| No (all doses not given)                                                                  | 6 (9)                                                              | 17 (15)            |                      |
| Child received all doses of the 6-week, 3-month and 5-month immunisations on time (n=183) |                                                                    |                    |                      |
| Yes (all doses given on time)                                                             | 46 (70)                                                            | 72 (62)            | 0.27                 |
| No (not all doses given on time)                                                          | 20 (30)                                                            | 45 (38)            |                      |

GP=General Practitioner; HPV=Human Papillomavirus

\* Percentages may not add up to 100% due to rounding

† Chi squared test

**Table 10B: Maternal factors potentially associated with maternal HPV vaccination intentions for Māori BOYS (unadjusted analysis)**

| Variable                                                                                         | Whether mothers have decided to vaccinate sons against HPV (n=185) |                    | P-value <sup>†</sup> |
|--------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|--------------------|----------------------|
|                                                                                                  | Will vaccinate (n=67)                                              | Undecided (n=118)  |                      |
|                                                                                                  | n (%) <sup>*</sup>                                                 | n (%) <sup>*</sup> |                      |
| Parity (n=183)                                                                                   |                                                                    |                    |                      |
| First-born                                                                                       | 15 (23)                                                            | 46 (39)            | 0.03                 |
| Subsequent child                                                                                 | 50 (77)                                                            | 72 (61)            |                      |
| Mother was born in New Zealand (n=183)                                                           |                                                                    |                    |                      |
| No                                                                                               | 5 (8)                                                              | 10 (8)             | 0.85                 |
| Yes                                                                                              | 60 (92)                                                            | 108 (92)           |                      |
| Socioeconomic deprivation (NZDep2013) (n=185)                                                    |                                                                    |                    |                      |
| Low (deciles 1-3)                                                                                | 11 (16)                                                            | 16 (14)            | 0.26                 |
| Moderate (deciles 4-7)                                                                           | 15 (22)                                                            | 40 (34)            |                      |
| High (deciles 8-10)                                                                              | 41 (61)                                                            | 62 (53)            |                      |
| Maternal age at 8-year follow-up (n=185)                                                         |                                                                    |                    |                      |
| Less than 35 years                                                                               | 23 (34)                                                            | 42 (36)            | 0.80                 |
| 35 to 39 years                                                                                   | 14 (21)                                                            | 31 (26)            |                      |
| 40 to 44 years                                                                                   | 18 (27)                                                            | 27 (23)            |                      |
| 45 years or over                                                                                 | 12 (18)                                                            | 18 (15)            |                      |
| Mother's highest education qualification (antenatal and 72-month follow-up) (n=180)              |                                                                    |                    |                      |
| Less than a bachelor's degree                                                                    | 49 (77)                                                            | 73 (63)            | 0.06                 |
| Bachelor's degree or higher                                                                      | 15 (23)                                                            | 43 (37)            |                      |
| Mother had partner at 54-month follow-up (n=184)                                                 |                                                                    |                    |                      |
| No                                                                                               | 18 (27)                                                            | 18 (15)            | 0.05                 |
| Yes                                                                                              | 48 (73)                                                            | 100 (85)           |                      |
| Mother had partner at 2-year follow-up (n=183)                                                   |                                                                    |                    |                      |
| No                                                                                               | 11 (17)                                                            | 15 (13)            | 0.44                 |
| Yes                                                                                              | 54 (83)                                                            | 103 (87)           |                      |
| Takes child to same GP or GP practice at 2-year follow-up as when child was 9 months old (n=176) |                                                                    |                    |                      |
| No                                                                                               | 12 (19)                                                            | 17 (15)            | 0.54                 |
| Yes                                                                                              | 52 (81)                                                            | 95 (85)            |                      |
| Satisfaction with child's usual GP at 2-year follow-up (n=176)                                   |                                                                    |                    |                      |
| Less than satisfied                                                                              | 5 (8)                                                              | 11 (10)            | 0.60                 |
| Fairly satisfied                                                                                 | 16 (25)                                                            | 37 (33)            |                      |
| Very satisfied                                                                                   | 23 (36)                                                            | 32 (29)            |                      |
| Completely satisfied                                                                             | 20 (31)                                                            | 32 (29)            |                      |

|                                                                       |         |          |      |
|-----------------------------------------------------------------------|---------|----------|------|
| Belonged to religion/denomination at 2-year follow-up (n=183)         |         |          |      |
| No                                                                    | 35 (54) | 70 (59)  | 0.47 |
| Yes                                                                   | 30 (46) | 48 (41)  |      |
| Belonged to Christian religion at 2-year follow-up (n=183)            |         |          |      |
| No                                                                    | 36 (55) | 76 (64)  | 0.23 |
| Yes                                                                   | 29 (45) | 42 (36)  |      |
| Duration of being part of a religion at 2-year follow-up (n=183)      |         |          |      |
| Not religious                                                         | 35 (54) | 70 (59)  | 0.72 |
| All of the mother's life                                              | 22 (34) | 37 (31)  |      |
| Less than mother's lifetime                                           | 8 (12)  | 11 (9)   |      |
| Frequency of attending religious services at 2-year follow-up (n=183) |         |          |      |
| Not religious                                                         | 35 (54) | 70 (59)  | 0.56 |
| Daily to monthly                                                      | 14 (22) | 18 (15)  |      |
| Not often or never                                                    | 16 (25) | 30 (25)  |      |
| Belongs to a church at 9-month follow-up (n=182)                      |         |          |      |
| No                                                                    | 52 (80) | 100 (85) | 0.34 |
| Yes                                                                   | 13 (20) | 17 (15)  |      |
| Mother had partner at 9-month follow-up (n=181)                       |         |          |      |
| No                                                                    | 11 (17) | 14 (12)  | 0.36 |
| Yes                                                                   | 54 (83) | 102 (88) |      |

GP=General Practitioner; HPV=Human Papillomavirus; NZDep2013=2013 New Zealand Deprivation Index

\* Percentages may not add up to 100% due to rounding

† Chi squared test

**Table 11: Multivariable analysis of factors associated with maternal HPV vaccination intentions for girls and boys of Māori ethnicity**

| Variable                                                                    | Mother is undecided regarding HPV vaccination of daughter/son |          |                          |          |
|-----------------------------------------------------------------------------|---------------------------------------------------------------|----------|--------------------------|----------|
|                                                                             | Māori girls (n=199)                                           |          | Māori boys (n=180)       |          |
|                                                                             | Adjusted OR<br>(95% CI)*                                      | P-value* | Adjusted OR<br>(95% CI)† | P-value† |
| Child mostly saw regular doctor when sick (2-year follow-up)                |                                                               |          |                          |          |
| No                                                                          | Reference                                                     |          | N/A                      | N/A      |
| Yes                                                                         | 1.67 (0.92-3.02)                                              | 0.09     | N/A                      |          |
| Parity                                                                      |                                                               |          |                          |          |
| First-born                                                                  | 1.62 (0.90-2.92)                                              | 0.11     | 1.79 (0.88-3.64)         | 0.11     |
| Subsequent child                                                            | Reference                                                     |          | Reference                |          |
| Mother's highest education qualification (antenatal and 72-month follow-up) |                                                               |          |                          |          |
| Less than a bachelor's degree                                               | 1.81 (0.97-3.40)                                              | 0.06     | 0.63 (0.31-1.30)         | 0.21     |
| Bachelor's degree or higher                                                 | Reference                                                     |          | Reference                |          |
| Mother had partner at 54-month follow-up                                    |                                                               |          |                          |          |
| No                                                                          | N/A                                                           | N/A      | 0.61 (0.28-1.31)         | 0.20     |
| Yes                                                                         | N/A                                                           |          | Reference                |          |

CI=Confidence Interval; HPV=Human Papillomavirus; N/A= Not Applicable; OR=Odds Ratio

\* Logistic regression models with mothers who have decided to vaccinate GIRLS of Māori ethnicity against HPV as the reference group

† Logistic regression models with mothers who have decided to vaccinate BOYS of Māori ethnicity against HPV as the reference group

## **Maternal HPV vaccination intentions for girls and boys of Pacific ethnicity**

### ***Girls of Pacific ethnicity***

In the unadjusted analysis, maternal HPV vaccination intentions for girls of Pacific ethnicity were associated with the child's uptake of immunisations (full or partial) due at age 4 years and the mother's partner status at the 9-month follow-up, but not with other child and maternal factors (**Table 12A** and **Table 12B**). Compared with mothers who had decided to vaccinate Pacific girls against HPV, a larger proportion of mothers who were undecided about HPV vaccination had daughters of Pacific ethnicity who had not received immunisations (full or partial) due at age 4 years (19% vs 7%). In addition, a smaller proportion of mothers who were undecided about HPV vaccination for Pacific girls had a partner at the 9-month follow-up compared with mothers who had decided to vaccinate Pacific girls against HPV (76% vs 90%). Nevertheless, none of the factors examined in the multivariable analysis were associated with maternal HPV vaccination intentions for girls of Pacific ethnicity (**Table 14**).

### ***Boys of Pacific ethnicity***

In the unadjusted analysis, maternal HPV vaccination intentions for boys of Pacific ethnicity were associated with belonging to a Christian religion at the 2-year follow-up, but not with other child and maternal factors (**Table 13A** and **Table 13B**). Compared with mothers who had decided to vaccinate Pacific boys against HPV, a smaller proportion of mothers who were undecided about HPV vaccination for Pacific boys belonged to a Christian religion at the 2-year follow-up (62% vs 77%). However, none of the factors examined in the multivariable analysis were associated with maternal HPV vaccination intentions for girls of Pacific ethnicity (**Table 14**).

**Table 12A: Child factors potentially associated with maternal HPV vaccination intentions for Pacific GIRLS (unadjusted analysis)**

| Variable                                                                                  | Whether mothers have decided to vaccinate daughters against HPV (n=152) |                    | P-value <sup>†</sup> |
|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|--------------------|----------------------|
|                                                                                           | Will vaccinate (n=69)                                                   | Undecided (n=82)   |                      |
|                                                                                           | n (%) <sup>*</sup>                                                      | n (%) <sup>*</sup> |                      |
| Child needed to see GP/doctor 12 months prior to 54-month follow, but not able to (n=152) |                                                                         |                    |                      |
| Yes                                                                                       | 5 (7)                                                                   | 7 (8)              | 0.79                 |
| No                                                                                        | 64 (93)                                                                 | 76 (92)            |                      |
| Child received immunisations (full or partial) due at age 4 years (n=150)                 |                                                                         |                    |                      |
| No                                                                                        | 5 (7)                                                                   | 15 (19)            | 0.04                 |
| Yes                                                                                       | 64 (93)                                                                 | 66 (81)            |                      |
| Child mostly saw regular doctor when sick (2-year follow-up) (n=146)                      |                                                                         |                    |                      |
| No                                                                                        | 19 (29)                                                                 | 18 (22)            | 0.33                 |
| Yes                                                                                       | 46 (71)                                                                 | 63 (78)            |                      |
| Child received all doses of the 6-week, 3-month and 5-month immunisations on time (n=150) |                                                                         |                    |                      |
| Yes (all doses given on time)                                                             | 49 (72)                                                                 | 53 (65)            | 0.33                 |
| No (all doses not given on time)                                                          | 19 (28)                                                                 | 29 (35)            |                      |

GP=General Practitioner; HPV=Human Papillomavirus

\* Percentages may not add up to 100% due to rounding

† Chi square test

**Table 12B: Maternal factors potentially associated with maternal HPV vaccination intentions for Pacific GIRLS (unadjusted analysis)**

| Variable                                                                                         | Whether mothers have decided to vaccinate daughters against HPV (n=152) |                    | P-value <sup>†</sup> |
|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|--------------------|----------------------|
|                                                                                                  | Will vaccinate (n=69)                                                   | Undecided (n=82)   |                      |
|                                                                                                  | n (%) <sup>*</sup>                                                      | n (%) <sup>*</sup> |                      |
| Parity (n=150)                                                                                   |                                                                         |                    |                      |
| First-born                                                                                       | 22 (32)                                                                 | 31 (38)            | 0.42                 |
| Subsequent child                                                                                 | 47 (68)                                                                 | 50 (62)            |                      |
| Mother was born in New Zealand (n=150)                                                           |                                                                         |                    |                      |
| No                                                                                               | 30 (43)                                                                 | 34 (42)            | 0.85                 |
| Yes                                                                                              | 39 (57)                                                                 | 47 (58)            |                      |
| Socioeconomic deprivation (NZDep2013) (n=151)                                                    |                                                                         |                    |                      |
| Low (deciles 1-3)                                                                                | 9 (13)                                                                  | 7 (9)              | 0.07                 |
| Moderate (deciles 4-7)                                                                           | 23 (33)                                                                 | 16 (20)            |                      |
| High (deciles 8-10)                                                                              | 37 (54)                                                                 | 59 (72)            |                      |
| Maternal age at 8-year follow-up (n=151)                                                         |                                                                         |                    |                      |
| Less than 35 years                                                                               | 21 (30)                                                                 | 36 (44)            | 0.28                 |
| 35 to 39 years                                                                                   | 21 (30)                                                                 | 20 (24)            |                      |
| 40 to 44 years                                                                                   | 20 (29)                                                                 | 16 (20)            |                      |
| 45 years or over                                                                                 | 7 (10)                                                                  | 10 (12)            |                      |
| Mother's highest education qualification (antenatal and 72-month follow-up) (n=147)              |                                                                         |                    |                      |
| Less than a bachelor's degree                                                                    | 55 (81)                                                                 | 67 (85)            | 0.53                 |
| Bachelor's degree or higher                                                                      | 13 (19)                                                                 | 12 (15)            |                      |
| Mother had partner at 54-month follow-up (n=151)                                                 |                                                                         |                    |                      |
| No                                                                                               | 8 (12)                                                                  | 18 (22)            | 0.09                 |
| Yes                                                                                              | 61 (88)                                                                 | 64 (78)            |                      |
| Mother had partner at 2-year follow-up (n=145)                                                   |                                                                         |                    |                      |
| No                                                                                               | 9 (14)                                                                  | 15 (19)            | 0.43                 |
| Yes                                                                                              | 56 (86)                                                                 | 65 (81)            |                      |
| Takes child to same GP or GP practice at 2-year follow-up as when child was 9 months old (n=143) |                                                                         |                    |                      |
| No                                                                                               | 7 (11)                                                                  | 6 (8)              | 0.49                 |
| Yes                                                                                              | 57 (89)                                                                 | 73 (92)            |                      |
| Belonged to religion/denomination at 2-year follow-up (n=145)                                    |                                                                         |                    |                      |
| No                                                                                               | 16 (25)                                                                 | 18 (23)            | 0.77                 |
| Yes                                                                                              | 49 (75)                                                                 | 62 (78)            |                      |
| Belonged to Christian religion at 2-year follow-up (n=145)                                       |                                                                         |                    |                      |

|                                                                       |         |         |      |
|-----------------------------------------------------------------------|---------|---------|------|
| No                                                                    | 18 (28) | 19 (24) | 0.59 |
| Yes                                                                   | 47 (72) | 61 (76) |      |
| Duration of being part of a religion at 2-year follow-up (n=145)      |         |         |      |
| Not religious                                                         | 16 (25) | 18 (23) | 0.54 |
| All of the mother's life                                              | 37 (57) | 41 (51) |      |
| Less than mother's lifetime                                           | 12 (18) | 21 (26) |      |
| Frequency of attending religious services at 2-year follow-up (n=145) |         |         |      |
| Not religious                                                         | 16 (25) | 18 (23) | 0.92 |
| Daily to monthly                                                      | 36 (55) | 44 (55) |      |
| Not often or never                                                    | 13 (20) | 18 (23) |      |
| Belongs to a church at 9-month follow-up (n=145)                      |         |         |      |
| No                                                                    | 30 (45) | 41 (53) | 0.35 |
| Yes                                                                   | 37 (55) | 37 (47) |      |
| Mother had partner at 9-month follow-up (n=145)                       |         |         |      |
| No                                                                    | 7 (10)  | 19 (24) | 0.03 |
| Yes                                                                   | 60 (90) | 59 (76) |      |
| Had family doctor or GP before becoming pregnant (n=150)              |         |         |      |
| No                                                                    | 9 (13)  | 5 (6)   | 0.15 |
| Yes                                                                   | 60 (87) | 76 (94) |      |

GP=General Practitioner; HPV=Human Papillomavirus; NZDep2013=2013 New Zealand Deprivation Index

\* Percentages may not add up to 100% due to rounding

† Chi square test

**Table 13A: Child factors potentially associated with maternal HPV vaccination intentions for Pacific BOYS (unadjusted analysis)**

| Variable                                                                                  | Whether mothers have decided to vaccinate sons against HPV (n=163) |                    | P-value <sup>†</sup> |
|-------------------------------------------------------------------------------------------|--------------------------------------------------------------------|--------------------|----------------------|
|                                                                                           | Will vaccinate (n=83)                                              | Undecided (n=80)   |                      |
|                                                                                           | n (%) <sup>*</sup>                                                 | n (%) <sup>*</sup> |                      |
| Child needed to see GP/doctor 12 months prior to 54-month follow, but not able to (n=163) |                                                                    |                    |                      |
| Yes                                                                                       | 8 (10)                                                             | 7 (9)              | 0.84                 |
| No                                                                                        | 75 (90)                                                            | 73 (91)            |                      |
| Child received immunisations (full or partial) due at age 4 years (n=163)                 |                                                                    |                    |                      |
| No                                                                                        | 7 (8)                                                              | 8 (10)             | 0.73                 |
| Yes                                                                                       | 76 (92)                                                            | 72 (90)            |                      |
| Child mostly saw regular doctor when sick (2-year follow-up) (n=160)                      |                                                                    |                    |                      |
| No                                                                                        | 25 (30)                                                            | 26 (33)            | 0.70                 |
| Yes                                                                                       | 57 (70)                                                            | 52 (67)            |                      |
| Child received all doses of the 6-week, 3-month and 5-month immunisations (n=158)         |                                                                    |                    |                      |
| Yes (all doses given)                                                                     | 72 (89)                                                            | 68 (88)            | 0.91                 |
| No (all doses not given)                                                                  | 9 (11)                                                             | 9 (12)             |                      |
| Child received all doses of the 6-week, 3-month and 5-month immunisations on time (n=158) |                                                                    |                    |                      |
| Yes (all doses given on time)                                                             | 55 (68)                                                            | 55 (71)            | 0.63                 |
| No (all doses not given on time)                                                          | 26 (32)                                                            | 22 (29)            |                      |

