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# Childhood immunisations in Northland, New Zealand: declining care and the journey through the immunisation pathway

Juliet Rumball-Smith, Timothy Kenealy

## ABSTRACT

**AIM:** In a region with high rates of immunisation refusal, we examine whether refusing an immunisation at 6 weeks (the first scheduled immunisation) predicts the pattern for subsequent scheduled immunisations, and the characteristics of those who declined these immunisations.

**METHOD:** We used data from the National Immunisation Register to identify 11,972 children born between 1 January 2009 and 31 December 2013 (inclusive), and who had their first immunisation (due at 6 weeks age) in Northland, New Zealand. At each immunisation event, individual vaccines are recorded as being delivered or declined. This cohort was 'followed' to determine which of these children received or declined the scheduled 3-month and 5-month immunisations.

**RESULTS:** Immunisation providers delivered a full immunisation programme to 10,828/11,927 (90%) of the cohort. Caregivers of 897 (7%) of children declined the 6-week vaccination. Of this group, 872 (97%) also declined the 3-month and 850 (95%) declined the 5-month immunisations, constituting 872/962 (91%) and 850/923 (92%) of all declined immunisations, respectively. In the decline group, there was variability with primary care practice, and differences according to ethnic group and deprivation profile.

**CONCLUSION:** Increasing Northland's immunisation coverage may require primary care providers to more actively engage with declining caregivers prior to the 3-month and 5-month vaccinations. Immunisation information and decision-making programmes targeted at parents and providers in the antenatal and prenatal period may also be of benefit, in addition to considering regulatory and incentive strategies.

Childhood immunisation is unanimously supported and encouraged by governments worldwide, the International Pediatric Association and the World Health Organization. New Zealand has made gains in immunisation coverage in the last decades, from less than 60% at age 2 years in 1991, to around 92% in 2014.<sup>1,2</sup> These improvements reflect the prioritisation of immunisation coverage in national policy, and associated interventions, such as the creation of the National Immunisation Register (NIR) in 2005, public monitoring of District Health Board (DHB) performance against national health targets, and funding to ensure minimal financial barriers in access to primary care for children. However, the coverage rate is sub-

optimal for some groups of New Zealanders, and the Northland region has been a consistent outlier with lower coverage than the national average.

New Zealand provides free immunisations to residents, according to a schedule of delivery at seven specified ages between 6 weeks and 12 years. The immunisation schedule in use during the study period called for two vaccines at age 6 weeks, 3 months and 5 months: the first, a combination vaccine covering diphtheria, tetanus, pertussis, polio, hepatitis B, and Haemophilus influenzae type b; and the second a pneumococcal vaccine. March 2015 data recorded that only 87% of Northland babies were fully immunised

at age 8 months, such that they have had timely delivery of their immunisations at 6 weeks, 3 months and 5 months.<sup>3</sup> This level of ‘coverage’ is well below the national Health Target of 95%, and also below estimates required for ‘herd immunity’ for some of the vaccine-preventable diseases included in the schedule.<sup>4,5</sup>

Low ‘coverage’ encompasses three distinct groups: first, the small number who may or may not receive vaccines, but opt off the NIR. Second, those whose receipt of the vaccines are untimely—for example, children who have not received the 6-week, 3-month, and 5-month vaccines by age 8 months are considered ‘not fully immunised’ by the New Zealand Ministry of Health, and so are not counted in the coverage estimates. That is, vaccines classified as ‘completed’ on the NIR also include those given outside the coverage period, and the proportion of completed vaccinations in a population does not necessarily align with coverage. The third important group includes those children whose caregivers make an active choice to decline a specific vaccination.

The factors associated with refusing vaccination and timeliness of vaccination may differ, and require separate strategies to address. We have chosen to focus this research on the third group mentioned above—the population who actively refuse immunisations for their children. Nationally, by age 8 months, around 3.5% of caregivers are recorded as declining one or more of these childhood vaccinations, and this proportion has been noted to be higher in Northland. This research aimed to describe how children moved through the immunisation pathway in the Northland region, and to identify the characteristics of babies whose caregivers declined childhood immunisations, as formally documented as such on the NIR. We used an extract from the NIR to ‘follow’ the journey of Northland children from immunisations due at age 6 weeks until those due at 5 months.

## Methods

### Sample

Children are automatically registered with the NIR at birth. Caregivers can choose to ‘opt-off’, an option taken by less

than 1% nationally.<sup>5</sup> The NIR notifies the nominated primary care provider, which must confirm or decline that the child be enrolled at their practice. After that, the NIR is updated directly from the primary care patient management system after an immunisation event. The NIR captures immunisations occurring anywhere in the country. We obtained a NIR data extract from Ministry of Health pertaining to all babies with addresses coded as part of the Northland District Health Board (DHB) domicile at the time of their 6-week immunisation, and born between 1 January 2009 and 31 December 2013 (inclusive). This work was audited for the purposes of improving service and, as such, did not require formal ethics review (confirmed by the New Zealand Health and Disability Ethics Committees).

### Measures

The data were structured in long format with multiple entries for each individual, identified through their unique National Health Index number. Each line of data pertained to an immunisation event (eg, 6 weeks) and a specific vaccine event (several vaccines may be due at the same event, and each vaccine gets its own line in the data). Each vaccine-event was coded as ‘completed’ (for a child receiving the vaccine) or ‘declined’, which is used only when the caregiver specifically states that they do not consent to the vaccination due at that particular age.

We created a wide format database (one line per individual) with indicator variables giving the status of each vaccine due at 6 weeks, 3 months and 5 months. We defined a ‘decline’ as the decline of one or more of the scheduled vaccinations at a given due date; ‘accept’ was defined by the ‘completed’ indicator for all of their scheduled immunisations. We used the individual’s National Health Index ethnic group—this source has been shown to have reasonable accuracy.<sup>6,7</sup>

### Analysis

We used descriptive statistics to describe the cohort and count numbers of vaccines accepted or declined. Sub-groups by acceptance or decline status are compared by demographic variables using the Pearson’s Chi-squared test. Statistical significance is cited at  $p \leq 0.05$ . Tests were conducted in Stata v 13.

**Figure 1:** Journey through immunisation pathway for vaccines due at 6 weeks, 3 months and 5 months, Northland 2009–2013.



**Table 1:** Demographic characteristics of the cohort (n=11,972).

		n	%
Year of birth	2009	2,416	20.2
	2010	2,577	21.5
	2011	2,427	20.3
	2012	2,340	19.6
	2013	2,212	18.5
Ethnicity <sup>1</sup>	Asian	312	2.6
	Māori	6,496	54.3
	NZ European	4,551	38.0
	Pacific	260	2.2
	Other	353	3.0
Quintile <sup>2</sup>	1	385	3.3
	2	1,262	10.7
	3	1,875	15.9
	4	3,358	28.5
	5	4,908	41.6

Note: 1=Ethnicity defined according to National Health Index, prioritised ethnicity coding. 2=Quintile defined from New Zealand Deprivation Index 2006, where 1=least deprived, 5=most deprived. 184 individuals were missing data.

## Results

The data included 12,034 children born between 1 January 2009 and 31 December 2013, domiciled to the Northland region at the time they are recorded as receiving or declining the vaccines due at 6 weeks. Nearly all these children received the immunisation service at primary care

clinics in Northland. The 30 children whose 6-week service was delivered outside the region, and the 32 with missing clinic and region data, were excluded from further analysis, leaving a final sample of 11,972.

Table 1 shows similar numbers of children included from each year 2009–2013. More than half of the cohort identified as Māori, and around 42% lived in the most materially and economically deprived quintile in the country.

Figure 1 shows the number of children receiving and declining vaccinations due at 6 weeks, 3 months and 5 months. Of 11,972 children followed, 10,828 (90%) received all the vaccinations. Eight hundred and ninety-seven (8%) were declined one or more of the 6 week vaccines. Of those who accepted the 6 week vaccines, 10,828 (99%) went on to accept both their 3-month and 5-month vaccinations. Of those who declined any of their 6-week immunisations, only 22 subsequently accepted both the 3-month and 5-month immunisations. There were 897 caregivers who declined one or more 6-week vaccination for their baby; 872 (97%) of these also declined the 3-month, and 850 (95%) declined the 5-month immunisations, constituting 872/962 (91%) and 850/923 (92%) of all declined immunisations, respectively. Attrition was small—30 (0.3%) babies had no NIR entry for either accepting or declining vaccines due at 3 months, and 74 (0.6%) had no record for vaccines due at 5 months.