GP=General Practitioner; HPV=Human Papillomavirus

\* Percentages may not add up to 100% due to rounding

† Chi squared test

**Table 13B: Maternal factors potentially associated with maternal HPV vaccination intentions for Pacific BOYS (unadjusted analysis)**

| Variable                                                                            | Whether mothers have decided to vaccinate sons against HPV (n=163) |                    | P-value <sup>†</sup> |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------|--------------------|----------------------|
|                                                                                     | Will vaccinate (n=83)                                              | Undecided (n=80)   |                      |
|                                                                                     | n (%) <sup>*</sup>                                                 | n (%) <sup>*</sup> |                      |
| Parity (n=163)                                                                      |                                                                    |                    |                      |
| First-born                                                                          | 26 (31)                                                            | 21 (26)            | 0.48                 |
| Subsequent child                                                                    | 57 (69)                                                            | 59 (74)            |                      |
| Mother was born in New Zealand (n=163)                                              |                                                                    |                    |                      |
| No                                                                                  | 33 (40)                                                            | 25 (31)            | 0.26                 |
| Yes                                                                                 | 50 (60)                                                            | 55 (69)            |                      |
| Socioeconomic deprivation (NZDep2013) (n=161)                                       |                                                                    |                    |                      |
| Low (deciles 1-3)                                                                   | 6 (7)                                                              | 9 (11)             | 0.10                 |
| Moderate (deciles 4-7)                                                              | 11 (14)                                                            | 20 (25)            |                      |
| High (deciles 8-10)                                                                 | 64 (79)                                                            | 51 (64)            |                      |
| Maternal age at 8-year follow-up (n=162)                                            |                                                                    |                    |                      |
| Less than 35 years                                                                  | 34 (41)                                                            | 24 (30)            | 0.13                 |
| 35 to 39 years                                                                      | 18 (22)                                                            | 29 (36)            |                      |
| 40 to 44 years                                                                      | 21 (26)                                                            | 15 (19)            |                      |
| 45 years or over                                                                    | 9 (11)                                                             | 12 (15)            |                      |
| Mother's highest education qualification (antenatal and 72-month follow-up) (n=159) |                                                                    |                    |                      |
| Less than a bachelor's degree                                                       | 64 (78)                                                            | 55 (71)            | 0.34                 |
| Bachelor's degree or higher                                                         | 18 (22)                                                            | 22 (29)            |                      |
| Mother had partner at 54-month follow-up (n=163)                                    |                                                                    |                    |                      |
| No                                                                                  | 14 (17)                                                            | 12 (15)            | 0.75                 |
| Yes                                                                                 | 69 (83)                                                            | 68 (85)            |                      |
| Mother had partner at 2-year follow-up (n=160)                                      |                                                                    |                    |                      |
| No                                                                                  | 15 (18)                                                            | 14 (18)            | 0.96                 |
| Yes                                                                                 | 67 (82)                                                            | 64 (82)            |                      |
| Satisfaction with child's usual GP at 2-year follow-up (n=155)                      |                                                                    |                    |                      |
| Less than satisfied                                                                 | 12 (15)                                                            | 5 (7)              | 0.27                 |
| Fairly satisfied                                                                    | 25 (31)                                                            | 20 (27)            |                      |
| Very satisfied                                                                      | 23 (29)                                                            | 25 (33)            |                      |
| Completely satisfied                                                                | 20 (25)                                                            | 25 (33)            |                      |
| Belonged to religion/denomination at 2-year follow-up (n=159)                       |                                                                    |                    |                      |
| No                                                                                  | 18 (22)                                                            | 25 (32)            | 0.14                 |
| Yes                                                                                 | 64 (78)                                                            | 52 (68)            |                      |

|                                                                       |         |         |      |
|-----------------------------------------------------------------------|---------|---------|------|
| Belonged to Christian religion at 2-year follow-up (n=158)            |         |         |      |
| No                                                                    | 19 (23) | 29 (38) | 0.04 |
| Yes                                                                   | 63 (77) | 47 (62) |      |
| Duration of being part of a religion at 2-year follow-up (n=159)      |         |         |      |
| Not religious                                                         | 18 (22) | 25 (32) | 0.33 |
| All of the mother's life                                              | 44 (54) | 36 (47) |      |
| Less than mother's lifetime                                           | 20 (24) | 16 (21) |      |
| Frequency of attending religious services at 2-year follow-up (n=159) |         |         |      |
| Not religious                                                         | 18 (22) | 25 (32) | 0.32 |
| Daily to monthly                                                      | 49 (60) | 39 (51) |      |
| Not often or never                                                    | 15 (18) | 13 (17) |      |
| Belongs to a church at 9-month follow-up (n=155)                      |         |         |      |
| No                                                                    | 28 (35) | 34 (46) | 0.15 |
| Yes                                                                   | 53 (65) | 40 (54) |      |
| Mother had partner at 9-month follow-up (n=155)                       |         |         |      |
| No                                                                    | 12 (15) | 11 (15) | 0.99 |
| Yes                                                                   | 69 (85) | 63 (85) |      |

GP=General Practitioner; HPV=Human Papillomavirus; NZDep2013=2013 New Zealand Deprivation Index

\* Percentages may not add up to 100% due to rounding

† Chi squared test

**Table 14: Multivariable analysis of factors associated with maternal HPV vaccination intentions for girls and boys of Pacific ethnicity**

| Variable                                                          | Mother is undecided regarding HPV vaccination of daughter/son |          |                          |          |
|-------------------------------------------------------------------|---------------------------------------------------------------|----------|--------------------------|----------|
|                                                                   | Pacific girls (n=142)                                         |          | Pacific boys (n=155)     |          |
|                                                                   | Adjusted OR<br>(95% CI)*                                      | P-value* | Adjusted OR<br>(95% CI)† | P-value† |
| Child received immunisations (full or partial) due at age 4 years |                                                               |          |                          |          |
| No                                                                | 2.73 (0.91-8.23)                                              | 0.07     | N/A                      | N/A      |
| Yes                                                               | Reference                                                     |          | N/A                      |          |
| Socioeconomic deprivation (NZDep2013)                             |                                                               |          |                          |          |
| Low (deciles 1-3)                                                 | Reference                                                     |          | Reference                |          |
| Moderate (deciles 4-7)                                            | 1.11 (0.33-3.74)                                              | 0.87     | 1.25 (0.33-4.73)         | 0.74     |
| High (deciles 8-10)                                               | 1.78 (0.59-5.37)                                              | 0.31     | 0.56 (0.18-1.82)         | 0.34     |
| Mother had partner at 9-month follow-up                           |                                                               |          |                          |          |
| No                                                                | 2.62 (1.00-6.88)                                              | 0.05     | N/A                      | N/A      |
| Yes                                                               | Reference                                                     |          | N/A                      |          |
| Maternal age at 8-year follow-up                                  |                                                               |          |                          |          |
| Less than 35 years                                                | N/A                                                           | N/A      | 0.49 (0.17-1.42)         | 0.19     |
| 35 to 39 years                                                    | N/A                                                           |          | 1.41 (0.47-4.22)         | 0.54     |
| 40 to 44 years                                                    | N/A                                                           |          | 0.43 (0.14-1.36)         | 0.15     |
| 45 years or over                                                  | N/A                                                           |          | Reference                |          |
| Belonged to Christian religion at 2-year follow-up                |                                                               |          |                          |          |
| No                                                                | N/A                                                           | N/A      | Reference                |          |
| Yes                                                               | N/A                                                           |          | 0.49 (0.23-1.02)         | 0.06     |

CI=Confidence Interval; HPV=Human Papillomavirus; NZDep2013=2013 New Zealand Deprivation Index; N/A= Not Applicable; OR=Odds Ratio

\* Logistic regression models with mothers who have decided to vaccinate GIRLS of Pacific ethnicity against HPV as the reference group

† Logistic regression models with mothers who have decided to vaccinate BOYS of Pacific ethnicity against HPV as the reference group

# Discussion

## Statement of principal findings

The maternal intentions for HPV vaccination of their 8-year-old children differed significantly by their child's sex, with the proportion of mothers who stated they would vaccinate their 8-year-olds against HPV being higher for girls than boys, whereas the proportion of mothers who were undecided about HPV vaccination was higher for boys than girls.

For girls, maternal responses regarding HPV vaccination intentions differed by their daughter's ethnic group. Maternal age and maternal status at the 72-month follow-up and belonging to a church at the 9-month follow-up were associated with HPV vaccination intentions for girls but maternal parity, country of birth and area-level socioeconomic deprivation were not.

For boys, maternal responses regarding HPV vaccination intentions differed by their son's ethnic group. Maternal parity, country of birth, education status at the 72-month follow-up, and frequency of maternal attendance at religious services at the 2-year follow-up were associated with HPV vaccination intentions for boys, but area-level socioeconomic deprivation was not.

For girls but not for boys, maternal responses regarding HPV vaccination intentions differed significantly by their daughter's access to healthcare prior to the 2-year follow-up, but not for the 12 months prior to the 54-month follow-up.

For girls and boys, maternal HPV vaccination intentions differed significantly by their child uptake and timing of all doses of primary infant immunisation series and uptake of immunisations (full or partial) due at age 15 months and age 4 years.

# Limitations and future directions

## Strengths and weaknesses of the study

This project was completed within a cohort study in which many research constructs were considered. The cohort study was not designed to be specifically about HPV immunisation, nor more generally about immunisation. This decreased the potential for immunisation-related biases in terms of participation in the cohort or in responses to the questions asked about immunisation and specifically about HPV intentions. However, it has limited the scope of the investigation reported here.

Of note, no further questions on HPV vaccines were asked, including why mothers were for, against or undecided about HPV vaccination for 8-year-old girls or boys. Factors that have been identified in studies in the US and Europe include parental perceptions that they lack information about the vaccine, safety concerns about the vaccine, mistrust of health authorities and health workers and of new vaccines, concerns about the potential impact of the vaccine on their child's sexual behaviours, a perceived low risk of HPV infection, social influences and access to healthcare.<sup>14,30,31</sup> Parents consistently cite healthcare professional recommendations as one of the most important factors in parental decision making regarding their child receiving the HPV vaccine.<sup>30</sup>

The study was limited by its sample size. This resulted in us being unable to make all the comparisons intended in the stratified analyses.

Multiple comparisons were made, in part because the outcome variable had four categories. This increases the potential risk of type 1 errors (false positive results).

The analytical sample included 4,448 children, with the cohort size at enrolment being 6,853 children. In comparison with the children who participated in the eight-year data-collection-wave, the children who did not participate in this data-collection-wave had mothers who were younger, had lower educational status, identified with an ethnic group other than European and were more likely to live in areas of high deprivation. Missing data will also have introduced bias, however we minimised the effect of this by only including variables with small amounts of missing data.

The demographic differences between the cohort at enrolment compared with those cohort members included in the analytical sample results in bias, although none related to child sex.

As a result of the smaller proportion of mothers whose daughters were of Māori or Pacific ethnicity in the analytical sample, it is likely that the proportion of mothers of daughters in the complete cohort who were undecided about HPV vaccination and the proportion who had not heard about the HPV vaccine would

have been larger; and the proportion of mothers who had decided not to vaccinate their daughters would have been smaller.

As a result of the smaller proportion of mothers whose sons were of Pacific ethnicity in the analytical sample, it is likely that the proportion of mothers of sons in the complete cohort who had decided not to vaccinate their sons against HPV and the proportion who were undecided about HPV vaccination would have been smaller.

As a result of the smaller proportion of mothers whose sons were of Māori ethnicity in the analytical sample, it is likely that the proportion of mothers of sons in the complete cohort who had not heard about the HPV vaccine would have been larger.

## **Findings from this study in relation to other studies**

This study of maternal intentions sought these at a younger child age than published studies from other countries and well before the scheduled age of HPV vaccine receipt in New Zealand of 11 to 12 years.<sup>32</sup> In this context, the findings about vaccination intentions for the population being studied are not influenced by some of the children having already received HPV vaccine. In such a scenario, parental intentions can be about their intent for their child to complete the HPV vaccine series rather than to initiate it. Intentions for these two actions are not necessarily the same.<sup>14</sup>

### ***Mothers who had decided not to vaccinate girls against HPV compared with mothers who had decided to vaccinate girls against HPV***

Mothers whose daughters were of Māori or Pacific ethnicity or whose sons were of Pacific ethnicity were less likely to have decided not to vaccinate their daughters against HPV. These intentions are consistent with earlier data on vaccination intentions from this cohort, which showed that maternal Pacific ethnicity was associated with increased odds of intending full infant vaccination.<sup>18</sup>

For mothers of both daughters and sons, receipt of previous scheduled vaccines was associated with the intentions for their child to receive the HPV vaccine. Thus, while there are HPV-specific factors associated with parental intent, there are also more general vaccine-related determinants which also apply to HPV vaccine. It is important to consider the delivery of the childhood vaccine series as an integrated component of care rather than considering each vaccine and vaccine preventable disease separately. Numerous previous examples of this exist, for example the impact of concerns about MMR vaccine on the update of other components of childhood immunisation schedules.<sup>33</sup>

Lower maternal education status was associated with increased odds of having decided not to vaccinate daughters or sons. The maternal education – HPV vaccine intention relationship differs between countries. The associations seen in

this study are consistent with findings reported from the US.<sup>34</sup> In contrast, in Canada and Norway, higher maternal education has been shown to be associated with a decreased odds of initiating HPV vaccination for daughters.<sup>35,36</sup>

Parental religious beliefs appear to have stronger relationships with intentions for HPV vaccine relative to other vaccines in the childhood schedule. Some religious practices are associated with an increased likelihood of perceptions of non-severity of 'childhood' diseases, fear of vaccine side-effects, and the need for more information about the risk of vaccination.<sup>37</sup> In addition, some religious practices are associated specifically with negative perceptions about the HPV vaccine because of sexual behaviour-related concerns.<sup>38</sup> The relationship with religion is complex through, with for example negative associations between Christian non-Catholic religions and intentions for HPV vaccination in Argentina,<sup>38</sup> but parents with a Catholic religious faith being more likely than non-religious parents to have their daughters receive HPV vaccine in the US.<sup>39</sup>

In this study stronger parental religious beliefs were associated with an increased likelihood of having decided to not vaccinate daughters (if they belonged to a church at the 9-month follow-up) and sons (if mothers attended religious services at least monthly at the 2-year follow-up compared with non-religious mothers). More detailed exploration of specific religious associations with HPV vaccination in New Zealand would appear necessary for strategies to be developed to encourage HPV vaccine uptake by children of parents with stronger religious beliefs.

### ***Mothers who were undecided about HPV vaccination for girls compared with mothers who had decided to vaccinate girls against HPV***

Vaccine hesitancy, defined as being undecided about but not necessarily opposed to a vaccine, has been associated with outbreaks of vaccine preventable diseases in several countries in recent decades.<sup>40</sup> Vaccine hesitancy is believed to be one of the strongest reasons for low uptake of the HPV vaccine.<sup>41</sup>

In this cohort, mothers were more likely to be undecided about HPV vaccination for their daughters and sons if they had not received immunisations (full or partial) due at age 15 months; more likely to be undecided for their daughters if they had lower education status and more likely to be undecided for their sons if their son was their first-born child. Mothers whose sons were of Pacific ethnicity were less likely to be undecided about HPV vaccination compared with mothers of non-Māori non-Pacific boys.

Despite vaccine safety surveillance data in the US showing decreasing rates of HPV vaccine-associated adverse events in recent years, rates of parental refusal of HPV vaccine for their children because of safety concerns is increasing.<sup>42</sup> Decreases in uptake of HPV vaccine in several countries in recent years for example Japan (2013),<sup>43</sup> Ireland (2014),<sup>44</sup> Denmark (2015),<sup>45</sup> and Colombia (2015),<sup>46</sup> have been attributed to vaccine safety concerns.

Addressing safety concerns regarding HPV vaccine appears necessary for caregivers to have greater confidence in HPV vaccine.<sup>42</sup> Healthcare provider recommendations for and discussion of HPV vaccine,<sup>47</sup> and increasing public awareness appear to be key to improving uptake of HPV vaccine in children.<sup>48</sup>

### ***Mothers who had not heard about the HPV vaccine compared with mothers who had decided to vaccinate their child against HPV***

Mothers whose daughters were of Pacific ethnicity were more likely to report that they had not heard about the HPV vaccine compared with mothers of non-Māori non-Pacific girls. In addition, the likelihood of mothers stating that they had not heard about the HPV vaccine was greater if their daughters had not received immunisations (full or partial) due at age 15 months. Mothers with lower educational status at the 72-month follow-up were also more likely to report that they had not heard of the HPV vaccine, as were mothers aged under 35 years at the 8-year follow-up compared with mothers aged 45 years or over.