Table 2 shows demographic characteristics of the group that declined one or more vaccine due at 6 weeks. A majority of these children were New Zealand European (52%), with 42% identified as Māori. The

**Table 2:** Characteristics of children whose caregiver declined one/more 6-week vaccines.

		<b>Decline</b>	<b>%</b>	<b>Accept</b>	<b>%</b>	
<b>Total</b>		897		11,075		
<b>Ethnicity</b>	Asian	8	0.9	304	2.7	
	Māori	372	41.4	6,124	55.3	
	NZ European	464	51.7	4087	36.9	p <0.001
	Pacific	39	4.4	246	2.2	
	Other	14	1.6	314	2.8	
<b>Quintile<sup>1</sup></b>	1	32	3.6	353	3.3	
	2	102	11.5	1,160	10.7	
	3	202	22.8	1,673	15.9	p <0.001
	4	241	27.2	3,117	28.5	
	5	310	34.5	4,598	41.6	

Note: 1 = decline n=887, accept n=10,901, 184 missing data

Māori decline group was most likely to reside in quintile 5 areas (50%) compared with 24% for the non-Māori babies. However, this difference likely reflects the differential distribution of deprivation in the total cohort. When we analysed socio-economic position separately within the Māori and NZ European groups, there was no clear pattern in the proportion of decline by deprivation. Analysis by year suggests that there may be a reducing rate of declined vaccinations from 2009–2013 (2009: 8.8%; 2010: 8.0%; 2011: 6.9%; 2012: 7.1%; 2013: 6.6%; test for trend p=0.06).

There were 40 identifiable Northland primary care providers. Apart from one outlier, with a decline prevalence of 63%, the proportion of declines varied from 2.2% to 14.6% with a mean of 8.6%. There were ten clinics with a decline proportion of more than 10%; collectively, these practices cared for around 40% of those who declined the 6 week vaccinations. The outlier is a small urban clinic which has had consistently high rates of immunisation refusal over many years. Anecdotally, it is said to have a high proportion of clients who favour complementary and alternative medicines.

## Discussion

We analysed a cohort of 11,972 babies born in Northland over 5 years from 2009 to 2013. More than 40% of these babies were characterised as living in marked

socio-economic deprivation, representing startling losses in opportunity for health in the future,<sup>8</sup> which will only be exacerbated if they are also subject to vaccine-preventable illness.

Of this cohort, about 7% declined one or more of the scheduled 6-week childhood immunisations, a proportion of around twice the national average in 2014.<sup>5</sup> Forty percent of these babies were Māori, and 52% New Zealand European. There was no pattern within ethnic groups by deprivation quintile. Ninety-five percent of those children who were declined their 6-week childhood immunisations were also declined the vaccinations at the 3-month and 5-month milestones, such that this small group accounted for more than 90% of subsequent declined vaccines. This is consistent with other reports from New Zealand,<sup>9</sup> and internationally.<sup>10</sup> The proportion of those declining immunisation at 6 weeks may have decreased over the last 5 years.

The study has some limitations. First, this research was designed to provide data to support activities in the Northland region, and so is descriptive and cross-sectional only. Second, the sample is not an entire birth cohort—we have no information on those children who did register with the NIR, but who did not ever subsequently engage with an immunisation provider, such that they are not recorded as a

‘decline’ or an ‘accept’. This proportion is likely to be small, however their exclusion may underestimate the association seen between decline at 6 weeks and subsequent decline. We also have no information on children who have ‘opted out’ of the NIR, however, estimates from the Northland DHB suggest the proportion of opt-offs is less than 1% at the 6-month milestone. Statistics New Zealand states that there were 11,232 births in the Northland region between 2009 and end-2013.<sup>11</sup> The 11,972 children in our cohort are net of any migration in or out of Northland between birth and 6 weeks of age. All these factors considered, our cohort is otherwise a near-complete population of children present in Northland for the 6-week vaccination, so confidence in our findings is high.<sup>12</sup> Third, this research considered only the first three vaccination milestones. Considering the consistency and strength of the association, we can assume that the pattern will continue into later vaccination events. Finally, there are many factors that may influence vaccination that have not been examined here, including the Lead Maternity Carer (mostly midwives) responsible for each child’s antenatal and post-natal care. Anecdotes suggest that these providers have a strong influence on immunisation choices, and that some midwives hold ambivalent or negative views about immunisation.<sup>13</sup>

We find that despite the prioritisation of immunisation coverage by Northland DHB and associated targeted resources, primary care providers were not able to change the immunisation journey for 95% of the children for whom their caregivers declined the 6-week immunisation. The Immunisation Advisory Centre recommends that immunisation providers offer to contact and re-engage with caregivers who have previously declined vaccines when the next scheduled immunisation is due.<sup>14</sup> However, a rapid survey of Northland primary care practices identified that a third of 38 centres followed an informal policy of delaying re-contact of declining caregivers until the 15-month milestone; that is, they considered a decline at 6 weeks as a decline for the entire primary series. Accordingly, many of the caregivers who declined initially did not receive the pre-call and reminder systems

that the ‘accepting’ parents received. It is likely that some of these caregivers may have re-evaluated their decline decision at an earlier stage, had they had the opportunity. On the other hand, one New Zealand study found that nearly all caregivers made their decision about whether or not to immunise during the antenatal period.<sup>15</sup> Together with our findings, this suggests that activities and interventions related to immunisation should be focused prior to the 6-week scheduled visit.

It is important to consider the heterogeneity of the caregivers who choose to decline immunisation for their baby. While some of these individuals may be opposed to all vaccines (and without doubt), the remainder are likely to be ‘vaccine hesitant’. This latter group, defined by the ‘delay in acceptance or refusal of vaccination despite availability of vaccination services’, encompass a continuum, from full acceptance to full decline of all vaccines. The factors involved for the choices of this group were recently conceptualised by the SAGE Working Group on Vaccine Hesitancy (SAGE) as the ‘3Cs model’—Confidence, Convenience, and Complacency. These three broad categories each require different approaches and interventions; vaccine hesitancy is a growing area of research.<sup>16</sup>

In Northland (and likely elsewhere), some caregivers may decline immunisation because of difficulties in accessing this care. Although immunisation is free-of-charge through their registered general practitioner, there may be other barriers not directly financial. The recently published 2014 New Zealand Health Survey found Northland Māori were more likely to report transport as contributing to unmet need for general practice services than the New Zealand European respondents. Northland Māori were also less likely to state they had full trust and confidence in their general practitioner.<sup>17</sup> This makes it important to continue to fund nurse or kaimahi-driven services such as pre-call and outreach.<sup>18</sup>

In our cohort, the proportion who declined immunisation was more than twice the national proportion at the same milestone. While there has been significant improvement in national immunisation coverage over the past decade (and our estimates suggest that the rate of decline

in Northland has decreased over the period of this study), it is possible that we have reached the limit of what we can achieve within our present regulatory framework. Others (including the World Health Organization<sup>19</sup>) have suggested that supplementary measures may be required in New Zealand, particularly in areas of greater need.<sup>12</sup> This may be a time to consider other potential policies for immunisation, such as incentives for caregivers and vaccination providers,<sup>20,21</sup> or quasi-mandatory strategies such as ensuring full immunisation at school entry (with the possibility of defined exemptions). Resources for focusing our education and outreach systems on the antenatal and early post-natal period may also decrease the prevalence of immunisation refusal.

In conclusion, we recommend that high-needs/low-coverage areas such as Northland undergo regular immunisation surveillance (involving cohorts of children), to monitor improvement and patterns at a

regional level. Primary care should actively pre-call and invite caregivers who decline the 6-week immunisation to nevertheless bring children for later vaccinations. Research into exemplar Lead Maternity Carers may identify how they successfully support caregivers in the decision-making around immunisation. It is probable that primary care and public health providers need to employ multiple messages and activities to decrease the incidence of immunisation refusal in Northland, reflecting the heterogeneity of those who refuse vaccines in this area. SAGE recommends providers working to understand the factors contributing to vaccine hesitancy in their specific population; and carefully tailoring interventions to their reasons, the target group, and the broader context.<sup>22</sup> This research also supports the consideration of further facilitative national immunisation policy, in order to support the success of this important public health intervention.

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**Competing interests:**

Nil

**Author information:**

Juliet Rumball-Smith, Public and Population Health, Northland District Health Board, Whangarei; Timothy Kenealy, South Auckland Clinical School, University of Auckland, Auckland.