Mothers whose sons were of Māori ethnicity were more likely to report that they had not heard about the HPV vaccine compared with mothers of non-Māori non-Pacific boys, as were mothers whose sons were their first-born children. The likelihood of mothers stating that they had not heard about the HPV vaccine was also greater if their sons had not received immunisations (full or partial) due at age 15 months. In addition, mothers who were not born in New Zealand were more likely to report that they had not heard of the HPV vaccine, as were mothers with lower educational status at the 72-month follow-up.

Some mothers will only have known the HPV vaccine by the brand name Gardasil. This might have affected responses to the HPV intentions questions option 4 "I have never heard of the HPV vaccine". However, the mothers reporting not having heard about the HPV vaccine varied by maternal demographics which may be an indicator of deficits in the currently available resources that parents in New Zealand can access about HPV vaccination for their children. Differences in awareness of HPV and HPV vaccine by ethnic group and English proficiency have been reported from the US.<sup>49</sup>

## **Meaning of the study: possible mechanisms and implications for clinicians or policymakers**

### **Maternal responses regarding HPV vaccination intentions for 8-year-olds**

The overall low percentage of mothers with intentions for their child at age 8 years to receive the HPV vaccine, relative to the HPV vaccine coverage being sought at age 11-12 years, is noteworthy. Parental intentions for childhood vaccinations do not equate with actual receipt of vaccines by children. As shown previously in this cohort, antenatal parental intentions for the 6-week, 3-month, 5-month immunisation series were highest for those women living in the most

deprived quintile of neighbourhoods in New Zealand, but completion of this primary immunisation series was lowest for the children of these women.<sup>50</sup>

Healthcare practice and practitioner characteristics explain much of the variance in immunisation coverage achieved for different primary care practices in New Zealand.<sup>51</sup> The child needing to see the GP/doctor during the 12 months prior to 54-month follow-up but not being able to, was independently associated with increased odds of deciding not to have daughters vaccinated in this study. Thus, variance in healthcare practice, using access as the example primary care characteristic, is associated with parental immunisation intentions.

### ***By child's sex***

Maternal intentions for their 8-year-old child to receive the HPV vaccine differed by their child's sex, being lower for boys than girls but were low for both sexes (boys 32%, girls 41%). A larger proportion of mothers were undecided about HPV vaccination for their sons (50%) than their daughters (43%) but the proportion who were undecided was high for both sexes.

The proportion of mothers of the children in this cohort intending for their child to receive HPV vaccination (36%) was considerably lower than the proportion who had antenatal intentions for their infant to receive all vaccines scheduled during infancy (81%).<sup>18</sup> And the proportion of mothers who were undecided about HPV vaccine was considerably higher than the proportion who had been undecided about the vaccines given during infancy (46% vs 13%).<sup>18</sup>

Initiation and completion of the HPV vaccination series is dependent upon parental intent.<sup>14</sup> The factors that determine intentions to initiate HPV vaccination and intentions to complete HPV vaccination once initiated are not the same.<sup>14</sup>

Lack of parental intent for HPV vaccine to be given to their children is a major current public health concern. The parents of 82,297 adolescents 13 to 17 years old in the US participated in the 2017-2018 National Immunization Survey.<sup>14</sup> In the US, HPV vaccination is recommended at age 11 to 12 years but can start at age nine years.<sup>52</sup> Thirty-seven percent of the children in the survey were unvaccinated and 11% had received only one dose of HPV. The parents of 58% of the unvaccinated adolescents had no intention for their child's HPV vaccination series to be initiated.<sup>14</sup>

In this US study, the most common reason for lack of intent to initiate the vaccine were safety concerns.<sup>14</sup> Having received a recommendation from a healthcare provider was associated with increased odds of parental intent to initiate HPV vaccination.<sup>14</sup> However, while 46% of parents of unvaccinated children had reported receiving a recommendation for HPV vaccination from a healthcare professional, 61% of those who had received this recommendation had no intention to initiate HPV vaccination.<sup>14</sup> Lack of a recommendation from a healthcare provider was the most frequently cited reason for not intending to

complete the HPV vaccination series for those children who had received one dose of HPV vaccine.<sup>14</sup>

## **Unanswered questions and future research**

Internationally, coverage of the HPV vaccination remains low. For example, the US Centers for Disease Control estimated that in 2018 nearly half of the adolescents who were eligible for the HPV vaccination had not completed this vaccine series, and 32% were unvaccinated.<sup>53</sup> Parental vaccination behaviour is the primary focus for vaccine-promoting interventions.<sup>54,55</sup> Data from Europe indicates that the determinants of confidence in HPV vaccine vary between countries and population groups.<sup>31</sup> There is a need to develop context-specific interventions to improve confidence in HPV vaccination and for community specific engagement strategies to be developed.

Actual HPV vaccination uptake is frequently lower than intended uptake.<sup>56</sup> Shared decision making between the child and parent is believed to be important, with discordance in intention between the child and parent believed to result in lower uptake.<sup>57</sup> However, a recently published study from Amsterdam, showed that for Dutch parent-daughter dyads, both the parent and the child intentions were associated with HPV vaccine uptake, whereas for non-Dutch parent-child dyads only the child's intentions were associated with vaccine uptake.<sup>57</sup> Thus, the role of the child needs to be considered in future interventions that seek to improve uptake. It will be important to understand the relative importance of parental and child intentions for parent-son dyads and by ethnic group and parental country of birth.

## Conclusions and recommendations

- The maternal intentions for HPV vaccination of their 8-year-old children differed significantly by their child's sex, with the proportion of mothers who stated they would vaccinate their 8-year-olds against HPV being higher for girls than boys, whereas the proportion of mothers who were undecided about HPV vaccination was higher for boys than girls.
- Mothers whose daughters were of Māori or Pacific ethnicity or whose sons were of Pacific ethnicity were less likely to have decided not to vaccinate their child against HPV.
- While there are HPV specific factors associated with parent intent, there are also more general vaccine-related determinants which also apply to HPV vaccine.
- Addressing safety concerns regarding HPV vaccine appears necessary for caregivers to have greater confidence in HPV vaccine. Healthcare provider recommendations for and discussion of HPV vaccine, and increasing public awareness are key to improving uptake of HPV vaccine in children.
- There appear to be deficits in the currently available resources that parents in New Zealand can access about HPV vaccination for their children.
- Before the birth of their child, parents in New Zealand have high intentions for immunisation of their children with only 2% of future mothers intending that their child will not be immunised. Experiences during childhood of difficulties in accessing primary care for their child are associated with increased odds of parents deciding that their children will not receive the HPV vaccine.

# References

1. World Health Organization. Human papillomavirus vaccines: WHO position paper, May 2017. Geneva: World Health Organization, 2017.
2. Bruni L, Diaz M, Barrionuevo-Rosas L, et al. Global estimates of human papillomavirus vaccination coverage by region and income level: a pooled analysis. *Lancet Glob Health* 2016;4(7):e453-63.
3. Spayne J, Hesketh T. Estimate of global human papillomavirus vaccination coverage: analysis of country-level indicators. *BMJ Open* 2021;11(9):e052016.
4. Anonymous. Guidelines for the management of genital, anal and throat HPV infection in New Zealand. Auckland: Sexually Transmitted Infections Education Foundation, 2017.  
(<https://www.hpv.org.nz/application/files/3415/1555/8255/HPVGuidelines-2017.pdf>).
5. Innes CR, Williman JA, Simcock BJ, et al. Impact of human papillomavirus vaccination on rates of abnormal cervical cytology and histology in young New Zealand women. *New Zealand Medical Journal* 2020;133(1508):72-84. ).
6. Ministry of Health. NCSP Annual Report 2016 Wellington: Ministry of Health, 2019.
7. Australian Government Department of Health. Human papillomavirus (HPV) immunisation service. (<https://www.health.gov.au/health-topics/immunisation/immunisation-services/human-papillomavirus-hpv-immunisation-service>).
8. Government of Canada. Canada's provincial and territorial routine (and catch-up) vaccination routine schedule programs for infants and children.  
(<https://www.canada.ca/en/public-health/services/provincial-territorial-immunization-information/provincial-territorial-routine-vaccination-programs-infants-children.html>).
9. National Health Service. HPV vaccine overview. 2019  
(<https://www.nhs.uk/conditions/vaccinations/who-should-have-hpv-cervical-cancer-cervarix-gardasil-vaccine/>).
10. Centers for Disease Control and Prevention. Vaccinating boys and girls against HPV. (<https://www.cdc.gov/hpv/parents/vaccine.html>).
11. Bruni L, Saura-Lazaro A, Montoliu A, et al. HPV vaccination introduction worldwide and WHO and UNICEF estimates of national HPV immunization coverage 2010-2019. *Prev Med* 2021;144:106399.
12. MacDonald NE, Sage Working Group on Vaccine Hesitancy. Vaccine hesitancy: Definition, scope and determinants. *Vaccine* 2015;33(34):4161-4.
13. Begg N, Nicoll A. Myths in medicine. *Immunisation*. [Review] [35 refs]. 1994;1(6961):1073-5.
14. Sonawane K, Zhu Y, Montealegre JR, et al. Parental intent to initiate and complete the human papillomavirus vaccine series in the USA: a nationwide, cross-sectional survey. *The Lancet Public Health* 2020;21:21.

15. Gilkey MB, Calo WA, Marciniak MW, Brewer NT. Parents who refuse or delay HPV vaccine: Differences in vaccination behavior, beliefs, and clinical communication preferences. *Hum Vaccin Immunother* 2017;13(3):680-686.
16. Sonawane K, Zhu Y, Lin YY, et al. HPV Vaccine Recommendations and Parental Intent. *Pediatrics* 2021;147(3):03.
17. Rose SB, Lawton BA, Lanumata TS, Hibma M, Baker MG. Predictors of intent to vaccinate against HPV/cervical cancer: a multi-ethnic survey of 769 parents in New Zealand. *New Zealand Medical Journal* 2012;125(1350):51-62.
18. Grant CC, Chen MH, Bandara DK, et al. Antenatal immunisation intentions of expectant parents: Relationship to immunisation timeliness during infancy. *Vaccine* 2016;34(11):1379-88.
19. Veerasingam P, Grant CC, Chelimo C, et al. Vaccine Education During Pregnancy and Timeliness of Infant Immunization. *Pediatrics* 2017;140(3)
20. Morton SM, Atatoa Carr PE, Grant CC, et al. Cohort profile: Growing Up in New Zealand. *Int J Epidemiol* 2013;42(1):65-75.
21. Morton SM, Ramke J, Kinloch J, et al. Growing Up in New Zealand cohort alignment with all New Zealand births. *Aust N Z J Public Health* 2015;39(1):82-7.
22. Becker MH. The health belief model and personal health behavior. *Health Educ Monogr* 1974;2:324-473.
23. Janz NK, Becker MH. The Health Belief Model: a decade later. *Health Educ Q* 1984;11(1):1-47.
24. Rosenstock IM. Historical origins of the health belief model. *Health Educ Monogr* 1974;2:328-35.
25. Bennett D, Gilchrist CA, Lee R, et al. Determinants of exclusive breastfeeding for Māori women New Zealand Medical Journal 2022;135(15550):73-87.
26. Durie MH. A Maori perspective of health. *Soc Sci Med* 1985;20(5):483-6.
27. Pitama S, Huria T, Lacey C. Improving Maori health through clinical assessment: Waikare o te Waka o Meihana. 2014;1(1393):107-19.
28. Ministry of Health. Māori health models – Te Wheke Wellington: Ministry of Health, 2018. (<https://www.health.govt.nz/our-work/populations/maori-health/maori-health-models/maori-health-models-te-wheke>).
29. Harmsworth GR, Awatere S. Indigenous Maori Knowledge and Perspectives of Ecosystems. *Conditions and Trends* 2013;2013:274-86.
30. Holman DM, Benard V, Roland KB, Watson M, Liddon N, Stokley S. Barriers to human papillomavirus vaccination among US adolescents: a systematic review of the literature. *Jama, Pediatr* 2014;168(1):76-82.
31. Karafillakis E, Simas C, Jarrett C, et al. HPV vaccination in a context of public mistrust and uncertainty: a systematic literature review of determinants of HPV vaccine hesitancy in Europe. *Hum Vaccin Immunother* 2019;15(7-8):1615-1627.
32. Ministry of Health. Immunisation Handbook. Wellington: Ministry of Health, 2020.
33. Motta M, Stecula D. Quantifying the effect of Wakefield et al. (1998) on skepticism about MMR vaccine safety in the U.S. *PLoS ONE [Electronic Resource]* 2021;16(8):e0256395.

34. Mohammed KA, Vivian E, Loux TM, Arnold LD. Factors Associated With Parents' Intent to Vaccinate Adolescents for Human Papillomavirus: Findings From the 2014 National Immunization Survey-Teen. *Prev Chronic Dis* 2017;14:E45.
35. Ogilvie G, Anderson M, Marra F, et al. A population-based evaluation of a publicly funded, school-based HPV vaccine program in British Columbia, Canada: parental factors associated with HPV vaccine receipt. *PLoS Medicine / Public Library of Science* 2010;7(5):e1000270.
36. Feiring B, Laake I, Molden T, et al. Do parental education and income matter? A nationwide register-based study on HPV vaccine uptake in the school-based immunisation programme in Norway. *BMJ Open* 2015;5(5):e006422.
37. Fournet N, Mollema L, Ruijs WL, et al. Under-vaccinated groups in Europe and their beliefs, attitudes and reasons for non-vaccination; two systematic reviews. *BMC Public Health* 2018;18(1):196.
38. Chaparro RM, Rodriguez B, Maza Y, Moyano D, Hernandez-Vasquez A. Factors associated with hindering the acceptance of HPV vaccination among caregivers - A cross-sectional study in Argentina. *PLoS ONE [Electronic Resource]* 2020;15(3):e0229793.
39. Shelton RC, Snavely AC, De Jesus M, Othus MD, Allen JD. HPV vaccine decision-making and acceptance: does religion play a role? *J Relig Health* 2013;52(4):1120-30.
40. Dube E, Laberge C, Guay M, Bramadat P, Roy R, Bettinger J. Vaccine hesitancy: an overview. *Hum Vaccin Immunother* 2013;9(8):1763-73.
41. Patel PR, Berenson AB. Sources of HPV vaccine hesitancy in parents. *Hum Vaccin Immunother* 2013;9(12):2649-53.
42. Sonawane K, Lin YY, Damgacioglu H, et al. Trends in Human Papillomavirus Vaccine Safety Concerns and Adverse Event Reporting in the United States. *JAMA netw* 2021;4(9):e2124502.
43. Hanley SJ, Yoshioka E, Ito Y, Kishi R. HPV vaccination crisis in Japan. 2015;1(9987):2571.
44. Corcoran B, Clarke A, Barrett T. Rapid response to HPV vaccination crisis in Ireland. *Lancet* 2018;391(10135):2103.
45. Suppli CH, Hansen ND, Rasmussen M, Valentiner-Branth P, Krause TG, Molbak K. Decline in HPV-vaccination uptake in Denmark - the association between HPV-related media coverage and HPV-vaccination. *BMC Public Health* 2018;18(1):1360.
46. Castro CJ. The unbelievable story of the HPV vaccination program in Colombia...from a beautiful dream to a nightmare! *Proc Am Soc Clin Oncol* 2018;4(suppl 2):169s.
47. Oh NL, Biddell CB, Rhodes BE, Brewer NT. Provider communication and HPV vaccine uptake: A meta-analysis and systematic review. *Prev Med* 2021;148:106554.
48. Polonijo AN, Lee SS, Nagpal N, et al. How do patient-provider relationship continuity, gender, and language affect pediatric HPV vaccine acceptance? *Hum Vaccin Immunother* 2021;17(11):4467-4469.

49. Lee HY, Luo Y, Neese J, Daniel C, Hahm HC. The Role of English Proficiency in HPV and HPV Vaccine Awareness: A Cross-Sectional Study Across Race/Ethnicity. *Asian Pacific Journal of Cancer Prevention: Apjcp* 2021;22(2):349-357.
50. Morton SMB, Atatoa Carr PE, Grant CC, et al. Growing Up in New Zealand: A longitudinal study of New Zealand children and their families. Report 2: Now we are born Auckland: Growing Up in New Zealand, 2012.
51. Grant CC, Turner NM, York DG, Goodyear-Smith F, Petousis-Harris HA. Factors associated with immunisation coverage and timeliness in New Zealand. *Br J Gen Pract* 2010;60:180-186.
52. Meites E, Szilagyi PG, Chesson HW, Unger ER, Romero JR, Markowitz LE. Human Papillomavirus Vaccination for Adults: Updated Recommendations of the Advisory Committee on Immunization Practices. *MMWR - Morbidity & Mortality Weekly Report* 2019;68(32):698-702.
53. Walker TY, Elam-Evans LD, Yankey D, et al. National, Regional, State, and Selected Local Area Vaccination Coverage Among Adolescents Aged 13-17 Years - United States, 2018. *MMWR - Morbidity & Mortality Weekly Report* 2019;68(33):718-723.
54. Dempsey AF, Zimet GD, Davis RL, Koutsky L. Factors that are associated with parental acceptance of human papillomavirus vaccines: a randomized intervention study of written information about HPV. *Pediatrics* 2006;117(5):1486-93.
55. Kahn JA, Ding L, Huang B, Zimet GD, Rosenthal SL, Frazier AL. Mothers' intention for their daughters and themselves to receive the human papillomavirus vaccine: a national study of nurses. *Pediatrics* 2009;123(6):1439-45.
56. Alberts CJ, van der Loeff MF, Hazeveld Y, et al. A longitudinal study on determinants of HPV vaccination uptake in parents/guardians from different ethnic backgrounds in Amsterdam, the Netherlands. *BMC Public Health* 2017;17(1):220.
57. Jongen VW, van der Loeff MFS, Boyd A, et al. Human papillomavirus vaccination uptake: a longitudinal study showing ethnic differences in the influence of the intention-to-vaccinate among parent-daughter dyads. *Hum Vaccin Immunother* 2021;17(4):990-999.
58. Salmond C, Crampton P, Atkinson J. NZDep2006 Index of Deprivation. Wellington: Department of Public Health, University of Otago, 2007. (<http://www.uow.otago.ac.nz/academic/dph/research/NZDep/NZDep2006%20research%20report%2004%20September%202007.pdf>).
59. Bartholomew K, Morton SM, Atatoa Carr PE, Bandara DK, Grant CC. Early engagement with a Lead Maternity Carer: Results from Growing Up in New Zealand. *Aust N Z J Obstet Gynaecol* 2015;55(3):227-32.
60. Statistics New Zealand. 2006 Census Questionnaires. Christchurch: Information Centre, Statistics New Zealand, 2008. (<http://www.stats.govt.nz/Census/about-2006-census/information-by-variable.aspx>).
61. Statistics New Zealand. General Social Survey. Wellington: Statistics New Zealand, Wellington, Social Conditions Business Unit, Statistics New Zealand, 2008.

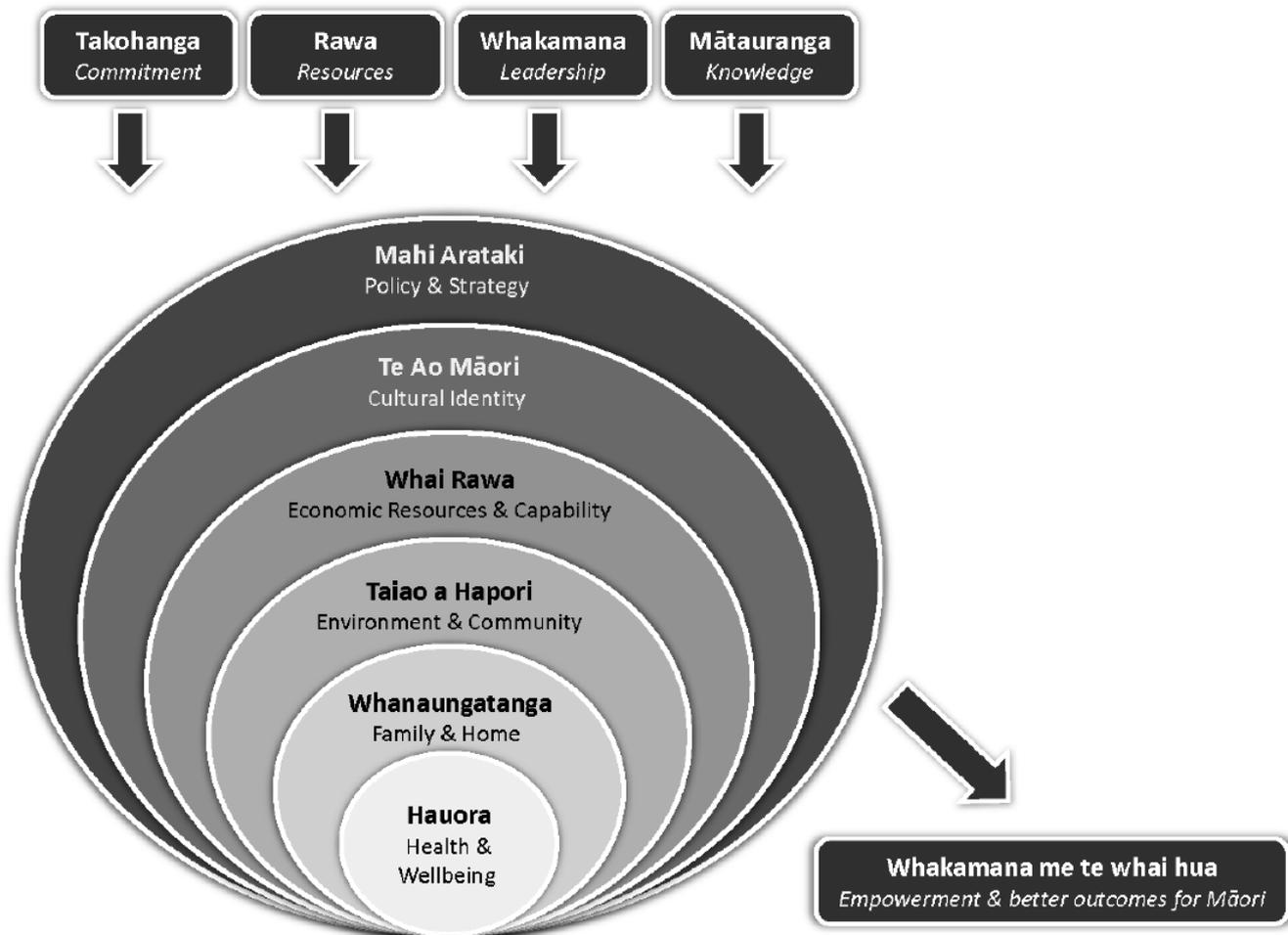
([http://www.stats.govt.nz/browse\\_for\\_stats/people\\_and\\_communities/Households/nzgss\\_HOTP2008.aspx](http://www.stats.govt.nz/browse_for_stats/people_and_communities/Households/nzgss_HOTP2008.aspx)).

62. Iost C, Name JJ, Jeppsen RB, Ashmead HD. Repleting hemoglobin in iron deficiency anemia in young children through liquid milk fortification with bioavailable iron amino acid chelate. *Journal of the American College of Nutrition* 1998;17(2):187-94.

# Appendix 1: Te Anga o ngā Horopaki Māori: *A conceptual framework for considering Māori circumstances or environments.*

**Appendix Figure 1. Te Anga o ngā Horopaki Māori: A conceptual framework for considering Māori lived realities.**

Comprises six interconnected domains: Mahi Arataki (Policy and strategy); Te Ao Māori (Cultural identity); Whai Rawa (Economic resources and capability); Taiao a Hapori (Environment and community); Whanaungatanga (Family and home); and Hauora (Health and wellbeing).<sup>25</sup>



Application for the investigation of factors related to whether or not the child's caregiver has decided yet if they will have their child immunised with the HPV vaccine

| Te Anga o ngā Horopaki Māori Domain          | <i>Growing Up in New Zealand</i> research domain | Constructs examined                                               | Tools and variables used                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------------------|--------------------------------------------------|-------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Mahi Arataki</b><br>(Policy and Strategy) | Policy and strategy                              | Have you decided yet if you will have your child fully immunised? | Mother <ul style="list-style-type: none"> <li>• Antenatal: PRG34_AM</li> </ul> Partner <ul style="list-style-type: none"> <li>• Antenatal: PRG34_AP</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                                              | Knowledge resources                              | Information about immunisation                                    | Antenatal information sources about infant immunisations<br>Mother <ul style="list-style-type: none"> <li>• Antenatal (PRG35_AM, NPRG36_1_AM, NPRG36_2_AM, NPRG36_3_AM, NPRG36_4_AM, NPRG36_5_AM, NPRG36_6_AM, NPRG36_7_AM, NPRG36_8_AM, NPRG36_9_AM, NPRG36_10_AM, NPRG36_11_AM, NPRG36_12_AM, NPRG36_13_AM, PRG37_AM, NPRG38_1_AM, NPRG38_2_AM, NPRG38_3_AM, NPRG38_4_AM, NPRG38_5_AM, NPRG38_6_AM, NPRG38_7_AM, NPRG38_8_AM, NPRG38_9_AM, NPRG38_10_AM, NPRG38_11_AM, NPRG38_12_AM, NPRG38_13_AM)</li> </ul> Partner <ul style="list-style-type: none"> <li>• Antenatal: (PRG35_AP, NPRG36_1_AP, NPRG36_2_AP, NPRG36_3_AP, NPRG36_4_AP, NPRG36_5_AP, NPRG38_6_AP, NPRG36_7_AP, NPRG36_8_AP, NPRG36_9_AP, NPRG36_10_AP, NPRG36_11_AP, NPRG36_12_AP, NPRG36_13_AP, PRG37_AP, NPRG38_1_AP, NPRG38_2_AP, NPRG38_3_AP, NPRG38_4_AP, NPRG38_5_AP, NPRG38_6_AP, NPRG38_7_AP, NPRG38_8_AP, NPRG38_9_AP, NPRG38_10_AP, NPRG38_11_AP, NPRG38_12_AP, NPRG38_13_AP)</li> </ul> |
| <b>Te Ao Māori</b><br>(Cultural Identity)    | Cultural identity                                | Parental country of birth and when first arrived in NZ            | <ul style="list-style-type: none"> <li>• Antenatal:<br/>               Mother: (OL1_AM, AGETONZ_AM)<br/>               Partner: (OL1_AP, AGETONZ_AP, TIMEINNZ_AP)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

|                                  |                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                        |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                  | Parental country of residence                                                                                                                                                                                                                           | <ul style="list-style-type: none"> <li>2-year: Mother: (RESIDENTIALCOUNTRY_Y2CO, RESIDENTIALCOUNTRY_Y2M) Partner: RESIDENTIALCOUNTRY_Y2P</li> <li>54-month: COUNTRY_M54M</li> <li>72-month: COUNTRYM_M72M</li> <li>8-year: COUNTRYMGP_Y8M</li> </ul> |                                                                                                                                                                                                                                                                                        |
|                                  | Child's usual country of residence                                                                                                                                                                                                                      | <ul style="list-style-type: none"> <li>54-month: COUNTRY_M54CM</li> <li>72-month: COUNTRYC_M72M</li> <li>8-year: COUNTRYCGP_Y8CM</li> </ul>                                                                                                          |                                                                                                                                                                                                                                                                                        |
|                                  | Ethnicity                                                                                                                                                                                                                                               | Parental ethnicity                                                                                                                                                                                                                                   | <ul style="list-style-type: none"> <li>Antenatal Mother: (ETH4_E_AM, ETH4_M_AM, ETH4_P_AM, ETH4_A_AM, ETH4_MELA_AM, ETH4_O_AM, ETH4_NZDER_AM, SELF_PROETH_AM) Partner: (ETH4_E_AP, ETH4_M_AP, ETH4_P_AP, ETH4_A_AP, ETH4_MELA_AP, ETH4_O_AP, ETH4_NZDER_AP, SELF_PROETH_AP)</li> </ul> |
|                                  |                                                                                                                                                                                                                                                         | Child prioritised ethnicity & child's main ethnic group (reported by mother) -Māori, Pacific                                                                                                                                                         | <ul style="list-style-type: none"> <li>CSELF_PROETH_M54CM, CETH1_M_M54CM, CETH1_P_M54CM</li> </ul>                                                                                                                                                                                     |
|                                  |                                                                                                                                                                                                                                                         | Religion and spirituality                                                                                                                                                                                                                            | <ul style="list-style-type: none"> <li>2-year: Mother: (RA1_Y2M, NRA2_Y2M, RA3_Y2M, RA4_Y2M, RA5_Y2M) Partner: RA1_Y2P, NRA2_Y2P, RA3_Y2P, RA4_Y2P, RA5_Y2P</li> </ul>                                                                                                                 |
|                                  |                                                                                                                                                                                                                                                         | Type of school child will attend                                                                                                                                                                                                                     | <ul style="list-style-type: none"> <li>54-month: (SS3_M54M, SS4_1_M54M, SS4_2_M54M, SS4_3_M54M, SS4_4_M54M, SS4_6_M54M, SS4_7_M54M, SS4_8_M54M, SS4_9_M54M, SS4_97_M54M, SS4_99_M54M, SS4_98_M54M)</li> </ul>                                                                          |
|                                  |                                                                                                                                                                                                                                                         | Child attending primary school                                                                                                                                                                                                                       | <p>Attending primary school &amp; reasons not attending primary school:</p> <ul style="list-style-type: none"> <li>72-month: (SS31_M72M, NSS32_M72M)</li> </ul>                                                                                                                        |
| Type of primary school attending | <ul style="list-style-type: none"> <li>72-month: (SS35_1_M72M, SS35_2_M72M, SS35_3_M72M, SS35_4_M72M, SS35_5_M72M, SS35_6_M72M, SS35_7_M72M, SS35_8_M72M, SS35_9_M72M, SS35_10_M72M, SS35_11_M72M, SS35_97_M72M, SS35_99_M72M, SS35_98_M72M)</li> </ul> |                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                        |

|  |                   |                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |                   | How important were these factors when deciding which school your Growing Up in New Zealand study child/children attends? The school values align with our preferred religious practices or activities                                                                           | <ul style="list-style-type: none"> <li>72-month: SS44_M72M</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|  | Cultural heritage | Experiences of racist or discriminatory sentiments or behaviour or being treated unfairly based upon gender, age, spiritual beliefs, weight, skin colour, ethnicity, sexual orientation, socioeconomic status, physical disability, for having children, marital status, other. | <ul style="list-style-type: none"> <li>Antenatal:<br/>Mother: (ETH9_1_AM, ETH9_2_AM, ETH9_3_AM, ETH9_4_AM)<br/>Partner: (ETH8_1_AP, ETH8_2_AP, ETH8_3_AP)</li> <li>2-year:<br/>Mother: (NDIS0_1_Y2M, NDIS0_2_Y2M, NDIS0_3_Y2M, NDIS0_4_Y2M, NDIS0_5_Y2M, NDIS0_6_Y2M, NDIS0_7_Y2M, NDIS0_8_Y2M, NDIS0_9_Y2M, NDIS0_10_Y2M, NDIS0_11_Y2M, NDIS0_13_Y2M, NDIS0_97_Y2M, NDIS1_6_Y2M, NDIS2_6_Y2M, NDIS3_6_Y2M, NDIS4_6_Y2M, NDIS5_6_Y2M, NDIS6_6_Y2M, NDIS8_6_Y2M, NDIS10_6_Y2M, NDIS11_6_Y2M, NDIS12_6_Y2M)<br/>Partner: (DIS0_1_Y2P, NDIS0_2_Y2P, NDIS0_3_Y2P, NDIS0_4_Y2P, NDIS0_5_Y2P, NDIS0_6_Y2P, NDIS0_7_Y2P, NDIS0_8_Y2P, NDIS0_9_Y2P, NDIS0_10_Y2P, NDIS0_11_Y2P, NDIS0_13_Y2P, NDIS0_97_Y2P, NDIS1_6_Y2P, NDIS2_6_Y2P, NDIS3_6_Y2P, NDIS4_6_Y2P, NDIS5_6_Y2P, NDIS6_6_Y2P, NDIS8_6_Y2P, NDIS10_6_Y2P, NDIS11_6_Y2P, NDIS12_6_Y2P)</li> </ul> |

|                                                         |                                   |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------------------------------|-----------------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Whai Rawa</b><br>(Economic Resources and Capability) | Economic resources and capability | Socioeconomic deprivation | New Zealand Index of Deprivation (NZDep06) <sup>58</sup> - combines nine socioeconomic characteristics from 2006 census data collected at aggregations of approximately 100 people and assigned to individual households based on geo-coded address data<br>NZDep2006 <ul style="list-style-type: none"> <li>• Antenatal:<br/> Mother: NZDEP2006_AM<br/> Partner: NZDEP2006_AP</li> <li>• 9-month:<br/> Mother: NZDEP2006_M9M<br/> Partner: NZDEP2006_M9P</li> <li>• 2-year:<br/> Mother: NZDEP2006_Y2M<br/> Partner: NZDEP2006_Y2P</li> </ul> NZDep2013 <ul style="list-style-type: none"> <li>• 54-month: NZDEP2013_M54M</li> <li>• 72-month: NZDEP2013_M72M</li> <li>• 8-year: DHBGP_2013_Y8M</li> </ul> |
|                                                         |                                   |                           | Not enough money for food, heating, clothing, food grants/banks, charity <ul style="list-style-type: none"> <li>• 54-month: (DP1_M54M, DP2_M54M, DP3_M54M, DP4_M54M, DP5_M54M, DP6_M54M)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

|  |                                      |                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--|--------------------------------------|------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | Access to organisations and services | Rurality and DHB                                                                                     | <p>Rurality code</p> <ul style="list-style-type: none"> <li>• Antenatal:<br/>Mother: RURALITYGP_AM<br/>Partner: RURALITYGP_AP</li> <li>• 9-month:<br/>Mother: RURALITYGP_M9M<br/>Partner: RURALITYGP_M9P</li> <li>• 2-year:<br/>Mother: RURALITYGP_Y2M<br/>Partner: RURALITYGP_Y2P</li> <li>• 54-month: RURALITYGP13_M54M</li> <li>• 8-year: RURALITYGP_2013_Y8M</li> </ul> <p>District health board of maternal domicile</p> <ul style="list-style-type: none"> <li>• Antenatal:<br/>Mother: DHB_AM<br/>Partner: DHBGP_AP</li> <li>• 9-month:<br/>Mother: DHB_M9M<br/>Partner: DHB_M9P</li> <li>• 2-year:<br/>Mother: DHB_Y2M<br/>Partner: DHBGP_Y2P</li> <li>• 54-month: DHB_2013_M54M</li> <li>• 8-year: DHBGP_2013_Y8M</li> </ul>                                                              |
|  |                                      | Availability and access to health services including delay in access to maternity care <sup>59</sup> | <p>Developed within <i>Growing Up in New Zealand</i></p> <ul style="list-style-type: none"> <li>• Antenatal GP and LMC care: (PRG17_AM, PRG18_AM, PRG19_AM, PRG20_AM, PRG21_AM, PRG22_AM, PRG23_AM, PRG24_AM, NPRG25_1_AM, NPRG25_2_AM, NPRG25_3_AM, NPRG25_4_AM, NPRG25_5_AM, PRG26_AM, PRG27_AM)</li> <li>• Any difficulties accessing GP for child at 9-months (HC1_M9M, NHC4_1_M9M, NHC4_2_M9M, NHC4_3_M9M, NHC4_4_M9M, NHC4_97_M9M, HC5_M9M)</li> <li>• Use of and access to GP for child at age 2-years (GP2_Y2CM, GP4_Y2CM) (NHC1_Y2M, HC3_Y2M, NHC8_Y2M, HC9_Y2M, HC10_Y2M, HC11_Y2M, HC11_YEARS_Y2M, HC11_MONTHS_Y2M, NHC12_Y2M, HC5_Y2M)</li> <li>• Use of and access to GP for child at age 54-months (GP12_M54CM, GP21_M54CM, GP21S_M54CM, GP4_M54CM, GP5_M54CM, GP6_M54CM)</li> </ul> |