**Corresponding author:**

Juliet Rumball-Smith, Public and Population Health, Northland District Health Board, Whangarei.

juliet.rumball-smith@northlanddhb.org.nz

**URL:**

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**REFERENCES:**

1. Ministry of Health, The National Childhood Immunisation Coverage Survey 2005. 2007, Wellington: Ministry of Health.
2. Statistics New Zealand, National immunisation coverage, 2014. [http://www.stats.govt.nz/browse\\_for\\_stats/snapshots-of-nz/nz-social-indicators/Home/Health/childhood-immunisation.aspx](http://www.stats.govt.nz/browse_for_stats/snapshots-of-nz/nz-social-indicators/Home/Health/childhood-immunisation.aspx) Accessed July 2015.
3. Ministry of Health, NIR Datamart reports, Northland. 2015: Accessed March 2015.
4. Ministry of Health, Immunisation Handbook 2014. 2014: Wellington: Ministry of Health.
5. Ministry of Health, National and DHB immunisation data. 2015, <http://www.health.govt.nz/our-work/preventative-health-wellness/immunisation/immunisation-coverage/national-and-dhb-immunisation-data>, accessed July 2015.
6. Rumball-Smith J, Sarfati D. Improvement in the accuracy of hospital ethnicity data. *N Z Med J*, 2011. 124(1340): p. 96-7.
7. Riddell T, Lindsay G, Kenealy T, et al. The accuracy of ethnicity data in primary care and its impact on cardiovascular risk assessment and management—PREDICT CVD-8. *N Z Med J*, 2008. 121(1281): p. 40-8.
8. Poulton R, Caspi A, Milne BJ, et al. Association

- between children's experience of socioeconomic disadvantage and adult health: a life-course study. *The Lancet*. 360(9346): p. 1640-1645.
9. Petousis-Harris H, Grant CC, Goodyear-Smith F, et al. What contributes to delays? The primary care determinants of immunisation timeliness in New Zealand. *J Prim Health Care*, 2012. 4(1): p. 12-20.
  10. Guyer B, Hughart N, Holt E, et al. Immunization coverage and its relationship to preventive health care visits among inner-city children in Baltimore. *Pediatrics*, 1994. 94(1): p. 53-8.
  11. Statistics New Zealand, Births and deaths: year end December 2014 - tables. 2015, [http://www.stats.govt.nz/browse\\_for\\_stats/population/births/BirthsAndDeaths\\_HOTPYeDec14.aspx](http://www.stats.govt.nz/browse_for_stats/population/births/BirthsAndDeaths_HOTPYeDec14.aspx). Accessed July 2015.
  12. Mueller S, Exeter DJ, Petousis-Harris H, et al., Measuring disparities in immunisation coverage among children in New Zealand. *Health Place*, 2012. 18(6): p. 1217-23.
  13. <http://www.stuff.co.nz/life-style/parenting/68674972/Discredited-vaccine-advice-endangers-babies>.
  14. Immune Advisory Centre, OFFER information about delaying or declining immunisation. 2015, Auckland: Immune Advisory Centre, University of Auckland.
  15. Wroe AL, Turner N, Salkovskis PM. Understanding and predicting parental decisions about early childhood immunizations. *Health Psychol*, 2004. 23(1): p. 33-41.
  16. MacDonald NE. Vaccine hesitancy: Definition, scope and determinants. *Vaccine*, 2015. 33(34): p. 4161-4.
  17. Ministry of Health, Regional results from the 2011-2014 New Zealand Health Survey. 2015, <http://www.health.govt.nz/publication/regional-results-2011-2014-new-zealand-health-survey>, accessed July 2015.
  18. Crampton P, Carr J. Socially or materially marginal children are less likely to be fully immunised—a systems response. *BMJ*, 2006. 332(7553): p. 1314.
  19. Regional Office for the Western Pacific - World Health Organization, Measles elimination and importations in the Western Pacific Region. *Measles-Rubella Bulletin*, 2012. 6(2): p. 9-10.
  20. NZ Health Committee, Inquiry into how to improve completion rates of childhood immunisation, and Briefings from the Chief Coroner on the coronial process, from Dr Michael Tatley on the adverse reaction process, and from Professor Sir Peter Gluckman on how to improve completion rates of childhood immunisation. 2011: Wellington: Report of the Health Committee, presented to the House of Representatives. .
  21. Wilson N, Baker MG. Celebrating 50 years of polio elimination in New Zealand: but inadequate progress in eliminating other vaccine-preventable diseases. *N Z Med J*, 2012. 125(1365): p. 67-74.
  22. Jarrett C, Wilson R, O'Leary M, et al. Strategies for addressing vaccine hesitancy - A systematic review. *Vaccine*, 2015. 33(34): p. 4180-90.



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