|                                                          |                                |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------------------------------|--------------------------------|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                          | Education                      | Parent education             | <p>Statistics New Zealand 2006 national census<sup>60</sup><br/> Statistics New Zealand 2008 General Social Survey<sup>61</sup></p> <ul style="list-style-type: none"> <li>• Antenatal: Highest completed secondary school qualification<br/> Mother: (NNE18_2_AM)<br/> Partner: (EDALL_AP)</li> <li>• 72-month: new educational qualification since your Growing Up in New Zealand study child was/children were born? (ED10_M72M, ED11_1_M72M, ED11_2_M72M, ED11_3_M72M, ED11_4_M72M, ED11_5_M72M, ED11_6_M72M, ED11_7_M72M, ED11_97_M72M, ED11_99_M72M, ED11_98_M72M)</li> </ul>                                                                          |
| <b>Taiao me te Hapori</b><br>(Environment and Community) | Community belonging            | Parental community belonging | <ul style="list-style-type: none"> <li>• Some people feel they belong to a community because of things like family ties, a school, where they live or maybe a church or club do you feel you belong to any communities at the moment?</li> <li>• Antenatal:<br/> Mother (NE17_AM)</li> <li>• What is the community or communities of people to which you belong based around: religion?</li> <li>• Antenatal:<br/> Mother (NNE18_2_AM)<br/> Partner: NNE18_2_AP</li> <li>• Do you belong to any of the social networks and groups or organisations: Church spiritual group?</li> <li>• 9-months:<br/> Mother: NBL7_2_M9M<br/> Partner: NBL7_2_M9P</li> </ul> |
| <b>Whanaungatana</b><br>(Family and Home)                | Parental relationship dynamics | Partner                      | <p>Current partner</p> <ul style="list-style-type: none"> <li>• Antenatal: Mother: REL1_AM</li> <li>• 9-month:<br/> Mother PQ5_M9M<br/> Partner: PQ5_M9P</li> <li>• 2-year: PQ5_Y2M</li> <li>• 54-month: PQ5_M54M</li> </ul> <p>Does partner live with you and your children</p> <ul style="list-style-type: none"> <li>• 54-month: PQ6_M54M</li> </ul> <p>In relationship with same partner as at age 2-years?</p> <ul style="list-style-type: none"> <li>• 54-month: PQ5A_M54M</li> </ul>                                                                                                                                                                  |

|                                         |                              |                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----------------------------------------|------------------------------|--------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                         | Household dynamics           | Number & relationship of household members | <ul style="list-style-type: none"> <li>• Antenatal: How many people are in the household, and their relationship<br/>Mother (HH2_AM, HHST_AM)<br/>Partner (HH2_AP, REL2_AP)</li> <li>• 72-months includes age of children: (HH46_M72M, HH46S_M72M, HHA1_1_M72M, HHA1_2_M72M)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                     |
|                                         |                              | Household mobility                         | <ul style="list-style-type: none"> <li>• 23-month: Moved house &amp; number of moves since your CHILD/CHILDREN was 9 months old: (NE19A_M23M, NE19A_NUMBEROFMOVES_M23M)</li> <li>• 72-month: Moved house since age 54-months: NE31_M72M</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Hauora</b><br>(Health and Wellbeing) | Health and wellbeing         | Parental health                            | <p>Maternal age</p> <ul style="list-style-type: none"> <li>• At antenatal interview (AGE_AM)</li> <li>• At 9 month interview (AGE_M9M)</li> <li>• At 24 month interview (AGE_Y2M)</li> <li>• At 54-month interview (AGE_M54M)</li> <li>• At 72-month: AGE_M72M</li> <li>• At 8-year: AGE_Y8M</li> </ul> <p>Maternal gender</p> <ul style="list-style-type: none"> <li>• At 54-month interview (GENDER_M54M)</li> </ul>                                                                                                                                                                                                                                                                      |
|                                         |                              |                                            | <p>Partner age</p> <ul style="list-style-type: none"> <li>• At antenatal interview (AGE_AP)</li> <li>• At 9-month interview (AGE_M9P)</li> <li>• At 24-month interview (AGE_Y2P)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                                         | Health status and behaviours | Health behaviours                          | <ul style="list-style-type: none"> <li>• Were the 6-week, 3-month and 5-month immunisations all given and were they given on time? (VAC_ALL6_NUM_NIR1, VAC_ALL6_ONTIME_NIR1)</li> <li>• 2-year immunisations received, and reasons not received (CH61_Y2CM, CH62_Y2CM, NCH64_8_Y2CM)</li> <li>• 4-year immunisations received and reasons 4-year immunisations not received (CH107_M54CM, CH109_1_M54CM, CH109_2_M54CM, CH109_3_M54CM, CH109_4_M54CM, CH109_5_M54CM, CH109_6_M54CM, CH109_7_M54CM, CH109_8_M54CM, CH109_9_M54CM, CH109_10_M54CM, CH109_11_M54CM, CH109_12_M54CM, CH109_13_M54CM, CH109_14_M54CM, CH109_15_M54CM, CH109_97_M54CM, CH109_99_M54CM, CH109_98_M54CM)</li> </ul> |

|  |              |  |                                                                                                                                                                                                        |
|--|--------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | Child health |  | <ul style="list-style-type: none"><li>• Antenatal: ETH9_4_AM</li><li>• CHILD_AM: (Is this your first child?)</li><li>• Child sex: GENDER_PDL</li><li>• 72-months: (HHG1_1_M72M, HHG1_2_M72M)</li></ul> |
|--|--------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## Appendix 2: Variables of interest

The content presented in this appendix (including any typos!) is as extracted from the GUINZ external data dictionaries which are available here: <https://www.growingup.co.nz/available-data-2>

### 1.1 Child: 9-month data

| Questionnaire number | Question                                                              | Variable name        | Variable type      | Notes                                                                                                   |
|----------------------|-----------------------------------------------------------------------|----------------------|--------------------|---------------------------------------------------------------------------------------------------------|
|                      | Child ID                                                              | IDN_CHILD            | Identification key | Randomly generated child ID. Allows linking to other datasets                                           |
| Q2                   | Baby's gender                                                         | GENDER_PDL           | Raw                | Harmonised information with perinatal data                                                              |
|                      | Mother ID (at 6 week data collection)                                 | IDN_W6M              | Identification key | Randomly generated mother ID at six week interview. Allows linking to other datasets                    |
|                      | Child's age at 6 weeks data collection                                | AGE_WK6              | Derived            | Age in weeks                                                                                            |
|                      | Mother ID (at 9 month data collection)                                | IDN_M9M              | Identification key | Randomly generated mother ID at nine month interview. Allows linking to other datasets                  |
|                      | Partner ID (at 9 month data collection)                               | IDN_M9P              | Identification key | Randomly generated partner ID at nine month interview. Allows linking to other datasets                 |
|                      | Child's age at 9 month data collection                                | AGE_M9CM             | Derived            | Age in weeks                                                                                            |
|                      | Were the 6-week, 3-month and 5-month immunisations all given?         | VAC_ALL6_NUM_NIR1    | Derived            | Participants were linked with National Immunisation Register data and then the information was derived. |
|                      | Were the 6-week, 3-month and 5-month immunisations all given on time? | VAC_ALL6_ONTIME_NIR1 | Derived            | Participants were linked with National Immunisation Register data and then the information was derived. |

## 1.2 Child: 2-year data

| Questionnaire number | Question                                                                                                                                                       | Variable name           | Variable type      | Notes                                                                                                         |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------|---------------------------------------------------------------------------------------------------------------|
|                      | Child ID                                                                                                                                                       | IDN_CHILD               | Identification key | Randomly generated child ID. Allows linking to other datasets                                                 |
|                      | Mother ID (Linkable to other datasets)                                                                                                                         | IDN_Y2CM                | Identification key | Randomly generated mother ID at 24 month interview. Allows linking to other datasets                          |
|                      | Interview date                                                                                                                                                 | AGE_Y2CM                | Derived            | Values derived from interview date (Interview_Date_Y2CM) and date of birth (CDOB_PDL) and converted to months |
| C101                 | When child is sick and goes to the doctor, how often do you see [his/her] regular doctor?                                                                      | GP2_Y2CM                | Raw                |                                                                                                               |
| C103                 | In the last 12 months, has there been any time when child needed to see a GP or family doctor about [his/her] health, but didn't get to see any doctor at all? | GP4_Y2CM                | Raw                |                                                                                                               |
| C223                 | Has your child received the immunisations due at age 15 months (this includes partial or full immunisations)?                                                  | CH61_Y2CM               |                    |                                                                                                               |
| C224                 | Did child receive all the immunisations due at 15 months, or just some of them?                                                                                | CH62_Y2CM               | Raw                |                                                                                                               |
| C226                 | Which of the following were reasons for your child not having been immunised: concerns about the risk of side-effects and complications from immunisations?    | NCH64_8_Y2CM            | Raw                |                                                                                                               |
|                      | Partner ID (Linkable to other datasets)                                                                                                                        | IDN_Y2CP                | Identification key | Randomly generated partner ID at 24 month interview. Allows linking to other datasets                         |
|                      | Age of child at 24 month child observations interview in months                                                                                                | CHILD_AGE_Y2CO          | Derived            |                                                                                                               |
|                      | Country of residence                                                                                                                                           | RESIDENTIALCOUNTRY_Y2CO | Categorised        | Countries other than New Zealand grouped as 'Other'                                                           |

### 1.3 Child: 54-month data

| Questionnaire number | Question                                                                                                                                                               | Variable name      | Variable type      | Notes                                                                                |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------|--------------------------------------------------------------------------------------|
|                      | Child ID at 54 month interview                                                                                                                                         | IDN_CHILD          | Identification key | Randomly generated child ID at 54 month interview. Allows linking to other datasets  |
|                      | Mother ID at 54 month interview (Linkable to other datasets)                                                                                                           | IDN_M54M           | Identification key | Randomly generated mother ID at 54 month interview. Allows linking to other datasets |
| 0.1                  | Relationship to child                                                                                                                                                  | PQ103_M54CM        | Categorised        | Mothers other than Biological mother grouped as 'Other (Please specify)'             |
| 0.2                  | Child's usual country of residence                                                                                                                                     | COUNTRY_M54CM      | Categorised        | Countries other than New Zealand grouped as 'Other countries'                        |
|                      | Ceth1-level 1. Prioritised ethnicity (reported by mother)?                                                                                                             | CSELF_PROETH_M54CM | Re-classified      | Level 1 -single response ethnicity                                                   |
|                      | Ceth1-level 1. Child's main ethnic group (reported by mother) -Māori?                                                                                                  | CETH1_M_M54CM      | Re-classified      | Re-classified to Statistics New Zealand Level 1 classification of ethnicity          |
|                      | Ceth1-level 1. Child's main ethnic group (reported by mother) -Pacific?                                                                                                | CETH1_P_M54CM      | Re-classified      | Re-classified to Statistics New Zealand Level 1 classification of ethnicity          |
| 3.1                  | Which practice (or doctor) is <sup>62</sup> enrolled with?                                                                                                             | GP12_M54CM         | Raw                |                                                                                      |
| 3.2                  | In the past 12 months, how many times has <sup>62</sup> seen a GP or family doctor?                                                                                    | GP21_M54CM         | Raw                |                                                                                      |
| 3.2.1                | In the past 12 months, how many times has <sup>62</sup> seen a GP or family doctor? (Specify)                                                                          | GP21S_M54CM        | Categorised        | Categorise upper extreme at 25+                                                      |
| 3.4                  | In the last 12 months, has there been any time when <sup>62</sup> needed to see a GP or family doctor about {his/her} health, but didn't get to see any doctor at all? | GP4_M54CM          | Raw                |                                                                                      |
| 3.5                  | How many times has this happened in the past 12 months?                                                                                                                | GP5_M54CM          | Raw                |                                                                                      |

| Questionnaire number | Question                                                                                                                                                                                      | Variable name | Variable type | Notes                                                                        |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------|------------------------------------------------------------------------------|
| 3.6                  | The last time <sup>62</sup> was not able to see a GP when {he/she} needed to, what was the main reason {he/she} wasn't able to see a GP?                                                      | GP6_M54CM     | Categorised   | Combined low cell counts of 'Lack of Childcare' with 'Other(Please specify)' |
| 6.1                  | Has <sup>62</sup> received the immunisations due at four years (this includes partial or full immunisation)?                                                                                  | CH107_M54CM   | Raw           |                                                                              |
| 6.3.1                | For which of the following reasons was <sup>62</sup> not immunised, or only partially immunised at four years - child unwell when immunisations due?                                          | CH109_1_M54CM | Raw           |                                                                              |
| 6.3.2                | For which of the following reasons was <sup>62</sup> not immunised, or only partially immunised at four years - inconvenient clinic hours?                                                    | CH109_2_M54CM | Raw           |                                                                              |
| 6.3.3                | For which of the following reasons was <sup>62</sup> not immunised, or only partially immunised at four years - unable to get appointment at GP practice?                                     | CH109_3_M54CM | Raw           |                                                                              |
| 6.3.4                | For which of the following reasons was <sup>62</sup> not immunised, or only partially immunised at four years - unable to afford visit to GP practice?                                        | CH109_4_M54CM | Raw           |                                                                              |
| 6.3.5                | For which of the following reasons was <sup>62</sup> not immunised, or only partially immunised at four years - lack of transport to GP practice?                                             | CH109_5_M54CM | Raw           |                                                                              |
| 6.3.6                | For which of the following reasons was <sup>62</sup> not immunised, or only partially immunised at four years - nurse advised immunisation be delayed or not given?                           | CH109_6_M54CM | Raw           |                                                                              |
| 6.3.7                | For which of the following reasons was <sup>62</sup> not immunised, or only partially immunised at four years - doctor advised immunisation be delayed or not given?                          | CH109_7_M54CM | Raw           |                                                                              |
| 6.3.8                | For which of the following reasons was <sup>62</sup> not immunised, or only partially immunised at four years - concerns about the risk of side-effects and complications from immunisations? | CH109_8_M54CM | Raw           |                                                                              |

| Questionnaire number | Question                                                                                                                                                                                                   | Variable name  | Variable type | Notes |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------------|-------|
| 6.3.9                | For which of the following reasons was <sup>62</sup> not immunised, or only partially immunised at four years - concerns regarding child's immune system?                                                  | CH109_9_M54CM  | Raw           |       |
| 6.3.10               | For which of the following reasons was <sup>62</sup> not immunised, or only partially immunised at four years - diseases not severe enough to justify immunisation?                                        | CH109_10_M54CM | Raw           |       |
| 6.3.11               | For which of the following reasons was <sup>62</sup> not immunised, or only partially immunised at four years - concerns about the effectiveness of immunisations ?                                        | CH109_11_M54CM | Raw           |       |
| 6.3.12               | For which of the following reasons was <sup>62</sup> not immunised, or only partially immunised at four years - having or knowing a child thought to have suffered an adverse effect from an immunisation? | CH109_12_M54CM | Raw           |       |
| 6.3.13               | For which of the following reasons was <sup>62</sup> not immunised, or only partially immunised at four years - work commitments?                                                                          | CH109_13_M54CM | Raw           |       |
| 6.3.14               | For which of the following reasons was <sup>62</sup> not immunised, or only partially immunised at four years - difficult to organise care for other children?                                             | CH109_14_M54CM | Raw           |       |
| 6.3.15               | For which of the following reasons was <sup>62</sup> not immunised, or only partially immunised at four years - intend to but not yet organised?                                                           | CH109_15_M54CM | Raw           |       |
| 6.3.97               | For which of the following reasons was <sup>62</sup> not immunised, or only partially immunised at four years - other specify?                                                                             | CH109_97_M54CM | Raw           |       |
| 6.3.99               | For which of the following reasons was <sup>62</sup> not immunised, or only partially immunised at four years - DK                                                                                         | CH109_99_M54CM | Raw           |       |
| 6.3.98               | For which of the following reasons was <sup>62</sup> not immunised, or only partially immunised at four years - Ref                                                                                        | CH109_98_M54CM | Raw           |       |

## 1.4 Child: 8-year data

| Questionnaire number | Question                                                                                              | Variable name   | Variable type      | Notes                                                                               |
|----------------------|-------------------------------------------------------------------------------------------------------|-----------------|--------------------|-------------------------------------------------------------------------------------|
|                      | Child ID at 8 years interview (linkable to other datasets)                                            | IDN_CHILD       | Identification key | Randomly generated child ID at 8 years interview. Allows linking to other datasets  |
|                      | Mother ID at 8 years interview (linkable to other datasets)                                           | IDN_Y8M         | Identification key | Randomly generated mother ID at 8 years interview. Allows linking to other datasets |
|                      | Child age at 8 year interview (months)                                                                | AGE_Y8CM        | Derived            | Child's age in years at 8 years interview                                           |
| 0.1                  | Please confirm that your relationship to <sup>62</sup> is (Choose one only)                           | PQ103_Y8CM      | Categorised        | Mothers other than Biological mother grouped as 'Other (Please specify)'            |
| 0.2                  | What is <sup>62</sup> 's usual country of residence?                                                  | COUNTRYCGP_Y8CM | Categorised        | Countries other than New Zealand grouped as 'Other countries                        |
| 6.13                 | Have you decided yet if you will have <sup>62</sup> immunised with the HPV vaccine? (Choose one only) | CH134_Y8CM      | Raw                |                                                                                     |

## 1.5 Mother: Antenatal data

| Questionnaire number | Question                                                                                           | Variable name | Variable type      | Notes                                                                                 |
|----------------------|----------------------------------------------------------------------------------------------------|---------------|--------------------|---------------------------------------------------------------------------------------|
| ID                   | ID                                                                                                 | IDN_AM        | Identification key | Randomly generated mother ID at antenatal interview. Allows linking to other datasets |
| BG1                  | Age (years) of mother at antenatal interview                                                       | AGE_AM        | Derived            | Values converted to years. Extreme values categorised                                 |
| PRG17                | Did you have a family doctor or GP before you became pregnant?                                     | PRG17_AM      | Raw                |                                                                                       |
| PRG18                | Have you seen any family doctor or GP since you became pregnant?                                   | PRG18_AM      | Raw                |                                                                                       |
| PRG19                | Is this the same family doctor or GP as the one you saw before you became pregnant?                | PRG19_AM      | Raw                |                                                                                       |
| PRG20                | Do you know who the family doctor or GP will be for your baby after s/he is born?                  | PRG20_AM      | Raw                |                                                                                       |
| PRG21                | Is this the same family doctor or GP as the one you saw before you became pregnant?                | PRG21_AM      | Raw                |                                                                                       |
| PRG22                | Do you have a lead maternity caregiver (LMC)?                                                      | PRG22_AM      | Raw                |                                                                                       |
| PRG23                | Did you have a choice of midwife or other lead maternity caregiver (LMC) during this pregnancy?    | PRG23_AM      | Raw                |                                                                                       |
| PRG24                | How long did it take you to find a lead maternity caregiver (LMC) from the time you began looking? | PRG24_AM      | Raw                |                                                                                       |
| PRG25                | What type of lead maternity caregiver (LMC) do you have: GP (family doctor)?                       | NPRG25_1_AM   | Raw                |                                                                                       |
|                      | What type of lead maternity caregiver (LMC) do you have: independent midwife?                      | NPRG25_2_AM   | Raw                |                                                                                       |
|                      | What type of lead maternity caregiver (LMC) do you have: hospital midwife?                         | NPRG25_3_AM   | Raw                |                                                                                       |
|                      | What type of lead maternity caregiver (LMC) do you have: obstetrician?                             | NPRG25_4_AM   | Raw                |                                                                                       |
|                      | What type of lead maternity caregiver (LMC) do you have: shared care GP and midwife?               | NPRG25_5_AM   | Raw                |                                                                                       |

| Questionnaire number | Question                                                                                                                                | Variable name | Variable type | Notes |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------|-------|
| PRG26                | Was this type of LMC your first choice?                                                                                                 | PRG26_AM      | Raw           |       |
| PRG27                | If you had a choice, who would you most prefer as your primary carer in this pregnancy?                                                 | PRG27_AM      | Raw           |       |
| PRG34                | Have you decided yet if you will have your child fully immunised?                                                                       | PRG34_AM      | Raw           |       |
| PRG35                | During this pregnancy have you received or been told any information that is encouraging you to immunise this child once s/he is born?  | PRG35_AM      | Raw           |       |
| PRG36                | Where did you get this information from: family/whanau?                                                                                 | NPRG36_1_AM   | Raw           |       |
|                      | Where did you get this information from: friends?                                                                                       | NPRG36_2_AM   | Raw           |       |
|                      | Where did you get this information from: GP (family doctor)?                                                                            | NPRG36_3_AM   | Raw           |       |
|                      | Where did you get this information from: midwife?                                                                                       | NPRG36_4_AM   | Raw           |       |
|                      | Where did you get this information from: obstetrician?                                                                                  | NPRG36_5_AM   | Raw           |       |
|                      | Where did you get this information from: dietician/nutritionist?                                                                        | NPRG36_6_AM   | Raw           |       |
|                      | Where did you get this information from: alternative health practitioner?                                                               | NPRG36_7_AM   | Raw           |       |
|                      | Where did you get this information from: antenatal class?                                                                               | NPRG36_8_AM   | Raw           |       |
|                      | Where did you get this information from: the internet?                                                                                  | NPRG36_9_AM   | Raw           |       |
|                      | Where did you get this information from: radio?                                                                                         | NPRG36_10_AM  | Raw           |       |
|                      | Where did you get this information from: TV?                                                                                            | NPRG36_11_AM  | Raw           |       |
|                      | Where did you get this information from: books, magazines, newspapers?                                                                  | NPRG36_12_AM  | Raw           |       |
|                      | Where did you get this information from: other?                                                                                         | NPRG36_13_AM  | Raw           |       |
| PRG37                | During this pregnancy have you received or been told any information that is discouraging you to immunise this child once s/he is born? | PRG37_AM      | Raw           |       |
| PRG38                | Where did you get this information from: family/whanau?                                                                                 | NPRG38_1_AM   | Raw           |       |
|                      | Where did you get this information from: friends?                                                                                       | NPRG38_2_AM   | Raw           |       |
|                      | Where did you get this information from: GP (family doctor)?                                                                            | NPRG38_3_AM   | Raw           |       |
|                      | Where did you get this information from: midwife?                                                                                       | NPRG38_4_AM   | Raw           |       |
|                      | Where did you get this information from: obstetrician?                                                                                  | NPRG38_5_AM   | Raw           |       |

| Questionnaire number | Question                                                                                       | Variable name | Variable type           | Notes                                                                       |
|----------------------|------------------------------------------------------------------------------------------------|---------------|-------------------------|-----------------------------------------------------------------------------|
|                      | Where did you get this information from: dietician/nutritionist?                               | NPRG38_6_AM   | Raw                     |                                                                             |
|                      | Where did you get this information from: alternative health practitioner?                      | NPRG38_7_AM   | Raw                     |                                                                             |
|                      | Where did you get this information from: antenatal class?                                      | NPRG38_8_AM   | Raw                     |                                                                             |
|                      | Where did you get this information from: the internet?                                         | NPRG38_9_AM   | Raw                     |                                                                             |
|                      | Where did you get this information from: radio?                                                | NPRG38_10_AM  | Raw                     |                                                                             |
|                      | Where did you get this information from: TV?                                                   | NPRG38_11_AM  | Raw                     |                                                                             |
|                      | Where did you get this information from: books, magazines, newspapers?                         | NPRG38_12_AM  | Raw                     |                                                                             |
|                      | Where did you get this information from: other?                                                | NPRG38_13_AM  | Raw                     |                                                                             |
| HH2                  | How many people are in the household, not counting yourself?                                   | HH2_AM        | Categorised             | Upper extremes categorised                                                  |
| HH2B                 | Person in the household: relationship 1 to relationship 7                                      | HHST_AM       | Categorised             | Values categorised                                                          |
| HH3A                 | First, do you have a spouse or partner whom you consider to be a member of your family/whanau? | HH3A_AM       | Raw                     |                                                                             |
| REL1                 | Do you have a current partner?                                                                 | REL1_AM       | Raw                     |                                                                             |
| ETH1                 | Which country were you born in?                                                                | OL1_AM        | Re-classified           | Birth countries categorised into regions                                    |
| ETH2                 | When did you first arrived to live in New Zealand?                                             | AGETONZ_AM    | Derived and Categorised | Values converted to years. Upper extremes categorised                       |
| ETH4                 | Eth4-level 1. Main ethnicity - European                                                        | ETH4_E_AM     | Re-classified           | Re-classified to Statistics New Zealand Level 1 classification of ethnicity |
|                      | Eth4-level 1. Main ethnicity - Māori                                                           | ETH4_M_AM     | Re-classified           | Re-classified to Statistics New Zealand Level 1 classification of ethnicity |
|                      | Eth4-level 1. Main ethnicity - Pacific                                                         | ETH4_P_AM     | Re-classified           | Re-classified to Statistics New Zealand Level 1 classification of ethnicity |
|                      | Eth4-level 1. Main ethnicity - Asian                                                           | ETH4_A_AM     | Re-classified           | Re-classified to Statistics New Zealand Level 1 classification of ethnicity |

| Questionnaire number | Question                                                                                                                                                                                                                            | Variable name  | Variable type | Notes                                                                       |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------------|-----------------------------------------------------------------------------|
|                      | Eth4-level 1. Main ethnicity - MELAA                                                                                                                                                                                                | ETH4_MELA_AM   | Re-classified | Re-classified to Statistics New Zealand Level 1 classification of ethnicity |
|                      | Eth4-level 1. Main ethnicity - Other                                                                                                                                                                                                | ETH4_O_AM      | Re-classified | Re-classified to Statistics New Zealand Level 1 classification of ethnicity |
|                      | Eth4-level 1. All ethnicities - New Zealander                                                                                                                                                                                       | ETH4_NZDER_AM  | Re-classified | Re-classified to Statistics New Zealand Level 1 classification of ethnicity |
|                      | Self prioritised ethnicity                                                                                                                                                                                                          | SELF_PROETH_AM | Re-classified | Level 1 - single response ethnicity                                         |
| ETH9                 | Have you ever felt you have been treated unfairly, e g , treated differently, kept waiting, by a health professional, e g , doctor, nurse, dentist etc. , because of your ethnicity in New Zealand: yes, within the past 12 months? | ETH9_1_AM      | Raw           |                                                                             |
|                      | Have you ever felt you have been treated unfairly, e g , treated differently, kept waiting, by a health professional, e g , doctor, nurse, dentist etc. , because of your ethnicity in New Zealand: yes, more than 12 months ago?   | ETH9_2_AM      | Raw           |                                                                             |
|                      | Have you ever felt you have been treated unfairly, e g , treated differently, kept waiting, by a health professional, e g , doctor, nurse, dentist etc. , because of your ethnicity in New Zealand: no?                             | ETH9_3_AM      | Raw           |                                                                             |
|                      | Have you ever felt you have been treated unfairly, e g , treated differently, kept waiting, by a health professional, e g , doctor, nurse, dentist etc. , because of your ethnicity in New Zealand: not applicable?                 | ETH9_4_AM      | Raw           |                                                                             |
| OCC30                | Is this your first child?                                                                                                                                                                                                           | CHILD_AM       | Derived       |                                                                             |
| NE17                 | Some people feel they belong to a community because of things like family ties, a school, where they live or maybe a church or club do you feel you belong to any communities at the moment?                                        | NE17_AM        | Raw           |                                                                             |
| NE18                 | What is the community or communities of people to which you belong based around: religion?                                                                                                                                          | NNE18_2_AM     | Raw           |                                                                             |
|                      | What is your highest completed secondary school qualification?                                                                                                                                                                      | EDALL_AM       | Re-classified |                                                                             |

| <b>Questionnaire number</b> | <b>Question</b>                            | <b>Variable name</b> | <b>Variable type</b> | <b>Notes</b>                                      |
|-----------------------------|--------------------------------------------|----------------------|----------------------|---------------------------------------------------|
|                             | NZDep2006                                  | NZDEP2006_AM         | Raw                  | New Zealand deprivation index 2006 classification |
|                             | District health board of maternal domicile | DHB_AM               | Raw                  |                                                   |
|                             | Rurality code                              | RURALITYGP_AM        | Categorised          |                                                   |
|                             | Mother interview date                      | INTERVIEW_AM         | Categorised          |                                                   |

## 1.6 Mother: 9-month data

| Questionnaire number | Question                                                                                                          | Variable name  | Variable type      | Notes                                                                                                                                               |
|----------------------|-------------------------------------------------------------------------------------------------------------------|----------------|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
|                      | Mother ID at nine month interview                                                                                 | IDN_M9M        | Identification key | Randomly generated mother ID at nine month interview. Allows linking to other datasets                                                              |
|                      | Age (years) of mother at 9 month interview                                                                        | AGE_M9M        | Derived            | Values derived from interview date(STTIME_M9M/ENDTIME_M9M) and date of birth (BG1A_AM) and converted to years. Lower and upper extremes categorised |
| PQ5                  | Do you have a current partner?                                                                                    | PQ5_M9M        | Raw                |                                                                                                                                                     |
| M45                  | With regard to your baby's[babies] health care, which of the statements below best describes your situation?      | HC1_M9M        | Raw                |                                                                                                                                                     |
| M48                  | Did you have difficulties finding a GP for your baby [babies]: No difficulties?                                   | NHC4_1_M9M     | Raw                |                                                                                                                                                     |
|                      | Did you have difficulties finding a GP for your baby [babies]: Difficulty finding a GP I was happy with?          | NHC4_2_M9M     | Raw                |                                                                                                                                                     |
|                      | Did you have difficulties finding a GP for your baby [babies]: Practices were not taking new patients?            | NHC4_3_M9M     | Raw                |                                                                                                                                                     |
|                      | Did you have difficulties finding a GP for your baby [babies]: Moved to new area and did not know local services? | NHC4_4_M9M     | Raw                |                                                                                                                                                     |
|                      | Difficulties finding a GP - could not find a GP who spoke my language                                             |                |                    | Combined low cell count responses of NHC4_5_M9M with 'Other' HC4_97_M9M                                                                             |
|                      | Did you have difficulties finding a GP for your baby [babies]: Other?                                             | NHC4_97_M9M    | Re-classified      | Combined low cell count responses of NHC4_5_M9M with 'Other' NHC4_97_M9M                                                                            |
| M49                  | All things considered, how satisfied are you with your baby's [babies'] usual GP practice?                        | HC5_M9M        | Raw                |                                                                                                                                                     |
| M226                 | Do you belong to any of the social networks and groups or organisations: Church spiritual group?                  | NBL7_2_M9M     | Raw                |                                                                                                                                                     |
|                      | NZDep2006 Index of Deprivation                                                                                    | NZDEP2006_M9M  | Raw                |                                                                                                                                                     |
|                      | Rurality                                                                                                          | RURALITYGP_M9M | Raw                |                                                                                                                                                     |
|                      | District health board group                                                                                       | DHB_M9M        | Categorised        |                                                                                                                                                     |

## 1.7 Mother: 2-year data

| Questionnaire number | Question                                                                                                       | Variable name            | Variable type      | Notes                                                                                                                                           |
|----------------------|----------------------------------------------------------------------------------------------------------------|--------------------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
|                      | Mother ID at 16 month interview (Linkable to other datasets)                                                   | IDN_M16M                 | Identification key | Randomly generated mother ID at 24 month interview. Allows linking to other datasets                                                            |
|                      | Mother ID at 23 month interview (Linkable to other datasets)                                                   | IDN_M23M                 | Identification key | Randomly generated mother ID at 24 month interview. Allows linking to other datasets                                                            |
| M5                   | Have you moved house since your CHILD/CHILDREN was 9 months old?                                               | NE19A_M23M               | Raw                |                                                                                                                                                 |
|                      | Number of moves: Have you moved house since your CHILD/CHILDREN was 9 months old?                              | NE19A_NUMBEROFMOVES_M23M | Categorised        | Upper extremes categorised                                                                                                                      |
|                      | Mother ID at 24 month interview (Linkable to other datasets)                                                   | IDN_Y2M                  | Identification key | Randomly generated mother ID at 24 month interview. Allows linking to other datasets                                                            |
|                      | Age (years) of mother at 24 month interview                                                                    | AGE_Y2M                  | Derived            | Values derived from interview date (Interview_Date_Y2M) and date of birth(BG1A_AM) and converted to years. Lower and upper extremes categorised |
|                      | Do you have a current partner?                                                                                 | PQ5_Y2M                  | Raw                |                                                                                                                                                 |
| M48                  | With regard to your [child's/children's] health care, which of these statements best describes your situation? | NHC1_Y2M                 | Raw                |                                                                                                                                                 |
| M49                  | Is this the same health practitioner or service that you usually go to first when you are feeling unwell?      | HC3_Y2M                  | Raw                |                                                                                                                                                 |
| M50                  | What is the main reason you have never had a GP or GP practice for your [child/children]?                      | NHC8_Y2M                 | Raw                |                                                                                                                                                 |

| <b>Questionnaire number</b> | <b>Question</b>                                                                                                        | <b>Variable name</b> | <b>Variable type</b> | <b>Notes</b>                                                                           |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------|----------------------|----------------------|----------------------------------------------------------------------------------------|
| M51                         | Is this the same GP or GP practice that you were using when your [child/children] was nine months old?                 | HC9_Y2M              | Raw                  |                                                                                        |
| M52                         | How many times have you changed GP or GP practice since your [child/children] was nine months old?                     | HC10_Y2M             | Raw                  |                                                                                        |
| M53                         | How long have you taken your [child/children] to this GP or GP practice?                                               | HC11_Y2M             | Raw                  |                                                                                        |
|                             | Number of years: taken your [child/children] to this GP or GP practice                                                 | HC11_YEARS_Y2M       | Raw                  |                                                                                        |
|                             | Number of months: taken your [child/children] to this GP or GP practice                                                | HC11_MONTHS_Y2M      | Raw                  |                                                                                        |
| M54                         | What is the main reason you have changed the GP or GP practice you take your [child/children] to?                      | NHC12_Y2M            | Raw                  |                                                                                        |
| M57                         | All things considered, how satisfied are you with your [child/children]'s usual GP practice?                           | HC5_Y2M              | Raw                  |                                                                                        |
| M244                        | Do you consider yourself as currently belonging to any particular religion or denomination?                            | RA1_Y2M              | Raw                  |                                                                                        |
| M245                        | Belonging to any particular religion or denomination                                                                   | NRA2_Y2M             | Re-classified        | Re-classified to Statistics New Zealand Level 1 classificaion of religious affiliation |
| M246                        | How long have you had this particular faith?                                                                           | RA3_Y2M              | Raw                  |                                                                                        |
| M247                        | Apart from special occasions such as weddings and funerals, about how often do you attend religious services nowadays? | RA4_Y2M              | Raw                  |                                                                                        |
| M248                        | Regardless of whether you belong to a particular religion, how spiritual would you say you are?                        | RA5_Y2M              | Raw                  |                                                                                        |
| M276                        | Have you felt, been treated unfairly or discriminated against: your gender?                                            | NDIS0_1_Y2M          | Raw                  |                                                                                        |
|                             | Have you felt, been treated unfairly or discriminated against: your age?                                               | NDIS0_2_Y2M          | Raw                  |                                                                                        |
|                             | Have you felt, been treated unfairly or discriminated against: your religious or spiritual beliefs?                    | NDIS0_3_Y2M          | Raw                  |                                                                                        |
|                             | Have you felt, been treated unfairly or discriminated against: your weight?                                            | NDIS0_4_Y2M          | Raw                  |                                                                                        |

| <b>Questionnaire number</b> | <b>Question</b>                                                                                                                                              | <b>Variable name</b> | <b>Variable type</b> | <b>Notes</b> |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|----------------------|--------------|
|                             | Have you felt, been treated unfairly or discriminated against: the shade or colour of your skin?                                                             | NDIS0_5_Y2M          | Raw                  |              |
|                             | Have you felt, been treated unfairly or discriminated against: your ethnicity?                                                                               | NDIS0_6_Y2M          | Raw                  |              |
|                             | Have you felt, been treated unfairly or discriminated against: your sexual orientation?                                                                      | NDIS0_7_Y2M          | Raw                  |              |
|                             | Have you felt, been treated unfairly or discriminated against: your socio-economic status (e.g., educational level, income level or type of job/occupation)? | NDIS0_8_Y2M          | Raw                  |              |
|                             | Have you felt, been treated unfairly or discriminated against: a physical disability?                                                                        | NDIS0_9_Y2M          | Raw                  |              |
|                             | Have you felt, been treated unfairly or discriminated against: you have children?                                                                            | NDIS0_10_Y2M         | Raw                  |              |
|                             | Have you felt, been treated unfairly or discriminated against: your marital status?                                                                          | NDIS0_11_Y2M         | Raw                  |              |
|                             | Have you felt, been treated unfairly or discriminated against: other?                                                                                        | NDIS0_13_Y2M         | Raw                  |              |
|                             | Have you felt, been treated unfairly or discriminated against: none of these?                                                                                | NDIS0_97_Y2M         | Raw                  |              |
| M277                        | Who treated you unfairly because of: your gender - health services?                                                                                          | NDIS1_6_Y2M          | Raw                  |              |
| M278                        | Who treated you unfairly because of: your age - health services?                                                                                             | NDIS2_6_Y2M          | Raw                  |              |
| M279                        | Who treated you unfairly because of: your religious or spiritual beliefs - health services?                                                                  | NDIS3_6_Y2M          | Raw                  |              |
| M280                        | Who treated you unfairly because of: your weight - health services?                                                                                          | NDIS4_6_Y2M          | Raw                  |              |
| M281                        | Who treated you unfairly with respect to: the shade or colour of your skin - health services?                                                                | NDIS5_6_Y2M          | Raw                  |              |
| M282                        | Who treated you unfairly because of: your ethnicity - health services?                                                                                       | NDIS6_6_Y2M          | Raw                  |              |
| M283                        | Who treated you unfairly because of: your sexual orientation - health services?                                                                              |                      |                      |              |
| M284                        | Who treated you unfairly because of: your socio-economic status - health services?                                                                           | NDIS8_6_Y2M          | Raw                  |              |

| <b>Questionnaire number</b> | <b>Question</b>                                                                                                                      | <b>Variable name</b>   | <b>Variable type</b> | <b>Notes</b>                                        |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------|------------------------|----------------------|-----------------------------------------------------|
| M285                        | Who treated you unfairly because of: a physical disability - health services?                                                        |                        |                      |                                                     |
| M286                        | Who treated you unfairly because of: you have children - health services?                                                            | NDIS10_6_Y2M           | Raw                  |                                                     |
| M287                        | Who treated you unfairly because of: your marital status - health services?                                                          | NDIS11_6_Y2M           | Raw                  |                                                     |
| M288                        | Who treated you unfairly because of other reason - health services?                                                                  | NDIS12_6_Y2M           | Raw                  |                                                     |
| M292                        | On this list are various groups of people. Could you please mention any that you would not like to have as neighbours: drug addicts? | NA01_1_Y2M             | Raw                  |                                                     |
|                             | NZDep2006 Index of Deprivation                                                                                                       | NZDEP2006_Y2M          | Raw                  |                                                     |
|                             | Rurality                                                                                                                             | RURALITYGP_Y2M         | Categorised          |                                                     |
|                             | District health board                                                                                                                | DHB_Y2M                | Categorised          |                                                     |
|                             | Participants' residential country at 24 month interview                                                                              | RESIDENTIALCOUNTRY_Y2M | Categorised          | Countries other than New Zealand grouped as "Other" |

## 1.8 Mother: 54-month data

| Questionnaire number | Question                                                                                         | Variable name | Variable type      | Notes                                                                                                     |
|----------------------|--------------------------------------------------------------------------------------------------|---------------|--------------------|-----------------------------------------------------------------------------------------------------------|
|                      | Mother ID at 54 month interview (Linkable to other datasets)                                     | IDN_M54M      | Identification key | Randomly generated mother ID at 54 month interview. Allows linking to other datasets                      |
|                      | Mother's age at 54 month data collection                                                         | AGE_M54M      | Derived            | Mother's age in years at 54 month interview. Categorised the low cell counts at 20 or less and 50 or more |
|                      | Mother's country of residence                                                                    | COUNTRY_M54M  | Categorised        | Countries other than New Zealand grouped as 'Other countries';                                            |
|                      | Mother's gender                                                                                  | GENDER_M54M   | Raw                |                                                                                                           |
| 15.1                 | Do you know which school your {child/children} will attend?                                      | SS3_M54M      | Raw                |                                                                                                           |
| 15.2.1               | What type of school will your {child/children} will attend - State/Public primary school?        | SS4_1_M54M    | Raw                |                                                                                                           |
| 15.2.2               | What type of school will your {child/children} will attend - Private/independent primary school? | SS4_2_M54M    | Raw                |                                                                                                           |
| 15.2.3               | What type of school will your {child/children} will attend - Charter/partnership school?         | SS4_3_M54M    | Raw                |                                                                                                           |
| 15.2.4               | What type of school will your {child/children} will attend - Home schooling?                     | SS4_4_M54M    | Raw                |                                                                                                           |
| 15.2.5               | What type of school will your {child/children} will attend - Correspondence school?              |               |                    | Information contained in a variable SS4_97_m54M due to the low cell count                                 |
| 15.2.6               | What type of school will your {child/children} will attend - Te kura kaupapa Māori?              | SS4_6_M54M    | Raw                |                                                                                                           |
| 15.2.7               | What type of school will your {child/children} will attend - Bilingual school/unit?              | SS4_7_M54M    | Raw                |                                                                                                           |
| 15.2.8               | What type of school will your {child/children} will attend - Religious school?                   | SS4_8_M54M    | Raw                |                                                                                                           |
| 15.2.9               | What type of school will your {child/children} will attend - Special education school?           | SS4_9_M54M    | Raw                |                                                                                                           |

| Questionnaire number | Question                                                                                                                                               | Variable name     | Variable type | Notes                                             |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------|---------------------------------------------------|
| 15.2.97              | What type of school will your {child/children} will attend - Other (specify)?                                                                          | SS4_97_M54M       | Raw           |                                                   |
| 15.2.99              | What type of school will your {child/children} will attend - DK                                                                                        | SS4_99_M54M       | Raw           |                                                   |
| 15.2.98              | What type of school will your {child/children} will attend - Ref                                                                                       | SS4_98_M54M       | Raw           |                                                   |
| 20.1                 | Do you have a current partner?                                                                                                                         | PQ5_M54M          | Raw           |                                                   |
| 20.2                 | Does this partner live with you and your {child/children}?                                                                                             | PQ6_M54M          | Raw           |                                                   |
| 20.3                 | Were you in a relationship with this same partner when your {child was/children were} two years old?                                                   | PQ5A_M54M         | Raw           |                                                   |
| 23.1                 | In the last 12 months have you personally been forced to buy cheaper food so that you could pay for other things you needed?                           | DP1_M54M          | Raw           |                                                   |
| 23.11                | In the last 12 months have you personally put up with feeling cold to save heating costs?                                                              | DP2_M54M          | Raw           |                                                   |
| 23.12                | In the last 12 months have you personally made use of special food grants or food banks because you did not have enough money for food?                | DP3_M54M          | Raw           |                                                   |
| 23.13                | In the last 12 months have you personally continued wearing shoes with holes because you could not afford replacements?                                | DP4_M54M          | Raw           |                                                   |
| 23.14                | In the last 12 months have you personally gone without fresh fruit and vegetables often, so that you could pay for other things you needed?            | DP5_M54M          | Raw           |                                                   |
| 23.15                | In the last 12 months have you personally received help in the form of food, clothes or money from a community organisation (like the Salvation Army)? | DP6_M54M          | Raw           |                                                   |
|                      | NZDep2013 Index of Deprivation                                                                                                                         | NZDEP2013_M54M    | Raw           | New Zealand deprivation index 2013 classification |
|                      | Rurality in 2013                                                                                                                                       | RURALITYGP13_M54M | Categorised   |                                                   |
|                      | District health board 2013                                                                                                                             | DHB_2013_M54M     | Categorised   |                                                   |

## 1.9 Mother: 72-month data

| Questionnaire number | Question                                                                                                                                                                                                                                                              | Variable name | Variable type      | Notes                                                                                                     |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------|-----------------------------------------------------------------------------------------------------------|
|                      | Mother ID at 72 month interview (Linkable to other datasets)                                                                                                                                                                                                          | IDN_M72M      | Identification key | Randomly generated mother ID at 72 month interview. Allows linking to other datasets                      |
|                      | Child ID                                                                                                                                                                                                                                                              | IDN_CHILD     | Identification key | Randomly generated child ID. Allows linking to other datasets                                             |
|                      | Mother's age at 72 month data collection                                                                                                                                                                                                                              | AGE_M72M      | Derived            | Mother's age in years at 72 month interview. Categorised the low cell counts at 22 or less and 52 or more |
| 0.1                  | What is your usual country of residence? Please specify                                                                                                                                                                                                               | COUNTRYM_M72M | Categorised        | Countries other than New Zealand grouped as 'Other countries'                                             |
| 0.2                  | What is your Growing Up in New Zealand study child/children's usual country of residence? Please specify                                                                                                                                                              | COUNTRYC_M72M | Categorised        | Countries other than New Zealand grouped as 'Other countries'                                             |
| 1                    | How many times have you moved house since your Growing Up in New Zealand study child/children were 4 and a half years old? (Choose one only)                                                                                                                          | NE31_M72M     | Categorised        | Categorised upper extreme at 7+                                                                           |
| 4                    | How many people live in your house? (Choose one only)                                                                                                                                                                                                                 | HH46_M72M     | Raw                | Participants either responded with number of people or preferred not to say.                              |
| 4.1                  | How many people live in your house? Number of People                                                                                                                                                                                                                  | HH46S_M72M    | Categorised        | Categorised upper extreme at 14+                                                                          |
| 4.1.1.1              | Age of Child 1                                                                                                                                                                                                                                                        | HHA1_1_M72M   | Raw                |                                                                                                           |
| 4.1.1.2              | Age of Child 2                                                                                                                                                                                                                                                        | HHA1_2_M72M   | Categorised        | Categorised upper and lower extreme at 6                                                                  |
| 4.1.2.1              | Growing Up Childs Gender 1                                                                                                                                                                                                                                            | HHG1_1_M72M   | Raw                |                                                                                                           |
| 4.1.2.2              | Growing Up Childs Gender 2                                                                                                                                                                                                                                            | HHG1_2_M72M   | Raw                |                                                                                                           |
| 8                    | Is your Growing Up in New Zealand study child/children attending primary school? Note this question refers to formal primary school attendance that typically starts around five years of age, and includes those children who are schooled at home (Choose one only) | SS31_M72M     | Raw                |                                                                                                           |

| Questionnaire number | Question                                                                                                                                                           | Variable name | Variable type | Notes                                                                                                                |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------|----------------------------------------------------------------------------------------------------------------------|
| 9.1                  | Which of the following reasons relate to why your Growing Up in New Zealand study child/children is/are not attending school? Because of their health needs        |               |               | Information contained in a variable NSS32_M72M                                                                       |
| 9.2                  | Which of the following reasons relate to why your Growing Up in New Zealand study child/children is/are not attending school? Because of their developmental needs |               |               | Information contained in a variable NSS32_M72M                                                                       |
| 9.3                  | Which of the following reasons relate to why your Growing Up in New Zealand study child/children is/are not attending school? Because of their social needs        |               |               | Information contained in a variable NSS32_M72M                                                                       |
| 9.97                 | Which of the following reasons relate to why your Growing Up in New Zealand study child/children is/are not attending school? Other                                |               |               | Information contained in a variable NSS32_M72M                                                                       |
| 9.98                 | Which of the following reasons relate to why your Growing Up in New Zealand study child/children is/are not attending school? Prefer not to say                    |               |               | Information contained in a variable NSS32_M72M                                                                       |
|                      | Which of the following reasons relate to why your Growing Up in New Zealand study child/children is/are not attending school?                                      | NSS32_M72M    | Categorised   | Code frames different to questionnaire. Different responses were combined together to protect participants' identity |
| 11                   | Where does your Growing Up in New Zealand study child/children go to school? (Choose one only)                                                                     | SS34_M72M     | Raw           | Free text information was not included.                                                                              |
| 12.1                 | What type of school is this? State/Public primary school                                                                                                           | SS35_1_M72M   | Raw           |                                                                                                                      |
| 12.2                 | What type of school is this? Private/independent primary school                                                                                                    | SS35_2_M72M   | Raw           |                                                                                                                      |
| 12.3                 | What type of school is this? Charter/partnership school                                                                                                            | SS35_3_M72M   | Raw           |                                                                                                                      |
| 12.4                 | What type of school is this? Home schooling                                                                                                                        | SS35_4_M72M   | Raw           |                                                                                                                      |
| 12.5                 | What type of school is this? Correspondence school                                                                                                                 | SS35_5_M72M   | Raw           |                                                                                                                      |
| 12.6                 | What type of school is this? Te Kura Kaupapa Māori                                                                                                                 | SS35_6_M72M   | Raw           |                                                                                                                      |
| 12.7                 | What type of school is this? Bilingual school                                                                                                                      | SS35_7_M72M   | Raw           |                                                                                                                      |
| 12.8                 | What type of school is this? Religious school                                                                                                                      | SS35_8_M72M   | Raw           |                                                                                                                      |
| 12.9                 | What type of school is this? State Integrated primary school                                                                                                       | SS35_9_M72M   | Raw           |                                                                                                                      |
| 12.1                 | What type of school is this? International school                                                                                                                  | SS35_10_M72M  | Raw           |                                                                                                                      |

| Questionnaire number | Question                                                                                                                                                                                              | Variable name  | Variable type | Notes                                             |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------------|---------------------------------------------------|
| 12.11                | What type of school is this? Special needs school                                                                                                                                                     | SS35_11_M72M   | Raw           |                                                   |
| 12.97                | What type of school is this? Other                                                                                                                                                                    | SS35_97_M72M   | Raw           |                                                   |
| 12.99                | What type of school is this? Don't Know                                                                                                                                                               | SS35_99_M72M   | Raw           |                                                   |
| 12.98                | What type of school is this? Prefer not to say                                                                                                                                                        | SS35_98_M72M   | Raw           |                                                   |
| 16.6                 | How important were these factors when deciding which school your Growing Up in New Zealand study child/children attends? The school values align with our preferred religious practices or activities | SS44_M72M      | Raw           |                                                   |
| 56                   | Have you completed a new educational qualification since your Growing Up in New Zealand study child was/children were born? (Choose one only)                                                         | ED10_M72M      | Raw           |                                                   |
| 57.1                 | What is the qualification that you completed? National certificate levels 1-4                                                                                                                         | ED11_1_M72M    | Raw           |                                                   |
| 57.2                 | What is the qualification that you completed? Trade certificate                                                                                                                                       | ED11_2_M72M    | Raw           |                                                   |
| 57.3                 | What is the qualification that you completed? Diploma below Bachelors level or National Certificate levels 5 or 6                                                                                     | ED11_3_M72M    | Raw           |                                                   |
| 57.4                 | What is the qualification that you completed? Bachelor's degree                                                                                                                                       | ED11_4_M72M    | Raw           |                                                   |
| 57.5                 | What is the qualification that you completed? Bachelor's degree with honours, or postgraduate diploma                                                                                                 | ED11_5_M72M    | Raw           |                                                   |
| 57.6                 | What is the qualification that you completed? Master's degree                                                                                                                                         | ED11_6_M72M    | Raw           |                                                   |
| 57.7                 | What is the qualification that you completed? PhD                                                                                                                                                     | ED11_7_M72M    | Raw           |                                                   |
| 57.97                | What is the qualification that you completed? Other                                                                                                                                                   | ED11_97_M72M   | Raw           |                                                   |
| 57.99                | What is the qualification that you completed? Don't Know                                                                                                                                              | ED11_99_M72M   | Raw           |                                                   |
| 57.98                | What is the qualification that you completed? Prefer not to say                                                                                                                                       | ED11_98_M72M   | Raw           |                                                   |
|                      | NZDep2013 Index of Deprivation                                                                                                                                                                        | NZDEP2013_M72M | Raw           | New Zealand Deprivation Index 2013 classification |

## 1.10 Mother: 8-year data

| Questionnaire number | Question                                                    | Variable name       | Variable type      | Notes                                                                               |
|----------------------|-------------------------------------------------------------|---------------------|--------------------|-------------------------------------------------------------------------------------|
|                      | Mother ID at 8 years interview (linkable to other datasets) | IDN_Y8M             | Identification key | Randomly generated mother ID at 8 years interview. Allows linking to other datasets |
| 0.2                  | Mother's usual country of residence                         | COUNTRYMGP_Y8M      | Categorised        |                                                                                     |
|                      | Rurality in 2013                                            | RURALITYGP_2013_Y8M | Categorised        |                                                                                     |
|                      | District health board 2013                                  | DHBGP_2013_Y8M      | Categorised        |                                                                                     |
|                      | NZDep 2013                                                  | NZDEP2013_Y8M       | Raw                |                                                                                     |
|                      | Mother's age at 8 year collection wave                      | AGE_Y8M             | Derived            |                                                                                     |

## 1.11 Partner: Antenatal data

| Questionnaire number | Question                                                                                                                               | Variable name | Variable type      | Notes                                                                                                  |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------|--------------------------------------------------------------------------------------------------------|
|                      | Partners ID                                                                                                                            | IDN_AP        | Identification key | Randomly generated partner ID at antenatal interview. Allows linking to other datasets                 |
| BG1                  | Age (years) of partner at antenatal interview                                                                                          | AGE_AP        | Derived            | Upper extremes categorised                                                                             |
| PRG34                | Have you decided yet if you will have your child fully immunised?                                                                      | PRG34_AP      | Raw                |                                                                                                        |
| PRG35                | During this pregnancy have you received or been told any information that is encouraging you to immunise this child once s/he is born? | PRG35_AP      | Raw                |                                                                                                        |
| PRG36                | Where did you get this information from: family/whanau?                                                                                | NPRG36_1_AP   | Raw                |                                                                                                        |
|                      | Where did you get this information from: friends?                                                                                      | NPRG36_2_AP   | Raw                |                                                                                                        |
|                      | Where did you get this information from: GP (family doctor)?                                                                           | NPRG36_3_AP   | Raw                |                                                                                                        |
|                      | Where did you get this information from: midwife?                                                                                      | NPRG36_4_AP   | Raw                |                                                                                                        |
|                      | Where did you get this information from: obstetrician?                                                                                 | NPRG36_5_AP   | Raw                |                                                                                                        |
|                      | Where did you get this information from: dietician/nutritionist?                                                                       |               |                    | Combined low cell count responses of 'Dietician/Nutritionist' (NPRG36_6_AP) with 'Other'               |
|                      | Where did you get this information from: alternative health practitioner?                                                              | NPRG36_7_AP   | Raw                |                                                                                                        |
|                      | Where did you get this information from: antenatal class?                                                                              | NPRG36_8_AP   | Raw                |                                                                                                        |
|                      | Where did you get this information from: the internet?                                                                                 | NPRG36_9_AP   | Raw                |                                                                                                        |
|                      | Where did you get this information from: radio?                                                                                        | NPRG36_10_AP  | Raw                |                                                                                                        |
|                      | Where did you get this information from: TV?                                                                                           | NPRG36_11_AP  | Raw                |                                                                                                        |
|                      | Where did you get this information from: books, magazines, newspapers?                                                                 | NPRG36_12_AP  | Raw                |                                                                                                        |
|                      | Where did you get this information from: other?                                                                                        | NPRG36_13_AP  | Re-classified      | Combined low cell count responses of 'Dietician/Nutritionist' (NPRG36_6_AP) with 'Other' NPRG36_13_AP) |

| <b>Questionnaire number</b> | <b>Question</b>                                                                                                                         | <b>Variable name</b> | <b>Variable type</b>    | <b>Notes</b>                                                                |
|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|----------------------|-------------------------|-----------------------------------------------------------------------------|
| PRG37                       | During this pregnancy have you received or been told any information that is discouraging you to immunise this child once s/he is born? | PRG37_AP             | Raw                     |                                                                             |
| PRG38                       | Where did you get this information from: family/whanau?                                                                                 | NPRG38_1_AP          | Raw                     |                                                                             |
|                             | Where did you get this information from: friends?                                                                                       | NPRG38_2_AP          | Raw                     |                                                                             |
|                             | Where did you get this information from: GP (family doctor)?                                                                            | NPRG38_3_AP          | Raw                     |                                                                             |
|                             | Where did you get this information from: midwife?                                                                                       | NPRG38_4_AP          | Raw                     |                                                                             |
|                             | Where did you get this information from: obstetrician?                                                                                  | NPRG38_5_AP          | Raw                     |                                                                             |
|                             | Where did you get this information from: dietician/nutritionist?                                                                        | NPRG38_6_AP          | Raw                     |                                                                             |
|                             | Where did you get this information from: alternative health practitioner                                                                | NPRG38_7_AP          | Raw                     |                                                                             |
|                             | Where did you get this information from: antenatal class?                                                                               | NPRG38_8_AP          | Raw                     |                                                                             |
|                             | Where did you get this information from: the internet?                                                                                  | NPRG38_9_AP          | Raw                     |                                                                             |
|                             | Where did you get this information from: radio?                                                                                         | NPRG38_10_AP         | Raw                     |                                                                             |
|                             | Where did you get this information from: TV?                                                                                            | NPRG38_11_AP         | Raw                     |                                                                             |
|                             | Where did you get this information from: books, magazines, newspapers?                                                                  | NPRG38_12_AP         | Raw                     |                                                                             |
|                             | Where did you get this information from: other?                                                                                         | NPRG38_13_AP         | Raw                     |                                                                             |
| HH2                         | How many people are in the household, not counting yourself?                                                                            | HH2_AP               | Categorised             | Upper extremes re-categorised                                               |
| REL2                        | What best describes the nature of your relationship with the baby's mother?                                                             | REL2_AP              | Raw                     |                                                                             |
| ETH1                        | Which country were you born in?                                                                                                         | OL1_AP               | Re-classified           | Birth countries re-classified into regions                                  |
| ETH2                        | When did you first arrive to live in New Zealand?                                                                                       | AGETONZ_AP           | Derived and categorised | Information contained in derived variable AGETONZ_AP                        |
|                             | Number of years in NZ                                                                                                                   | TIMEINNZ_AP          | Derived and categorised | Values converted to years and categorised                                   |
| ETH4                        | Eth4-level 1. Main ethnicity - European                                                                                                 | ETH4_E_AP            | Re-classified           | Re-classified to Statistics New Zealand Level 1 classification of ethnicity |

| Questionnaire number | Question                                                                                                                                                                                                                         | Variable name  | Variable type | Notes                                                                       |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------------|-----------------------------------------------------------------------------|
|                      | Eth4-level 1. Main ethnicity - Māori                                                                                                                                                                                             | ETH4_M_AP      | Re-classified | Re-classified to Statistics New Zealand Level 1 classification of ethnicity |
|                      | Eth4-level 1. Main ethnicity - Pacific                                                                                                                                                                                           | ETH4_P_AP      | Re-classified | Re-classified to Statistics New Zealand Level 1 classification of ethnicity |
|                      | Eth4-level 1. Main ethnicity - Asian                                                                                                                                                                                             | ETH4_A_AP      | Re-classified | Re-classified to Statistics New Zealand Level 1 classification of ethnicity |
|                      | Eth4-level 1. Main ethnicity - MELAA                                                                                                                                                                                             | ETH4_MELA_AP   | Re-classified | Re-classified to Statistics New Zealand Level 1 classification of ethnicity |
|                      | Eth4-level 1. Main ethnicity - Other                                                                                                                                                                                             | ETH4_O_AP      | Re-classified | Re-classified to Statistics New Zealand Level 1 classification of ethnicity |
|                      | Eth4-level 1. ALL ethnicities - New Zealander                                                                                                                                                                                    | ETH4_NZDER_AP  | Re-classified | Re-classified to Statistics New Zealand Level 1 classification of ethnicity |
|                      | Self prioritised ethnicity                                                                                                                                                                                                       | SELF_PROETH_AP | Re-classified | Level 1 - single response ethnicity                                         |
| ETH8                 | Have you ever felt you have been treated unfairly, e g , treated differently, kept waiting, by a health professional, e g , doctor, nurse, dentist etc., because of your ethnicity in New Zealand: yes, more than 12 months ago? | ETH8_1_AP      | Raw           |                                                                             |
|                      | Have you ever felt you have been treated unfairly, e g , treated differently, kept waiting, by a health professional, e g , doctor, nurse, dentist etc., because of your ethnicity in New Zealand: no?                           | ETH8_2_AP      | Raw           |                                                                             |
|                      | Have you ever felt you have been treated unfairly, e g , treated differently, kept waiting, by a health professional, e g , doctor, nurse, dentist etc., because of your ethnicity in New Zealand: not applicable?               | ETH8_3_AP      | Raw           |                                                                             |
|                      | What is your highest completed secondary school qualification?                                                                                                                                                                   | EDALL_AP       | Re-classified |                                                                             |

| Questionnaire number | Question                                                                                                                                                    | Variable name | Variable type | Notes                                              |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------|----------------------------------------------------|
|                      | Apart from secondary school qualifications, do you have any other completed qualifications, the equivalent of 3 months or more full-time study to complete? |               |               | Information contained in derived variable EDALL_AP |
|                      | What is your highest completed qualification?                                                                                                               |               |               | Information contained in derived variable EDALL_AP |
| NE18                 | What is the community or communities of people to which you belong based around: religion?                                                                  | NNE18_2_AP    | Raw           |                                                    |
|                      | NZDep2006                                                                                                                                                   | NZDEP2006_AP  | Raw           | New Zealand deprivation index 2006 classification  |
|                      | District health board of maternal domicile                                                                                                                  | DHBGP_AP      | Raw           |                                                    |
|                      | Rurality code                                                                                                                                               | RURALITYGP_AP | Categorised   |                                                    |
|                      | Partner interview date                                                                                                                                      | INTERVIEW_AP  | Raw           |                                                    |

## 1.12 Partner: 9-month data

| Questionnaire number | Question                                                                                                        | Variable name  | Variable type      | Notes                                                                                   |
|----------------------|-----------------------------------------------------------------------------------------------------------------|----------------|--------------------|-----------------------------------------------------------------------------------------|
|                      | Partner ID                                                                                                      | IDN_M9P        | Identification key | Randomly generated partner ID at nine month interview. Allows linking to other datasets |
|                      | Age (years) of partner at 9 month interview                                                                     | AGE_M9P        | Derived            | Values converted to years. Lower and upper extremes categorised                         |
| PQ5                  | Do you have a current partner?                                                                                  | PQ5_M9P        | Raw                |                                                                                         |
| P176                 | Do you belong to any of the following social networks and groups or organisations: A church or spiritual group? | NBL7_2_M9P     | Raw                |                                                                                         |
|                      | NZDep2006 Index of Deprivation                                                                                  | NZDEP2006_M9P  | Raw                |                                                                                         |
|                      | Rurality                                                                                                        | RURALITYGP_M9P | Raw                |                                                                                         |
|                      | District health board group                                                                                     | DHB_M9P        | Re-classified      | Re-classified into seven main regions                                                   |

## 1.13 Partner: 2-year data

| Questionnaire number | Question                                                                                                               | Variable name          | Variable type      | Notes                                                                                                                                           |
|----------------------|------------------------------------------------------------------------------------------------------------------------|------------------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
|                      | Partner ID                                                                                                             | IDN_Y2P                | Identification key | Pseudo ID are provided for data integration                                                                                                     |
|                      | Age (years) of partner at 24 month interview                                                                           | AGE_Y2P                | Derived            | Values derived from interview date (Interview_Date_Y2P) and date of birth(BG1A_AP) and converted to years. Lower and upper extremes categorised |
|                      | Country of residence                                                                                                   | RESIDENTIALCOUNTRY_Y2P | Categorised        | Countries other than New Zealand grouped as "Other"                                                                                             |
| M244                 | Do you consider yourself as currently belonging to any particular religion or denomination?                            | RA1_Y2P                | Raw                |                                                                                                                                                 |
| M245                 | Belonging to any particular religion or denomination                                                                   | NRA2_Y2P               | Re-classified      | Re-classified to Statistics New Zealand Level 1 classification of religious affiliation                                                         |
| M246                 | How long have you had this particular faith?                                                                           | RA3_Y2P                | Raw                |                                                                                                                                                 |
| M247                 | Apart from special occasions such as weddings and funerals, about how often do you attend religious services nowadays? | RA4_Y2P                | Raw                |                                                                                                                                                 |
| M248                 | Regardless of whether you belong to a particular religion, how spiritual would you say you are?                        | RA5_Y2P                | Raw                |                                                                                                                                                 |
| M276                 | Have you felt, been treated unfairly or discriminated against: your gender?                                            | NDIS0_1_Y2P            | Raw                |                                                                                                                                                 |
|                      | Have you felt, been treated unfairly or discriminated against: your age?                                               | NDIS0_2_Y2P            | Raw                |                                                                                                                                                 |
|                      | Have you felt, been treated unfairly or discriminated against: your religious or spiritual beliefs?                    | NDIS0_3_Y2P            | Raw                |                                                                                                                                                 |
|                      | Have you felt, been treated unfairly or discriminated against: your weight?                                            | NDIS0_4_Y2P            | Raw                |                                                                                                                                                 |
|                      | Have you felt, been treated unfairly or discriminated against: the shade or colour of your skin?                       | NDIS0_5_Y2P            | Raw                |                                                                                                                                                 |

| Questionnaire number | Question                                                                                                                                                     | Variable name | Variable type | Notes |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------|-------|
|                      | Have you felt, been treated unfairly or discriminated against: your ethnicity?                                                                               | NDIS0_6_Y2P   | Raw           |       |
|                      | Have you felt, been treated unfairly or discriminated against: your sexual orientation?                                                                      | NDIS0_7_Y2P   | Raw           |       |
|                      | Have you felt, been treated unfairly or discriminated against: your socio-economic status (e.g., educational level, income level or type of job/occupation)? | NDIS0_8_Y2P   | Raw           |       |
|                      | Have you felt, been treated unfairly or discriminated against: a physical disability?                                                                        | NDIS0_9_Y2P   | Raw           |       |
|                      | Have you felt, been treated unfairly or discriminated against: you have children?                                                                            | NDIS0_10_Y2P  | Raw           |       |
|                      | Have you felt, been treated unfairly or discriminated against: your marital status?                                                                          | NDIS0_11_Y2P  | Raw           |       |
|                      | Have you felt, been treated unfairly or discriminated against: other?                                                                                        | NDIS0_13_Y2P  | Raw           |       |
|                      | Have you felt, been treated unfairly or discriminated against: none of these?                                                                                | NDIS0_97_Y2P  | Raw           |       |
| M277                 | Who treated you unfairly because of: your gender - health services?                                                                                          | NDIS1_6_Y2P   | Raw           |       |
| M278                 | Who treated you unfairly because of: your age - health services?                                                                                             | NDIS2_6_Y2P   | Raw           |       |
| M279                 | Who treated you unfairly because of: your religious or spiritual beliefs - health services?                                                                  | NDIS3_6_Y2P   | Raw           |       |
| M280                 | Who treated you unfairly because of: your weight - health services?                                                                                          | NDIS4_6_Y2P   | Raw           |       |
| M281                 | Who treated you unfairly with respect to: the shade or colour of your skin - health services?                                                                | NDIS5_6_Y2P   | Raw           |       |
| M282                 | Who treated you unfairly because of: your ethnicity - health services?                                                                                       | NDIS6_6_Y2P   | Raw           |       |
| M283                 | Who treated you unfairly because of: your sexual orientation - health services?                                                                              |               |               |       |
| M284                 | Who treated you unfairly because of: your socio-economic status - health services?                                                                           | NDIS8_6_Y2P   | Raw           |       |

| <b>Questionnaire number</b> | <b>Question</b>                                                                  | <b>Variable name</b> | <b>Variable type</b> | <b>Notes</b> |
|-----------------------------|----------------------------------------------------------------------------------|----------------------|----------------------|--------------|
| M285                        | Who treated you unfairly because of: a physical disability - health services?    |                      |                      |              |
| M286                        | Who treated you unfairly because of: you have children - health services?        | NDIS10_6_Y2P         | Raw                  |              |
| M287                        | Who treated you unfairly because of: your marital status - health services?      | NDIS11_6_Y2P         | Raw                  |              |
| M288                        | Who treated you unfairly because of other reason (DIS0-other) - health services? | NDIS12_6_Y2P         | Raw                  |              |
|                             | NZDep2006 Index of Deprivation                                                   | NZDEP2006_Y2P        | Raw                  |              |
|                             | Rurality                                                                         | RURALITYGP_Y2P       | Categorised          |              |
|                             | District health board group                                                      | DHBGP_Y2P            | Categorised          |              |